Northrop Grumman-Bethpage Facility
Naval Weapons Industrial Reserve Plant
Grumman-Steel Los Plant 2

Oyster Bay (T), Nassau County, New York
Site No. 1-30-003A
Site No. 1-30-003B
Site No. 1-30-003C

PROPOSED REMEDIAL ACTION PLAN
Operable Unit No. 2
Groundwater Remedy

JUNE 2000

Prepared by:

Division of Environmental Remediation
New York State Department of Environmental Conservation

gummanou2rev1prap.wpd

PROPOSED REMEDIAL ACTION PLAN
Operable Unit No. 2
NORTHROP GRUMMAN - BETHPAGE FACILITY
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT - BETHPAGE
GRUMMAN-STEEL LOS PLANT 2

Town of Oyster Bay, Nassau County, New York
NYS Site Nos. 130003A, 130003B and 130003C
June 2000

SECTION 1: SUMMARY AND PURPOSE OF THE PROPOSED PLAN

The New York State Department of Environmental Conservation (NYSDEC) in consultation with the New York State Department of Health (NYSDOH) is proposing a remedy to address the significant threat to human health and/or the environment created by the presence of hazardous waste at the Northrop Grumman Bethpage Plant, Naval Weapons Industrial Reserve Plant-Bethpage (NWIRP), and the Grumman-Steel Los Plant 2, Class 2, Class 2 and Class 4 inactive hazardous waste disposal sites respectively. As more fully described in Sections 3 and 4 of this document, plant wastes were disposed directly into either drainage sumps, dry wells and/or on the ground surface resulting in the disposal of a number of hazardous wastes, including the volatile organic compounds (VOCs) perchloroethene (PCE) and trichloroethene (TCE), the semi-volatile organic compound (SVOC) polychlorinated bi-phenyls (PCBs) and the inorganics chromium and cadmium at the site. Some of these contaminants have migrated from the points of disposal to surrounding areas, including the soils of the Sites and the groundwater beneath and down gradient of Northrop Grumman, NWIRP and the Grumman-Steel Los Plant 2 facilities. These disposal activities have resulted in the following significant threats to the public health and/or the environment:

- a significant threat to public health associated with contaminated soils, groundwater and drinking water;

- a significant threat to the environment associated with contaminated soils and groundwater;

In order to eliminate or mitigate the significant threats to the public health and/or the environment that the hazardous wastes disposed at Northrop Grumman, NWIRP and Grumman-Steel Los Plant 2 may have caused, the following remedy is proposed:

- Alternative 3 of the Operable Unit 2 (OU 2) Groundwater Feasibility Study with the modifications as detailed in this PRAP. This remedy includes:

- continued operation of the on-site containment groundwater extraction and treatment system at Grumman's southern property line;
- mass contaminant removal through offsite groundwater extraction and treatment in an area near the Bethpage Water District Wellfields Wells 4, 5 and 6, wellhead treatment and carbon polishing for Bethpage Water District Public Wellfields 4, 5 and 6:
- long term operation and maintenance of all operating systems;
- long term monitoring of the groundwater including monitored natural attenuation;
- and public water supply wellhead treatment contingency plans.

These items address the potential threats to human health and/or the environment.

The proposed remedy, discussed in detail in Section 7 of this document, is intended to attain the remediation goals selected for this site in Section 6 of this Proposed Remedial Action Plan (PRAP), in conformity with applicable standards, criteria, and guidance (SCGs).

This PRAP identifies the preferred remedy, summarizes the other alternatives considered, and discusses the reasons for this preference. The NYSDEC will select a final remedy for the site only after careful consideration of all comments received during the public comment period.

The NYSDEC has issued this PRAP as a component of the citizen participation plan developed pursuant to the New York State Environmental Conservation Law and 6 NYCRR Part 375. This document is a summary of the information that can be found in greater detail in the Remedial Investigation (RI), Feasibility Study (FS) and other relevant reports and documents, available at the document repositories.

To better understand the site and the investigations conducted, the public is encouraged to review the project documents at the following repositories:
Main Document Repository:

1. Bethpage Public Library
   Powell Avenue
   Bethpage, New York 11714
   (516) 931-3907
   Hours: M-F 9:30am-9:00pm
   Saturday: 9:30am-5pm
   9:30am -1pm during July and August
   Sunday: 12:00pm-5pm
   Closed Sundays, May 1 to Sept 30
   Karen Gruskin or Lois Lovisolo, Reference Librarians

2. NYSDEC Region 1 Office
   Building 40 Loop Road
   SUNY Stony Brook
   Stony Brook, New York 11790
   (631) 444-0294
   Hours: 8:30 - 4:45 (M-F)
   Attn: Mark Lowery

3. NYSDEC -Division of Environmental Remediation- Bureau of Eastern Remedial Action
   50 Wolf Road
   Albany, New York 12233-7010
   (518) 457-3395
   Hours: 8:00 - 4:15 (M-F)
   Project Manager: Steven Scharf, P.E.

The NYSDEC seeks input from the community on all PRAPs. A public comment period has been set from **{DATES}** to provide an opportunity for public participation in the remedy selection process for this site. A public meeting is scheduled for **(DATE}** at the **{LOCATION}** beginning at **{Time}**.

At the meeting, the results of the RI/FS will be presented along with a summary of the proposed remedy. After the presentation, a question-and-answer period will be held, during which you can submit verbal or written comments on the PRAP.

The NYSDEC may modify the preferred alternative or select another of the alternatives presented in this PRAP, based on new information or public comments. Therefore, the public is encouraged to review and comment on all of the alternatives identified here.

Comments will be summarized and responses provided in the Responsiveness Summary section of the Record of Decision. The Record of Decision is the NYSDEC's final selection of the remedy for this site. Written comments may be sent to Mr. Steven Scharf, project manager, at the above address for the NYSDEC Albany office through {add **date comment period closes}**.

During the course of the investigation certain actions, known as Interim Remedial Measures (IRMs), were undertaken at the Northrop Grumman Site in response to the threats identified above. An IRM is conducted at a site when a source of contamination or exposure pathway can be effectively addressed before completion of the RI/FS. The IRMs undertaken at this site included the Onsite Groundwater Containment System at Grumman's southern property line currently in operation and the Bethpage Water District (BWD) Wellfields 4, 5 and 6 wellhead treatment systems. These IRMs are described in more detail in Section 4.

SECTION 2: SITE LOCATION AND DESCRIPTION

Northrop Grumman, NWIRP, and the Grumman-Steel Los Plant 2 facility inactive hazardous waste disposal sites are located in east-central Nassau County, Long Island (see Figures 1 and 2).

The entire Grumman site was initially more than 600 acres in area, but has been reduced in size through previous remedial activities and confirmatory sampling events. The portions of the former Grumman site that remain listed in the New York State Registry of Inactive Hazardous Waste Disposal Sites includes the southern recharge basins, the NWIRP and the Grumman-Steel Los Plant 2 site (formerly the Grumman Plant 2 facility). The southern recharge basins and the Grumman-Steelos Plant 2 facility currently total about 35 acres in size. The NWIRP site is approximately 105 acres in size. There are numerous groundwater industrial supply wells and recharge basins at these sites.

There are other industrial and commercial facilities in the area along with several residential communities. There are several municipal supply wells within a two-mile radius of the sites.

SECTION 3: SITE HISTORY

3.1: Operational/Disposal History Northrop Grumman and Grumman-Steel Los Plant 2, Sites Nos. 1-30-003A and C:

The Grumman Aerospace Corporation was established in the early 1930s at the present site in Bethpage. Several naval aircraft were developed and manufactured at the site. Other activities at the site included the manufacturing of naval amphibious craft and the manufacturing of various satellites, etc. for the National Aeronautics and Space Administration (NASA).

Grumman Aerospace was reportedly notified in December 1947 that a water sample collected from Well No. 3 of the Bethpage Water District (then known as the Central Park Water District) contained chromium at 1.4 parts per million (ppm). As a result, the District's well No.'s 1, 2 and 3, located on Jackson Avenue near the train station, were closed permanently. Eventually Grumman Aerospace reimbursed the District for these wells.

From 1943-1949, Grumman disposed of their chromic acid wastes directly on the ground or in open seepage basins. In 1949, a chromic acid treatment system was put on-line at Plant 2. Since the early 1950s, some of the wastes generated by Grumman were taken to the NWIRP property for treatment or storage before being taken off site by private haulers. These wastes included common organic solvents consisting of chlorinated hydrocarbons. There were several locations on the Grumman site where wastes were stored, treated, or disposed of. These areas were targeted for investigation during the Remedial Investigation/Feasibility Study that was conducted at the site. In addition to the chromic acid treatment system located at Plant 2, systems for treating phenols, oils, and other organic compounds, and for recovering silver were also used at Plant 2. Trichloroethene (TCE) was stored in an above ground tank along the northeastern corner of Plant 2. A release of TCE from this tank (or the associated piping system) occurred and was discovered during the Grumman Remedial Investigation.

In 1994, the Grumman Aerospace Corporation was purchased by the Northrop Corporation and became known as the Northrop Grumman Corporation. In December 1996, Northrop Grumman sold Plant 2 and the surrounding land to the Steel Los III Corporation (Steel Los). Steel Los refurbished the Plant 2 complex and now leases the former Plant 2 as commercial real estate.

NWIRP Site No. 1-30-003B:

The NWIRP facility was established in 1933. Since its inception, the primary mission for the facility has been the research, prototyping, testing, design engineering, fabrication, and primary assembly of military aircraft.

The facilities at the NWIRP include four plants (Nos. 3, 5, and 20, used for assembly and prototype testing; and No. 10, which contains a group of quality control laboratories), two warehouse complexes, a salvage storage area, water recharge basins, an industrial wastewater treatment plant, and several smaller support buildings.

The following is a discussion of the waste handling practices at the three identified disposal sites at the NWIRP facility (see Figure 3):

Site 1 - Former Drum Marshaling Area

From the early 1950's to 1978, drums containing liquid wastes were stored on a cinder covered area over a cesspool leach

field. This leach field may have been used to discharge process wastewater. In 1978, the drum storage area was moved a few yards to the south to a 100- by 100-foot concrete pad. This pad did not have a cover nor were there any berms around it. In 1982, the drum storage area was moved to Site 3.

Various solvents were stored at Site 1. Cadmium and cyanide wastes were also stored in this area from the early 1950's through 1974. Approximately 200 to 300 drums were stored at these locations at any given time. Reportedly, all drums of waste which were stored at these areas were taken offsite by a private contractor for treatment and disposal.

Site 2 - Recharge Basin Area

Prior to 1984, some Plant 3 production-line rinse waters were discharged in the three on-site recharge basins. These waters were directly exposed to chemicals used in the industrial processes (rinsing of manufactured parts). Only non-contact cooling water has been discharged into these basins since 1984. The source of this non-contact cooling water has been on-site production wells.

On at least one occasion (1956), hexavalent chromium was detected in the water in the recharge basins at concentrations in excess of allowable limits. This matter was discovered and handled by the Nassau County Department of Health.

Adjacent to and west of the recharge basins are the former sludge drying beds. Sludge from the Plant 2 Industrial Waste Treatment Plant (part of the Grumman Site as known above) was dewatered in these beds before being disposed of off-site.

Site 3 - Salvage Storage Area

The NWIRP salvage storage area is located at this site which is located to the west of Site 2. This area has been used for the storage of fixtures, tools, and metallic wastes such as aluminum and titanium scraps, since the early-1950's.

In addition to salvage storage, a 100- by 100-foot area within this site was used for the storage of drummed wastes. This area was reportedly covered with coal ash cinders. Halogenated and non-halogenated waste solvents were stored in this area from the early-1950's through 1969. The exact location of this drum storage area is not known. Since 1969, drums have been stored in a covered area with a concrete pad and berms.

OXY Hooker Ruco, Site No. 1-30-004 (Not the Subject of this PRAP)

The RUCO Polymer site (RUCO site) see figure 4) was originally the Rubber Corporation of America. The Hooker Chemical Corporation (now the Occidental Chemical Corporation, also known as OCC or OXY) purchased the Rubber Corporation of America (RUCO) in 1965. The RUCO plant was sold to the employees in 1982. The site is now operated by a privately held corporation under the name RUCO Chemical Corporation and OXY retained the environmental liability for the past disposal practices.

Between 1956 and 1975, industrial process wastewater and storm water runoff from the facility was discharged to six (6) on-site recharge basins or sumps. This wastewater contained chlorinated hydrocarbons including PCE, TCE and vinyl chloride monomer (VCM), as well as other organic and inorganic

wastes. These waste waters have contributed to the contamination of the Bethpage regional aquifer upgradient and beneath the Northrop Grumman, NWIRP and Grumman-Steel Los facilities. The OXY Hooker Ruco Site is listed on the National Priorities List (NPL) of the United States Environmental Protection Agency (USEPA). A separate remedial program is being carried out for the OXY site under the oversight of the USEPA. Therefore, the OXY site is not a direct focus of this PRAP except inasmuch as it may affect select groundwater remedies (see for example Item D in Section 7.1).

3.2: Remedial History

Northrop Grumman and Grumman Steel Los Plant 2:

Grumman was reportedly notified in December 1947 that a sample collected from Well No. 3 of the Central Park Water District (predecessor of the Bethpage Water District) contained chromium at a concentration of 1.4 parts per million (ppm). The well was closed and Grumman installed a chromic acid treatment system for its Plant 2 waste waters. This system went on-line in 1949.

Odor and taste problems were discovered in water pumped from some of Grumman's on-site production wells in 1973. Several investigations into the source(s) of this problem were conducted from 1973 through the early 1980's. It was ultimately determined that these problems were due to chlorinated hydrocarbons in the groundwater.

The Grumman site was added to the New York State Department of Environmental Conservation's Registry of Inactive Hazardous Waste Disposal Sites in New York State (Registry) in 1983. The site was initially listed as a Class 2a site. This classification was assigned to this site because there was insufficient data to assign it a classification set forth in the Environmental Conservation Law (ECL). At the time, the NWIRP-Bethpage site was considered part of the Grumman site.

Based on a review of existing data, the Grumman site was reclassified to a Class 2 site by the NYSDEC in December 1987. A Class 2 site is a site which poses a significant threat to human health and/or the environment, and for which action is required.

