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December 6, 2001

Todd Caffoe, P.E.
New York State Department of Environmental Conservation
Division of Environmental Remediation
6274 East Avon-Lima Road
Avon, New York 14414-9519

Subject: Enhanced Bioremediation and Monitored Natural Attenuation Work Plan
Xerox Building 801 – Henrietta, NY (NYSDEC Site No. 828069)

Dear Mr. Caffoe:

Attached for your review is the Work Plan to evaluate Enhanced Bioremediation and Monitored Natural Attenuation (EBMNA) for potential implementation at Xerox Building 801. This Work Plan was prepared in accordance with our 6 November 2001 review meeting and the recommendations of the Focused Feasibility Study that was submitted to your office last week.

If you have any questions regarding this submittal, please contact me at (716) 265-7267.

Very truly yours,

Scott M Huber

Scott M. Huber
Program Manager – EH&S Assessment & Remediation

cc: F. Navratil – NYSDOH, Albany
J. Charles, Esq. – NYSDEC, Buffalo
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Xerox Corporation
800 Phillips Road
Webster New York, 14580

WORKPLAN TO EVALUATE ENHANCED BIOREMEDIATION/NATURAL ATTENUATION IN GROUNDWATER XEROX BUILDING 801 HENRIETTA, NEW YORK

for

Xerox Corporation
Webster, New York

by

Haley & Aldrich of New York
Rochester, New York

70290-114
December 2001

HALEY & ALDRICH

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7 December 2001
File No. 70290-114

Xerox Corporation
800 Phillips Road, MS0205-99F
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Attention: Mr. Scott Huber

Subject: Workplan to Evaluate Enhanced Bioremediation/Natural Attenuation
In Groundwater, Xerox Building 801 Site
Henrietta, New York

Dear Scott:

As discussed in the 6 November 2001 meeting between NYSDEC, Xerox Corporation and Haley & Aldrich, this plan is submitted as a follow-up to the Focused Feasibility Study (FFS, November 2001). The results of the FFS recommended evaluation of an Enhanced Bioremediation and Monitored Natural Attenuation (EBMNA) approach. As indicated in the FFS, additional studies are required to determine the efficacy of this approach and to determine appropriate bioremediation amendment(s) for the B801 site conditions. This document presents the proposed action plan for implementation of those studies.

In addition, this document includes discussion of the recent sporadic surface water detections at the B801 site and describes proposed actions regarding these detections.

I. INTRODUCTION

Monitored natural attenuation (MNA) is a remedial approach that relies on natural processes to reduce contaminant concentrations to acceptable levels. Natural attenuation includes a variety of physical, biological and chemical processes. These processes which work to reduce the mass, toxicity, mobility and concentration of contaminants in the soil or water, include the following:

- Biodegradation
- Chemical Stabilization
- Dispersion
- Sorption
- Volatilization
- Dilution

While the aforementioned processes generally work together toward reducing subsurface impacts, the biodegradation process can be augmented through various amendments and will be the focus of the additional studies to assess whether an enhanced bioremediation approach, combined with MNA, is appropriate for implementation at the B801 site.

The natural biodegradation of contaminants can be slowed by the relative depletion of certain compounds in an aquifer, such as oxygen for aerobically degradable contaminants and electron donors (carbon, hydrogen) for anaerobically degradable compounds. The contaminants present at the B801 site generally biodegrade more rapidly via anaerobic processes and generally require the addition of electron donors. For an Enhanced Bioremediation approach to be successful at reducing contaminant concentrations, careful evaluation of compound-specific and site-specific factors should be performed to appropriately implement the selected bioremediation enhancing amendment. This Study will assess those factors.

As indicated in the previous initial MNA and Rebound Studies performed at the site in 1998-99, there is evidence that natural attenuation is occurring at B801 site. This evidence includes substantial decreases in the contaminant concentrations downgradient of the source area and the presence of biodegradation products. However, the 2-PHASE Extraction system remained in operation in the source area throughout the duration of the year long MNA study. This active extraction and aeration of the subsurface limited the production of the anaerobic conditions necessary for appreciable biodegradation of site contaminants. In addition, the results of these studies were inconclusive regarding the presence of a complete dechlorination pathway (from tetrachloroethene through to its final degradation products of ethene, ethane, and carbon dioxide). Recent research has indicated incomplete dechlorination may occur if the appropriate microorganisms are not present and could result in an unacceptable buildup of cis-1,2-dichloroethene (cis-1,2-DCE) in the subsurface.

Therefore, the goals of this Study are as follows:

- Shut-down the 2-PHASE Extraction system and allow for production of aquifer equilibrium conditions. As approved by the NYSDEC, the B801 2-PHASE system was shut-down on 14 November 2001. The system had reached the limit of its effectiveness for removal of contaminants from the subsurface and was acting to oxygenate the subsurface, thereby inhibiting the reducing conditions required for natural biodegradation of site contaminants.

- Implement a groundwater monitoring plan to assess the MNA processes active in the subsurface for a period of one year.

- Perform laboratory testing using site aquifer soils and groundwater to assess the presence of appropriate microorganisms for complete dechlorination and determine if additional microorganisms are necessary.

- Perform laboratory testing to determine appropriate bioremediation enhancing amendment(s).

- If the approach is found to be appropriate, determine a site-specific strategy for implementation of EBMNA to further reduce source area contaminant concentrations.

II. SAMPLING AND ANALYSIS PROGRAMS

Sampling and analysis programs are described below for the MNA Evaluation, Microbial Assessment, and Bioremediation Amendment Assessment portions of this Study.

A. Monitored Natural Attenuation Evaluation

As described in the introduction of this letter, MNA includes many processes, one of which is biodegradation. The MNA program for the B801 Site is designed to evaluate the extent to which natural attenuation of the source compound (PCE) and its biodegradation breakdown products, was occurring as a combination of these processes.

The main biodegradation pathway of PCE is reductive dechlorination, a successive removal of chlorine atoms that occurs under anoxic (oxygen poor) conditions and results in the production of trichloroethene, cis-1,2-DCE, vinyl chloride, ethene, and ethane, respectively. TCE can also be biodegraded via other processes, such as direct oxidation and cometabolism. The potential contribution of the various potential biodegradation pathways will be reviewed as part of this evaluation.

Verification that natural attenuation is occurring at a site involves two main lines of evidence: (1) historic groundwater concentrations that indicate a clear and meaningful decreasing trend and (2) hydrogeologic and geochemical data that indicate the presence of a geochemical footprint in the aquifer consistent with MNA processes. These footprints are due to changes in concentrations of reactants or products of the biogeochemical processes that transform the contaminants. The MNA program will include collection of the following parameters:

- Volatile organic compounds – collection of parent (trichloroethene) and biodegradation breakdown products (cis-1,2-dichloroethene, vinyl chloride, ethene, and ethane)
- Biodegradation indicators – dissolved oxygen, oxidation-reduction potential, methane, carbon dioxide, electron acceptors (nitrate, sulfate, iron (dissolved and total), manganese (total and dissolved)), and chloride.
- Additional groundwater quality parameters - pH, temperature, and conductivity.

A complete listing of the MNA parameters, sampling and analysis methods, and data use can be found in Table 1. The MNA parameters will be sampled semiannually, in conjunction with the March and September 2002 groundwater monitoring events from ten MNA program wells, as summarized in Table 2. The program wells were selected on the basis of the site

conceptual model and our understanding of the three-dimensional distribution of contaminants. The selected wells target areas upgradient and downgradient, as well as within the known source area, as summarized in the table below.

Source Area Wells:	Down-gradient Wells:
RW-1	MW-10
RW-4	MW-13S
VE-6	MW-14S
	MW-18S
Up-gradient Wells:	MW-19
MW-24S	MW-27

The location of the MNA program wells are shown in Figure 1.

A successful MNA program requires obtaining groundwater samples that that are representative of in-situ aquifer conditions. Care will be taken during purging and sampling to not disrupt the anaerobic conditions present in the aquifer. Purging and collection of the field parameters, particularly dissolved oxygen and redox, should be performed using low flow techniques and flow-through cells.

B. Microbial Assessment

The MNA and Rebound Studies performed previously at the B801 site indicated that natural attenuation processes are active at the site, but the low concentrations of vinyl chloride and ethene indicate these processes may not be proceeding to completion. This evidence suggests that specific microorganisms necessary to completely degrade the source contaminant (such as *dehalococcoides ethenogenes,* or similar dehalorespirers) may not be present in sufficient quantity. As a result, cis-1,2-DCE may buildup in the subsurface if the process is left unamended.

To assess whether the appropriate microorganisms necessary for complete dechlorination exist in the B801 subsurface, site soils and groundwater will be collected during the March 2002 monitoring event and will be sent to a specialty laboratory for testing. During sample collection and transport, care will be given in obtaining and maintaining samples that are representative of in-situ aquifer conditions. If the appropriate microorganisms are not present in sufficient quantities, laboratory evaluations of biodegradation of site contaminants with introduced microorganisms will be performed.

C. Enhanced Bioremediation Amendment Assessment

As previously mentioned, sites contaminated with chlorinated solvents sites tend to be electron-donor limited. Amendments that are typically added to enhance biodegradation at these types of sites include Hydrogen Release Compound (HRC), lactic acid, molasses, or edible oils, among others.

To determine the most appropriate bioremediation enhancing amendments, site groundwater and soils will be obtained from the source and will be submitted to a laboratory for testing. Care will be taken during sample collection and transport to ensure these samples are representative. At the laboratory, microcosms of soil and groundwater will be prepared and amended with the various compounds listed above and others if appropriate. Parent compound and breakdown product concentrations will be monitored over time to determine the efficiency of the biodegradation with each amendment. If introduced microorganisms are determined to be necessary in the microbial assessment step, testing with the various amendments will also be performed on these innoculated microcosms. In addition, killed and live/unamended microcosms will be monitored as laboratory controls.

The results of these microcosms will provide information regarding the biodegradation kinetics and dosage requirements for each amendment and will allow for a cost/benefit analysis to be performed regarding potential full-scale implementation at the B801 site.

Both the microbial and amendment assessment portions of this Study will be sub-contracted to an appropriate laboratory or university where research with these types of amendments and microorganisms is currently ongoing, such as Cornell University, University of Toronto, Waterloo University, or North Carolina State University.

D. Groundwater Sampling Procedures

Groundwater samples will be collected from the selected monitoring wells utilizing Low Stress/Low Flow Sampling Methods, as described in EPA's Low Flow (Minimal Drawdown) Groundwater Sampling Procedures, EPA/540/S-95/504, April 1996. This method will be utilized to obtain natural attenuation parameters that are more representative of in-situ aquifer conditions than samples obtained by conventional purging techniques. The Low Stress/Low Flow Sampling procedures are summarized in Appendix A.

III. DATA ANALYSIS

The goal of this Study is to assess the appropriateness of an EBMNA approach for additional reductions for B801 residual concentrations. The data obtained during this Study will be evaluated via the following methods:

- Preparation of source contaminant and breakdown product posting maps and time series plots. These maps and plots will assist with determination of spatial and temporal trends in biodegradation processes within the aquifer.

- Preparation of posting maps and/or isoconcentration maps of biodegradation indicators (such as dissolved oxygen, chloride, alternate electron acceptors). These maps will assist with analysis of the biogeochemical "footprint" caused by natural attenuation processes and assist with determination of the extent of the biodegradation processes at the site.

- Calculation of site-specific biodegradation rates. These rates will assist with evaluating the robustness of the natural attenuation processes present and to determine if the biodegradation rates observed at the site are similar to those documented in available literature.

- Assessment of the results of the amendment laboratory microcosm studies with respect to increased biodegradation and cost of implementation. Recommendation will be made regarding the most appropriate bioremediation enhancing amendment and whether introduced microorganisms will be necessary.

IV. SURFACE WATER DISCUSSION

As requested by the NYSDEC in the 6 November 2001 review meeting, Xerox and Haley & Aldrich reviewed historic and recent surface water data with regards to recent sporadic detections at surface water sampling location SW-35. A discussion of the results of this review and associated action items are included in Appendix B of this document.

V. SCHEDULE

The EBMNA program will encompass one year of data collection, starting with 1st quarter 2002. Once the data from the entire program has been collected and results from the laboratory analyses and tests have been received, a final report will be prepared. It is estimated that this report would be finalized and submitted in 1st quarter 2003. Implementation of the recommended alternative would initiate in approximately 2nd 2003. These schedules are an approximation only and could change depending upon field data collection and laboratory schedules.

If you have any questions or require any additional information, please contact us.

Sincerely yours,
HALEY & ALDRICH, INC.

Susan L. Boyle
Senior Engineer

Vincent B. Dick
Vice-President

Attachments:

Table 1	Summary of Natural Attenuation Sampling Parameters
Table 2	Enhanced Bioremediation and MNA Sampling Schedule
Figure 1	Location of Enhanced Bioremediation and MNA Program Wells
Appendix A	Generic Groundwater Sample Collection Procedures
Appendix B	Surface Water Discussion

Table 1. Summary of Natural Attenuation Sampling Parameters
Xerox Building 801 Site

FIELD PARAMETERS

Matrix	Analysis	Method/Reference	Comments	Data Use	Recommended Frequency of Analysis	Sample Volume, Sample Container, Sample Preservation	Field or Fixed~Base Laboratory
Water	Alkalinity	Hach Alkalinity test kit model AL AP MG-L	Phenolphthalein method	General water quality parameter used (I) as a marker to verify that all site samples are obtained from the same ground-water system and (2) to measure the buffering capacity of ground water. (3) indicator of biodegradation	Each sampling round	Collect 100 mL of water in glass container.	Field
Water	Carbon Dioxide	Hach Carbon Dioxide Kit	Field	Indicator of ongoing aerobic biodegradation, correlates with alkalinity	Each sampling round	Collect 100 mL of water in glass or plastic container and analyze as soon as possible	Field
Water	pH	Field probe with direct reading meter calibrated in the field according to the supplier's specifications.	Field	Aerobic and anaerobic biological processes are pH-sensitive. Lower pH can be indication of biodegradation.	Each sampling round	Measure immediately after purging is complete site using a flow-through cell or over-flow cell.	Field
Water	Conductivity	E120.l/SW9050,	direct reading meter	General water quality parameter used as a marker to verify that site samples are obtained from the same ground-water system.	Each sampling round	Collect 100 to 250 mL of water in a glass or plastic container.	Field
Water	Iron (II) (Fe+2)	Colorimetric Hach Method #8146	Filter if turbid.	May indicate an anaerobic degradation process due to depletion of oxygen, nitrate, and manganese.	Each sampling round	Collect 100 mL and analyze as soon as possible.	Field
Water	Temperature	Field probe with direct reading meter.	Field only	To determine if a well is adequately purged for sampling.	Each sampling round	Read from oxygen meter,	Field
Water	Redox	Field probe with direct reading meter.	Field only, care should be taken to not aerate the sample during sampling.	To determine the redox conditions in groundwater for assessing biodegradation potential.	Each sampling round	Measure immediately after purging is complete site using a flow-through cell or over-flow cell.	Field
Water	Dissolved Oxygen	Field probe with direct reading meter.	Field only, care should be taken to not aerate the sample during sampling.	To determine the level of dissolved oxygen in groundwater (assessing biodegradation potential.)	Each sampling round	Measure dissolved oxygen on site using a flow-through cell or over-flow cell.	Field

Table 1. Summary of Natural Attenuation Sampling Parameters
Xerox Building 801 Site

FIXED LABORATORY

Matrix	Analysis	Method/Reference	Comments	Data Use	Recommended Frequency of Analysis	Sample Volume, Sample Container, Sample Preservation	Field or Fixed-Base Laboratory
Water	Chloride	EPA 325.1	Mercuric nitrate titration (Ion chromatography (IC) method E300 or method SW9050 may also be used)	General water quality parameter used as a marker to verify that site samples are obtained from the same ground-water system. Final product of chlorinated solvent reduction.	Each sampling round	Collect 250 mL of water in a glass container. **cool to 4°C**	Fixed-base
Water	Nitrate	EPA 353.2		Substrate for microbial respiration if oxygen is depleted.	Each sampling round	Collect to 250 mL of water in a glass or plastic container; **add H_2SO_4 to pH less than 2, cool to 4°C.**	Fixed-base
Water	Sulfate (SO_4^{2-})	EPA 375.4	If this method is used for sulfate analysis, do not use the field method.	Substrate for anaerobic microbial respiration.	Each sampling round	Collect to 250 mL of water in a glass or plastic container; **cool to 4°C**	Fixed-base
Water	Total Iron and Dissolved and Total Manganese	SW6010	ICP Atomic Emission Spectroscopy	To determine if anaerobic biological activity is solubilizing manganese from the aquifer matrix material. To determine the total amount of iron present in groundwater.	One round of sampling	Collect 100 ml in a glass or plastic container that is rinsed in the field with the ground water to be sampled. **Adjust pH to 2 with nitric acid.** Do not insert pH paper or an electrode into the sample.	Fixed Base

Table 1. Summary of Natural Attenuation Sampling Parameters
Xerox Building 801 Site

FIXED LABORATORY, CONT'D

Matrix	Analysis	Method/Reference	Comments	Data Use	Recommended Frequency of Analysis	Sample Volume, Sample Container, Sample Preservation	Field or Fixed-Base Laboratory
Water	Aromatic and chlorinated hydrocarbons (BTEX, trimethylbenzene isomers, chlorinated compounds)	SW8260A	Analysis may be extended to higher molecular weight alkyl benzenes	Method of analysis for BTEX and chlorinated solvents/byproducts, which are the primary target analytes for monitoring natural attenuation; method can be extended to higher molecular weight alkyl benzenes; trimethyl-benzenes are used to monitor plume dilution if degradation is primarily anaerobic.	Each sampling round	Collect water samples in a 40 mL VGA vial; **cool to 4°C**	Fixed-base
Water	Methane, ethane, and ethene	Kampbell eral., 1989 and 1998 or SW3810 Modified	Method published by researchers at the U.S. Environmental Protection Agency.	The presence of CH_4 suggests BTEX degradation via methanogenesis. Ethane and ethene data are used where chlorinated solvents are suspected of undergoing biological transformation.	Each sampling round	Collect water samples in 50 mL glass serum bottles with gray butyl /Teflon-faced septa and crimp caps, **cool to 4°C.**	Fixed-base
Water	Total Organic Carbon (TOC) and Dissolved Organic Carbon (DOC)	EPA 415.1	UV/Persulfate Oxidation – Dohrmann Analyzer	Used to classify plume and to determine if reductive dechlorination is possible in the absence of anthropogenic carbon.	Each sampling round	Collect to two 40 mL vials, **cool to 4°C.**	Fixed Base

NOTES:

1. "Hach" refers to the Hach Company catalog, 1990.
2. "SW" refers to *Standard Methods for the Examination of Water and Wastewater,* 1 8th edition, 1992.
3. "EPA" refers to *Methods for Chemical Analysis of Water and Wastes,* U.S. EPA, 1983.
4. "SW" refers to the *Test Methods for Evaluating Solid Waste, Physical, and Chemical Methods,* SW-846, U.S. EPA, 3rd edition, 1986.

Table 2
Enhanced Bioremediation and MNA Sampling Schedule
Xerox Corporation, Building 801 Site
Henrietta, New York

Sampling Frequency	VOCs	Field MNA Parameters	Laboratory MNA Parameters	Aquifer Material Sampling
November 2001				
December 2001	X	X*		
January 2002		X*		
February 2002		X*		
March 2002	X	X	X	X
June 2002	X			
September 2002	X	X	X	
December 2002	X			

Notes: EBMNA Program wells include RW-1, RW-4, VE-6, MW-10, MW-13S, MW-19, MW-14S, MW-18S, MW-24S, and MW-27.

All program wells are normally sampled on a quarterly basis for VOCs, except RW-1, RW-4, and VE-6 which are sampled only annually. For the EBMNA program, these wells will be sampled for VOCs quarterly.

X* - Field measurements of DO and redox will be obtained from several source area program wells in late 2001-early 2002 to assess the development of anaerobic conditions in the subsurface following shut-down of the 2-PHASE system in November 2001.

Site soils sampling will be performed in the approximate timeframe of the March 2001 groundwater sampling event to provide aquifer soils for laboratory microcosm testing.

MW-18S MW-18D

MW-15S,D

N

MW-13S

MW-13D

VE-9

MW-16

VE-8

MW-14S,D

MW-19

MW-27

MW-2

MW-10

VE-7

MW-26D

RW-2

VE-6

RW-5

MW-12

MW-6

BLDG. #4

MW-25D

RW-4

VE-5

VE-15

SHED

VE-14

MW-7

VE-10

VE-2

RW-1

VE-11

VE-12

VE-13

VE-4

VE-3

RW-3

MW-23D

HOFSTRA ROAD

VE-1A

MW-20

VE-1

MW-22D

MW-21

XEROX
BUILDING 801

MW-24S

MW-24D

0 80 160

SCALE IN FEET

LEGEND:

- MNA PROGRAM WELLS (IN BLACK)
- MW-1S — GROUNDWATER MONITORING WELL
- VE-1A — 2-PHASE EXTRACTION WELL
- STORM SEWER
- STREAM W/ DIRECTION OF FLOW

NOTES:

1. LOCATIONS ARE APPROXIMATE

HALEY & ALDRICH

UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

XEROX CORPORATION
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HENRIETTA, NEW YORK

MONITORED NATURAL ATTENUATION AND ENHANCED BIOREMEDIATION PROGRAM WELLS

SCALE: AS SHOWN

DECEMBER 2001

70290-114 MNAALT2.DWG

FIGURE 1

APPENDIX A

GENERIC GROUNDWATER SAMPLE COLLECTION PROCEDURES

Appendix A

Generic Groundwater Sample Collection for Laboratory Analysis

INTRODUCTION

This procedure is for the collection of groundwater samples for laboratory analysis.

The following describes two techniques for groundwater sampling: "Low Stress/Low Flow Methods" and "Typical Sample Methods."

"Low Stress/Low Flow" methods will be employed when it is critical to collect groundwater samples truly representative of the groundwater present, not impacted by overpurging and sediment/colloid presence. Analysis typically sensitive to overpurging and turbidity/sediment issues are Monitored Natural Attenuation (MNA) parametes, polychlorinated-biphenyls (PCBs), semi-volatile compounds (SVOCs) and metals.

The "Typical Sample Methods" will be employed where the collection of parameters less sensitive to overpurging and turbidity/sediment issues are being collected (volatile organics - VOCs, and general chemisty).

NOTE: If Non-aqueous phase liquids (NAPL) (light or dense) are detected in a monitoring well, groundwater sample collection will not be conducted and the Project Manager must be contacted to determine a course of action.

PREPARATORY REQUIREMENTS

- Verify well identification and location using borehole log details and location layout figures. Note the condition of the well and inform the Project Manager of any necessary repair work required.

- Prior to opening the well cap, measure the breathing space above the well casing with a PID to establish baseline levels. Repeat this measurement once the well cap is opened. If either of these measurements exceeds the air quality criteria in the health and safety plan, field personnel should adjust their PPE accordingly.

- Prior to commencing the groundwater purging/sampling tasks, water level and total depth measurements must be obtained to determine the well volume for hydraulic purposes. In some settings it maybe necessary to allow the water level time to equilibrate. This condition exists if a water tight seal exists at the well cap and the water level has fluctuated above the top of screen; creating a vacuum or pressurized area in this air space. Three water level checks will verify static water level conditions or changing conditions.

- Calculate the water volume in the well. Typically overburden well volumes consider only the quantity of water standing in the well screen and riser; bedrock well volumes are calculated on the quantity of water within the open corehole and within the overburden casing.

- Estimate natural groundwater flow rate into well to determine the approximate pumping rate for purging/sampling activities.

WELL PURGING AND STABILIZATION MONITORING (LOW STRESS/LOW FLOW METHOD)

- The method of preference for groundwater sampling will be the low stress/low flow method described below.

- Bladder pumps/submersible variable rate pumps (i.e., Grundfos™ Rediflo or equivalent) are typically employed.

- Slowly lower the pump, safety cable, tubing and electrical lines into the well to the depth specified by the project requirements. The pump should be placed in the well approximately 24 hours prior to purging (if possible). The pump intake must be at the mid-point of the well to prevent disturbance and resuspension of any sediment at the bottom of the well

- Before starting the pump, measure the water level again with the pump in the well leaving the water level measuring device in the well when completed.

- Purge the well at 100 to 500 (maximum) milliliters per minute (mL/min) which correlates to 0.03 to 0.13 gallons per minute. During purging, the water level should be monitored approximately every 5 minutes, or as appropriate. A steady flow rate should be maintained that results in drawdown of 0.3 feet or less. The rate of pumping should not exceed the natural flow rate conditions of the well being sampled. Care should be taken to maintain pump suction and to avoid entrainment of air in the tubing. Record adjustments made to the pumping rates and water levels immediately after each adjustment.
- During the purging of the well, monitor and record the field indicator parameters (pH, temperature, conductivity, oxidation-reduction (redox) reaction potential (ORP), dissolved oxygen (DO), and turbidity) approximately every five minutes. Stabilization is considered to be achieved when the final groundwater flow rate is achieved, and three consecutive readings for each parameters are within the following limits:
  - pH ±0.1 pH units of the average value of the three readings;
  - temperature ±3 percent of the average value of the three readings;
  - conductivity ±3% of the average value of the three readings.
  - ORP ±10 millivolts (mV) of the average value of the three readings;
  - DO ±10 percent of the average value of the three readings; and
  - turbidity ±10 percent of the average value of the three readings, or a final value of less than 5 nephelometric turbidity units (NTU).

- Should stabilization not be achieved for all field parameters, purging is continued until a maximum of 5 well screen volumes have been purged from the well. Since low-flow purging (LFP) likely will not draw groundwater from a significant distance above or below the pump intake, the screen volume is based upon a 5-foot (1.4 m) screen length. After purging 20 well screen volumes, purging is continued if the purge water remains visually turbid and appears to be clearing, or if stabilization parameters are varying slightly outside of the stabilization criteria listed above and appear to be approaching stabilization.

- If low-turbidity samples are critical to the project goals, purging will be extended until turbidity has been reduced to 5 NTU or less.

- The pump must not be removed from the well between purging and sampling.

WELL PURGING AND STABILIZATION MONITORING (TYPICAL METHOD)

- Typically peristaltic pumps or bladder pumps or submersible pumps are preferred. Bailers can be used but are less desirable.

- Pump placement is typically performed at the mid-point of the screen.

- Purge the well until three consecutive well volume measurements of temperature and specific conductivity are approximately plus or minus 10 percent and if the pH values are within 1 pH unit of the last three value averages, and the groundwater turbidity values are less than 5 NTU. If stabilization has not occurred within the first five well volumes removed, continue purging and monitoring until eight well volumes have been pumped.

- Groundwater turbidity may be evaluated by a visual examination for sediment/silt presence or use of a nephlometer. Work Plan Specific goals may exist for turbidity values that may require extending the purging, or require an alternate pumping system.

- Monitoring well purging is accomplished by using in-place pumps or by a peristaltic, bladder or other appropriate pump, depending on the well depth. The pump/hose assembly or bailer used for purging should be lowered into the top of the standing water column and not deep into the column. Typically pump placement at the mid-point of the screen is adequate.

SAMPLING TECHNIQUES

- If an alternate pump is utilized, the first pump discharge volumes should be discarded to allow the equipment a period of acclimation to the groundwater.

- Samples are typically collected directly from the pump with the groundwater being discharged directly into the appropriate sample container. Avoid handling the interior of the bottle or bottle cap and don new gloves for each well sampled to avoid contamination of the sample.

- Order of sample collection:
  - Volatile organic compounds
  - Total organic carbon (TOC)
  - Total metals
  - Dissolved metals
  - Sulfate and chloride
  - Nitrate and ammonia

- For low stress/low flow sampling, samples should be collected at a flow rate between 100 and 500 mL/min (0.03 to 0.13 gpm) and such that drawdown of the water level within the well does not exceed the maximum allowable drawdown of 0.3 feet.

- The pumping rate used to collect a sample for VOCs should not exceed 100 mL/min. Samples should be transferred directly to the final container 40 mL glass vials completely full and topped with a teflon cap. Once capped the vial must be inverted and tapped to check for headspace/air presence (bubbles). If air is present the sample vial will be discarded, and re-collected until free of air.

- Field filtration will be performed if dictated by the project Work Plan.

- Sample labels/sample identification

- All samples must be labeled with:
  - A unique sample number
  - Date and time
  - Parameters to be analyzed
  - Project Reference ID
  - Samplers initials

- Labels should be secured to the bottle and should be written in indelible inks.

EQUIPMENT/MATERIALS

- pH meter, Conductivity meter, Dissolved Oxygen (DO) meter, Oxidation-reduction (redox) reaction potential (ORP) meter, Nephlometer, Temperature guage

- Field filtration units (if required)

- Purging/sampling equipment – to be utilized for low flow sample collection.

  - Peristaltic Pump (not suitable for VOCs[1]/SVOCs or depths >25 feet);
  - Suction Pumps (not suitable for LFP, VOCs/SVOCs, or depths >25 feet);
  - Submersible Pumps (suitable for VOCs/SVOCs only at low flow rates);
  - Air Lift Pumps (not suitable for VOCs/SVOCs);
  - Bladder Pumps (suitable for LFP and VOCs/SVOCs);

- Inertia Pumps (gaining acceptability for VOCs/SVOCs generally not suited for GM programs); and
- Bailers (not suitable for LFP)

- Water Level Probe
- Sampling Materials (containers, log book/forms, coolers, chain-of-custody)
- Work Plan
- Health and Safety Plan

Note[1]: Peristaltic pump use for VOC collection is not acceptable on NYSDEC sites; this technique has gained acceptance in select areas where it is permissible to collect VOCS using a peristaltic pump at a low flow rate (ex. Michigan).

FIELD NOTES

- Field notes must document all the events, equipment used, and measurements collected during the sampling activitiesThe log book should document the following for each well sampled:
  - Identification of well
  - Well depth
  - Static water level depth and measurement technique
  - Sounded well depth
  - Presence of immiscible layers and detection/collection method
  - Well yield – high or low
  - Purge volume and pumping rate
  - Time well purged
  - Measured field parameters – record measurements obtained every 3-5 minutes to monitor for stabilization.
  - Purge/sampling device used
  - Well sampling sequence
  - Sampling appearance
  - Sample odors
  - Sample volume
  - Types of sample containers and sample identification
  - Preservative(s) used

- Parameters requested for analysis
- Field analysis data and method(s)
- Sample distribution and transporter
- Laboratory shipped to
- Chain of custody number for shipment to laboratory
- Field observations on sampling event
- Name collector(s)
- Climatic conditions including air temperature
- Problems encountered and any deviations made from the established sampling protocol.

GROUNDWATER/DECON FLUID DISPOSAL

- Groundwater disposal methods will vary on a case-by-case basis but may range from:
  - Off-site treatment at private treatment/disposal facilities or public owned treatment facilities
  - On-site treatment at Facility operated facilities
  - Direct discharge to the surrounding ground surface, allowing groundwater infiltration to the underlying subsurface regime
  - Direct discharge to impervious pavement surfaces, allowing evaporation to occur

- Decon fluids should be segregated and collected separately from wash waters/groundwater containers. This material will be disposed of appropriately.

REFERENCE

1. ASTM D5474 Guide for selection of Data Elements for Groundwater Investigations
2. ASTM D4696 Guide for pore-liquid sampling from the vadose zone
3. ASTM D5979 Guide for conceptualization and characterization of groundwater systems
4. ASTM D5903 Guide for planning and preparing for a groundwater sampling event
5. ASTM D4448 Standard guide for sampling groundwater wells
6. ASTM D6001 Standard guide for direct push water sampling for geo-environmental investigations.

7. USEPA Low-flow (minimal drawdown) ground water sampling procedures (EPA/540/S-95/504).

8. USEPA RCRA Groundwater Monitoring: Draft Technical guidance (EPA/530-R-93-001).

APPENDIX B

SURFACE WATER EVALUATION

HALEY & ALDRICH

APPENDIX B
SW-35 SURFACE WATER EVALUATION

As discussed in the 6 November 2001 review meeting with NYSDEC, Xerox Corporation and Haley & Aldrich, surface water sampling location SW-35 has experienced recent sporadic detections of VOCs which have historically been detected at the site. This section of the workplan summarizes these detections, discusses the potential sources and identifies proposed actions .

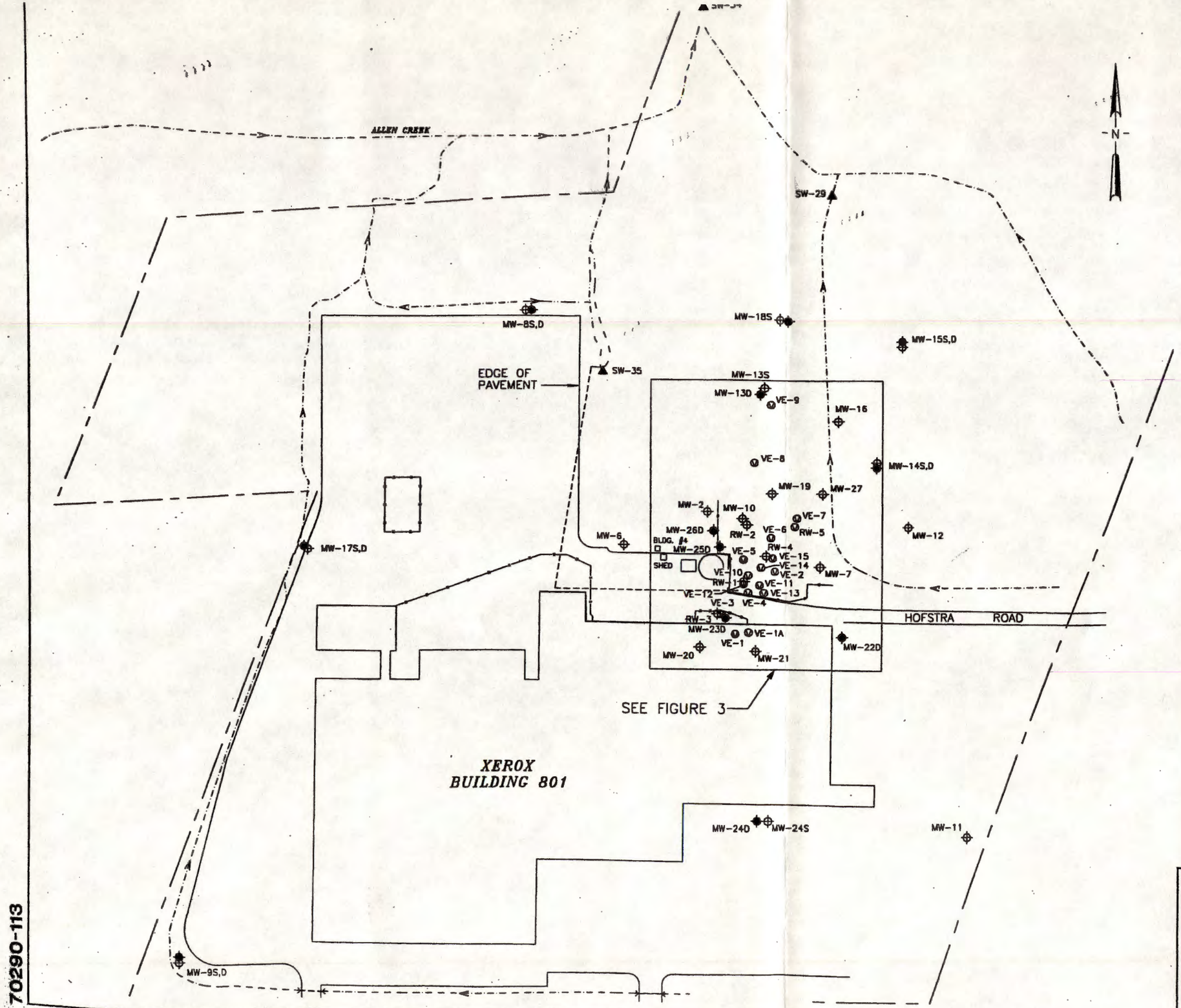
- SW-35 is sampled on a quarterly basis, as are surface water locations SW-29 and SW-34. SW-34, is the point of compliance as it is located downgradient of the confluence of the site surface waters. These three sampling locations are shown on Figure B-1.

- Since March 1998, SW-35 has experienced sporadic detections of VOCs ranging from 103 to 151 ppb. SW-34 has experienced three low detections (ranging from 1.7 to 38 ppb) of VOCs since 1997 and SW-29 has experienced one low detection of 0.3 ppb in 1999. Current data indicates no exceedances of NYS Ambient Water Quality Standards and Guidance Values (TOGS 1.1.1) at the point of compliance, SW-34. Figure B-2 summarizes recent and historic data for the three sampling locations.

- Two remedial actions were previously performed to address surface water detections at the B801 site: in 1993, an inflatable plug was installed in the pipe leading from a storm sewer manhole immediately west of the remediation area (Figure B-3) , and in 1995, a stream was re-directed to avoid routing surface water through the Lawn Area (Figure B-1). The integrity of the sewer plug is checked by Xerox maintenance personnel on a quarterly basis and has remained intact since installation.

- As shown on Figure B-3, SW-35 is located at the outfall of the storm sewer that travels along the southwest and west boundaries of the Lawn Area. The sewer plug that was installed in 1993 was designed to limit migration of contaminated groundwater that may be infiltrating into this sewer. Upon review of the sporadic detections at SW-35, it appears that either (1) groundwater may be migrating past theexisting plug , (2) contaminated groundwater is entering the sewer beyond the plug, or (3) contaminated groundwater is entering and migrating down the higher permeability sewer bedding.

