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Northrop Grumman Systems Corporation

Final Design Report
Operable Unit 3
Groundwater Interim Remedial Measure

Former Grumman Settling Ponds,

Bethpage, New York

Site # 1-30-003A

August 2008

ARCADIS

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NY001464.1807.00003

Date:
August 2008

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1. Introduction

This Operable Unit 3 (OU3) Groundwater Interim Remedial Measure (Groundwater IRM) Final Design Report (Design Report) was prepared by ARCADIS of New York, Inc. (ARCADIS) on behalf of Northrop Grumman Systems Corporation (Northrop Grumman), and is being submitted pursuant to the Order On Consent (Consent Order or CO) Index # W1-0018-04-01 that was executed by the New York State Department of Environmental Conservation (NYSDEC) and Northrop Grumman, effective July 4, 2005 (NYSDEC 2005). The present day Bethpage Community Park property (Park), has been termed the "Former Grumman Settling Ponds Area" and designated as OU3, by the NYSDEC. The Park has been owned and operated by the Town of Oyster Bay since 1962. The term Site, as used herein, refers to the Park and the former Grumman Plant 24 Access Road (which is located south and west of the Park).

The CO allows the implementation of Interim Remedial Measures (IRMs) for OU3. In response to NYSDEC's December 22, 2006 letter to Northrop Grumman, Northrop Grumman elected to implement two IRMs; a soil gas mitigation system (soil gas IRM), which has been operational since February 2008, and a groundwater containment system (Groundwater IRM). This report presents the final design for the Groundwater IRM. Included in this report is a brief project background, objectives of the groundwater IRM, design criteria of the Groundwater IRM, descriptions and theory of major system components, and a set of turnkey (Construction-by-Engineer) drawings (Contract Drawings).

This report is organized into the following sections:

- Section 2 provides a brief project background.
- Section 3 summarizes the project objectives and design criteria.
- Section 4 provides a description of the Groundwater IRM system components and some theory of how the technology works.
- Section 5 provides a description of the construction site controls that will be implemented during construction to protect human health and the environment.
- Section 6 presents a summary of the Operation, Maintenance, and Monitoring (OM&M) program and objectives.

- Section 7 discusses permit and/or permit equivalent requirements.

- Section 8 summarizes the permanent site security measures that will be implemented following construction completion.

2. Project Background

The following subsections of this Plan summarize details regarding the Site description, location, history, and environmental setting. Much of the information related to Site description and background that is presented herein was originally presented in the December 2003 Field Report - Town of Oyster Bay, Bethpage Community Park, Investigation Sampling Report, prepared by Dvirka & Bartilucci Consulting Engineers (D&B) on behalf of Northrop Grumman.

2.1 Site Description

The Site is bordered by Cherry Avenue Extension and the Robert Plan Company Building to the north, Stewart Avenue and Bethpage High School to the east, the Former Plant 24 Access Road and residential areas to the south, and a second Robert Plan Company Building (the former Northrop Grumman Plant 24) to the west. Other properties owned by Northrop Grumman, including the McKay Field property, ball fields and former nursery area are located to the west. The Site location is shown on Figure 1. The adjoining streets and properties, as well as current site features and structures are shown on Drawing 1.

The present-day Park is operated by the Town of Oyster Bay (TOB or Town) and is comprised of approximately 18 acres. The Park, up to about mid-2006, was open year-round and contained two swimming pools, an ice rink, offices, parking lot, picnic and playground areas, tennis courts, paddleball courts, basketball court, shuffleboard courts, horseshoe pits, baseball field, bicycle rack areas, and a stormwater recharge basin. Freon 12 and 22, which we believe is attributable to the Town's operation of the ice rink, has been found in soil gas and groundwater samples collected at the Park. Currently the Park is closed to the public to allow the Town to implement a soil IRM and redevelopment of the Park, including construction of a new ice rink. Adjoining the Park property to the south and west is the former Plant 24 Access Road Property, which is a partially asphalt-paved/partially grassed area that runs east-west along the Park southern and western boundary. The former Plant 24 Access Road Property is owned by Northrop Grumman.

2.2 Environmental Setting

This section of the Plan provides a brief, physical description of the Site, the local geology, and the area hydrogeology.

The Site is approximately 120 feet above mean sea level and, topographically, is generally flat. In general, the geology at the Site, from land surface down to the basal Magothy Formation, consists primarily of sand with interbedded lenses of silt, clay, and gravel. The uppermost sequence of these sediments is part of the Upper Pleistocene glacial outwash deposits, while the lower geologic sequence comprises the Magothy Formation. The Upper Pleistocene deposits in this area of Long Island tend to be coarser than the underlying upper portion of the Magothy Formation. Within the Magothy Formation, the deposits tend to become finer with depth, except for the basal Magothy, where coarse sand and gravel deposits are more prevalent. Vertical profile borings drilled at the Site indicate the presence of a low permeability zone (LPZ) that consists of interbedded slit, clay, and sandy silts and clays. The upper surface of the LPZ was encountered from approximately 36 to 46 feet below land surface (ft bls) and ranging in thickness from approximately 1 ft to greater than 20 ft, and underlies most of the Site between the recharge basin and the ball field, as well as the western portion of the parking lot. A more detailed description of the Site geology is provided in the March 2006 OU3 Remedial Investigation/Feasibility Study (RI/FS) Work Plan prepared by ARCADIS.

The principal aquifers underlying the project area are the Upper Glacial deposits and Magothy Formation; these hydrogeologic units are in direct hydraulic connection with each other. Groundwater in the Upper Glacial deposits and Magothy Formation occurs under unconfined conditions at and near the Site (although the Magothy Formation in other areas of Long Island can exhibit semi-confined conditions; the degree of confinement increases with depth due to stratification caused by numerous silt and clay lenses). Within the project area, the average horizontal hydraulic conductivity of the Upper Glacial deposits is approximately 270 feet per day (ft/d); with an anisotropy of approximately 10:1 (horizontal to vertical, respectively). The average horizontal hydraulic conductivity of the Magothy Formation in the project area is approximately 50 ft/d, with an anisotropy ratio of approximately 100:1 (horizontal to vertical, respectively) (Geraghty & Miller, Inc. 1994).

Depth to groundwater at the Site is approximately 55 ft bls. Water-level elevation data collected in the area of the Site indicate a resultant direction of shallow groundwater flow that is horizontally south-southeasterly and vertically, slightly downward. The on-site stormwater recharge basin may produce local, water-table mounding during intense storm events, however no data currently exist to verify this. Perched water is present above the LPZ described above.

2.3 Environmental Investigations and Remedial Activities

An extensive remedial investigation (RI) of the OU3 site was performed by ARCADIS and D&B on behalf of Northrop Grumman. The RI results are presented in the February 2008 Remedial Investigation Report (Site Area), Operable Unit 3 Former Grumman Settling Ponds), Bethpage, New York, prepared by ARCADIS.

As noted, Northrop Grumman elected to implement two IRMs. This reports documents the design associated with the groundwater IRM. The other IRM, the soil gas IRM has been operational since February 2008. The soil gas IRM design is provided in the September 2007 95% Design Report, Operable Unit 2, Soil Gas Interim Measure, Former Grumman Settling Ponds, Bethpage, New York, prepared by ARCADIS.

3. Project Objectives and Design Criteria

This section presents the Groundwater IRM remedial objectives and design criteria.

3.1 Remedial Objectives

The specific remedial objectives of the Groundwater IRM are:

- To mitigate the off-Site migration of dissolved-phase volatile organic compounds (VOCs) through the implementation of a groundwater pump-and-treat system that will extract groundwater along the former Plant 24 Access Road property, south of the Park. Specifically the Groundwater IRM will address: (a) groundwater that has TVOC concentrations greater than 5 micrograms per liter (ug/L) in the upper twenty feet of the surficial aquifer across the 1,200-foot wide lateral extent of the Site boundary and (b) groundwater below the upper 20 feet of the surficial aquifer that has TVOC concentrations above 50 ug/L.

- To comply with applicable NYSDEC Standards, Criteria, and Guidelines (SCGs) for the various effluents (i.e. treated water and the air stripper off-gas).

A secondary benefit of the Groundwater IRM will be to create a clean-water front atop the downgradient groundwater, thereby minimizing the potential for vapor intrusion issues associated with groundwater downgradient of the site.

3.2 Design Criteria

This section presents the design criteria for the following parts of the proposed Groundwater IRM: pumping rates, predicted influent groundwater concentrations, treated water effluent requirements, predicted air stripper off-gas concentrations, and air effluent requirements.

3.2.1 Pumping Rates

A comprehensive groundwater flow and contaminant transport model for the site was developed by ARCADIS. The model is based on data collected for Operable Unit 2 (OU2) and OU3. Based on a series of model simulations run for the Groundwater IRM, a total system flow rate of 210 gallons per minute (gpm) from four recovery wells is predicted to be needed to achieve the hydraulic containment objective. A summary of the modeling performed along with the model output is provided in Appendix A. The approximate locations of the recovery wells are shown on Figure 2.

For design purposes, the individual system components are designed with a safety factor of an additional 10 gpm per well, resulting in a design flow rate of 250 gpm.

To confirm many of the Groundwater IRM design parameters, Remedial Well RW-2 was installed and a pumping test was performed. The results of the pumping test are summarized in Appendix B. In summary, the pumping test results validated the modeling results, thereby confirming/finalizing the Groundwater IRM design parameters. However, the performance of RW-2 during the pumping test was adversely impacted by bio-fouling that occurred at an abnormally rapid rate. ARCADIS is currently investigating the cause of this rapid bio-fouling and will be developing preventative measures and/or engineering controls. To date, no allowances have been made within the design to accommodate the potential remedial, or engineering controls, to address the bio-fouling, if it is determined that something is needed.

3.2.2 Predicted Influent Groundwater Concentrations

The predicted Groundwater IRM influent groundwater concentrations for the project compounds are provided in Table 1. The predicted influent concentrations are based on results of sampling and modeling activities performed by ARCADIS during the OU3 remedial investigations and the pumping test, include a 50% safety factor for each of the project VOCs, and were used to design system components.

3.2.3 Treated Water Effluent Requirements

Prior to discharge to the former NWIRP recharge basins, the treated water needs to comply with applicable regulatory requirements, specifically the "Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, per Division of Water Technical and Operation Guidance Series (1.1.1), reissued June 1998 for ambient water classification "GA – Source of Drinking Water (groundwater)". The applicable, regulatory discharge limit for the project compounds are provided in Table 1. As shown in Table 1, VOC concentrations in the extracted groundwater need to be reduced prior to discharge.

An air stripper will be used to reduce the concentration of VOCs to meet the regulatory limits. Specifically, the air stripper will be designed to reduce the influent design concentration of individual VOCs to one-half its regulatory limit. The design discharge values for the individual VOCs are also provided in Table 1.

3.2.4 Predicted Air Stripper Off-gas Concentrations

The predicted air stripper off-gas concentrations for the project compounds are provided in Table 2. The predicted influent vapor concentrations were calculated assuming that 100% of the VOCs in the influent groundwater are transferred from the groundwater to the air stripper off-gas. Also shown in Table 2, are the potential annual mass emissions, which are the amounts of the project VOCs that would be emitted if there were no treatment of the air stripper off-gas to reduce non-Freon VOCs.

3.2.5 Air Discharge Requirements

Prior to discharge to the atmosphere, the system vapor emission needs to comply with the applicable regulatory requirements, per the "Annual Guidance Criteria (AGC) and Short-Term Guidance Criteria (SGC) per the NYSDEC Division of Air Resources-1 (DAR-1) Guidelines for the Control of Toxic Ambient Air Contaminants dated 1991, and the AGC/SGC Tables dated December 22, 2003." The AGCs and SGCs for the project VOCs are presented in Table 2.

As shown in Table 2, vapor phase treatment is required since the potential annual emission of vinyl chloride (161 lbs) exceeds the allowable annual emission rate (51 lbs). However, since the predicted emissions are conservatively estimated and include a safety factor, treatment of the air stripper off-gas may not be needed to meet applicable SGCs or the AGCs. An emission control system will be constructed and operated to ensure compliance with applicable regulatory requirements but, in the future, depending on what the actual emissions are, Northrop Grumman may petition to eliminate or reduce the amount of vapor phase treatment. Initially, a series of emission control units (ECUs) with both vapor phase granular activated carbon (VPGAC) and potassium-permanganate impregnated zeolite (PPZ) will be used to reduce the VOC concentrations in the air stripper off-gas prior to discharge. The ECUs will be designed to meet applicable discharge requirements.

4. Groundwater IRM Design

The Groundwater IRM consists of the following major components:

- A groundwater extraction system, consisting of four remedial wells, located and designed to efficiently capture and contain VOC-impacted groundwater to be addressed by this IRM. The extraction system collects impacted groundwater at a constant pumping rate and delivers it to the air stripper system via four influent pipelines.

- An air stripper system designed to reduce the concentration of VOCs in the recovered groundwater to one-half of their respective regulatory limit prior to discharge to surface water located on the neighboring former Naval Weapons Industrial Reserve Property (NWIRP) property.

- ECUs containing VPGAC and PPZ to reduce the concentration of VOCs in the air stripper off-gas to less than their respective AGCs, and SGCs.

- Process controls to provide necessary safeties and interlocks to ensure that the Groundwater IRM operates efficiently, and safely, without unnecessary interruption.

- A treatment building to house the majority of the process equipment and a concrete foundation to stage the ECUs.

- Electric utility service to power the system.

The following subsections of this Design Report describe the primary components of the Groundwater IRM and include some discussion of key design considerations.

4.1 Recovery Wells, Pumps, and Influent Pipelines

The off-site remediation groundwater recovery system consists of four remedial wells (RW-1 through RW-4), four well pumps (P-100 through P-140), and the four dedicated influent pipelines.

4.1.1 Recovery Wells and Pumps

To develop and maintain the desired hydraulic containment along the former Plant 24 access road, groundwater will be extracted from the four, six-inch diameter, 105-feet deep, steel-cased, recovery wells (RW-1 through RW-4). The proposed well locations are shown on Figure 2 and Contract Drawing 1. Each well will be flush mounted, have a pitless adaptor located 3.5-feet below grade, and be completed with 20-feet of continuous slot, stainless steel screen. A typical recovery well detail is provided in Contract Drawing 8.

Submersible groundwater pumps, one in each of the four recovery wells, will be used to extract and convey the groundwater from the wells to the air stripper located in the treatment building. Based on groundwater modeling, in order to achieve the desired hydraulic containment, well pumps P-110 and P-140 will be located in recovery wells RW-1 and RW-4, respectively. Well pumps P-120 and P-130 will be located in recovery wells RW-2 and RW-3, respectively. Pumps P-110 and P-140 are 3 horsepower (HP), Grundfos Model No. 40S30-9, 460V, 3 phase motors capable of 40 gpm at a total dynamic head (TDH) of 200 feet. P-120 and P-130 are 7.5 HP, Grundfos Model No. 75S75-9, 460V, 3 phase motors capable of 85 gpm at a TDH of 220 feet. Head loss calculations were completed using standard equations for pipe friction and losses due to valves and fittings. The calculations are presented in Appendix C. Pump specifications are provided on Contract Drawing 11. Additional information associated with the pipe location, pipe size, and well head arrangement is provided on Contract Drawings 1, 2, and 8.

The RW-1 through RW-4 wellheads will be enclosed in a below-grade, locked vault along with associated piping and the electrical junction box. Well pumps (P-110, P-120, P-130, and P-140) will be connected to influent piping using a pitless adapter. The remaining flow controls (manual throttling valve), electrical devices (start/stop switch, instrumentation, and interlocks), and accessories associated with the recovery wells will be housed in the treatment building.

4.1.2 Influent piping

The influent piping, used to convey the groundwater recovered via Recovery Wells RW-1 through RW-4 to the treatment building, consists of four individual pipelines. Each well has a dedicated, subsurface, high-density polyethylene (HDPE) pipeline to convey the extracted groundwater to the treatment building. Specifically, the pipelines from RW-1 and RW-4 consists of two 3-inch-diameter standard dimension ratio (SDR)-17 HDPE pipes and the pipelines from RW-2 and RW-3 consists of two 4-inch-diameter SDR-17 HDPE pipes. The majority of the influent piping was installed during the soil gas IRM construction. New influent piping required to be installed includes connections at the wells and piping from the soil gas IRM area to the treatment building. The existing and proposed influent piping is shown on Contract Drawings 1 and 2.

Valves and instrumentation on the influent pipes will be located within the treatment building. Upon entering the building, influent piping will transition from HDPE to schedule 80 polyvinyl chloride (PVC) and each influent pipe will be equipped with a low-pressure switch, pressure transmitter, globe valve, local pressure gauge, magnetic flowmeter with a bypass loop, sample tap, and a check valve. Influent pipes will then connect into a common 4-inch-diameter schedule 80 PVC header that will convey flow to the air stripper.

4.2 Groundwater Treatment System

The groundwater treatment system will consist of an air stripper to remove VOCs from the recovered groundwater followed by a bag filter system to remove particulate matter, which may be generated by aerating the influent groundwater, prior to discharge to the former NWIRP recharge basin. The groundwater treatment system is also designed with the flexibility to add a sequestering agent addition system in the future, if required, to control iron precipitation in the air stripper trays.

The following subsections include a description of the air stripper process, design criteria and parameters, and information on the system components (the air stripper, blower, discharge pump, bag filter system, discharge piping, sequestering agent addition system, and booster pump system).

4.2.1 Air Stripper Process Description

Air stripping is a mass transfer process. In a low-profile air stripper, air and water are run in a counter-flow arrangement through multiple aeration trays. The trays enhance air/liquid contact by producing microbubbles in the liquid and exposing a large amount of the liquid surface area to the counter-flowing air. This large amount of surface area allows efficient transfer of the VOCs out of the water into the passing air.

4.2.2 Air Stripper System Design Criteria and Parameters

The design criteria for the Groundwater IRM influent and effluent groundwater are listed below.

Maximum Water Flow Rate	250 gpm
Typical Water Flow Rate	210gpm
Minimum Water Temperature	40 degrees Fahrenheit
Influent VOC Concentrations	see Table 1
Effluent VOC Concentrations	50% of the regulatory limit (see Table 1)

Based on the above-listed design criteria, the resulting Groundwater IRM design parameters are:

Number of Air Strippers	1
Design Air to Water Ratio	54:1
Materials of Construction	316 Stainless Steel
Dimensions	12-feet long by 4-feet wide by 9 ½ -feet high
Removal Efficiency	>99.5%

4.2.3 Air Stripper System Components

The air stripper (AS-400) will be a low-profile air stripper (NEEP Systems Model 31261) equipped with six aeration trays, an induced draft blower, a variable frequency drive (VFD)-controlled discharge pump, instrumentation, and a local control panel.

4.2.3.1 Air Stripper Blower

The air stripper blower (B-400) will have an induced draft configuration and is designed to pull ambient air from outside the treatment building through AS-400, and forces the exhaust through the ECUs.

An air stripper model was used to determine the design air flow rate. A series of modeling runs were performed for the project VOCs (i.e., cis-1,2-dichloroethene, trichloroethene, and vinyl chloride). Based on the model results, an air flow rate of 1,800 cubic feet per minute (CFM) is required to reduce the design concentration of cis-1,2-dichloroethene at 250 gpm to less than its' design effluent concentration of 2.5 micrograms per liter (µg/L). Similar modeling runs using 1,800 CFM were performed for the other VOCs and in each case the effluent concentration was calculated to be less than its respective design discharge concentration. A copy of the 1,800 CFM model results for cis 1,2-DCE is provided in Appendix D.

Pressure drop calculations were completed using standard equations for duct friction and minor losses due to valves and fittings. Total pressure drop for a conservative flow rate of 2,000 CFM was determined from these losses and the predicted pressure drop through the ECUs, which was provided by the ECU supplier. The calculations are presented in Appendix E. As shown, the total pressure drop through the system is approximately 40 inches of water gauge.

Blower (B-400) is an American Fan backward inclined centrifugal fan, Model VP-5-08-26.5A with a 40 hp, 3,600 rpm, 460V motor rated for 2,000 standard cubic feet per minute (SCFM) at 53 inches static pressure.

4.2.3.2 Discharge Pump

The low-profile air stripper will be equipped with a discharge pump (P-400) to pump treated water from the air stripper sump through a bag filter system to the discharge pipeline which ultimately ties into Northrop Grumman's stormwater system. To maintain a constant, continuous flow through the bag filter system, the pump is controlled using a VFD that adjusts the speed of the pump to maintain a constant liquid level in the air stripper sump.

Pump P-400 will be a Goulds Model SSH-27H, single-stage pump with a 7.5 HP, 460V, 1,800 revolutions per minute (rpm) motor rated for 250 gpm at 70 ft TDH. Head loss calculations were completed using standard equations for pipe friction and losses due to valves and fittings. Total head required for the design maximum flow rate (250 gpm) was determined from these losses, an assumed loss of 15 psi across any filter vessels that may be used, and the change in elevation. The calculations are presented in Appendix C. Additional information associated with pipe sizing, pipe layout, valve location and sizing is provided in the Contract Drawings.

4.2.3.3 Bag Filter System and Discharge Piping

Groundwater treated by the air stripper will be pumped through a bag filter system for solids removal prior to being discharged to the former NWIRP basins via Northrop Grumman's stormwater system.

Two, dual-bag filter systems (two housing units that contain one bag per unit) (Filtration Systems Model NC-223-V) with motor-actuated control valves will be used to remove particulate matter before discharge to surface water. The filter bags used will be 10 to 25 micron size. Only one bag filter system will be used at a time. The actuators are controlled based on the influent pressure to the bag filter unit. Once the influent pressure reaches the filter system changeover set point, an actuator opens the valve for the bag filter system which is on "stand-by" and at the same time initiates an advisory condition, then closes the valve for the unit which has been "in service," redirecting the flow into the fresh filter units. When the operator replaces the filter bags in the unit that was just taken off line with new filter bags, the unit is placed in stand-by mode by the operator acknowledging the advisory condition. Should the influent pressure reach the high set point without having a "stand-by" filter available, the entire system will automatically and immediately shutdown.

After filtration, treated groundwater will be discharge to the NWIRP former recharge basins via an underground discharge pipeline that will be connected to Northrop Grumman's existing stormwater system. The discharge pipeline will consist of the following four sections: (a) above-ground four-inch diameter, schedule 80 PVC pipe between the pump and the bag filters, (b) above- and below-ground, six-inch-diameter, SDR17 HDPE line, which will tie-into (c) an existing below-ground eight-inch diameter schedule 80 PVC line, and (d) another section of below-grade six-inch diameter pipe, SDR 17 HDPE line between the existing six-inch diameter PVC line and the existing manhole, where the plant discharge will feed into Northrop Grumman's stormwater system, which ultimately discharges into the three recharge basins located on the former NWIRP property. Additional information and detail regarding the bag filter system, and discharge line is provided in the Contract Drawings.

4.2.3.4 Sequestering Agent Addition System

The treatment system has been designed with the flexibility to add a sequestering agent addition system in the future, if it is determined that excessive equipment fouling resulting from precipitating metals (iron), is occurring. Currently, the future sequestering agent system would consist of a 330 gallon chemical tote of sequestering agent (proprietary non-hazardous mixture that is soluble in water) and a chemical metering pump. The sequestering agent will be pumped directly into the combined influent header line feeding the air stripper system. The metering pump operation will be flow paced based on the total influent flow rate to the air stripper.

4.2.3.5 Booster Pump System

To support maintenance of the treatment building, piping and air stripper, the groundwater treatment system will be equipped with a 300-gallon HDPE tank and a booster pump system (Davey Model HS12-40HTI) to provide treated water to hose bibs installed inside the building.

4.3 Emission Control System

The emission control system is designed to reduce the concentration of non-Freon VOCs in the air stripper off-gas to less than their regulated limits prior to discharge to the atmosphere using VPGAC and PPZ. The following subsections include a description of the VPGAC and PPZ processes, design criteria and parameters, and information on the system components.

4.3.1 Emission Control System Process Description

VOCs are removed with VPGAC by the process of adsorption. VPGAC is manufactured to ensure an extensive natural surface area that is available for the adsorption process. The surface area of granular carbons can range up to 1,400 square meters per gram of material. The physical adsorption of VOCs on, and into VPGAC is concentration gradient driven. Thus, the adsorption capacity of the VPGAC is dependent on the concentration of VOCs in the air stripper exhaust. For example, as VOC concentration increases, additional pounds of VOCs per pound of VPGAC can be adsorbed.