Grumman conducted a remedial investigation (RI) on site between October 1989 and September 1994. As a result of this investigation, two source areas were identified. A soil vapor extraction system was installed in 1994 adjacent to a former storage tank that was used to store trichloroethene (TCE) at Plant 2. This system ha been shut sown pending termination confirmatory sampling. This system was shut down for a short period of time and was used to remediate a small area of contamination (perchloroethene or PCE) at Plant 15. The Plant 15 source area has been adequately remediated.

Certain specific areas of the former Plant 2, or Steel Los property, have elevated levels of chromium and cadmium. These areas are well below ground surface and have been deed restricted. The Steel Los Corporation opted to remove only the hazardous waste levels of contamination and then restrict access to the remainder of the soils with contamination above NYSDEC soil cleanup criteria.

An off-site remedial investigation and feasibility (RI/FS) was conducted from early 1991 through January 1998.

NWIRP

An Initial Assessment Study was conducted at the NWIRP-Bethpage site in 1986. Based upon the results of this study, it was concluded that three areas at the site posed a threat to human health or the environment. A description of the Northrop Grumman and NWIRP Sites is presented in Section 3.1. In March 1993, NYSDEC listed the NWIRP as a separate Class 2 Site, distinct from the Grumman Site, in the Registry. The NWIRP Site was excluded from the 1990 Northrop Grumman RI/FS Order on Consent. Therefore, it was a separate site with a separate investigation.

An RI/FS was conducted at the site from August 1991 through July 1995. The purpose of the RI was to determine the nature and extent of the contamination that was found during the Initial Assessment Study.

The NYSDEC divided the remedial programs at the Northrop Grumman Site and the NWIRP site into two operable units; site soils and the regional groundwater. An operable unit is designated to represent a portion of the site remedy which for technical or administrative reasons can be addressed separately to eliminate or mitigate a release, threat of release or exposure pathway resulting from contamination at a site. In addition to these operable units for these sites, other remedial measures (sometimes called corrective actions), have been implemented under NYSDECs RCRA program (discussed below) and under the USEPA's underground injection control (UIC) program.

The purpose of the first Feasibility Study was to develop and evaluate remedial alternatives for remediating the soils contamination defined during the RI. A Record of Decision (ROD) for operable unit one (OU1) for the Grumman Plant 2 Site was executed in March 1995 and for the NWIRP site was executed on July 5, 1995. The on-site soil remedies are being addressed as separate entities within the OU1 soils ROD for each of the two sites. The selected remedies for addressing the contamination in the unsaturated zones (source control remedies) were outlined in the OU1 RODs.

OXY Hooker RUCO

The RUCO Site is broken into three operable units. OU 1 addresses site soils and adjacent groundwater, OU 2 addresses soils associated with a particular drainage sump and OU 3 is the offsite migration of groundwater contaminated with VOCs including vinyl chloride and tentatively identified compounds, or TICs, that generally fall into the category of semi-volatile organic compounds, (SVOCs). The USEPA is preparing to release a PRAP for the offsite groundwater contamination in the near future. The OU 1 and OU 2 Rods have already been issued.

3.3: Enforcement History

Grumman

Grumman entered into a Consent Order with the NYSDEC on October 25, 1990 in which Grumman agreed to conduct a RIFS at the Grumman Aerospace - Bethpage Site.

NWIRP

The United States Navy has undertaken their environmental studies pursuant to the Navy's Installation Restoration Program. The State of New York provided oversight of the work conducted by the Navy pursuant to a

Memorandum of Understanding between the State and the Department of Defense.

Resource Conservation and Recovery Act

The purpose of this PRAP is to set forth the groundwater remedial program for the Northrop Grumman and NWIRP Sites as set forth in 6 NYCRR Part 375, "Inactive Hazardous Waste Disposal Sites." These two sites are also covered under 6 NYCRR Part 373, commonly known as the Resource, Conservation and Recovery Act, (RCRA) program. This is the permitting and ultimately the closure process for active facilities that store, generate, and treat hazardous wastes over a certain quantity as defined under this regulation. The RCRA program as promulgated under NYSDEC regulations is authorized by the USEPA to issue RCRA permits.

3.4: Regional Groundwater Study

The investigation of onsite and offsite groundwater contamination associated with the Northrop Grumman and NWIRP Sites is referred to as the regional groundwater study. The information gathered was used to screen alternatives in the Operable Unit 2 (OU 2) Groundwater Feasibility Study. The groundwater plume is estimated to extend over an area of approximately 2,000 acres and to a depth of approximately 500 feet. Due to the magnitude of this contamination and the multiple sources of the contamination, a regional remedy for addressing the groundwater contamination was required. The process of developing a regional remedy began in October 1994 and originally included Northrop Grumman, the NWIRP and the RUCO Sites. Subsequently, in September 1998, the involved Agencies determined that the RUCO Site would be most appropriately addressed as a separate OU 3 under the USEPAs RI/FS program for that Site.

SECTION 4: SITE CONTAMINATION

To evaluate the contamination present at the site and to evaluate alternatives to address the significant threat to human health and the environment posed by the presence of hazardous waste, the Northrop Grumman Corporation and the Navy have conducted two area wide RI/FSs and a smaller focused RI/FS on the Navy property. The first two FSs were for soils remedies covered under OU 1 RODs with the Navy and Northrop Grumman. The Focused RI/FS, being conducted by Northrop Grumman, is still ongoing for the two remaining PCB contaminated dry wells at the NWIRP. An additional FS, which is the subject of this PRAP, was prepared for offsite groundwater issues.

In addition, both Grumman and the Navy are working towards completing the remediation of large capacity underground fuel oil tanks that historically leaked. All the tanks have been removed and residual contaminants in these areas are being remediated under the NYSDEC Bureau of Spill Response's Underground Storage Tanks (UST) program.

4.1: Summary of the Remedial Investigation

The purpose of the RI was to define the nature and extent of any soil and groundwater contamination resulting from previous activities at the Site.

The RI was conducted in 2 phases. The first phase was conducted between February, 1991 and October, 1991 and the second phase

between August 1992 and September 1993. For the Northrop Grumman property, a report entitled "Remedial Investigation Report, Grumman Aerospace Corporation, Bethpage, New York, May 1994," has been prepared. For the NWIRP, two reports entitled "Final Remedial Investigation Report NWIRP, May 1992," and "Phase 2 Remedial Investigation Report, NWIRP, October 1993," describe the field activities and findings of the RIs in detail.

The following investigatory techniques were used in order to achieve the goals for the RIs:

- Soil gas surveys were conducted in various locations throughout the Site in order to locate potential areas which could be sources of groundwater contamination.

- Soil samples were collected in various locations throughout the Site to confirm the results of the soil gas surveys and to identify source areas that could not initially be located using the soil gas survey technique.

- Groundwater samples were collected from monitoring wells that were installed as part of the two Remedial Investigations and by other organizations (such as the United States Geological Survey).

To determine whether the groundwater is contaminated at levels of concern, the RI analytical data were compared to environmental Standards, Criteria, and Guidance values (SCGs). Groundwater, drinking water and surface water SCGs identified for the Northrop Grumman and NWIRP Sites are based on NYSDEC Ambient Water Quality Standards and Guidance Values and Part 5 of New York State Sanitary Code.

Based on the RI results, in comparison to the SCGs and potential public health and environmental exposure routes, the groundwater requires remediation. These are summarized below. More complete information can be found in the RI Report on file in the document repositories.

Chemical concentrations are reported in parts per billion (ppb) or parts per million (ppm). For comparison purposes, where applicable, SCGs are provided for each medium.

4.1.1: Site Geology and Hydrogeology

The sites are underlain by five geologic/hydrogeologic formations (descending from ground surface):

- Pleistocene deposits (Upper Glacial Aquifer)

- Magothy Formation (Magothy Aquifer)

- Raritan Clay Formation

- Lloyd Sand Formation (Lloyd Aquifer)

- Bedrock

The Upper Glacial and Magothy aquifers are the most important of these formations for the purposes of this PRAP. Groundwater from these two aquifers is the sole source of drinking water for residents of Long Island. The Magothy Aquifer is the aquifer that is utilized the most as a source of drinking water. The water table, or the top of the

Upper Glacial Aquifer, is approximately 50 feet below ground surface.

4.1.2: Nature of Contamination

As described in the RI report, numerous soil, soil gas, groundwater and sediment samples were collected at the site to characterize the nature and extent of contamination. The main categories of contaminants which exceed their SCGs are inorganics (metals), volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides and polychlorinated biphenyls (PCBs).

A summary of the groundwater analytical data generated during the RIs is presented in Table 1. Summaries of the soils analytical data are presented in the RODs for onsite soils that are referenced in Section 3.2. It is recognized that residual soil contaminants such as chromium and cadmium beneath the Plant 2 property could serve as a source of groundwater contamination in the future. Although this PRAP addresses groundwater contaminants, this relationship between soils and groundwater is recognized throughout the PRAP.

The sites are located in an area of deep aquifer recharge. Precipitation that percolates through the soil and enters the aquifer system travels vertically down through the aquifers thus replenishing the water that is pumped for potable uses. Pollutants in the unsaturated soils and upper reaches of the aquifer system also migrate downward with infiltrating water.

The primary groundwater contaminants are chlorinated VOCs which were either used and disposed of at the sites or are breakdown products of chemicals used and disposed of. These compounds are:

- perchloroethene (PCE)
- trichloroethene (TCE)
- dichloroethenes (DCE)
- vinyl chloride
- 1,1,1-trichloroethane

Inorganic analytes (metals), specifically arsenic, cadmium and chromium were detected in groundwater samples that were collected at the sites. The arsenic, cadmium, and chromium were detected at concentrations greater than the corresponding standards, and only in a small number of on-site monitoring wells.

4.1.3: Extent of Contamination

Groundwater

By current estimates, the groundwater plumes emanating from the two sites total 2,000 acres in area and are over 500 feet deep in places. An estimate of the areal extent of the plume is presented on Figure 5.

On-Site Groundwater Plume

The highest concentrations of VOCs in groundwater were detected in samples collected from on-site wells. The most contaminated on-site well was HN-24I, located on the southwest corner of the Navy property, in which TCE was detected at a concentration of 58,000 ppb (the drinking water standard is 5 ppb). An attempt to isolate the source of this contamination was unsuccessful. Concentrations (greater than 1,000 ppb) have been detected in some of Grumman's and the Navy's production wells (see Figure 6). Consistently high concentrations of VOCs have been detected in Grumman production well GP-1 for some time, and a treatment system has been

installed to treat the water that is pumped from that well (see Section 4.4).

Off-Site Groundwater Plume

To date, the plume(s) emanating from the sites have impacted or threaten three public water supplies operated by the Bethpage Water District (see Figure 5). There are treatment systems in place at each of the three impacted or threatened water supplies. The water that is distributed to the community is tested on a monthly basis to ensure that the drinking water standards promulgated by the NYSDOH are met.

Because of the proximity of the contaminants to the Bethpage Water District (BWD) well fields, nine (9) outpost or sentry wells were installed upgradient of the water supplies. These wells have been sampled on a quarterly basis since March 1995.The purpose of this quarterly sampling is to provide the BWD with the data they need to make sure that the existing treatment systems are adequate to treat the level of contaminants that may impact their public supply wells. The data are also used to make decisions about the need for groundwater remediation.

Based upon a review of the sentry well data, there is an area surrounding monitoring well cluster GM 38 that contains high concentrations of site-related contamination. The outpost wells will continue to be monitored to determine the groundwater concentrations of these site-related contaminants.

Soil

The Northrop Grumman and Navy OU1 RODs dealt with soil contamination outside the areas of the site buildings at the Northrop Grumman and NWIRP Sites. Contaminated soils beneath the Site buildings are being addressed by the RCRA program, or active facilities permitting program.

Sediments

Sediments in some of the onsite recharge basins contained elevated levels of inorganics. Any sediments that were removed from the recharge basins were characterized and sent offsite for disposal. The closure of the onsite storm drains was through the USEPA UIC program.

4.1.4: Development of a Computer Groundwater Model

A groundwater computer model was developed as a tool for developing and evaluating remedial alternatives for addressing the groundwater contamination. The study area that is encompassed in the model is 24.1 square miles in area (see Figure 8). The model was constructed in order to simulate groundwater flow throughout the entire thickness of the Upper Glacial and Magothy aquifers. A detailed description of the model is presented in the Northrop Grumman Groundwater Feasibility Study Report, Appendix B, dated January, 2000. Copies of this report are on file at the document repositories listed on Page 2 of this document.

4.2: Interim Remedial Measures

An Interim Remedial Measure (IRM) is conducted at a site when a source of contamination or exposure pathway can be effectively addressed before completion of the RI/FS. Two groundwater IRMs have been implemented over the past seven years that ultimately have become part of this proposed plan.

1. Protection of the Bethpage Water District Public Supply Wells

Treatment systems have been installed at the three currently operated and impacted or threatened public supply wells operated by the BWD (see also section 4.1.2). The treatment systems at BWD Plants 4 and 6 were funded by Grumman. The treatment system at BWD Plant 5 was funded by the U.S. Navy as specified in the May 1995 ROD for the NWIRP-Bethpage site.

2. On-Site Containment IRM

The On-Site Containment (ONCT) IRM was installed by Northrop Grumman. It was realized during the early stages of the Feasibility Study that one of the components of the final remedy for addressing the groundwater contamination was the containment of the portions of the plume(s) that are still below beneath the sites (i.e. - prevent further migration of contaminants off site to the extent practicable). Pumping at the onsite production wells had helped contain much of the contamination onsite. However, as Northrop Grumman and the Navy began closing down their Bethpage operations, many of the on-site production wells were slated to be removed from service. Therefore, it was decided to implement a specific groundwater containment remedy as an Interim Remedial Measure (IRM) in advance of making a decision regarding the final groundwater remedy. This system went on-line in November 1997.

As designed, the ONCT IRM system consists of seven extraction wells; four of which were pre-existing, and three others that were installed in 1996-97 (see Figure 7). The bulk of the contaminant removal is predicted to occur in wells ONCT-1 and GP-1, with lesser amounts of contaminants extracted from wells ONCT-2, ONCT-3, GP-11, GP-10 and GP-16. The combined pumping rate for wells GP-1, ONCT-1, ONCT-2, and ONCT-3 is 3,375 gallons per minute. The other wells are pumped at a combined rate of 700 - 2,500 gallons per minute (depending upon demand).