- As current data indicate no exceedances of NYS Ambient Water Quality Standards (TOGS 1.1.1) at the point of compliance (SW-34), it is recommended that continued monitoring of these surface water locations during the 2-PHASE shut-down and Enhanced Bioremediation and Monitored Natural Evaluation program (EBMNA) described in the main portion of this workplan occur. When implemented, the EBMNA approach will provide additional reductions of source area contaminants allowing for additional mitigation of surface water issues. While ongoing monitoring will continue, it is felt that specific additional corrective measures are not warranted at this time.



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LEGEND:

- MW-15 — SHALLOW GROUNDWATER MONITORING WELL
- MW-10 — DEEP GROUNDWATER MONITORING WELL
- SW-28 — SURFACEWATER SAMPLING LOCATION
- VE-1A — 2-PHASE EXTRACTION WELL
- STORM SEWER
- STREAM W/ DIRECTION OF FLOW
- PROPERTY LINE

NOTES:

1. BASEMAP DATA FILE PREPARED BY BERGMANN ASSOCIATES, ROCHESTER, NEW YORK UNDER DIRECT CONTRACT WITH XEROX CORPORATION.
2. STREAM LOCATIONS ARE APPROXIMATE.
3. PIEZOMETERS SHOWN ON FIGURE 3.
4. REFER TO TEXT FOR ADDITIONAL INFORMATION.

0 200 400
SCALE IN FEET

HALEY & ALDRICH
UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

XEROX CORPORATION
BUILDING 801
HENRIETTA, NEW YORK

SITE PLAN

SCALE: AS SHOWN

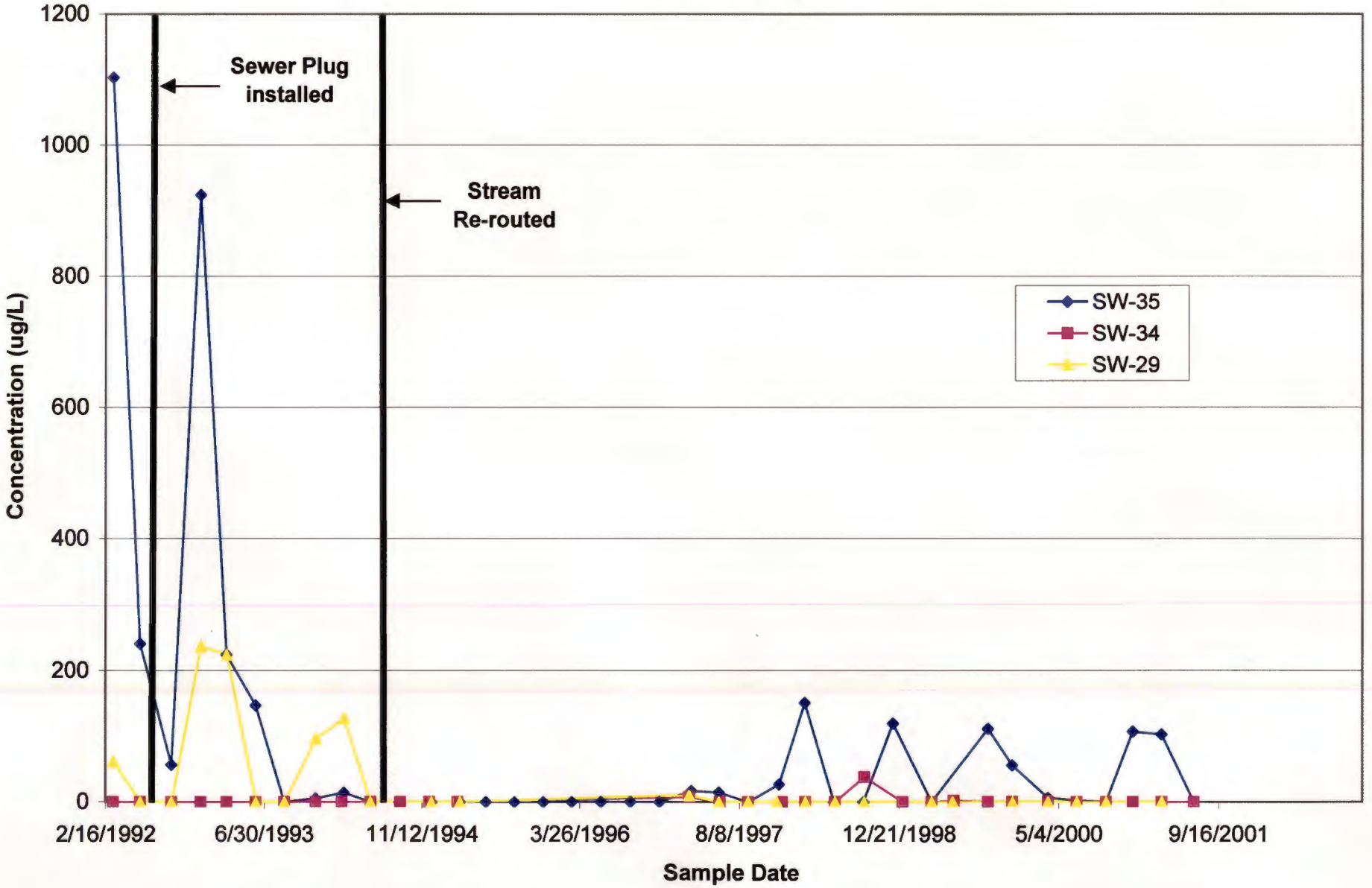
FEBRUARY 2001

FILENAME: SITE.DWG

70290-113

FIGURE B-1

Figure B-2
Xerox Corporation - B801 Site
Total Volatile Surface Water
Historic Trends



70290\114\801 surface water hits.xls

Note: Not all data is presented here, some data gaps exist (1995-1996 for SW-34 and SW-29).