ARCADIS
Infrastructure, environment, facilities

ARCADIS of New York, Inc.
Two Huntington Quadrangle
Suite 1S10
Melville
New York 11747
Tel 631.249.7600
Fax 631.249.7610

Transmittal Letter

To:
Steve Scharf
NYSDEC
Division of Environmental Remediation
625 Broadway
Albany, NY 12233-7015

Copies:
Andrew Musgrave, Bethpage Water District
Klaus Schmidke, Conestoga Rovers & Associates
John Mirando, Dvirka & Bartilucci
Steve Whyte, Glenn Springs Holdings Inc.
Gary Loesch, H2M Group
Rich Humman, H2M Group
Frank Flood, Massapequa Water Dist.
John Lovejoy, NCDOH
Walter Parish, NYSDEC
Jacquelyn Nealon, NYSDOH
John Cofman, Northrop Grumman
Larry Leskovjan, Northrop Grumman
Lois Lovisolo, Bethpage Public Library
Anthony Sabino, Forchelli Curto
Bill Pitrowski, Town of Oyster Bay
Susan Clark, U.S. Navy
Paul Olivio, USEPA
Carl Struble, USEPA
Kevin Lumpe, Steel Equities
John Waltz, Brown AE&T Group

From:
David Stern

Date:
August 21, 2007

Subject:
2006 Annual Groundwater Monitoring Report

ARCADIS Project No.:
NY001464.0407.00004

We are sending you:

☒ **Attached** ☐ **Under Separate Cover Via _____ the Following Items:**

☐ Shop Drawings ☐ Plans ☐ Specifications ☐ Change Order
☐ Prints ☐ Samples ☐ Copy of Letter ☐ Reports
☒ Other: CD

Copies	Date	Drawing No.	Rev.	Description	Action*
1	8/20/07			2006 Annual Groundwater Monitoring Report, Operable Unit 2, Northrop Grumman Corporation, Bethpage, New York, NYSDEC Site #s 1-30-0003A & B, August 20, 2007	F

Action*

☐ A Approved
☐ AN Approved As Noted
☐ AS As Requested
☐ Other:
☐ CR Correct and Resubmit
☒ F File
☐ FA For Approval
☐ Resubmit _____ Copies
☐ Return _____ Copies
☐ Review and Comment

ARCADIS

Infrastructure, environment, facilities

Mailing Method

☐ U.S. Postal Service 1st Class	☐ Courier/Hand Delivery	☐ FedEx Priority Overnight	☐ FedEx 2-Day Delivery
☐ Certified/Registered Mail	☐ United Parcel Service (UPS)	☒ FedEx Standard Overnight	☐ FedEx Economy
☐ Other:			

Comments:

ARCADIS

Infrastructure, environment, facilities

Imagine the result

2006 Annual Groundwater Monitoring Report

Operable Unit 2

Northrop Grumman Systems Corporation

Bethpage, New York

NYSDEC Site #s 1-30-0003A & B

August 20, 2007

ARCADIS

David E. Stern
Senior Hydrogeologist

Carlo San Giovanni
Project Manager

Michael F. Wolfert
Hydrogeologist/Project Director

2006 Annual Groundwater Monitoring Report

Operable Unit 2
Northrop Grumman Systems Corporation,
Bethpage, New York
NYSDEC Site #s 1-30-0003A&B

Prepared for:
Northrop Grumman Systems Corporation

Prepared by:
ARCADIS of New York, Inc.
Two Huntington Quadrangle
Suite 1S10
Melville
New York 11747
Tel 631.249.7600
Fax 631.249.7610

Our Ref.:
NY001464.0407.00004

Date:
August 20, 2007

Table of Contents

Tables

Figures

Appendix

ARCADIS

2006 Annual Groundwater Monitoring Report

Operable Unit 2
Northrop Grumman Systems Corporation,
Bethpage, New York
NYSDEC Site #s 1-30-0003A & B

1. Introduction

This groundwater monitoring report was prepared to document the operation, maintenance, and monitoring (OM&M) activities for the Operable Unit 2 (OU2) groundwater remedy at the Northrop Grumman Systems Corporation (Northrop Grumman) Bethpage, New York facility. These activities are currently being conducted by Northrop Grumman, in accordance with the New York State Department of Environmental Conservation (NYSDEC)-approved OU2 Groundwater Monitoring Plan (ARCADIS Geraghty & Miller, Inc. 2001), as modified in June 2006 (ARCADIS G&M, Inc. 2006) and the Public Water Supply Contingency Plan (PWSCP) (ARCADIS G&M Inc. 2003b) collectively to meet the remedial objectives set forth in the March 2001 OU2 Record of Decision (ROD) (NYSDEC 2001).

This report describes the performance and effectiveness monitoring of the on-site portion of the OU2 groundwater remedy for the period from October 12, 2006 through December 28, 2006, which is referred to in this report as the Fourth Quarter 2006 report period, or the current period. This report also constitutes the 2006 Annual Report, and compares the current data to Year 2005 and to longer-term data trends, as applicable.

The monitoring program, as well as the findings, conclusions, and recommendations will be re-evaluated, as additional data become available. The complete description of the on-site portion of the OU2 groundwater remedy, the monitoring program, and rationale/basis for collection and evaluation of data can be found in the NYSDEC-approved OU2 Groundwater Monitoring Plan (ARCADIS Geraghty & Miller, Inc. 2001), as modified in June 2006 (ARCADIS G&M, Inc. 2006) and the PWSCP (ARCADIS G&M Inc. 2003b).

This report also includes the status of the annual update to the NYSDEC-accepted regional groundwater model, as required by the PWSCP.

2. Monitoring Program

The results obtained from monitoring activities conducted during this reporting period are provided in Tables 1 through 6 and are described and discussed in the following report sections: Remedial System Operational Performance (Section 3), Groundwater Flow (Section 4), and Groundwater Quality (Section 5).

Except as described in Tables 1 through 6 and in Sections 3, 4, and 5 of this report, the procedures, methodologies, and monitoring network utilized for the subject period are consistent with procedures and methodologies used previously (ARCADIS Geraghty & Miller, Inc. 2001; ARCADIS G&M, Inc. 2003a). The complete description of the procedures to collect groundwater samples from outpost wells and evaluate and document the results is provided in the PWSCP (ARCADIS G&M, Inc. 2003b).

The locations of the Northrop Grumman site, the OU2 on-site groundwater remedy, the neighboring properties (i.e., the Naval Weapons Industrial Reserve Plant [NWIRP] and Occidental Chemical Corporation [OCC]/RUCO Polymer Corporation sites), and existing wells utilized in the monitoring programs are shown on Figure 1. Appendix A of this report contains the field documentation for monitoring activities performed by ARCADIS (i.e., groundwater sampling logs and chain-of-custody records).

3. Remedial System Performance Monitoring

This report section summarizes the routine performance monitoring conducted during the Fourth Quarter 2006 and Year 2006 for the on-site portion of the OU2 groundwater remedy, which included the following: (1) remedial well water quality monitoring, remedial treatment system effluent water quality monitoring, remedial treatment system efficiency monitoring, and determination of volatile organic compound (VOC) mass removal, and (2) monitoring of remedial well pumpage and remedial treatment system treated effluent discharge to on-site recharge basins.

Also summarized in this report section are the remedial treatment system and remedial well troubleshooting as well as non-routine maintenance activities performed by ARCADIS and Northrop Grumman during the Fourth Quarter 2006.

As stated in previous reports, the on-site remedial wells and remedial treatment systems will be referred to by names that are consistent with Northrop Grumman nomenclature, as summarized in the following table. All monitoring activities will utilize the revised nomenclature.

Former Nomenclature	Revised Nomenclature
Remedial Wells	
GP-1	Well 1
GP-3	Well 3
ONCT-1	Well 17
ONCT-2	Well 18
ONCT-3	Well 19
Remedial Treatment Systems	
GP-1	Tower 96
ONCT	Tower 102

3.1 Water Quality, Treatment Efficiencies, and Mass Removal

Tables 1 and 4 provide the total VOC (TVOC) concentrations detected in the remedial wells. Table 1 provides TVOC concentrations and VOC mass removed by the remedial wells for the current period and Year 2006, and treatment efficiencies for the Tower 96 and Tower 102 remedial treatment system air strippers for the current period.

TVOC concentrations from the remedial wells ranged from 158 micrograms per liter (µg/L) (Well 18) to 3,752 µg/L (Well 3) this period. The discussion of water quality data and trends for the remedial wells is provided in Section 5.1.4 of this report.

A total of approximately 3,076 pounds of VOCs were removed from the aquifer by the remedial wells and treated during the current period. For Year 2006, approximately 14,764 lbs of VOC mass were removed from the aquifer and treated by the OU2 remedial systems. Since full-time remedial system startup in November 1998, approximately 107,041 lbs of VOCs have been removed from the aquifer and treated by the OU2 remedial system.

Northrop Grumman's State Pollutant Discharge Elimination System (SPDES) discharge monitoring results (Permit No. NY0096792) are representative of treated water quality and are used in calculating remedial system treatment efficiency and determining the quality of water returned to the aquifer. SPDES discharge monitoring data are documented on a monthly basis by Northrop Grumman to NYSDEC under separate cover in Discharge Monitoring Reports (DMRs). Northrop Grumman Outfalls

005 and 006 represent the termini of the Tower 102 and Tower 96 systems effluent water (i.e., inlets to the South Recharge Basins and West Recharge Basins) respectively. Based on VOC concentrations in the remedial wells and the SPDES discharge this period, the efficiencies of the Tower 96 and Tower 102 remedial treatment systems for the current period were calculated to be 99.9 percent and 99.2 percent, respectively.

3.2 Remedial System Pumpage and Discharge

Table 1 summarizes the remedial well pumpage (with comparison to design criteria) for the current period and Year 2006. For the current period, Remedial Wells 1, 3, 17, 18, and 19 collectively pumped approximately 406 million gallons (MG) of groundwater, which is equivalent to approximately 95 percent of the design remedial well pumpage volume (427 MG) for the current period. For Year 2006, the remedial system pumped approximately 1,869 MG, equivalent to approximately 93 percent of the total design remedial well pumpage volume of 2,008 MG.

Based on measurements collected by ARCADIS, the South Recharge Basins collectively received the treated effluent discharge from the Tower 102 remedial treatment system along with incidental stormwater runoff and contribution from the Tower 96 remedial system for a total average of approximately 2,588 gpm, equivalent to 251 MG, during the current period.

As discussed in previous reports, a portion of the treated water from the Tower 96 remedial treatment system is provided on demand to the Calpine Energy facility for consumptive use. The demand rate is controlled by a "Cla-Val" located within a new subsurface transmission pipeline between Tower 96 and the Calpine Energy facility. Based on Raw Water Consumption information provided by Calpine Energy to ARCADIS in June 2007, the weighted average facility demand by Calpine for this period was 295 gpm, indicating that the West Recharge Basins received an average discharge rate from the Tower 96 remedial system of approximately 758 gpm this period, equivalent to 46 MG.

3.3 Troubleshooting/Maintenance Activities

Based on water-level and pumping data presented in prior reports, OU2 remedial well specific capacities remain above the minimum required to sustain the design pumping rates, as such no additional maintenance was needed on remedial wells this period (ARCADIS of New York, Inc. 2007a; b).

During the Fourth Quarter 2006, the Tower 96 remedial system was shut down for 31.5 hours between October 25 and October 27 for the replacement of two sluice gates on the stormwater system which transmits treated water to the West Recharge Basins. Other, minor short-term repairs, testing of new component systems, and temporary power outages were also noted during this period.

4. Groundwater Flow

Hydraulic monitoring was performed semi-annually in the Year 2006, in March 22 and September 8. The hydraulic monitoring results are described in prior quarterly reports (ARCADIS of New York, Inc. 2007a; b).

In general, the hydraulic monitoring data collected in Year 2006 indicated that vertical hydraulic gradients in the shallow-intermediate wells pairs are oriented downward and are close to or greater than model predicted values. Mounding of the water table and potentiometric surface exists in the shallow and intermediate zones, respectively, extending beneath the South Recharge Basins and across the Northrop Grumman site southern boundary. Downward vertical gradients were also present in the intermediate-deep and deep-deep2 well pairs, supporting the conclusion that groundwater is flowing in a predominantly vertical direction in the deep zone along the Northrop Grumman site southern boundary. Data obtained in Year 2006 indicates that the combination of shallow recharge at the South Recharge Basins coupled with pumpage of the remedial wells in the D2 zone forms a hydraulic barrier to groundwater flow that is preventing the off-site migration of VOC-impacted groundwater. The capture zone formed by the combined pumpage of OU2 remedial wells extended approximately 800 feet down gradient of Well 17.

5. Groundwater Quality

This report section describes the analytical results of the various groundwater quality monitoring activities for the Fourth Quarter 2006 that are specified in the NYSDEC-approved Groundwater Monitoring Plan (ARCADIS G&M, Inc., 2001; ARCADIS G&M, Inc. 2006) and the PWSCP (ARCADIS G&M Inc., 2003b). Analytical results are summarized in Tables 2 through 6.

5.1 Volatile Organic Compounds

The evaluation of VOC concentrations is presented herein in consideration of the following factors: (1) proximity to the hydraulic barrier formed by the on-site portion of

the OU2 groundwater remedy (i.e., upgradient, along the Northrop Grumman site southern boundary, and downgradient of the hydraulic barrier), (2) hydrogeologic zone (i.e., shallow, intermediate, deep, and D2 zones), and (3) NYSDEC Standards, Criteria, and Guidance Values.

Tables 2 through 6 provide the complete analytical results of samples collected for VOC analysis from monitoring wells, remedial wells, outpost wells, and remedial treatment systems for this period. Time-concentration graphs depicting the long-term VOC concentration trends are shown on Figures 2 through 9.

5.1.1 Shallow Zone

The detailed results of monitoring in the shallow zone are provided in prior reports (ARCADIS of New York, Inc. 2007a; b). In summary, few detections of VOCs in shallow monitoring wells were identified in wells located upgradient of the Northrop Grumman site southern boundary and no detections were identified in wells located immediately downgradient of the Northrop Grumman site southern boundary. These data collectively support the conclusion that the hydraulic barrier formed by the on-site portion of the OU2 Groundwater Remedy remains effective in preventing the off-site migration of VOC-impacted groundwater in the shallow zone.

5.1.2 Intermediate Zone

Analytical data for intermediate monitoring wells is provided in Table 2. Intermediate wells sampled during this period (GM-20I, GM-21I, and GM-79I) are located immediately downgradient of the Northrop Grumman site southern boundary.

Laboratory results indicated no exceedences of SCGs along the Northrop Grumman site southern boundary during this period or Year 2006. These analytical results are consistent with data obtained since the start-up of the OU2 Groundwater Remedy in November 1998 (or for the period of record, for wells monitored prior to November 1998), confirming that the operation of the on-site portion of the OU2 groundwater remedy has formed an effective hydraulic barrier that prevents the off-site migration of VOC-impacted groundwater in the intermediate zone.

5.1.3 Deep Zone

Groundwater monitoring data from the deep zone is summarized in Table 3 and data trends are selectively shown in Figures 3, 4, 5, 7 and 8. Attached data trend graphs

include key wells with detectable concentrations of VOCs that were sampled this period.

Well GM-13D, located upgradient of the OU2 Groundwater Remedy, continued to exhibit a downward trend in TVOC concentrations, with recent results indicating a decrease in TVOC concentrations by more than 50 percent since 1999 (Figure 4).

Four deep wells (i.e., GM-18D, GM-39D_A, GM-39D_B, and GM-73D) located on-site, along the Northrop Grumman site southern boundary, and upgradient of the remedial wells (Figure 1), exhibited SCG exceedences in the Year 2006. These monitoring wells are within the capture zone of the remedial wells, therefore, groundwater in this area is hydraulically contained and over time will be extracted and treated.

Groundwater quality data from wells immediately downgradient of the Northrop Grumman site (Monitoring Wells GM-20D and GM-21D) exhibited no VOC detections or trace VOC detections during this period,

Wells located further downgradient of the hydraulic barrier exhibited TVOC concentrations consistent with the expected concentrations in the portions of the groundwater VOC plume not actively remediated. Of particular note, downgradient Well GM-34D historically exhibited several VOCs (primarily trichloroethene) exceeding SCGs at concentrations that have increased over time. This well is located south of the GM-75D2 Area (Figure 1 – see Section 5.1.4 for additional detail).

Groundwater quality data continues to support the conclusion that the expected bifurcation of the VOC plume is occurring along the Northrop Grumman site southern boundary, as shown by no detections in wells located within the capture zone and immediately downgradient of the site. SCG exceedences continue to persist in wells screened in the portion of the groundwater VOC plume not actively remediated.

In general, the water quality data from the deep wells sampled during the current period and Year 2006 continue to support the interpretation of the hydraulic data and confirm that the operation of the on-site portion of the OU2 groundwater remedy has formed an effective hydraulic barrier that prevents the off-site migration of VOC-impacted groundwater in the deep zone.

5.1.4 Deep2 Zone and Remedial Wells

Groundwater monitoring data from the D2 zone are summarized in Table 4 and data trends are presented on Figures 2, 3, 6, 7, and 8. Attached data trend graphs include key wells with detectable concentrations of VOCs that were sampled this period.

Monitoring Well GM-33D2, located along the southwestern boundary of the Northrop Grumman site, had several VOCs that exceeded SCGs in this period. Similar exceedances were detected in Well GM-33D2 the first three quarters of Year 2006. TVOC values in Well GM-33D2 were slightly higher in the Second and Third Quarters compared to the First and Fourth Quarters, but the overall trend in this well from November 1998 is a decreasing one. The overall decreasing trend in Well GM-33D2 is attributable to the pumping of the OU2 remedial wells. Well GM-33D2 is located within the capture zone of the remedial wells (which are screened in the D2 zone) and therefore groundwater in this area is hydraulically contained and over time will be extracted and treated by the on-site portion of the OU2 groundwater remedy.

For the GM-75D2 Area, off-site Wells GM-35D2 and GM-75D2 had several SCG exceedances during this period, with TVOC concentrations of 335 µg/L and 402 µg/L, respectively. These data are consistent with concentrations expected in the off-site portion of the VOC plume not actively remediated. TVOC concentrations in Well GM-75D2 have shown a decreasing trend since the Year 2002, while TVOC concentrations in Wells GM-34D2 and GM-35D2 increased in the Year 2002 with the latter having remained fairly constant since that time. Well GM-34D2 has exhibited an increasing trend for the period of record. Currently, the Department of the Navy is preparing a work plan for investigation of groundwater in the GM-75D2 Area.

The GM-38 Area monitoring results during Year 2006 were provided in prior reports (ARCADIS of New York, Inc. 200a; b). Well GM-38D2 continues to exhibit a stable VOC concentration trend that was first identified in Year 2002. Remediation of VOCs in the GM-38 Area will be performed by the Department of the Navy.

The other off-site D2 zone monitoring wells continue to exhibit stable to decreasing TVOC concentration trends.

For the remedial wells, TVOC concentrations ranged from 158 µg/L (Well 18) to 3,751 µg/L (Well 3). Wells 3 and 19 concentration trends continue to increase, while the remaining wells exhibit stable to decreasing trends. Well 3 continues to exhibit the highest TVOC concentrations.

In general, the water quality data from the D2 wells sampled during the current period and Year 2006 continue to support the interpretation of the hydraulic data and confirm that the operation of the on-site portion of the OU2 groundwater remedy has formed an effective hydraulic barrier that prevents the off-site migration of VOC-impacted groundwater in the D2 zone.

5.2 Outpost Monitoring

The results of the current outpost well monitoring round are provided in Table 5 and data trends are presented in Figure 9. The complete description of the procedures to collect groundwater samples from the outpost wells and evaluate and document the results is provided in the PWSCP (ARCADIS G&M, Inc., 2003b).

VOCs were not detected in Outpost Wells OW1-2, OW3-1, OW3-2, OW4-1, and OW4-2 during this period and the period of record. Outpost Wells OW1-1, OW1-3, OW2-1 and OW2-2 exhibited detections of site-related VOCs below their respective SCGs, but above the TVOC outpost trigger (except Well OW2-1) values this period. Well OW2-1 has shown an increase in TVOC concentrations since Year 2003 (primarily due to the detection of benzene and methyl-tertiary butyl ether [MTBE], which are not site-related VOCs); the remaining wells exhibit stable VOC concentration trends.

As no new outpost trigger values were exceeded in Year 2006, the requirements for notification/reporting of the initial trigger value exceedances, as outlined in the PWSCP (ARCADIS G&M, Inc., 2003b), have already been met.

5.3 Vinyl Chloride Monomer

Vinyl chloride monomer (VCM) was detected in Well 3 during this period and the Year 2006, but was not detected in the other remedial wells or monitoring wells sampled this period. Implementation of off-site remediation of groundwater to address VCM upgradient (northwest) of Well 3 is currently underway by Occidental Chemical Corporation (OCC) under USEPA oversight.

5.4 Cadmium and Chromium

Cadmium and chromium analysis results for Year 2006 are provided in prior reports (ARCADIS of New York, Inc. 2007a;b).

Based on data for the period of record, cadmium concentrations near former Northrop Grumman Plant 2 continue to persist above the SCG in Well MW-3R, however downgradient monitoring wells have remained below the SCG, with the exception of the most recent result from Well N-10631 (Figure 10).

Based on data for the period of record, chromium concentrations for the wells near former Northrop Grumman Plant 2 continued to be below the SCG (Figure 11). During Year 2006, the chromium concentration trends in the wells near former Northrop Grumman Plant 1 have been stable to decreasing over time (Figure 12).

5.5 Tentatively Identified Compounds

Tentatively Identified Compounds (TICs) were not detected during Year 2006. A review of the cumulative last five years of TIC data shows no discernable trends in concentrations or consistency in TIC detections.

5.6 QA/QC Samples and Data Validation

The results of analysis of QA/QC samples from the current period are provided in Table 6. Results for replicate samples from Wells GM-33D2 and OW1-1 are reported in Tables 4 and 5, respectively.

ARCADIS performed validation of all groundwater quality data collected (including TICs) by following the contract laboratory program national functional guidelines for organic and inorganic data review (USEPA 1999). The quality of the data is considered acceptable with the qualifications indicated on Tables 2 through 6.

6. Annual Groundwater Model Update Evaluation

In accordance with the provisions of the PWSCP, ARCADIS has conducted an evaluation of the supply well pumpage and water quality data provided by public water supply purveyors within the area of the model domain, as well as water quality data collected by ARCADIS and Northrop Grumman from the OU2 groundwater quality monitoring well network to assess the efficacy of the outpost well network in meeting the objectives set forth in the PWSCP.

The following discussions describe the mass and pumpage evaluations and updates performed in Year 2006.

6.1 Purpose of the Evaluation

The purpose of conducting this comparison was to determine if the assigned initial TVOC concentrations in the Year 2000 Model are representative of conditions observed through groundwater sampling conducted between Year 2001 and Year 2004. Likewise a comparison of model-assigned pumping rates to records of remedial system operation and public supply well pumpage was made to ensure the model accurately represented present-day conditions.

6.2 Pumpage Update

A comparison of model-assigned pumping rates to records of both remedial system operation and public supply well pumpage was made to ensure the model accurately represented present-day conditions.

Specifically, average supply well pumping rates for public supply wells from Year 2001 through the end of Year 2004 were computed for each public supply and remedial well located within the model domain. The computed rates were then compared to the model assigned rates. If deviations from the model-assigned rates were greater than 10 percent then the model was updated using the new computed pumping rate. Note that most of the model pumping wells did not require updating.

Following an update of the model-assigned pumping rates, the flow model was re-run, and the model-generated flow field was reviewed. Results showed that the model accurately represented regional flow field conditions and the effect of the revised pumping rates was minimal.

6.3 Mass Update

Recent groundwater quality data (from the beginning of 2001 through the end of 2004) was compared to TVOC concentration distirubtions in the existing Grumman Regional Groundwater Model (Year 2000 Model). The water quality data was comprised of both data collected by ARCADIS for Northrop Grumman during routine groundwater sampling rounds, and analytical water quality results supplied by municipal water suppliers.

The evaluation process consisted of the following:

1. Groundwater quality data from both monitoring and supply wells was compiled, based on sampling events between early Year 2001 and the end of Year 2004.

2. An updated average TVOC concentration for each monitoring well or supply well for the referenced period was calculated.

3. The 2001-2004 time-period Average TVOC Concentration (2001-2004 TVOC Average) was compared to the initial TVOC concentrations assigned in the 2000 Model at each of the monitoring well or supply well locations.

A comparison of the TVOC concentrations assigned as initial conditions in the Year 2000 Model to the 2001-2004 TVOC Average indicated that model-wide increases in assigned TVOC concentrations were not necessary. Rather, only local areas within the defined boundaries of the simulated plume required modification (based on a significant difference between the 2000 Model's initial conditions and the 2001-2004 TVOC Average).

In most cases, only moderate to significant local increases in assigned TVOC concentrations were necessary to update the model. Increases in assigned TVOC concentrations at specific model cells (model cells in which a well existed for which data was available) in turn necessitated additional changes to those model cells proximal to the cells undergoing the reassignment of initial conditions (i.e., changes in a single cell will likely require modifications to neighboring cells both within the layer initially modified, as well as layers above and below the cell initially modified to maintain a "smoothness" in the distribution of assigned TVOC concentrations). Following completion of the process, it was apparent that no significant changes were made to the extent of the model plume, nor to the concentration levels proximal to that extent.

6.4 Results

Based on the model update evaluation performed, a model re-run and an update to the outpost well monitoring program, per the provisions in the PWSCP, was determined to not be necessary at this time. The outpost well data and attendant evaluation/ update of the model will continue to be performed as additional data are generated.

7. Summary and Conclusions

1. The following data indicate that the OU2 groundwater remedy continues to meet remedial performance goals for Year 2006.

    a. During the current period, the OU2 remedial wells pumped 406 MG, or approximately 95 percent of the design volume of groundwater, while the recharge basins received a collective total of 375.8 MG of treated groundwater. For the Year 2006, the OU2 remedial wells pumped 1,869 MG, or approximately 93 percent of the design volume of groundwater, while the recharge basins received approximately 1,611.1 MG of treated groundwater.

    b. Based on data presented in prior reports, OU2 remedial well specific capacities remain above the minimum required to sustain the design pumping rates.

    c. Approximately 3,076 lbs of VOCs were removed from the aquifer and treated by the on-site portion of the OU2 groundwater remedy during the current period. In Year 2006, approximately 14,764 lbs of VOCs were removed from the aquifer and treated, and approximately 107,041 lbs of VOCs were removed and treated since full-time system startup in November 1998.

    d. The treatment efficiencies of both groundwater treatment systems remain above 99 percent for the current period.

2. The following data indicate that the OU2 groundwater remedy continues to meet remedial effectiveness goals for Year 2006.

    a. The hydraulic data indicate hydraulic containment has been achieved in a manner consistent with previous years.

    b. Wells immediately downgradient of the hydraulic barrier show no or trace VOC concentrations or decreasing VOC concentration trends. Groundwater quality data indicates that bifurcation of the VOC plume is occurring in the deep and D2 zones south of the hydraulic barrier.

3. Other significant findings and conclusions with respect to groundwater are summarized as follows:

a. Based on prior reports for Year 2006, in the shallow, intermediate, and deep zones, the majority of wells located along the Northrop Grumman site perimeter showed trace or non-detectable concentrations of VOCs.

b. The majority of D2 wells located along and immediately downgradient of the Northrop Grumman site southern boundary exhibit stable or decreasing concentrations of VOCs. Such wells are located within the capture zone of the remedial wells. Wells located in areas not actively remediated (further downgradient of the Northrop Grumman site) exhibit concentrations indicative of expected VOC plume heterogeneity. Additional investigation of groundwater in the GM-75D2 Area and remediation of deep/D2 zone groundwater in the GM-38 Area will be performed by the Department of the Navy.

c. Site-related VOCs were detected in Outpost Wells OW1-1, OW1-3, OW2-1 and OW2-2. The remaining outpost wells exhibited no VOC detections.

d. Based on prior reports for Year 2006, Cd/Cr SCG exceedences are limited to on-site areas, with the exception of Cr in Well N-10631 in the most recent round.

e. VCM in groundwater remains limited to the area near and upgradient of Remedial Well 3; additional groundwater remedial action currently being implemented by OCC.

8. Recommendation

The NYSDEC granted the request from ARCADIS to reduce the monitoring frequency for selected wells, as reflected in the limited number of wells sampled during the Fourth Quarter of 2006. ARCADIS makes no other recommendations to modify the groundwater monitoring program at this time.

9. References

ARCADIS of New York, Inc. 2007a. First Quarter 2007 Groundwater Monitoring Report, Operable Unit 2, Northrop Grumman Corporation, Bethpage, New York.

ARCADIS of New York. 2007b. Second and Third Quarters 2007 Groundwater Monitoring Report, Operable Unit 2, Northrop Grumman Corporation, Bethpage, New York.

ARCADIS G&M, Inc. 2006. Petition for Recommended Modifications to the Operable Unit 2 Groundwater Monitoring Plan, Northrop Grumman Corporation, Bethpage, New York. June 2006.

ARCADIS G&M, Inc. 2005. Memo to J. Cofman Re: Calpine Water Supply Modeling Results for Simulation 2, 4, and 5. November 18, 2005.

ARCADIS G&M, Inc. 2003a. 2002 Annual Groundwater Monitoring Report, Northrop Grumman Corporation, Bethpage, New York. August 14, 2003.

ARCADIS G&M, Inc. 2003b. Public Water Supply Contingency Plan, Naval Facilities Engineering Command. July 22, 2003.

ARCADIS Geraghty & Miller, Inc. 2001. Operable Unit 2 Groundwater Monitoring Plan. Northrop Grumman Corporation, Bethpage, New York. May 11, 2001.

Naval Weapons Industrial Reserve Plant Site #130003B.

NYSDEC 2005. Letter to Messrs. John Cofman and James Colter Re: Northrop Grumman and Naval, Weapons Industrial Reserve Plant Site. Town of Oyster Bay, Nassau County, Site Nos. 1-30-003A and B. July 13, 2005.

New York State Department of Environmental Conservation (NYSDEC). 2001. Record of Decision Operable Unit 2 Groundwater Northrop Grumman and Naval Weapons Industrial Reserve Plant Sites, Nassau County Site Numbers 1-30-003A & B.

New York State Department of Environmental Conservation (NYSDEC). 1998. Division of Water Technical and Operation Guidance Series (TOGS 1.1.1).

Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. Promulgated October 22, 1993. Re-issued June 1998

U.S. Environmental Protection Agency (USEPA). 1999. Contract Laboratory Program National Functional Guidelines for Organic Data Review. October 1999.

Table 1. Summary of Operational Data and Water Balance for the On-Site Portion of the OU2 Groundwater Remedy, Fourth Quarter 2006 and Year 2006, Northrop Grumman Systems Corporation, Bethpage, New York.

(a) Remedial well pumping rates based on computer modeling (ARCADIS Geraghty & Miller, Inc. 2000). Acceptable minimum recharge rates based on computer modeling (ARCADIS G&M, Inc. 2004b). Design pumping and recharge rates were modified in April, 2005. Total recharge includes remedial well pumpage (minus pipe loss) and incidental runoff from precipitation.

(b) Actual Average Pumping Rates were calculated based on Actual Total Pumpage and hours of operation from October 12 to December 28, 2006 (78 days) for the Fourth Quarter 2006, and hours of operation from December 29, 2005, to December 28, 2006 (367 days) for Year 2006.
Current average recharge rates have been determined using the entire 78-day span of time for the Fourth Quarter 2006, as opposed to current average pumping rates, which account for varying amounts of downtime, as indicated below.
OU2 wells were operational during the Fourth Quarter 2006, at the following percentages: Well 1 (98%), Well 3 (98%); Well 17 (100%), Well 18 (100%), and Well 19 (100%). The Actual Average Pumping Rates are for when the wells are pumping. All readings accurate to +/- 10% due to gauge limitations.

(c) The TVOC concentration for each well was calculated based on Fourth Quarter 2006 groundwater monitoring data (Table 4).

(d) VOC mass removed during the Fourth Quarter and Year 2006 was based on the TVOC data given on page 1 and the following formula:

(TVOC concentration in ug/L) X (gallons pumped) X (3.785 L/gal) X (1 x 10^{-6} g/ug) X (2.2 x 10^{-3} lb/g)

(e) Air Stripping Efficiency calculated from values above and in Table 4 using the following formula:

$$1 - \left[\frac{\text{Average SPDES TVOC Concentration at Outfall}}{\frac{[(\text{TVOC}_{\text{Well 1}} \times Q_{\text{Well 1}}) + (\text{TVOC}_{\text{Well 2}} \times Q_{\text{Well 2}})]}{(Q_{\text{Well 1}} + Q_{\text{Well 2}})}} \right]$$

When non-detectable levels of VOCs are found in the effluent, a value of zero is used to estimate the efficiency of the air stripper.

(f) Cumulative calculated Year-to-Date VOC Mass Removed includes the record from December 29, 2005, through December 28, 2006.
Cumulative calculated VOC Mass Removed includes mass removed since start-up of the Toiwer 102 system in November 1998.

(g) Current year to date and cumulative TVOC Mass Removed includes Wells Well 1, Well 3, Well 17, Well 18 and Well 19.

--	Not Available or Not Applicable	lb/g	pounds per gram
TVOC	Total Volatile Organic Compounds	lbs	pounds
g/ug	grams per microgram	MG	Million Gallons
gpm	gallons per minute	ug/L	micrograms per liter
L/gal	Liters per gallon	OU2	Operable Unit 2
SPDES	State Pollutant Discharge Elimination System	Q	Pumping Rate

ARCADIS

Table 2. Concentrations of Volatile Organic Compounds Detected in Intermediate Wells, Fourth Quarter 2006, Operable Unit 2, Northrop Grumman Systems Corporation, Bethpage, New York.

CONSTITUENT (Units in ug/L)	NYSDEC Standards Criteria and Guidance Values[1]	WELL: GM-20I SAMPLE ID: GM-20I DATE: 11/21/2006	GM-21I GM-21I 11/20/2006	GM-79I GM-79I 11/21/2006
Chloromethane	5	<5	<5	<5
Bromomethane	5	<5	<5	<5
Vinyl chloride	2	<2	<2	<2
Chloroethane	5	<5	<5	<5
Methylene chloride	5	<5	<5	<5
Acetone	50	<10	<10	<10
Carbon disulfide	50	<5	<5	<5
1,1-Dichloroethene	5	<5	<5	<5
1,1-Dichloroethane	5	<5	<5	<5
cis-1,2-Dichloroethene	5	<5	<5	<5
trans-1,2-Dichloroethene	5	<5	<5	<5
Chloroform	7	<5	<5	<5
1,2-Dichloroethane	5	<5	<5	<5
2-Butanone	50	<10	<10	<10
1,1,1-Trichloroethane	5	<5	<5	<5
Carbon tetrachloride	5	<5	<5	<5
Bromodichloromethane	50	<5	<5	<5
1,2-Dichloropropane	5	<5	<5	<5
cis-1,3-Dichloropropene	5	<5	<5	<5
Trichloroethene	5	<5	<5	<5
Dibromochloromethane	5	<5	<5	<5
1,1,2-Trichloroethane	5	<5	<5	<5
Benzene	0.7	<0.7	<0.7	<0.7
trans-1,3-Dichloropropene	5	<5	<5	<5
Bromoform	50	<5	<5	<5
4-Methyl-2-pentanone	50	<10	<10	<10
2-Hexanone	50	<10	<10	<10
Tetrachloroethene	5	<5	<5	<5
1,1,2,2-Tetrachloroethane	5	<5	<5	<5
Toluene	5	<5	<5	<5
Chlorobenzene	5	<5	<5	<5
Ethylbenzene	5	**0.62J**	<5	<5
Styrene	5	<5	<5	<5
Xylene (total)	5	**2.7J**	**1.1J**	<5
Vinyl Acetate	NE	<5	<5	<5
Freon 113	5	<5	<5	<5
Chlorodifluoromethane	5	<5	<5	<5
Dichlorodifluoromethane	5	<5	<5	<5
Total VOCs		**3.3**	**1.1**	0

ug/L	Micrograms per liter
J	Estimated value
Bold	Constituent detected
(1)	Standards, Criteria, and Guidance (SCG) values based on documents referenced in the Groundwater Feasibility Study Report (ARCADIS Geraghty & Miller, Inc. 2000) that are based on the NYSDEC TOGs (NYSDEC 1998); most stringent value listed.
VOCs	Volatile organic compounds
NYSDEC	New York State Department of Environmental Conservation
*	Freon 113 also known as 1,1,1-Trichloro-2,2,2-trifluoroethane.
NE	No SCG established
TOGS	Technical and Operational Guidance Series

ARCADIS

Table 3. Concentrations of Volatile Organic Compounds Detected in Deep Wells,
Fourth Quarter 2006, Operable Unit 2, Northrop Grumman Systems Corporation, Bethpage, New York.

CONSTITUENT (Units in ug/L)	NYSDEC Standards Criteria and Guidance Values[1]	WELL: / SAMPLE ID: / DATE:	GM-20D / GM-20D / 11/21/2006	GM-21D / GM-21D / 11/20/2006	GM-34D / GM-34D / 11/30/2006	GM-79D / GM-79D / 11/21/2006
Chloromethane	5		<5	<5	<5	<5
Bromomethane	5		<5	<5	<5	<5
Vinyl chloride	2		<2	<2	<2	<2
Chloroethane	5		<5	<5	<5	<5
Methylene chloride	5		<5	<5	<5	<5
Acetone	50		<10	<10	<10	<10
Carbon disulfide	50		<5	<5	<5	<5
1,1-Dichloroethene	5		<5	<5	**19**	<5
1,1-Dichloroethane	5		<5	<5	**1.5J**	<5
cis-1,2-Dichloroethene	5		<5	<5	**12**	<5
trans-1,2-Dichloroethene	5		<5	<5	<5	<5
Chloroform	7		<5	<5	**0.65J**	<5
1,2-Dichloroethane	5		<5	<5	<5	<5
2-Butanone	50		<10	<10	<10	<10
1,1,1-Trichloroethane	5		<5	<5	<5	<5
Carbon tetrachloride	5		<5	<5	<5	<5
Bromodichloromethane	50		<5	<5	<5	<5
1,2-Dichloropropane	5		<5	<5	<5	<5
cis-1,3-Dichloropropene	5		<5	<5	<5	<5
Trichloroethene	5		<5	**2J**	**1100D**	**47**
Dibromochloromethane	5		<5	<5	<5	<5
1,1,2-Trichloroethane	5		<5	<5	<5	<5
Benzene	0.7		<0.7	<0.7	<0.7	<0.7
trans-1,3-Dichloropropene	5		<5	<5	<5	<5
Bromoform	50		<5	<5	<5	<5
4-Methyl-2-pentanone	50		<10	<10	<10	<10
2-Hexanone	50		<10	<10	<10	<10
Tetrachloroethene	5		<5	<5	**15B**	**1.4J**
1,1,2,2-Tetrachloroethane	5		<5	<5	<5	<5
Toluene	5		<5	<5	<5	<5
Chlorobenzene	5		<5	<5	<5	<5
Ethylbenzene	5		<5	<5	<5	<5
Styrene	5		<5	<5	<5	<5
Xylene (total)	5		<5	<5	<5	<5
Vinyl Acetate	NE		<5	<5	<5	<5
Freon 113	5		<5	<5	**22**	**0.68J**
Chlorodifluoromethane	5		<5	<5	**1.3J**	<5
Dichlorodifluoromethane	5		<5	<5	**0.57J**	<5
Total VOCs			0	**2**	**1,172**	**49.1**

ug/L Micrograms per liter
B Detected in an associated blank.
D Constituent identified at a secondary dilution.
J Estimated value
Bold Constituent detected
[1] Standards, Criteria, and Guidance (SCG) values based on documents referenced in the Groundwater Feasibility Study Report (ARCADIS Geraghty & Miller, Inc. 2000) that are based on the NYSDEC TOGs (NYSDEC 1998); most stringent value listed.
VOCs Volatile organic compounds
NYSDE New York State Department of Environmental Conservation
Freon 113 also known as 1,1,1-Trichloro-2,2,2-trifluoroethane.
[ ] Value exceeds associated SCG value.
NE No SCG established
TOGS Technical and Operational Guidance Series
ug/L Micrograms per liter

ARCADIS

Table 4. Concentrations of Volatile Organic Compounds Detected in Deep2 Monitoring Wells and Groundwater Remedial Wells and Treatment Systems Fourth Quarter 2006, Operable Unit 2, Northrop Grumman Systems Corporation, Bethpage, New York.

CONSTITUENT (Units in ug/L)	NYSDEC Standards Criteria and Guidance Values[1]	WELL: / SAMPLE ID: / DATE:	GM-33D2 GM-33D-2 11/29/2006	GM-33D2 REP-11-29-06 11/29/2006	GM-35D2 GM-35D-2 11/29/2006	GM-75D2 GM-75D-2 11/27/2006
Chloromethane	5		<5	<5	<5	<5
Bromomethane	5		<5	<5	<5	<5
Vinyl chloride	2		<2	<2	<2	<2
Chloroethane	5		<5	<5	<5	<5
Methylene chloride	5		<5	<5	<5	<5
Acetone	50		<10	<10	<10	<10
Carbon disulfide	50		<5	<5	<5	<5
1,1-Dichloroethene	5		**1J**	**0.94J**	**1.9J**	**7.5**
1,1-Dichloroethane	5		<5	<5	<5	<5
cis-1,2-Dichloroethene	5		**1.9J**	**1.9J**	**3.5J**	**1.6J**
trans-1,2-Dichloroethene	5		<5	<5	<5	<5
Chloroform	7		<5	<5	<5	<5
1,2-Dichloroethane	5		<5	<5	<5	<5
2-Butanone	50		<10	<10	<10	<10
1,1,1-Trichloroethane	5		<5	<5	<5	<5
Carbon tetrachloride	5		<5	<5	<5	<5
Bromodichloromethane	50		<5	<5	<5	<5
1,2-Dichloropropane	5		<5	<5	<5	<5
cis-1,3-Dichloropropene	5		<5	<5	<5	<5
Trichloroethene	5		**120J**	**120J**	**310DJ**	**380DJ**
Dibromochloromethane	5		<5	<5	<5	<5
1,1,2-Trichloroethane	5		<5	<5	<5	<5
Benzene	0.7		<0.7	<0.7	<0.7	<0.7
trans-1,3-Dichloropropene	5		<5	<5	<5	<5
Bromoform	50		<5	<5	<5	<5
4-Methyl-2-pentanone	50		<10	<10	<10	<10
2-Hexanone	50		<10	<10	<10	<10
Tetrachloroethene	5		**22B**	**24B**	**12B**	**9.8B**
1,1,2,2-Tetrachloroethane	5		<5	<5	<5	<5
Toluene	5		<5	<5	<5	<5
Chlorobenzene	5		<5	<5	<5	<5
Ethylbenzene	5		<5	<5	<5	<5
Styrene	5		<5	<5	<5	<5
Xylene (total)	5		<5	<5	<5	<5
Vinyl Acetate	NE		<5	<5	<5	<5
Freon 113	5		**69**	**70**	**6.6**	**3.3J**
Chlorodifluoromethane	5		<5	<5	**1.1J**	<5
Dichlorodifluoromethane	5		<5	<5	<5	<5
Total VOCs			**213.9**	**216.8**	**335.1**	**402.2**

ug/L	Micrograms per liter
B	**Detected in an associated blank.**
D	Constituent identified at a secondary dilution.
J	Estimated value
Bold	Constituent detected
[1]	Standards, Criteria, and Guidance (SCG) values based on documents referenced in the Groundwater Feasibility Study Report (ARCADIS Geraghty & Miller, Inc. 2000) that are based on the NYSDEC TOGs (NYSDEC 1998); most stringent value listed.
VOCs	Volatile organic compounds
NYSDEC	**New York State Department** of Environmental Conservation
	Freon 113 also known as 1,1,1-Trichloro-2,2,2-trifluoroethane.
	Value exceeds associated SCG value.
NE	No SCG established
TOGS	**Technical and Operational Guidance Series**

Table 4. Concentrations of Volatile Organic Compounds Detected in Deep2 Monitoring Wells and Groundwater Remedial Wells and Treatment Systems Fourth Quarter 2006, Operable Unit 2, Northrop Grumman Systems Corporation, Bethpage, New York.

CONSTITUENT (Units in ug/L)	NYSDEC Standards Criteria and Guidance Values[1]	WELL: / SAMPLE ID: / DATE:	WELL 1 WELL1 12/14/2006	WELL 3 WELL3 12/14/2006	T-96-INFL T96INF 12/14/2006	T-96-EFFL T96EFF 12/14/2006
Chloromethane	5		<5	<5	<5	<5
Bromomethane	5		<5	<5	<5	<5
Vinyl chloride	2		<2	160	76	<2
Chloroethane	5		<5	4.3J	2J	<5
Methylene chloride	5		<5	<5	<5	<5
Acetone	50		<10	<10	<10	<10
Carbon disulfide	50		<5	<5	<5	<5
1,1-Dichloroethene	5		4.6J	21	12	<5
1,1-Dichloroethane	5		1.8J	3.9J	2.9J	<5
cis-1,2-Dichloroethene	5		8.6	17	12	<5
trans-1,2-Dichloroethene	5		<5	<5	<5	<5
Chloroform	7		<5	0.5J	<5	<5
1,2-Dichloroethane	5		<5	<5	<5	<5
2-Butanone	50		<10	<10	<10	<10
1,1,1-Trichloroethane	5		<5	<200	<5	<5
Carbon tetrachloride	5		<5	<5	<5	<5
Bromodichloromethane	50		<5	<5	<5	<5
1,2-Dichloropropane	5		1.5J	<5	<5	<5
cis-1,3-Dichloropropene	5		<5	<5	<5	<5
Trichloroethene	5		540D	3200D	2000D	1.4J
Dibromochloromethane	5		<5	<5	<5	<5
1,1,2-Trichloroethane	5		<5	210	<5	<5
Benzene	0.7		<0.7	53	10	<0.7
trans-1,3-Dichloropropene	5		<5	<5	<5	<5
Bromoform	50		<5	<5	<5	<5
4-Methyl-2-pentanone	50		<10	<10	<10	<10
2-Hexanone	50		<10	<10	<10	<10
Tetrachloroethene	5		140	60	100	<5
1,1,2,2-Tetrachloroethane	5		<5	<5	<5	<5
Toluene	5		<5	<5	<5	<5
Chlorobenzene	5		<5	<5	<5	<5
Ethylbenzene	5		<5	<5	<5	<5
Styrene	5		<5	<5	<5	<5
Xylene (total)	5		<5	<5	<5	<5
Vinyl Acetate	NE		<5	<5	<5	<5
Freon 113	5		8.2	22	14	<5
Chlorodifluoromethane	5		0.38J	<5	0.27J	<5
Dichlorodifluoromethane	5		<5	<5	<5	<5
Total VOCs			**705.1**	**3,751.7**	**2,229.2**	**1.4**

ug/L	Micrograms per liter
B	Detected in an associated blank.
D	Constituent identified at a secondary dilution.
J	Estimated value
Bold	Constituent detected
[1]	Standards, Criteria, and Guidance (SCG) values based on documents referenced in the Groundwater Feasibility Study Report (ARCADIS Geraghty & Miller, Inc. 2000) that are based on the NYSDEC TOGs (NYSDEC 1998); most stringent value listed.
VOCs	Volatile organic compounds
NYSDEC	New York State Department of Environmental Conservation
	Freon 113 also known as 1,1,1-Trichloro-2,2,2-trifluoroethane.
	Value exceeds associated SCG value.
NE	No SCG established
TOGS	Technical and Operational Guidance Series

Table 4. Concentrations of Volatile Organic Compounds Detected in Deep2 Monitoring Wells and Groundwater Remedial Wells and Treatment Systems, Fourth Quarter 2006, Operable Unit 2, Northrop Grumman Systems Corporation, Bethpage, New York.

CONSTITUENT (Units in ug/L)	NYSDEC Standards Criteria and Guidance Values[1]	WELL: / SAMPLE ID: / DATE:	WELL 17 WELL17 12/15/2006	WELL 18 WELL18 12/15/2006	WELL 19 WELL19 12/15/2006	T-102-INFL T102INF 12/15/2006	T-102-EFFL T102EFF 12/15/2006
Chloromethane	5		<5	<5	<5	<5	<5
Bromomethane	5		<5	<5	<5	<5	<5
Vinyl chloride	2		<2	<2	<2	<2	<2
Chloroethane	5		<5	<5	<5	<5	<5
Methylene chloride	5		<5	<5	<5	<5	<5
Acetone	50		<10	<10	<10	<10	<10
Carbon disulfide	50		<5	<5	<5	<5	<5
1,1-Dichloroethene	5		**2.7J**	**4.6J**	**1.5J**	**2.3J**	<5
1,1-Dichloroethane	5		<5	<5	<5	<5	<5
cis-1,2-Dichloroethene	5		**3.7J**	**1.7J**	**22**	**8.8**	<5
trans-1,2-Dichloroethene	5		<5	<5	<5	<5	<5
Chloroform	7		<5	<5	**0.94J**	<5	<5
1,2-Dichloroethane	5		<5	<5	<5	<5	<5
2-Butanone	50		<10	<10	<10	<10	<10
1,1,1-Trichloroethane	5		**0.53J**	<5	<5	**0.77J**	<5
Carbon tetrachloride	5		<5	<5	<5	<5	<5
Bromodichloromethane	50		<5	<5	<5	<5	<5
1,2-Dichloropropane	5		<5	<5	<5	<5	<5
cis-1,3-Dichloropropene	5		<5	<5	<5	<5	<5
Trichloroethene	5		**410D**	**140**	**180**	**270D**	**1.7J**
Dibromochloromethane	5		<5	<5	<5	<5	<5
1,1,2-Trichloroethane	5		<5	<5	<5	<5	<5
Benzene	0.7		<0.7	<0.7	<0.7	<0.7	<0.7
trans-1,3-Dichloropropene	5		<5	<5	<5	<5	<5
Bromoform	50		<5	<5	<5	<5	<5
4-Methyl-2-pentanone	50		<10	<10	<10	<10	<10
2-Hexanone	50		<10	<10	<10	<10	<10
Tetrachloroethene	5		**24**	**10**	**9.6**	**17**	<5
1,1,2,2-Tetrachloroethane	5		<5	<5	<5	<5	<5
Toluene	5		<5	<5	<5	<5	<5
Chlorobenzene	5		<5	<5	<5	<5	<5
Ethylbenzene	5		<5	<5	<5	<5	<5
Styrene	5		<5	<5	<5	<5	<5
Xylene (total)	5		<5	<5	<5	<5	<5
Vinyl Acetate	NE		<5	<5	<5	<5	<5
Freon 113	5		**10**	**1.6J**	**0.9J**	**5.6**	<5
Chlorodifluoromethane	5		<5	**0.37J**	**0.29J**	**0.26J**	<5
Dichlorodifluoromethane	5		<5	<5	<5	<5	<5
Total VOCs			**450.9**	**158.3**	**215.2**	**304.7**	**1.7**

ug/L Micrograms per liter
B **Detected in an associated blank.**
D Constituent identified at a secondary dilution.
J Estimated value
Bold Constituent detected
[1] **Standards, Criteria**, and Guidance (SCG) values based on documents referenced in the Groundwater Feasibility Study Report (ARCADIS Geraghty & Miller, Inc. 2000) that are based on the NYSDEC TOGs (NYSDEC 1998); most stringent value listed.
VOCs Volatile organic compounds
NYSDE New York State Department of Environmental Conservation
Freon 113 also known as 1,1,1-Trichloro-2,2,2-trifluoroethane.
[ ] Value exceeds associated SCG value.
NE No SCG established
TOGS Technical and Operational Guidance Series

ARCADIS

Table 5. Concentrations of Site-Related Volatile Organic Compounds Detected in Outpost Wells, Fourth Quarter 2006, Operable Unit 2, Northrop Grumman Systems Corporation, Bethpage, New York. [1]

CONSTITUENT (Units in ug/L)	NYS DEC Standards Criteria and Guidance Values	WELL: / SAMPLE ID: / DATE:	OW1-1 BPOW1-1 12/1/2006	OW1-1 REP 12-6-06 12/1/2006	OW1-2 BPOW1-2 12/1/2006	OW1-3 BPOW 1-3 12/1/2006	OW 2-1 [5] BPOW 2-1 12/1/2006	OW2-2 BPOW 2-2 12/1/2006	OW3-1 BPOW 3-1 12/8/2006	OW3-2 BPOW 3-2 12/8/2006	OW4-1 BPOW 4-1 12/1/2006	OW4-2 BPOW 4-2 12/1/2006
Chlorobenzene	5		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
1,1-Dichloroethene	5		**1.8**	**1.8**	<0.50	**3.1**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
1,1-Dichloroethane	5		**1.5**	**1.4**	<0.50	**1.4**	<0.50	**0.67**	<0.50	<0.50	<0.50	<0.50
trans-1,2-Dichloroethene	5		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
cis-1,2-Dichloroethene	5		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Chloroform	7		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
1,2-Dichloroethane	5		<0.50	<0.50	<0.50	<0.50	**2.2**	<0.50	<0.50	<0.50	<0.50	<0.50
1,1,1-Trichloroethane	5		**3.1J**	**3.1J**	<0.50	**4.7J**	**0.62J**	<0.50	<0.50	<0.50	<0.50	<0.50
Carbon tetrachloride	5		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Trichloroethene	5		**2**	**2**	<0.50	**0.93**	**1.4**	**0.77**	<0.50	<0.50	<0.50	<0.50
1,1,2-Trichloroethane	5		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Tetrachloroethene	5		<0.50	<0.50	<0.50	<0.50	**0.93**	<0.50	<0.50	<0.50	<0.50	<0.50
Freon-113 *	5		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
1,1,2,2-Tetrachloroethane	5		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Site-Related VOCs [1]:			**8.4[3]**	**8.3[3]**	0	**10.13[3]**	**4.97[4]**	**1.44**	0	0	0	0
TVOC Trigger Value [2]:			**0.6**	**0.6**	**0.6**	**0.6**	NE	NE	**1.5**	**1.5**	**1.5**	**1.5**

(1) Site-related VOCs were established in the Public Water Supply Contingency Plan (PWSCP) (ARCADIS G&M, Inc. 2003).
(2) TVOC Trigger Values were established in the PWSCP (ARCADIS G&M, Inc. 2003).
(3) The TVOC Trigger Value for Cluster 1 was initially exceeded on April 23, 2004; confirmatory sampling and reporting was conducted as per the PWSCP (ARCADIS G&M, Inc. 2003)
(4) VOCs were initially detected in Cluster 2 on May 3, 2004; confirmatory sampling and reporting was conducted as per the PWSCP (ARCADIS G&M, Inc. 2003).
(5) Benzene and Methyl tert-butyl ether (MTBE), which are not site-related VOCs, were detected in Outpost Well OW 2-1 on 12/01/06 at 130 ug/L and 10 ug/L, respectively.

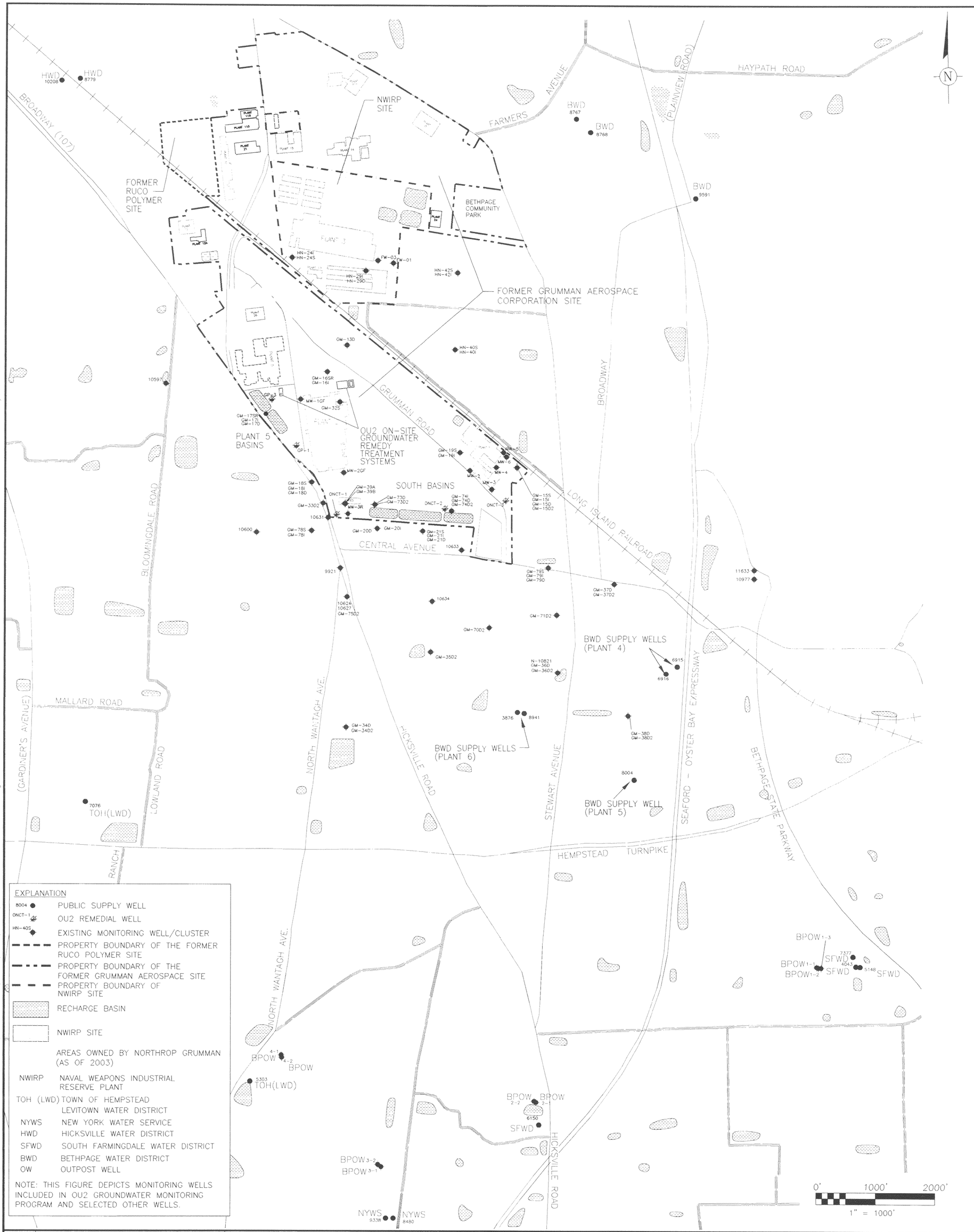
ug/L Micrograms per liter
Bold Constituent detected
TVOC Total Volatile Organic Compounds
NE Not Established

ARCADIS

Table 6. Concentrations of Volatile Organic Compounds Detected in Blank Samples,
Fourth Quarter 2006, Operable Unit 2, Northrop Grumman Systems Corporation, Bethpage, New York.

CONSTITUENT (Units in ug/L)	NYSDEC Standards Criteria and Guidance Values[1]	WELL: / SAMPLE ID: / DATE:	TRIP BLANK TB-11-20-06 11/20/2006	TRIP BLANK TB11-21-06 11/21/2006	TRIP BLANK TB-11-27-06 11/27/2006	TRIP BLANK TB-11-29-06 11/29/2006	TRIP BLANK TB11-30-06 11/30/2006	TRIP BLANK TB12141506 12/14/2006
Chloromethane	5		<5	<5	<5	<5	<5	<5
Bromomethane	5		<5	<5	<5	<5	<5	<5
Vinyl chloride	2		<2	<2	<2	<2	<2	<2
Chloroethane	5		<5	<5	<5	<5	<5	<5
Methylene chloride	5		**3.8JB**	**3.9JB**	**4.6JB**	**4.2JB**	**4.7JB**	**5.2B**
Acetone	50		<10	**4.3J**	**3.3JB**	**3.3JB**	**2.4J**	**3.1JB**
Carbon disulfide	50		<5	<5	<5	<5	<5	<5
1,1-Dichloroethene	5		<5	<5	<5	<5	<5	<5
1,1-Dichloroethane	5		<5	<5	<5	<5	<5	<5
cis-1,2-Dichloroethene	5		<5	<5	<5	<5	<5	<5
trans-1,2-Dichloroethene	5		<5	<5	<5	<5	<5	<5
Chloroform	7		<5	<5	<5	<5	<5	<5
1,2-Dichloroethane	5		<5	<5	<5	<5	<5	<5
2-Butanone	50		<10	<10	<10	<10	<10	<10
1,1,1-Trichloroethane	5		<5	<5	<5	<5	<5	<5
Carbon tetrachloride	5		<5	<5	<5	<5	<5	<5
Bromodichloromethane	50		<5	<5	<5	<5	<5	<5
1,2-Dichloropropane	5		<5	<5	<5	<5	<5	<5
cis-1,3-Dichloropropene	5		<5	<5	<5	<5	<5	<5
Trichloroethene	5		<5	<5	<5	<5	<5	<5
Dibromochloromethane	5		<5	<5	<5	<5	<5	<5
1,1,2-Trichloroethane	5		<5	<5	<5	<5	<5	<5
Benzene	0.7		<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
trans-1,3-Dichloropropene	5		<5	<5	<5	<5	<5	<5
Bromoform	50		<5	<5	<5	<5	<5	<5
4-Methyl-2-pentanone	50		<10	<10	<10	<10	<10	<10
2-Hexanone	50		<10	<10	<10	<10	<10	<10
Tetrachloroethene	5		<5	<5	**1.3JB**	**1.9JB**	<5	<5
1,1,2,2-Tetrachloroethane	5		<5	<5	<5	<5	<5	<5
Toluene	5		<5	<5	<5	<5	<5	<5
Chlorobenzene	5		<5	<5	<5	<5	<5	<5
Ethylbenzene	5		<5	<5	<5	<5	<5	<5
Styrene	5		<5	<5	<5	<5	<5	<5
Xylene (total)	5		<5	<5	<5	<5	<5	<5
Vinyl Acetate	NE		<5	<5	<5	<5	<5	<5
Freon 113	5		<5	<5	<5	<5	<5	<5
Chlorodifluoromethane	5		<5	<5	<5	<5	<5	<5
Dichlorodifluoromethane	5		<5	<5	<5	<5	<5	<5
Total VOCs			**3.8**	**8.2**	**9.2**	**9.4**	**7.1**	**8.3**

ug/L	Micrograms per liter
B	Detected in an associated blank.
D	Constituent identified at a secondary dilution.
J	Estimated value
Bold	Constituent detected
[1]	Standards, Criteria, and Guidance (SCG) values based on documents referenced in the Groundwater Feasibility Study Report (ARCADIS Geraghty & Miller, Inc. 2000) that are based on the NYSDEC TOGs (NYSDEC 1998); most stringent value listed.
VOCs	Volatile organic compounds
NYSDEC	New York State Department of Environmental Conservation Freon 113 also known as 1,1,1-Trichloro-2,2,2-trifluoroethane.
NE	No SCG established
TOGS	Technical and Operational Guidance Series



EXPLANATION

- 8004 ● PUBLIC SUPPLY WELL
- ONCT-1 ⊛ OU2 REMEDIAL WELL
- HN-40S ◆ EXISTING MONITORING WELL/CLUSTER
- PROPERTY BOUNDARY OF THE FORMER RUCO POLYMER SITE
- PROPERTY BOUNDARY OF THE FORMER GRUMMAN AEROSPACE SITE
- PROPERTY BOUNDARY OF NWIRP SITE
- RECHARGE BASIN
- NWIRP SITE
- AREAS OWNED BY NORTHROP GRUMMAN (AS OF 2003)

NWIRP	NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
TOH (LWD)	TOWN OF HEMPSTEAD LEVITOWN WATER DISTRICT
NYWS	NEW YORK WATER SERVICE
HWD	HICKSVILLE WATER DISTRICT
SFWD	SOUTH FARMINGDALE WATER DISTRICT
BWD	BETHPAGE WATER DISTRICT
OW	OUTPOST WELL

NOTE: THIS FIGURE DEPICTS MONITORING WELLS INCLUDED IN OU2 GROUNDWATER MONITORING PROGRAM AND SELECTED OTHER WELLS.

ARCADIS OF NEW YORK, INC.
Two Huntington Quadrangle
Suite 1S10
Melville, NY 11747
Tel: 631-249-7600 Fax: 631-249-7610
www.arcadis-us.com

PROJECT TITLE

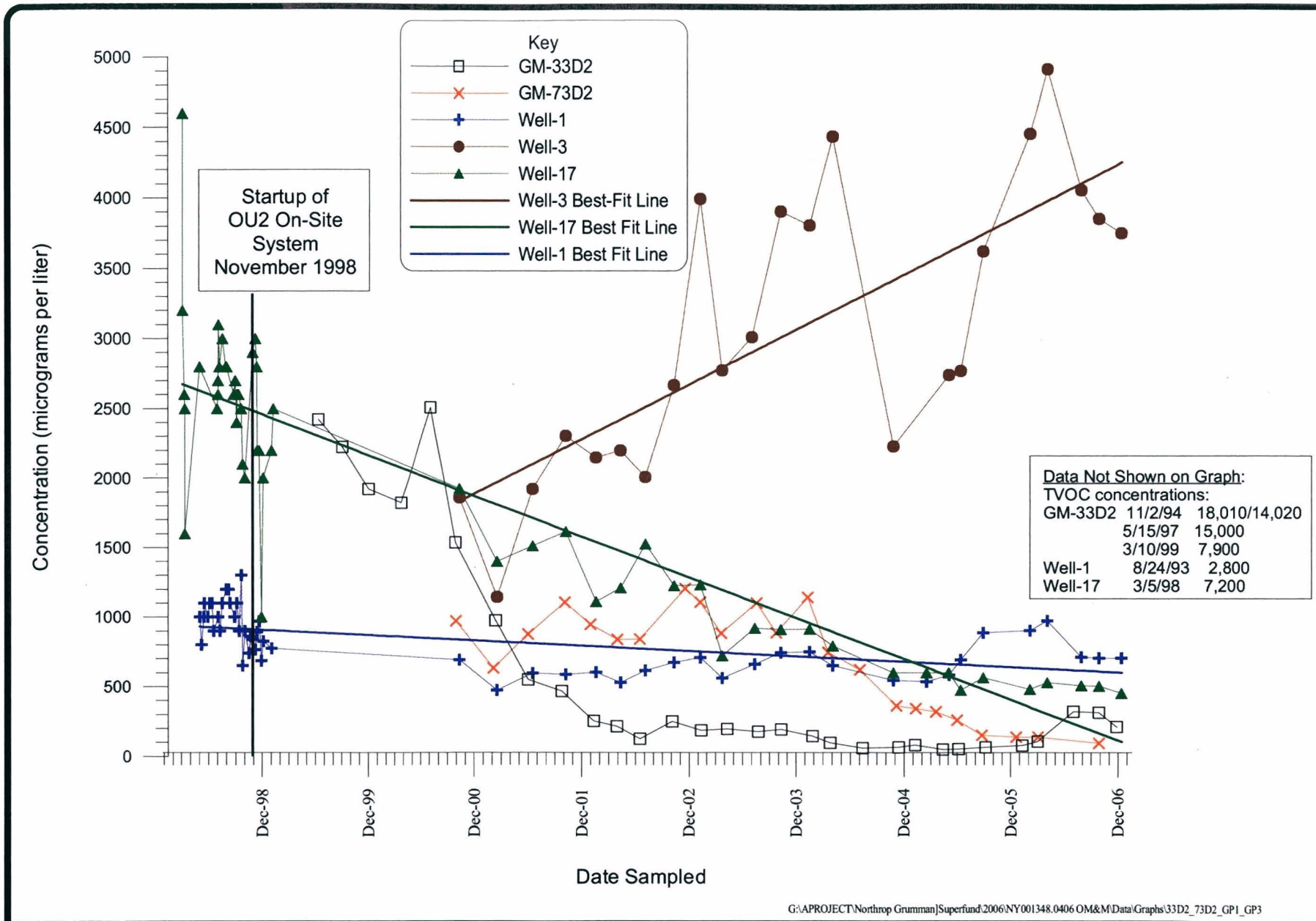
OPERABLE UNIT 2
NORTHROP GRUMMAN CORPORATION
BETHPAGE, NEW YORK

PROJECT MANAGER	DEPARTMENT MANAGER	LEAD DESIGNER	CHECKED BY
C. SAN GIOVANNI	M. WOLFERT		M. SAURBORN

SHEET TITLE

LOCATION OF OU-2
ON-SITE GROUNDWATER
REMEDY AND WELLS

TASK/PHASE NUMBER	DRAWN BY
00004	A. SANCHEZ
PROJECT NUMBER	DRAWING NUMBER
NY001464.0407	1

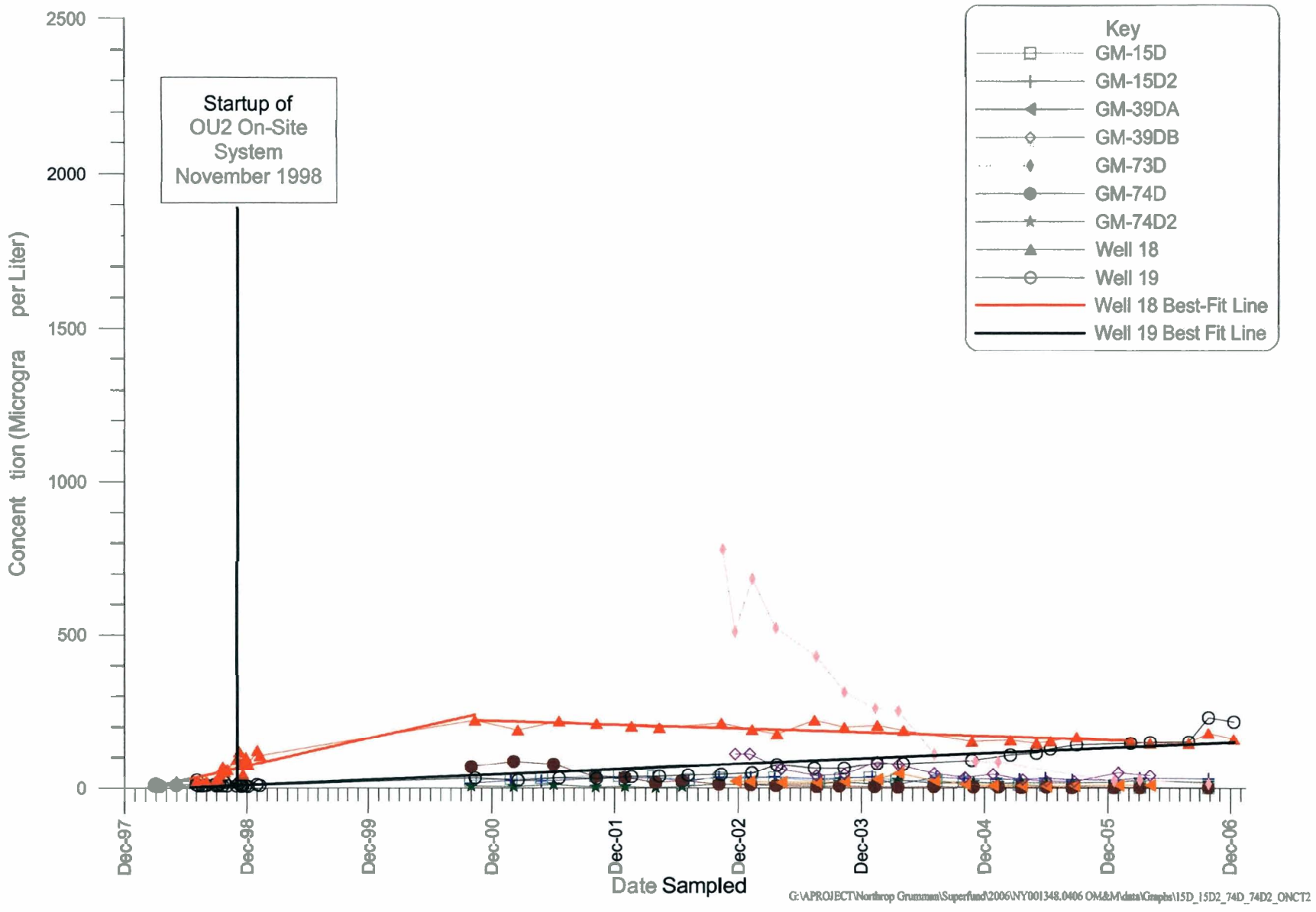


G:\APROJECT\Northrop Grumman]Superfund\2006\NY001348.0406 OM&M\Data\Graphs\33D2_73D2_GP1_GP3

ARCADIS

Total Volatile Organic Compound Concentrations (Southern and Southwestern Site Boundary) in OU2 Remedial Wells and Monitoring Wells GM-33D2 and GM-73D2
Northrop Grumman Systems Corporation, Bethpage, New York