The groundwater that is pumped from these wells is treated to remove VOC contaminants prior to being recharged back into the aquifer via on-site recharge basins. This combination of pumping, treating and recharge are the factors by which the on-site plumes will be contained ("hydraulic containment"). Eventually, most of the Northrop Grumman production (GP) wells will be closed and the ONCT system will consist only of GP-1 and ONCT extraction wells 1, 2 and 3. This eventuality was foreseen and was accommodated in the system designed.

4.3: Summary of Human Exposure Pathways:

This section describes the types of human exposures that may present added health risks to persons at or around the site. A more detailed discussion of the health risks can be found in Section 5 of the RI report entitled, "Contaminant Fate and Transport."

An exposure pathway is the manner by which an individual may come in contact with a contaminant. The five elements of an exposure pathway are; 1) the source of contamination; 2) the environmental media and transport mechanisms; 3) the point of exposure; 4) the route of exposure; and 5) the receptor population. These elements of an exposure pathway may be based on past, present, or future events.

Human exposure pathways known to presently exist or that have historically existed at the site include:

- direct contact with (dermal absorption), ingestion of, and inhalation of contaminated onsite soils; and

- direct contact with (dermal absorption), ingestion of, and inhalation associated with contaminated groundwater through residential or commercial use.

Contaminated soil, dry well sediments, and groundwater at known or potential source areas (such as various Northrop Grumman and NWIRP facilities) have been or are being addressed under OU 1 and/or appropriate RCRA and UIC closure programs.

Human exposures could occur by ingesting or coming into direct contact with untreated ~~(or inadequately treated)~~ contaminated groundwater pumped from a water supply well. Additionally, inhalation of VOCs could occur if contaminated water is used for cooking, cleaning or bathing. Several BWD public water supply wells were impacted by contamination from the Site. Water from the affected municipal wells is either no longer used or treated to remove the contaminants prior to distribution to the community. Routine monitoring of the treated water supplies has demonstrated the effectiveness of these treatment systems in mitigating exposures to groundwater contaminants.

There are no known private wells in use within the contaminated aquifer under study here. This was verified by a survey conducted by the Nassau County Department of Health (NCDH). The nearest down gradient private well, a non-contact cooling water well at a hospital, was tested in 1998 and found to be free of site-related contaminants.

In summary, while human exposures to contaminated groundwater may have occurred in the past. There are no known exposuresthat are presently occurring.

4.4: Summary of Environmental Exposure Pathways

There are no surface water bodies or other environmentally sensitive areas within a two-mile radius of the sites. Therefore, it was concluded that there is a negligible risk to wildlife in the area from the disposal of hazardous wastes at the sites.

SECTION 5: ENFORCEMENT STATUS

Potentially Responsible Parties (PRPs) are those who may be legally liable for contamination at a site. This may include past or present owners and operators, waste generators, and haulers.

The NYSDEC and the Northrop Grumman Corporation entered into a Consent Order on October 25, 1990. The Department of the Navy entered into a Memorandum of Understanding (MOU) with the NYSDEC in 1993. The Order obligated Northrop Grumman to implement an RI/FS. The MOU brought the NYSDEC into the Department of the Navy's Installation Restoration (IR) progam. Upon issuance of the Record of Decision for operable unit 2 (OU2) the NYSDEC will approach Northrop Grumman to implement the selected remedy under an Order on Consent. The Navy and Northrop Grumman have, in turn, will come to an

understanding for cost sharing with respect to this remedy.

SECTION 6: SUMMARY OF THE REMEDIATION GOALS

Goals for the remedial program have been established through the remedy selection process stated in 6 NYCRR Part 375-1.10. The overall remedial goal is to meet all Standards, Criteria and Guidance (SCGs) and be protective of human health and the environment. At a minimum, the remedy selected must eliminate or mitigate all significant threats to public health and/or the environment presented by the hazardous waste disposed at the site through the proper application of scientific and engineering principles.

The goals selected for this site are:

- ~~*Eliminate, to the extent practicable, site-related contaminants from the affected public water supplies.*~~
- *Eliminate, to the extent practicable, exposures to contaminated groundwater.*
- *Eliminate, to the extent practicable, off-site migration of groundwater that does not attain NYSDEC Class GA Ambient Water Quality Criteria.*
- *Eliminate, to the extent practicable, the migration of soils contamination into the groundwater.*
- *Eliminate, to the extent practicable, exceedances of applicable environmental quality standards related to releases of contaminants to the waters of the state.*

SECTION 7: SUMMARY OF THE EVALUATION OF ALTERNATIVES

The selected remedy must be protective of human health and the environment, be cost effective, comply with other statutory laws and utilize permanent solutions, alternative technologies or resource recovery technologies to the maximum extent practicable. Potential remedial alternatives for the Northrop Grumman and the NWIRP sites were identified, screened and evaluated in the Operable Unit 2 (OU2) Report entitled "Groundwater Feasibility Study, Northrop Grumman, Bethpage."

The on-site containment IRM and the wellhead treatment IRM for the BWD Wells are presumptive remedy strategies for this site. All of the remedial alternatives contained in the Northrop Grumman OU2 Groundwater FS include the continued operation, maintenance and monitoring (OM&M) of these two IRMs.

A summary of the detailed analysis follows. As presented below, the time to implement reflects only the time required to put the remedy in place, and does not include the time required to design the remedy, procure contracts for design and construction or to negotiate with responsible parties for implementation of the remedy.

7.1: Description of Remedial Alternatives

The potential remedies are intended to address the contaminated groundwater at the site.

For Alternatives 1 thru 8, The Following Items A Through F, Are included in Some Or All of the Remedial Alternatives:

A. On-Site Plume Containment (ONCT), Treatment, and Discharge to On-Site Recharge Basins via the On-going IRM:
Under this component of each alternative, the existing on-site groundwater IRM which has been installed would continue operating. The pumpage from the groundwater IRM treatment system (See Figure 9) would continue at the approximate rate of 4,350 gallons per minute. The water would be recharged into the recharge basins located adjacent to Plant 5 and to the Southern Recharge Basins.

B. Long Term, Operation and Maintenance of VOC Removal Systems At Three Off-Site Bethpage Public Water Supply Wellfields:
A long-term agreement is being renegotiated between the BWD and Northrop Grumman to pay for the operation and maintenance of the treatment systems at BWD wellfields 4, 5 and 6. That agreement would become part of the ROD and would be effective for 30 years or until the public supply wells no longer show contamination attributable to the Navy or Northrop Grumman.

C. Long-Term Groundwater Monitoring including Monitored Natural Attenuation (MNA), Public Supply Wellhead treatment contingency and Long-Term Operation and Maintenance of All Operating Treatment Systems On-site.
A long-term monitoring program would be designed and implemented for this component of each alternative. This includes the installation of at least twenty new monitoring wells. The goals for this monitoring program would be to monitor the groundwater plume(s) both on-site and off-site and monitor the effectiveness of the groundwater remedy or remedies. Monitored Natural Attenuation, or MNA, would also be used with respect to the fate and transport of site contamination. This component would also contain operation and maintenance provisions for all treatment systems.

The goals for the long term monitoring program would be to:

- monitor the groundwater plume(s) both on-site and off-site; and
- monitor the effectiveness of the groundwater remedy.

Samples would be collected on a quarterly, semi-annual or annual basis from a monitoring well network (approximately 20 - 40 wells). The specific sampling locations and the specific analytes would be based upon periodic reviews under the ongoing long term operation, maintenance and monitoring (OM&M) program. In addition, water level data would be collected on a regular basis. These results would be evaluated by means of periodic updating of the computer groundwater model that has been developed (see Section 4.1.3) for this site.

D. Vinyl Chloride Contingency Plan
The feasibility study does not include specific treatment for vinyl chloride. The RUCO Site is upgradient of the Northrop Grumman Site and historically upgradient of the NWIRP Site due to large scale pumping by Northrop Grumman. The OXY site discharged vinyl chloride, other chlorinated solvents and other organic compounds directly into the aquifer through on-site recharge basins. Currently

the United States Environmental Protection Agency (USEPA) is moving towards a remedy for the RUCO Site vinyl chloride plume. However if no remedial measures are taken with respect to vinyl chloride, based on the current concentrations and time of travel, it has been estimated that vinyl chloride could reach the Northrop Grumman/NWIRP ONCT system in as early as 10 years. The existing ONCT system was not designed to treat vinyl chloride, a VOC that requires unique methods of treatment to meet stringent air discharge limits. Thus, the NYSDEC directed Northrop Grumman to develop a continency treatment plan in the event that treatment for vinyl chloride becomes necessary.

E. Offsite GM 38 Area Remedy:

The monitoring well GM38 area process option is the offsite groundwater extraction and treatment remedy for the elevated concentration of total volatile organic compounds (TVOCs) in groundwater. The modeling data from the OU 2 Groundwater FS indicated a majority (5,000 pounds) of the contaminant mass that could be removed at this location (7,000 pounds total) would be removed after five years of operation (see figure 10). About ten years of additional operation would be required to remove most of the remaining contaminant mass. Therefore, this process option would be operated for five years as a mass removal option and evaluated thereafter on an annual review basis to determine the need (if any) for continued operation. The GM 38 area OM&M costs have been revised to five years from the fifteen years of the FS, thus reduces the present worth of the OM&M from the OU 2 FS from $2,200,000 to $950,000.

Capital Cost:	$ 4,390,000
Annual O&M Cost:	$ 220,000
Present Worth:	$ 5,342,380

F. Carbon Polishing For The Bethpage Water District Wellfields 4, 5 and 6:

Carbon polishing is a remedial process option that is proposed for inclusion in all but the no further action alternative. This option is not discussed in the OU 2 FS. Activated carbon adsorption is a process that effectively removes low levels of VOC contaminants from water. Air stripping units, such as those presently in use at the affected wellfields, are capable of removing the majority of VOC contaminants from highly contaminated water. The air stripping systems typically leave some residual contaminants, even though these are often below detectable levels in the treated water. The activated carbon systems, when used in combination with the air stripping units, are able to remove the trace residual of contaminants from the water prior to distribution to the community. For this reason, This secondary water treatment process is commonly referred to as "carbon polishing." These combined VOC removal systems are very effective and have been used at other contaminated water supply wellfields on Long Island to further reduce public exposure to VOC contaminants in drinking water.

There is ample justification for considering this option. First, it would prevent any potential exposure to site related contaminants between monthly sampling events. Second, the long term O&M costs for this additional protective measure are relatively low.

The estimated costs for carbon polishing for a thirty year period are:

Capital Cost:	$ 475,000
O&M Cost:	$ 22,500

Present Worth: $ 985,000

Alternative 1: No Further Action, A, B, C and D above: This alternative is the baseline alternative to which the other alternatives will be compared. Under this alternative, no additional remedial actions would be incorporated into the existing on-site groundwater IRM which has been installed and is now operating. This alternative would leave the site in its present condition and would not provide any additional protection to human health or the environment than that already provided. Under this alternative, no additional remedial actions would be taken and the existing on-site groundwater IRM which has been installed and is now operating would continue to be operated over the next 30 years.

The IRM system would be modified, however, in order to account for changes that are occurring at the Grumman/Navy facility. Supply wells GP-10, 11, and 16, which are located on or north of the NWIRP-Bethpage site, have been used to supply non-contact cooling water to Plant 5 which is located south of the railroad tracks. The use of these three wells to supply Plant 5 with cooling water will cease in the near future as a result of real estate transactions. In order to maintain hydraulic containment of the groundwater plume(s), production well GP-1 has been included in the ONCT pump and treatment system design. The GP 1 water would be treated at the IRM treatment system located to the north of Plant 2.

As a result of implementing the changes outlined in the previous paragraph, the combined pumpage from the groundwater treatment system would be 4,350 gallons per minute (GPM). The water would be recharged into the recharge basins located adjacent to Plant 1 and to the Southern Recharge Basins.

Capital Cost:	$ 3,670,000
O&M Cost:	$ 1,480,000
Present Worth:	$26,600,000

Alternative 2: A, B, C, D and F above, and HN-24 Area Treatment:
Alternative 2 would add treatment of the HN-24 area on the Navy Plant 3 property. Treatment at the HN-24 area would consist of the use of reactive iron powder injected into the impacted groundwater through a series of injection wells. After injection the reactive iron powder would become immobilized within the soil pore space and begin to react with the contaminants of concern (COCs). However, the concentrations of VOCs in the HN-24 area have dropped significantly as indicated in recent sampling that occurred after the remedies for the groundwater FS were developed. Therefore, the HN-24 area remedy would no longer be expected to significantly reduce the TVOC loading to the ONCT system.

Capital Cost:	$ 5,375,000
O&M Cost:	$ 1,506,000
Present Worth:	$ 28,830,000

Alternative 3: A, B, C, D, E and F above:
Alternative 3 contains the addition of groundwater extraction and treatment system at the GM-38 area. The purpose of the GM-38 groundwater extraction and treatment system would be to accelerate off-site contaminant mass removal and to restore the off-site portion of the impacted aquifer in the vicinity of BWD Supply Wellfields 4, 5 and 6 to RAOs in a shorter time frame than under Alternative 2. The GM-38 area is located

approximately 4,500 feet southeast of the Northrop Grumman south recharge basin area, and is defined by the inferred 1 ppm TVOC contour line drawn around Well GM-38D2.

Capital Cost:	$ 8,535,000
O&M Cost:	$ 1,722,500
Present Worth:	$ 32,945,000

Alternative 4: A, B, C, D, E and F above, with HN-24 Area Treatment:

Alternative 4 is the combination of Alternatives 2 and 3. Alternative 4, is undertaken in an attempt to accelerate on-site contaminant mass removal, and restore groundwater quality in these localized areas to RAOs in a shorter time frame than under Alternative 1.

Capital Cost:	$ 9,765,000
O&M Cost:	$ 1,748,000
Present Worth:	$ 34,172,000

Alternative 5: A, B, C, D and F above, and Off-Site Plume Containment, Treatment, and Discharge to Off-Site Storm Sewers:

Alternative 5 would add six new off-site groundwater extraction wells to achieve containment of the full extent of the off-site portion of the TVOC plume. Alternative 5 would provide mass removal from the entire aquifer through groundwater extraction and treatment, preventing the on-site groundwater plume from migrating south of the Northrop Grumman property and would provide groundwater pumping at the farthest downgradient edge of the plume, to contain the full extent (off-site as well as on-site portions) of the plume. The off-site wells would be installed south of the Northrop Grumman facility and north of Hempstead Turnpike (see Figure 11).