Due to the need for direct contact between the VOC molecule and the VPGAC surface, the presence of moisture in the air stream will impact the rate of adsorption. The capacity of the activated carbon declines rapidly as the relative humidity of the air increases above 60%. The air stripper blower will be installed after the air stripper and before the ECUs. As the air stripper off gas (100% relative humidity) passes through the induced draft blower, the air stream will be heated and the relative humidity will be reduced to less than 50% relative humidity. In order to ensure proper operation and efficient use of the carbon, the temperature of the air stream will be periodically monitored to ensure the temperature stays elevated and the relative humidity of the air stays low.

Due to its molecular structure, vinyl chloride is not effectively treated by VPGAC. Therefore, PPZ will be used to reduce concentration of vinyl chloride prior to discharge. Basically, the VPGAC will be used to reduce the concentration of the non-vinyl chloride VOCs. The VPGAC effluent will then be further treated to reduce vinyl chloride concentrations.

Both VPGAC and PPZ treatment trains will consist of two ECUs each, for a total of four ECUs. To improve overall treatment effectiveness, both sets of VPGAC and PPZ. ECUs will be operated in lead/lag process trains.

4.3.2 Emission Control System Design Criteria and Parameters

The emission control system design parameters are listed below:

Maximum Air Flow Rate	2,000 SCFM
Typical Air Flow Rate	1,800 SFCM
VOC loading	See Tables 1 and 2, assumes 100% of VOCs are stripped from recovered groundwater
Relative Humidity	100% at the blower inlet, 40% at the blower outlet

Influent (raw) Temperature	55 degrees Fahrenheit
Effluent VOC Annual Emission Rate	See Table 2
Changeout Frequency	43 days or greater (per manufacture)
Expected PPZ Changeout Frequency	107 days or greater (per manufacture)

4.3.3 Emission Control System Components

4.3.3.1 Emission Control Units

The sizing and configuration of the VPGAC and PPZ ECUs were determined based on expected air flow rates, VOC characteristics and loadings. In summary, the ECUs beds and the media were selected to allow for a minimum changeout frequency of 43 days based on the maximum groundwater design flow rate of 250 gpm and the design concentrations (see Table 1). The following ECUs with VPGAC type, PPZ type, and mass media loadings were selected:

- Primary Units: Two (2) TIGG Model NB-8 ECUs, each filled with 7,000 pounds (lbs) of TIGG 5CC 6X12 virgin vapor-phase coconut shell carbon (for a total of 14,000 pounds of VPGAC) or equivalent; and

- Secondary Units: Two (2) T1GG Model NB-8 ECUs, each filled with 10,000 lbs of Hydrosil 600 PPZ.

The ECUs will be configured in a series arrangement, with the air stripper gas passing through the VPGAC-filled ECUs first, then into the two PPZ-filled ECUs.

All four of the ECUs will be insulated with 2-inch thick, rigid Styrofoam boards to help maintain desired temperature and relative humidity conditions throughout the vapor-phase treatment system. The insulation is finished with stucco embossed aluminum jacketing. The insulation is applied to the top of the ECUs to withstand mild personnel traffic. The ECUs will have safety railings, sampling ports, and access ladders.

4.3.3.2 Duct and Insulation

The duct will be 16-inch-diameter, schedule 10 (~1/8-inch thick), aluminum. The duct was sized to balance cost and pressure drop requirements. The exterior duct has a 2-

inch thick, 370 Melamine foam insulation with brown PVC coating. Condensate traps will be installed in duct low points to collect condensation from various locations in the duct. Condensate will be collected and disposed on an as-needed basis by operating personnel. Additional information about duct work sizing, configuration and process instrumentation is provided in the Contract Drawings.

4.4 Process Controls and Operation

The process control system is designed to provide the necessary safeties and interlocks to ensure that the recovery wells, piping, and treatment system operate smoothly, efficiently, and as one unit. Additionally, the system includes the capability of allowing local or remote operator(s) to observe and control the operation of the system from a single computer workstation. Initially, the system will be constructed without an external communication network that would allow remote monitoring of the system.

Controls and instrumentation will be interconnected via a main control panel (MCP). The MCP, located in the control room of the treatment plant, includes a programmable logic controller (PLC) which monitors and integrates the operation of the remedial wells, air stripping system, emission control system, the bag filter system, and the treatment system interlocks. This panel serves as the node through which communication with the control system takes place. The PLC is integrated with an operator interface station. The control system also utilizes fail-safe logic to automatically and immediately shut down the entire treatment system in the event of a critical alarm input or a failure of the PLC. An alarm light located within the treatment building notifies the operator of any critical alarms. If operating personnel are not on-site, project team members will be alerted of the shut down by a dedicated cellular autodialer. The dedicated autodialer will also notify project team members of power loss.

The power supply for the PLC, system instrumentation, and process control devices are protected with transient voltage surge suppression (TVSS) systems to limit voltage spikes to the systems. The PLC, system instrumentation, and process control devices are also protected by separate uninterrupted power supplies (UPS) that maintain power to these devices in case of a power outage.

4.4.1 Operation and Programmable Logic Controller

Operation of the Groundwater IRM is controlled and integrated through the PLC located in the system's MCP. The PLC provides the necessary control logic to coordinate signals from the remote switches and instrumentation throughout the treatment system. These interlocks ensure proper operating conditions are maintained within the treatment system.

Under normal operating conditions, the control system has the following functions:

- Provides run indication signals and elapsed run-time for each extraction well
- Monitors the line pressure on the influent pipelines to ensure that the pipes maintain structural integrity and there are no leaks;
- Monitors the groundwater flow rate from each recovery well to ensure that there is no degradation in flow produced by each well or loss of flow due to leakage of the influent piping;
- Monitors combined groundwater flow rate to the air stripper to ensure that air stripper influent flow rate is within design conditions
- Monitors air stripper system pressure and level alarms via dry contacts provided at the local air stripper control panel
- Provides run indication signals for air stripper blower and discharge pump
- Monitors the air stream discharge flow rate, pressure, and temperature from the air stripper blower to ensure that they are within design conditions
- Monitors bag filter system influent pressure which controls the bag filter sequencing
- Monitors groundwater flow rate discharging from the air stripper through the bag filter system to discharge
- Monitors groundwater treatment building temperature to ensure that building heating and ventilation system is functioning

- Maintains fail-safes and alarm interlocks to maintain safe and effective operation of the system. Fail-safes and alarm interlocks are described in the Section 4.4.2, including calling project team members when plant shut downs occur; and

- Ensures that once the system is shut down, regardless of whether it is due to a power failure or an alarm condition, the system does not automatically restart. The system will have to be manually restarted. Manual restart is required so that the cause of the alarm is investigated and the problem can be addressed prior to restart.

Major instrument operational controls are listed below.

- The recovery well pumps (P-110, -120, -130, -140) are operated with start/stop switches mounted at the MCP. The recovery well pumps will not operate unless permitted by the PLC interlocks and fail-safe interlocks.

- The air stripper system, which has it's own local control panel, will not operate unless permitted by the PLC interlocks and fail-safe interlocks.

- Influent pressure to the bag filter system is continuously monitored. Once the influent pressure measured reaches the high set point value, the PLC opens the valve for the stand-by unit, activates an advisory, and then closes the valve for the previously operating filter unit. Upon switching to the stand-by unit, an advisory is sent out to the project team members alerting them that a bag filter change out is required. If this advisory is not cleared, which can only be done manually at the site, before the influent pressure reaches the high-high set point value, the entire system will be automatically and immediately shut down.

4.4.2 Alarms and Interlocks

The recovery well, air stripping, emission control, and treated water discharge systems are interlocked and alarmed to ensure that water and air are properly treated, and for efficient system operation. Three types of interlocks and alarms are incorporated into the treatment system to prevent water from being discharged from the air stripper system in the event that an air stripper blower is not operating, a leak in either the influent conveyance lines, or flooding conditions in the air stripper or building sump. The three types of alarms and interlocks used are: primary alarms, fail-safe alarms, and advisories. Each type of alarm/interlock, including the fail-safe circuitry, is described below. A list of the proposed alarms and advisories is provided on Contract Drawing 6 and Tables 3, 4, and 5.

Primary alarms are alarms that are processed by the PLC to shut the system down. The PLC is constantly receiving signals from the instrumentation listed below and shown on Contract Drawing 3, 4, 5 and 6. When the PLC detects an alarm condition from one of these instruments, the PLC automatically and immediately sends a signal to relays which causes the starter coils for the extraction wells and air stripper system (blower and discharge pump) to open, thus causing all the equipment to shut down. The one exception is that there is a delay on the air stripper blower and discharge pump to allow for additional treatment of the water remaining within the air stripper when the alarm condition occurs. A complete list of the primary alarms is provided in Table 3. The PLC will alert project team members of the shut down via cell phone when there is a primary alarm.

Secondary, or critical, alarms are used to back-up key primary alarms or to shut the system down in the event of a PLC failure. If a primary alarm instrument fails to appropriately respond to an alarm condition (or the PLC fails), a hard-wired fail-safe circuit switch will open a remote relay contact, thus shutting down the process equipment automatically and immediately. Relay contacts will also send inputs to the PLC and the autodialer as advisories.

Fail-safe circuitry means the normal condition of a circuit is energized. If for some reason (e.g., loss of power, a broken wire or a relay burns out) the "switch" becomes de-energized and opens, the circuit is broken, which immediately cuts power to other devices on the circuit. These systems will be implemented to make sure (fail-safe) that a circuit does not close, or remain closed, when the circuit/switch is de-energized. At the Groundwater IRM, this system shuts the treatment process down once the circuit is broken by any of the hard-wired switches (the secondary alarms), and ensures that if there is a power failure or a key system component loses power, switches will open causing the entire system to shut down. For example, the fail-safe circuitry act as a permissive signal in that it is wired in series with the starter coils associated with all the process equipment (well pumps and air stripper) such that if a critical, hard-wired switch (i.e., a critical alarm) opens, the failsafe circuitry will cause the output relays to all process equipment to de-energize, thus shutting all the process equipment down. The failsafe circuitry is wired such that it has to be manually reset in the field before the process can be restarted and to prevent unwanted automatic restart.

A complete list of the critical fail safe alarms is provided in Table 4. Critical alarms also send a signal to the autodialer to call project team members.

Advisory conditions occur when process variables are outside of their desired range, but do not require immediate shut down of the Treatment Plant. An advisory is programmed to allow operators to get an advanced warning of a possible problem. The advisories that are incorporated into the system are listed in Table 5.

4.5 Treatment Building

A 26-feet by 32-feet pre engineered, metal building located near the Soil Gas IRM treatment equipment near McKay Field will be used to house the Groundwater IRM air stripper system, bag filter system, and the majority of the instrumentation, controls, and electrical components. The treatment building will be installed on concrete slab with 6-inch high secondary containment curb. The concrete foundation and treatment building specifications are included on Contract Drawings 18 through 22.

4.6 Utility Services

The Groundwater IRM will require an electrical utility connection. Electrical power will be obtained from an existing 400 amp disconnect installed as part of the soil gas IRM. A cellular autodialer will be used to eliminate the need for telephone services at the present time. Cable, telephone, or natural gas utilities may be required at a later date.

5. Construction Site Controls

The goals of site controls are to prevent access to the project areas by unauthorized personnel, identify and delineate the various locations within the project area, manage the flow of activity within and between the various work locations, and provide protection of the public, site workers, and the environment during construction. A description of the proposed construction site controls is provided below.

5.1 Site Security

To reduce the risk of vandalism during construction and provide protection of the public, the following temporary security measures are specified in the building/site design:

- The former Plant 24 south access road will be closed until all intrusive work in this area is completed.

- Traffic flow along the western access road will be controlled with temporary site barriers, signage, and flagmen (during loading/offloading of material for offsite disposal and/or backfilling and during trenching and well drilling), when necessary.

- Signage will be posted at strategic locations to deter the public from entering the limits of disturbance.

- All equipment will be stored within the 6-foot fence around McKay Field with locking gates.

A description of the proposed erosion and sediment (E&S) controls is provided below.

5.2 Erosion and Sediment Controls

E&S controls will be emplaced before construction activities begin to control surface runoff within any disturbed areas to minimize the potential for sediment-laden run-off to discharge from the Site. Specific areas targeted for E&S controls include:

- The south side of the southern access road including any areas where trenching will be completed.

- The west side of the western access road including any areas where trenching will be completed.

- Existing drainage structures; and,

- Temporary stockpile locations.

In general, E&S controls will consist of the installation and maintenance of perimeter silt fence at these locations. However, straw bales may be used in conjunction with silt fence if additional protection is deemed necessary. In addition to silt fence, all surge (temporary stockpiled) material will be covered with polyethylene sheeting when not actively in-use and during all storm events. Finally, stormwater inlets will be protected with temporary berms or other means, as necessary. The construction contractor will be responsible for maintaining these measures throughout the project. An E&S control plan and accompanying details have been provided on Contract Drawing 12.

5.3 Traffic Control

The primary site access will be through the Cherry Avenue Extension/Aerospace Boulevard (Blvd.) entrance. During site activities, waste hauler access will be limited to the access road from the proposed offsite disposal stockpile area to the Cherry Avenue Extension/Aerospace Blvd. Waste haulers will then receive the appropriate waste from the hazardous or non-hazardous stockpile areas and will be directed to the washdown pad prior to reentry onto public roads. Authorized personnel may access the site from either the Cherry Avenue Extension or the southern access road. As referenced previously, the southern access road will be closed for the duration of the work. Accordingly, access along the southern access road will be limited to authorized personnel vehicles only. As shown on Contract Drawings 1, the primary recovery trench was installed immediately north of the current southern access road. Construction equipment traffic will be limited to the north side of the proposed trench (e.g., along the "former" access road) except during connection of individual well headers to the common trench.

5.4 Soil Management

Based on previous site operations and soils investigation data the handling and management of soils during intrusive work will be an important part of construction activities. In accordance with data obtained during previous investigations, polychlorinated biphenyl's (PCBs), chromium, VOCs, and semi-volatile organic compounds (SVOCs) are the primary constituents of concern along the southern and western access roads where intrusive activities are planned. The primary intrusive activities that will result in the generation of soils requiring management include well installation and trenching. Soils management will be accomplished through a variety of site controls, engineering controls, and construction methodologies. Accordingly, the following activities have been identified for soils management:

- Immediately containing all drill cuttings within 55-gallon drums. Subsequent characterization of wastes and disposal in accordance with all applicable regulations.

- Implementation of a pre-characterization sampling program along all areas where trenching activities are planned and soils investigation has not been completed and/or insufficient data exists.

- Implementation of soil management controls including:

  - Implementation of the traffic controls referenced in Section 5.3.
  - Engineering controls on all site soils which are managed through the installation of temporary stockpile areas; and,
  - Engineering controls around all active trenching areas.
- Implementation of the E&S control plan referenced in Section 5.2 above; and,
- Implementation of dust suppression and air monitoring activities as listed in Section 5.5 below.

As referenced above, prior to trenching activities, soil cores will be collected in areas where a soil investigation has not been completed and/or insufficient data exists using a Geoprobe® rig. The samples will be collected and selectively analyzed for PCBs, total chromium, VOCs, and SVOCs using United States Environmental Protection Agency (USEPA) Methods 8082, 6010, 8260, and 8270, respectively. The depth of sample collection will be dependent on the anticipated depth of trenching in that particular location. It is anticipated that a minimum of one sample will be collected for each sampling location. The pre-characterization data will be used to estimate the quantity of soil materials requiring offsite disposal (as either hazardous or non-hazardous material) and accordingly the amount of imported backfill required. Delineation of these materials prior to construction will minimize the amount of time materials will require staging, will expedite the backfilling process, and will identify which areas require additional E&S controls, if necessary.

Pre-characterization soil data will be compared to the soil cleanup objectives (SCOs) in 6 NYCRR Part 375 for Industrial Classified areas. Soils which are characterized as having a constituent greater than its' respective SCO will be excavated and staged in the designated area near McKay field for offsite disposal. Soils which are characterized as having all constituents below their respective SCOs will be reused as backfill material. The staged soils will be further characterized for TCLP metals, TCLP VOCs, and TCLP SVOCs to classify them as either hazardous or non-hazardous waste, prior to transport and disposal at the receiving facility. For example, soils characterized as less than 25 parts per million (ppm) total PCBs will be stockpiled on-site for reuse as trench backfill material. Soils characterized as greater than or equal to 25 ppm total PCBs will be stockpiled in the designated area near McKay field for offsite disposal as non-hazardous waste. Soils characterized as greater than or equal to 50 ppm total PCBs will be managed in accordance with the hazardous waste generator requirements contained in 6NYCRR Part 372.2. The Contractor shall notify the engineer and Northrop Grumman's ESH&M department when a hazardous waste is discovered or, if possible, prior to generation to a hazardous waste. The Contractor shall provide a hazardous waste profile to ESH&M and follow ESH&M direction regarding location of hazardous waste accumulation areas, installation of secondary containment, containers to be used for hazardous waste accumulation, marking, labeling, and dating of hazardous containers, etc. Hazardous waste accumulation containers must be in good condition, i.e., free from leaks or major denting.

This same methodology would apply to each of the COCs characterized as part of the pre-characterization program. Every effort will be made to reuse soils in the same location where it was excavated as a best management practice. In addition, appropriate institutional controls will be considered and implemented, as needed, as part of the overall remedy for the parcel.

The proposed temporary stockpile locations for non-hazardous reuse fill, imported fill, and materials requiring offsite disposal are provided on Contract Drawing 12. Temporary stockpiles will be covered with plastic sheeting to prevent exposure to rainwater and reduce airborne particulates. In addition, stockpiles will also be covered at the end of each day. The plastic sheeting used to cover stockpiles will have a thickness of 6 millimeters and will be anchored so the sheeting does not slide or blow off the stockpiles. If necessary, damaged sheets will be disposed with each pile of non-hazardous material and fresh plastic sheeting will be used to cover new piles. Finally, a HDPE or PVC liner will be installed below each stockpile area. All sheeting and/or liners will be disposed at the end of the project as non-hazardous material.

5.5 Dust Suppression and Air Monitoring

Dust suppression and air monitoring will be an integral part of the project for the protection of site workers and the public. The dust suppression and air monitoring program will be implemented to eliminate the potential for impacted dust or any other potentially hazardous respirable materials to migrate during construction activities and to protect on-site workers. Dust emissions will be controlled by misting work areas with water. During application of the water, attempts will be made to keep the work areas damp while limiting runoff resulting from the misting.

In addition to the dust suppression activities listed above, the existing Community Air Monitoring Plan (CAMP) will be implemented during all intrusive site activities. The CAMP requires real-time monitoring of VOCs and dust (PM-10) during all intrusive activities and periodic monitoring of VOCs during non-intrusive activities. Real-time monitoring will be provided to establish baseline values each day prior to initiating construction activities each day and an appropriate number of monitoring stations will be emplaced downwind of intrusive construction activities each day. The wind direction will be periodically monitored throughout the day and adjustments will be made to monitoring locations, as necessary.

6. Operation, Maintenance, and Monitoring

The system OM&M phase will begin immediately following system construction and the system startup/shakedown period. The goals of system OM&M will be to:

- Operate and maintain the Groundwater IRM in accordance with equipment manufacturer recommendations and the site-specific OM&M Manual.
- Inspect and evaluate system data periodically to confirm that the system continues to be effective for protection of human health and the environment.
- Monitor and report performance of the Groundwater IRM by:
  - Assessing compliance with the air permit equivalent limits.
  - Assessing achievement of the Groundwater IRM design criteria referenced herein; and,
  - Sampling and analysis of appropriate media.
- Inspect and evaluate site-wide data periodically to determine when operation of the groundwater IRM to meet the project objectives described herein.

A formal OM&M Manual will be provided to the NYSDEC within 60 days of beginning full-time system operation. This will allow sufficient system operational time to develop site-specific OM&M requirements and protocols based on the results of the system startup/shakedown period. Furthermore, this will allow sufficient time to receive and organize equipment cut sheets from the individual manufacturers.

7. Permitting

The proposed facility can be exempt from air registration and treated effluent discharge requirements pursuant to 6 NYCRR Part 201-3.3(c)(29). Regardless permit equivalencies are required. Therefore, a completed NYSDEC Minor Facility Air Registration form is included as Appendix F and a completed State Pollutant Discharge Elimination System (SPDES) permit application is provided in Appendix G.

Additionally, required building and construction permits will be applied for through the Town of Oyster Bay building division and other applicable town divisions.

8. Security

To reduce the risk of vandalism following construction the following permanent security measures are specified in the building/site design:

- All groundwater recovery and monitoring wells will be encased in lockable below grade well vaults.
- The treatment building site perimeter will be surrounded by an 6-foot high chain link fence with locking gates.
- The treatment building will be secured with lockable double doors; and,
- Exterior security lights will be installed on the treatment building. Each light will be equipped with a photocell.

If vandalism were to occur that affects operation of the system, the proposed alarm and interlock system be triggered and will most likely result in callout of the autodialer. In addition, periodic inspections will be completed as part of system OM&M. The periodic inspections will include a visual examination for signs of vandalism on all above grade structures.

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Table 1. Predicted influent, regulatory discharge, and design discharge water concentrations, Groundwater IRM, Operable Unit 3, Former Grumman Settling Ponds, Bethpage, New York.

PARAMETER (1)	BASIS OF DESIGN CONCENTRATIONS - WATER (ug/L)		
	Predicted Influent (2)	Regulatory Standard (3)	Design Effluent (4)
Trichloroethene	46	5	<2.5
cis-1,2 Dichloroethene	780	5	<2.5
Vinyl Chloride	147	2	<1

NOTES

1. The three primary project compounds; Trichloroethene, cis 1,2 Dichloroethene, and vinyl chloride are listed.
2. Predicted influent concentrations are based on data collected during the remedial investigation, projected pumping rates, and include a 50% factor of safety.
3. Regulatory concentration per "Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, per Division of Water Technical and Operational Guidance Series (1.1.1), reissued June 1998 for ambient water classification 'GA - Source Drinking Water (groundwater)'".
4. The design effluent concentrations calculated by dividing the regulatory levels of VOCs by 2 for a safety factor.

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Table 2. Predicted influent, regulatory discharge, and design discharge vapor concentrations, Groundwater IRM, Operable Unit 3, Former Grumman Settling Ponds, Bethpage, New York.

PARAMETER (1)	BASIS OF DESIGN CONCENTRATIONS - VAPOR (ug/m3)			MASS EMISSIONS - VAPOR	
	Predicted Influent (2)	Regulatory Standards (3,4)		Potential Annual Emission (lbs)	
		AGC	SGC	Predicted (5)	Allowable (6)
Trichloroethene	855	0.5	54,000	51	233
cis-1,2 Dichloroethene	14,498	1,900	190,000	854	884,172
Vinyl Chloride	2,732	0.11	180,000	161	51

NOTES

1. There are three primary project compounds: Trichloroethene, cis 1,2 Dichloroethene, and vinyl chloride.
2. Predicted vapor influent concentrations calculated by multiplying the design influent (water) concentration by the design pumping rate (250 gpm) and dividing by the projected air flow rate (1,800 CFM).
3. Regulatory concentration per "New York State DAR-1 Guidelines for the Control of Toxic Ambient Air Contaminants, 1991 Edition and DAR-1 AGC/SGC Tables, dated December 22, 2003".
4. AGC refers to Annual Guidance Concentration.
   SGC refers to Short-term Guidance Concentration.
5. The predicted potential (uncontrolled) annual mass emissions were calculated by multiplying the influent (vapor) concentrations by the expected flow rate of 1,800 CFM and assuming a continuous discharge for the entire year.
6. The allowable mass that can be emitted by the system was calculated using the Screen 3 Air Dispersion Model developed by the United States Environmental Protection Agency (EPA) using the following project information:

Stack Height (ft)	18
Stack Diameter (ft)	1.5
Stack Gas Temp (K)	283.7
Receptor Height (ft)	5.8
Bldg (ECU) Height (ft)	8.5
Bldg Width (ft)	26
Bldg Length (ft)	32

Table 3. Primary Shut Down Alarms in Main PLC, Groundwater IRM, Operable Unit 3, Former Grumman Settling Ponds, Bethpage, New York.

ALARM DESCRIPTION (ALARM SCREEN ON HMI)	TAG NO.	DEVICE TYPE	LOCATION
EMERGENCY STOP ENGAGED	-	PUSH BUTTON/TOUCH SCREEN	3 IN FIELD, 1 ON MCP AND 1 ON TOUCH SCREEN
TREATMENT PLANT INFLUENT LOW PRESSURE (SET POINT)	PT-110	PRESSURE TRANSMITTER	INFLUENT LINE IN BUILDING
TREATMENT PLANT INFLUENT HIGH PRESSURE (SET POINT)	PT-110	PRESSURE TRANSMITTER	INFLUENT LINE IN BUILDING
TREATMENT PLANT INFLUENT LOW PRESSURE (SET POINT)	PT-120	PRESSURE TRANSMITTER	INFLUENT LINE IN BUILDING
TREATMENT PLANT INFLUENT HIGH PRESSURE (SET POINT)	PT-120	PRESSURE TRANSMITTER	INFLUENT LINE IN BUILDING
TREATMENT PLANT INFLUENT LOW PRESSURE (SET POINT)	PT-130	PRESSURE TRANSMITTER	INFLUENT LINE IN BUILDING
TREATMENT PLANT INFLUENT HIGH PRESSURE (SET POINT)	PT-130	PRESSURE TRANSMITTER	INFLUENT LINE IN BUILDING
TREATMENT PLANT INFLUENT LOW PRESSURE (SET POINT)	PT-140	PRESSURE TRANSMITTER	INFLUENT LINE IN BUILDING
TREATMENT PLANT INFLUENT HIGH PRESSURE (SET POINT)	PT-140	PRESSURE TRANSMITTER	INFLUENT LINE IN BUILDING
TREATMENT PLANT INFLUENT LOW FLOW RATE (SET POINT)	FIT-110	FLOW METER	INFLUENT LINE IN BUILDING
TREATMENT PLANT INFLUENT LOW FLOW RATE (SET POINT)	FIT-120	FLOW METER	INFLUENT LINE IN BUILDING
TREATMENT PLANT INFLUENT LOW FLOW RATE (SET POINT)	FIT-130	FLOW METER	INFLUENT LINE IN BUILDING
TREATMENT PLANT INFLUENT LOW FLOW RATE (SET POINT)	FIT-140	FLOW METER	INFLUENT LINE IN BUILDING
AIR STRIPPER INFLUENT LOW FLOW RATE (SET POINT)	FI-200	COMPUTER FUNCTION	PLC

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Table 3. Primary Shut Down Alarms in Main PLC, Groundwater IRM, Operable Unit 3, Former Grumman Settling Ponds, Bethpage, New York.

ALARM DESCRIPTION (ALARM SCREEN ON HMI)	TAG NO.	DEVICE TYPE	LOCATION
AIR STRIPPER INFLUENT HIGH FLOW RATE (SET POINT)	FI-200	COMPUTER FUNCTION	PLC
AIR STRIPPER HIGH AIR FLOW RATE (SET POINT)	FIT-500	FLOW INDICATING TRANSMITTER	AIR STRIPPER DISCHARGE DUCTING
AIR STRIPPER LOW AIR FLOW RATE (SET POINT)	FIT-500	FLOW INDICATING TRANSMITTER	AIR STRIPPER DISCHARGE DUCTING
AIR STRIPPER HIGH AIR PRESSURE (SET POINT)	PT-500	PRESSURE TRANSMITTER	AIR STRIPPER DISCHARGE DUCTING
AIR STRIPPER LOW AIR PRESSURE (SET POINT)	PT-500	PRESSURE TRANSMITTER	AIR STRIPPER DISCHARGE DUCTING
AIR STRIPPER LOW AIR TEMPERATURE (SET POINT)	TT-500	TEMPERATURE TRANSMITTER	AIR STRIPPER DISCHARGE DUCTING
BAG FILTER HIGH INFLUENT PRESSURE	PT-700	PRESSURE TRANSMITTER	BAG FILTER INFLUENT PIPING
TREATMENT BUILDING SUMP HIGH LEVEL	LSH-900	FLOAT SWITCH	TREATMENT BUILDING SUMP
TREATMENT BUILDING LOW TEMPERATURE (SET POINT)	TT-900	TEMPERATURE TRANSMITTER	TREATMENT BUILDING WALL
AIR STRIPPER DISCHARGE PUMP VFD FAULT	VFD FAULT CONTACT	PUMP P-400 VFD FAULT CONTACT	AIR STRIPPER CONTROL PANEL
TREATMENT PLANT INFLUENT LOW PRESSURE	PSL-111	PRESSURE SWITCH	INFLUENT LINE IN BUILDING
TREATMENT PLANT INFLUENT LOW PRESSURE	PSL-121	PRESSURE SWITCH	INFLUENT LINE IN BUILDING
TREATMENT PLANT INFLUENT LOW PRESSURE	PSL-131	PRESSURE SWITCH	INFLUENT LINE IN BUILDING
TREATMENT PLANT INFLUENT LOW PRESSURE	PSL-141	PRESSURE SWITCH	INFLUENT LINE IN BUILDING

Table 3. Primary Shut Down Alarms in Main PLC, Groundwater IRM, Operable Unit 3, Former Grumman Settling Ponds, Bethpage, New York.

ALARM DESCRIPTION (ALARM SCREEN ON HMI)	TAG NO.	DEVICE TYPE	LOCATION
AIR STRIPPER LOW AIR PRESSURE	PSL-AS	PRESSURE SWITCH	AIR STRIPPER CONTROL PANEL (DRY CONTACT)
AIR STRIPPER HIGH AIR PRESSURE	PSH-AS	PRESSURE SWITCH	AIR STRIPPER CONTROL PANEL (DRY CONTACT)
AIR STRIPPER SUMP HIGH WATER LEVEL	LSH-AS	LEVEL SWITCH	AIR STRIPPER CONTROL PANEL (DRY CONTACT)

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Table 4. Secondary Fail-Safe Alarms Groundwater IRM, Operable Unit 3, Former Grumman Settling Ponds, Bethpage, New York.

ALARM DESCRIPTION	TAG NO.	DEVICE TYPE	LOCATION
TREATMENT PLANT INFLUENT LOW PRESSURE	PSL-111	PRESSURE SWITCH	INFLUENT LINE IN BUILDING
TREATMENT PLANT INFLUENT LOW PRESSURE	PSL-121	PRESSURE SWITCH	INFLUENT LINE IN BUILDING
TREATMENT PLANT INFLUENT LOW PRESSURE	PSL-131	PRESSURE SWITCH	INFLUENT LINE IN BUILDING
TREATMENT PLANT INFLUENT LOW PRESSURE	PSL-141	PRESSURE SWITCH	INFLUENT LINE IN BUILDING
AIR STRIPPER LOW AIR PRESSURE	PSL-AS	PRESSURE SWITCH	AIR STRIPPER CONTROL PANEL (DRY CONTACT)
AIR STRIPPER HIGH AIR PRESSURE	PSH-AS	PRESSURE SWITCH	AIR STRIPPER CONTROL PANEL (DRY CONTACT)
AIR STRIPPER SUMP HIGH WATER LEVEL	LSH-AS	LEVEL SWITCH	AIR STRIPPER CONTROL PANEL (DRY CONTACT)

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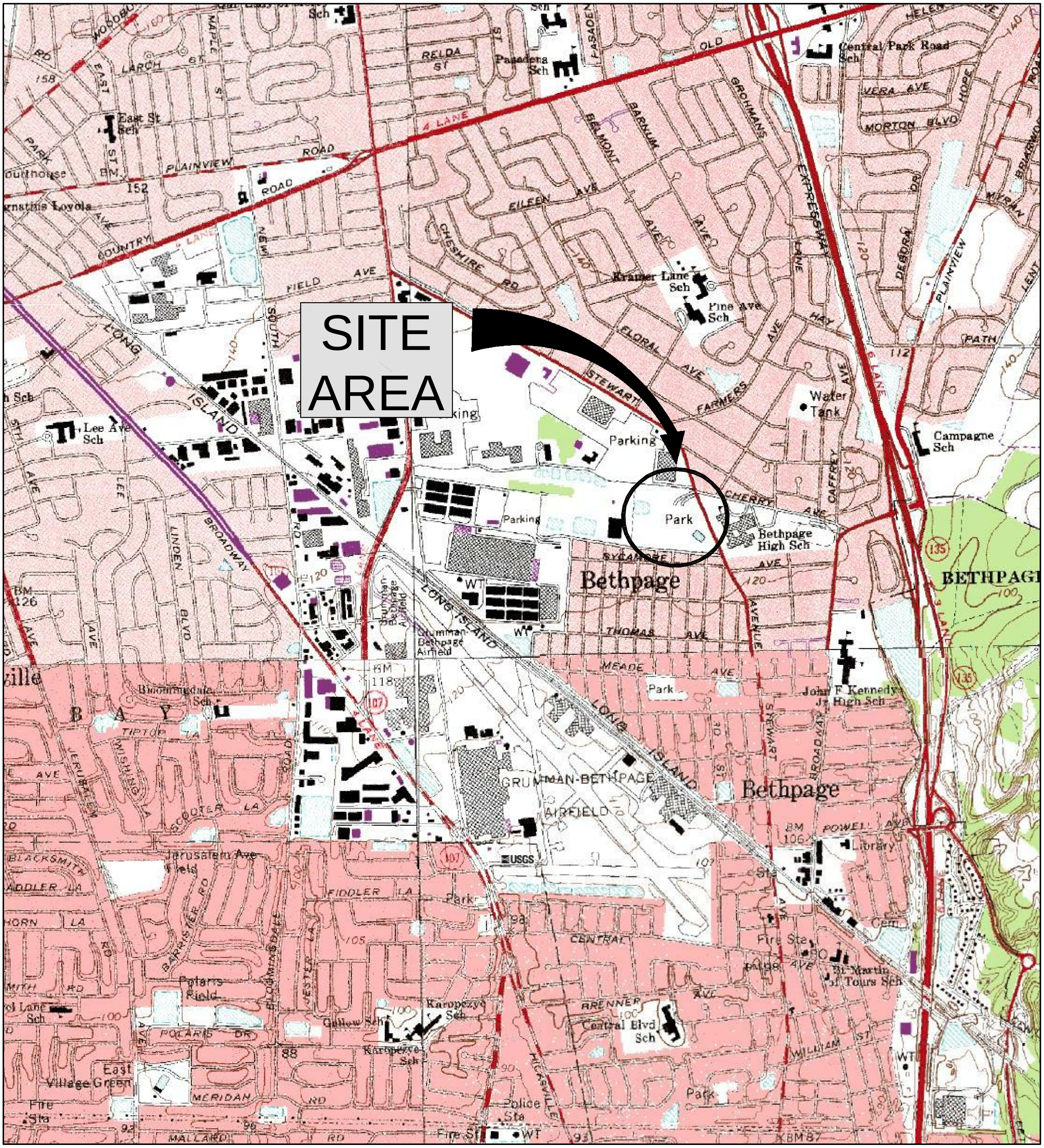
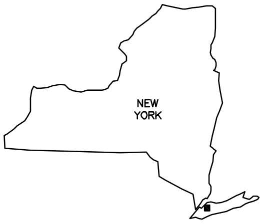
Table 5. Advisory Conditions at PLC, Groundwater IRM, Operable Unit 3, Former Grumman Settling Ponds, Bethpage, New York.

ADVISORY DESCRIPTION (ADVISORY SCREEN ON HMI)	TAG NO.	DEVICE(S) TYPE	LOCATION
BAG FILTER PRESSURE ADVISORY FILTER SWITCH OCCURRED	PT-700	PRESSURE TRANSMITTER	INFLUENT LINE TO BAG FILTER
WELL PUMP (P-110) RUN INDICATION ADVISORY	YI-110	RUN INDICATOR	MCP/PLC
WELL PUMP (P-120) RUN INDICATION ADVISORY	YI-120	RUN INDICATOR	MCP/PLC
WELL PUMP (P-130) RUN INDICATION ADVISORY	YI-130	RUN INDICATOR	MCP/PLC
WELL PUMP (P-140) RUN INDICATION ADVISORY	YI-140	RUN INDICATOR	MCP/PLC
AIR STRIPPER BLOWER (B-410) RUN INDICATION ADVISORY	YI-410	RUN INDICATOR	AIR STRIPPER CONTROL PANEL
AIR STRIPPER DISCHARGE PUMP (P-400) RUN INDICATION ADVISORY	YI-400	RUN INDICATOR	AIR STRIPPER CONTROL PANEL



SOURCE:
USGS 7.5 MIN. AMITYVILLE QUADRANGLE, AMITYVILLE, NY. 1994
USGS 7.5 MIN. FREEPORT QUADRANGLE, FREEPORT, NY., 1994
USGS 7.5 MIN. HICKSVILLE QUADRANGLE, HICKSVILLE, NY., 1967, PHOTOREVISED 1979
USGS 7.5 MIN. HUNTINGTON QUADRANGLE, HUNTINGTON, NY. 1967, PHOTOREVISED 1979



QUADRANGLE LOCATION

N

0 2000' 4000'

SCALE IN FEET

NORTHROP GRUMMAN CORPORATION
BETHPAGE, NEW YORK

FINAL DESIGN REPORT OPERABLE UNIT 3
FORMER GRUMMAN SETTLING PONDS

SITE LOCATION MAP

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FIGURE
1

CITY:MELVILLE DIV/GROUP:ENR1 DB:ALS LD: PIC: PM:CSG TM:BW LYR:ON=*;OFF=*REF*
G:\APROJECT\Northrop Grumman\Superfund\2008\OU3\NY001464.1807 GWIRM\Design Documents\Design Report\Final Design Report\Figures\final F01.dwg LAYOUT: 1SAVED: 9/3/2008 1:33 PM ACADVER: 17.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS_MELVILLE.CTB PLOTTED: 9/3/2008 1:37 PM BY: SANCHEZ, ADRIAN
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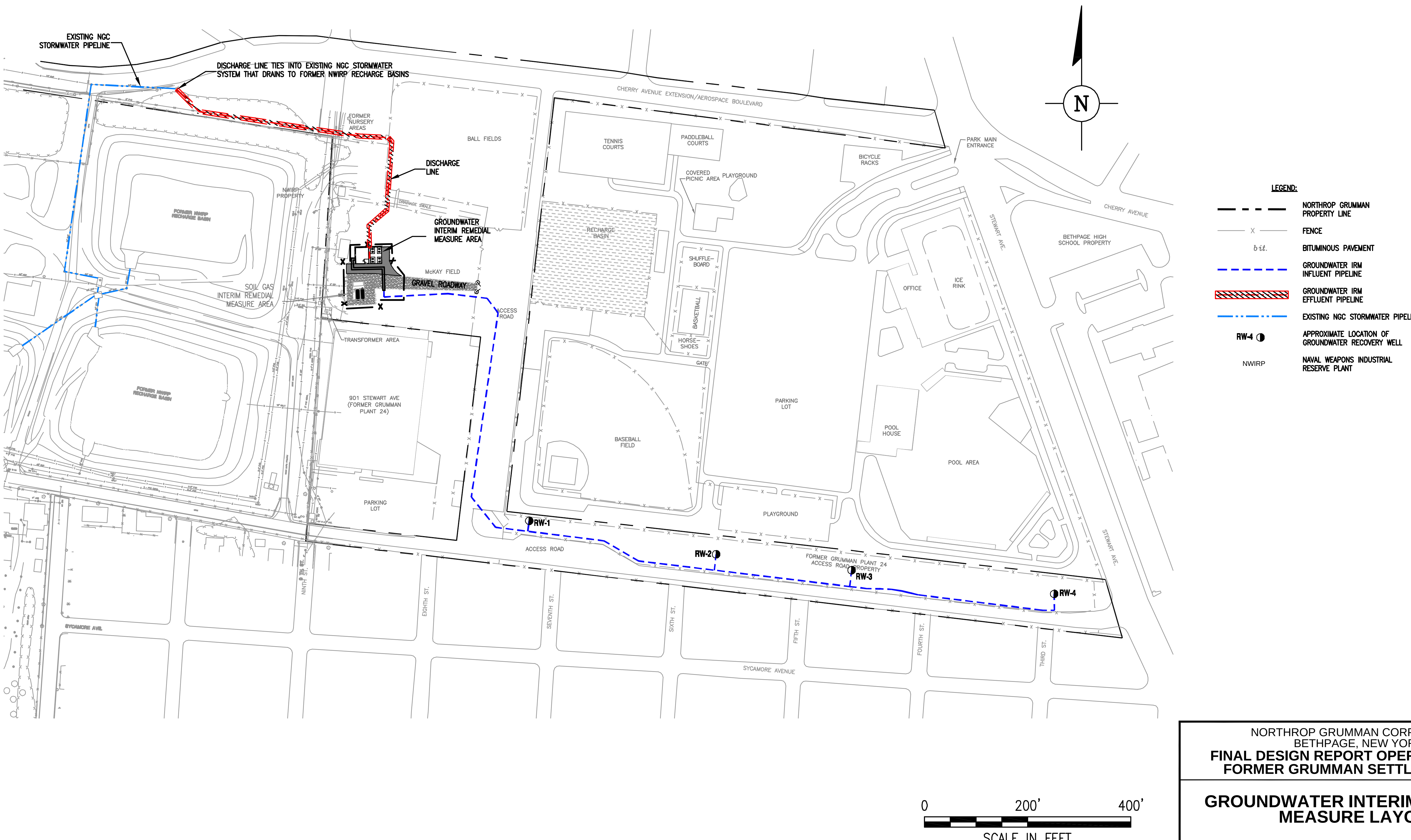

NORTHROP GRUMMAN CORPORATION
BETHPAGE, NEW YORK

FINAL DESIGN REPORT OPERABLE UNIT 3
FORMER GRUMMAN SETTLING PONDS

GROUNDWATER INTERIM REMEDIAL MEASURE LAYOUT

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FIGURE
2

CITY:MELVILLE DIV/GROUP:ENR1 DB:ALS LD: PIC: PM:CSG TM: LYR:ON=*;OFF=*REF*
G:\APROJECT\Northrop Grumman\Superfund\2008\OU3\NY001464.1807 GWIRM\Design Documents\Design Report\Final Design Report\Figures\final F02.dwg LAYOUT: 2 SAVED: 9/3/2008 1:33 PM ACADVER: 17.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS_MELVILLE.CTB PLOTTED: 9/3/2008 1:37 PM BY: SANCHEZ, ADRIAN
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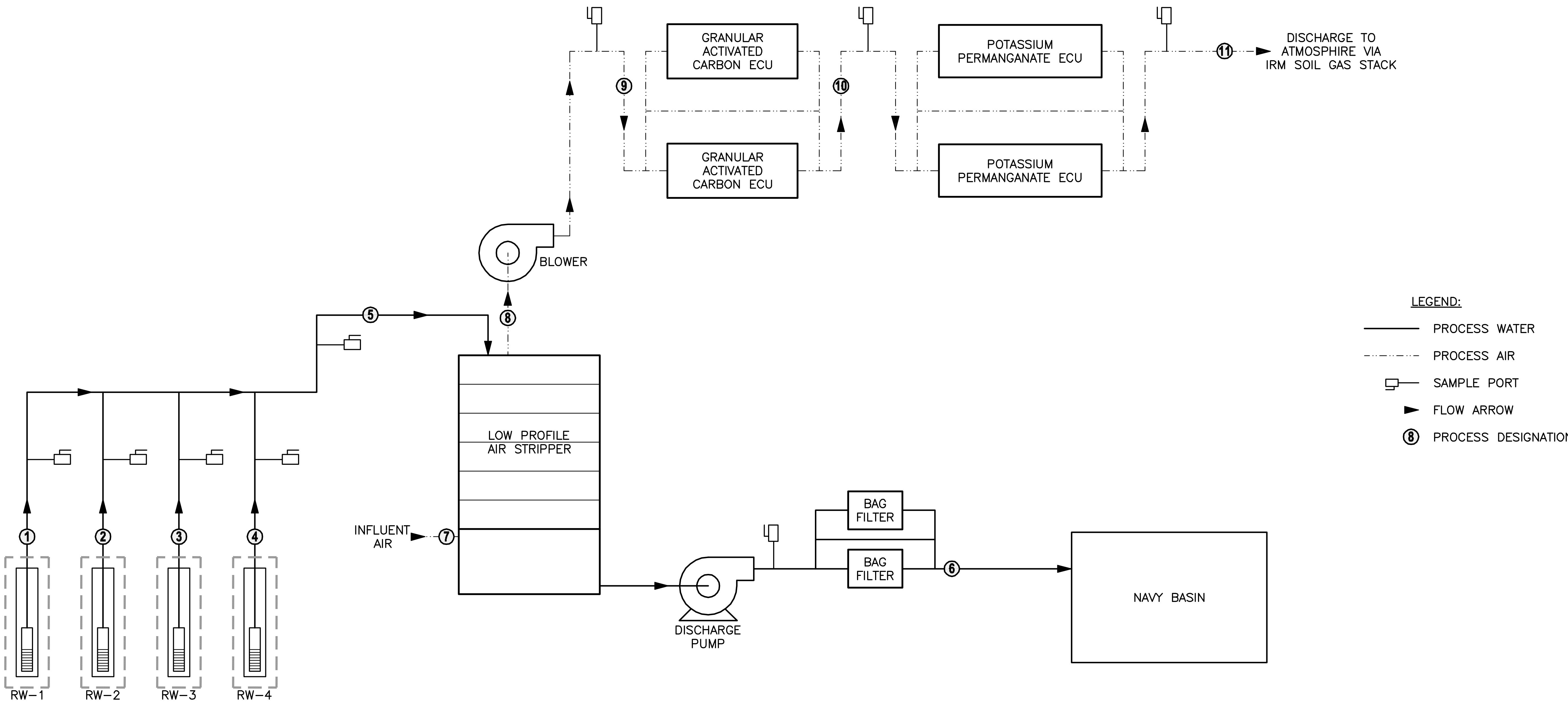
BCP-08_NAD83 BCP_Aerial.jpg
Navy2_Basin_NAD83



PROCESS	1	2	3	4	5	6	7	8	9	10	11
Mass Loading (lbs/day)											
Trichloroethene	0.009	0.041	0.082	0.008	0.140	<0.008	0.000	0.140	0.140	<0.014	<0.014
cis -1,2 Dichloroethene	0.007	1.877	0.431	0.030	2.346	<0.008	0.000	2.346	2.346	<0.235	<0.235
Vinyl Chloride	0.000	0.443	0.001	0.000	0.444	<0.003	0.000	0.444	0.444	0.444	<0.044
Flow Rate (gpm)	40	85	85	40	250	250	---	---	---	---	---
Flow Rate (CFM)	---	---	---	---	---	---	1,300 - 1,600	1,300	1,535	1,557	1,581
Pressure (feet of water)	10	10	10	10	8	15	---	---	---	---	---
Pressure (inches of water)	---	---	---	---	---	---	0	- 28 to - 38	12	6	0
pH	6.4	6.4	6.4	6.4	6.4	6.2	---	---	---	---	---
Temperature	55	55	55	55	55	55	10	55	97	95	95
Relative Humidity	---	---	---	---	---	---	20 - 80	100	<50	<50	<50

NORTHROP GRUMMAN CORPORATION
BETHPAGE, NEW YORK

FINAL DESIGN REPORT OPERABLE UNIT 3
FORMER GRUMMAN SETTLINNG PONDS

PROCESS FLOW DIAGRAM

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FIGURE
3

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Drawings

Under Separate Cover

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Appendix A

Groundwater Modeling
Memorandum, December, 3, 2007

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MEMO

To:
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New York State Department of Environmental Conservation

Copies:
Mike Wolfert
Carlo San Giovanni
David Stern

From:
Robert Porsche & Doug Smolensky

Date:
December 3, 2007

ARCADIS Project No.:
NY001464.1107.00001

Subject:
Preliminary Results of Groundwater Interim Remedial Measure Modeling, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York.

Introduction

This memo has been prepared to document the modeling conducted in support of the development of a Groundwater Interim Remedial Measure (IRM) for Operable Unit 3 (Former Grumman Settling Ponds), located in Bethpage, New York. Specifically, this memo discusses the selected preliminary remedial design: "Pump and Treat without Local Recharge", which is explained further below and described in the Groundwater IRM Work Plan, dated November 14, 2007, currently under review by the New York State Department of Environmental Conservation (NYSDEC).

Groundwater IRM Design Goals

The Groundwater IRM is being designed to accomplish the following goals.

- Mitigate the off-site migration of volatile organic compounds (VOCs) in groundwater where total VOCs exceed 50 micrograms per liter (µg/L), through the implementation of a groundwater pump and treat system that will extract groundwater along the former Grumman Plant 24 Access Road property, south of the Bethpage Community Park.

- Comply with applicable NYSDEC Standards, Criteria, and Guidance Values (SCGs).

Model Scenario Configuration

For the simulations described herein, the current, NYSDEC-accepted regional groundwater flow model for the Northrop Grumman/Navy, Bethpage, NY sites was utilized. For this effort, the model focused specifically on Bethpage Park and the surrounding area.

Multiple simulations were conducted to assess various pumping and recharge configurations of the "Pump and Treat without Local Recharge" scenario. Extraction well screen settings, pumping rates, and the number of wells were varied and the effect of the changes evaluated with respect to containment of VOCs in groundwater.

The scenario that best met the IRM design goals in a technically efficient manner included four extraction wells (identified as Wells EW-1 through EW-4) simulated as pumping along the former Grumman Plant 24 Access Road. Spacing between the extraction wells was approximately 300 ft. Moving across the former Grumman Plant 24 Access Road from west to east, each well was simulated to pump continuously at rates of 30, 75, 75, and 30 gallons per minute (gpm), respectively; with wells screened from 20 to -2, 41 to 22, 41 to 22, and 18 to -5 ft relative to mean sea level (ft msl), respectively. The irregular and inconsistent screen zone settings are directly related to the distribution of VOCs observed in the subsurface and hydrogeologic conditions.

The treated effluent from the IRM will be discharged to one of the basins located on the Naval Weapons Industrial Reserve Plant (NWIRP) property such that there will be no hydraulic interference at the extraction wells.

Model Simulation Results

Simulation results are best observed through the use of particle tracking techniques. Figures 1 through 8 indicate particle pathlines of particles initialized in the uppermost eight model layers (where VOCs have been observed) within and around the Bethpage Park. The impact that the extraction wells have on flow is significant as particles are shown to be drawn towards and captured by the four extraction wells. With the exception of several particles started outside the Park boundary in Model Layers 1 and 2 (the uppermost layers, i.e. the water table), particle tracking results indicate full containment from the water table to Model Layer 8 (approximately -17 ft msl) throughout the footprint of groundwater exhibiting detectable concentrations of VOCs.

Figure No. 1
Model Layer 1
Groundwater Pump and Treat Simulation for Bethpage Park, Northrop Grumman Corporation, Bethpage, New York.
Head Contour Interval is 0.5 ft.#

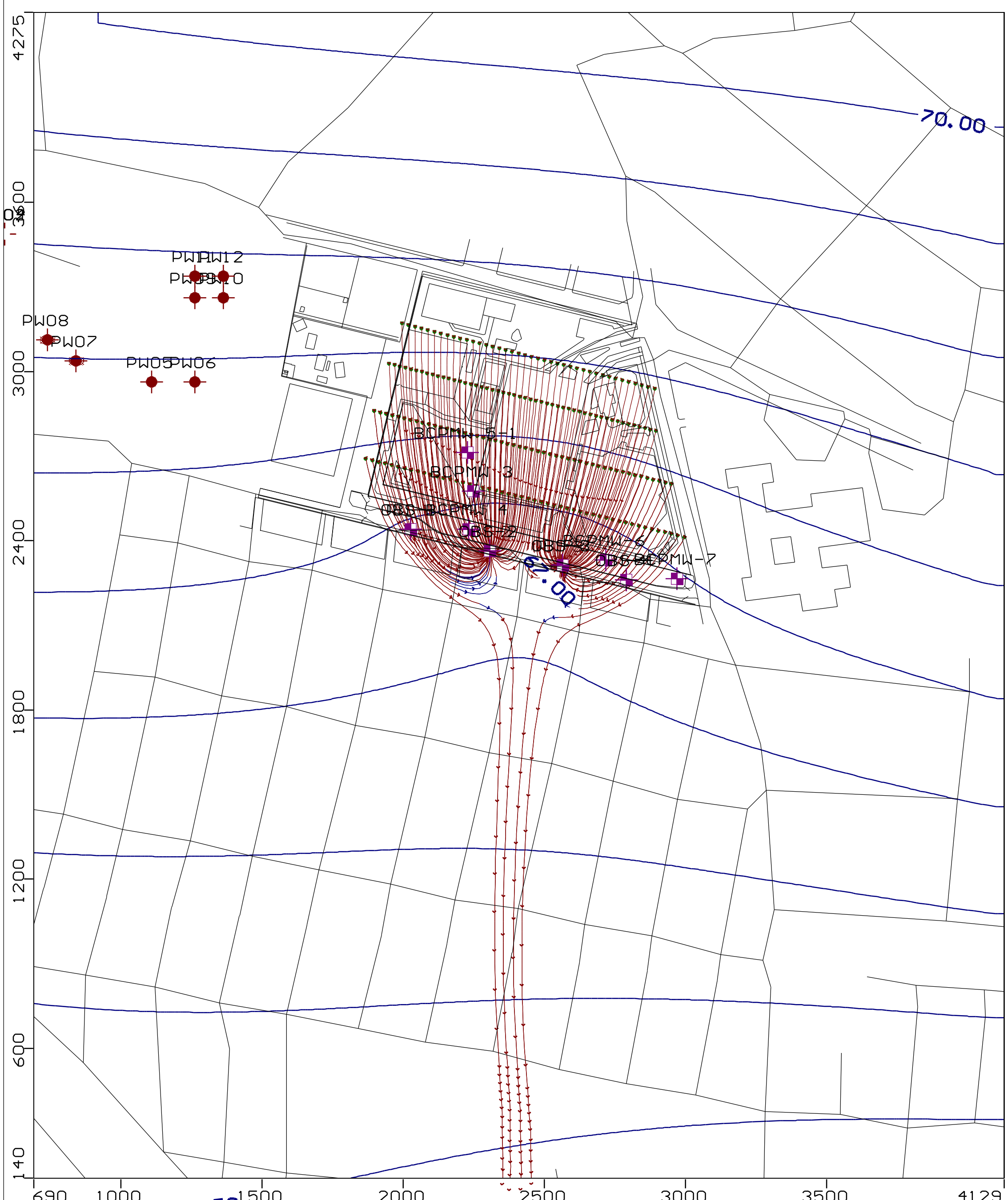


Figure No. 2
Model Layer 2
Groundwater Pump and Treat Simulation for Bethpage Park, Northrop Grumman Corporation, Bethpage, New York.
Head Contour Interval is 0.5 ft.#

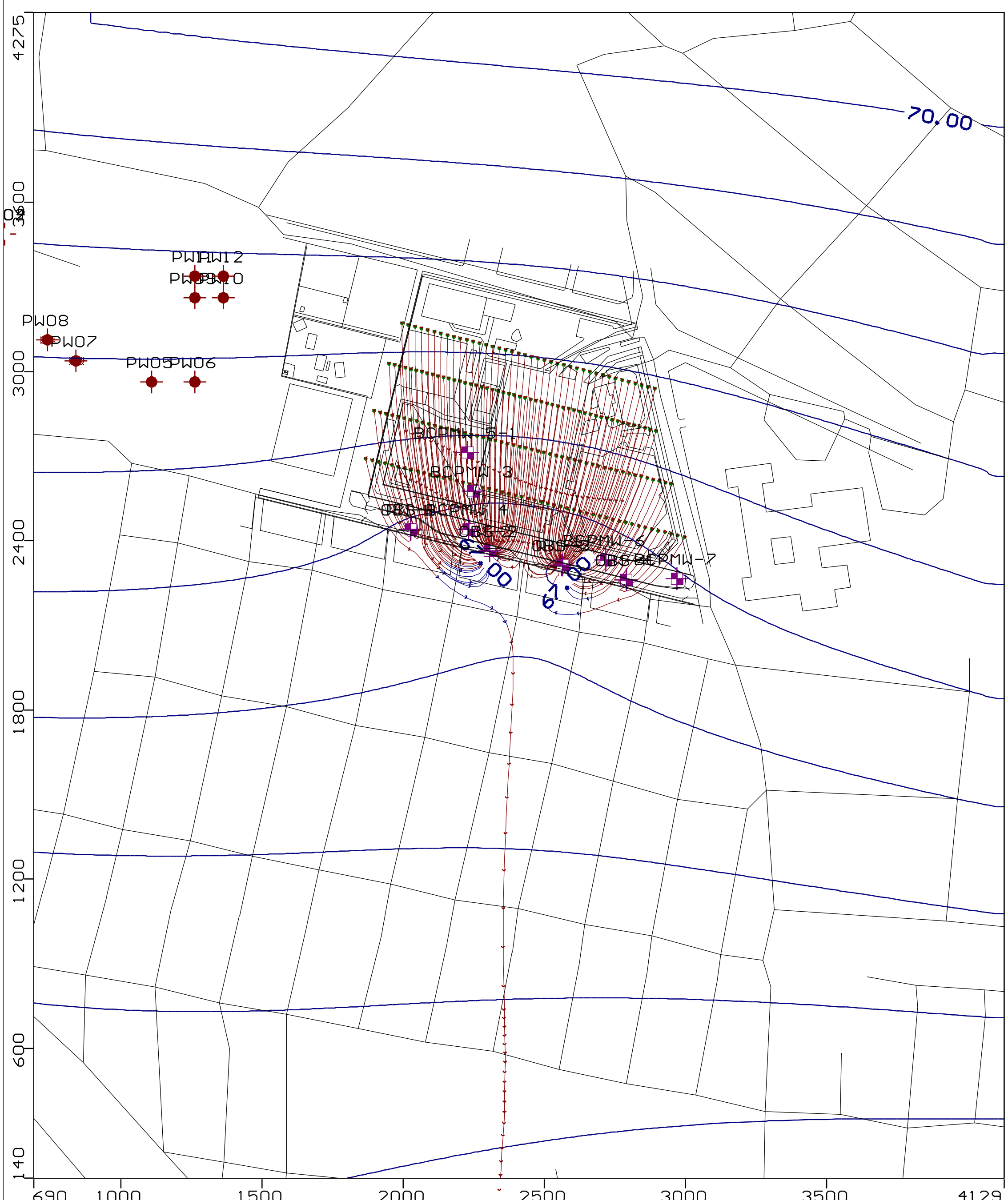


Figure No. 3
Model Layer 3
Groundwater Pump and Treat Simulation for Bethpage Park, Northrop Grumman Corporation, Bethpage, New York.
Head Contour Interval is 0.5 ft.#

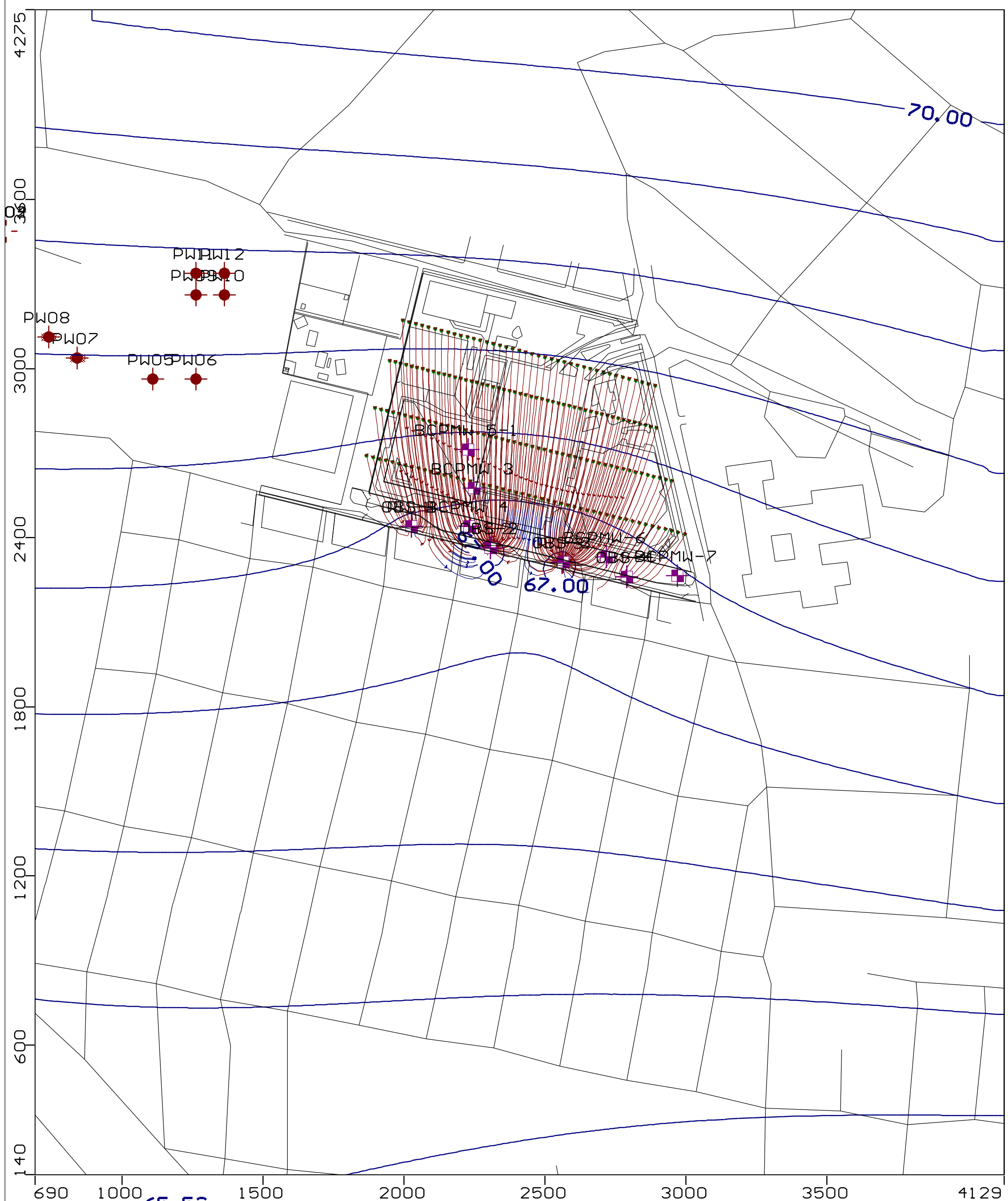


Figure No. 4
Model Layer 4
Groundwater Pump and Treat Simulation for Bethpage Park, Northrop Grumman Corporation, Bethpage, New York.
Head Contour Interval is 0.5 ft.#

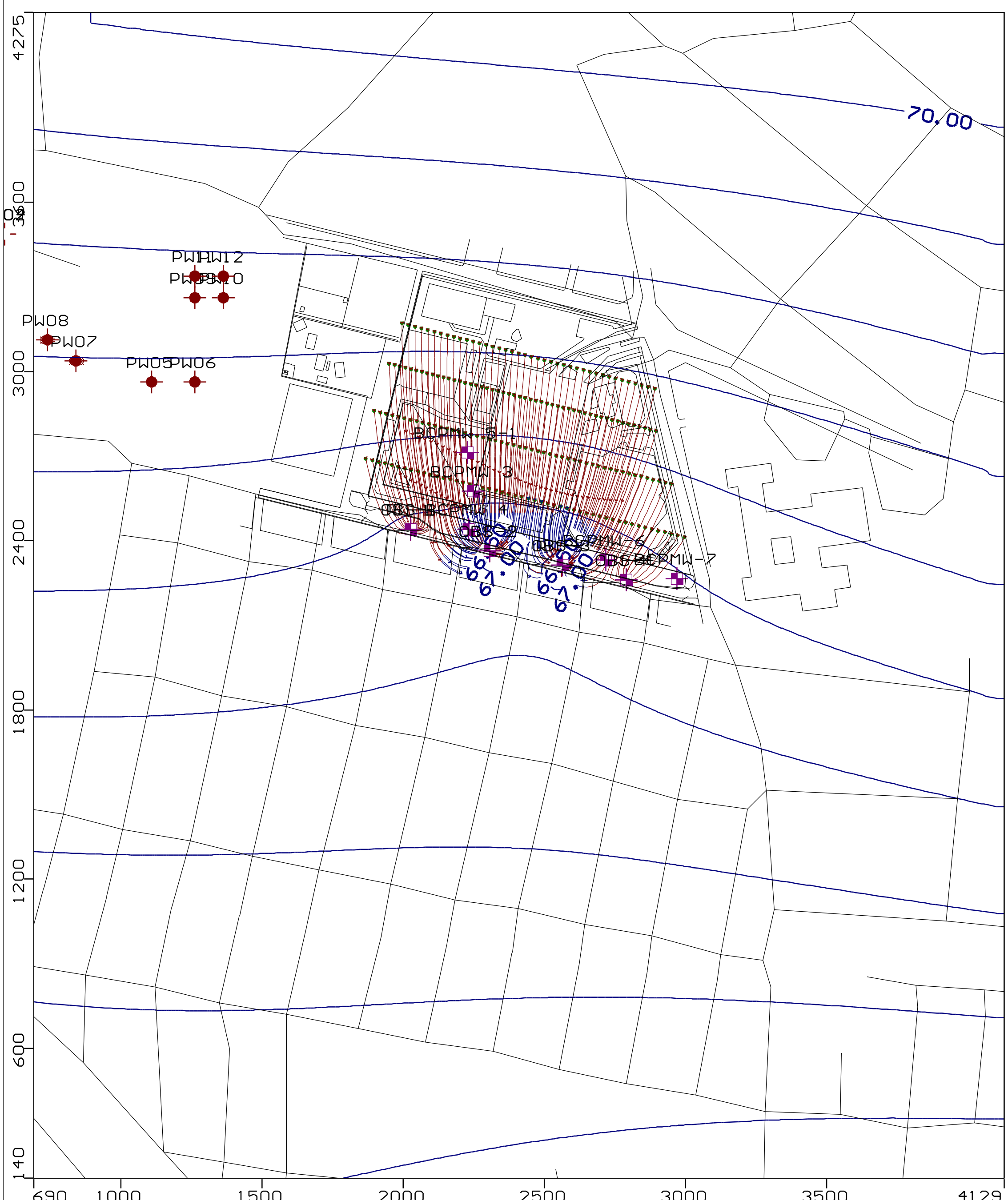


Figure No. 5
Model Layer 5
Groundwater Pump and Treat Simulation for Bethpage Park, Northrop Grumman Corporation, Bethpage, New York.
Head Contour Interval is 0.5 ft.#

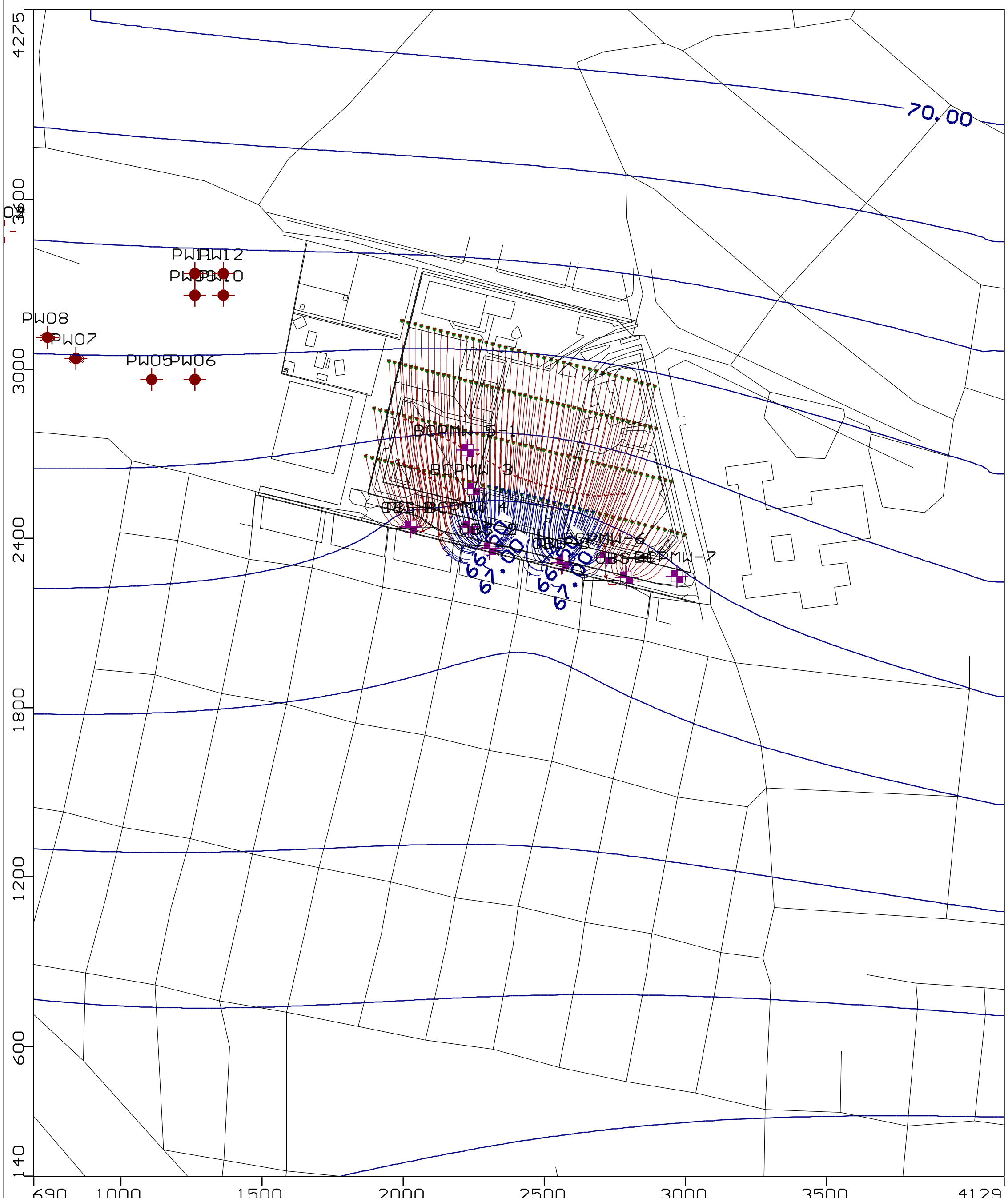


Figure No. 6
Model Layer 6
Groundwater Pump and Treat Simulation for Bethpage Park, Northrop Grumman Corporation, Bethpage, New York.
Head Contour Interval is 0.5 ft.#

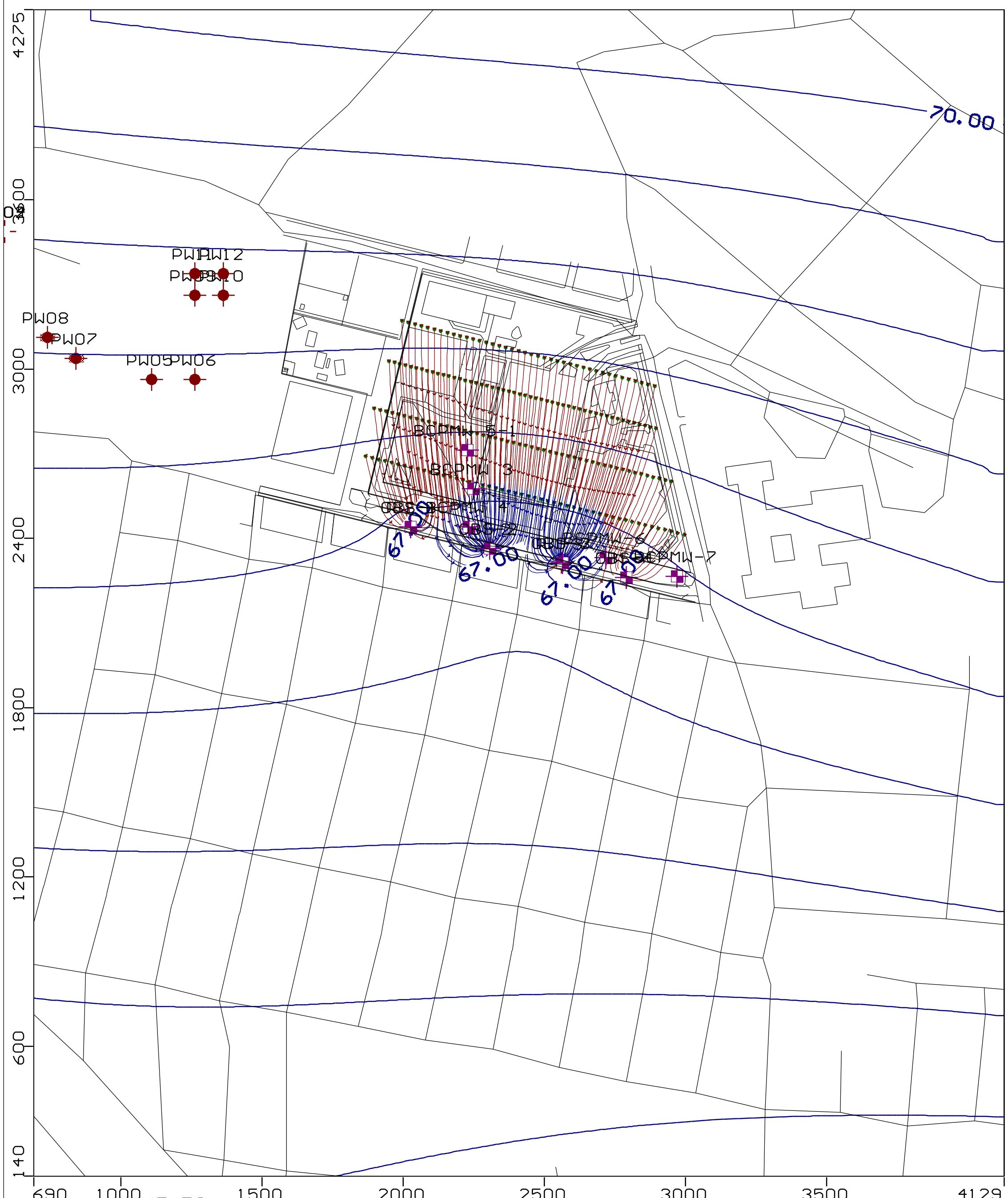


Figure No. 7
Model Layer 7
Groundwater Pump and Treat Simulation for Bethpage Park, Northrop Grumman Corporation, Bethpage, New York.
Head Contour Interval is 0.5 ft.#

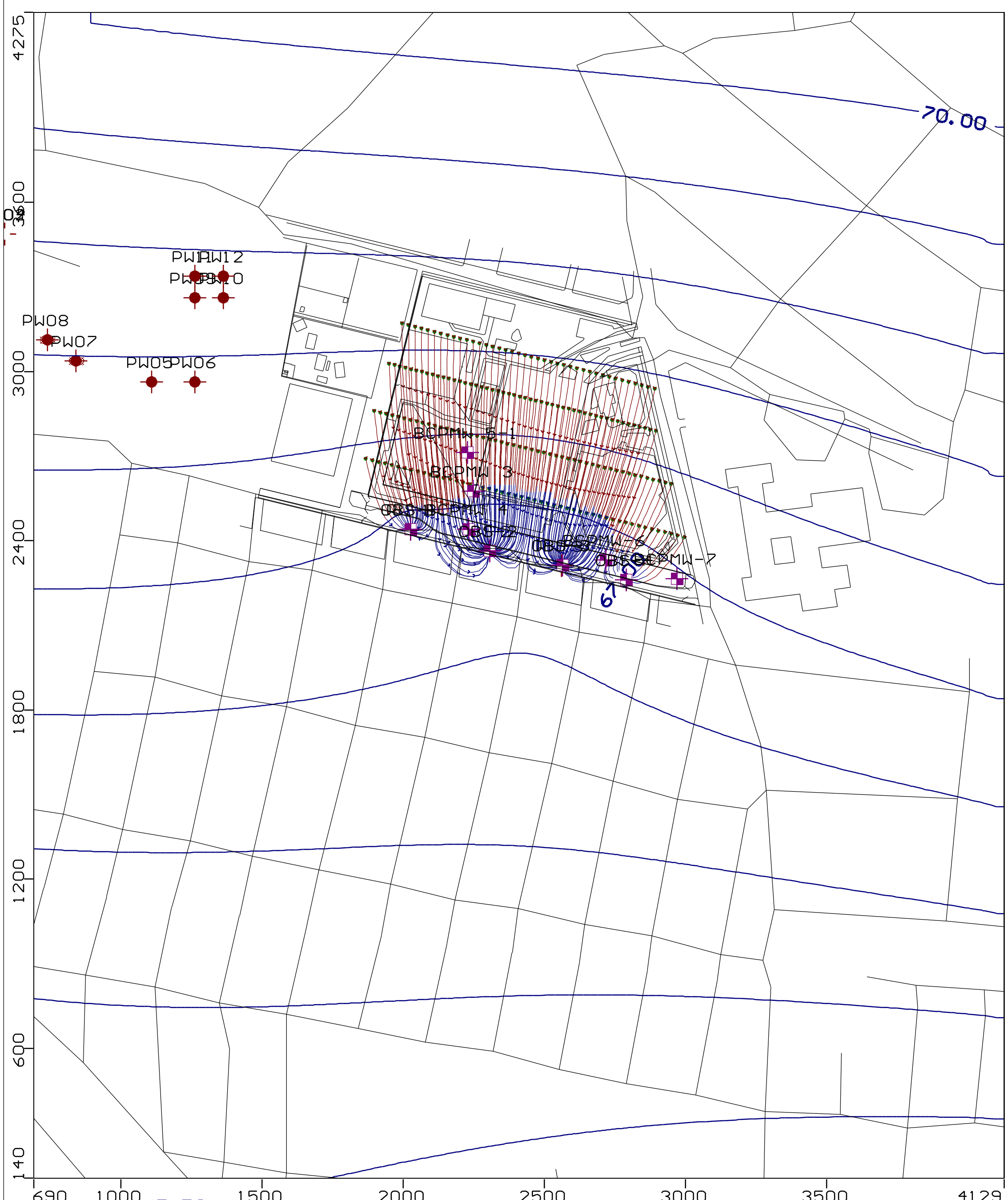
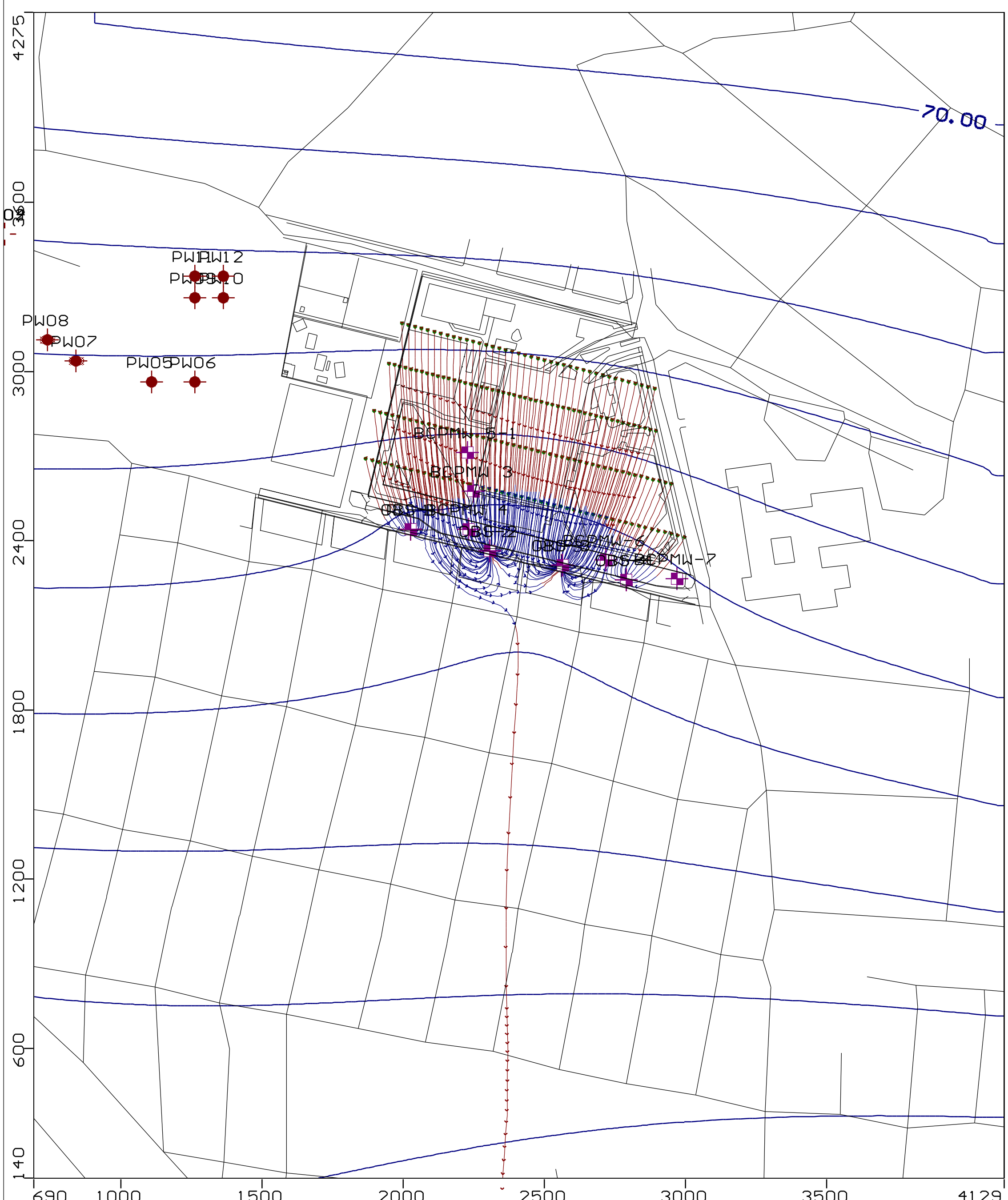


Figure No. 8
Model Layer 8
Groundwater Pump and Treat Simulation for Bethpage Park, Northrop Grumman Corporation, Bethpage, New York.
Head Contour Interval is 0.5 ft.#



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Appendix B

Pumping Test Memorandum, April 22, 2008

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MEMO

To:
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Michael Wolfert

From:
Robert Porsche and Doug Smolensky

Date:
April 22, 2008

ARCADIS Project No.:
NY001464.1807.00002

Subject:
Analysis of 48-hour Pumping Test on Remedial Well RW-02, Northrop Grumman Operable Unit 3, Bethpage, New York.

A 48-hour pumping test was conducted (April 8–10, 2008) on proposed Remedial Well RW-02 in support of the design of a groundwater Interim Remedial Measure (IRM) for Northrop Grumman's Operable Unit 3 (Bethpage Park), in Bethpage, New York. This pumping test was specifically conducted to verify the hydraulic conductivity assignments in the groundwater flow model used to design the IRM extraction well network.

This memo summarizes the design of the test well and monitoring wells, discusses the data analysis and interpretation effort and describes the groundwater flow model validation effort.

Well Construction Details

Remedial Well Design and Construction

Remedial Well RW-02 was constructed with 6-inch diameter, black steel casing and a 20-ft long, 0.025-inch wire wrapped continuous slot stainless steel screen. Based on this design, the well has a theoretical yield of 310 gallons per minute at an entrance velocity of 0.1 feet per second.

Monitoring Well Network

A monitoring well network consisting of two 3-piezometer clusters (PZ-1a, PZ-1b, PZ-1c, PZ-2a, PZ-2b and PZ-2c) and two piezometers (PZ-3 and PZ-4) were installed to monitor drawdown and recovery in the aquifer during the pumping test. Monitoring wells were constructed of 1 or 2-inch diameter schedule 40 PVC and fitted with 5-ft long, 0.01-inch slotted screens. **Table 1** summarizes the IRM Pilot Test Monitoring Well Network. The locations of the remedial well and monitoring wells are shown on **Figure 1**.

Remedial Well Development and Testing

Remedial Well Development

Remedial well RW-02 was developed using air lifting, bailing, surging and jetting techniques. ARCADIS' hydrogeologist monitored the well's discharge, estimated the rate and volume of discharge (by observing the flow from the well head into a mud tub) and tracked the turbidity, pH, conductance and temperature of the water discharged. All development water was temporarily containerized in a Baker tank to allow any suspended sediment to settle before discharging the water to the Sixth Street Publicly Owned Treatment Works (POTW) manhole.

During development by air-jetting, a peak discharge rate of 30 gpm (estimated from the discharge to the mud tub) was achieved.

Remedial Well Step Testing

Preliminary step testing of Remedial Well RW-02 with a 10 HP submersible pump (capable of pumping 230 gpm with a net positive suction head of 13ft) indicated additional development was needed. Following development using air jetting, the wells sustainable yield increased to 120 gpm, at a specific capacity of about 3 gpm/ft of drawdown. Although this level of well performance is satisfactory for the proposed IRM pumping rate of 75 gpm, a rate of 120 gpm is less than that planned for the pumping test. The specific capacity data indicates that well performance could likely be improved with additional development. However, in the interest of the overall project schedule for the design and construction of the IRM system, the pumping test was conducted at 120 gpm.

Pre-Test Water-Level and Precipitation Monitoring

Pre-test water-level, barometric pressure, and precipitation monitoring was conducted from 4/4/08 to 4/7/08. Water-level monitoring was accomplished with down-hole transducers and data loggers to observe and record water-levels every half hour in the days prior to the test. Accumulated precipitation was manually monitored twice a day with an on-site rain gage (installed in the southeast corner of the baseball field). No significant precipitation occurred immediately prior (within 48 hours) to the pumping test.

In addition to water level monitoring, each data logger was equipped with an internal pressure transducer to monitor barometric pressure. Water level monitoring was conducted using the monitoring well network shown on **Figure 1** and consisted of PZ-1a,b,c; PZ-2a,b,c; PZ-3; PZ-4; H3-PZ; and BCPMW5-1. **Figure 2** is a plot of the pre-test water level trends.

Pumping Test Procedure

Although ARCADIS was permitted (by the Town of Oyster Bay's POTW) to discharge 200 gpm to the Sixth Street manhole for the test, the sustainable yield of RW-02 was limited to 120 gpm. Therefore, the test was conducted by pumping RW-02 continuously at 120 gpm for approximately 48 hours. The pumping test was conducted from 4/8/05 to 4/10/08.

To regulate and monitor the rate of discharge, Remedial Well RW-02 was equipped with a flow control valve and flow meter (indicating both instantaneous flow and total discharged).

Groundwater pumped from RW-02 during the aquifer test was impacted with volatile organic compounds (VOCs), therefore, water was conveyed from the well head through a fire hose to a pair of liquid phase carbon vessels prior to being discharged via a POTW manhole on the north end of Sixth Street.

Data Collection and Interpretation

This section describes methods of data collection used during the pumping test, and provides an interpretation of the data collected. With the exception of the rain gage, each of the monitoring points described below (i.e., monitoring well network, upgradient monitoring point, and piezometers) were equipped with a pressure transducer connected to a data logger (Hermit 3000 by In-Situ Inc.).

Changes in aquifer water levels in response to pumping Remedial Well RW-02 were recorded by data loggers. Observations of water level (follow pump start-up) were recorded at the frequency described below:

- For the first minute, measurements were taken every 2 seconds.
- Between 1 and 3 minutes, measurements were taken every 5 seconds.
- Between 3 and 10 minutes, measurements were taken every 10 seconds.
- Between 10 and 20 minutes, measurements were taken every 1 minute.
- Between 20 and 40 minutes, measurements were taken every 2 minutes.
- Between 40 and 60 minutes, measurements were taken every 3 minutes.
- Between 60 and 80 minutes, measurements were taken every 4 minutes.

- Between 80 and 100 minutes, measurements were taken every 5 minutes.
- Between 100 and 500 minutes, the interval between measurements was gradually raised to 30 minutes.
- After 500 minutes, measurements were taken every 30 minutes.

Rain Gage

No significant precipitation occurred during the test; a correction to remove the effect of recharge due to precipitation during this test was not necessary.

Barometric Pressure

During the pumping test, barometric pressure fell by approximately 0.35 ft of water (between 200 and 2,630 minutes after the start of the test). Just prior to the end of the test (between 2,630 and 2,870 minutes elapsed time) barometric pressure increased by approximately 0.1 ft of water. Water level fluctuations in all monitoring points except H3-PZ exhibited a response matching the late-time barometric fluctuations. That is, the fluctuations observed in barometric pressure between about 2,000 and 2,870 minutes after the start of the test are mirrored in the recorded water-level response (water levels rose as barometric pressure fell, and water levels declined as barometric pressure increased). As the observed barometric effect was limited in magnitude and occurred near the conclusion of the test, no correction was made for the effect of barometric pressure changes on observed water-levels.

Upgradient Monitoring Point

Monitoring well BCPMW5-1 was used to monitor water-level variability in the shallow aquifer prior to and during the pumping test. The data collected from monitoring well BCPMW5-1 indicated that prior to the test, water-levels in the area were generally stable; therefore a correction for regional groundwater trends is not necessary prior to evaluating the test data (**Figure 2**).

The well was believed to be sufficiently distant (and upgradient) from Remedial Well RW-02 so that it was not expected to exhibit a response to pumping during the test. However, the observed water level decline (0.046 ft by 2600 minutes after the start of the test) in monitoring well BCPMW5-1 is believed to be a response to the pumping at Remedial Well RW-02 (**Figure 3**). Their minor response, which occurred late in the test, does not preclude this use of this well as a valid upgradient (background) monitoring point.

Piezometer

Piezometer H3-PZ was used to monitor the response of perched water to pumping. The water-level in piezometer H3-PZ declined 0.03 ft by the conclusion of the test (**Figure 3**). Given the similar decline noted in BCPMW5-1, it appears that the water level decline observed in H3-PZ may be the result of infiltration induced by the pumping of Remedial Well RW-02.

Monitoring Well Network

Drawdown observed during the test throughout the monitoring well network, the upgradient monitoring point, and the perched water piezometer are shown on **Figure 3.** The semi-logarithmic plot of drawdown vs. time indicates a maximum observed drawdown of 0.75 ft (observed in piezometer PZ-01b). A review of **Figure 3** indicates that the magnitude of drawdown response declines with distance from Remedial Well RW-02.

Remedial Well RW-02

Significant drawdown was noted in Remedial Well RW-02 during the pumping test. At 120 gpm, the water level in the pumping well was drawn down 36.54 ft after about 1 minute of pumping (**Figure 4**). During the remainder of the test, the water level in the pumping well declined an additional 4.2 ft for a total drawdown at the conclusion of the test of 40.74 ft.

It is believed that the significant observed drawdown is the result of well inefficiency rather than inappropriate well design or overpumping.

Preliminary Evaluation of Transmissivity

AQTESOLV for Windows (HydroSOLVE, Inc.) was used to estimate values of transmissivity from the time-drawdown data collected during the pumping test. A preliminary evaluation of the pump test data using the Cooper Jacob method for unconfined aquifers resulted in a hydraulic conductivity estimate of about 250 ft/d.

While this method can be used for estimating a transmissivity, the assumptions for this solution method are not consistent with the conditions under which the test was conducted; specifically, the pumping well was not fully penetrating, and there appears to have been a delayed gravity response in the aquifer. A more appropriate analytical technique, based on the conditions of the test is the Neuman (1974) method for a pumping test in an unconfined aquifer.

Final Evaluation of Transmissivity

Interpretation of pumping test data is predicated on the selection of the appropriate evaluation method. Each method is associated with a set of assumptions regarding the aquifer (confined vs. unconfined) and the conditions imposed on it during the test (i.e., no recharge, steady pumping rate, partial penetration of the aquifer with pumping and observation wells, etc.)

The Neuman method assumes:

- the aquifer has infinite areal extent,
- the aquifer is homogeneous and has uniform thickness,
- the aquifer potentiometric surface is initially horizontal,
- the pumping well is fully or partially penetrating,
- the aquifer is unconfined with delayed gravity response,
- flow is unsteady, and
- the diameter of the pumping well is very small so that storage in the well can be neglected.

As shown on **Table 1** the monitoring wells observed during this pumping test are screened above, near the top of and below the screen zone of Remedial Well RW-02.

As shown on **Table 2**, using the Neuman analytical method a transmissivity of 21,200 ft^2/d was estimated using wells screened above, near the top of and below the screen zone of Remedial Well RW-02. Based on an assumed saturated thickness of 120 ft (estimated from plots of drawdown vs. depth of observation point below the water table at the conclusion of the test), the estimated average hydraulic conductivity is 176 ft/d.

Based on the estimated aquifer transmissivity of 21,200 ft^2/d and assuming remedial well RW-02 were 100% efficient, it should have a specific capacity of about 18 gpm/ft (**Table 3**). Therefore, when pumping at 120 gpm, the well should exhibit 6.7 ft of drawdown. However, observed drawdown in Remedial Well RW-02 was 40.6 ft at the conclusion of the test. Using the theoretical drawdown (6.7 ft), and the observed drawdown from the conclusion of the pumping test (40.6 ft), the well has an efficiency of 16%. The observed specific capacity at the conclusion of the pumping test (2,870 minutes) was 3 gpm/ft.

IRM Design Modeling

Groundwater quality data collected during the site investigation effort indicates that the aquifer segment represented by model layers 1 through 8 is impacted with dissolved volatile organic compounds (VOCs). The groundwater IRM system was designed to provide full containment of site groundwater in model layers 1 through 8. Model predictions indicate that full capture of site groundwater can be achieved with a 4-well system. Full capture of groundwater was demonstrated by tracking the movement through the aquifer of four lines of particles from each of the VOC-impacted model layers (i.e., layers 1 through 8) and ensuring that the particles stopped in one of the four simulated remedial wells. The four lines of particles were started parallel to the sites southern boundary; 50 particles per line, approximately 25 ft between each particle in a line, and approximately 170 ft separating the lines of particles. In total, 1,600 particles were tracked (4 lines of 50 particles each; 200 per layer, distributed over 8 layers).

Verification of Model Parameters

In the groundwater flow model the upper glacial aquifer and Magothy formation deposits are assigned hydraulic conductivities of 200 and 120 feet per day (ft/d), in model layers 4 and 5, respectively. To assess the sensitivity of the model-generated IRM design to changes in hydraulic conductivity anisotropy, the assigned conductivities in model layers 4 and 5, corresponding to the elevation of the screen zone of remedial well RW-02, were changed to 176 ft/d, and two model runs were conducted. For the first, the horizontal to vertical anisotropy assigned in the model was left unchanged, at 5:1. For the second, the horizontal to vertical anisotropy was set to 10:1. Under both scenarios, the model predicts that the groundwater IRM system will fully contain all site groundwater from model layers 1 through 8.

Conclusions and Recommendations

1. The verification and sensitivity analysis conducted for this evaluation indicates that additional groundwater modeling of the IRM design is not necessary, as the existing groundwater flow model reasonably approximates the transmissivity estimated from the analysis of the pumping test.

2. The specific capacity of RW-02 is 3 gpm/ft of drawdown, and its efficiency has been calculated at 18.5%. Additional development of Remedial Well RW-02 is needed to increase the well's specific capacity and efficiency.

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Table 1. Summary of IRM Pilot Test Monitoring Network, Former Grumman Settling Ponds, Bethpage, New York.

Well ID	Land Surface Elevation (ft msl)	Screen Elevation Top (ft msl)	Screen Elevation Bottom (ft msl)	Well Diameter (inches)	Depth to Screen Top (ft)	Depth to Screen Bottom (ft)	Screen Length (ft)	Well Depth (ft)	Distance from Remedial Well (ft)	Purpose of Well/Cluster.	Flushmount/ StickUp	Transducer Length (ft)
RW-02	125	41	21	6	84	104	20	104	0	Pumping Well	StickUp	130
PZ-01a	125	65	60	2	60	65	5	68	35	Drawdown/vertical gradient monitoring	StickUp	108
PZ-01b	125	45	40	1	80	85	5	88	35	Drawdown/vertical gradient monitoring	StickUp	115
PZ-01c	125	-5	-10	1	130	135	5	138	35	Drawdown/vertical gradient monitoring	StickUp	105
PZ-02a	125	65	60	2	60	65	5	68	75	Drawdown/vertical gradient monitoring	StickUp	105
PZ-02b	125	45	40	1	80	85	5	85	75	Drawdown/vertical gradient monitoring	StickUp	105
PZ-02c	125	-5	-10	1	130	135	5	138	75	Drawdown/vertical gradient monitoring	StickUp	105
PZ-03	125	45	40	1	80	85	5	88	60	Drawdown Monitoring	Flushmount	135
PZ-04	125	45	40	1	80	85	5	88	50	Drawdown Monitoring	Flushmount	120

RW - Remedial Well.
PZ- Piezometer.
ft - feet.
ft msl - feet relative to mean sea level.
-- Not Applicable.

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Table 2. Estimated Aquifer Parameters, Northrop Grumman Operable Unit 3, Bethpage Park, Bethpage, New York.

Well ID	Analytical Method	T (ft^2/d)	S	Sy	Kz/Kr	b (ft)
"a" wells	Theis (unconfined)	24,670	0.029	--	0.43	120
	Neuman (unconfined)	11,740	0.018	0.30	0.10	120
"b" wells	Neuman (unconfined)	21,160	0.023	0.26	0.06	120
"mid"wells	Neuman (unconfined)	23,640	0.019	0.16	0.04	120
"c" wells	Neuman (unconfined)	28,220	0.007	0.62	0.08	120
PZ-3 and PZ-4	Theis (unconfined)	28,910	0.005	--	0.10	120
	Neuman (unconfined)	15,380	0.018	0.50	0.08	120
	Neuman average(1):	19,125				
	Neuman average(2):	21,200				

RW-02 pumped for 48 hrs. at 120 gallons per minute.

Based on its design, this well has a theoretical yield of 310 gallons/minute at an enterance velocity of 0.1 feet/second.

The well is constructed with a 6-inch diameter, 20-ft long, 0.025-inch wire wrapped continuous slot screen.

--	not computed by this method.
T	Transmissivity.
ft^2/d	square feet per day.
S	Storage coefficient.
Sy	Specific Yield.
b	Saturated thickness.
"a" wells	Screened above RW-02; PZ-1a and PZ-2a were included in this analysis.
"b" wells	Screened coincident with RW-02; PZ-1b and PZ-2b were included in this analysis.
"c" wells	Screened below RW-02; PZ-1c and PZ-2c were included in this analysis.
"mid" wells	Screened coincident with RW-02; PZ-1b, PZ-2b, PZ-3 and PZ-4 were included in this analysis.
(1)	Includes wells "a", "b", "c", PZ-3 and PZ-4.
(2)	Includes the "a", "mid", and "c" wells

Table 3. Specific Capacity for RW-02, Northrop Grumman Operable Unit 3, Bethpage Park, Bethpage, New York.

For a 100% efficient well in an unconfined aquifer with T=21,200 ft^2/day,

Specific capacity	=(Transmissivity (gpd/ft) x (Well Screen Length/Aquifer Thickness)) / 1,500
	=((21,200 ft^2/d x 7.48 gallons/ft^3)*(20 ft /120 ft))/1,500
	=26,430 gpd/ft /1500
Estimated Specific Capacity:	**17.6 gpm/ft**
Pumping Rate:	70 gpm
Observed Drawdown:	22.17 ft
Observed Specific Capacity:	**3.2 gpm/ft**
Pumping Rate:	120 gpm
Observed Drawdown:	40.6 ft
Observed Specific Capacity:	**3.0 gpm/ft**

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Table 4. Pre-Test Vertical Gradients, Northrop Grumman Operable Unit 3, Bethpage Park, Bethpage, New York.

Well ID	Assumed Measuring Point Elevation (ft msl)	Depth to Water (ft)	Static Head (ft msl)	Elevation of Screen Mid-Point (ft msl)	Gradient [1] (ft/ft)	Well Pairs
PZ-01a	125	55.34	69.66	62.5	0.0030	a-b
PZ-01b	125	55.4	69.6	42.5	0.0006	b-c
PZ-01c	125	55.43	69.57	-7.5	0.0013	a-c
PZ-02a	125	54.92	70.08	62.5	-0.0010	a-b
PZ-02b	125	54.9	70.1	42.5	0.0026	b-c
PZ-02c	125	55.03	69.97	-7.5	0.0016	a-c

ft msl feet relative to mean sea level
ft feet
(1) Positive vertical gradient indicates downward groundwater movement; negative vertical gradient indicates upward groundwater movement.

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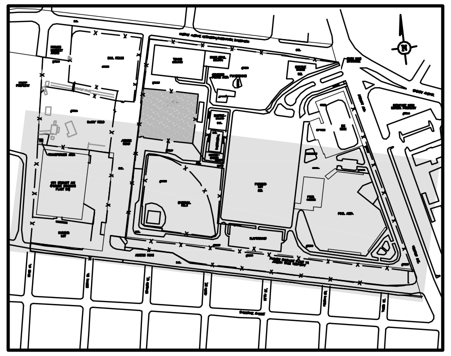
Table 5. Vertical Gradients after 48-hour Pump Test, Northrop Grumman Operable Unit 3, Bethpage Park, Bethpage, New York.

Well ID	Assumed Measuring Point Elevation (ft msl)	Depth to Water (ft)	Static Head (ft msl)	Drawdown at End of Test (ft)	Head at End of Test (ft msl)	Elevation of Screen Mid-Point (ft msl)	Gradient (1) (ft/ft)	Well Pairs
PZ-01a	125	55.34	69.66	0.626	69.034	62.5	0.0099	a-b
PZ-01b	125	55.4	69.6	0.763	68.837	42.5	-0.0102	b-c
PZ-01c	125	55.43	69.57	0.225	69.345	-7.5	-0.0044	a-c
PZ-02a	125	54.92	70.08	0.468	69.612	62.5	-0.0002	a-b
PZ-02b	125	54.9	70.1	0.485	69.615	42.5	-0.0029	b-c
PZ-02c	125	55.03	69.97	0.208	69.762	-7.5	-0.0021	a-c

ft msl feet relative to mean sea level
ft feet
(1) Positive vertical gradient indicates downward groundwater movement; negative vertical gradient indicates upward groundwater movement.

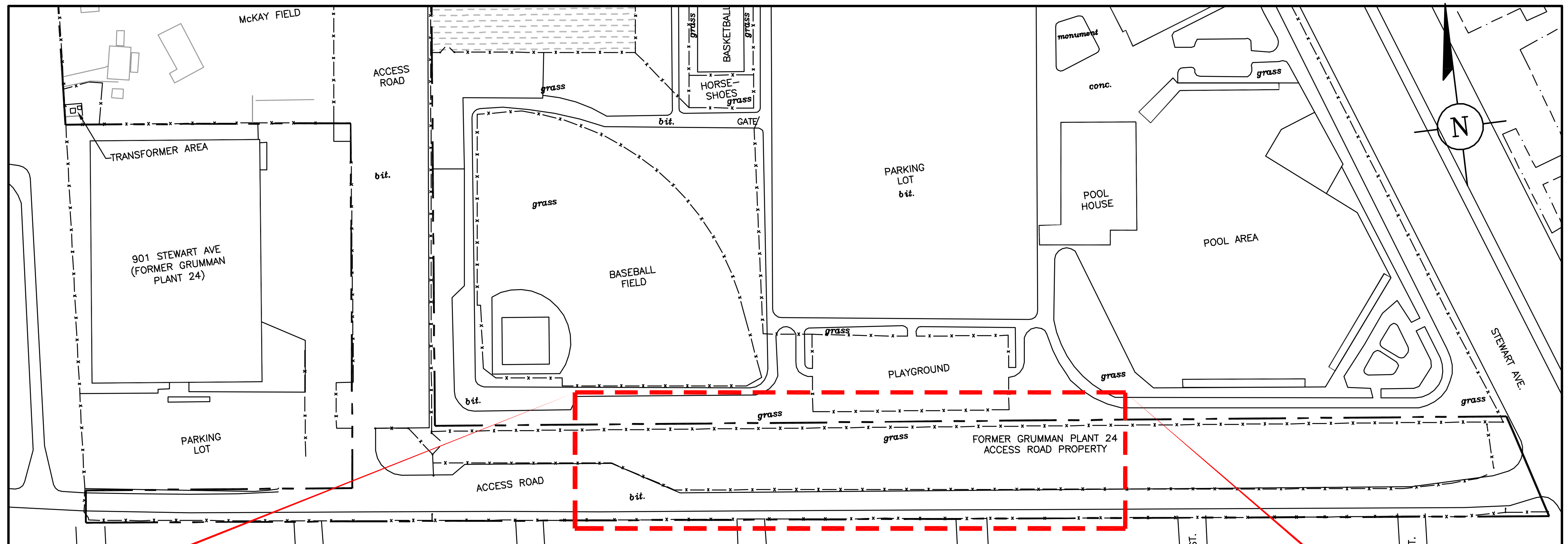


KEY MAP

SCALE: 1" = 500'

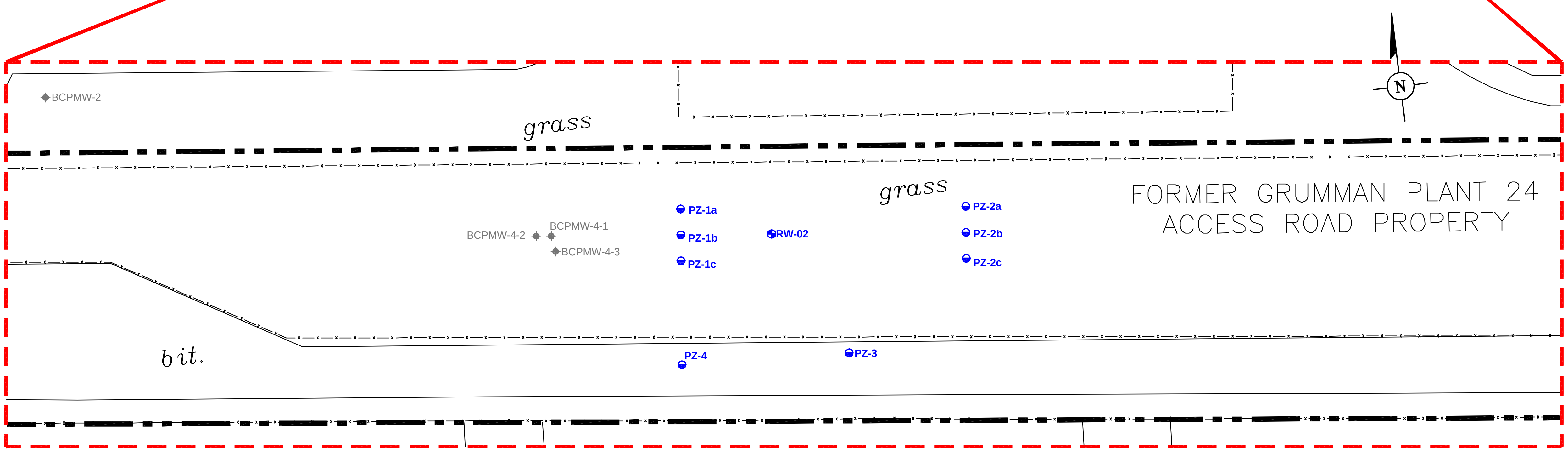
EXPLANATION

- NORTHROP GRUMMAN PROPERTY LINE
- FENCE
- LIMITS OF BETHPAGE HIGH SCHOOL MAIN BUILDING
- BASIN
- bit. BITUMINOUS PAVEMENT
- EXISTING WELL
- EXISTING PERCHED WATER PIEZOMETER
- RW-02 RECOVERY WELL
- PZ-1a PIEZOMETER



SITE PLAN

0 100' 200'
SCALE IN FEET



DETAIL

0 30' 60'
SCALE IN FEET

NOTES:

1. MONITORING WELLS AND PERCHED WATER PIEZOMETERS SURVEYED TO NORTH AMERICAN DATUM (NAD) 83. RECOVERY WELL RW-02 AND ASSOCIATED PIEZOMETERS ARE APPROXIMATE BASED ON FIELD MEASUREMENTS.
2. PARK FEATURES SHOWN WERE PRESENT PRIOR TO TOWN OF OYSTER BAY REDEVELOPMENT IN 2005.

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK
OPERABLE UNIT 3
(FORMER GRUMMAN SETTLING PONDS)

SITE PLAN SHOWING LOCATION OF PILOT TEST WELL AND PIEZOMETER

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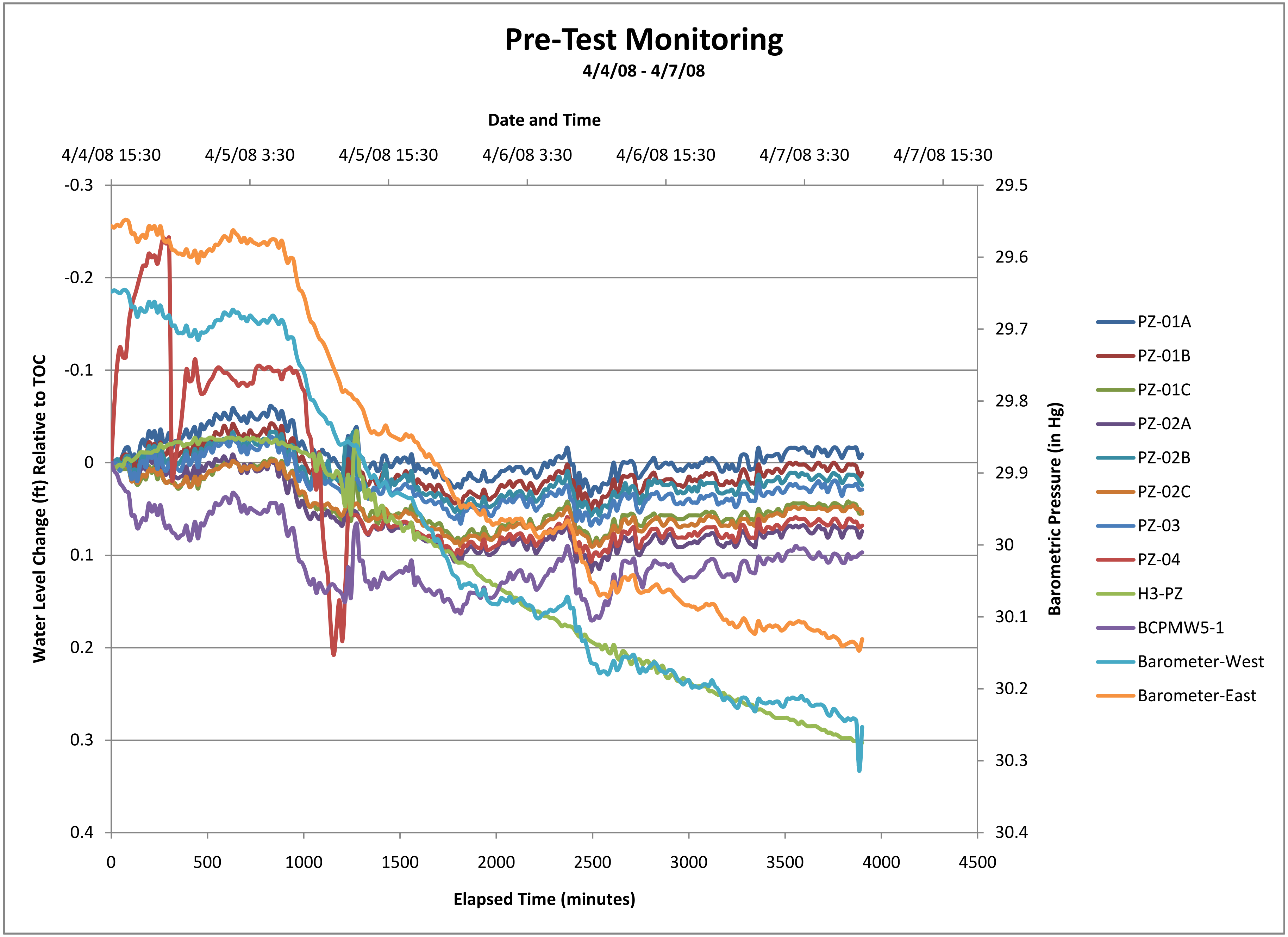
FIGURE
1

Figure No. 2, Pre-Test Monitoring, RW-02 Pumping Test, Northrop Grumman OU3, Bethpage, New York.



G:\APROJECT\Northrop Grumman\Superfund\2008\OU3\NY001464.1807 GWIRM\Data\TransducerTests\Background_Weekend_all.xls - Chart1

Figure 3, Observed Drawdown in the Monitoring Well Network,
RW-02 Pumping Test, Northrop Grumman OU3, Bethpage, New York.

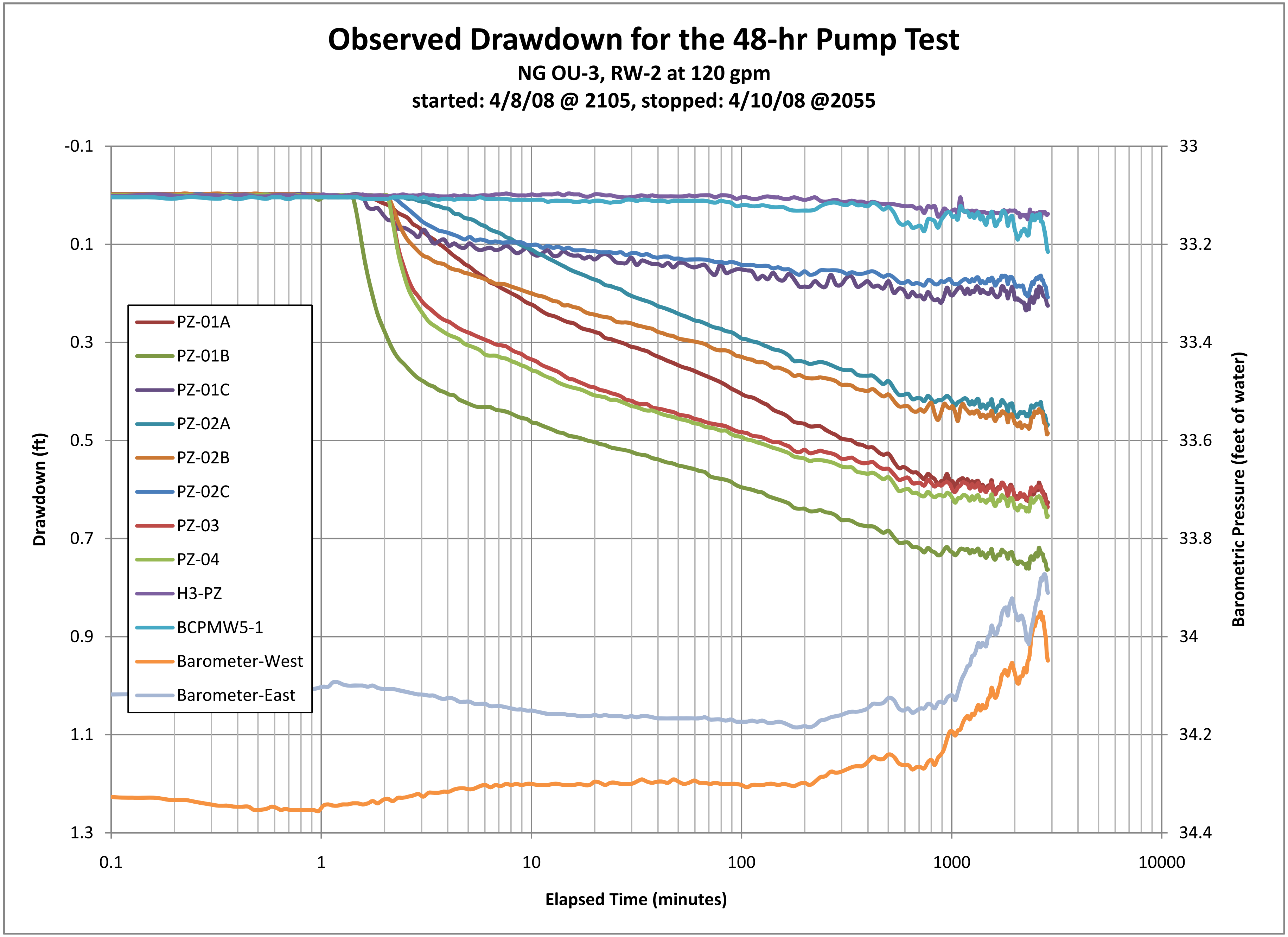
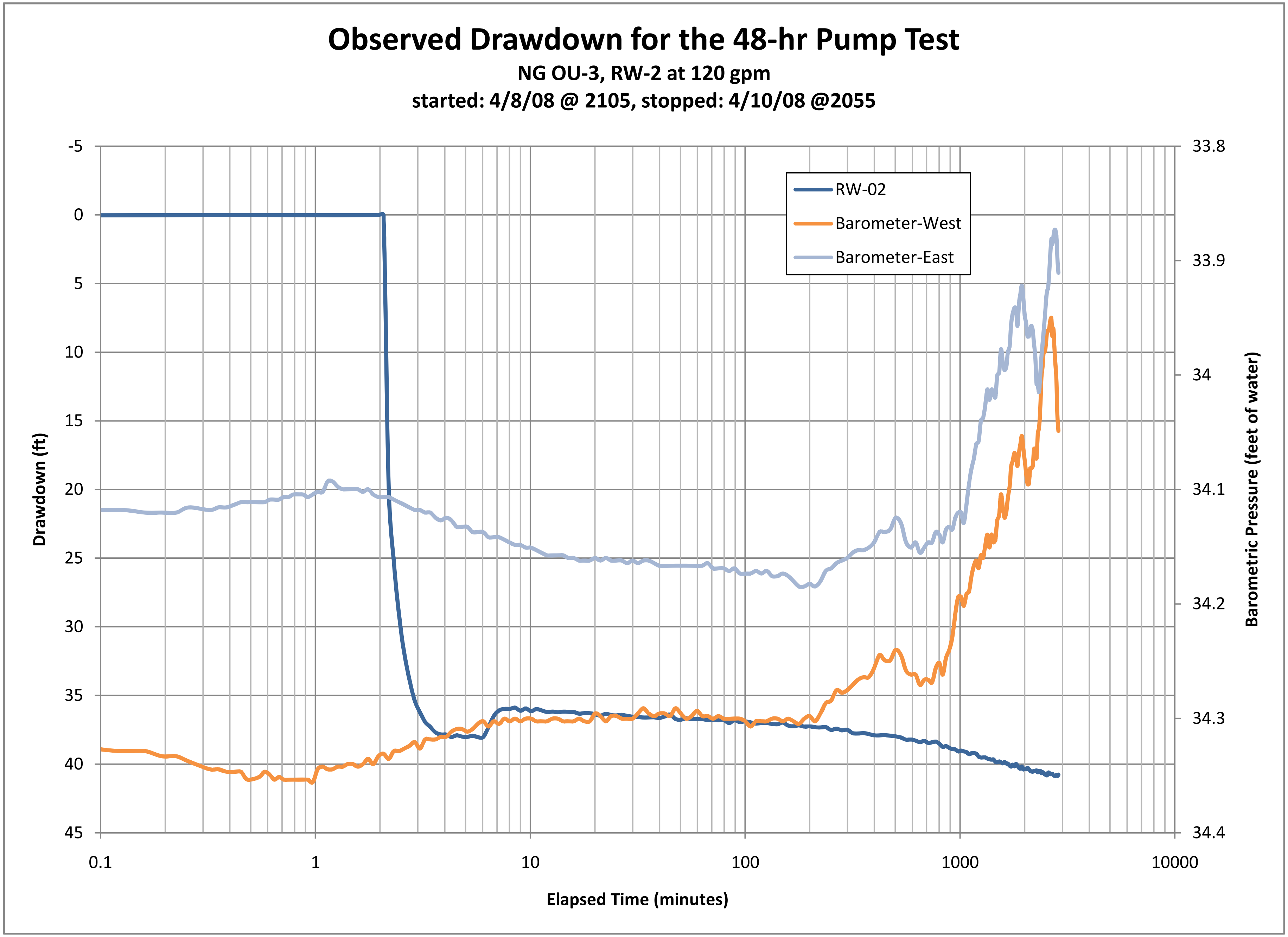


Figure 4, Observed Drawdown in Pumping Well RW-02,
RW-02 Pumping Test, Northrop Grumman OU3, Bethpage, New York.



G:\APROJECT\Northrop Grumman\Superfund\2008\OU3\NY001464.1807 GWIRM\Data\TransducerTests\PumpTest_48hrs.xlsx - Drawdown-RW-2

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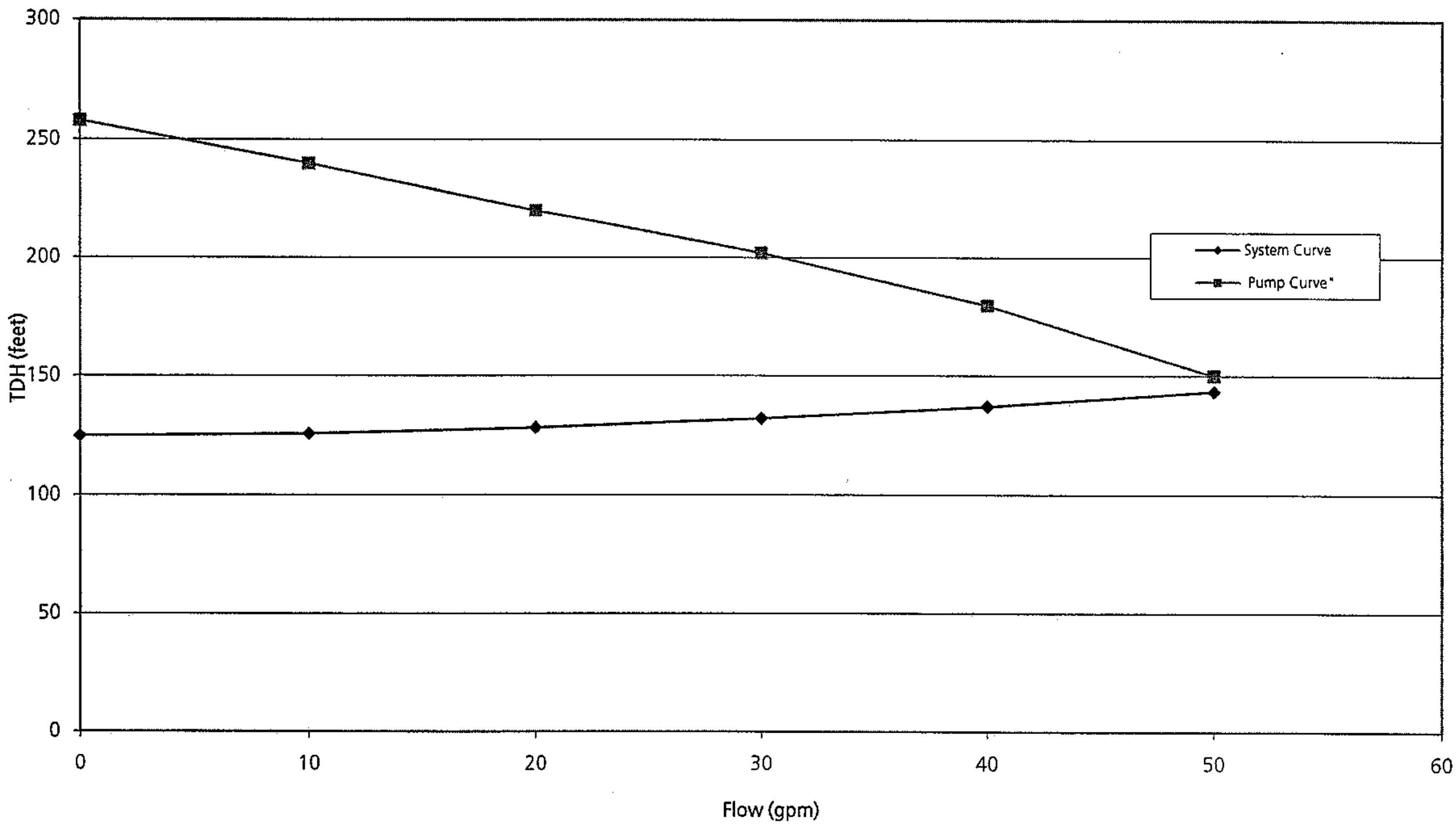
Appendix C

Total Discharge Head Calculations – Recovery Well and Discharge Pump

Northrop Grumman Systems Corporation
Bethpage, New York
OU3 Groundwater IRM
RW-1 & 4 Pumps (P-110 and P-140)



NORTHROP GRUMMAN SYSTEMS CORPORATION - BETHPAGE, NEW YORK
OU3 GROUNDWATER IRM
PUMP SIZING CALCULATIONS - FITTINGS EQUIVALENT LENGTH
P-110 AND P-140 (DESIGN FLOW RATE = 40GPM)

Fittings (plastic unless otherwise noted)

Pipe Diameter = 3.949 inch tee to discharge

Fitting	Quantity	Eq. Length Per Fitting (Pipe Diameters)	Total Eq. Length (Feet)	
90 deg. el.	4	30	39.49	
60 deg. el.		25	0.00	
45 deg. el.	6	16	31.59	
45 deg. Y		60	0.00	
22 1/2 deg. bend		8	0.00	
Running Tee	2	20	13.16	
Branch Tee	0	50	0.00	
Gate Valve, full open		8	0.00	
Butterfly Valve		40	0.00	(3" to 14")
Butterfly Valve		30	0.00	(14" and greater)
Swing Check	1	100	32.91	
Ball Valve, full open	2	3	1.97	
Globe Valve, full open	1	400	131.63	
Reducer	2	50	32.91	
	Total		**283.67**	

NORTHROP GRUMMAN SYSTEMS CORPORATION - BETHPAGE, NEW YORK
OU3 GROUNDWATER IRM
P-110 AND P-140 PUMP SIZING CALCULATIONS
(DESIGN FLOW RATE = 40GPM)

This spreadsheet uses Hazen-Williams to calculate the friction head loss for the straight pipe: hf = (10.44*Length)*((GPM^1.85)/((Friction Factor^1.85)*(diameter in inches^4.8655)))
The friction loss for the fittings is added in by determining equivalent lengths for each fitting, then adding the total equivalent length to the straight pipe length; H-W eqn is then used for the total (straight pipe plus equivalent) length

Pipe, Fittings, and Static Head Loss

3" SDR17 HDPE

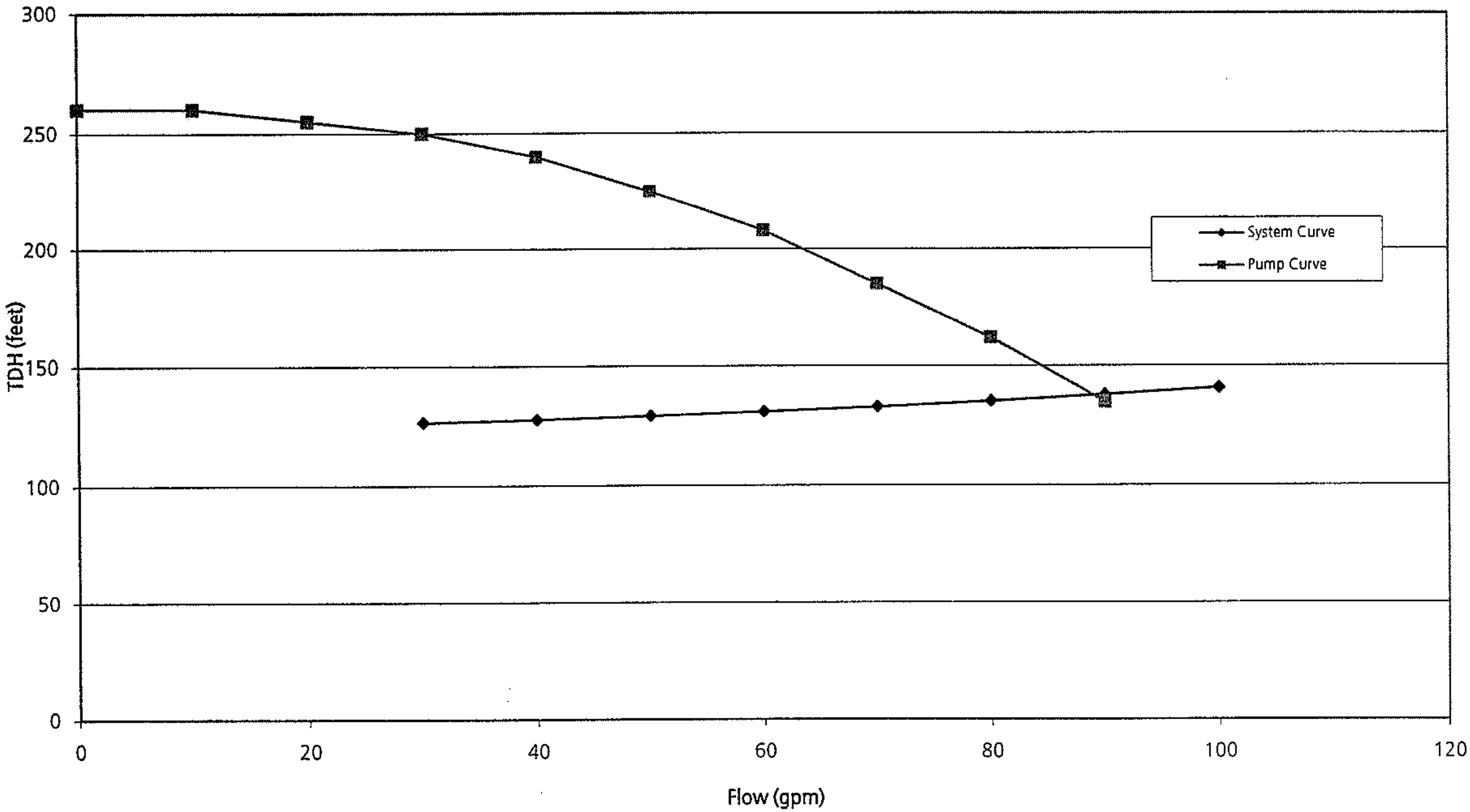
Inside Diameter =	3.07	(in)
Friction Factor =	120	
Pipe Length =	1825	(ft)
Fittings Eq. Length	284	(ft)
Pump Elevation	0	(ft)
Outlet Elevation	125	(ft)
Static Head Loss =	125	(ft)

Hazen-Williams Calculation

	Straight Pipe	Equiv. Length		Static Headloss	
Pump Flow Rate (gpm)	H_f (ft)	H_f (ft)	Vel. (ft)	Hsd (ft)	TDH (ft)
0	0.0	0.0	0.0	125	125
10	0.8	0.1	0.4	125	126
20	2.9	0.5	0.9	125	128
30	6.2	1.0	1.3	125	132
40	10.6	1.6	1.7	125	137
50	16.0	2.5	2.2	125	143
60	22.4	3.5	2.6	125	151
70	29.7	4.6	3.0	125	159
80	38.1	5.9	3.5	125	169
90	47.3	7.4	3.9	125	180
100	57.5	8.9	4.3	125	191

Pump curve (40S30-9(3HP))					
Head	GPM				
258	0				
240	10				
220	20				
202	30				
180	40				
150	50				

Northrop Grumman Systems Corporation
Bethpage, New York
OU3 Groundwater IRM
RW-2 & 3 Pumps (P-120 and P-130)



NORTHROP GRUMMAN SYSTEMS CORPORATION - BETHPAGE, NEW YORK
OU3 GROUNDWATER IRM
PUMP SIZING CALCULATIONS - FITTINGS EQUIVALENT LENGTH
P-120 AND P-130 (DESIGN FLOW RATE = 85GPM)

Fittings (plastic unless otherwise noted)

Pipe Diameter = 3.949 inch tee to discharge

Fitting	Quantity	Eq. Length Per Fitting (Pipe Diameters)	Total Eq. Length (Feet)	
90 deg. el.	4	30	39.49	
60 deg. el.		25	0.00	
45 deg. el.	6	16	31.59	
45 deg. Y		60	0.00	
22 1/2 deg. bend		8	0.00	
Running Tee	2	20	13.16	
Branch Tee	0	50	0.00	
Gate Valve, full open		8	0.00	
Butterfly Valve		40	0.00	(3" to 14")
Butterfly Valve		30	0.00	(14" and greater)
Swing Check	1	100	32.91	
Ball Valve, full open	2	3	1.97	
Globe Valve, full open	1	400	131.63	
Reducer	2	50	32.91	
	Total		**283.67**	

NORTHROP GRUMMAN SYSTEMS CORPORATION - BETHPAGE, NEW YORK
OU3 GROUNDWATER IRM
P-120 AND P-130 PUMP SIZING CALCULATIONS
(DESIGN FLOW RATE = 85GPM)

This spreadsheet uses Hazen-Williams to calculate the friction head loss for the straight pipe: hf = (10.44*Length)*((GPM^1.85)/((Friction Factor^1.85)*(diameter in inches^4.8655)) The friction loss for the fittings is added in by determining equivalent lengths for each fitting, then adding the total equivalent length to the straight pipe length; H-W eqn is ther used for the total (straight pipe plus equivalent) length

Pipe, Fittings, and Static Head Loss

4" SDR17 HDPE

Inside Diameter =	3.95	(in)
Friction Factor =	120	
Pipe Length =	1425	(ft)
Fittings Eq. Length	284	(ft)
Pump Elevation	0	(ft)
Outlet Elevation =	125	(ft)
Static Head Loss =	125	(ft)

Hazen-Williams Calculation

Pump Flow Rate (gpm)	Straight Pipe H_f (ft)	Equiv. Length H_f (ft)	Vel. (ft)	Static Headloss Hsd (ft)	TDH (ft)
0	0.0	0.0	0.0	125	125
10	0.2	0.0	0.3	125	125
20	0.7	0.1	0.5	125	126
30	1.4	0.3	0.8	125	127
40	2.4	0.5	1.0	125	128
50	3.7	0.7	1.3	125	129
60	5.1	1.0	1.6	125	131
70	6.8	1.4	1.8	125	133
80	8.7	1.7	2.1	125	135
90	10.9	2.2	2.4	125	138
100	13.2	2.6	2.6	125	141

Pump curve (75S50-8 (5HP))					
Head	GPM				
260	0				
260	10				
255	20				
250	30				
240	40				
225	50				
208	60				
185	70				
162	80				
135	90				

NORTHROP GRUMMAN SYSTEMS CORPORATION - BETHPAGE, NEW YORK
OU3 GROUNDWATER IRM

PUMP SIZING CALCULATIONS - FITTINGS EQUIVALENT LENGTH

Fittings (plastic unless otherwise noted)

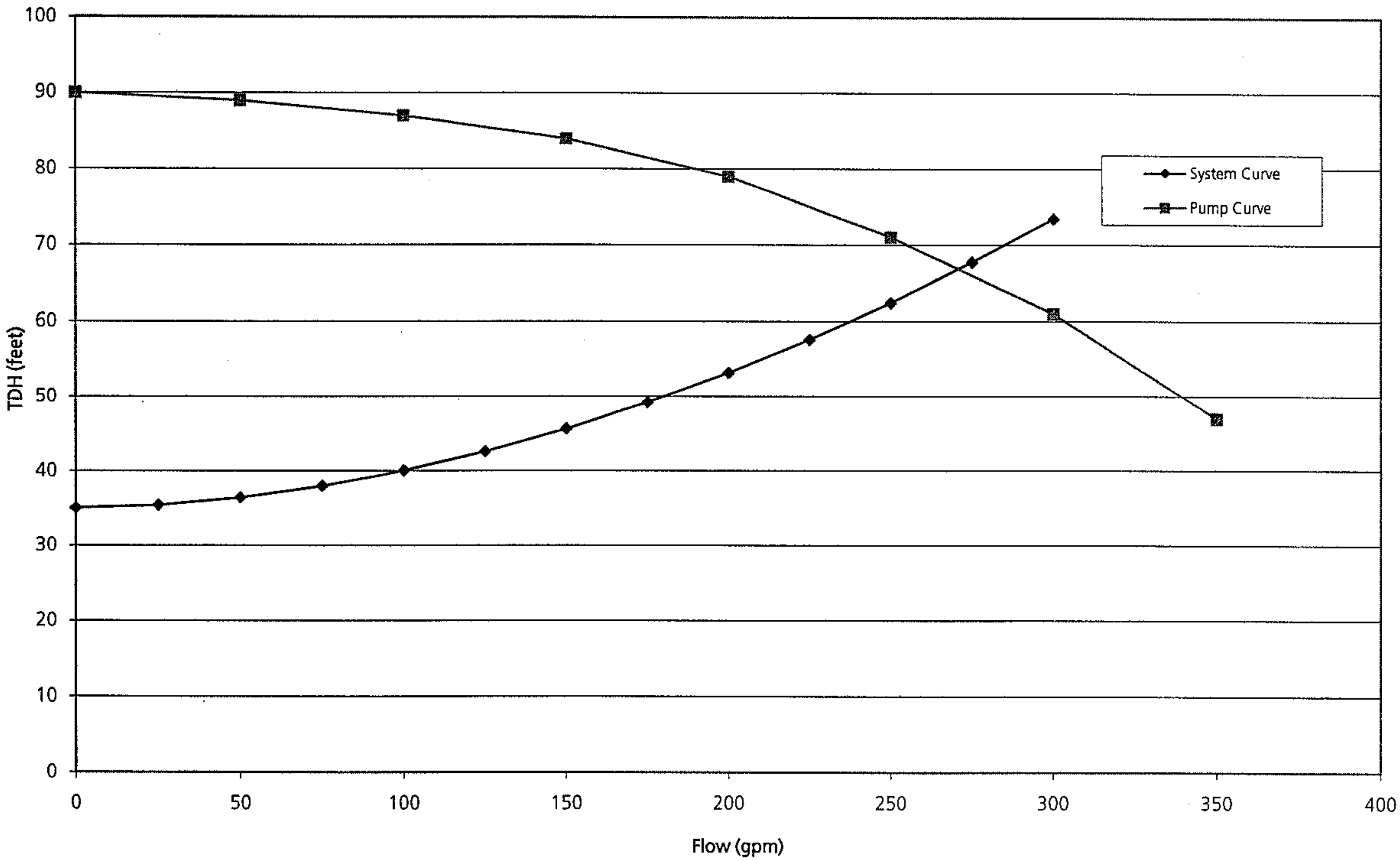
Pipe Diameter = 3.786 inch

Fitting	Quantity	Eq. Length Per Fitting (Pipe Diameters)	Total Eq. Length (Feet)	
90 deg. el.	11	30	104.12	
60 deg. el.		25	0.00	
45 deg. el.		16	0.00	
45 deg. Y		60	0.00	
22 1/2 deg. bend		8	0.00	
Running Tee	5	20	31.55	
Branch Tee	2	50	31.55	
Gate Valve, full open		8	0.00	
Butterfly Valve		40	0.00	(3" to 14")
Butterfly Valve		30	0.00	(14" and greater)
Swing Check	1	100	31.55	
Ball Valve, full open	2	3	1.89	
Globe Valve, full open		400	0.00	
Reducer	1	50	15.78	
	Total		**216.43**	

Pipe Diameter = 5.846 inch

Fitting	Quantity	Eq. Length Per Fitting (Pipe Diameters)	Total Eq. Length (Feet)
90 deg. el.	5	30	47.33
60 deg. el.		25	0.00
45 deg. el.	5	16	25.24
45 deg. Y		60	0.00
22 1/2 deg. bend		8	0.00
Running Tee		20	0.00
Branch Tee		50	0.00
Gate Valve, full open		8	0.00
Butterfly Valve		40	0.00
Butterfly Valve		30	0.00
Swing Check		100	0.00
Ball Valve, full open		3	0.00
Globe Valve, full open		400	0.00
Reducer	2	50	31.55
	Total		**104.12**

Northrop Grumman Systems Corporation
Bethpage, New York
OU3 Groundwater IRM
Discharge Pump (P-400)



NORTHROP GRUMMAN SYSTEMS CORPORATION - BETHPAGE, NEW YORK
OU3 GROUNDWATER IRM
PUMP SIZING CALCULATIONS

This spreadsheet uses Hazen-Williams to calculate the friction head loss for the straight pipe: hf = (10.44*Length)*((GPM^1.85)/((Friction Factor^1.85)*(diameter in inches^4.8655)))
The friction loss for the fittings is added in by determining equivalent lengths for each fitting, then adding the total equivalent length to the straight pipe length; H-W eqn is then used for the total (straight pipe plus equivalent) length

Pipe, Fittings, and Static Head Loss

4" Sch80 PVC

Inside Diameter =	3.79	(in)
Friction Factor =	120	
Pipe Length =	100	(ft)
Fittings Eq. Length	284	(ft)
Pump Elevation	0	(ft)
Outlet Elevation	0	(ft)
Static Head Loss =	0	(ft)

Filter Head Loss =	35	(ft)

6" SDR 17 HDPE

Inside Diameter =	5.85	(in)
Friction Factor =	120	
Pipe Length =	300	(ft)
Fittings Eq. Length	104	(ft)
Pump Elevation	0	(ft)
Outlet Elevation	0	(ft)
Static Head Loss =	0	(ft)

existing 8" PVC

Inside Diameter =	7.8	(in)
Friction Factor =	120	
Pipe Length =	330	(ft)
Fittings Eq. Length	0	(ft)

Hazen-Williams Calculation

	4" Sch80 PVC Straight Pipe	Equiv. Length		6" SDR17 HDPE Straight Pipe	Equiv. Length			
Pump Flow Rate (gpm)	Hf 4" Sch80 PVC (ft)	Hf 4" Sch80 PVC (ft)	Vel 4" Sch80 PVC (ft)	Hf 6" SDR11 HDPE (ft)	Hf 6" SDR11 HDPE (ft)	Vel 6" SDR11 HDPE (ft)	Hf existing 8" PVC (ft)	TDH (ft)
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35
25	0.1	0.2	0.7	0.0	0.0	0.3	0.0	35
50	0.3	0.9	1.4	0.1	0.0	0.6	0.0	36
75	0.7	1.9	2.1	0.2	0.1	0.9	0.1	38
100	1.1	3.2	2.8	0.4	0.1	1.2	0.1	40
125	1.7	4.9	3.6	0.6	0.2	1.5	0.2	43
150	2.4	6.8	4.3	0.9	0.3	1.8	0.2	46
175	3.2	9.1	5.0	1.2	0.4	2.1	0.3	49
200	4.1	11.6	5.7	1.5	0.5	2.4	0.4	53
225	5.1	14.5	6.4	1.8	0.6	2.7	0.5	58
250	6.2	17.6	7.1	2.2	0.8	3.0	0.6	62
275	7.4	21.0	7.8	2.7	0.9	3.3	0.7	68
300	8.7	24.7	8.5	3.1	1.1	3.6	0.8	73

Pump curve					
Head	GPM				
90	0				
89	50				
87	100				
84	150				
79	200				
71	250				
61	300				
47	350				

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Appendix D

Air Stripper Modeling

CLIENT INFORMATION

NGC Bethpage

Maximum flow and concentraion

FLOW	WATER	AIR	Safety Factor
250 GPM	55 °F	50 °F	

Units:

NGC Bethpage

Maximum flow and concentraion

Series chosen:	31200	
Water Flow Rate:	250 gpm	56.8 m3/hr
Air Flow Rate:	1800 acfm	3060 m3/hr
Water Temp:	55 °F	13 °C
Air Temp:	50 °F	10 °C
A/W Ratio:	54 :1	
Safety Factor:	0%	

Contaminant	Untreated Influent Effluent Target	Model 31211 Effluent lbs/hr ppmv %removal	Model 31221 Effluent lbs/hr ppmv %removal	Model 31231 Effluent lbs/hr ppmv %removal	Model 31241 Effluent lbs/hr ppmv %removal	Model 31251 Effluent lbs/hr ppmv %removal	Model 31261 Effluent lbs/hr ppmv %removal
Trichloroethylene Solubility 1100 ppm Mwt 131.5	46 ppb 2.5 ppb	10 ppb 0.00 0.12 78.63%	2 ppb 0.01 0.15 95.43%	<1 ppb 0.01 0.15 99.02%	<1 ppb 0.01 0.15 99.79%	<1 ppb 0.01 0.15 99.96%	<1 ppb 0.01 0.15 99.99%
cis-1,2-DCE Solubility 6,690 ppm Mwt 96.94	780 ppb 2.5 ppb	244 ppb 0.07 2.43 68.69%	77 ppb 0.09 3.19 90.18%	24 ppb 0.09 3.43 96.92%	8 ppb 0.10 3.51 99.04%	2 ppb 0.10 3.53 99.70%	<1 ppb 0.10 3.53 99.91%
Vinyl Chloride Solubility 1100 ppm Mwt 62.5	147 ppb 1 ppb	13 ppb 0.02 0.94 91.01%	1 ppb 0.02 1.03 99.19%	<1 ppb 0.02 1.03 99.93%	<1 ppb 0.02 1.04 99.99%	<1 ppb 0.02 1.04 100.00%	<1 ppb 0.02 1.04 100.00%
Total ppb Total VOC lbs/hr - ppmv Total	973 ppb	267 ppb 0.09 3.50 72.51%	80 ppb 0.11 4.37 91.79%	25 ppb 0.12 4.62 97.48%	8 ppb 0.12 4.70 99.22%	2 ppb 0.12 4.72 99.76%	<1 ppb 0.12 4.72 99.95%

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Appendix E

Total Discharge Pressure
Calculations – Air Stripper Blower

NORTHROP GRUMMAN SYSTEMS CORPORATION - BETHPAGE, NEW YORK
OU3 GROUNDWATER IRM

Blower Pressure Drop

Suction (Air Stripper)		
ΔP per tray (in. w.c.)	# of trays	Suction ΔP (in. w.c.)
5	6	30

Discharge (ECUs + Ductwork)			
ΔP per ECU (in. w.c.)	# of ECUs	ΔP per due to Duct Losses (in. w.c.)	Discharge ΔP (in. w.c.)
2	4	1.5	9.5

Total pressure drop =	39.5	(in. w.c.)
Available fan pressure =	54	(in. w.c. at 2,000 cfm)

Duct Pressure Loss and Velocity Presure Results		
Total Duct Loss (inches Water): 1.39	**Velocity Pressure (inches Water): 0.128**	
Job Number: Client: Date: Line Number: Fluid: Duct Type: ROUND Duct Diameter (in): 16 Flow Rate: 2000 ACFM Duct Length (ft): 200 Viscosity (cP): 0.018 Inlet Pressure (PSIG): 0 Temperature (F): 70 Duct Material: ALUMINUM Duct Roughness (ft): 0.00015	Fluid Velocity (ft/min): 1433.12 Reynolds Number: 197364 Flow Region: Turbulent Friction Factor: 0.0165 Density at Inlet: 0.075 Specific Volume at Inlet: 13.34 Specific Heat Ratio: 1.4	Velocity Pressure (inches Water): 0.128 Total Duct Loss (inches Water): 1.39 Straight Duct Loss (inches Water): 0.318 Hood Entry Type: None Elbow Type 1: 4 piece Radius / Duct Diameter 1: 1.50 Number Of Elbows 1: 31 Elbow Sweep 1 (Degrees): 90 Elbow Loss Factor 1: 0.27 Elbow Loss 1 (inches Water): 1.073 Duct Exit Configuration: Main Duct Line Exit Configuration Loss (inches Water): 0

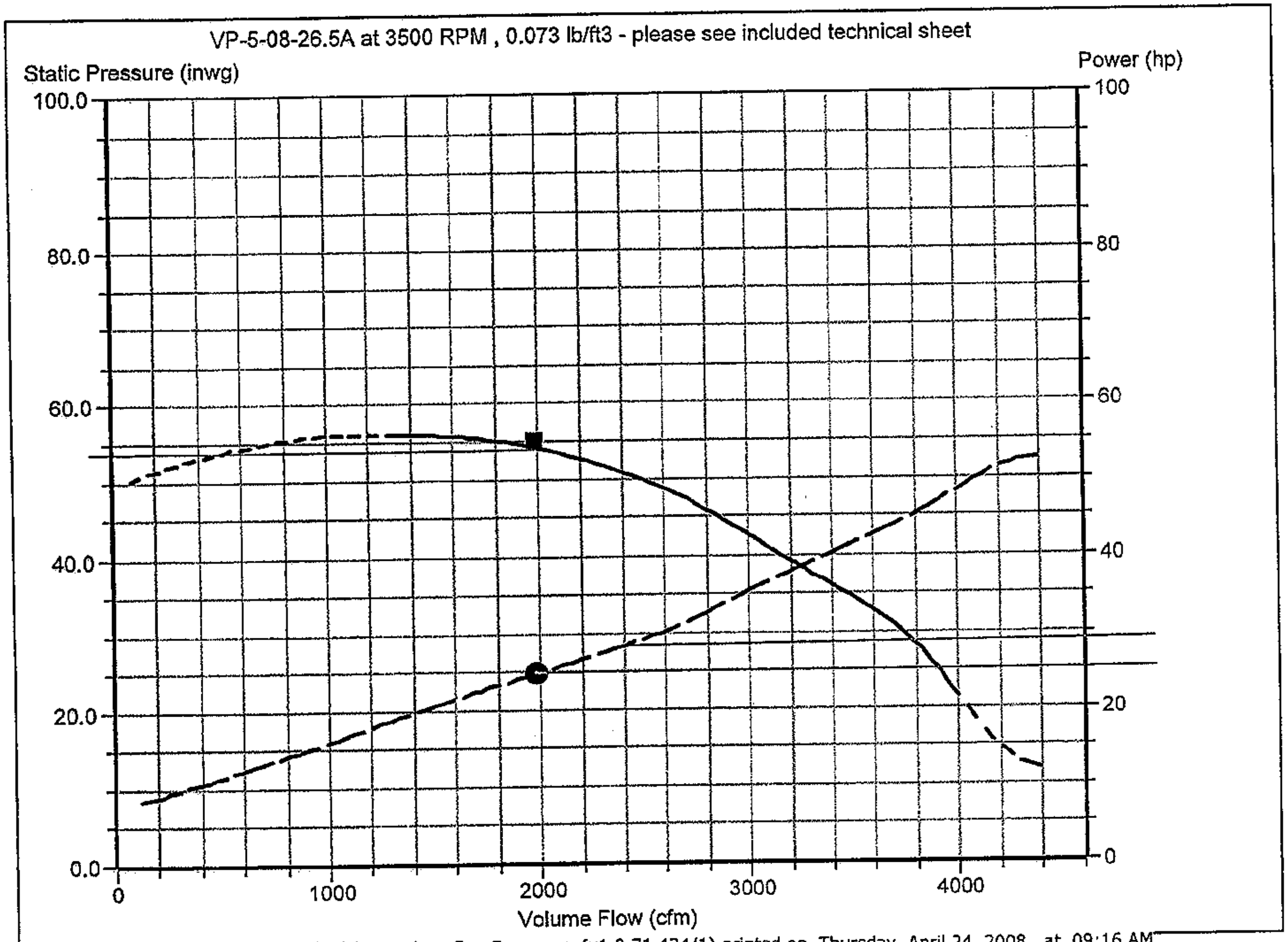
'Copy and Paste' Pressure Loss or Head Loss into other applications

American Fan Company

Curve Key	
■ Duty Point	——— Performance Curve
	— — — Power Curve

Date 4/24/2008
Customer
Contact
Customer Ref.

Proposal
Tag
Project
Location



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Appendix F

Air Facility Registration

New York State Department of Environmental Conservation
Air Facility Registration

DEC ID
- -

Owner/Firm			Taxpayer ID: 1 3 6 4 0 0 4 3 4
Name	Northrop Grumman Systems Corporation		
Street Address	Mail Stop Z18-025, 600 Grumman Road West		
City / Town / Village: **Bethpage**	State or Province: **NY**	Country: **USA**	Zip: **11714-3583**

Owner/Firm Contact	
Name: **John Cofman**	Phone No. **516-575-4680**

Facility		
Name	**Northrop Grumman Systems Corporation**	
Location Address	**Mail Stop Z18-025, 600 Grumman Road West, Bethpage, NY**	
■ City / Town / Village	**New York**	Zip **11714-3583**

Facility Information	
Total Number of Emission Points: 1 (stack)	Cap by Rule

Description

Northrop Grumman Systems Corporation (NGC) is implementing the Operable Unit 3 (OU3) Groundwater Interim Remedial Measure (Groundwater IRM) pursuant to the Order On Consent (Consent Order or CO) Index # W1-0018-04-01 that was executed by the New York State Department of Environmental Conservation (NYSDEC) and NGC, effective July 4, 2005 (NYSDEC 2005). The present day Bethpage Community Park property (Park), which the NYSDEC has termed the "Former Grumman Settling Ponds Area" and designated as OU3, as well as the adjacent Plant 24 Access Road Property are collectively referred to herein as the Site. NGC has elected to implement a groundwater IRM to mitigate the off-site migration of VOCs through the implementation of a groundwater pump-and-treat system. The concentration of non-Freon VOCs in the air stripper off-gas will be reduced by vapor phase granular activated carbon and potassium permanganate-impregnated zeolite, as needed, prior to discharge to the atmosphere via a stack with a discharge height of 18 feet above grade.

A summary of the design potential (uncontrolled) annual mass emission rates of individual project VOCs and the allowable annual mass emission rates, as determined by the Screen 3 air dispersion model, are presented in Table 2 of the 95% Design Report. The system will be periodically monitored to determine actual, and allowable, annual emission rates to ensure that the AGCs and SGCs are not exceeded.

Standard Industrial Classification Codes

NAICS 336411					

HAP CAS Numbers

00156-59-2	00079-01 -6	00075-01 -4			

Applicable Federal and New York State Requirements (Part Nos.)

201-3.3 (29)					

Certification

I certify that this facility will be operated in conformance with all provisions of existing regulations.

Responsible Official	Title **Deputy Commissioner**
Signature	Date ____/____/____

7/29/96

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Appendix G

SPDES Permit Application

State Pollutant Discharge Elimination System (SPDES)
INDUSTRIAL APPLICATION FORM NY-2C
For New Permits and Permit Modifications to Discharge Industrial Wastewater and Storm Water

Section I - Permittee and Facility Information

Please type or print the requested information.

1. Current Permit Information (leave blank if for new discharge)

SPDES Number:	DEC Number:

2. Permit Action Requested: (Check applicable box)

- [X] A **NEW** proposed discharge
- [ ] A **MODIFICATION** of the existing permit
- [ ] An **EBPS INFORMATION REQUEST** response
- [ ] An **EXISTING** discharge currently without permit
- [ ] A **RENEWAL** of an existing SPDES permit

Does this request include an increase in the quantity of water discharged from your facility to the waters of the State?

- [ ] **YES** - Describe the increase:
- [ ] **NO** - Go to Item 3. below.

3. Permittee Name and Address

Name: Northrop Grumman Systems Corp.		Attention: John Cofman
Street Address: Mail Stop W16-35, 925 South Oyster Bay Road		
City or Village: Bethpage	State: NY	ZIP Code: 11714-3583

4. Facility Name, Address and Location

Name: OU3 Ground Water Treatment System			
Street Address: Cherry Road Extension/Aerospace Blvd.		P.O. Box:	
City or Village: Bethpage	State: NY	ZIP Code: 11714	
Town: Oyster Bay	County: Nassau		
Telephone:	FAX:	NYTM - E:	NYTM - N:
Tax Map Info (New York City, Nassau County and Suffolk County only)			
Section: 46	Block: G	Subblock:	Lot: 92

5. Facility Contact Person

Name: John Cofman		Title: Senior Environmental Engineer	
Street Address: Mail Stop W16-35, 925 South Oyster Bay Road			P.O. Box:
City or Village: Bethpage		State: NY	ZIP Code: 11714-3583
Telephone: 516-575-4680	FAX: 516-575-6672	E-Mail or Internet: John.cofman@ngc.com	

6. Discharge Monitoring Report (DMR) Mailing Address

Mailing Name: John Cofman			
Street Address: Mail Stop W16-35, 925 South Oyster Bay Road			P.O. Box:
City or Village: Bethpage		State: NY	ZIP Code: 11714-3583
Telephone: 516-575-4680	FAX: 516-575-6672	E-Mail or Internet: John.cofman@ngc.com	
Name and Title of person responsible for signing DMRs: John Cofman		Signature:	

INDUSTRIAL APPLICATION FORM NY-2C
Section I - Permittee and Facility Information

Facility Name: OU3 Ground Water Treatment System	SPDES Number:

7. Summarize the outfalls present at the facility:

Outfall Number	Receiving Water	Type of discharge
OU1	Ground water via recharge	Effluent from ground water treatment
	basin	system

8. Map of Facility and Discharge Locations:

Provide a detailed map showing the location of the facility, all buildings or structures present, wastewater discharge systems, outfall locations into receiving waters, nearby surface water bodies, water supply wells, and groundwater monitoring wells, and attach it to this application. Also submit proof, either by indication on the map or other documentation, that a right of way for the discharges exists from the facility property to a public right of way.

9. Water Flow Diagram:

Figure 3 (attached)

INDUSTRIAL APPLICATION FORM NY-2C
Section I - Permittee and Facility Information

Facility Name: OU3 Ground Water Treatment System	SPDES Number:

10. Nature of business: (Describe the activities at the facility and the date(s) that operation(s) at the facility commenced)

Proposed facility is a ground water treatment system where an air stripper will be used to treat extracted ground water prior to discharge. Pilot testing and start-up are scheduled to occur in 2009.

11. List the 4-digit SIC codes which describe your facility in order of priority:

Priority 1	Description:	Priority 3	Description:
Priority 2	Description:	Priority 4	Description:

12. Is your facility a primary industry as listed in Table 1 of the instructions?

[ ] YES - Complete the following table.

[X] NO - Go to Item 13. below.

Industrial Category	40 CFR		Industrial Category	40 CFR	
	Part	Subpart		Part	Subpart

13. Does this facility manufacture, handle, or discharge recombinant-DNA, pathogens, or other potentially infectious or dangerous organisms?

[ ] YES - Attach a detailed explanation to this application.

[X] NO - Go to Item 14 below.

14. Is storm runoff or leachate from a material storage area discharged by your facility?

[ ] YES - Complete the following table, and show the location of the stockpile(s) and discharge point(s) on the diagram in Item 9.

[X] NO - Go to Item 15 on the following page.

Size of area	Type(s) of material stored	Quantity of material stored	Runoff control devices

INDUSTRIAL APPLICATION FORM NY-2C
Section I - Permittee and Facility Information

Facility Name:	SPDES Number:
OU3 Ground Water Treatment System	

15. Facility Ownership: (Place an "X" in the appropriate box)

Corporate [X] Sole Proprietorship [ ] Partnership [ ] Municipal [ ] State [ ] Federal [ ] Other [ ]

Are any of the discharges applied for in this application on Indian lands? Yes [ ] No [ ]

16. List information on any other environmental permits for this facility:

Issuing Agency	Permit Type	Permit Number	Permit Status		
			Active	Applied for	Inactive
NYSDEC	Air			X	

17. Laboratory Certification:

Were any of the analyses reported in Section III of this application performed by a contract laboratory or a consulting firm?

[ ] **YES** - Complete the following table.

[X] **NO** - Go to Item 18 below.

Name of laboratory or consulting firm	Address	Telephone (area code and number)	Pollutants analyzed

18. Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name and official title (type or print)		Date signed
John Cofman, Senior Environmental Engineer		
Signature	Telephone number	FAX number
	516-575-4680	516-575-6672

INDUSTRIAL APPLICATION FORM NY-2C
Section I - Permittee and Facility Information

Facility Name: OU3 Ground Water Treatment System	SPDES Number:

19. Industrial Chemical Survey (ICS)

Complete all information for those substances your facility has used, produced, stored, distributed, or otherwise disposed of in the past five (5) years at or above the threshold values listed in the instructions. Include substances manufactured at your facility, as well as any substances that you have reason to know or believe present in materials used or manufactured at your facility. Do not include chemicals used only in analytical laboratory work, or small quantities of routine household cleaning chemicals. Enter the name and CAS number for each of the chemicals listed in Tables 6-10 of the instructions, and the table number which lists the chemical. You may use ranges (e.g. 10-100 lbs., 100-1000 lbs., 1000-10000 lbs., etc.) to describe the quantities used on an annual basis as well as for the amount presently on hand. For those chemicals listed in Tables 6, 7, or 8 which are indicated as being potentially present in the discharge from one or more outfalls at the facility, indicate which outfalls may be affected in the appropriate column below, and include sampling results in Section III of this application for each of the potentially affected outfalls. Make additional copies of this sheet if necessary.

Name of Substance	Table	CAS Number	Average Annual Usage	Amount Now On Hand	Units (gallons, lbs, etc)	Purpose of Use (see codes in Table 2 of instructions)	Present in Discharge? (Outfall(s)?)
Not applicable, new facility							

This completes Section I of the SPDES Industrial Application Form NY-2C. Section II, which requires specific information for each of the outfalls at your facility, and Section III, which requires sampling information for each of the outfalls at your facility, must also be completed and submitted with this application.

State Pollutant Discharge Elimination System (SPDES)

INDUSTRIAL APPLICATION FORM NY-2C

For New Permits and Permit Modifications to Discharge Industrial Wastewater and Storm Water

Section II - Outfall Information

Please type or print the requested information.

Facility Name:	SPDES Number:
OU3 Ground Water Treatment System	

1. Outfall Number and Location

Outfall No.: 001		
Latitude ° ' "	Longitude ° ' "	Receiving Water

2. Type of Discharge and Discharge Rate (List all information applicable to this outfall)

	Volume/Flow	Units				Volume/Flow	Units		
		MGD	GPM	Other (specify)			MGD	GPM	Other (specify)
a. Process Wastewater					f. Noncontact Cooling Water				
b. Process Wastewater					g. Remediation System Discharge	250		X	
c. Process Wastewater					h. Boiler Blowdown				
d. Process Wastewater					i. Storm Water				
e. Contact Cooling Water					j. Sanitary Wastewater				
k. Other discharge (specify):									
l. Other discharge (specify):									

3. List process information for the Process Wastewater streams identified in 2.a-d above:

a. Name of the process contributing to the discharge			Process SIC code:
Describe the contributing process	Category / Subcategory	Quantity per day	Units of measure
b. Name of the process contributing to the discharge			**Process SIC code:**
Describe the contributing process	Category / Subcategory	Quantity per day	Units of measure
c. Name of the process contributing to the discharge			**Process SIC code:**
Describe the contributing process	Category / Subcategory	Quantity per day	Units of measure
d. Name of the process contributing to the discharge			**Process SIC code:**
Describe the contributing process	Category / Subcategory	Quantity per day	Units of measure

4. Expected or Proposed Discharge Flow Rates for this outfall:

a. Total Annual Discharge	b. Daily Minimum Flow	c. Daily Average Flow	d. Daily Maximum Flow	e. Maximum Design flow rate
132 MG	0.0 MGD	0.30 MGD	0.36 MGD	0.36 MGD

INDUSTRIAL APPLICATION FORM NY-2C
Section II - Outfall Information

Facility Name: OU3 Ground Water Treatment System	Outfall No.: 001 SPDES Number:

5. Is this a seasonal discharge?

[ ] YES - Complete the following table.

[X] NO - Go to Item 6 below.

Operations contributing flow (list)	Discharge frequency		Flow				
	Batches per year	Duration per batch	Flow rate per day		Total volume per discharge	Units	Duration (Days)
			LTA	Daily Max			

6. Water Supply Source (indicate all that apply)

	Name or owner of water supply source	Volume or flow rate	Units (check one)		
Municipal Supply			MGD	GPD	GPM
Private Surface Water Source			MGD	GPD	GPM
Private Supply Well 5	Northrop Grumman Systems Corp.	250	MGD	GPD	X GPM
Other (specify)			MGD	GPD	GPM

7. Outfall configuration: (Surface water discharges only)

A. Where is the discharge point located with respect to the receiving water?

In the streambank: [ ]

In the stream: [ ]

Within a lake or ponded water: [ ]

Within an estuary: [ ] Attach Supplement C, MIXING ZONE REQUIREMENTS FOR DISCHARGES TO ESTUARIES.

Discharge is equipped with diffuser: [ ] Attach description, including configuration and plan drawing of diffuser, if used.

B. If located in a stream, approximately what percentage of stream width from shore is the discharge point located?

10% [ ] 25% [ ] 50% [ ] Other: [ ]

C. If located in a stream, describe the stream geometry in the general vicinity of the discharge point, under low flow conditions:

Stream width	Stream depth	Stream velocity
Feet	Feet	Feet/Sec

Are the results of a mixing/diffusion study attached? [ ] YES [ ] NO

Section II - Outfall Information

Facility Name:	Outfall No.: 001
OU3 Ground Water Treatment System	SPDES Number:

8. Thermal Discharge Criteria

Is your facility one of the applicable types of facilities listed in the instructions, and does the temperature of this discharge exceed the receiving water temperature by greater than three (3) degrees Fahrenheit?

[ ] **YES** - Complete the following table.

[X] **NO** - Go to Item 9. below.

[ ] **Information on the intake and discharge configuration of this outfall is attached.**

Discharge Temperature, deg. F			Duration of maximum discharge temperature		Dates of maximum discharge temperature		Maximum flow rate	Discharge configuration (e.g. subsurface, surface, effluent diffuser, diffusion well, etc.)
Average change in temperature (delta T)	Maximum change in temperature (delta T)	Maximum temperature	hours per day	days per year	From	To	MGD	

9. Are any water treament chemicals or additives that are used by your facility subsequently discharged through this outfall?

[ ] **YES** - Complete the following table and complete pages 1 of 3 and 2 of 3 of Form WTCFX for each water treatment chemical listed.

[X] **NO** - Go to Item 10. below.

Manufacturer	WTC trade name	Manufacturer	WTC trade name

10. Has any biological test for acute or chronic toxicity been performed on this outfall or on the receiving water in relation to this outfall in the past three (3) years?

[ ] **YES** - Complete the following table.

[X] **NO** - Go to Item 11. on the following page.

Water tested	Purpose of test	Type of test	Chronic or Acute?	Subject species	Testing date(s)		Submitted? (Date)
					Start	Finish	

INDUSTRIAL APPLICATION FORM NY-2C
Section II - Outfall Information

	Outfall No.: 001
Facility Name: OU3 Ground Water Treatment System	SPDES Number:

11. Is the discharge from this outfall treated to remove process wastes, water treatment additives, or other pollutants?

[X] YES - Complete the following table. Treatment codes are listed in Table 4.

[ ] NO - Go to Item 12 below.

Treatment process	Treatment Code(s)	Treatment used for the removal of:	Design Flow Rate (include units)
Recovered ground water is treated by an air stripper	1-4	Chlorinated Solvent	250 gpm

12. Does this facility have either a compliance agreement with a regulating agency, or have planned changes in production, which will materially alter the quantity and/or quality of the discharge from this outfall?

[X] YES - Complete the following table.

[ ] NO - Go to Section III on the following page.

Description of project	Subject to Condition or Agreement in existing permit or consent order? (List)	Change due to production increase?	Completion Date(s)	
			Required	Projected
Ground water remediation per NYSDEC Consent Order	Order on Consent index #W1-0018-04-01			

This completes Section II of the SPDES Industrial Application Form NY-2C. Section I, which requires general information regarding your facility, and Section III, which requires sampling information for each of the outfalls at your facility, must also be completed and submitted with this application.

INDUSTRIAL APPLICATION FORM NY-2C
Section III - Sampling Information

Facility Name:	SPDES No.:	Outfall No.:
OU3 Ground Water Treatment System		001

1. Sampling Information - Conventional Parameters

Provide the analytical results of at least one analysis for every pollutant in this table. If this outfall is subject to a waiver as listed in Table 5 of the instructions for one or more of the parameters listed below, provide the results for those parameters which are required for this type of outfall.

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets (using the same format) instead of completing this page.

Pollutant	Effluent data							Units		Intake data (optional)		
	a. Maximum daily value		b. Maximum 30 day value		c. Long term average		d. Number of analyses	a. Concentration	b. Mass	a. Long term average value		b. Number of analyses
	1. Concentration	2. Mass	1. Concentration	2. Mass	1. Concentration	2. Mass				1. Concentration	2. Mass	
a. Biochemical Oxygen Demand 5 day (BOD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
b. Chemical Oxygen Demand (COD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
c. Total Suspended Solids (TSS)	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
d. Total Dissolved Solids (TDS)	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
e. Oil & Grease	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
f. Chlorine, Total Residual (TRC)	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
g. Total Organic Nitrogen (TON)	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
h. Ammonia (as N)	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
i. Flow	Value 0.36		Value 10.8		Value 0.30		N/A			Value		
j. Temperature, winter	Value N/A		Value N/A		Value N/A		N/A			Value		
k. Temperature, summer	Value N/A		Value N/A		Value N/A		N/A			Value		
l. pH	Minimum N/A	Maximum N/A	Minimum N/A	Maximum N/A			N/A			Minimum	Maximum	

2. Sampling Information - Priority Pollutants, Toxic Pollutants, and Hazardous Substances

a. Primary Industries:

i. Does the discharge from this outfall contain process wastewater?

- [ ] **Yes** - Go to Item **ii.** below.
- [X] **No** - Go to Item **b.** below.

ii. Indicate which GC/MS fractions have been tested for: Volatiles: [ ] Acid: [ ] Base/Neutral: [ ] Pesticide: [ ]

b. All applicants:

i. Do you know or have reason to believe that any of the pollutants listed in Tables 6, 7, or 8 of the instructions are present in the discharge from this outfall?

- [X] **Yes** - Concentration and mass data attached.
- [ ] **No** - Go to Item **ii.** below.

ii. Do you know or have reason to believe that any of the pollutants listed in Table 9 or Table 10 of the instructions, or any other toxic, harmful, or injurious chemical substances not listed in Tables 6-10, are present in the discharge from this outfall?

- [ ] **Yes** - Source or reason for presence in discharge attached
- [ ] **Yes** - Quantitative or qualitative data attached
- [X] **No**

INDUSTRIAL APPLICATION FORM NY-2C
Section III - Sampling Information

Facility Name:	SPDES No.:	Outfall No.:
OU3 Ground Water Treatment System		001

3. Projected Effluent Quality - Priority Pollutants, Toxic Pollutants, and Hazardous Substances

Provide analytical results of at least one analysis for each pollutant that you know or have reason to believe is present in this discharge, as well as for any GC/MS fractions and metals required to be sampled from Section III Forms, Item 2.a on the preceding page.

List the name and CAS number for each pollutant that you know or have reason to believe is present in the discharge from this outfall. For each pollutant listed from Tables 6, 7, or 8, provide the results of at least one analysis for that pollutant, and determine the mass discharge based on the flow rate reported in Item 1.i. For each pollutant listed from Table 9, or any other toxic pollutant not listed in Tables 6-10, you must provide concentration and mass data (if available) and/or an explanation for their presence in the discharge. Make as many copies of this table as necessary for each outfall.

Page 1 of 1

Pollutant and CAS Number	Effluent data							Units		Intake data (optional)			Believed present, no sampling results available
	a. Maximum daily value		b. Maximum 30 day value (if available)		c. Long term average value (if available)		d. Number of analyses	a. Concentration	b. Mass	a. Long term average value		d. Number of analyses	
	(1) Concentration	(2) Mass	(1) Concentration	(2) Mass	(1) Concentration	(2) Mass				(1) Concentration	(2) Mass		
cis-1,2-Dichloroethene CAS Number: 00156-59-2	<5	N/A	<5	N/A	N/A	N/A	ug/L	N/A	N/A	N/A	N/A	N/A	N/A
Trichloroethene CAS Number: 00079-01-6	<5	N/A	<5	N/A	N/A	N/A	ug/L	N/A	N/A	N/A	N/A	N/A	N/A
Vinyl Chloride CAS Number: 00075-01-4	<5	N/A	<5	N/A	N/A	N/A	ug/L	N/A	N/A	N/A	N/A	N/A	N/A
Chromium, Total CAS Number: 07440-47-3	<50	N/A	<50	N/A	N/A	N/A	ug/L	N/A	N/A	N/A	N/A	N/A	N/A
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