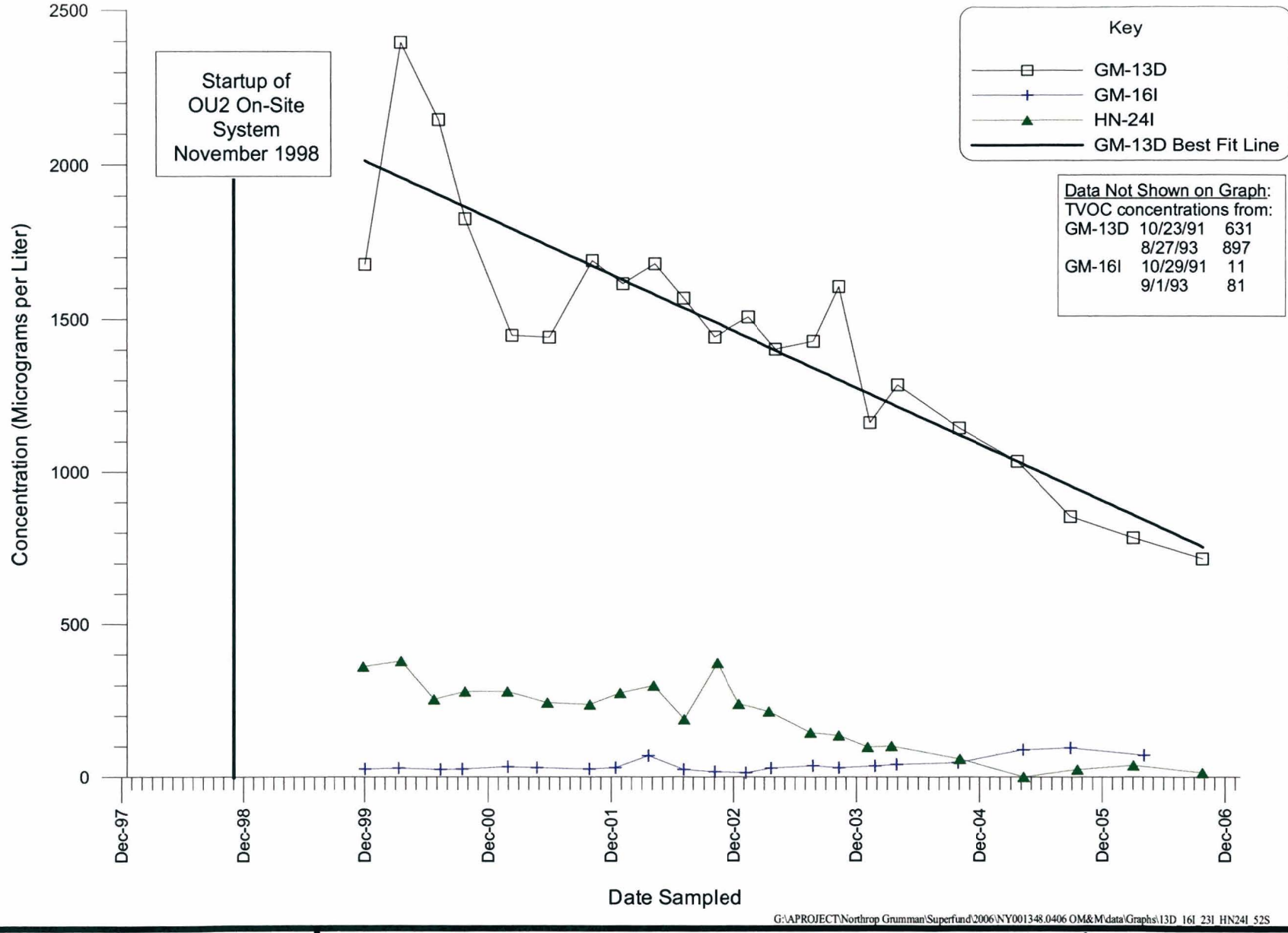
FIGURE 2



ARCADIS

**Total Volatile Organic Compound Concentrations
(Southeastern Site Boundary) in On-Site Deep and Deep2
Monitoring Wells and OU2 Remedial Wells 18 and 19
Northrop Grumman Systems Corporation, Bethpage, New York**

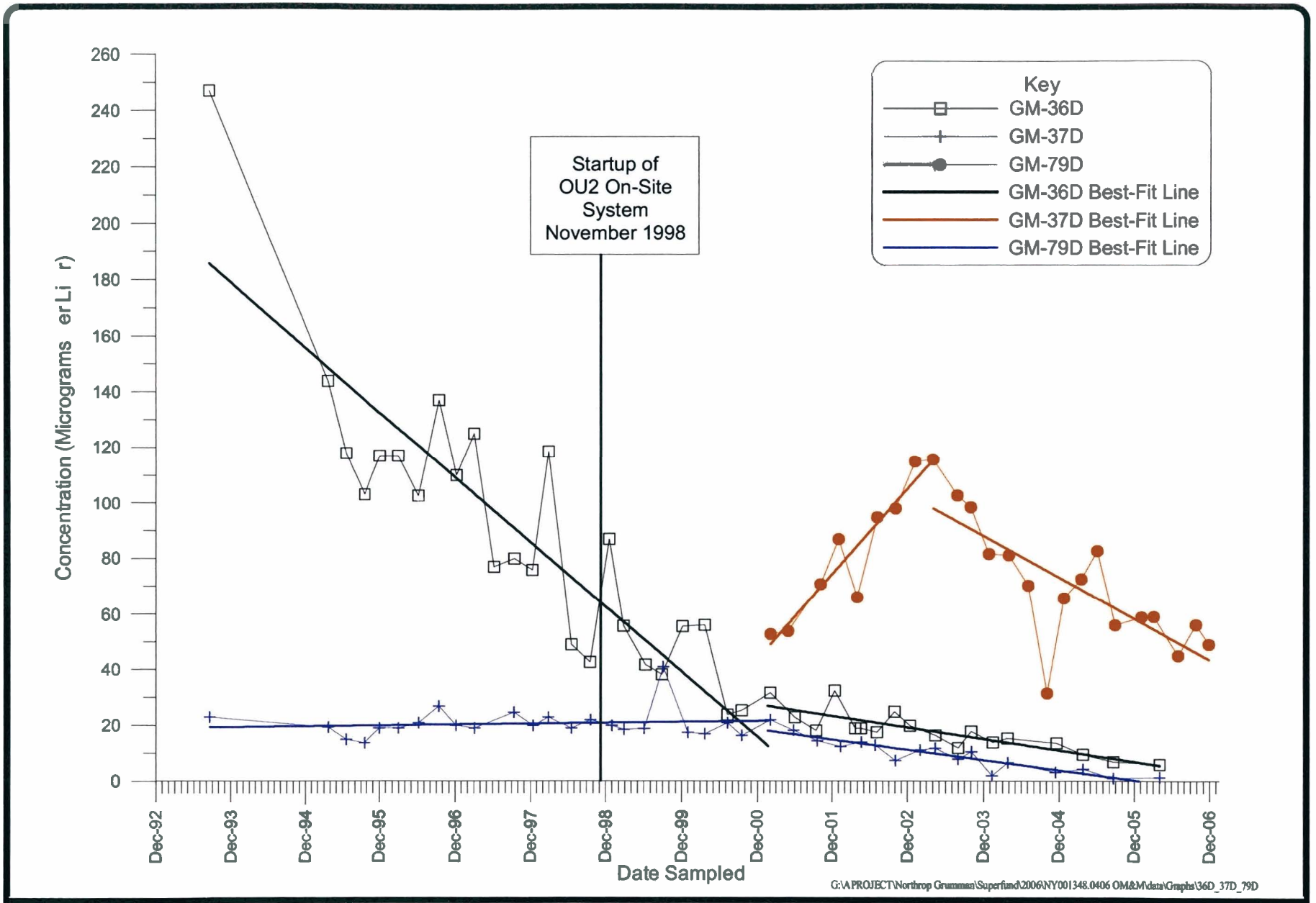
**FIGURE
3**



ARCADIS

Total Volatile Organic Compound Concentrations in On-Site Intermediate and Deep Monitoring Wells Northrop Grumman Systems Corporation, Bethpage, New York

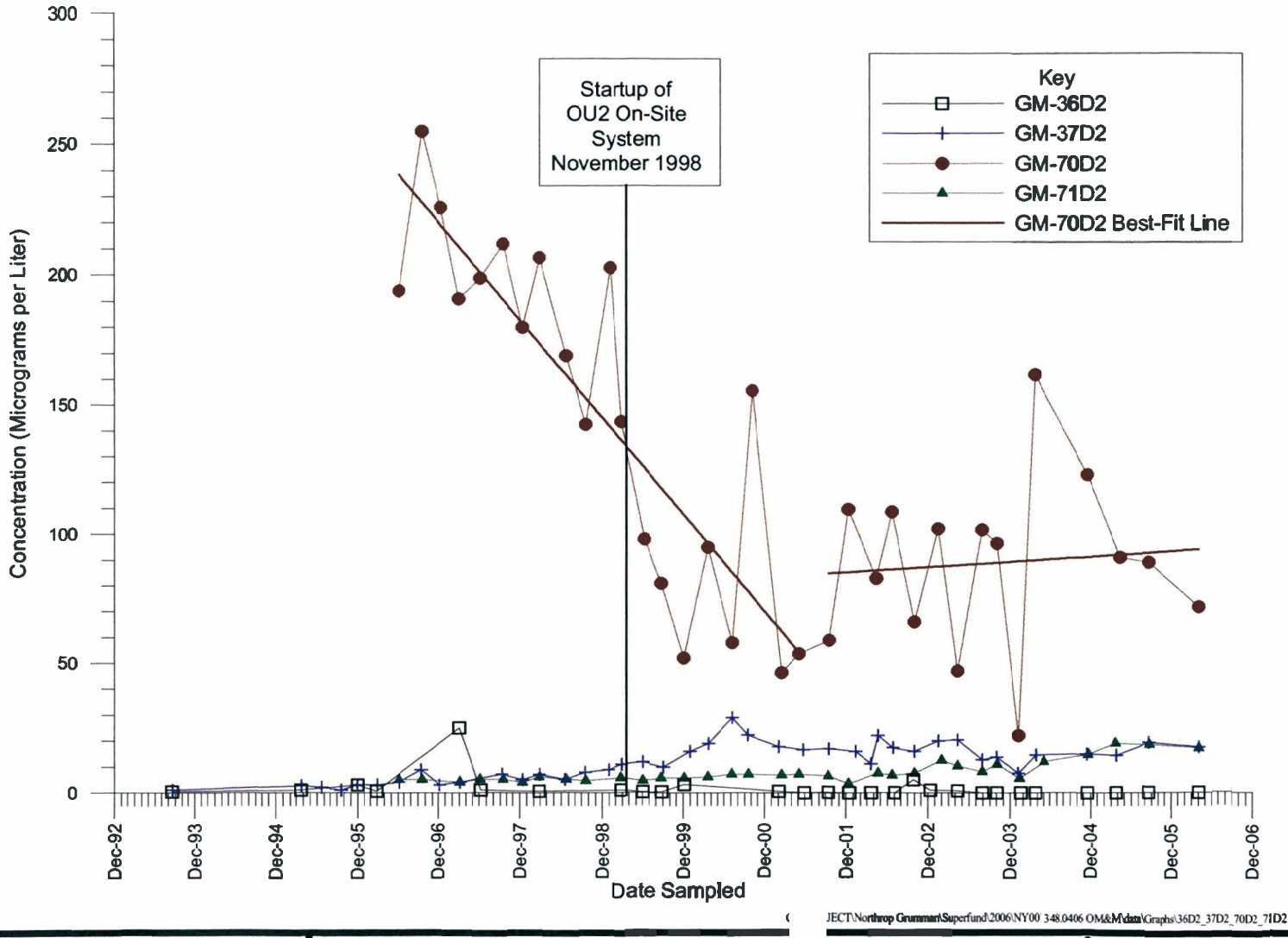
FIGURE 4



ARCADIS

Total Volatile Organic Compound Concentrations in Off-Site Deep Monitoring Wells (Southeast of the Site) Northrop Grumman Systems Corporation, Bethpage, New York

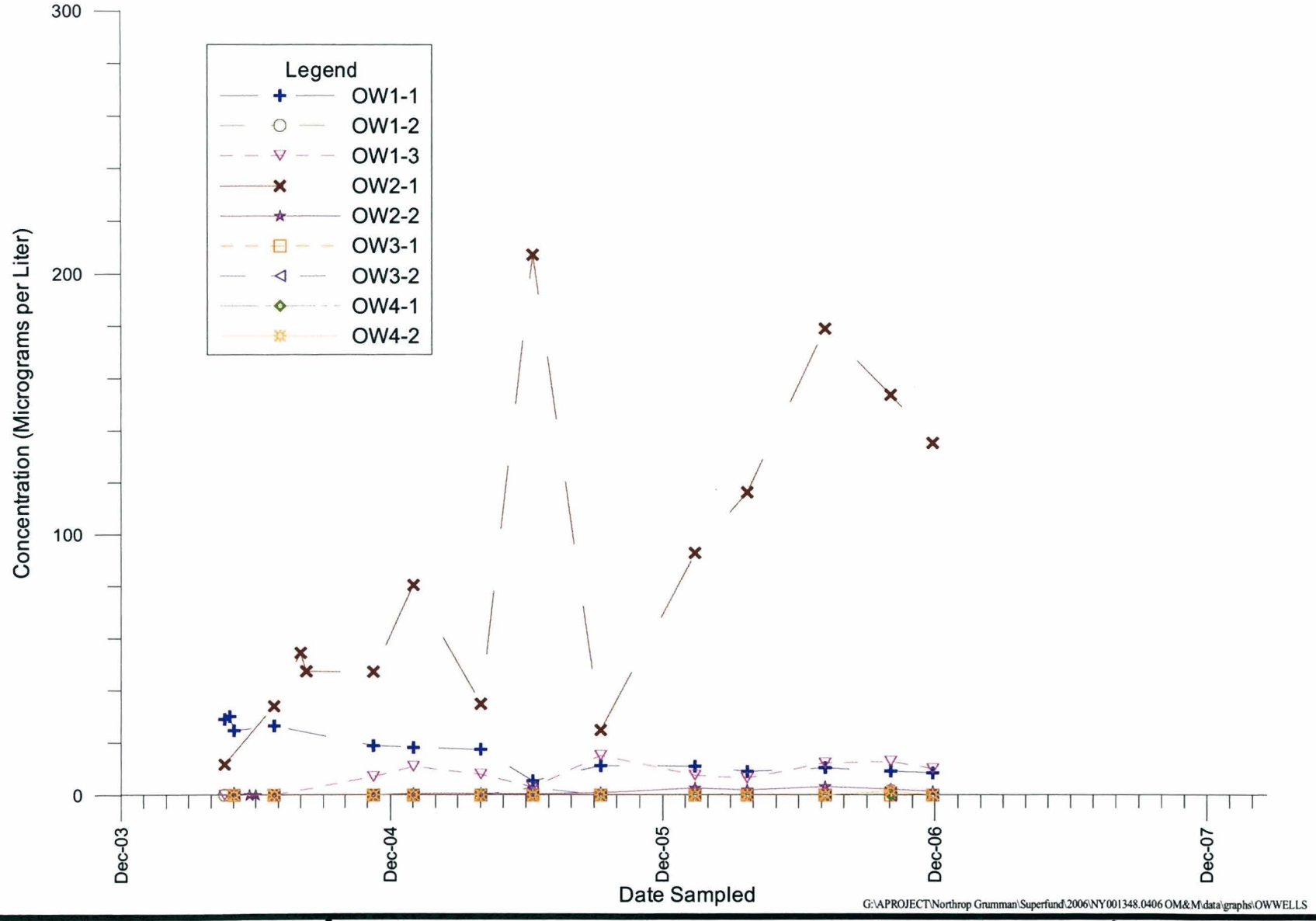
FIGURE 5



ARCADIS

Total Volatile Organic Compound Con trations in
Off-Site Deep2 Monitoring Wells (South t of the Site)
Northrop Grumman Systems Corporation. E ida e, New York

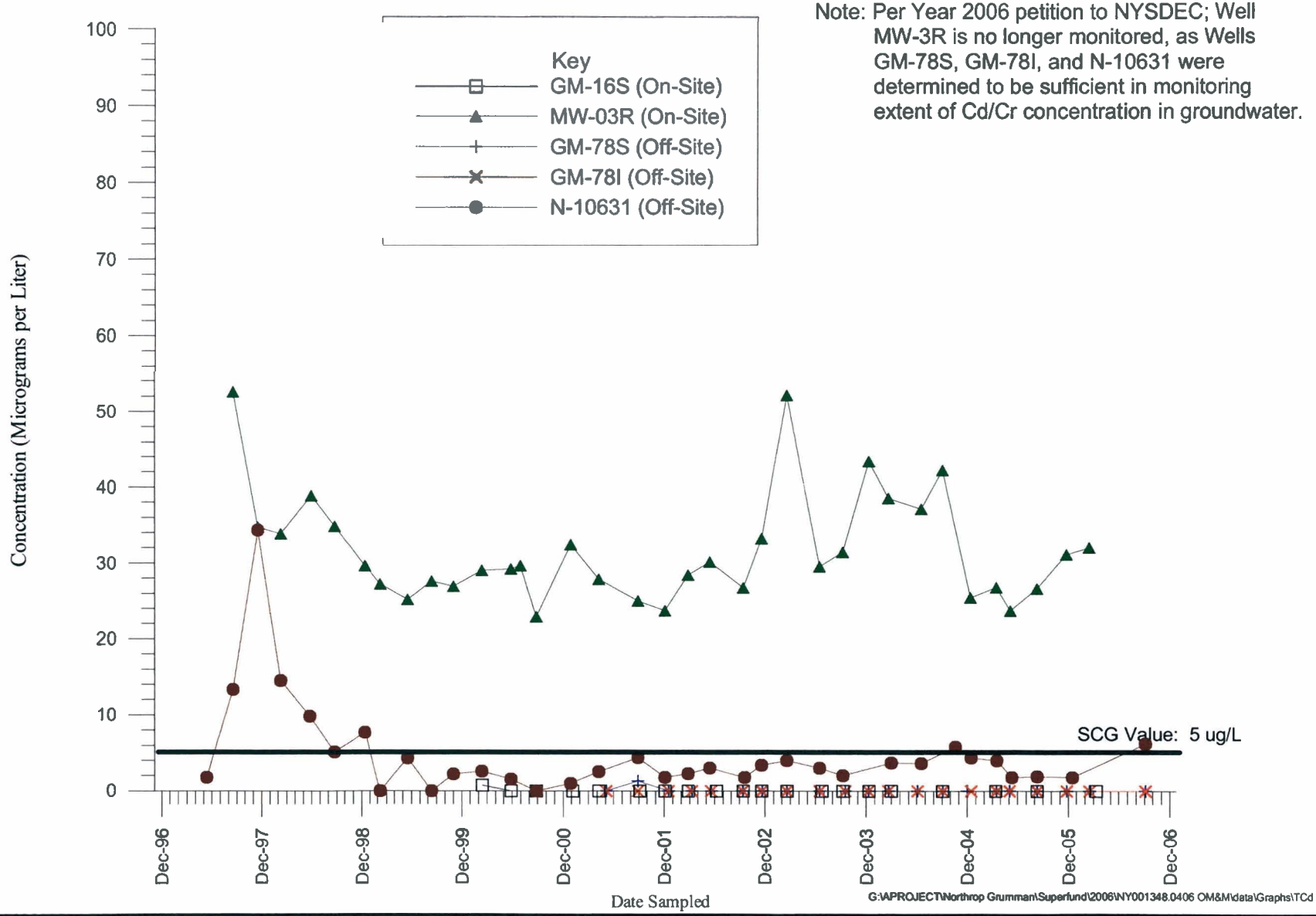
FIGURE
6



ARCADIS

Total Volatile Organic Compound Concentrations in Outpost Wells
Northrop Grumman Systems Corporation, Bethpage, New York

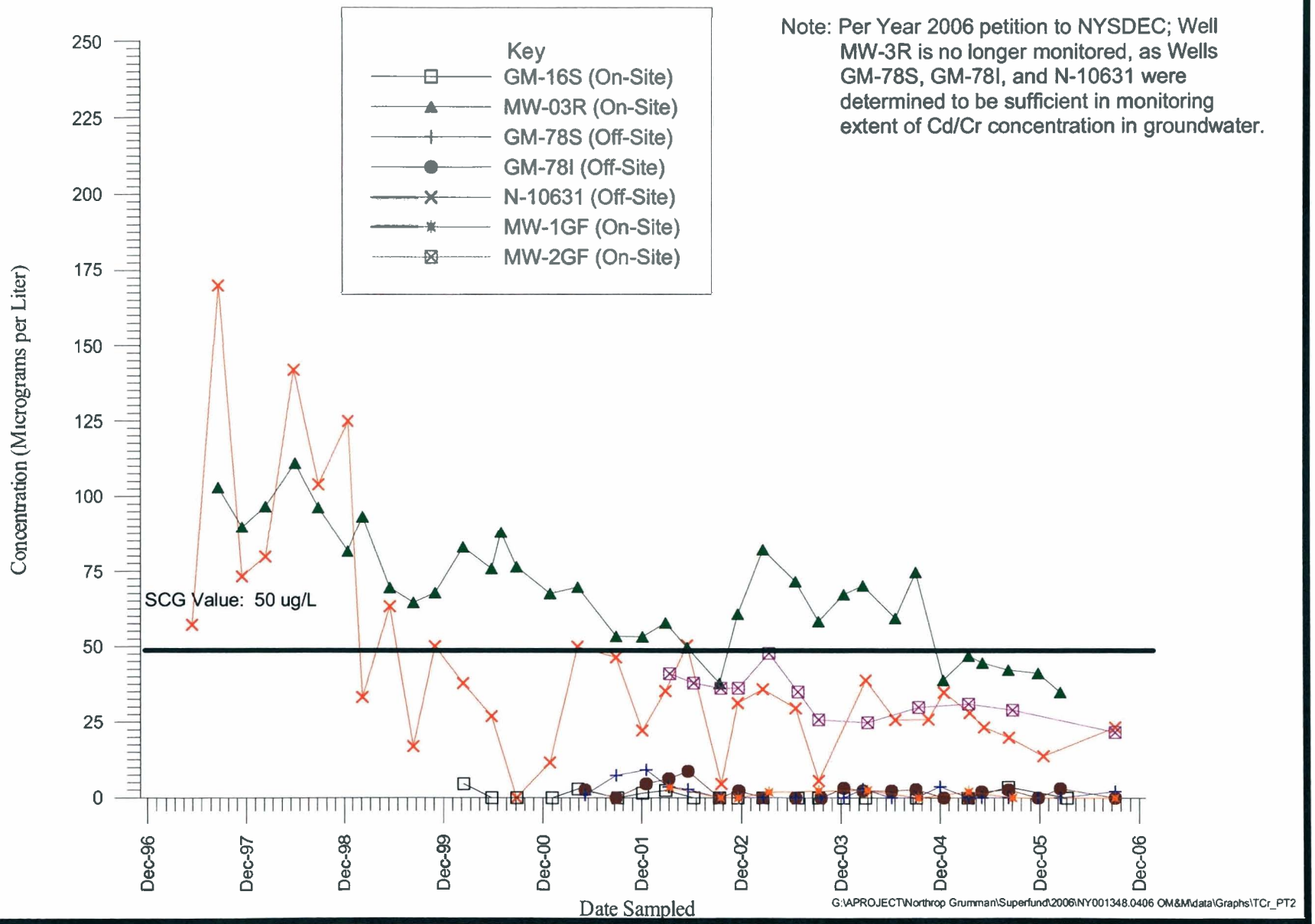
FIGURE 9



ARCADIS

Total Cadmium Concentrations in Monitoring Wells
Near Former Plant 2
Northrop Grumman Systems Corporation, Bethpage, New York

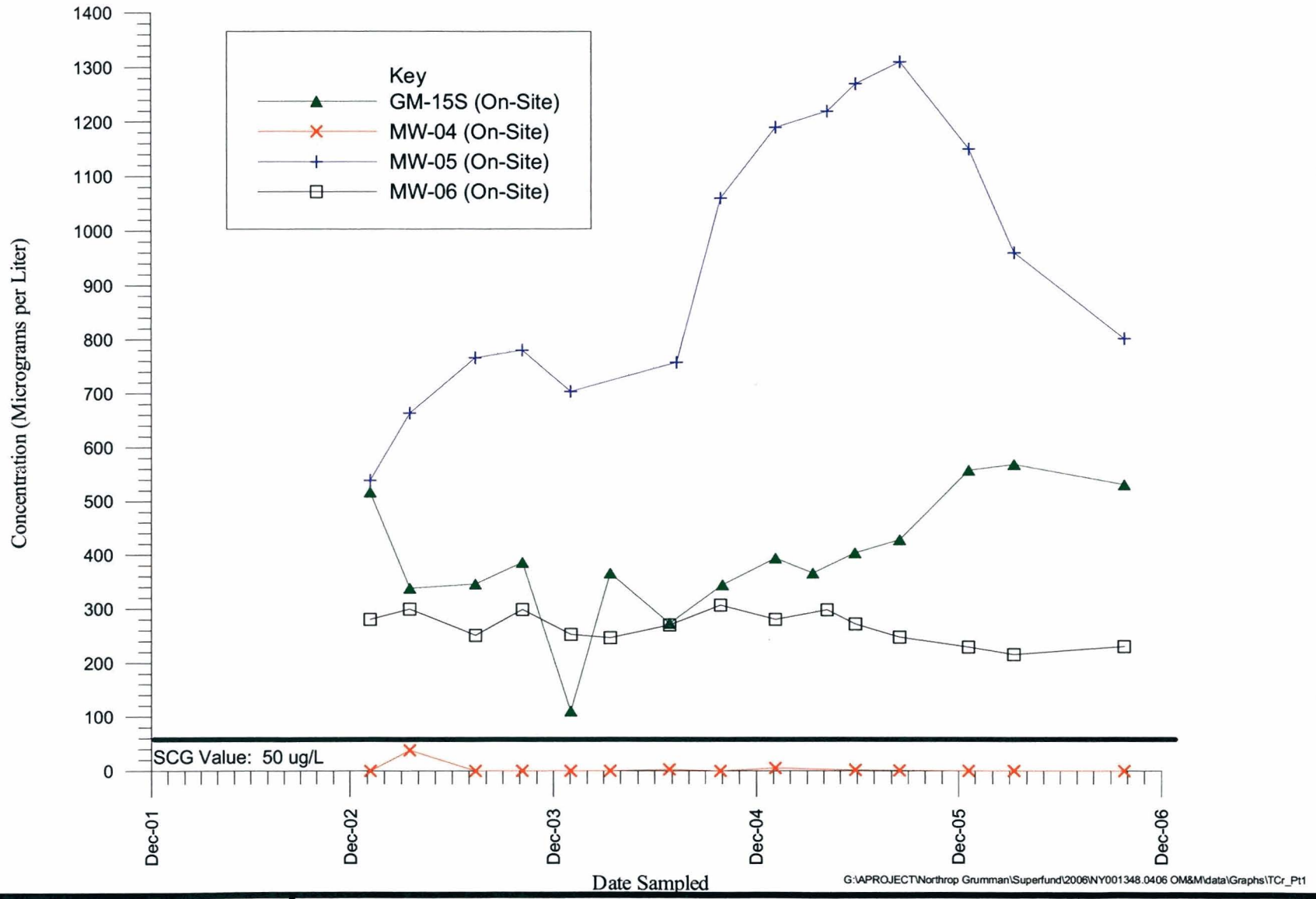
FIGURE
10



ARCADIS

Total Chromium Concentrations in Monitoring Wells
Near Former Plant 2
Northrop Grumman Systems Corporation, Bethpage, New York

FIGURE 11



ARCADIS

Total Chromium Concentrations in Monitoring Wells
Near Former Plant 1
Northrop Grumman Systems Corporation, Bethpage, New York

FIGURE
12

ARCADIS

Appendix A

Groundwater Sampling Logs and
Chain of Custody Records

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project: NORTHROP-GRUMMAN Project No. N4001348.0406.00002 Page 1 of ____

Site Location: BETHPAGE NY Date: 11-20-06

Site/Well No.: GM-2FI Replicate No. ____ Code No. ____

Weather: CLEAR 45° Sampling Time: Begin ____ End ____

Evacuation Data

Measuring Point	TOC
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	140
Depth to ~~Water~~ PACKER (ft bmp)	129
Water-Level Elevation (ft)	—
Water Column in Well (ft)	11
Casing Diameter/Type	4" (0.65)
Gallons in Well	7.15
Gallons ~~Pumped/Bailed~~ Prior to Sampling	x3 21.45
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin 2:30 end 3:50
Pumping Rate (gpm)	
Evacuation Method	

Field Parameters

Field Parameters	I	1V	2V	3V
Color				COLORLESS
Odor				NONE
Appearance				CLEAR
pH (s.u.)	9.54	9.56	9.75	9.70
Conductivity (mS/cm)				
(µmhos/cm)	1157	1168	1178	1178
Turbidity (NTU)				13.7
Temperature (°C)	13.8	13.9	13.7	13.6
Dissolved Oxygen (mg/L)				
Salinity (%)				

Sampling Method: PACKERED 3 VOV

Remarks: PID - 0.0

DTW 35.80

129 - 35.80 x .43 + 50 = 290 PSI

5 GALLON PAILS 11

Constituents Sampled	Container Description	Number	Preservative

Sampling Personnel: GW

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS

Low-Flow Groundwater Sampling Log

Project Number: NY001348.0406 Task: 00002 Well ID: GM-21D
Date: 11-20-06 Sampled By: GW
Sampling Time: Recorded By: GW
Weather: CLEAR 45° Coded Replicate No.:

Instrument Identification
Water Quality Meter(s): OAKTON, YSI DO, OAKTON ACORN Serial #:

Purging Information
Casing Material: Purge Method: LOW FLOW
Casing Diameter: Screen Interval (ft bmp): Top Bottom
Sounded Depth (ft bmp): Pump Intake Depth (ft bmp):
Depth to Water (ft bmp): 41.52 Purge time Start: Finish:

Field Parameter Measurements Taken During Purging

Time	Minutes Elapsed	Rate (mL/min)	Volume Purged	Temp (°C)	pH (SI Units)	Spec. Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Depth to Water (ft bmp)	Comments
1:15		450			5.05	140.6	-58	5.17		41.52	
1:20		↓			5.04	126.5	-57	4.40			
1:25					5.04	114.5	-33	4.13			
1:30					5.02	101.5	25	4.06			
1:35					5.02	98.5	30	4.57		41.52	
1:40					5.05	96.3	47	4.57			
1:45					5.03	95.3	59	4.57			
1:50					5.01	93.2	77	4.40		41.52	
1:55					5.01	93.1	67	4.63			
2:00					5.02	92.7	61	4.73			
2:05					5.02	92.7	61	4.63			
2:10					5.02	90.9	71	4.73			
2:15		↓			5.02	90.8	70	4.68	13.3	41.60	

Sample Condition Color: COLORLESS Odor: NONE Appearance: CLEAR
Sample Collection

Parameter:	Container:	No.	Preservative:
SEE COC			

PID Reading 0.0
Comments DEDICATED BLADDER PUMP

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project: NORTHROP-GRUMMAN Project No. NY001348.0416.00002 Page 1 of ____

Site Location: BETHPAGE NY Date: 11-21-06

Site/Well No.: MW 6M-20D Replicate No. ____ Code No. ____

Weather: ____ Sampling Time: Begin ____ End ____

Evacuation Data	
Measuring Point	____
MP Elevation (ft)	____
Land Surface Elevation (ft)	____
Sounded Well Depth (ft bmp)	226
Depth to PACKER ~~Water~~ (ft bmp)	215
Water-Level Elevation (ft)	—
Water Column in Well (ft)	11
Casing Diameter/Type	4 (0.65)
Gallons in Well	~~8.45~~ 7.15 x 3
Gallons Pumped/Bailed Prior to Sampling	21.45
Sample Pump Intake Setting (ft bmp)	____
Purge Time	begin 9:00 end ____
Pumping Rate (gpm)	____
Evacuation Method	____

Field Parameters	I	1J	2J	3J
Color				COLORLESS
Odor				NONE
Appearance				CLEAR
pH (s.u.)	7.21	6.65	6.62	6.32
Conductivity ~~(mS/cm)~~ (µmhos/cm)	376	113.1	1063	105.7
Turbidity (NTU)				9.76
Temperature (°C)	11.6	12.7	13.2	12.6
Dissolved Oxygen (mg/L)				
Salinity (%)				

Sampling Method: ____

Remarks: DTW 37.96

215 - 37.96 x .43 + 50 = ~130 PSI

5 GALLON PAILS 11 1/2

Constituents Sampled	Container Description	Number	Preservative

Sampling Personnel: GW

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project NORTHROP-GRUMMAN Project No. NY001348.0406.00002 Page 1 of ____

Site Location BETHPAGE NY- Date 11-21-06

Site/Well No. 6M-20I Replicate No. ____ Code No. ____

Weather ____ Sampling Time: Begin ____ End ____

Evacuation Data

Measuring Point	TOC
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	105
Depth to ~~Water~~ PACKER (ft bmp)	94
Water-Level Elevation (ft)	
Water Column in Well (ft)	11
Casing Diameter/Type	4" (0.65)
Gallons in Well	7.15 x3
Gallons Pumped/Bailed Prior to Sampling	21.45
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin 10:55 end 12:35
Pumping Rate (gpm)	
Evacuation Method	

Field Parameters

	I	1J	2J	3J
Color				COLORLESS
Odor				NONE
Appearance				CLEAR
pH (s.u.)	9.59	10.55	10.65	9.77
Conductivity ~~(mS/cm)~~ (µmhos/cm)	123.7	136.7	136.8	139.6
Turbidity (NTU)				10.51
Temperature (°C)	14.8	15.4	15.7	16.3
Dissolved Oxygen (mg/L)				

Salinity (%) ____

Sampling Method ____

Remarks OW 34.87

94 - 34.87 x .43 + 50 = 80 PSI

5 GALLON PAILS IIII ½

Constituents Sampled	Container Description	Number	Preservative
SEE COC			

Sampling Personnel G. W.

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS

Low-Flow Groundwater Sampling Log

Project Number: N400134B.0406 Task: 00002 Well ID: GM-79I
Date: 11-21-06 Sampled By: GW
Sampling Time: Recorded By: GW
Weather: CLEAR 50° Coded Replicate No.:

Instrument Identification
Water Quality Meter(s): SEE CAL LOG Serial #:

Purging Information
Casing Material: Purge Method: LOW FLOW
Casing Diameter: Screen Interval (ft bmp): Top Bottom
Sounded Depth (ft bmp): ~~39.36~~ Pump Intake Depth (ft bmp):
Depth to Water (ft bmp): 39.36 Purge time Start: Finish:

Field Parameter Measurements Taken During Purging

Time	Minutes Elapsed	Rate (mL/min)	Volume Purged	Temp (°C)	pH (SI Units)	Spec. Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Depth to Water (ft bmp)	Comments
1:25		450		13.1	5.68	109.2	-88	6.31		39.36	
1:30				13.0	5.61	109.5	-93	6.29		39.40	
1:35				13.0	5.56	108.9	-76	6.30			
1:40				13.0	5.54	108.0	-60	6.01			
1:45				12.8	5.53	108.0	38	6.14		39.40	
1:50				12.8	5.51	108.0	-1	6.17			
1:55				12.7	5.51	107.7	38	6.14			
2:00				12.7	5.50	107.9	64	6.18		39.40	
2:05				12.7	5.50	107.8	65	6.19			
2:10				12.7	5.50	107.6	67	6.17	9.47		

Sample Condition Color: COLORLESS Odor: NONE Appearance: CLEAR
Sample Collection

Parameter:	Container:	No.	Preservative:

PID Reading 0.0
Comments ORP PROBE NOT ACCURATE?

ARCADIS

Low-Flow Groundwater Sampling Log

Project Number: NY001348.0406 Task: 00002 Well ID: GM-79D
Date: 11-21-06 Sampled By: GW
Sampling Time: Recorded By: GW
Weather: CLEAR 50° Coded Replicate No.:

Instrument Identification
Water Quality Meter(s): SEE CAL LOG Serial #:

Purging Information
Casing Material: Purge Method: LOWFLOW
Casing Diameter: Screen Interval (ft bmp): Top Bottom
Sounded Depth (ft bmp): **Pump Intake Depth (ft bmp):**
Depth to Water (ft bmp): 40.67 Purge time Start: Finish:

Field Parameter Measurements Taken During Purging

Time	Minutes Elapsed	Rate (mL/min)	Volume Purged	Temp (°C)	pH (SI Units)	Spec. Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Depth to Water (ft bmp)	Comments
2:15		450		12.2	5.56	106.1	77	5.84	40.67	40.67	
2:20				11.6	5.33	106.90	84	2.92			
2:25				11.7	5.31	106.7	94	4.66			
2:30				11.7	5.32	106.7	98	5.04		40.63	
2:35				11.7	5.28	106.8	101	5.34			
2:40				11.8	5.30	107.4	106	5.37			
2:45				11.8	5.29	107.7	108	5.35			
2:50				11.8	5.29	107.2	108	5.40		40.67	
2:55				11.7	5.29	107.5	116	5.54			
3:00				11.8	5.28	107.3	115	5.52			
3:05				11.5	5.25	107.5	116	5.57		40.61	
3:10				11.6	5.26	107.4	117	5.50			
3:15		↓		11.60	5.25	107.1	117	5.57	6.62		

Sample Condition Color: COLORLESS Odor: NONE Appearance: CLEAR
Sample Collection

Parameter:	Container:	No.	Preservative:

PID Reading 0.0

Comments

ARCADIS

Low-Flow Groundwater Sampling Log

Project Number: 44003480406 Task: 00002 Well ID: GM-75D-2
Date: 11-27-06 Sampled By: GD
Sampling Time: _____ Recorded By: GD
Weather: _____ Coded Replicate No.: ~~11-27-06~~ REP GM-31

Instrument Identification
Water Quality Meter(s): _____ Serial #: _____

Purging Information
Casing Material: _____ Purge Method: Lowflow
Casing Diameter: _____ Screen Interval (ft bmp): Top _____ Bottom _____
Sounded Depth (ft bmp): _____ Pump Intake Depth (ft bmp): _____
Depth to Water (ft bmp): 33.80 Purge time Start: _____ Finish: _____

Field Parameter Measurements Taken During Purging

Time	Minutes Elapsed	Rate (mL/min)	Volume Purged	Temp (°C)	pH (SI Units)	Spec. Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Depth to Water (ft bmp)	Comments
3:00		450		14.0	4.94	133.0	134	4.96		33.80	
3:05				13.9	4.94	132.4	135	4.90			
3:10				13.8	4.82	130.8	135	4.28			
3:15				13.7	4.82	128.7	136	3.95		33.80	
3:20				13.7	4.86	129.3	136	3.92			
3:25				13.6	4.87	128.9	137	3.87			
3:30				13.6	4.89	129.5	139	3.79			
3:35				13.6	4.90	129.3	139	3.75		33.80	
3:40				13.5	4.90	129.3	140	3.64			
3:45				13.5	4.91	129.2	144	3.67			
3:50				13.4	4.91	129.5	145	3.70			
3:55				13.3	4.91	129.3	146	3.62		33.80	
4:00		↓		13.3	4.91	129.3	148	3.60	6.88		

Sample Condition Color: _____ Odor: _____ Appearance: _____
Sample Collection

Parameter:	Container:	No.	Preservative:

PID Reading _____

Comments _____

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project: NORTHROP-GRUMMAN Project No. N40013348.0406.00002 Page 1 of ____

Site Location: BETHPAGE NY. NY Date: 1-29-06

Site/Well No.: GM-35D-2 Replicate No. ____ Code No. ____

Weather: OVERCAST 55° Sampling Time: Begin ____ End ____

Evacuation Data

Measuring Point	TOC
MP Elevation (ft)	—
Land Surface Elevation (ft)	—
Sounded Well Depth (ft bmp)	530
Depth to PACKER (ft bmp)	507
Water-Level Elevation (ft)	
Water Column in Well (ft)	23
Casing Diameter/Type	4" (0.65)
Gallons in Well	14.95
Gallons Pumped/Bailed Prior to Sampling	x 3 = 45
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	

Field Parameters

	I	1V	2V	3V
Color				COLORLESS
Odor				NONE
Appearance				CLEAR
pH (s.u.)	6.60	6.60	6.57	6.52
Conductivity ~~(mS/cm)~~ (µmhos/cm)	104.4	104.1	86.4	87.1
Turbidity (NTU)				6.29
Temperature (°C)	15.3	15.3	16.0	16.0
Dissolved Oxygen (mg/L)				
Salinity (%)				
Sampling Method				

Remarks: DTW - 38.41

5 GAL PAILS ////

507 - 38.41 x .43 + 50 = 255 PSI

Constituents Sampled	Container Description	Number	Preservative
SEE COC			

Sampling Personnel: G. WILLIAMS

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS

Low-Flow Groundwater Sampling Log

Project Number: 40013148.0406 Task: 00202 Well ID: GM-33D-2
Date: Sampled By: GW
Sampling Time: Recorded By: GW
Weather: Coded Replicate No.: REP-11-2406

Instrument Identification
Water Quality Meter(s): Serial #:

Purging Information
Casing Material: Purge Method: Low flow
Casing Diameter: Screen Interval (ft bmp): Top Bottom
Sounded Depth (ft bmp): Pump Intake Depth (ft bmp):
Depth to Water (ft bmp): 47.60 Purge time Start: Finish:

Field Parameter Measurements Taken During Purging

Time	Minutes Elapsed	Rate (mL/min)	Volume Purged	Temp (°C)	pH (SI Units)	Spec. Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Depth to Water (ft bmp)	Comments
4:30		450		16.16	5.21	107	146.7	7.86		47.60	
4:35				16.07	5.16	102	145.5	6.21			
4:40				15.77	5.49	94	140.5	5.97			
4:45				15.58	5.83	93	131.7	6.07			
4:50				15.68	6.11	93	124.8	6.38		47.56	
4:55				15.71	6.05	93	125.9	6.24			
5:00				15.75	6.07	90	124.4	6.30			
5:05				15.70	6.06	91	125.0	6.34			
5:10				15.68	5.85	88	132.2	6.65			
5:15				15.69	5.62	88	137.7	6.45		47.57	
5:20				15.66	5.59	88	149.4	6.38			
5:25				15.66	5.40	88	145.4	6.42			
5:30											

Sample Condition Color: COLORLESS Odor: NONE Appearance: CLEAR
Sample Collection

Parameter:	Container:	No.	Preservative:
SEE COC			

PID Reading 0.10

Comments

ARCADIS

Low-Flow Groundwater Sampling Log

Project Number: 4001348.0116 Task: 00002 Well ID: CM-34D
Date: 11-30-06 Sampled By: GW
Sampling Time: Recorded By: GW
Weather: OVERCAST, 50° Coded Replicate No.:

Instrument Identification
Water Quality Meter(s): Serial #:

Purging Information
Casing Material: Purge Method: LOW FLOW
Casing Diameter: Screen Interval (ft bmp): Top Bottom
Sounded Depth (ft bmp): Pump Intake Depth (ft bmp):
Depth to Water (ft bmp): 13.07 Purge time Start: Finish:

Field Parameter Measurements Taken During Purging

Time	Minutes Elapsed	Rate (mL/min)	Volume Purged	Temp (°C)	pH (SI Units)	Spec. Cond. (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Depth to Water (ft bmp)	Comments
2:00		450		15.66	6.50	44	92.2	4.42		13.07	
2:05				15.64	6.68	46	87.4	4.54			
2:10				15.55	6.81	45	81.6	4.56		13.13	
2:15				15.50	6.89	45	68.6	4.67			
2:20				15.5	6.57	45	59.1	4.47			
2:25				15.91	6.49	45	50.5	4.68		13.10	
2:30				15.51	6.42	45	50.1	4.57			
2:35				15.71	6.22	45	46.1	4.58			
2:40				15.74	6.36	45	46.4	4.69		13.14	
2:45				15.72	6.22	45	45.7	4.54			
2:50				15.59	6.13	45	45.8	4.47	9.31		
2:55				15.64	6.11	45	45.9	4.49		13.14	
3:00		↓		15.73	6.14	45	44.5	4.50			

Sample Condition Color: COLORLESS Odor: NONE Appearance: CLEAR
Sample Collection

Parameter:	Container:	No.	Preservative:
SEE COC			

PID Reading 0.0

Comments

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project: NORTHROP GRUMMAN Project No.: NY003348.0406.0000 Page: 1 of ____

Site Location: BETHPAGE NY Date: 12-1-06

Site/Well No.: BPOW-2-2 Replicate No.: ____ Code No.: ____

Weather: RAINY 50° Sampling Time: Begin ____ End ____

Evacuation Data

Measuring Point	TOC
MP Elevation (ft)	—
Land Surface Elevation (ft)	—
Sounded Well Depth (ft bmp)	495
Depth to ~~Water~~ PRODUCT (ft bmp)	419
Water-Level Elevation (ft)	?
Water Column in Well (ft)	76
Casing Diameter/Type	4" (0.65)
Gallons in Well	49.48
Gallons Pumped/Bailed Prior to Sampling	x 3 = 148.20
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin 230 end ____
Pumping Rate (gpm)	
Evacuation Method	

Field Parameters

	1	2	3	3
Color				COLORLESS
Odor				NONE
Appearance				CLEAR
pH (s.u.)	4.35	4.62	4.62	4.04
Conductivity ~~(mS/cm)~~ (µmhos/cm)	64.8	65.0	64.1	79.3
Turbidity (NTU)				
Temperature (°C)	14.5	13.5	13.6	13.4
Dissolved Oxygen (mg/L)				
~~Salinity~~ DTW (%)	13.67	22.30	22.25	20.55

Sampling Method: ____

Remarks: DTW - 13.67

419 - 13 x .43 + 50 = 225 PSI

Constituents Sampled	Container Description	Number	Preservative

Sampling Personnel: ____

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
	feet	msl	mean sea-level	s.u.	Standard units
	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project: NORTHROP-GRUMMAN | Project No.: NY001348.0426.00002 | Page: 1 of ____

Site Location: BETHPAGE NY | Date: 12-1-06

Site/Well No.: BPOW-2-1 | Replicate No.: ____ | Code No.: ____

Weather: RAINY 45° | Sampling Time: Begin ____ End ____

Evacuation Data

Measuring Point	TOC
MP Elevation (ft)	—
Land Surface Elevation (ft)	—
Sounded Well Depth (ft bmp)	400
Depth to ~~Water~~ DARKEN (ft bmp)	310
Water-Level Elevation (ft)	
Water Column in Well (ft)	90
Casing Diameter/Type	4" (0.65)
Gallons in Well	58.5 x 3
Gallons Pumped/Bailed Prior to Sampling	175.5
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin 1:08 end 1:37
Pumping Rate (gpm)	
Evacuation Method	

Field Parameters

Field Parameters	I	1J	2J	3J
Color				COLORLESS
Odor				NONE
Appearance				CLEAR
pH (s.u.)	5.76	5.63	5.01	3.88
Conductivity (~~mS/cm~~)				
(µmhos/cm)	82.6	128	86.1	99.0
Turbidity (NTU)				
Temperature (°C)	16.2	14.2	13.9	13.7
Dissolved Oxygen (mg/L)				
~~Salinity (%)~~ DTW	18.59	19.35	19.35	19.08
Sampling Method				2J0

Remarks: DTW = 18.59

310 - 24 x .43 + 50 = 175 PSI

RAIN NO BEN ROUND 180

Constituents Sampled	Container Description	Number	Preservative
SEE COC			

Sampling Personnel: GW

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project: NORTHROP-GRUMMAN Project No. NY003132D406.00002 Page 1 of ____

Site Location: BETHPAGE NY Date: 12-6-06

Site/Well No.: BPOW-1-1 Replicate No.: RISP 12-6-06 Code No. ____

Weather: CLEAR 45° Sampling Time: Begin ____ End ____

Evacuation Data	
Measuring Point	TOC
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	241
Depth to ~~Water~~ PACKER (ft bmp)	169
Water-Level Elevation (ft)	—
Water Column in Well (ft)	72
Casing Diameter/Type	4 (0.65)
Gallons in Well	46.8
Gallons Pumped/Bailed Prior to Sampling	x 3 = 140
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	

Field Parameters	I	W	2J	3J
Color				COLORLESS
Odor				NONE
Appearance				CLEAR
pH (s.u.)	6.78	5.61	5.41	5.41
Conductivity (~~mS/cm~~)				
(µmhos/cm)	104.5	105.5	105.6	104.7
Turbidity (NTU)				9.33
Temperature (°C)	15.3	13.6	12.9	12.8
Dissolved ~~Oxygen~~ (mg/L)	28.64	28.6	28.75	28.55
Salinity (%)				
Sampling Method				3 WELL VOLUMES

Remarks: 169 - 28.64 x .43 = 110 PSI

Constituents Sampled	Container Description	Number	Preservative
SEE COC			

Sampling Personnel: G. WOLLAM

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project: NORTHROP GRUMMAN | Project No.: NY001348.0426.00002 | Page: 1 of ____

Site Location: BETHPAGE | Date: 12-6-06

Site/Well No.: BPOW-1-2 | Replicate No.: ____ | Code No.: ____

Weather: CLEAR 40° | Sampling Time: Begin ____ End ____

Evacuation Data

Measuring Point	
MP Elevation (ft)	
Land Surface Elevation (ft)	
Sounded Well Depth (ft bmp)	335
Depth to ~~Water~~ PACKER (ft bmp)	294
Water-Level Elevation (ft)	
Water Column in Well (ft)	41
Casing Diameter/Type	(0.65) 4"
Gallons in Well	26.65
Gallons Pumped/Bailed Prior to Sampling	x 3 = 80.00
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	

Field Parameters

	I	1U	2U	3J
Color				COLORLESS
Odor				NONE
Appearance				CLEAR
pH (s.u.)	5.70	5.38	5.10	4.91
Conductivity ~~(mS/cm)~~ (µmhos/cm)	44.9	28.6	32.0	45.8
Turbidity (NTU)				7.75
Temperature (°C)	14.7	13.2	12.4	12.2
Dissolved Oxygen (mg/L)				
Salinity (%)	27.45	30.21	30.41	30.28

Sampling Method: 3 WELL VOLUME

Remarks: 294 − 28.45 x .43 + 50 = 165

Constituents Sampled	Container Description	Number	Preservative

Sampling Personnel: ____

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project NORTHROP-GRUMMAN Project No. NY001348.0006.00002 Page 1 of ____

Site Location BETHPAGE Date 12-7-06

Site/Well No. BPOW-1-3 Replicate No. ____ Code No. ____

Weather CLEAR Sampling Time: Begin 10:40 End 11:30

Evacuation Data		Field Parameters	I	1V	2V	3V
Measuring Point	TOC	Color				COLORLESS
MP Elevation (ft)	—	Odor				NONE
Land Surface Elevation (ft)	—	Appearance				CLEAR
Sounded Well Depth (ft bmp)	419	pH (s.u.)	5.19	4.85	4.81	5.70
Depth to ~~Water~~ PACKER (ft bmp)	344	Conductivity (~~mS/cm~~)				
Water-Level Elevation (ft)	—	(µmhos/cm)	110.	157.6	1162	148
Water Column in Well (ft)	75	Turbidity (NTU)				
Casing Diameter/Type	4" (0.65)	Temperature (°C)	15.4	14.4	12.9	2.7
Gallons in Well	48.75 x 3	Dissolved Oxygen (mg/L)				
Gallons Pumped/Bailed Prior to Sampling	146.25	PTW Salinity (%)	30.10	32.45	32.56	32.59
Sample Pump Intake Setting (ft bmp)		Sampling Method				
Purge Time	begin ____ end ____	Remarks	OTW 30.10			
Pumping Rate (gpm)			344 - 30.10 x .43 + 50 = 185 PSI			
Evacuation Method						

Constituents Sampled	Container Description	Number	Preservative
SEE COC			

Sampling Personnel GW

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project: NORTHROP-GRUMMAN | Project No. NY 001348.0406.0002 | Page 1 of ____

Site Location: BETHPAGE NY | Date: 12-7-06

Site/Well No.: BPDW-4-1 | Replicate No. ____ | Code No. ____

Weather: CLEAR 50° | Sampling Time: Begin 1200 End ____

Evacuation Data

	Static	Screen
Measuring Point	TOC	
MP Elevation (ft)	—	
Land Surface Elevation (ft)	STATIC	SCREEN
Sounded Well Depth (ft bmp)	6	692
Depth to Water (ft bmp)	503	652
Water-Level Elevation (ft)	←	44
Water Column in Well (ft)	149	40
Casing Diameter/Type	4"(0.65)	2(0.16)
Gallons in Well	96.5 V3	6.4 V3
Gallons Pumped/Bailed Prior to Sampling	290 + 19.2 = 310	
Sample Pump Intake Setting (ft bmp)		
Purge Time	begin ____	end ____
Pumping Rate (gpm)		
Evacuation Method		

Field Parameters

	I	10	20	30
Color			SLIGHTLY CLOUDY	CLOUDY
Odor				SLIGHT
Appearance				SLIGHTLY TURBID
pH (s.u.)	5.81	5.87	5.97	3.59
Conductivity (mS/cm) (µmhos/cm)	49.6	76.3	57.9	76.6
Turbidity (NTU)				
Temperature (°C)	14.4	14.2	13.5	13.7
Dissolved Oxygen (mg/L)				
PTW Salinity (%)	26.88	26.65	26.58	26.68

Sampling Method: ____

Remarks: PSI = 692 − 26 × .43 + 50 = 255

Constituents Sampled	Container Description	Number	Preservative

Sampling Personnel: ____

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project: NORTHROP GRUMMAN | Project No. NY001348.0406.00002 | Page 1 of ____

Site Location: BETHPAGE NY | Date: 12-7-06

Site/Well No.: BPOW-42 | Replicate No.: MS/MSD | Code No.: ____

Weather: CLEAR 50° | Sampling Time: Begin 1:45 | End ____

Evacuation Data

Measuring Point	TOC
MP Elevation (ft)	—
Land Surface Elevation (ft)	—
Sounded Well Depth (ft bmp)	764
Depth to ~~Water~~ PACKER (ft bmp)	503
Water-Level Elevation (ft)	—
Water Column in Well (ft)	261
Casing Diameter/Type	4 (0.65)
Gallons in Well	169.65 x 3
Gallons Pumped/Bailed Prior to Sampling	509.
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	

Field Parameters

Field Parameters	I	1J	2J	3J
Color				COLORLESS
Odor				NONE
Appearance				CLEAR
pH (s.u.)	4.40	5.65	4.43	4.45
Conductivity ~~(mS/cm)~~ (µmhos/cm)	68.3	121.2	86.6	75.6
Turbidity (NTU)				
Temperature (°C)	14.1	13.4	13.0	13.1
Dissolved Oxygen (mg/L)				
~~Salinity (%)~~ VOW	23.66	23.45	23.48	
Sampling Method				
Remarks	3 WERE DOWN			

503 − 23.66 x .43 + 50 = 255

Constituents Sampled	Container Description	Number	Preservative
SEE COC			

Sampling Personnel: ~~GARY~~ GW.

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project: NORTHROP GRUMMAN — Project No.: N4D0348.0406 00007 — Page 1 of ____

Site Location: BETHPAGE NY — Date: 12-8-06

Site/Well No.: BPOW-3-1 — Replicate No.: ____ — Code No.: ____

Weather: CLEAR 18° — Sampling Time: Begin ____ End ____

Evacuation Data

Measuring Point	TOC
MP Elevation (ft)	—
Land Surface Elevation (ft)	—
Sounded Well Depth (ft bmp)	516
Depth to Water (ft bmp)	414
Water-Level Elevation (ft)	—
Water Column in Well (ft)	102
Casing Diameter/Type	4" (0.65)
Gallons in Well	66.3 x 3
Gallons Pumped/Bailed Prior to Sampling	197.9
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin ____ end ____
Pumping Rate (gpm)	
Evacuation Method	

Field Parameters

	I	1U	2U	3U
Color				
Odor				
Appearance				
pH (s.u.)	5.24	4.26	4.26	
Conductivity ~~(mS/cm)~~ (µmhos/cm)	102.2	107.3	101.1	
Turbidity (NTU)				
Temperature (°C)	12.7	13.0	12.7	
Dissolved Oxygen (mg/L)				
Salinity (%)	24.	30.20	30.20	

Sampling Method: ____

Remarks: ~~SW~~

414 − 24 x .43 + 50 = 220 PSI

Constituents Sampled	Container Description	Number	Preservative
SEE COC			

Sampling Personnel: B.W.

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS GERAGHTY & MILLER

Water Sampling Log

Project: NORTHROP GRUMMAN — Project No. NY 000349.0406.00002 — Page 1 of ____

Site Location: BETHPAGE NY — Date: ____

Site/Well No.: BPOW 3-2 — Replicate No.: ____ — Code No.: ____

Weather: CLEAR 20° — Sampling Time: Begin 12:00 End: ____

Evacuation Data	
Measuring Point	TOC
MP Elevation (ft)	—
Land Surface Elevation (ft)	—
Sounded Well Depth (ft bmp)	647
Depth to Water (ft bmp)	503
Water-Level Elevation (ft)	—
Water Column in Well (ft)	144
Casing Diameter/Type	4 (0.65)
Gallons in Well	93.6 × 3
Gallons Pumped/Bailed Prior to Sampling	280
Sample Pump Intake Setting (ft bmp)	
Purge Time	begin 12:05 end ____
Pumping Rate (gpm)	
Evacuation Method	

Field Parameters	I	1V	2V	3V
Color				
Odor	MODERATE CLAY			
Appearance				
pH (s.u.)	4.86	5.13	4.97	3.18 ?
Conductivity (~~mS/cm~~) (µmhos/cm)	96.4	122.5	73.5	180.2
Turbidity (NTU)				
Temperature (°C)	13.4	13.2	11.1	
Dissolved Oxygen (mg/L)				
~~Salinity~~ DTW (%)	25.81	26.42	26.19	26.12

Sampling Method: ____

Remarks: 503 - 25 x .43 + 50 = 255 PSI

Constituents Sampled	Container Description	Number	Preservative
SEE COC			

Sampling Personnel: G.W.

Well Casing Volumes

Gal./Ft.				
	1-¼" = 0.06	2" = 0.16	3" = 0.37	4" = 0.65
	1-½" = 0.09	2-½" = 0.26	3-½" = 0.50	6" = 1.47

bmp	below measuring point	ml	milliliter	NTU	Nephelometric Turbidity Units
°C	Degrees Celsius	mS/cm	Milisiemens per centimeter	PVC	Polyvinyl chloride
ft	feet	msl	mean sea-level	s.u.	Standard units
gpm	Gallons per minute	N/A	Not Applicable	umhos/cm	Micromhos per centimeter
mg/L	Miligrams per liter	NR	Not Recorded	VOC	Volatile Organic Compounds

ARCADIS

Laboratory Task Order No./P.O. No. OU-2

CHAIN-OF-CUSTODY RECORD

Page ____ of ____

Project Number/Name N4001348.04106.00002

Project Location BETHPAGE NY

Laboratory SEVERN-TRENT SHELTON

Project Manager MIKE WOLFERT

Sampler(s)/Affiliation GW.

Sample ID/Location	Matrix	Date/Time Sampled	Lab ID	40 ml VOA w/ HCl VOC 2000 ASP (HCl)						Remarks	Total
GM-21D	L	11/20/06		2							2
GM-21I	↓	↓		2							2
TB-11-20-06	↓	↓		2							2

Sample Matrix: L = Liquid; S = Solid; A = Air

Total No. of Bottles/ Containers: 6

Relinquished by: [signature]	Organization: ARCADIS	Date 11/20/06	Time 5:00	Seal Intact?	
Received by:	Organization:	Date / /	Time	Yes	No N/A
Relinquished by:	Organization:	Date / /	Time	Seal Intact?	
Received by:	Organization:	Date / /	Time	Yes	No N/A

Special Instructions/Remarks: REPORT TO MELISSA REINOL

Delivery Method: ☐ In Person ☒ Common Carrier FEDEX (SPECIFY) ☐ Lab Courier ☐ Other (SPECIFY)

AG 05-12/01

GRUMMAN

ARCADIS

Laboratory Task Order No./P.O. No. 01-2

CHAIN-OF-CUSTODY RECORD

Page ____ of ____

Project Number/Name N4001348.040610000 2

Project Location BETHPAGE NY

Laboratory SEVERN-TRENT SHELTON

Project Manager MEKE WOLFORT

Sampler(s)/Affiliation G.W

Sample ID/Location	Matrix	Date/Time Sampled	Lab ID	ANALYSIS / METHOD / SIZE: 40ml VOA VOC 2000 ASP (HCl)						Remarks	Total
GM-20I	L	11-21-06		2							2
GM-20D				2							2
GM-79I				2							2
GM-79D				2							2
TB11-21-06				2							2

Sample Matrix: L = Liquid; S = Solid; A = Air

Total No. of Bottles/ Containers: 10

Relinquished by:	Organization: ARCADIS	Date 11/21/06	Time 5:00	Seal Intact?	
Received by:	Organization:	Date / /	Time	Yes No N/A	
Relinquished by:	Organization:	Date / /	Time	Seal Intact?	
Received by:	Organization:	Date / /	Time	Yes No N/A	

Special Instructions/Remarks: REPORT TO MELISSA KOLL

Delivery Method: ☐ In Person ☑ Common Carrier FED EX (SPECIFY) ☐ Lab Courier ☐ Other (SPECIFY)

AG 05-12/01

ARCADIS

Laboratory Task Order No./P.O. No. _____ **CHAIN-OF-CUSTODY RECORD** Page ____ of ____

Project Number/Name N400B48.0406.00002

Project Location BETHPAGE NY.

Laboratory SEVERN-TRENT SHELTON

Project Manager MIKE WOLFERT

Sampler(s)/Affiliation G.W

Sample ID/Location	Matrix	Date/Time Sampled	Lab ID	ANALYSIS / METHOD / SIZE: 40 ML VOC 200 ASP (#1)					Remarks	Total
GM-735D-2	L	11-29-06		2						2
GM-33D-2	↓	11-29-06		6*						6*
REP-11-29-06	↓	11-29-06		2						2
TB-11-29-06	↓	11-29-06		2						2
GM-750-2	L	11-27-06		2						2
TB-11-27-06	↓	11-27-06		2						2
			PLEASE NOTE	GM-750-2	AND	TB 11-27-06	~~ARE~~			
			WERE SAMPLED	ON	11-27-06	PLEASE	NOTE	SHORTER		
			HOLDING	TIME						

Sample Matrix: L = Liquid; S = Solid; A = Air

Total No. of Bottles/ Containers: 16

Relinquished by: _____	Organization: ARC-TOLS	Date 11/29/06	Time _____	Seal Intact?	
Received by: _____	Organization: _____	Date __/__/__	Time _____	Yes	No N/A
Relinquished by: _____	Organization: _____	Date __/__/__	Time _____	Seal Intact?	
Received by: _____	Organization: _____	Date __/__/__	Time _____	Yes	No N/A

Special Instructions/Remarks: REPORT TO MEDISCA PERSON

* PLEASE USE THIS SAMPLE FOR AN MS/MSD QA/QC SAMPLE

Delivery Method: ☐ In Person ☑ Common Carrier FED-EX SPECIFY ☐ Lab Courier ☐ Other _____ SPECIFY

AG 05-12/01

ARCADIS

Laboratory Task Order No./P.O. No. OU-2

CHAIN-OF-CUSTODY RECORD

Page ____ of ____

Project Number/Name NY 003348.0406.00002

Project Location BETHPAGE NY

Laboratory SEVERN-TRENT SHELTON

Project Manager MIKE WOLFERT

Sampler(s)/Affiliation GW

Sample ID/Location	Matrix	Date/Time Sampled	Lab ID	ANALYSIS / METHOD / SIZE: 4(0 ml VOA VOC 8260B (HCL)						Remarks	Total
GW-340	L	11.30.06		2							2
TB 11-30-06	✓	✓		2							2

Sample Matrix: L = Liquid; S = Solid; A = Air

Total No. of Bottles/ Containers: 4

Relinquished by:	Organization: ARCADIS	Date 11/30/06	Time 5:15	Seal Intact?	
Received by:	Organization:	Date / /	Time	Yes	No N/A
Relinquished by:	Organization:	Date / /	Time	Seal Intact?	
Received by:	Organization:	Date / /	Time	Yes	No N/A

Special Instructions/Remarks: REPORT TO MELISSA KOVOL

Delivery Method: ☐ In Person ☑ Common Carrier FED EX SPECIFY ☐ Lab Courier ☐ Other SPECIFY

AG 05-12/01

ARCADIS

Laboratory Task Order No./P.O. No. _____ **CHAIN-OF-CUSTODY RECORD** Page ____ of ____

Project Number/Name N4001348.0406

Project Location BETHPAGE NY

Laboratory SEVERN - TRENT SHERON

Project Manager MIKE WOLFERT

Sampler(s)/Affiliation GW

Sample ID/Location	Matrix	Date/Time Sampled	Lab ID	ANALYSIS / METHOD / SIZE: 40 ml VOA VOC 502.2 (HCl)						Remarks	Total
BPOW 2-1	L	12-1-06		2							2
BPOW 2-2	↓	↓		2							2
TB 12-1-06	↓	↓		2							2

Sample Matrix: L = Liquid; S = Solid; A = Air

Total No. of Bottles/ Containers: 6

Relinquished by: [signature]	Organization: ARCADIS	Date 12/1/06	Time _____	Seal Intact?	
Received by: _____	Organization: _____	Date / /	Time _____	Yes	No N/A
Relinquished by: _____	Organization: _____	Date / /	Time _____	Seal Intact?	
Received by: _____	Organization: _____	Date / /	Time _____	Yes	No N/A

Special Instructions/Remarks: REPORT TO MELISSA REINOL

Delivery Method: ☐ In Person ☒ Common Carrier FED-EX (SPECIFY) ☐ Lab Courier ☐ Other _____ (SPECIFY)

AG 05-12/01

ARCADIS

Laboratory Task Order No./P.O. No. _____ **CHAIN-OF-CUSTODY RECORD** Page ____ of ____

Project Number/Name N40D1342.0406.00002

Project Location LETHBRIDGE

Laboratory SEVERN-TRENT ~~SERVICES~~ STL

Project Manager MIKE WOLF

Sampler(s)/Affiliation G.L.

Sample ID/Location	Matrix	Date/Time Sampled	Lab ID	ANALYSIS / METHOD / SIZE: 40 ml VOA VOC 5022 (HCl)						Remarks	Total
BROW 1-1	L	12-6-06		2							2
BROW 1-2	↓	↓		2							2
REP 12-6-06	↓	↓		2							2
TB 12.6.06	↓	↓		2							2

Sample Matrix: L = Liquid; S = Solid; A = Air

Total No. of Bottles/ Containers: 8

Relinquished by: [signature]	Organization: ARCADIS	Date 12/6/06	Time 5:00	Seal Intact?	
Received by:	Organization:	Date / /	Time	Yes	No N/A
Relinquished by:	Organization:	Date / /	Time	Seal Intact?	
Received by:	Organization:	Date / /	Time	Yes	No N/A

Special Instructions/Remarks: REPORT TO MEISST REDNOL

Delivery Method: ☐ In Person ☑ Common Carrier FED EX (SPECIFY) ☐ Lab Courier ☐ Other _____ (SPECIFY)

AG 05-12/01

ARCADIS

Laboratory Task Order No./P.O. No. OU-2

CHAIN-OF-CUSTODY RECORD

Page ____ of ____

Project Number/Name N4001348.0406.00002

Project Location BETHPAGE NY

Laboratory SEVERN-TRENT STAFFORD

Project Manager MIKE WOLFERT

Sampler(s)/Affiliation G. W.

Sample ID/Location	Matrix	Date/Time Sampled	Lab ID	ANALYSIS / METHOD / SIZE: 40ml VOA VOC 502.2 HCl						Remarks	Total
BPOW 1-3	L	12-7-06		2							2
BPOW 4-1	✓	✓		2							2
BPOW-4-2	✓	✓		6*							6*
TB 12-7-06		✓		2							2

Sample Matrix: L = Liquid; S = Solid; A = Air

Total No. of Bottles/ Containers 12

Relinquished by: [signature]	Organization: ARCADIS	Date 12/7/06	Time 5:30	Seal Intact? Yes No N/A
Received by:	Organization:	Date / /	Time	
Relinquished by:	Organization:	Date / /	Time	Seal Intact? Yes No N/A
Received by:	Organization:	Date / /	Time	

Special Instructions/Remarks: * PLEASE USE THIS SAMPLE FOR AN MS/MSD QA/QC SAMPLE

REPORT TO MELISSA REINOL

Delivery Method: ☐ In Person ☒ Common Carrier FED-EX (SPECIFY) ☐ Lab Courier ☐ Other (SPECIFY)

AG 05-12/01

ARCADIS

Laboratory Task Order No./P.O. No. 00-2

CHAIN-OF-CUSTODY RECORD

Page ____ of ____

Project Number/Name: NY001348.0406.00002

Project Location: PETTIPAGE NY

Laboratory: SEVERN-TRENT SHELTON

Project Manager: MIKE WOLFGRAM

Sampler(s)/Affiliation: G.W.

Sample ID/Location	Matrix	Date/Time Sampled	Lab ID	ANALYSIS / METHOD / SIZE: 40MI VOA VOC 502.2 (HCl)						Remarks	Total
BPDW-3-1	L	12-8-06		2							2
BPDW-3-2	L			2							2
12-8-06	L			2							2

Sample Matrix: L = Liquid; S = Solid; A = Air

Total No. of Bottles/Containers: 6

Relinquished by: [signature]	Organization: ARCADIS	Date 12/8/06	Time 3:00	Seal Intact?		
Received by:	Organization:	Date / /	Time	Yes	No	N/A
Relinquished by:	Organization:	Date / /	Time	Seal Intact?		
Received by:	Organization:	Date / /	Time	Yes	No	N/A

Special Instructions/Remarks: REPORT TO MEETS A RESULT

Delivery Method: ☐ In Person ☒ Common Carrier FED EX SPECIFY ☐ Lab Courier ☐ Other ____ SPECIFY

AG 05-12/01

ARCADIS

OU 2 - GROUNDWATER QUARTERLY

Laboratory Task Order No./P.O. No. _____

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

Project Number/Name NY001348.0406.00002/NCAMMAQ

Project Location BETHPAGE, NY

Laboratory STL CT

Project Manager DAVE STERN

Sampler(s)/Affiliation P. RICHÉ / ARCADIS

Sample ID/Location	Matrix	Date/Time Sampled	Lab ID	ANALYSIS / METHOD / SIZE: 40 mL Clear VOAs (HCl)	VOC ASP 200	GRAB	STANDARD TAT	AND TICs		Remarks	Total
T96 EFF	W	12/14/06 339		2							2
T96 INF	L	12/14/06 335		2							2
Well 1	↓	4:17		2							2
Well 3	↓	5:40		2							2
T102 EFF	↓	12/15/06 9:50		2							2
T102 INF	↓	10:00		2							2
Well 17	↓	10:20		2							2
Well 18	↓	10:35		2							2
Well 19	↓	10:55		2							2
TB 121415 06	L	12/14/15/06		2	↓	↓	↓	↓			2

Sample Matrix: (L) = Liquid; S = Solid; A = Air

Total No. of Bottles/ Containers: 20

Relinquished by: P. Riché	Organization: ARCADIS	Date 12/15/06	Time 5:00PM	Seal Intact?	
Received by: _____	Organization: _____	Date / /	Time _____	(Yes) No N/A	
Relinquished by: _____	Organization: _____	Date / /	Time _____	Seal Intact?	
Received by: _____	Organization: _____	Date / /	Time _____	Yes No N/A	

Special Instructions/Remarks: _____

Delivery Method: ☐ In Person ☒ Common Carrier FEDEX (SPECIFY) ☐ Lab Courier ☐ Other _____ (SPECIFY)

AG 05-12/01

ARCADIS

Northrop Grumman [illegible]

Laboratory Task Order No./P.O. No. ____________

CHAIN-OF-CUSTODY RECORD

Page 1

Project Number/Name NY001348.0406.00002/N. Grumman

Project Location Bethpage, NY

Laboratory STL VT

Project Manager DAVE STERN

Sampler(s)/Affiliation P. RICHE/ARCADIS

Sample ID/Location	Matrix	Date/Time Sampled	Lab ID	6-Liter Summas	TO-15	+ TIC's	Standard TAT		Tank #	Remarks	Total
T96 Total EFF	A	12/14/06 3:20		↓	↓	↓	↓		2751	VAC -28/0 END	1
T96 Tank B Effluent	↓	12/14/06 3:23							3365	-29/0	1
T96 Influent		↓ 3:25							3486	-29/0	1
T102 Influent Tank A		12/15/06 12:00							3535	-29/0	1
T102 Effluent A	↓	↓ 12:03		↓	↓	↓	↓		4145	-29/0 ↓	1
Contaminated Sample	—	—		DO	NOT	ANALYZE —			2708	-29/NA	1

Sample Matrix: L = Liquid; S = Solid; (A) = Air

Total No. of Bottles/Containers 6

Relinquished by: P. Riche	Organization: ARCADIS	Date 12/15/06	Time 5:00	Seal Intact?
Received by:	Organization:	Date / /	Time	(Yes) No N/A
Relinquished by:	Organization:	Date / /	Time	Seal Intact?
Received by:	Organization:	Date / /	Time	Yes No N/A

Special Instructions/Remarks: *Ron P. I [illegible] contaminated [illegible] Sample to be [illegible] — Not Analyzed [illegible] Thanks —

Delivery Method: ☐ In Person ☒ Common Carrier FEDEX (SPECIFY) ☐ Lab Courier ☐ Other ______ (SPECIFY)

AG 05-12/01