Under Alternative 5, the six new off-site extraction wells (OFCT-1, OFCT-2, OFCT-3, OFCT-4, OFCT-5, and OFCT-6) would be pumped at the following rates: 520 gpm, 675 gpm, 675 gpm, 675 gpm, 570gpm, and 520 gpm, respectively. Each off-site well would require an individual treatment system to remove VOCs from the pumped groundwater. Construction of one central treatment facility, in lieu of six individual systems, would be impractical due to the dense residential development in the area, the substantial distances between proposed off-site extraction well locations, and the large quantity of water to be discharged. The total quantity of water to be pumped from the proposed off-site extraction wells would be 3,635 gpm (equal to 5.2 million gallons per day, or MGD).

Where necessary, monitoring wells will be installed to supplement the existing monitoring well network. The number, location, and depth of wells to be installed will be evaluated during the remedial design phase of the project.

Capital Cost:	$ 21,865,000
O&M Cost:	$ 3,002,000
Present Worth:	$ 63,670,000

Alternative 6: A, B, C, D and F above, Off-Site Plume Containment, Treatment, and Discharge to Off-Site Storm Sewers, and HN-24 Area Treatment:

Alternative 6 contains the elements of Alternative 5 as described above, with the addition of treatment at the HN-24 area, as described above in Alternative 3.

Alternative 6 would provide mass removal from the aquifer through groundwater extraction and treatment, and preventing the on-site groundwater plume from migrating

south of the Northrop Grumman property. Alternative 6 would also provide groundwater pumping at the farthest downgradient edge of the plume, to contain the full extent (both off-site as well as on-site portions) of the plume. Furthermore, Alternative 6 would provide localized groundwater treatment of the HN-24 areas.

Capital Cost:	$ 23,095,000
O&M Cost:	$ 3,102,500
Present Worth:	$ 65,086,000

Alternative 7: A, B, C, D, E and F above, Off-Site Plume Containment, Treatment, and Discharge to Off-Site Storm Sewers:
Alternative 7 contains the elements of Alternative 5 as described above, with the addition of treatment at the GM-38 area, as described in item E and Alternative 3. Under Alternative 7, Well ONCT-6 would be relocated approximately 500 feet to the northwest and at this location serves the dual purpose of being a local extraction well for the GM-38 area and also being part of the off-site containment well system.

Alternative 7 would provide mass removal from the aquifer through groundwater extraction and treatment, and preventing the on-site groundwater plume from migrating south of the Northrop Grumman property. Alterative 7 would also provide groundwater pumping at the farthest down gradient edge of the plume to contain the off-site as well as on-site portions of the plume. In addition, Alternative 7 would provide treatment of the GM-38 area.

Capital Cost:	$ 26,255,000
O&M Cost:	$ 3,222,500
Present Worth:	$ 69,010,000

Alternative 8: A, B, C, D, E and F above, Off-Site Plume Containment, Treatment, and Discharge to Off-Site Storm Sewers and HN-24 Area Treatment:
Alternative 8 is the combination of Alternatives 6 and 7. This alternative includes all of the remedial process options discussed above.

Capital Cost:	$ 27,485,000
O&M Cost:	$ 3,322,500
Present Worth:	$ 69,188,000

7.2 Evaluation of Remedial Alternatives

The criteria used to compare the potential remedial alternatives are defined in the regulation that directs the remediation of inactive hazardous waste sites in New York State (6 NYCRR Part 375). For each of the criteria, a brief description is provided, followed by an evaluation of the alternatives against that criterion. A detailed discussion of the evaluation criteria and comparative analysis is included in the Feasibility Study.

The first two evaluation criteria are termed threshold criteria and must be satisfied in order for an alternative to be considered for selection.

1. **Compliance with New York State Standards, Criteria, and Guidance (SCGs).** Compliance with SCGs addresses whether or not a remedy will meet applicable environmental laws, regulations, standards, and guidance.

The most significant SCGs for this PRAP are the New York State Water Quality Regulations. This includes Title 10, New York Codes Rules and Regulations (10 NYCRR) Part 5 Drinking Water Standards

and 6 NYCRR Part 700 Groundwater Standards. 6 NYCRR Part 200 Air Quality Regulations are relevant to the air discharges from each groundwater treatment system.

Alternatives 1, 2, 3 and 4 would be compliant with SCGs for the portion of the groundwater plume addressed by each alternative. Alternatives 5, 6, 7 and 8 would be compliant with SCGs for the entire groundwater plume. The groundwater treatment systems would be designed to be compliant with the NYSDEC Part 200 Air Quality Regulations.

The applicable SCGs for the drinking water are the State's maximum contaminant levels, or MCLs, as specified in Part 5 of the NYS Sanitary Code. These standards are currently being met for treated water at each of the affected public supply well fields in the area. GM-38 area offsite remedy was added to the feasibility study in order to evaluate the reduction of future contaminant loading to the BWD well fields. Carbon polishing is considered as a measure to prevent exposures between sampling periods and to remove any concentration of site related contaminants from the water supply.

The treatment systems for the IRM wells were not designed to treat vinyl chloride and may need to be modified if the vinyl chloride concentrations in the air discharge exceeds state air discharge guidelines. The raw and treated groundwater at the ONCT system, as well as the effluent air stream, would need to be monitored for vinyl chloride. If necessary, a vinyl chloride treatment component would be incorporated into existing treatment system.

The 5 ppb groundwater standard for principle organic contaminants would not be met with respect to full plume interception for alternatives 1 through 4, although natural attenuation should reduce site related contaminant concentrations to below 5 ppb over time.

2. <u>Protection of Human Health and the Environment</u>. This criterion is an overall evaluation of each alternative's ability to protect public health and the environment.

The contaminant-specific SCGs are currently being met with respect to treated water at the municipal water supplies (specifically the BWD). This is being accomplished via VOC-removal treatment systems that are operating at the wellheads. The addition of carbon polishing would ensure that the treatment is as close 100 percent effective as possible.

The plume(s) would be contained along the southern boundary of the Grumman site under each alternative based upon the computer modeling work that was conducted as part of the Feasibility Study. By containing the portion of the plume(s) that are on-site, the future contaminant load to the downgradient public water supplies would be reduced.

It is anticipated that the pump-and-treat programs for the ONCT system that are incorporated into each of the eight remedial alternatives under consideration here would need to be operated for 30 years or more. At that point there would be residual contamination remaining in the aquifers. The amount of remaining contamination, however, would be incrementally less as additional remedies are implemented under the various alternatives.

While there are presently no known exposures to site-related VOCs via the BWD public water supply, the risk of exposure remains in the event that current engineering controls fail. If the treatment systems at the public supply wells fail, VOC contaminants could be distributed through the public water supply. Such failure would be detected within one month's time through the routine monitoring system presently in place. If the monitoring systems were also to fail, the exposure durations could be longer. If contamination reaches wells not previously contaminated and without VOC treatment, some exposures could also occur via the public water supplies. Although these potential exposures are not expected to pose a health concern, such incremental exposures would result in increased risk, however slight.

For this reason, additional groundwater remedies that decrease mass loading of contaminant to public water supply wells offer an additional margin of protection. These remedies decrease, over the long-term, the potential impacts if existing or planned control systems fail in the future.

As contaminant mass loading decreases, the relative importance of reliance upon the wellhead controls and of vigilance in their maintenance also diminishes.

Deep groundwater at the GM-38 well area has been identified as an off-site "hotspot" because concentrations of TVOCs exceed 1,000 ppb (equal to 1 ppm) at that location. The GM-38 well area off-site remedy was evaluated in the OU2 FS for 15 years of operation. As a hotspot remedy, 15 years would be a conservative estimate for length of operation. Based on preliminary modeling results, five years of operation may suffice for rapid, contaminant-mass reduction. The main objective of the GM-38 well area remedy would be additional protection of human health by reducing the future elevated mass contaminant load to the downgradient public water supplies. The remedy would also enhance the long-term natural process of aquifer restoration.

There could be incremental potentials for exposure to VOCs in air posed to downwind populations due to emissions from each additional groundwater treatment plant installed under the eight alternatives. Air pollution and monitoring controls would be implemented as necessary to ensure that the air emissions from these treatment facilities are within the criteria set by the regulatory agencies. Additional engineering controls could be used to further reduce the potential of exposure.

There is a potential for exposure to VOCs in air if the vinyl chloride plume(s) is captured in the ONCT extraction wells. The treatment systems for these wells were not designed to treat vinyl chloride and could result in air effluent concentrations of vinyl chloride that exceed state air discharge guidelines. This potential exposure pathway would be minimized by implementing the vinyl chloride contingency plan.

The next five "primary balancing criteria" are used to compare the positive and negative aspects of each of the remedial strategies.

3. **Short-term Effectiveness.** The potential short-term adverse impacts of the remedial action upon the community, the workers, and the

environment during the construction and/or implementation are evaluated. The length of time needed to achieve the remedial objectives is also estimated and compared against the other alternatives.

There could be short-term impacts to the community if Alternatives 2 through 4 were implemented. The impacts could be dust emissions, VOC emissions and noise during construction activities. Engineering controls would be employed to minimize these impacts.

No short-term impacts to the community or the environment would be expected to occur as the result of implementing Alternative 1. The HN24 area remedy short term impacts would be negligible as the Navy property is now vacant.

The GM38 area remedy would have slightly higher short term impacts. This groundwater extraction and treatment system would be located closer to residential areas. Potential impacts would be addressed under the site specific community health and safety plan through emission control technologies.

For alternatives 5 through 8, the short term impacts would be much greater than alternatives 1 through 4. The offsite containment (OFCT) system would, in most if not all the locations, be placed on or near residential properties, streets and neighborhoods. In addition, it is envisioned that each OFCT location would require its own treatment system.

4. **Long-term Effectiveness and Permanence.** This criterion evaluates the long-term effectiveness of the remedial alternatives after implementation. If wastes or treated residuals remain on site after the selected remedy has been implemented, the following items are evaluated: 1) the magnitude of the remaining risks, 2) the adequacy of the controls intended to limit the risk, and 3) the reliability of these controls.

The sources of the groundwater contamination are being addressed as operable units for the Northrop Grumman-Bethpage Facility, NWIRP-Bethpage, and the RUCO Inactive Hazardous Waste Disposal Sites. The long-term effectiveness of each of the source area remedial actions was addressed in the RODs previously issued to date for these sites.

The time required to remediate the aquifer system is a function of the quantity and location of groundwater that is pumped and treated. It is projected that it would take more than 30 years to remediate the aquifer system onsite for all eight of the alternatives. However, the ONCT system would prevent any further migration of onsite contamination into the Bethpage regional aquifer.

The OFCT Containment pump-and-treat system that is incorporated into alternatives 5 through 8 would likely be operated for 30 years or longer. Based on the groundwater modeling, after 30 years of operation, residual contamination would likely exist onsite at concentrations slightly greater than the current drinking water standards.

The GM 38 area remedy is a hot spot remedy that was evaluated in the FS for 15 years. Based on the hydraulic groundwater modeling done for this site (see figure 10), it appears that a five year period of operation is more

realistic to achieve remedial action objectives (RAOs). Therefore, this PRAP reflects a five year operation period for the GM 38 area remedy. The long term effectiveness for this remedy would be to reduce the contamination loading to the BWD public supply wells on a permanent basis. Performance results from the ONCT IRM already demonstrate that TVOC concentrations in groundwater immediately down gradient from the ONCT system are diminishing. The GM 38 area remedy would enhance this permanent restoration of the natural resource.

The carbon polishing option would enhance the long term effectiveness of the public supply wellhead treatment currently in place to address the Northrop Grumman/Navy contamination. These controls are considered to be reliable and would add to the long term effectiveness and permanence of the remedy.

5. **Reduction of Toxicity, Mobility or Volume.** Preference is given to alternatives that permanently and significantly reduce the toxicity, mobility or volume of the wastes at the site.

Reduction of toxicity, mobility, and volume for the onsite groundwater contamination would be realized by the ONCT groundwater extraction and treatment system for all eight alternatives. These reductions would be achieved as a result of the extraction (reduction of mobility and volume) and treatment (reduction of toxicity) components which are incorporated into the ONCT system.

The greatest reductions in toxicity, mobility and volume would be realized under Alternatives 5 through 8 with the OFCT system. Alternative 8 has the highest reduction in mobility with the HN 24 area treatment, GM 38 area remedy and the ONCT and OFCT systems. Alternative 1 has the least reduction in toxicity, mobility and volume because it targets the on-site contamination only via the ONCT system.

6. **Implementability.** The technical and administrative feasibility of implementing each alternative are evaluated. Technical feasibility includes the difficulties associated with the construction and the ability to monitor the effectiveness of the remedy. For administrative feasibility, the availability of the necessary personnel and material is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, etc.

The HN 24 remedy of alternatives 2, 4, 6 and 8 would be fairly easy to implement technically and administratively. There are several vendors who could supply the treatment technologies which are incorporated into these alternatives. Alternatives 2, 3 and 4 are readily implementable with respect to the GM38 area remedy that would be located near an existing Nassau County recharge basin in an open space area. However, easements would have to be obtained from the municipal and private parties that own the property. Alternative 1 is already in place and therefore is the most easily implementable.

Alternatives 5, 6, 7 and 8 would be substantially more difficult to implement administratively with respect to the OFCT system. Private property would have to be purchased or accessed and potentially, zoning

changes would be required in order to construct the off-site extraction wells and treatment plants. The permit-related tasks would be difficult to implement. In addition construction of one central treatment facility, in lieu of six individual systems, would be impractical due to the dense residential development in the area, the substantial distances between proposed off-site extraction well locations, and the large quantity of water to be discharged.

7. **Cost.** Capital and operation and maintenance costs are estimated for each alternative and compared on a present worth basis. Although cost is the last balancing criterion evaluated, where two or more alternatives have met the requirements of the remaining criteria, cost effectiveness can be used as the basis for the final decision. The costs for each alternative are presented in Table 2.

This final criterion is considered a modifying criterion and is taken into account after evaluating those above. It is evaluated after public comments on the PRAP have been received.

8. **Community Acceptance** - Concerns of the community regarding the RI/FS reports and the PRAP are evaluated. A "Responsiveness Summary" will be prepared that describes public comments received and the manner in which the Department will address the concerns raised. If the selected remedy differs significantly from the proposed remedy, notices to the public will be issued describing the differences and reasons for the changes.

Members of the community at large have already expressed some of their concerns at the Remedial Advisory Board (RAB) meetings sponsored by the Department of the Navy. A major issue raised concerns the presence of any Northrop Grumman/Navy contamination in the BWD Drinking water supply, even if it is below drinking water standards or detectable levels. This sentiment has also been expressed of the BWD. The inclusion of the carbon polishing option in this PRAP is intended to be responsive to this concern.

SECTION 8: SUMMARY OF THE PROPOSED REMEDY

Based upon the results of the RI/FS, the evaluation presented in section 7 and the reasons presented below, the NYSDEC is proposing Alternative 3, as described in detail in the Northrop Grumman OU 2 FS and as modified in section 7.1 of this PRAP. The selected remedy, Alternative 3, contains on-site plume containment, treatment, and discharge to on-site recharge basins via the on-going IRM, the off-site GM-38 area groundwater extraction and treatment system, the operation and maintenance of air strippers for BWD wellfields 4, 5 and 6, activated carbon polishing, preparation of a wellhead treatment contingency plan for public supply wells not currently affected but that may become affected by site-related VOCs in the future and a vinyl chloride treatment contingency plan, long-term groundwater monitoring including monitored natural attenuation and long-term operation and maintenance of all operating treatment systems onsite and off-site .

This selection is based on the evaluation of the eight alternatives developed for this site and the alternatives ability to meet standards,

criteria and guidance for the containment portion of the groundwater plume remedy, to prevent of exposure to site related contaminants in the groundwater, and actively restore a natural resource (sole source aquifer) and to prevent further deterioration of down gradient groundwater conditions. Alternative 3 was also chosen based on the fact that it is not economically or technically feasible to contain and treat all the contaminated groundwater that has migrated from the Northrop Grumman and NWIRP Site with concentrations greater than the New York State Drinking Water Standard of 5 ppb for VOC concentrations greater than the respective groundwater quality standards.

The probability of impacts to additional public water supply wells is low. These wells would be protected by a long term monitoring program that includes sampling of wells upgradient of the public water supply wells and by a contingency to provide wellhead treatment, if necessary. The preference to permanently and significantly reduce the toxicity, mobility or volume of VOCs in groundwater is satisfied in that this remedy will attempt to reduce the mass of VOCs in the groundwater by recovering, treating and discharging groundwater contaminated by the Northrop Grumman and NWIRP Site plume(s). The remedial goal to provide for attainment of the 5 ppb groundwater standard will be met in the treated aquifer segment, to the extent practicable.

Part of the remedy may address contamination that has not been conclusively attributable to Northrop Grumman and or the NWIRP; for example, the RUCO Site. As more data becomes available, other PRPs may be identified. The USEPA is concluding the RI/FS process to select a groundwater remedy for the RUCO Site that would address the additional VOC loading, including vinyl chloride, to the Bethpage regional aquifer.

The estimated present worth cost to implement the remedy proposed in this PRAP is $32,900,000. The cost to construct the remedy is estimated to be $ 8,535,000 and the estimated average annual operation and maintenance cost for 30 years is $1,722,500.

The elements of the proposed remedy are as follows:

1. A remedial design program to verify the components of the conceptual design and provide the details necessary for the construction, operation and maintenance, and monitoring of the remedial program. Any uncertainties identified during the RI/FS would be resolved.

   Since the remedy results in untreated hazardous waste remaining at the site, a long term monitoring program, including monitored natural attenuation (MNA), would be instituted. This monitoring would verify the effectiveness of the ONCT groundwater extraction and treatment system, monitor the levels of select inorganics and volatile organic compound contaminants in the groundwater upgradient of the ONCT system, monitor the effectiveness of the offsite component of this remedy and the wellhead treatment systems, and track the offsite plume beyond the BWD municipal wells. This would allow the effectiveness of this remedy to be monitored and would be a component of the operation,

maintenance and monitoring (OM&M) program for the site.

2. Groundwater extraction via the Onsite Containment (ONCT) system to address the onsite TVOC groundwater contamination emanating from the former and current onsite source areas. This system must be sufficient to intercept the width and depth of the entire TVOC plume migrating from the Northrop Grumman Site.

3. A limited predesign investigation to determine the optimum location for the GM38 area groundwater extraction well(s). This predesign investigation would derive the data necessary to determine the screen zone of the extraction well(s). In addition, the number of extraction wells would be substantiated and the potential need to cluster these wells would be determined.

4. a. The installation of at least one groundwater extraction well, or comparable remedial technology, at the approximate location of the GM38 area, depicted on Figure 8, pumping a minimum of 250 gpm, or a comparable remedial technology; with all necessary piping to install the wells and properly run the discharge to the groundwater treatment systems.

   b. Utilize an existing storm water collection and groundwater recharge system. If one is not available, then a suitable method of system discharge and groundwater recharge would be developed.

5. The installation of the necessary air stripping systems or comparable remedial technology designed to remove VOCs from all the extracted groundwater to meet the State Pollutant Discharge Elimination System (SPDES) discharge limitations.

6. The installation of air emission controls, if required, to comply with the NYSDEC and any other applicable air regulations.

7. The long-term operation, maintenance and monitoring (OM&M) of the ONCT and GM-38 area extraction well(s). Monitoring would include the installation and use of upgradient and downgradient groundwater shallow, intermediate, deep and very deep monitoring wells. Testing would be done, at a minimum, on a quarterly basis unless otherwise approved by the NYSDEC, to verify the system performance. Additionally, monitoring of groundwater elevations would be done, initially on a quarterly basis (unless otherwise approved by the NYSDEC) to determine the groundwater capture zone in different seasons, and annually thereafter.

8. The installation and/or quarterly monitoring for VOCs of outpost monitoring wells installed with respect to potentially affected public and private supply wells, including BWD wellfields 4, 5 and 6. The remedial design would evaluate and determine the best locations for any additional outpost wells required for this program.

9. A Wellhead treatment contingency plan for the design, construction, operation and maintenance of wellhead treatment systems, if necessary. It is not envisioned that Site contamination would affect any additional public supply wells within the next 30 years, if ever. However, if the evaluation of the long term monitoring indicates that a public supply well has been or is in imminent danger of being affected with Northrop Grumman/NWIRP site related contaminants, treatment at the public supply well(s) would be necessary. A treatment system to produce potable water would be designed and constructed. Alternatively, if Northrop Grumman/NWIRP reaches a cash settlement with an affected Water District, then each settling District would be responsible for its respective monitoring and implementation of, as necessary, wellhead treatment. Operation and maintenance of all public supply well treatment systems would be assumed to operate, at a minimum, for the required Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) 30 year time frame.

10. Carbon polishing would be added to the existing VOC removal systems at BWD Wellfields 4, 5 and 6 to ~~comply~~ insure compliance with 10 NYCRR Part 5 drinking water standards. The reduction in cost for operating the GM38 area remedy for 5 years in lieu of 15 years would be $950,000. This represents over $1,200,000 reduction from the estimated GM 38 area remedy cost presented in the OU2 FS. In addition, adding carbon polishing would insure the removal of site-related VOCs from potable water entering the BWD supply system. Any future public supply wells that would require wellhead treatment would also require carbon polishing.

11. Any detection of 1 ppb or more of Northrop Grumman/NWIRP site related contamination in the outpost or long term monitoring wells upgradient of a public supply well would "trigger" Northrop Grumman or the Department of the Navy to evaluate the rate of movement of the Northrop Grumman/NWIRP contaminants towards the public supply wells. If VOC concentrations in the outpost well(s) come close to or exceed the respective standards, a minimum of one and a maximum of three confirmatory samples would be collected within 30 days and the results evaluated by the NYSDEC and the State and County Health Departments. If the NYSDEC's and the Health Departments' evaluation indicates that treatment is necessary, the design phase of the water treatment system(s) would begin.

12. The BWD public supply wells and any other supply wells determined to be at risk based on the long term OM&M, would be sampled on a monthly basis for total volatile organic compounds.

13. A performance evaluation conducted at least once a year to determine whether the remedial goals have been

or can be achieved, and whether the monitoring should continue.

14. The provision of public water to residential or commercial structures that have private drinking water wells determined to be affected or potentially affected by the offsite migration of the Northrop Grumman and NWIRP groundwater plume(s).

15. A plan to properly close all monitoring wells associated with the Northrop Grumman and NWIRP at such time that the wells are no loner necessary.

Table 1
Nature and Extent of Contamination

MEDIUM	CATEGORY	CONTAMINANT OF CONCERN	CONCENTRATION RANGE (ppb)	FREQUENCY of EXCEEDING SCGs	SCGs (ppb)
Groundwater (On-Site Monitoring and production Wells)	Volatile Organic Compounds (VOCs)	Perchloroethene	ND-3,600	39/121	5
		Trichloroethene	ND-58,000	55/121	5
		1,1-Dichloroethene	0.38-620	11/121	5
		1,2-Dichloroethene	ND-3,850	21/121	5
		Vinyl Chloride	ND-6,4000	11/121	2
		1,1-Dichloroethane	ND-880	8/121	5
		1,1,1-Trichloroethane	ND-10,000	21/121	5
Groundwater (On-Site Monitoring and production Wells)	Inorganic Analytes (Metals)	arsenic	ND(1)-68	7/82	25
		barium	ND(2)-164	0/82	1,000
		cadmium	ND(1)-130	3/82	10
		chromium	ND(1)-160	4/82	50
		lead	ND(1)-7.2	0/82	25
		mercury	ND(0.2)-1.2	0/82	2
		selenium	ND(1)-4	0/82	10
		silver	ND(1)-6	0/82	50
Groundwater Outpost Monitoring Wells for the BWD September 1997		Perchloroethene	ND(0.5)-10	1/9	5
		Trichloroethene	ND(1)-1,300	5/9	5
		1,1-Dichloroethene	ND(0.5)-5.1	1/9	5
		1,2-Dichoroethene	ND(0.5)-1	0/9	5
		Vinyl Chloride	ND(0.5)-1	0/9	2
		1,1-Dichloroethane	ND(0.5)-12	1/9	5
		1,1,1-Trichloroethane	ND(.5)-7	1/9	5

MEDIUM	CATEGORY	CONTAMINANT OF CONCERN	CONCENTRATION RANGE (ppb)	FREQUENCY of EXCEEDING SCGs/Background	SCG/ Bkgd. (ppb)
Groundwater Long Term Monitoring Data 1997-Present		Trichloroethene	ND-15,000	25/106	5
		Tetrachloroethene	ND-44	11/106	5
		1,1-Dichloroethene	ND–39	3/106	5
		1,2-Dichoroethene	ND-6	3/106	5
		Vinyl Chloride	ND-2,000	3/106	2
		1,1-Dichloroethane	ND-10	3/106	5

Table 2
Remedial Alternative Costs

Remedial Alternative	Capital Cost	Annual O&M	Total Present Worth
1. Alternative 1:	$3,670,000	$1,480,000	$26,600,000
2. Alternative 2:	$5,375,000	$1,506,000	$28,830,000
3. Alternative 3:	$8,535,000	$1,722,500	$32,945,000
4. Alternative 4:	$9,765,000	$1,748,000	$34,172,000
5. Alternative 5:	$21,865,000	$3,002,500	$63,670,000
6. Alternative 6:	$23,095,000	$3,102,500	$65,086,000
7. Alternative 7:	$26,255,000	$3,222,500	$69,010,000
8. Alternative 8:	$27,485,000	$3,322,500	$69,198,000

GLOSSARY OF TERMS

ARAR: Applicable or relevant and appropriate requirement.

BWD: Bethpage Water District.

Capital Cost: Refers to the up front cost of constructing a remedial alternative.

CERCLA: Comprehensive Environmental Response, and Comprehensive Liability Act (USEPA).

Chromium: An inorganic element used in various manufacturing processes.

DCE: Dichloroethene.

ECL: Environmental Conservation Law.

FS: Feasibility study.

Groundwater Contours: Equipotential lines of groundwater elevation above mean sea level.

Glacial: Refers the Glacial or shallow aquifer associated with Long Island.

IRM: Initial Remedial Measure.

Magothy: Refers to the section of the Long Island aquifer below the Glacial and above the Lloyd.

MPS: The Main Plant Site, or the former Fairchild Republic Aircraft manufacturing facility.

MCLs: Maximum contaminant levels.

MGD: Million gallons per day, refers to daily rate of pumping groundwater.

MNA: Monitored natural attenuation.

NASA: National Aeronautics and Space Administration

ND: Non-detect or below the detection limit of the analytical equipment.

NWIRP: Naval weapons Industrial Reserve Plant.

NYCRR: New York State Codes, Rules and Regulations.

NYSDEC: New York State Department of Environmental Conservation.

NYSDOH: New York State Department of Health.

OFCT: Offsite containment system.

ONCT: Onsite containment system.

O,M&M: Refers to operation, maintenance and monitoring, of remedial alternatives.

OU: Operable unit. Refers to portion of the remedial program that have been divided into sections.

PCB: Poly-chlorinated Bi-phenyl.

PCE: (Perchloroethylene or tetrachloroethlyne) A chlorinated, aliphatic organic solvent

Plume: Contaminant dispersion in the groundwater.

POTW: Publicly owned treatment works or sewage treatment plant

PPB: Part per billion. For water samples also termed micrograms per liter (ug/l) and for soil samples termed micrograms per kilogram (ug/kg).

PPM: Part per million. For water samples also termed milligrams per liter (mg/l) and for soil samples termed milligrams per kilogram (mg/kg).

PPMV: Part per million volume, used for air samples.

PRAP: Proposed Remedial Action Plan. This is a document listing the remedy(s) proposed to mitigate the threat of hazardous waste disposal to human health and the environment.

PRP: Potential Responsible Party.

RCRA: Resource Conservation and Recovery Act.

RI/FS: Remedial Investigation an Feasibility Study.

RAOs: Remedial Action Objectives, or the goals established to remedy a site based on findings of the RI (CERCLA).

RUCO: Rubber Corporation of America.

SCGs: Standards, Criteria and guidance.

SVOCs: Semi-volatile organic compounds. Semivolatile Compounds- compounds amenable to analysis by extraction of the sample with an organic solvent. Used synonymously with

Base/Neutral/Acid (BNA) compounds. Also, organic compounds with boiling points above 150 degrees Celsius.

TAGM: Technical Assistance and Guidance Memorandum. These guidance documents are used by the NYSDEC.

TCA: (Trichloroethane) A chlorinated aliphatic organic solvent.

TCLP: Toxicity Characteristic Leaching Procedure, is one test used to determine if hazardous waste is present.

TCE: (Trichloroethylene) A chlorinated, aliphatic organic solvent.

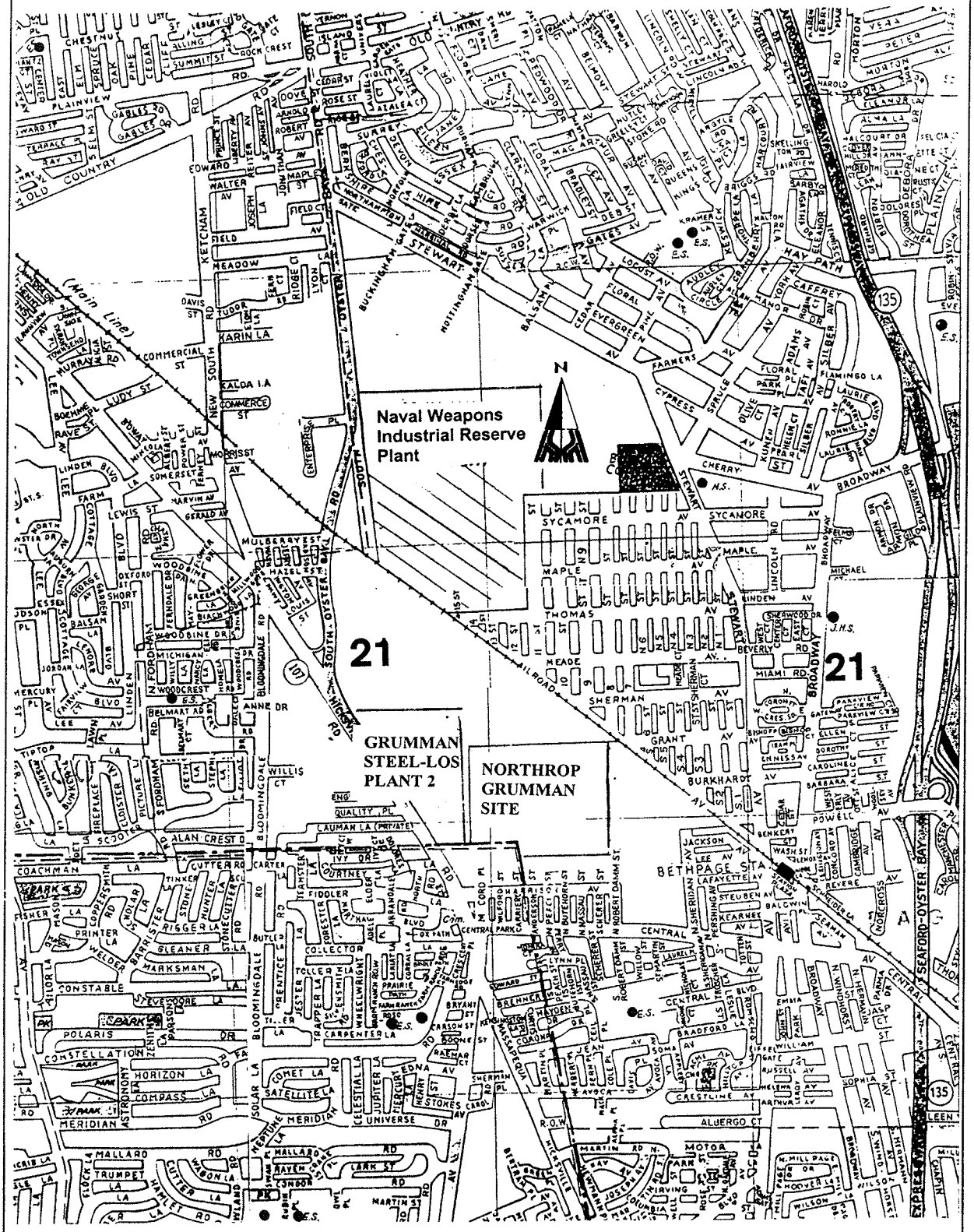
ug/l: Micrograms per liter. See also PPB.

UIC: Underground Injection Control Program.

UST: Underground Storage Tank.

VCM: Vinyl chloride monomer.

VOC: Volatile organic compound. Amenable to identification by gas chromatography analysis. Also, an organic compound that is readily vaporizable at a relatively low temperature.



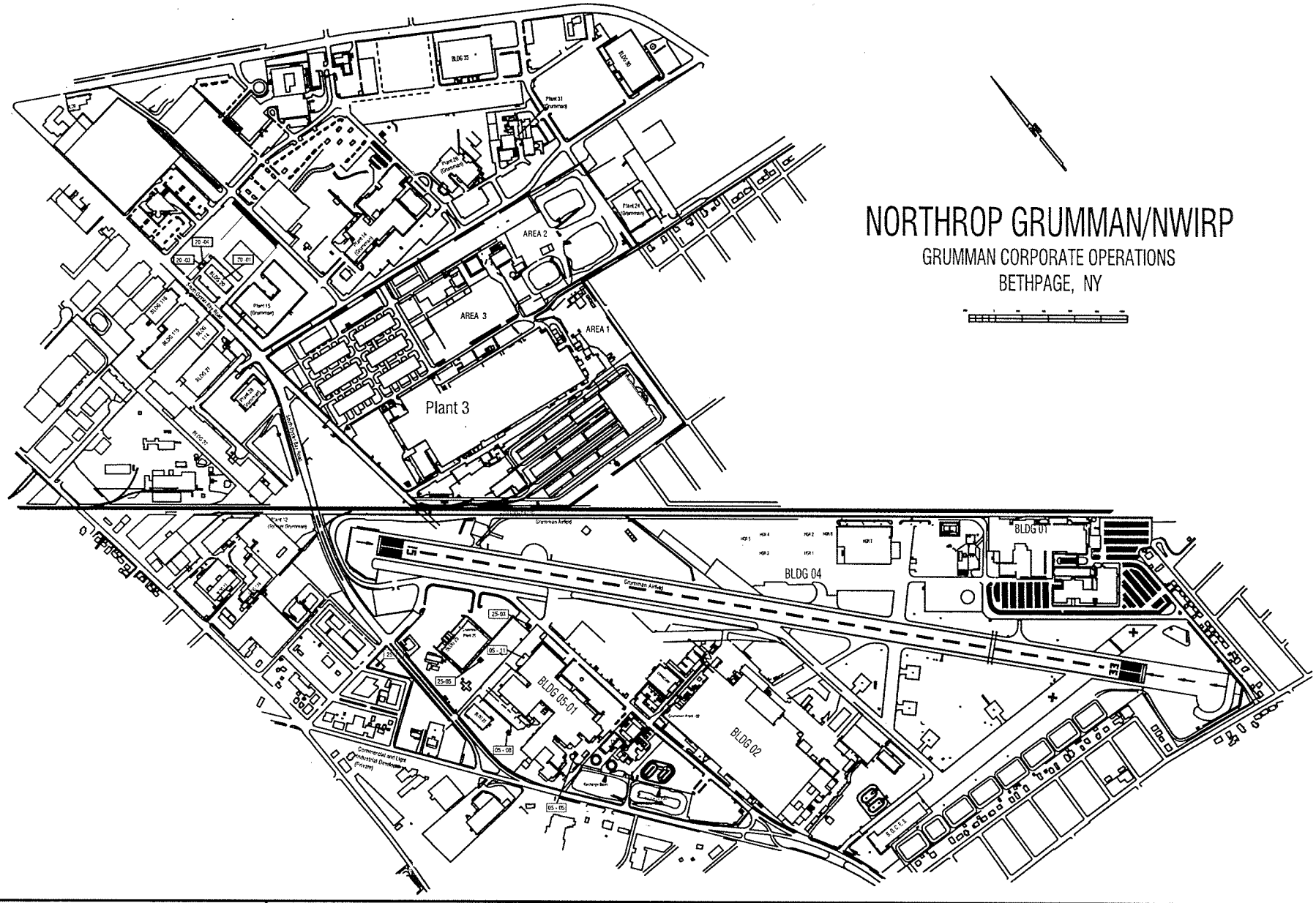
Northrop Grumman

Figure 1– Area Location Map

DIVISION OF ENVIRONMENTAL REMEDIATION

REVISED: DATE: 03/21/00	DRAWING:

Town of Oyster Bay, Site No.s 1–30–003A, B and C

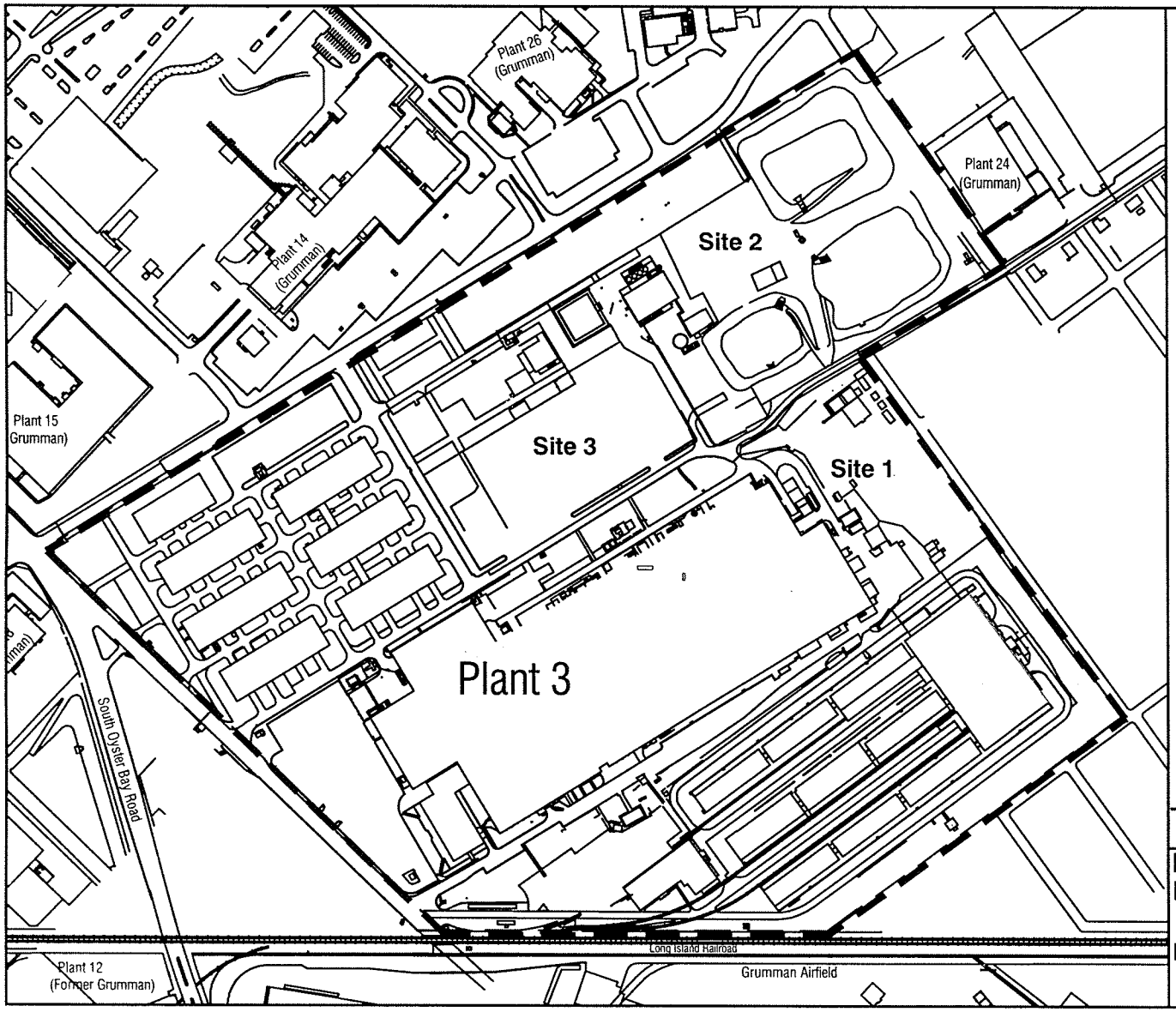


NORTHROP GRUMMAN/NWIRP SITE
BETHPAGE, NASSAU COUNTY, NEW YORK

GENERAL SITE LOCATION

FIGURE 2

Figure 3



Legend

Navy 105 Acre
Parcel Boundary

N

0 100 200 300 400

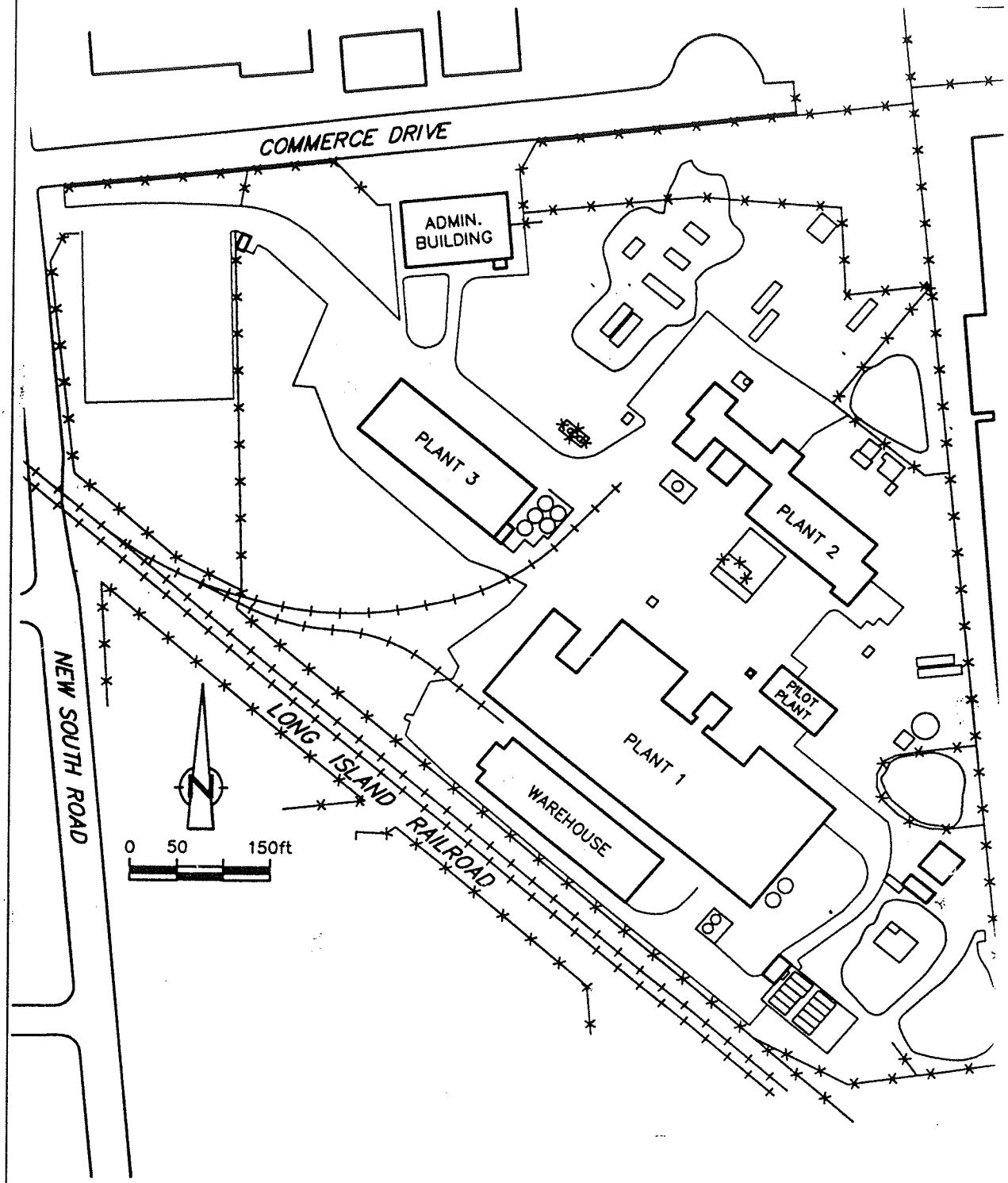
SCALE IN FEET

April, 2000	From TetraTech NUS Base Map Modified by: Steven M. Scharf, P.E.

Naval Weapons Industrial Reserve Plant
NWIRP Bethpage
(NWIRP.DWG)
For Estimating Purposes Only, Not To Scale

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

MAIN105.DWG



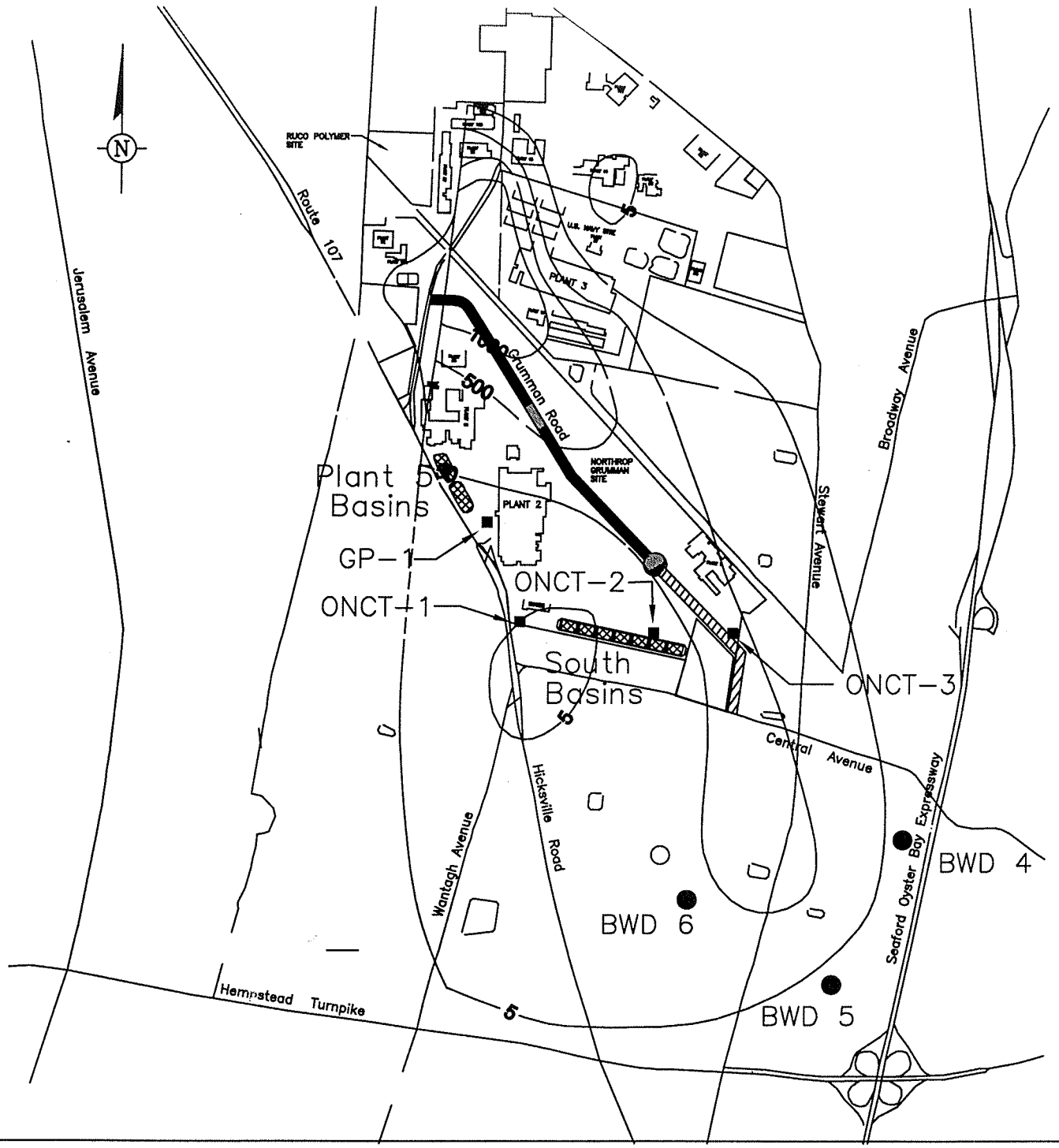
OXY Hooker Ruco Site
Figure 4

DIVISION OF ENVIRONMENTAL REMEDIATION

REVISED:
DATE: 04/25/00

DRAWING:

Town of Oyster Bay, Site No.s 1-30-004



LEGEND:

ONCT-1 ■ WELL LOCATION AND DESIGNATION

5 LINE OF EQUAL TOTAL VOLATILE ORGANIC COMPOUND CONCENTRATION IN PARTS PER BILLION

— — REPRESENTS MODIFIED WESTERN EXTENT OF TVOC PLUME AS REQUESTED BY NYSDEC BASED UPON HISTORIC DISCHARGE OF NON-CONTACT COOLING WATER TO PLANT 12 BASINS

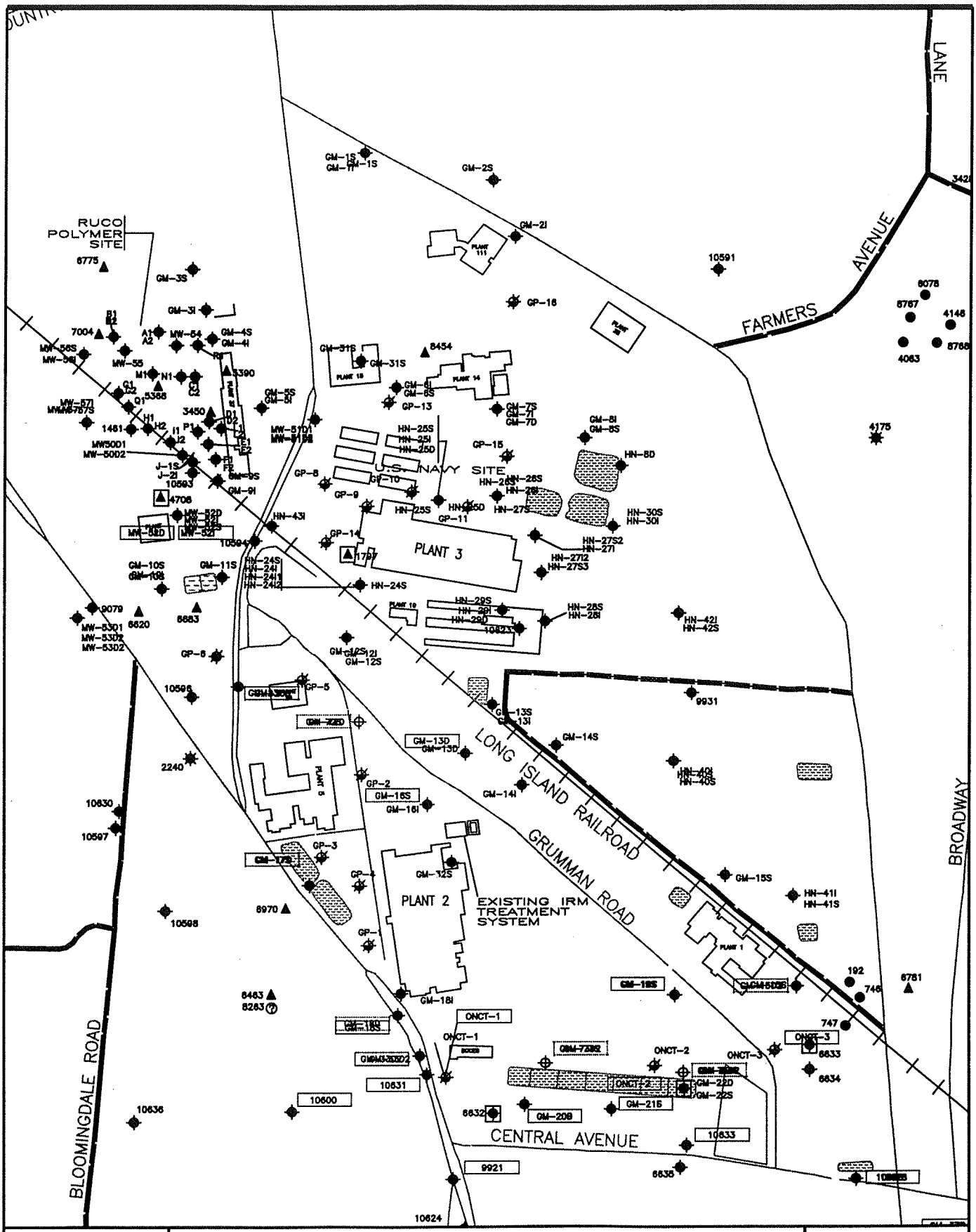
— — — APPROXIMATE WESTERN EXTENT OF TVOC PLUME

0 2000 FT

Modified by:
Steven M. Scharf, P.E.
From Original Map prepared
Arcadis Geraghty and Miller

INITIAL CONTOURED CONCENTRATIONS
OF TOTAL VOLATILE ORGANIC COMPOUNDS
IN MODEL LAYER 4

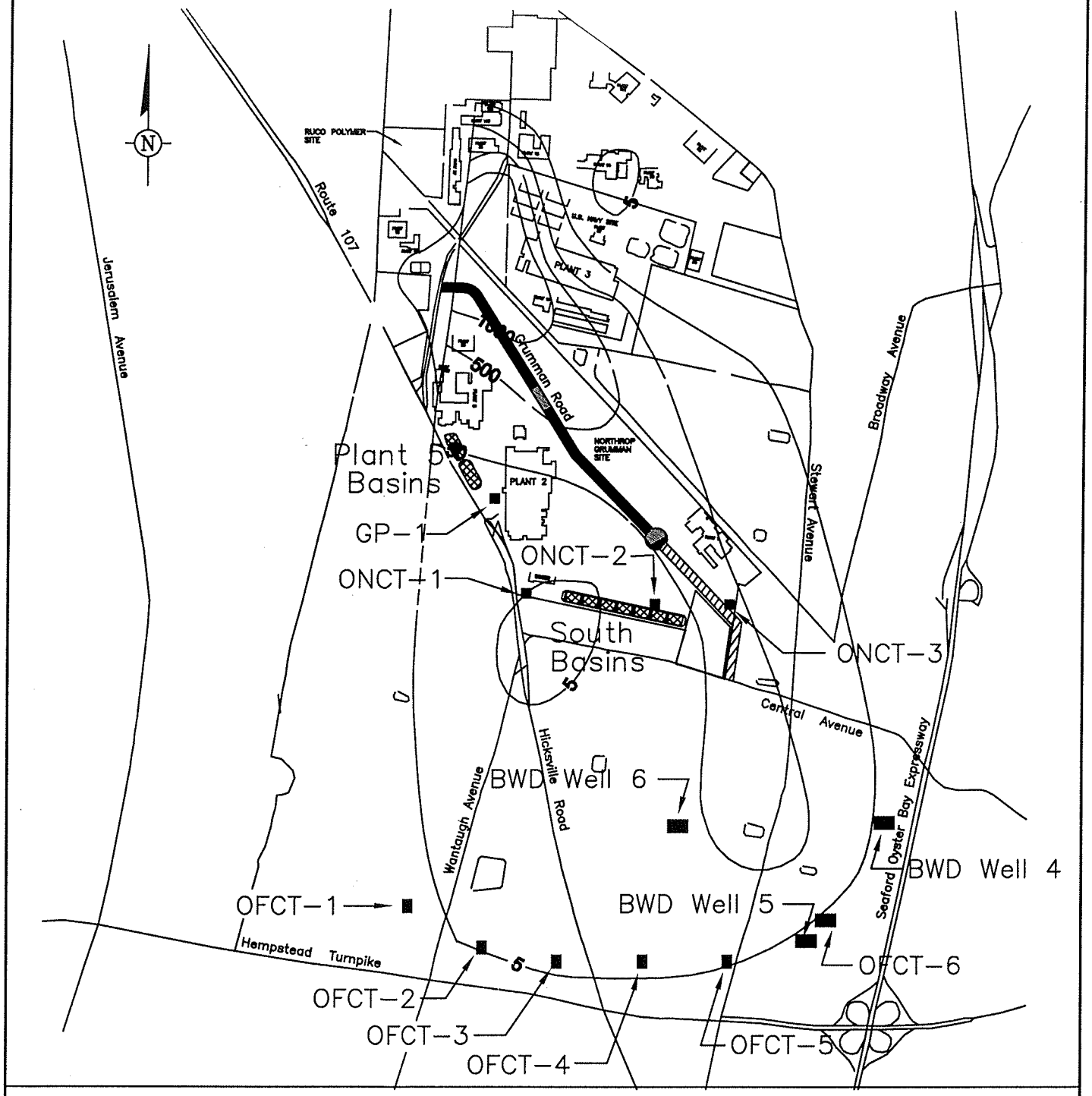
Figure 5



NORTHROP GRUMMAN/ NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK

SITE MONITORING WELL LOCATIONS

FIGURE 6



LEGEND:

OFCT-1 ■ WELL LOCATION AND DESIGNATION

5 LINE OF EQUAL TOTAL VOLATILE ORGANIC COMPOUND CONCENTRATION IN PARTS PER BILLION

– – – APPROXIMATE WESTERN EXTENT OF TVOC PLUME

– – REPRESENTS MODIFIED WESTERN EXTENT OF TVOC PLUME AS REQUESTED BY NYSDEC BASED UPON HISTORIC DISCHARGE OF NON-CONTACT COOLING WATER TO PLANT 12 BASINS

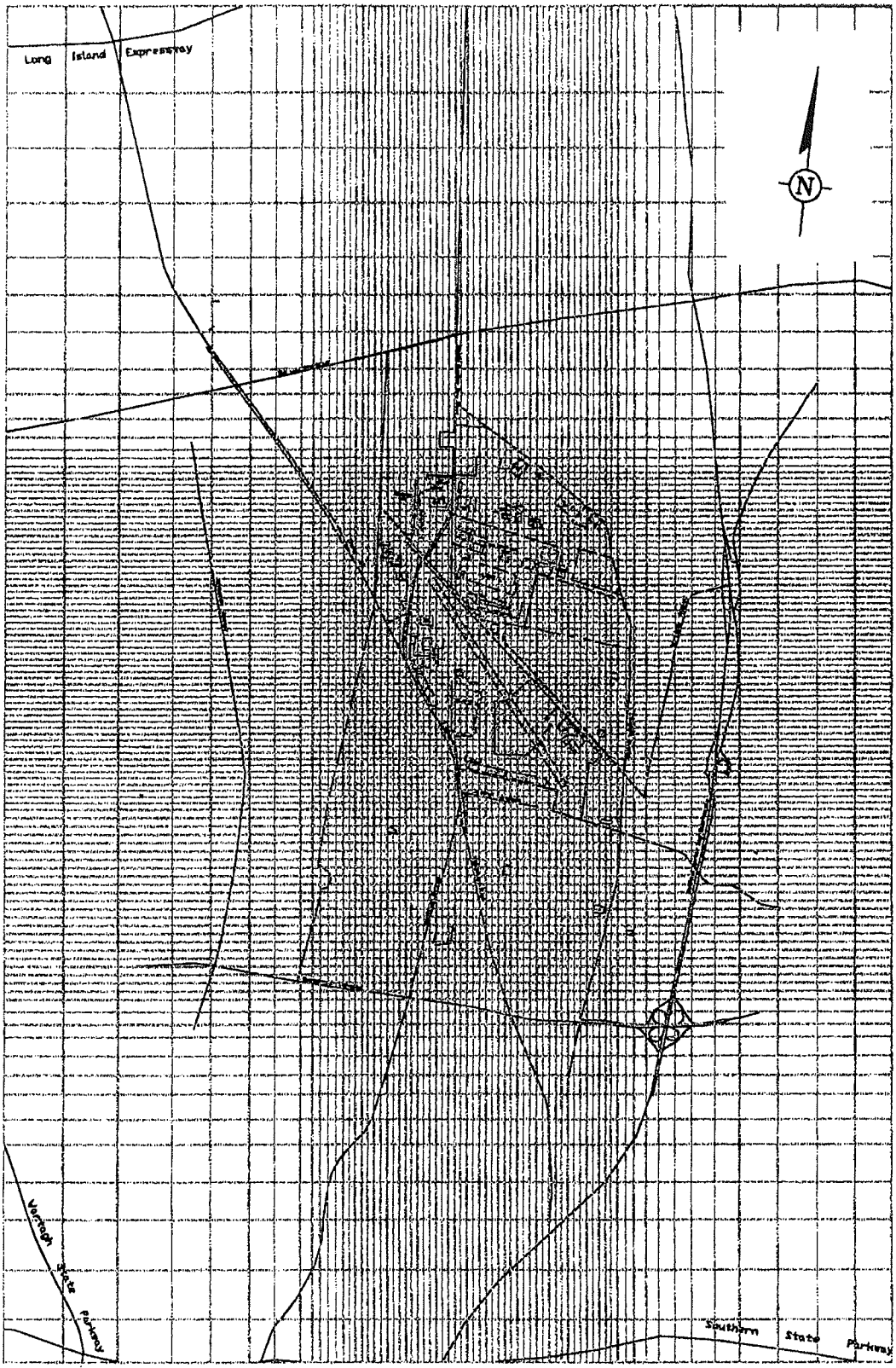
figure7.dwg

0 2000 FT

Modified by:
Steven M. Scharf, P.E.
From Original Map prepared
Arcadis Geraghty and Miller

NORTHROP GRUMMAN FEASIBILITY STUDY
VARIOUS EXTRACTION WELL LOCATIONS

Figure 7



0 4000 FT

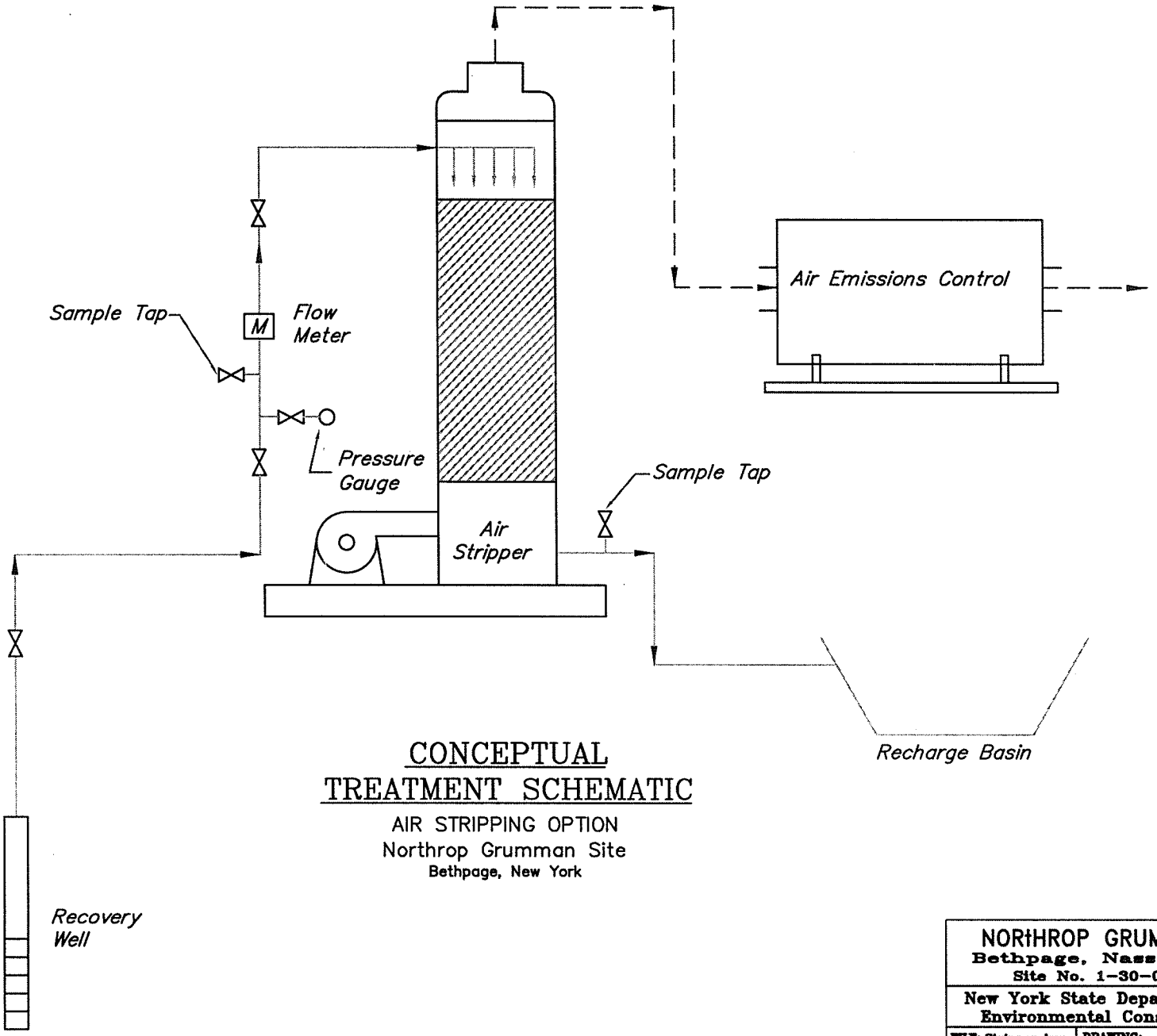
Groundwater Model Grid
Figure 8

DIVISION OF ENVIRONMENTAL REMEDIATION

REVISED:
DATE: 06/22/00

DRAWING:

Northrop Grumman Site



CONCEPTUAL TREATMENT SCHEMATIC

AIR STRIPPING OPTION

Northrop Grumman Site

Bethpage, New York

NORTHROP GRUMMAN SITE
Bethpage, Nassau County
Site No. 1-30-003A, B, C

New York State Department of Environmental Conservation

FILE: Stripper.dwg | DRAWING: Base Map

GROUNDWATER REMEDIATION SCHEMATIC VIEW

DATE: 04/26/00 | FIGURE 9

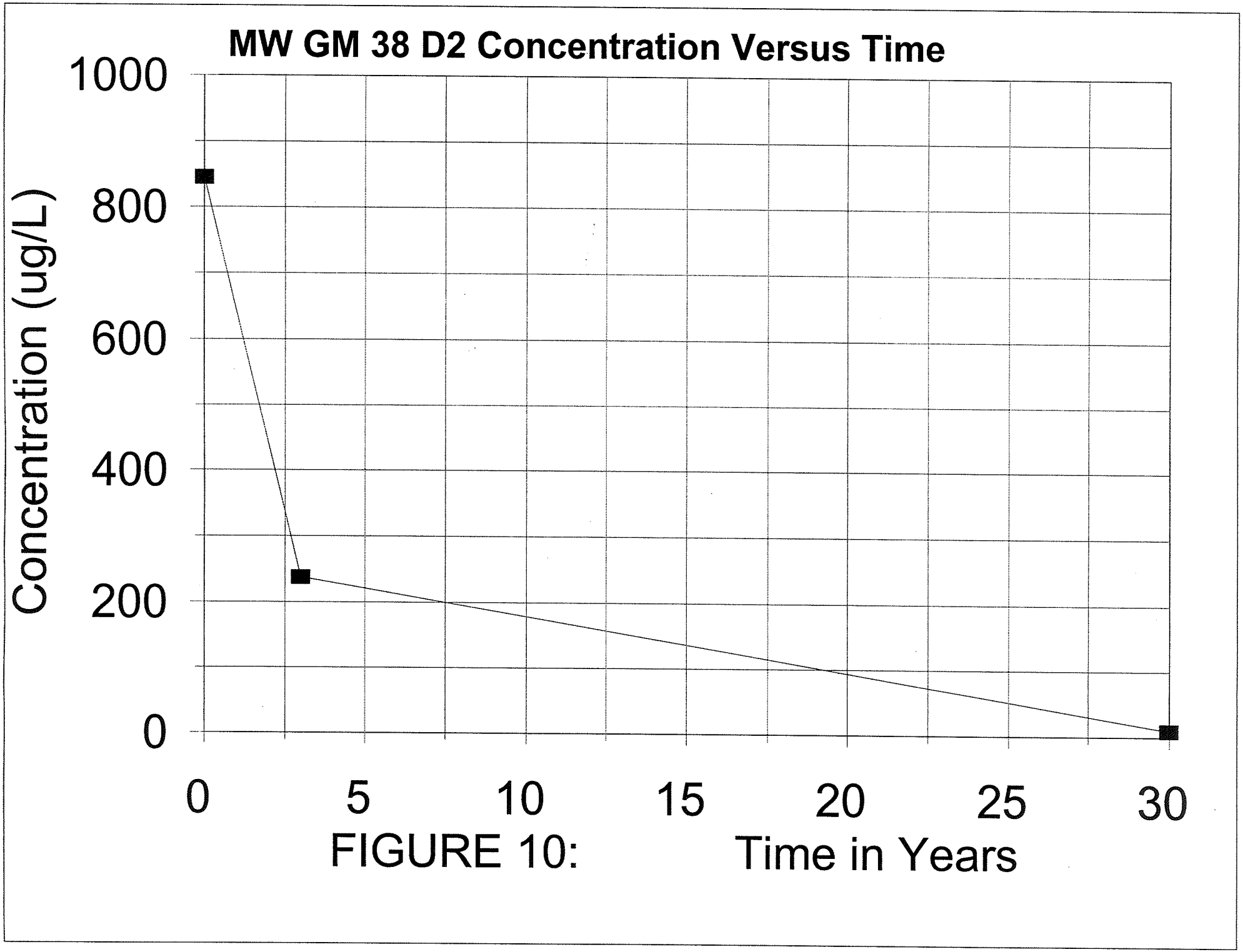

MW GM 38 D2 Concentration Versus Time
1000
800
600
400
200
0
Concentration (ug/L)
0
5
10
15
20
25
30
Time in Years

FIGURE 10: