REPORT

Remedial Investigation
Ley Creek Dredged Material Area

General Motors Corporation
Inland Fisher Guide
Syracuse, New York

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O'BRIEN & GERE
ENGINEERS, INC.

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REPORT

REMEDIAL INVESTIGATION

LEY CREEK DREDGED MATERIAL AREA

INLAND FISHER GUIDE DIVISION

GENERAL MOTORS CORPORATION

SYRACUSE, NEW YORK

SEPTEMBER 1993

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EXECUTIVE SUMMARY

The Ley Creek Dredged Material Area (site) is located along the south bank of Ley Creek between Townline Road and the Town of Salina Highway Garage in Onondaga County, New York. Materials dredged from Ley Creek were placed at the site during channel improvement programs conducted by Onondaga County. Following several investigations (EDI, 1985[a]; EDI, 1985[b]; O'Brien & Gere Engineers, 1987[a]; and O'Brien & Gere Engineers, 1989) conducted in the area of the site on behalf of the Inland Fisher Guide Division of General Motors (GM-IFG), the New York State Department of Environmental Conservation (NYSDEC) classified the approximately 1,000 feet length of dredged materials on the south bank of Ley Creek, beginning at the GM-IFG Outfall 003 and extending west, as a Class 2 site in the NYS Registry of Inactive Hazardous Waste Disposal Sites. A Remedial Investigation (RI) was conducted under a Consent Order between GM-IFG and NYSDEC to support previous investigatory work. The RI and previous investigations addressed the site and the area between Factory Avenue and Ley Creek extending approximately 4,000 ft west of the western site boundary (study area). The RI was conducted by O'Brien & Gere Engineers, Inc. on behalf of GM-IFG in accordance with the Remedial Investigation/Feasibility Study (RI/FS) Work Plan (O'Brien & Gere Engineers, 1992). This Report summarizes activities performed and data generated during the RI and previous investigations.

Investigatory activities conducted during the RI included installation of two deep monitoring wells and ground water sampling of new and existing wells, surface and subsurface soil sampling, sediment sampling, fish sampling, and storm sampling of GM-IFG Outfall 003 discharge water and sediment. A risk assessment and fish and wildlife impact analysis were also completed as part of the RI.

The site is characterized by relatively low, flat topography and is located in the watershed and along the floodplain of Ley Creek. Topography is hummocky and undulating in the areas of dredged material deposits.

Two deep monitoring wells were installed in the glacial till during the RI; ground water samples were collected from these wells and the 14 existing shallow wells and analyzed for polychlorinated biphenyls (PCBs). Ground water elevation measurements indicate shallow ground water flows north, discharging to Ley Creek. The calculated hydraulic gradient across the site in July 1992 was 0.021 ft/ft; the average hydraulic gradient, based on 1988, 1989, and 1992 calculated values, was 0.022 ft/ft. Shallow ground water flow velocity was calculated to be 0.08 feet/day. An estimated 11,035 gallons of ground water per day discharge from the site to Ley Creek. An upward flow potential exists between the upper fluvial deposits and the underlying till. Newly installed well OBG-9D is an artesian well.

PCB concentrations in filtered ground water samples and unfiltered deep well samples collected during the RI were less than detectable. PCB detections in unfiltered shallow ground water samples collected during the RI ranged from less than detectable to 4.2 ug/l, identified as Aroclor 1248. As a result of equipment blank contamination during ground water sampling in the RI, several of the PCB detections were qualified as less than detectable at elevated detection limits. Although qualified, ground water analytical data generated during the RI are useful as estimates of the maximum concentrations of PCBs potentially present in the wells. Although detected concentrations exceeded the NYS Class GA ground water standard of 0.1 ug/l, data indicate generally lower PCB concentrations in ground water than those indicated by previous investigations; data also indicate PCBs do not extend to ground water in the glacial till.

Detections of PCBs in unfiltered ground water samples and indication by hydraulic data that study area ground water discharges to Ley Creek demonstrate a potential for PCBs to discharge to the creek with ground water. Based on the calculated ground water discharge rate in the area of PCB detections in ground water during the RI and the mean PCB concentration detected in unfiltered ground water samples during the RI, potential mass transport of PCBs to Ley Creek from ground water at the study area was calculated to be 5.8×10^{-2} lb/day. RI data were used for this calculation because they provide the most current representation of site conditions. This calculation is conservative because it is based on the assumption that total PCBs detected in unfiltered ground water samples migrate to Ley Creek. It is likely that much of the PCBs detected in unfiltered ground water samples were not dissolved but were adsorbed to particulates in the sample; sorption interactions with aquifer solids also retard the migration of PCBs from the vicinity of the wells to the creek. Although the mass transport calculation indicated ground water discharge potentially contributes PCBs to Ley Creek, a mixing calculation based on potential mass transport and an average Ley Creek flowrate indicated that ground water discharge does not likely solely cause exceedence of the NYS Class B surface water standard of 1×10^{-3} ug/l. The mixing calculation yielded a theoretical Ley Creek surface water concentration of 2.0×10^{-4} ug/l.

Fourteen soil borings were installed on the north side of Factory Avenue during the RI to evaluate if there remains a significant source of PCBs associated with the former drainage ditch in this area. Six soil borings were also installed on the north side of Factory Avenue to evaluate whether certain detections of PCBs on the south side of Factory Avenue during the Onondaga County interceptor sewer installation extended north of Factory Avenue. Finally, three soil borings were installed for the purpose of obtaining samples for an independent treatability investigation.

From the borings installed during the RI, 54 composite soil samples were analyzed for PCBs. PCB concentrations in the borings installed during the RI ranged from less than detectable to 140 mg/kg dry weight. Samples analyzed for the purpose of locating the former drainage ditch did not exhibit elevated concentrations such as those observed on the south side of Factory Avenue in the former drainage ditch vicinity.

PCBs were detected on the north side of Factory Avenue at lower concentrations than those detected across Factory Avenue on the south side during the sewer installation. With the exception of two samples, Aroclor 1248 was the only aroclor detected in the subsurface soil samples; Aroclors 1248 and 1260 were detected in two samples from one off-site soil boring (B-6M) located approximately 2,000 ft west of GM-IFG Outfall 003.

Detection of Aroclor 1260 during the RI was limited to two isolated locations, boring B-6M and one surface soil sample location LCSS-4, each distanced from GM-IFG. Aroclor 1260 is not historically associated with GM-IFG process operations; Aroclor 1260 has not been detected in the past in environmental matrices associated with the dredged materials (soil, ground water), nor is it associated with the GM-IFG stormwater discharge. Aroclor 1260 is associated with electrical equipment; utility poles with transformers are present in the study area.

Surface soil samples were also collected during the RI from five locations and analyzed for PCBs. PCB concentrations in surface soil samples ranged from 0.048 mg/kg to 16 mg/kg dry weight, generally decreasing in the westerly direction.

Nine composite sediment samples were collected from Ley Creek during the RI. Sample locations were located approximately one-half mile upstream of GM-IFG Outfall 003, in the vicinity of GM-IFG Outfall 003, and approximately one-half mile downstream of GM-IFG Outfall 003. PCBs were not detected in upstream sediment samples; Aroclor 1248 was detected at one of the outfall sample locations, approximately 100 feet downstream of the outfall, and at the three locations approximately one-half mile downstream of the outfall at concentrations ranging from 0.19 mg/kg to 0.81 mg/kg dry weight. PCB concentrations in sediments in 1992 were generally lower than, or similar to, those detected in previous GM-IFG investigations.

Fish were collected during the RI using electroshocking techniques from three sampling locations: approximately one-half mile upstream of GM-IFG Outfall 003, in the vicinity of GM-IFG Outfall 003, and approximately one-half mile downstream of GM-IFG Outfall 003. Fish species collected included: pumpkinseed, mudminnow, stickleback, banded killifish, dace, white sucker, golden shiner, carp, and creek chub. Species were selected for analysis for comparison to previous data and for use in the fish and wildlife impact analysis and the risk assessment. Aroclor 1248 concentrations in whole fish samples ranged from less than detectable to 1.1 mg/kg; Aroclor 1260 concentrations in whole fish ranged from less than detectable to 0.7 mg/kg. Aroclor 1248 concentrations in fish filets or edible portion samples ranged from 0.11

mg/kg to 2.4 mg/kg; Aroclor 1260 was not detected in fish filets or edible portion samples. Comparisons of fish from upstream, outfall, and downstream sampling locations could not be made due to the tendency of the fish collected to migrate for several miles (Creech, 1992). Potential PCB transport pathways to Ley Creek in the study area (outfall discharge, ground water discharge, and surface runoff) likely contribute PCBs to fish; quantitative conclusions could not, however, be drawn related to the proportionate contribution by these pathways versus possible non-study area related sources to PCBs in fish. Because potential PCB transport pathways to Ley Creek are not fully related to the dredged material, quantitative conclusions could also not be drawn related to the contribution of the dredged material itself to PCBs in fish. The fish investigation was performed to comply with NYSDEC's requirement that fish sampling and analyses be performed during the RI for the purposes of comparison to previous data and use in the risk assessment (Kelly, 1989).

Samples of outfall discharge water were collected from GM-IFG Outfall 003 over a two hour period during a storm event during the RI and analyzed for PCBs. Aroclor 1248 was detected in the first two samples collected at concentrations of 1.2 ug/l and 1.8 ug/l; PCBs were not detected in the last two samples collected. Aroclor 1248 was detected in a sediment sample collected from the outfall pipe at a concentration of 0.18 mg/kg.

Potential pathways for PCB transport to Ley Creek in the study area include outfall discharge, ground water discharge, and surface runoff. The proportionate contributions of PCBs to Ley Creek by these pathways is undefined. The degree to which the dredged material contributes to these pathways is also undefined based on the following considerations:

- GM-IFG Outfall 003 discharge is a source of PCBs to Ley Creek; PCBs in outfall discharge are not related to the dredged material;
- Uncertainties exist as to whether the dredged material acts as a source of dissolved PCBs in site ground water; and
- The occurrence of surface runoff is not likely due to heavy vegetation at the site and a lack of evidence of erosion of dredged material.

The environmental fate of PCBs was documented to support the risk assessment and fish and wildlife impact analysis. PCBs have a low solubility in water and are strongly attracted to and favored in matrices high in organic carbon. Both anaerobic and aerobic biodegradation are potential PCB degradation mechanisms; volatilization, hydrolysis, and oxidation also provide degradation of PCBs. Due to the lipophilic and relatively inert nature of PCBs, they have a propensity to bioaccumulate in aquatic and terrestrial organisms.

The risk assessment prepared for the field investigation (O'Brien & Gere Engineers, 1989) was revised based on current United States Environmental Protection Agency (USEPA) guidelines to incorporate data generated during the RI and to address the fish ingestion exposure pathway. The risk assessment was conducted in five phases: characterization of exposure setting, data evaluation, exposure assessment, toxicity assessment, and risk characterization. Complete exposure pathways considered for the study area included direct contact of sediments and surface soils and ingestion of fish. Average and upper bound excess cancer risks and hazard indices (HIs) for direct contact with soils, direct contact with sediments, and ingestion of PCB residues in fish are as follows:

Exposure Pathway	Receptor	Average Excess Cancer Risk	Average HI	Upper Bound Excess Cancer Risk	Upper Bound HI
Direct Contact With Study Area Soil	Adults	7.5×10^{-8}	2.4×10^{-3}	5.0×10^{-7}	3.4×10^{-3}
	Children	2.3×10^{-7}	5.1×10^{-3}	3.3×10^{-7}	7.2×10^{-3}
Direct Contact With Study Area Sediments	Adults	2.3×10^{-9}	7.3×10^{-5}	7.0×10^{-8}	4.8×10^{-4}
	Children	2.8×10^{-8}	6.1×10^{-4}	1.8×10^{-7}	4.0×10^{-3}
Ingestion of PCB Residues in Fish	Adults	6.0×10^{-6}	8.6×10^{-2}	6.0×10^{-5}	2.6×10^{-1}
	Children	5.2×10^{-6}	1.1×10^{-1}	1.6×10^{-5}	3.4×10^{-1}

These risks are not a realistic presentation of actual study area risks to human health; they overestimate actual human health risks due to utilization of conservative exposure assumptions and dose response models as recommended by USEPA's standardized risk assessment methodology. The risks calculated for the fish ingestion pathway are especially unrealistic as the nature, size, and quantity of fish inhabiting Ley Creek in the vicinity of the study area do not make the study area a desirable location for subsistence or recreational fishing. Aesthetic problems in Ley Creek resulting from raw discharges and combined sewer overflows preclude fishing in the creek (NYSDEC, 1992). Risk calculations were performed to comply with NYSDEC's requirement that the fish ingestion pathway be evaluated (Kelly, 1989).

A Step I fish and wildlife impact analysis was performed in accordance with NYSDEC guidelines to evaluate whether ecological receptors inhabiting the study area could potentially be exposed to site-related contaminants. Three natural and three cultural covertypes exist in the study area; two natural covertypes provide good quality habitat for a variety of wildlife species. Cultural covertypes do not provide significant habitats which are capable of supporting a diversity of wildlife species. The study area is located within a NYS regulated wetland. Ley Creek general water quality is considered by NYSDEC to be very poor on a scale of criteria defined in the RIBS report (NYSDEC, 1992). NYSDEC's assessment was based on a severely impacted macroinvertebrate community at a Lemoyne Avenue sampling site, water column quality (parameters of concern include iron, mercury, lead, zinc, dissolved solids, total and fecal coliform, and trichloroethene), sediment quality (parameters of concern include cadmium, iron, copper, mercury, lead, nickel, zinc, and PCB Aroclors 1016, 1242, 1254, and 1260), and raw discharges and combined sewer overflows into Ley Creek (NYSDEC, 1992). Complete exposure pathways include soil, considered to have minimal impact on study area biota; surface water; and sediment. The food chain exposure pathway is considered complete, but quantitative conclusions can not be drawn related to the proportionate contribution of the study area to this pathway versus other non-study area related sources of PCBs to fish in Ley Creek.

It was concluded that the site has been adequately characterized to allow for the performance of the FS.

SECTION 1 - INTRODUCTION

1.01 Objectives and Overview

An RI was performed by O'Brien & Gere Engineers, Inc. on behalf of GM-IFG at the Ley Creek Dredged Material Area (site) in Syracuse, New York in accordance with a NYSDEC Order on Consent (#A7-0239-90-07). The RI was conducted in accordance with the RI/FS Work Plan (O'Brien & Gere Engineers, 1992) approved by NYSDEC on June 3, 1992 (Schick, 1992), consistent with the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA); the *National Oil and Hazardous Substances Pollution Contingency Plan* (NCP, 1990); and the United States Environmental Protection Agency's (USEPA's) *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA, 1988).

The objective of the RI was to build upon previous investigations and complete characterization of the horizontal and vertical extent of PCBs at the site. The following tasks were performed during the RI:

Task 1 - Compilation of Existing Data

Task 2 - Soil Sampling and Analyses

Task 3 - Monitoring Well Installation and Ground Water Sampling and Analyses

Task 4 - Fish Sampling and Analyses

Task 5 - Sediment Sampling and Analyses

Task 6 - Outfall Sampling and Analyses

Task 7 - Fish and Wildlife Impact Analysis

Task 8 - Risk Assessment

Task 9 - Remedial Investigation Report

The data generated during the RI are presented in this RI Report, in which data generated from the following GM-IFG studies are also incorporated: "Hydrogeologic Investigation" (EDI, 1985[a]), "Oil and PCB Sampling and Analyses of Portions of Ley Creek" (EDI, 1985[b]), "Hydrogeologic Investigation of Fill Area Along Ley Creek" (O'Brien & Gere Engineers, 1987[a]), and "Field Investigation" (O'Brien & Gere Engineers, 1989).

1.02 Site Description

The Ley Creek Dredged Material Area is located along the south bank of Ley Creek in the Town of Salina, Onondaga County, New York. A site location map is presented as Figure 1. The site is listed in the NYS Registry of Inactive Hazardous Waste Disposal Sites as extending approximately 1,000 ft west from the GM-IFG Outfall 003 along the south bank of Ley Creek. In the vicinity of the site, Ley Creek is less than 15 feet wide and less than 2 feet deep in most places. Dredged material generated during a channel improvement program conducted by the Onondaga County Department of Drainage and Sanitation lines the south bank of Ley Creek in the area of the site. A fence extends along the south side of the study area approximately 10 ft north of Factory Avenue.

Ley Creek drains an area of approximately 30 square miles. With the exception of the northeast portion, the Ley Creek drainage basin can generally be described as a highly urbanized area. Portions of the cities and towns of Syracuse, North Syracuse, East Syracuse, Cicero, Clay, Dewitt, Manlius, and Salina are located in the Ley Creek drainage basin. Several industries and businesses are also located in the Ley Creek drainage basin, including GM-IFG, Bristol-Myers Squibb Company, Carrier Corporation, Syracuse China Corporation, New Process Gear, and General Electric Company. Also located in the Ley Creek watershed are 14 miles of highway, eight interchanges, a service facility for the New York State Thruway, a Niagara-Mohawk Power Corporation electrical transfer station, Syracuse International Airport, and the US Air Force's Hancock Field. Streets, shopping areas, parking lots, and buildings cover other areas of this watershed. The northeast portion of the watershed is relatively undeveloped. The large areas of impermeable surfaces in the Ley Creek watershed cause rapid runoff during storms, resulting in rapid water level changes in the creek.

Industrial effluent streams and urban storm water runoff discharge into Ley Creek. Eight discharges into Ley Creek are permitted which originate from Sunnyside Nursing Home, Oberdorfer Foundries, and Roth Brothers Smelting Corporation, all upstream of GM-IFG; Ley Creek Pump Station, Lyncourt Sewer District, and Syracuse China Corporation, downstream of GM-IFG; and GM-IFG. Potential upstream sources of PCBs to Ley Creek include Roth Brothers Smelting Corporation, whose NYSDEC State Pollutant Discharge Elimination System (SPDES) permit includes PCB discharge limits (NYSDEC, 1989); Carrier Corporation, which discharges to Ley Creek upstream tributary Sanders Creek and has been documented to use PCBs (NYPIRG, 1983); and Hancock Field, where PCB-contaminated soils were stored uncontained and used for fill material in a hole approximately 30 ft from Ley Creek (Post Standard, 1992).

Ley Creek flows to the west and discharges to Onondaga Lake; the average Ley Creek flow rate at the USGS gauging station near Park Street for 11 years of record (1980 to 1990) is 32.9 ft^3/second (Colbert, 1992). The Onondaga County Department of Drainage and Sanitation monitors various water quality parameters and metals at the USGS gauging station near Onondaga Lake. In 1983, Ley Creek discharged less than 10% of the total estimated annual loading of all monitored pollutants to Onondaga Lake except biochemical oxygen demand (BOD), silica, and lead (10.5%, 10.5%, and 12.2%, respectively) (Calocerinos & Spina, 1984).

1.03 Site History

Prior to the early 1970's, the combination of poor channel conditions and large impermeable areas in the Ley Creek watershed caused extensive flooding, some of the worst of which was near the GM-IFG facility in 1969 (Calocerinos and Spina, 1969). The formation of the Ley Creek Drainage District and clearing and dredging of the channel occurred after the 1969 flooding event. Dredging of Ley Creek was performed by the Onondaga County Department of Drainage and Sanitation. In 1970, the section of the creek between Seventh North Street and Route 11 was dredged. Portions of the creek between Seventh North Street and Onondaga Lake were dredged in 1971. Ley Creek was dredged from Townline Road to Onondaga Lake in 1975. In 1983, the section of the creek between Townline Road and Route 11 was dredged (EDI, 1985[b]). Dredged material generated during these activities was placed along the south bank of the creek or used for land restoration projects.

A hydrogeologic investigation performed by EDI Engineering and Science (EDI) pursuant to a SPDES Consent Order indicated the presence of PCBs in the dredged material at the site. One source of the PCBs is believed to have originated from materials previously used in hydraulic equipment for die casting operations at the GM-IFG facility (EDI, 1985[a]). Data generated during this investigation which are relevant to the site are presented in Section 3 of this report.

In 1985, EDI also completed a program to evaluate the occurrence and concentration of PCBs in the sediments and water of Ley Creek. Sediment and water samples were collected at 500 feet intervals along a 4,000 feet length of Ley Creek, which included a 1,000 feet length upstream of GM-IFG Outfall 003 and a 3,000 feet length downstream of GM-IFG Outfall 003. During this study, fourteen fish inhabiting Ley Creek were caught and analyzed for PCBs. The pattern of PCB occurrence observed in sediments was irregular; the irregularity was attributed to the Ley Creek dredging program completed in 1983. Data generated during this investigation which are relevant to the site are presented in Section 3 of this report. The report cited background information indicating that Aroclors 1242 and 1248, which occurred in GM-IFG effluent, were not identified in Onondaga Lake fish, which contained PCB Aroclors 1016, 1254, and 1260 (EDI, 1985[b]).

Subsequent to the completion of the EDI study, NYSDEC requested that GM-IFG perform a more detailed study of the area between Factory Avenue and Ley Creek. Pursuant to NYSDEC's request, GM-IFG completed an investigation in 1987 of dredged materials and ground water in the area between Factory Avenue and Ley Creek beginning at Townline Road and continuing for 1,600 feet downstream. Ground water flow was determined to be north towards Ley Creek. PCBs were detected in dredged material (hereafter referred to as soil) and ground water samples

(O'Brien & Gere Engineers, 1987[a]). Data generated during this investigation are summarized in Section 3 of this report.

As a result of the 1987 investigation, NYSDEC decided that a more comprehensive evaluation of the Ley Creek dredged material would be necessary to define the extent of PCBs along the north and south banks of Ley Creek and evaluate the impacts to public health and the environment. GM-IFG completed a field investigation of the site in 1989 which included ground water, soil, sediment, and surface water sampling (O'Brien & Gere Engineers, 1989). The results of this field investigation are discussed in Section 3 of this report.

In its comments on the Field Investigation Report, NYSDEC indicated a desire for: (i) additional investigatory work to be performed at the site to complete the characterization of the areal and vertical extent of contamination present and (ii) the performance of a habitat based assessment (Kelly, 1989). GM-IFG and NYSDEC signed an Administrative Order on Consent for performance of an RI/FS at the site on May 23, 1991. Based on NYSDEC's Field Investigation Report comments and on several meetings between GM-IFG and NYSDEC, a Work Plan was developed for an RI/FS for the site (O'Brien & Gere Engineers, 1992) and approved by NYSDEC on June 3, 1992 (Schick, 1992).

SECTION 2 - STUDY AREA INVESTIGATORY ACTIVITIES

As discussed in Section 1.03, investigatory activities performed in the area of the site included a Ley Creek sampling program and a hydrogeologic investigation in 1985 by EDI Engineering & Science. Further, a hydrogeologic investigation in 1986/87, a field investigation in 1988/89, and the 1992 RI included investigatory activities performed by O'Brien & Gere Engineers, Inc. Geophysical surveys were performed during the 1988/89 field investigation. Monitoring wells were installed during the 1986/87 hydrogeologic investigation, the 1988/89 field investigation, and during the RI; ground water was sampled from monitoring wells during these investigations. Samples were collected from soil borings installed at the study area during the 1986/87 hydrogeologic investigation, the 1988/89 field investigation, and the RI. In addition, soil borings were installed north of Factory Avenue in the area of the study area by Blasland & Bouck Engineers, P.C. in 1988 for the purpose of investigation of a proposed alternate sewer route for the Ley Creek interceptor sewer project. Surface soil sampling was performed during the RI. Surface water sampling in Ley Creek was performed during three investigations: the 1985 Ley Creek sampling program, the 1985 hydrogeologic investigation, and the 1988/89 field investigation. Ley Creek sediments were sampled during the 1985 Ley Creek sampling, the 1988/89 field investigation, and the 1992 RI. Fish were collected for analysis in both the 1985 Ley Creek sampling program and the 1992 RI. Air sampling was performed during the 1988/89 field investigation. Finally, discharge water and sediment were sampled from GM-IFG Outfall 003 during the RI. These investigatory activities are described in Section 2, and the results of the activities are discussed in Section 3 of this report.

2.01 Geophysical Surveys; 1988/89 Field Investigation

Surface geophysical surveys were performed at the study area during the 1988/89 field investigation to evaluate the applicability of these techniques in delineating the horizontal and vertical limits of dredged material with respect to native materials. The techniques evaluated included electromagnetic terrain conductivity and electrical resistivity methods (O'Brien & Gere Engineers, 1989).

The study area is traversed by unshielded overhead high-tension power lines. In addition, underground utilities include a sewer main which runs south of Factory Avenue and a buried power line located along the eastern portion of the property. Preliminary inspection revealed the study area to be undeveloped, undulating, and covered with varying densities of tall weeds, brush and trees. Elevated mounds of fill material are evident throughout the study area. The mounds are composed of a variety of materials, including dredged fill and hard fill (concrete, rebar, pipes, etc.). The formerly flat area along Factory Avenue was used by numerous individuals (not GM-IFG) for open dumping of debris. These changes in surface materials, resulting from dumping and dredging, topographic irregularities and discontinuities (drainage, ravines, dense vegetation, etc.), and the presence of the overhead power lines preclude accurate resistivity data collection. In addition, the resistivity probes could not be driven into the hard fill materials and/or frozen ground conditions (O'Brien & Gere Engineers, 1989).

To evaluate the feasibility of electromagnetic techniques at the study area, a single traverse line 300 feet in length was established in a centralized area where quantitative cultural effects or interference (power lines, metal debris, etc.) would be at a minimum. A Geonics EM-31 Electromagnetic Terrain Conductivity Meter was used throughout the test survey. The traverse was essentially oriented east to west along the central portion of the study area. The initial 150 feet of the traverse was located in the immediate vicinity of the power lines. The remaining 150 feet of the traverse was located approximately 50 feet (horizontal distance) from the overhead power lines. Data were collected at 10 foot intervals along the initial 150 feet of the traverse. Data stations were located adjacent to and over elevated fill areas to evaluate conductivity variations related to changes in fill materials, and to assess the effects of cultural interferences. To further assess the quantitative effects of the cultural interferences ("noise"), additional data were also collected adjacent to the traverse, beneath the power lines, and along the creek bank, which is located approximately 100 feet from the power lines (O'Brien & Gere Engineers, 1989).

A review of the data revealed that conductivity contrasts between fill and non-fill materials were subtle (0 to 5 millimhos/meter) and/or poorly defined. By comparison, data variations related to the distance from the overhead power lines varied as much as 15 to 20 millimhos/meter. The cultural influences therefore affected the data values by as much as four times the actual variation in the soil conductivity (O'Brien & Gere Engineers, 1989). It was concluded that neither electromagnetic nor electrical resistivity techniques were suitable for delineating the horizontal and vertical limits of the dredged materials with respect to native soils.

2.02 Monitoring Well Installation

A total of 17 ground water monitoring wells were installed at the study area between November 10, 1986 and July 24, 1992. Monitoring wells installed during the 1986/1987 hydrogeologic investigation were installed using 3 1/4 inch inside diameter (I.D.) hollow stem augers. Wells completed during the subsequent 1988/1989 field investigation and 1992 RI were completed using 4 1/4 inch I.D. hollow stem augers. Subsurface materials were sampled continuously using 2 inch outside diameter split spoons. These samples were visually inspected and logged by the on-site hydrogeologist. A representative portion of each sample was retained for reference (O'Brien & Gere Engineers, 1987 and O'Brien & Gere Engineers, 1989).

Monitoring wells installed during the 1986/1987 investigation were constructed of 2 inch diameter galvanized pipe fitted with stainless steel well screens, as described in Section 2.02.1. The monitoring wells installed during the 1988/1989 and 1992 investigations were constructed of 2 inch diameter stainless steel well casing and wire wound stainless steel screens. The monitoring well screens were positioned so that a portion of each well screen was not submerged wherever possible (water table greater than 2 feet from the ground surface). In this manner, non-aqueous phase liquids with specific gravities less than water (s.g. = 1.0) could be detected at the water table surface, if present (O'Brien & Gere Engineers, 1987 and O'Brien & Gere Engineers, 1989).

Subsequent to well installation, the monitoring wells were developed with a low yield centrifugal pump and/or bottom loading bailer, to clear away fine grained materials that settled in or around the well during installation. Development was completed to maximize the ability of the well to transmit representative portions of ground water. Well development was continued until each well exhibited relatively sediment free ground water (O'Brien & Gere Engineers, 1987 and O'Brien & Gere Engineers, 1989).

Monitoring well data are summarized in Table 1. Boring logs and well construction data are included in Appendix A. The locations of the monitoring wells are shown on Figure 2 and described below.

2.02.1 1986/87 Hydrogeologic Investigation

Nine ground water monitoring wells were installed to the south of Ley Creek between November 10, 1986 and November 24, 1986. Monitoring wells OBG-1, OBG-2, OBG-3, OBG-5, and OBG-6 were installed adjacent to Ley Creek at approximately 300 feet intervals. Monitoring wells OBG-4, OBG-7A, OBG-7B, and OBG-7C were located in the vicinity of the former drainage ditch which drained the facility holding pond. Locations were selected based on a 1975 aerial photo which identified the location of this former drainage ditch bisecting the study area. Monitoring well OBG-7A was installed in the approximate center of the former drainage ditch, while OBG-4, OBG-7B, and OBG-7C extended laterally away from OBG-7A and were installed at 50 feet intervals (O'Brien & Gere Engineers, 1987[a]).

The wells were installed in the fill material immediately above the natural silty clay. The monitoring wells were installed to a depth of approximately nine feet, with the exception of OBG-6, which was installed to a depth of 17 feet because of the greater depth at which native materials were encountered. The wells in the vicinity of the former drainage ditch were constructed using a 3 feet length of 2 inch I.D. stainless steel screen connected to a 2 inch galvanized steel riser. The remaining wells were constructed using a 5 feet length of 2 inch I.D. stainless steel screen and galvanized riser (O'Brien & Gere Engineers, 1987[a]).

2.02.2 1988/89 Field Investigation

During the 1988/1989 field investigation, six ground water monitoring wells were installed between Townline Road and the Town of Salina Garage, to the west of the existing monitoring wells. Five of the wells, designated as MW-8, MW-9, MW-10, MW-11, MW-12, and MW-13, were installed along the south side of Ley Creek. One well, MW-11, was installed along the south side of Factory Avenue to serve as an upgradient monitoring point (O'Brien & Gere Engineers, 1989).

2.02.3 1992 Remedial Investigation

During the 1992 RI, two deep ground water monitoring wells were installed. One well, designated as OBG-3D, was installed adjacent to existing monitoring well OBG-3. An additional deep well, designated as MW-9D, was installed adjacent to existing monitoring well MW-9. These wells were installed to the top of bedrock to assess the ground water quality and potential flow conditions at depth.

2.03 *In Situ* Hydraulic Conductivity Tests

In situ hydraulic conductivity tests were performed on the ground water monitoring wells installed during the 1986/1987 hydrogeologic investigation and 1988/1989 field investigation. The tests were performed in order to obtain data necessary to evaluate ground water flow velocities through the subsurface materials.

These tests were performed by evacuating a volume of water from the well, thus creating a change in hydraulic head between the well and the surrounding aquifer. The rate of recovery of the water level was then measured in the well. This recovery rate is a function of the hydraulic conductivity of the aquifer. The collected data were interpreted using Hvorslev's formula to evaluate the hydraulic conductivity of the material at each well location. The data and associated hydraulic conductivity test results are presented in Appendix B. The resultant calculated hydraulic conductivity values (K) are presented in Table 1 (O'Brien & Gere Engineers, 1987 and O'Brien & Gere Engineers, 1989).

2.04 Well Elevation Survey

Subsequent to monitoring well installation, datum control surveys were performed to establish the location and elevation of each of the monitoring wells. Top of casing and ground elevations were measured relative to an assumed datum. These data are presented on Table 1.

Ground water elevation measurements were collected from monitoring wells on October 6, 1988; April 4, 1989; and July 29, 1992 in conjunction with the 1986/1987 hydrogeologic investigation, the 1988/1989 field investigation, and 1992

RI, respectively. These data were collected to evaluate study area ground water flow conditions. The summarized data are presented in Table 1.

2.05 Ground Water Sampling and Analyses

Ground water samples were collected from the monitoring wells in December 1987, October 1988, April 1989, and July 1992. Ground water sampling field logs are included in Appendix C. The ground water monitoring well locations are shown on Figure 2.

2.05.1 1986/87 Hydrogeologic Investigations

Ground water samples were collected in December 1986 from the ground water monitoring wells that were installed during the 1986/87 hydrogeologic investigation (OBG-1 through OBG-7C). The ground water samples were collected according to methods and procedures outlined in the work plan (EDI, n.d.). Prior to sampling, five well volumes of water were removed to provide representative ground water samples. The samples were collected with a bottom-loading stainless steel bailer and transferred into the appropriate sample containers. Prior to sampling, the bailer was thoroughly decontaminated between wells using an acetone-methanol-distilled water sequence of rinses, followed by a wipe using a clean, distilled water soaked towel (O'Brien & Gere Engineers, 1987[a]).

Following sample collection, the ground water samples were properly preserved in the field and stored in appropriate containers. The samples were promptly placed on ice and transported to OBG Laboratories, Inc. in

Syracuse, New York. Samples were transferred to the laboratory following chain of custody procedures. The samples were submitted for oil and grease analysis using USEPA Method 413.1, volatile halogenated organics using USEPA Method 601, and PCBs using USEPA Method 608 (O'Brien & Gere Engineers, 1987[a]).

2.05.2 1988/89 Field Investigations

Ground water samples were collected on October 6, 1988 and April 4, 1989 from each of the monitoring wells according to the procedures described in the work plan (O'Brien & Gere Engineers, 1987[b]). The sampling events were separated by a six-month period to monitor ground water quality during dry and wet seasonal conditions. Prior to collecting a ground water sample, the standing water within the well and filter pack was evacuated by removing a minimum of three well volumes of water from the well using a bottom loading stainless steel bailer. Once a sufficient volume of water was available within each ground water monitoring well following well evacuation, a ground water sample was collected using a bottom loading stainless steel bailer. Field sampling logs are presented in Appendix C (O'Brien & Gere Engineers, 1989).

Following sample collection, the ground water samples were properly preserved in the field and stored in appropriate containers. The samples were promptly placed on ice and transported to OBG Laboratories, Inc. Samples were transferred to the laboratory following chain of custody procedures. The samples were submitted for analysis of PCBs using USEPA Method 608 (O'Brien & Gere Engineers, 1989).

2.05.3 1992 Remedial Investigation

Each of the installed monitoring wells, with the exception of wells OBG-3D, MW-9D, and OBG-6 were sampled on July 24, 1992 during the RI. Samples were collected in accordance with the procedures described in the approved RI/FS Work Plan (O'Brien & Gere Engineers, 1992). Wells were developed and allowed to stabilize overnight prior to sampling. The newly installed deep wells, OBG-3D and MW-9D, were sampled on July 29, 1992. Well OBG-6 was sampled on September 17, 1992; OBG-6 was not sampled on the same day as the other wells because of a bent casing, which required a different sampling technique to be used. Monitoring well MW-11 was not sampled during the RI, as the well was demolished during the installation of the Onondaga County interceptor sewer located along the south side of Factory Avenue. The sample collection methods were the same as those detailed in Section 2.05.2. Field sampling logs are presented in Appendix C.

Following sample collection, the ground water samples were preserved in the field and stored in appropriate containers. Both filtered and unfiltered samples were collected. Filtering consisted of passing the ground water sample through dedicated tygon tubing attached to a 0.45 um filter. The samples were promptly placed on ice and transported to H2M Laboratories, Inc. in Melville, New York following chain of custody procedures. The samples were submitted for analysis of PCBs using Method 91-3 in accordance with NYSDEC's Analytical Services Protocol (ASP) (NYSDEC, 1991[c]).

2.06 Soil Boring Installation

A total of 55 soil borings were completed during the 1986/87 Hydrogeologic Investigation, the 1988/89 Field Investigation, and the RI between November 10, 1986 and December 4, 1992. Soil borings were completed using 3 1/4 inch I.D. hollow stem augers. Subsurface materials were sampled continuously using 2 inch outside diameter split spoons in accordance with ASTM Method D-1586-84. Each collected soil sample was divided lengthwise into two halves. One half of the sample was transferred to an appropriate sample container and the remaining half was visually inspected and logged by an on-site hydrogeologist.

The boreholes completed between November 10 and November 24, 1986 were subsequently completed as ground water monitoring wells as described in Section 2.02.1. Subsequent borings were backfilled with drill cuttings and capped with a minimum one foot thick plug of bentonite/cement grout.

Logs for borings installed by O'Brien & Gere Engineers are included in Appendix A. The locations of the soil borings are shown on Figure 2 and are described below.

2.06.1 1986/87 Hydrogeologic Investigation

Nine soil borings were completed to the south of Ley Creek between November 10, 1986 and November 24, 1986. Soil samples were collected continuously at two foot intervals from the ground surface to the bottom of the boring. The soil borings were installed in the fill material immediately above the natural silty clay. After completion of each soil boring, a ground water monitoring well was installed within the soil boring borehole as described in Section 2.02.1. Completed wells were designated as OBG-1 through OBG-6, OBG-7A, OBG-7B, and OBG-7C (O'Brien & Gere Engineers, 1987[a]). The soil borings were completed to a depth of approximately nine feet, with the exception of OBG-6, which was completed to a depth of 17 feet due to the greater depth at which native materials were encountered.

2.06.2 1988 Onondaga County Factory Avenue Sampling Program

Fourteen soil borings were installed in August 1988 as part of an investigation performed by Blasland & Bouck Engineers, P.C. for the Onondaga County Department of Drainage and Sanitation for the purpose of investigating a proposed alternate sewer route for the Ley Creek interceptor sewer project. Borings were installed on either side of the chain link fence at seven locations north of Factory Avenue and were located between approximately 500 feet and 4,100 feet west of Townline Road. Boring locations are indicated in Exhibit A (Blasland & Bouck Engineers, P.C., 1988).

Seven borings (B-91A, B-97A, B-102A, B-102B, B-118A, B-122.5A, and B-127A) were drilled using a Mobile-57 drill rig and 4 1/4 inch I.D. hollow stem augers. Seven borings (B-91B, B-97B, B-109A, B-109B, B-118B, B-122.5B and B-127B) were installed using a tripod rig due to locations being inaccessible to the mobile drill rig. Subsurface materials were sampled continuously using 2 inch outside diameter, 24 inch long split spoons. For each "A" boring south of the fence, samples were collected continuously to five feet below the approximate depth of the original ground surface, then every five feet to a depth of at least three feet below the invert of the proposed sewer line. For each "B" boring north of the fence, soil samples were collected continuously to below the former ground surface (Blasland & Bouck Engineers, P.C., 1988).

2.06.3 1988/89 Field Investigation

An investigation of dredged materials was performed along the north and south banks of Ley Creek during the field investigation. A total of 23 soil borings were completed. Soil boring locations were approved by representatives of NYSDEC and the Onondaga County Department of Health (OCDOH) prior to initiating the drilling program.

Seventeen soil borings were completed along the south side of Ley Creek, between Townline Road and the Town of Salina Garage (Figure 2). Using a mobile rig, these borings were completed to approximately four to six feet below the base of the fill materials, and ranged in depth from 10 to 16 feet.

Six soil borings completed on the north side of Ley Creek were completed to a depth of eight feet using a portable tripod rig. These methods were discussed with NYSDEC and OCDOH representatives prior to implementation. The mutually agreed upon alternative method of drilling was used to access areas which were otherwise inaccessible to a mobile drilling rig (O'Brien & Gere Engineers, 1989).

2.06.4 1992 Remedial Investigation

As part of the RI, additional soil borings were installed to evaluate if the former drainage ditch still extended to the north side of Factory Avenue and to evaluate if PCBs, which were detected in soils south of Factory Avenue outside of the interim remedial measure (IRM) work area during the Onondaga County sewer line installation, extend north of Factory Avenue. As an IRM, PCB-contaminated soils were removed in the vicinity of the former drainage ditch on the south side of Factory Avenue in the area of the 1991 Onondaga County sewer line installation. Three soil borings were also installed for an independent treatability investigation. A total of 23 soil borings were completed and designated as B-24 through B-43, OBG-6M, B-6M, and OBG-3DM. With the exception of the soil borings installed for the treatability investigation, boring locations were approved by NYSDEC representatives prior to initiating the drilling program. Borings were completed to approximately 4 to 6 feet below the base of the fill materials, and ranged in depth from 8 to 14 feet.

On July 20, 1992 and July 21, 1992, borings B-24, B-25, B-26, B-27, B-28, and B-29 were completed to evaluate if the former drainage ditch extended north of Factory Avenue. The boring locations were selected based on the location of the former drainage ditch on the south side of Factory Avenue and the apparent location of the former drainage ditch as depicted on a 1957 aerial photo of the area. The aerial photo is presented as Exhibit B. Soil boring locations are indicated on Figure 2. Composite samples collected from boring B-24 were not analyzed because the boring material was suspected to be sewer bedding material. Black staining was observed in borings B-25, B-28, and B-29.

Between July 21, 1992 and July 24, 1992, borings B-30, B-31, B-32, B-33, B-34, and B-35 were installed directly across Factory Avenue on the north side from PCB detections outside of the IRM work area on the south side. Boring B-30 was installed across Factory Avenue from an area in which PCBs were detected at concentrations of 190 mg/kg, 15 mg/kg, and 1,300 mg/kg; black staining was not observed in B-30. Boring B-31 was installed across Factory Avenue from a PCB detection at a concentration of 87 mg/kg. Black staining was observed throughout B-31; borings B-32 and B-33 were subsequently installed 15 feet east and west of B-31, respectively, for the purpose of visual observation. Black staining was observed in both B-32 and B-33. Borings B-34 and B-35 were installed across from PCB detections at concentrations of 110 mg/kg and 130 mg/kg; black staining was not observed in either of these borings. Soil boring locations are presented on Figure 2. Analytical results for the above-mentioned PCB detections south of Factory Avenue are presented in Exhibit C.

On July 22, 1992 and July 23, 1992, borings B-6M, OBG-3DM, and OBG-6M were completed for the purpose of obtaining samples for an independent treatability investigation. The locations of these borings are indicated on Figure 2.

On December 4, 1992, the following borings were installed to further evaluate the existence of a significant source of PCBs associated with the former drainage ditch in this area: B-36, B-37, B-38, B-39, B-40, B-41, B-42, and B-43. Soil boring locations are indicated on Figure 2. These borings were installed for visual observation, with provisions for sampling if materials potentially indicative of the former drainage ditch were observed. Black odorous materials were observed in five of the eight borings: B-37, B-38, B-41, B-42, and B-43.

2.07 Soil Sampling and Analyses

Soil samples were obtained from the 55 soil borings that were completed between November 10, 1986 and December 4, 1992; surface soil samples were also obtained from five locations during the RI. The soil boring and surface soil sample locations are shown on Figure 2.

2.07.1 1986/87 Hydrogeologic Investigation

A total of 54 soil samples were obtained by split spoons from two feet increments from the soil borings. Soil samples were submitted to OBG Laboratories, Inc. for PCB analysis by USEPA Method 8080 and Oil and Grease by USEPA Method 9070, Gravimetric Separatory Funnel Extraction for solid materials.

2.07.2 1988 Onondaga County Factory Avenue Sampling Program

A total of 34 soil samples were obtained from borings installed by Blasland & Bouck Engineers, P.C. in 1988. Soil samples were obtained with a 2 inch diameter, 24 inch long split spoon sampler. The samples were submitted to OBG Laboratories, Inc. for PCB analysis (Blasland & Bouck Engineers, P.C., 1988).

2.07.3 1988/89 Field Investigations

A total of 71 soil samples were collected from the soil borings completed during the 1988/89 Field Investigation for analysis. Of the samples collected, 51 samples were composites to represent 4 feet sampling intervals whereas 20 samples represented 2 feet sampling intervals. Soil samples were composited in the laboratory prior to analysis because ambient air temperatures (less than 20°F) caused the samples to freeze upon exposure. The samples were submitted, using chain of custody procedures, to OBG Laboratories, Inc. for PCB analysis using USEPA Method 8080.

2.07.4 1992 Remedial Investigation

2.07.4.1 Subsurface Soil

For the purpose of evaluation whether the former drainage ditch and elevated PCB concentrations found south of Factory Avenue extend to the north side, a total of 54 soil samples from 17 of the 23 soil borings, including field duplicate samples and excluding matrix spike and matrix spike duplicate samples, were collected for analysis during the RI. Of the samples collected, 28 were composited to represent 4 feet sampling intervals, whereas 26 samples represent 2 feet sampling intervals. Soil samples were composited in the field prior to submission to the laboratory. The samples were submitted, following chain of custody procedures, to H2M Laboratories Inc. for PCB analysis by Method 91-3 in accordance with NYSDEC's ASP (NYSDEC, 1991[c]).

2.07.4.2 Surface Soil

A total of five surface soil samples were collected during the RI. Surface soil sample locations are shown on Figure 2. The surface soil samples were collected in order to assess the PCB concentrations in soils in the area of the study area bordering Factory Avenue to the north. The samples were collected from the ground surface to a depth of approximately 3 inches. The samples were transferred to the appropriate sample containers and placed on ice. The samples were submitted, following chain of custody procedures, to H2M Laboratories Inc. for PCB analysis by Method 91-3 in accordance with NYSDEC's ASP (NYSDEC, 1991[c]).

2.08 Surface Water Sampling and Analyses

2.08.1 1985 Ley Creek Sampling

Surface water samples were collected by EDI on June 11, 1985 at nine sampling stations in Ley Creek. Sampling stations were located 500 feet and

1,000 feet upstream of GM-IFG Outfall 003, and at 10 feet, 500 feet, 1,000 feet, 1,500 feet, 2,000 feet, 2,500 feet, and 3,000 feet downstream of GM-IFG Outfall 003. Water samples were collected by submerging an open bottle in the center of the creek and allowing it to fill in order to sample dissolved, not floating, oils. Bottles were rinsed with creek water three times prior to sample collection. Surface water samples were analyzed by RECRA Environmental Laboratories for PCBs, freon extractable oils, and suspended solids. Samples were qualitatively screened for the presence of Aroclors 1016, 1221, 1232, 1242, 1248, 1252, 1260, and 1268, and quantitative analyses were done on Aroclors detected by the qualitative screening (EDI, 1985[b]).

2.08.2 1985 Hydrogeological Investigation

Surface water samples were collected by EDI on July 22, 1985 from six locations in Ley Creek located approximately 70 feet, 530 feet, and 1,280 feet upstream of GM-IFG Outfall 003 and approximately 220 feet, 570 feet, and 800 feet downstream of GM-IFG Outfall 003. Sample bottles were rinsed with creek water three times, then submerged completely to collect the sample without collecting floating material. Surface water samples were analyzed by EDI's laboratory for priority pollutant volatile organics (USEPA Method 624 or 601), nickel (USEPA Method 249.1), and chromium (USEPA Method 218.1) (EDI, 1985[a]).

2.08.3 1988/89 Field Investigation

Surface water samples were collected on January 15, 1988 and April 4, 1989 to represent dry and wet seasonal conditions, respectively. Samples were collected from the following three locations indicated on Figure 2: the downstream boundary of the study area (SW-1), immediately downstream of GM-IFG Outfall 003 (SW-2), and upstream east of Townline Road (SW-3). Representative samples were collected just below the surface of the water and were composited across the creek at each location. Samples were analyzed by OBG Laboratories, Inc. for PCBs using USEPA Method 608 (O'Brien & Gere Engineers, 1989).

2.09 Sediment Sampling and Analyses

2.09.1 1985 Ley Creek Sampling

Core sediment samples were collected by EDI on June 11, 1985 from three locations at each of nine sampling stations in Ley Creek. Cores were collected midstream and adjacent to each shore at each sampling station. Sampling stations were located 500 feet and 1,000 feet upstream of GM-IFG Outfall 003, and at 10 feet, 500 feet, 1,000 feet, 1,500 feet, 2,000 feet, 2,500 feet, and 3,000 feet downstream of GM-IFG Outfall 003. In addition, one core was collected 750 feet downstream of GM-IFG Outfall 003 on the south edge of the creek because of an apparent significant amount of organic material present. Cores were collected with a Wildco hand corer; two or three six inch intervals were extruded from each core and submitted to RECRA Environmental Laboratories for analysis for PCBs, freon extractable oils, and moisture content. Sediment texture was characterized visually at the time of collection. Samples were qualitatively screened for the presence of Aroclors 1016, 1221, 1232, 1242, 1248, 1252, 1260, and 1268, and quantitative analyses were done on Aroclors detected by the qualitative screening (EDI, 1985[b]).

2.09.2 1988/89 Field Investigation

Sediment samples were collected from the six locations in Ley Creek indicated on Figure 2 on January 15, 1988. Each sample consisted of composited subsamples from three to five locations equally spaced across the creek. The three inch deep sediment samples were obtained with a one inch diameter Lexan® core. Sediment samples were analyzed for PCBs using USEPA Method 8080 by OBG Laboratories, Inc. (O'Brien & Gere Engineers, 1989).

2.09.3 1992 Remedial Investigation

For the purpose of verification of the historic PCB concentrations in sediments of Ley Creek, nine composite sediment samples were collected during the RI from three locations in Ley Creek: approximately one half mile upstream of GM-IFG Outfall 003, directly downstream of GM-IFG Outfall 003, and approximately one-half mile downstream of GM-IFG Outfall 003. At each sample location, cores were collected from several locations traversing the creek and composited.

Sediment samples SED-1, SED-2, and SED-3 were collected from the upstream sampling location. SED-1 was collected at the furthest upstream location, immediately downstream of the confluence of the north and south branches of Ley Creek. SED-2 and SED-3 were collected approximately 50 feet and 100 feet downstream from SED-1, respectively. Sediment samples SED-4, SED-5, and SED-6 were collected from the outfall sampling location. SED-4 was collected immediately downstream from GM-IFG Outfall 003, and SED-5 and SED-6 were collected approximately 50 feet and 100 feet downstream from SED-4, respectively. Sediment samples SED-7, SED-8, and SED-9 were collected from the downstream sampling location. SED-7 was collected approximately one-half mile downstream of GM-IFG Outfall 003, upstream of an inflow of NYS Thruway runoff into Ley Creek. SED-8 and SED-9 were collected approximately 50 feet and 100 feet downstream of SED-7, downstream of the NYS Thruway runoff inflow. Outfall and downstream sampling locations are indicated on Figure 2.

Sediment samples were collected using two inch diameter Lexan® tubing, which was manually pushed down three inches into the sediment by a sampler standing downstream to minimize disturbance. Cores were composited by manually mixing in an aluminum compositing pan. Sediment samples were analyzed for PCBs using Method 91-3 and total organic carbon (TOC) using USEPA 415.1/Lloyd Kahn Method (Kahn, 1988) by H2M Laboratories, Inc. Sieve analysis using methods ASTM D422 and D1140 and hydrometer analysis using method ASTM D422 were performed on each of four sediment samples from locations SED-2, SED-4, SED-6, and SED-7 by Parratt Wolff, Inc.

2.10 Fish Sampling and Analyses

2.10.1 1985 Ley Creek Sampling

Fourteen fish were collected from Ley Creek on June 13 and 14, 1985 from a 4000 feet length of the creek extending from 1,000 feet upgradient of GM-IFG Outfall 003 to 3,000 feet downgradient of GM-IFG Outfall 003. Electroshocking and seining methods were utilized to collect the fish. The fish collected included 5 bluegills, 3 shiners, 1 brown bullhead, 1 pumpkinseed, and 4 carp. Fish were submitted to RECRA Environmental Laboratories for analysis for PCBs, lipid content, and moisture content on a whole fish basis. Samples were qualitatively screened for the presence of Aroclors 1016, 1221, 1232, 1242, 1248, 1252, 1260, and 1268, and quantitative analyses were done on Aroclors detected by the qualitative screening (EDI, 1985[b]).

2.10.2 1992 Remedial Investigation

Fish were collected on July 16, 1992 from three locations in Ley Creek: approximately one-half mile upstream of GM-IFG Outfall 003 (immediately downstream of the confluence of the north and south branches of Ley Creek), directly downstream of GM-IFG Outfall 003, and approximately one-half mile downstream of GM-IFG Outfall 003 (in the vicinity of a NYS Thruway runoff inflow into Ley Creek). These activities were conducted to comply with NYSDEC's requirement that fish sampling and analyses be performed to verify historic data and to generate data for use in the risk assessment (Kelly, 1989).

Average water depth in Ley Creek during fish sampling efforts was approximately 3.5 feet, and the average width of the creek was approximately 25 feet. The visually estimated velocity of the creek during sampling was 3 feet/sec. High turbidity, likely the result of recent heavy rains, resulted in vertical visibility of approximately 6 inches. The streambed consisted primarily of fine sand and gravel sediments over a dense clay. Very little submerged vegetation was observed. Dense stands of reed grass covered the north and south banks of Ley Creek, and the banks dropped sharply at the water's edge. A submerged delta was formed from the buildup of coarse sediments where the outfall entered the creek; water depth above the delta was approximately 1.5 to 2 feet. At the upstream sampling location, shoreline vegetation included a greater number of hardwood trees mixed with the grasses. The north branch of Ley Creek was brown in color as it merged with the south branch, which exhibited a whitish color.

Sampling locations were accessed by way of a 12-foot shallow draft aluminum boat equipped with an outboard motor. Electroshocking was performed in approximately 50 feet segments over an approximate 150 feet length of Ley Creek at each sampling location. A gill net was set up at the downstream end of the sampling area for the outfall and downstream locations. Fish were collected with dip nets as they appeared, placed in plastic bags, and stored in coolers on ice. Fish were identified to species, weighed, measured, labeled, wrapped in aluminum foil, and frozen for two weeks prior to submission to H2M Labs, Inc. for analysis.

Fish species collected from the upstream sampling location included pumpkinseed, mudminnow, stickleback, banded killifish, dace, white sucker, and golden shiner. Fish species collected from the outfall sampling location included white sucker, golden shiner, creek chub, dace, and stickleback. Carp, white sucker, pumpkinseed, banded killifish, and dace were the fish species collected from the downstream sampling location. Quantities of each species collected and associated length and mass measurements are presented in Table 2.

Fish were selected for analyses based on the objectives and rationale presented in the RI/FS Work Plan (O'Brien & Gere Engineers, 1992) and with the concurrence of NYSDEC personnel (Cooper, 1992). Species selected for whole fish analysis included species previously collected by EDI in 1985, for comparison with previous data, and species which were collected at each of the three sampling locations, for use in the fish and wildlife impact analysis. Species selected for filet or edible portion (gutted fish with head and tail removed) analysis were edible species for use in the risk assessment. Edible portion analysis was specified for edible species which were too small to be filleted for analysis. The specific species selected for analysis at each sampling location are indicated on Table 2. Fish samples were submitted to H2M Laboratories, Inc. for analysis for PCBs using Method 91-3 in accordance with NYSDEC ASP (NYSDEC, 1991[c]). For fish samples with sufficient mass, percent moisture and percent lipids were also measured.

2.11 Outfall Sampling and Analyses

2.11.1 1992 Remedial Investigation

For the purpose of evaluating whether GM-IFG Outfall 003 is a current source of PCBs to Ley Creek, four outfall discharge water samples were collected during the course of a storm event on August 13, 1992, in addition to one sample of sediment from the outfall pipe. Rain began at about 12:00 p.m. on the day of sampling; discharge water samples were collected at 2:30 p.m., 3:00 p.m., 3:30 p.m., and 4:30 p.m. Discharge water samples were collected from the end of the metal erosion plates, approximately 15 to 20 feet from the concrete discharge pipe protruding from the north side of Factory Avenue. A sample of sediment was collected from the first metal erosion plate located where the concrete discharge pipe discharges from beneath Factory Avenue.

The discharge flowrate was approximately 10 gallons per minute (gpm) at 2:30 p.m. and 3:00 p.m. Flowrates were approximately 100 gpm and 40 gpm at 3:30 p.m. and 4:00 p.m., respectively. Temperature, pH, and specific conductance were measured in the field for each water sample. Samples were submitted to H2M Laboratories, Inc. for analysis for PCBs using Method 91-3 in accordance with NYSDEC ASP (NYSDEC, 1991[c]).

2.12 Air Sampling and Analyses

2.12.1 1988/89 Field Investigation

For the purpose of evaluation of ambient air conditions around the perimeter of the study area, six air samples were collected on April 17, 1989 from locations indicated on Figure 2. Air sampling was conducted in accordance with NIOSH Method 5503. The sample trains consisted of 13 mm glass fiber filters connected in-line with florisil sorbent tubes for the collection of particulate and vapor forms of PCBs, respectively. Sample pumps were calibrated before and subsequent to sampling. Samples were collected at 0.1 liters per minute for eight hours. The wind direction during sampling was generally from the east/southeast. Air sample tubes were submitted to OBG Laboratories, Inc. and analyzed for PCBs in accordance with USEPA Method 608 (O'Brien & Gere Engineers, 1989).

SECTION 3 - RESULTS OF INVESTIGATORY ACTIVITIES

3.01 General Physiography

The project area lies within the Erie-Ontario Lowlands Physiographic Province of New York State. The area is characterized by relatively low, flat topography and lies between Lake Ontario to the north and the Appalachian Uplands to the south of Syracuse (EDI, 1985[a]). The study area is located in the watershed and along the floodplain of Ley Creek, which drains an area of about 30 square miles. Ley Creek flows to the west to Onondaga Lake, which acts as a regional discharge point. The area north and northeast of GM Circle (Figure 1) is a topographic low where the north and south branches of Ley Creek join. The natural study area topography is generally flat to gently sloping. However, in areas where dredged materials were deposited, primarily along the creek banks, the topography is hummocky and undulating.

3.02 Study Area Geology

The subsurface geologic conditions at the study area are described in detail on the test boring logs presented in Appendix A. These logs were used to construct a cross section of the study area shown in Figure 3. A review of these data indicates that the study area geology is characterized by the dredged fill materials at the surface, overlying silts, clays and fine-grained sand deposits. These fine-grained fluvial and lacustrine sediments overlie dense glacial till. The dredged materials deposited along the creek banks are comprised of these fluvial and lacustrine sediments.

The glacial till unit underlying the lacustrine deposits consists of dense reddish brown clayey silt with sand and imbedded gravel fragments. As a result of dredging, the glacial till is exposed in the stream bed of Ley Creek at the westernmost portion of the study area (in the vicinity of the Town of Salina Highway garage) and dips to the south. On-site, the till layer ranges in depth from approximately 11 feet at B-17 to approximately 30 feet at MW-3D (Figure 3). Shale bedrock was encountered at approximately 30 feet and 35 feet at MW-9D and MW-3D, respectively.

3.03 Study Area Ground Water Hydrology

Ground water elevation data were recorded on October 6, 1988, April 4, 1989, and July 29, 1992 during the hydrogeologic investigation, field investigation, and RI, respectively. These data are summarized in Table 1. These data were used to produce the ground water elevation contour maps shown in Figures 4, 5, and 6, respectively. Review of these figures indicates that, in general, the direction of shallow ground water flow is to the north toward Ley Creek. The calculated hydraulic gradient measured across the study area was estimated to be approximately 0.015 ft/ft on October 6, 1988 (dry conditions), 0.03 ft/ft on April 4, 1989 (wet conditions), and 0.021 ft/ft on July 29, 1992.

A comparison of ground water elevations measured in the two well nests, OBG-3/OBG-3D and MW-9/MW-9D, on July 29, 1992 indicates an upward flow potential exists between the upper fluvial deposits and the underlying till. Monitoring well MW-9D is a flowing artesian well. Hydraulic conductivity values, summarized on Table 1, ranged from 2.65×10^{-6} cm/sec to 2.63×10^{-3} cm/sec, or

0.056 gpd/ft^2 to 55.8 gpd/ft^2. The ground water flow velocity across the study area was calculated using Darcy's Law:

$$V = \frac{KI}{7.48\ (N)}$$

where:

V = ground water velocity in feet/day

K = hydraulic conductivity in gpd/ft^2

I = hydraulic gradient in ft/ft

N = porosity

Assuming an average study area-wide hydraulic conductivity of 4.5×10^{-4} cm/sec (9.5 gpd/ft^2), an average hydraulic gradient of 0.022 ft/ft, and an estimated porosity of 0.35, ground water will flow toward Ley Creek at an average estimated rate of 0.08 feet/day.

Based on these data, an assumed cross-sectional area of the study area extending horizontally from OBG1 to B17 (Figure 2), and an average saturated thickness of 12 feet, the ground water discharge to Ley Creek from the south side of the creek has been calculated as follows:

Ground water discharge rate Q = KiA

Where: K = average hydraulic conductivity (9.5 gpd/ft^2)

i = average hydraulic gradient (0.022 ft/ft)

A = cross sectional area (4400 feet (horizontal distance) X 12 feet (saturated thickness))

Based on these data, an estimated 11,035 gallons of ground water per day will be discharged from the study area into Ley Creek.

3.04 Quality Assurance/Quality Control Overview - 1992 Remedial Investigation

Analytical data generated during the RI were validated based on quality assurance/quality control (QA/QC) criteria established by NYSDEC Superfund - Contract Laboratory Program (CLP) (NYSDEC, 1991[c]) and QA/QC criteria presented in the Quality Assurance Project Plan in the RI/FS Work Plan (O'Brien & Gere Engineers, 1992). Validation procedures were based on CLP data validation guidelines developed by USEPA Region II. The data validation report is presented in Appendix D. As noted herein, sample data generated during the RI were concluded to be useable. Minor deficiencies in the data generation process resulted in approximation of some sample data. Approximation of a data point indicates uncertainty in the reported concentration of the chemical. The conservative assumptions used in the development of conclusions made based on these analytical results allow for the use of approximated analytical data while still adhering to the project data quality objectives. Qualification of sample data is discussed in Appendix D.

The subsurface soil data set was concluded to be useable. Data for 36 detections were accepted without qualification. Data for eight subsurface soil samples were approximated (J qualifier), and data from two subsurface soil samples were qualified as presumptively present at an approximated quantity (JN qualifier) due to excursions from confirmation column percent difference criteria. Data for two subsurface soil samples were approximated for exceeding duplicate relative percent difference (RPD) criteria.

The surface soil data set was concluded to be useable. Five surface soil detections were approximated and one detection was qualified as presumptively present for exceedence of confirmation column percent difference criteria. Two surface soil detections were approximated due to exceedence of duplicate RPD criteria. Non-detected results for surface soil sample LCSS-4 were approximated (UJ qualifier) due to exceedence of holding time criteria (resulting from reextraction and reanalysis).

The fish data set was concluded to be useable. Data for 13 detections were accepted without qualification. Three detections in fish samples were approximated, and three detections were qualified as presumptively present due to exceedence of confirmation column percent difference criteria. Percent lipids results were approximated for one fish sample due to exceedence of matrix spike recovery criteria.

The sediment data set was concluded to be useable. Data for three detections were accepted without qualification. Two detections in sediment samples were approximated for exceedence of confirmation column percent difference criteria.

The outfall data set was concluded to be useable. One outfall discharge water detection was approximated, and one detection was qualified as presumptively present at an approximated quantity due to exceedence of confirmation column percent difference criteria.

The ground water data set was concluded to be useable. The detection of 0.8 ug/l Aroclor 1248 in one ground water equipment blank resulted in the qualification of Aroclor 1248 detections in unfiltered samples from wells OBG-1, OBG-2, OBG-3, OBG-4, OBG-5, OBG-7B, OBG-7C, MW-10, and MW-12 as less than the detected concentrations. Practically, the equipment blank contamination likely does not impact the ground water data because the equipment blank sample was collected after each of the monitoring wells (with the exception of OBG-3D, MW-9D, and OBG-6, which were sampled on different days) were sampled, and PCBs were not detected in the last monitoring well sampled (MW-13) prior to the equipment blank sample collection. Although the possibility exists that the data may not be representative of the actual concentrations present in the wells, the data are useable as estimates of the maximum concentrations potentially present. Evaluation of these data is presented in Section 3.05.3.

3.05 Ground Water Analytical Results

3.05.1 1986/87 Hydrogeologic Investigation

Ground water data generated during the 1986/87 investigation are presented in Table 3. The spatial distribution of the ground water PCB data is presented on Figure 7. PCB concentrations were less than detectable in wells OBG-1 and OBG-2, the two wells east of GM-IFG Outfall 003. Total PCB concentrations in wells OBG-3, OBG-4, OBG-5, OBG-6, OBG-7A, OBG-7B, and OBG-7C, west of GM-IFG Outfall 003, ranged from 0.5 to 5.3 ug/l. The arithmetic mean PCB concentration was 1.3 ug/l and the geometric mean concentration was 0.84 ug/l, calculated with less than detectable concentrations averaged in as one-half of the detection limit. Aroclors identified for these detections were 1016, 1242, and 1248. Each detected PCB concentration exceeded the NYS Class GA ground water standard for PCBs of 0.1 ug/l. Oil and grease concentrations in wells OBG-6 and OBG-7A were 3 mg/l and 2 mg/l, respectively; oil and grease concentrations were less than detectable in each of the other wells (O'Brien & Gere Engineers, 1987[a]).

Detections of PCBs in ground water samples and indication by hydraulic data that study area ground water discharges to Ley Creek demonstrate a potential for PCBs to discharge to the creek with ground water. The potential mass transport of PCBs to Ley Creek from the study area was estimated based on the calculated ground water discharge rate to Ley Creek and the arithmetic mean PCB concentration detected in ground water samples during this investigation. As discussed in Section 3.12, it is unlikely that total PCBs detected in unfiltered ground water samples will migrate to Ley Creek, and this calculation is therefore conservative. The calculation was performed as follows:

$$\text{PCB Mass Transport Rate} = C_{PCB}\ (\text{ug/l}) \times Q\ (\text{gpd}) \times 3.785\ \text{l/gal} \times 2.2 \times 10^{-6}\ \text{lb/ug}$$

where:

C_{PCB} = 1.3 ug/l - arithmetic mean PCB concentration detected in ground water samples during 1986/87 hydrogeologic investigation; and

Q = 670 gpd - ground water discharge rate based on an average hydraulic conductivity of 2.65 gpd/ft^2, an average hydraulic gradient of 0.07 ft/ft, a saturated cross sectional area of 3,600 ft, and assumptions that the underlying silt/clay unit prohibits vertical migration of ground water and that Ley Creek is an effective discharge boundary for ground water.

The potential mass transport of PCBs to Ley Creek from the study area was calculated to be 7.3 x 10^{-3} lb/day. A mixing calculation, however, indicated that PCB discharge to Ley Creek from ground water would likely not solely cause an exceedence of the NYS Class B surface water standard for PCBs, 1 x 10^{-3} ug/l. The estimated PCB concentration in Ley Creek resulting solely from ground water discharge was calculated to be 3.0 x 10^{-5} ug/l. The mixing calculation was based on the potential PCB mass transport rate to Ley Creek and an average estimated Ley Creek flow rate of 3.29 x 10^{7} gal/day (Colbert, 1992).

3.05.2 1988/89 Field Investigation

Ground water data generated during the 1988/89 investigation are summarized in Table 3. The spatial distribution of the ground water PCB data is presented on Figure 7. Total PCB concentrations in wells OBG-1, OBG-2, OBG-3, OBG-4, OBG-5, OBG-6, OBG-7A, OBG-7B, OBG-7C, MW-8, MW-9, MW-10, MW-11, MW-12, and MW-13 ranged from 0.2 ug/l to 18 ug/l during the October sampling event (excluding wells OBG-3 and OBG-7C which were dry in October) and from less than detectable to 21 ug/l during the April sampling event. The arithmetic mean PCB concentrations in October and April were 4.5 ug/l and 3.3 ug/l, respectively, calculated with less than detectable concentrations averaged in as one-half of the detection limit. The geometric mean PCB concentrations in October and April were

1.6 ug/l and 0.72 ug/l, respectively, also calculated with less than detectable concentrations averaged in as one-half of the detection limit. Aroclors 1242 and 1248 were identified in the October samples, and Aroclor 1248 was identified in the April samples. PCB concentrations in each well sampled in October exceeded the NYS Class GA ground water standard of 0.1 ug/l. PCB concentrations in twelve of the fifteen wells sampled in April exceeded the Class GA standard; concentrations in wells OBG-2, OBG-5, and MW-11 were at or below the Class GA standard (O'Brien & Gere Engineers, 1989).

PCB concentrations were generally higher in the ground water samples collected in October than in April. Based on the ground water elevation data for October and April, the hydraulic gradient is higher during wet conditions, which promotes an increase in ground water flow velocity. PCB concentrations may be subsequently lower during the wet period due to dilution (O'Brien & Gere Engineers, 1989). PCB concentrations in ground water were generally highest in the central portion of the study area, between wells MW-8 and MW-13, which corresponds with the area of highest PCB concentrations detected in soil during this investigation, between borings B-1 and B-11. The highest PCB concentrations in ground water were detected in well MW-9 in each sampling event: 18 ug/l and 21 ug/l in October and April, respectively. PCBs, identified as Aroclors 1242/1248, were detected in the upgradient well, MW-11, during the October sampling event at 0.2 ug/l but were not detected in April (O'Brien & Gere Engineers, 1989).

As in the 1986/87 hydrogeologic investigation, there is a potential for PCBs to discharge into Ley Creek with ground water based upon detections of PCBs in ground water samples and indication by hydraulic data that study area ground water discharges to Ley Creek. The calculated ground water discharge rate to Ley Creek and the arithmetic mean PCB concentration detected in ground water samples during this investigation were used to estimate the potential mass transport of PCBs to Ley Creek from the study area. It is unlikely that total PCBs detected in unfiltered ground water samples will migrate to Ley Creek, and this calculation is therefore conservative; this was discussed in Section 3.12. The calculation was performed as follows:

$$\text{PCB Mass Transport Rate} = C_{PCB}\ (\text{ug/l}) \times Q\ (\text{gpd}) \times 3.785\ \text{l/gal} \times 2.2 \times 10^{-6}\ \text{lb/ug}$$

where:

C_{PCB} = 3.7 ug/l - arithmetic mean PCB concentration detected in ground water samples during 1988/89 field investigation; and

Q = 9,500 gpd - ground water discharge rate based on an average hydraulic conductivity of 9.5 gpd/ft^2, an average hydraulic gradient of 0.0225 ft/ft, a horizontal distance of 3,700 ft in the area of PCB detections (OBG-1 to B-11), and a 12 ft estimated saturated thickness of PCB detections in soil.

The potential mass transport of PCBs to Ley Creek from the study area was calculated to be 2.9 x 10^{-1} lb/day. A mixing calculation, however, indicated that PCB discharge to Ley Creek from ground water would likely not solely cause an exceedence of the NYS Class B surface water standard for PCBs, 1

$x\ 10^{-3}$ ug/l. The estimated PCB concentration in Ley Creek resulting solely from ground water discharge was calculated to be 1.0×10^{-3} ug/l. The mixing calculation was based on the potential PCB mass transport rate to Ley Creek and an average estimated Ley Creek flow rate of 3.29×10^{7} gal/day (Colbert, 1992).

3.05.3 1992 Remedial Investigation

A summary of ground water data generated during the RI is presented in Table 4; 1992 data are also presented in comparison to historical data in Table 3. The spatial distribution of ground water PCB concentrations is presented on Figure 7. The PCB concentration in each filtered ground water sample was less than detectable. PCB concentrations in unfiltered deep well samples (OBG-3D and MW-9D) were less than detectable. PCBs were not detected in unfiltered samples from wells MW-3D, OBG-6, MW-8, MW-9, MW-9D, and MW-13. As a result of equipment blank contamination, PCB detections in unfiltered samples from wells OBG-1, OBG-2, OBG-3, OBG-4, OBG-5, OBG-7B, OBG-7C, MW-10, and MW-12 were qualified as less than the detected concentrations according to data validation procedures, as discussed in Section 3.04 of this report. These detected PCB concentrations ranged from 0.5 to 3.0 ug/l, identified as Aroclor 1248. Aroclor 1248 was also detected in well OBG-7A at a concentration of 4.2 ug/l. Each of the detected concentrations exceeded the NYS Class GA ground water standard of 1.0×10^{-1} ug/l; wells were therefore potentially in exceedence of the standard, considering the equipment blank contamination.

The highest PCB concentrations were detected in wells OBG-4, OBG-7A, OBG-7B, and OBG-7C. Based on a conservative calculation averaging PCB detections at full value, disregarding qualifiers resulting from equipment blank contamination, and less than detectable concentrations as one-half the detection limits, the arithmetic mean PCB concentration in the unfiltered ground water samples was 1.0 ug/l, and the geometric mean PCB concentration was 0.68 ug/l. Considering the detected PCB concentrations in ground water during the RI as the maximum concentrations potentially present, as discussed in Section 3.04, the ground water data indicate generally lower PCB concentrations than those detected in previous investigations in unfiltered samples from wells west of OBG-5. PCB concentrations in unfiltered samples from the monitoring wells east of OBG-5 are generally either similar or, in some instances, potentially slightly higher (considering equipment blank contamination) than those detected in previous investigations. Less than detectable PCB concentrations in each filtered ground water sample collected during the RI indicate the possibility of the PCBs in ground water being attributable to adsorption on particulates in the ground water samples.

As in previous investigations, the detection of PCBs in unfiltered ground water samples and the direct discharge of ground water into the creek, supported by hydraulic data, manifests a potential for PCBs to discharge to the creek with ground water. The specific potential mass transport calculation for this site is explained below. The assumption that total PCBs detected in unfiltered ground water samples migrate to Ley Creek, as discussed in earlier sections, is conservative.

PCB Mass Transport Rate = C_{PCB} (ug/l) x Q (gpd) x 3.785 l/gal x 2.2 x 10^{-6} lb/ug

where:

C_{PCB} = 1.0 ug/l - arithmetic mean PCB concentration detected in unfiltered RI ground water samples, disregarding qualifiers resulting from equipment blank contamination; and

Q = 7,000 gpd - ground water discharge rate based on an average hydraulic conductivity of 9.5 gpd/ft^2, an average hydraulic gradient of 0.022 ft/ft, a horizontal distance of 2,800 ft in the area of PCB detections in ground water during the RI (OBG-1 to OBG-12), and a 12 ft estimated saturated thickness of PCB detections in soil.

The potential mass transport of PCBs to Ley Creek from the study area was calculated to be 5.8 x 10^{-2} lb/day. A mixing calculation, however, indicated that PCB discharge to Ley Creek from ground water would likely not solely cause an exceedence of the NYS Class B surface water standard for PCBs, 1 x 10^{-3} ug/l. The estimated PCB concentration in Ley Creek resulting solely from ground water discharge was calculated to be 2.0 x 10^{-4} ug/l. The mixing calculation was based on the estimated PCB mass transport rate to Ley Creek and an average estimated Ley Creek flow rate of 3.29 x 10^{7} gal/day (Colbert, 1992).

3.06 Soil Investigation Results

3.06.1 Subsurface Soil

3.06.1.1 1986/87 Hydrogeologic Investigation

The results of analyses of soil samples collected from wells installed during the 1986/87 investigation are summarized in Table 5. A cross-sectional representation of the soil PCB data is included in Figure 8. Total PCB concentrations detected in the soil samples ranged from less than detectable to 470 mg/kg on a dry weight basis. The arithmetic mean PCB concentration was 32 mg/kg and the geometric mean PCB concentration was 2.1 mg/kg, calculated with less than detectable concentrations averaged in as one-half of the detection limit. Aroclors identified in the soil samples were 1016, 1242, and 1248. PCBs were detected throughout the fill profile in wells OBG-3, OBG-4, OBG-6, OBG-7A, OBG-7B, and OBG-7C. PCBs were detected in underlying silt and clay soils in wells OBG-3, OBG-7A, and OBG-7B. The presence of PCBs was limited to the upper two feet of fill material in borings OBG-1 and OBG-5, and the upper four feet of fill material in OBG-2.

Oil and grease were detected throughout the soil profile in each of the wells. Oil and grease concentrations detected in the soil samples ranged from less than detectable to 8,890 mg/kg on a dry weight basis. The arithmetic mean oil and grease concentration was 1,070 mg/kg and the geometric mean PCB concentration was 230 mg/kg, calculated with less than detectable concentrations averaged in as one-half of the detection limit (O'Brien & Gere Engineers, 1987[a]).

3.06.1.2 1988 Onondaga County Factory Avenue Sampling Program

The unvalidated results of analyses of subsurface soil samples collected from borings completed by Blasland & Bouck Engineers, P.C. in 1988 are presented in Exhibit A. The borings were completed for the Onondaga County Department of Drainage and Sanitation for the purpose of investigating a proposed alternate sewer route. PCB concentrations ranged from less than detectable to 1,600 mg/kg. With the exception of one sample in the westernmost boring (0 to 5 feet, B-91A-1), PCBs were less than detectable in the borings located approximately 3000 feet or more west of Townline Road. The highest PCB concentrations were observed in the three borings located approximately 500 feet to 1,400 feet west of Townline Road. The data did not exhibit a correlation between the location of the borings with respect to the fence and PCB concentrations (Blasland & Bouck Engineers, P.C., 1988).

3.06.1.3 1988/89 Field Investigation

The results of analyses of subsurface soil samples collected during the 1988/89 investigation are summarized in Table 6. A cross-sectional representation of the PCB concentrations in soil is presented in Figure 8. Total PCB concentrations ranged from less than detectable to 180 mg/kg on a dry weight basis. The arithmetic mean PCB concentration was 8.3 mg/kg and the geometric mean PCB concentration was 1.6 mg/kg, calculated with less than detectable concentrations averaged in as one-half of the detection limit. Aroclor 1248 was the predominant aroclor identified in the soil samples; Aroclors 1016 and 1242 were also identified in three soil samples. These data, in combination with the 1986/87 data, indicate that PCBs are most prevalent south of Ley Creek between boring B-11 and well OBG-1. With the exception of borings B-4 and B-6, soil samples exhibiting PCB concentrations in excess of 25 mg/kg on the south side of Ley Creek are limited to the area between well OBG-3 and boring B-1 (Figure 2). Along the north side of Ley Creek, PCBs were detected in composite samples from 0 to 4 feet in borings B-19, B-21, and B-22, at concentrations of 27 mg/kg, 3.5 mg/kg, and 2 mg/kg, respectively. The presence of PCBs on the north side of Ley Creek may be due to the possible deposition of dredged materials on the north side of Ley Creek or stream flooding (O'Brien & Gere Engineers, 1989).

3.06.1.4 1992 Remedial Investigation

Analytical data for composite samples collected from borings installed during the RI are presented in Table 7. A cross-sectional representation of the PCB soil data is presented in Figure 8. Total PCB concentrations in the 1992 subsurface soil samples ranged from less than detectable to 140 mg/kg dry weight. The arithmetic mean

PCB concentration in the 1992 subsurface soil samples was 10 mg/kg and the geometric mean PCB concentration was 1.0 mg/kg, calculated with less than detectable concentrations averaged in as one-half of the detection limit. With the exception of two samples, Aroclor 1248 was the only aroclor detected in soil samples; Aroclors 1248 and 1260 were both detected in the 4 to 6 feet and 8 to 10 feet samples from off-site boring B-6M, located approximately 2,000 ft west of GM-IFG Outfall 003.

Detection of Aroclor 1260 during the RI was limited to two isolated locations, boring B-6M and surface soil sample location LCSS-4, each distanced from GM-IFG. Aroclor 1260 is not historically associated with GM-IFG process operations; it was not detected in the past in environmental matrices associated with the dredged material (soil, ground water), nor is it associated with the GM-IFG stormwater discharge. Aroclor 1260 is associated with electrical equipment; utility poles with transformers are present in the study area.

Samples analyzed from borings installed in July 1992 for the purpose of evaluation of whether the former drainage ditch still exists on the north side of Factory Avenue (B-25, B-26, B-27, B-28, and B-29) exhibited lower concentrations of PCBs compared with previous samples collected on the south side of Factory Avenue. The highest PCB concentrations detected in these borings were in the upper 0 to 4 feet and ranged from 4.2 mg/kg to 48 mg/kg dry weight. PCB concentrations in the 4 to 8 feet samples from these borings ranged from 0.15 mg/kg to 19 mg/kg; residual PCB concentrations from the former drainage ditch would be expected in the 4 to 8 feet sample interval, since this elevation range would correspond to the native soils prior to placement of the dredged material.

Because elevated PCB concentrations were not observed in these borings, eight additional borings (B-34 through B-43) were installed on December 4, 1992 in an effort to further evaluate if there remains a significant source of PCBs associated with the former drainage ditch in this area. Black odorous materials were sampled from these borings. The nine samples analyzed from these borings also exhibited lower PCB concentrations than samples collected during the IRM south of Factory Avenue. Aroclor 1248 concentrations in these borings ranged from 0.87 mg/kg to 140 mg/kg. These results, in combination with the July 1992 sample results, did not indicate the presence of the former drainage ditch north of Factory Avenue.

PCBs were detected in borings installed for the purpose of evaluating if PCBs detected in soils south of Factory Avenue outside the IRM work area during the Onondaga County sewer line installation extend north of Factory Avenue (B-30, B-31, B-32, B-33, B-34, and B-35). Concentrations of PCBs on the north side of Factory Avenue were generally significantly lower than previously detected concentrations across Factory Avenue. Borings in which black staining was observed were specified in Section 2.06.4.

3.06.2 Surface Soil

3.06.2.1 1992 Remedial Investigation

Analytical data for surface soil samples collected during the RI are presented in Table 8. Total PCB concentrations ranged from 0.048 mg/kg to 16 mg/kg in the surface soil samples. Aroclor 1248 was detected in each sample; both Aroclor 1248 and 1260 were detected in sample LCSS-4. These data indicate that the presence of PCBs does extend to the area of the study area directly north of Factory Avenue and that PCB concentrations generally decrease in the westerly direction.

Detection of Aroclor 1260 during the RI was limited to two isolated locations, soil boring B-6M and surface soil sample LCSS-4, each distanced from GM-IFG. Aroclor 1260 is not historically associated with GM-IFG process operations; it was not detected in the past in environmental matrices associated with the dredged material (soil, ground water), nor is it associated with the GM-IFG stormwater discharge. Aroclor 1260 is associated with electrical equipment; utility poles with transformers are present in the study area.

3.07 Surface Water Investigation Results

3.07.1 1985 Ley Creek Sampling

Analytical results generated from surface water sampling and analyses performed during EDI's 1985 investigation are presented in Table 9. Aroclor 1248 was detected in Ley Creek water samples downstream of GM-IFG

Outfall 003 at concentrations ranging from 0.27 ug/l to 2.3 ug/l. Each of these detected concentrations exceeded the NYS Class B surface water standard of 1.0 x 10^{-3} ug/l. Freon extractable oil concentrations were less than detectable in each surface water sample (EDI, 1985[b]). Only one of the detected concentrations, 2.3 ug/l, however, exceeded the Federal Ambient Water Quality Criterion for protection of aquatic life (freshwater acute) for PCBs, 2 ug/l.

3.07.2 1985 Hydrogeological Investigation

Analytical data for detected compounds from surface water sampling and analyses performed during EDI's 1985 investigation are presented in Table 9. t-1,2-Dichloroethene was detected in upgradient and downgradient surface water samples at 3.0 x 10^{-3} mg/l; trichloroethene was detected in upgradient and downgradient surface water samples at concentrations ranging from 6.0 x 10^{-3} to 8.0 x 10^{-3} mg/l; and toluene and chloroform were detected only in upgradient samples. Volatile organic concentrations did not exceed NYS Class B surface water standards or guidance values. Nickel and chromium were not detected in surface water samples (EDI, 1985[a]).

3.07.3 1988/89 Field Investigation

Analytical results generated from surface water sampling and analyses performed during O'Brien & Gere Engineers' 1988 and 1989 sampling events are presented in Table 9. Aroclor 1248 was detected at 1.4 ug/l in the sample immediately downstream of GM-IFG Outfall 003 in April 1989 but was not detected in January 1988. The detected concentration exceeded the NYS Class B surface water standard of 1.0×10^{-3} ug/l (O'Brien & Gere Engineers, 1989). The detected concentration did not, however, exceed the Federal Ambient Water Quality Criterion for protection of aquatic life for PCBs (freshwater acute), 2 ug/l, or the outfall water effluent limit of 4 ug/l established pursuant to the SPDES discharge Consent Order.

3.08 Sediment Investigation Results

3.08.1 1985 Ley Creek Sampling

Analytical results generated from sediment sampling and analyses conducted during EDI's 1985 investigation are presented in Table 10. Concentrations of Aroclors 1248 and 1260 upgradient of GM-IFG Outfall 003 ranged from less than detectable to 0.83 mg/kg and less than detectable to 0.45 mg/kg, respectively. Aroclors 1248 and 1260 concentrations downgradient of GM-IFG Outfall 003 ranged from less than detectable to 34 mg/kg and from less than detectable to 0.75 mg/kg, respectively. Aroclor 1254 was detected at 1.7 mg/kg in one sample 2,500 feet downstream of GM-IFG Outfall 003. Generally, PCB concentrations were higher in samples taken adjacent to the shore than in midstream samples at each location. PCB concentrations were highest 500, 2,000, 2,500, and 3,000 feet downstream of GM-IFG Outfall 003. With the exception of the highest detected PCB concentration in the sediments (34 mg/kg at 6-12 inches), PCB concentrations generally decreased with depth. It was concluded during this study that the irregular distribution of PCBs in sediments may be a result of: previous dredging activities; the more organic nature of shoreline sediments, resulting in greater PCB adsorption, as compared to midstream sediments; and/or the tendency for PCB deposition in areas of lower flow, such as the creek margins (EDI, 1985[b]).

Freon extractable oil concentrations ranged from less than detectable to 4,690 mg/kg upstream of GM-IFG Outfall 003 and from less than detectable to 9,520 mg/kg downstream of GM-IFG Outfall 003. Freon extractable oil concentrations in the sediments generally decreased with depth. Higher freon extractable oil concentrations were detected 500 feet, 1,500 feet, and 2,000 feet downstream of GM-IFG Outfall 003. It was concluded in this study that a correlation between PCB and freon extractable oil concentrations did not exist (EDI, 1985[b]).

3.08.2 1988/89 Field Investigation

Analytical data for sediment samples collected during the field investigation are presented in Table 11. PCBs were less than detectable in the upstream sediment sample, SS-1, and the furthest downstream sample, SS-6. Total PCB concentrations ranged from 1.9 to 8.6 mg/kg dry weight in samples SS-2 through SS-5. Aroclors 1016/1242/1248 were identified in samples SS-2 and SS-3, and Aroclor 1242 was identified in samples SS-4 and SS-5. The highest PCB concentration in sediments, 8.6 mg/kg, was detected in the sample immediately downstream of GM-IFG Outfall 003, SS-2 (O'Brien & Gere Engineers, 1989).

3.08.3 1992 Remedial Investigation

Analytical data for sediment samples collected during the RI are presented in Table 12. PCBs were not detected in the upstream sediment samples. Aroclor 1248 was detected at one of the three outfall sampling locations, approximately 100 feet downstream from GM-IFG Outfall 003, in the SED-6 sample (0.23 mg/kg dry weight) and in the blind duplicate sample at SED-6 (0.34 mg/kg dry weight). Aroclor 1248 was detected in each of the three downstream samples, SED-7, SED-8, and SED-9, at concentrations of 0.19 mg/kg, 0.71 mg/kg, and 0.81 mg/kg on a dry weight basis, respectively. Total organic carbon concentrations in sediment samples ranged from 1.36% to 2.17%.

Comparing 1992 data to 1985 and 1988 data, Aroclor 1248 was not detected upstream of GM-IFG Outfall 003 in 1988 or 1992 and ranged from less than detectable to 0.83 mg/kg dry weight in the upper six inches of sediment samples in 1985. Concentrations of Aroclor 1248 detected in sediments in the vicinity of GM-IFG Outfall 003 in 1992 are similar to concentrations detected in 1985, but less than that detected in 1988. Concentrations of Aroclor 1248 detected in sediments in the vicinity of GM-IFG Outfall 003 ranged from 0.049 mg/kg to 1.4 mg/kg dry weight in the upper six inches of sediment samples in 1985, and from less than 0.045 mg/kg to 0.34 mg/kg dry weight in 1992; 8.6 mg/kg dry weight PCBs (Aroclors 1016/1242/1248) were detected in the sediment sample near the outfall in 1988. Aroclor 1248 concentrations detected in 1992 approximately one-half mile downstream of GM-IFG Outfall 003 were less than Aroclor 1248 concentrations detected 2,000, 2,500, and 3,000 feet downstream of GM-IFG Outfall 003 in 1985. Downstream Aroclor 1248 concentrations in 1992 ranged from 0.19 mg/kg to 0.81 mg/kg dry weight; Aroclor 1248 concentrations ranged from non-detectable to 10 mg/kg dry weight in the upper six inches of sediment samples located 2,000, 2,500, and 3,000 feet downstream of GM-IFG Outfall 003. Aroclor 1242 was detected in this vicinity in 1988 at 3.8 mg/kg dry weight. Aroclor 1260 was not detected in the 1992 or 1988 sediment samples, whereas, in 1985, Aroclor 1260 was detected both upstream and downstream of GM-IFG Outfall 003 at concentrations ranging from 0.01 mg/kg to 0.75 mg/kg.

The results of the sieve analyses performed on sediment samples SED-2, SED-4, SED-6, and SED-7 are presented in Appendix E. The silt and clay fractions were lowest in the upstream sediment sample SED-2 (3% and 7%, respectively); silt and clay fractions in sediment samples from the outfall area (SED-4) and downstream (SED-6 and SED-7) were 28% and 15%, 33% and 8%, and 14% and 3%, respectively. The sand fraction was greatest in SED-7 (65%); sand fractions in SED-2, SED-4, and SED-6 were 28%, 35%, and 39%, respectively. Gravel fractions for SED-2, SED-4, SED-6, and SED-7 were 42%, 22%, 20%, and 18%, respectively.

3.09 Fish Investigation Results

3.09.1 1985 Ley Creek Sampling

Analytical results generated from the fish sampling and analyses in 1985 are presented in Table 13. Concentrations of Aroclor 1248 ranged from less than the detection limit to 4.1 mg/kg; concentrations of Aroclor 1254 ranged from non-detectable to 2.7 mg/kg, with total PCB concentrations ranging from less than the detection limit to 6.8 mg/kg. Concentrations of PCBs greater than the detection limit were observed only in carp (EDI, 1985[b]).

3.09.2 1992 Remedial Investigation

Data generated from analysis of fish samples collected during the RI are presented in Table 14. PCB concentrations in whole fish upstream ranged from less than detectable to 0.86 mg/kg, identified as Aroclor 1248, on a wet weight basis. PCB concentrations in the edible portions of upstream pumpkinseeds ranged from 0.11 mg/kg to 2.4 mg/kg, identified as Aroclor 1248, on a wet weight basis. The lipid percentages in the upstream fish samples were 0.1%, with the exception of 0.5% in the golden shiner. Moisture percentage was not measured for upstream fish samples due to insufficient sample quantity.

Aroclor 1248 concentrations in whole fish collected from the outfall sampling location ranged from 0.19 mg/kg to 0.82 mg/kg on a wet weight basis. Aroclor 1260 was detected in one of the whole fish from the outfall location, a white sucker, at 0.23 mg/kg. Lipid percentages ranged from 0.1% to 0.5% in the outfall fish samples. Moisture percentage was measured for one of the outfall fish samples, a golden shiner, at 79.7%.

Aroclor 1248 concentrations in whole fish downstream ranged from 0.46 mg/kg to 1.1 mg/kg on a wet weight basis. Aroclor 1260 concentrations in whole fish downstream ranged from less than detectable to 0.35 mg/kg on a wet weight basis. Aroclor 1248 concentrations in filet and edible portion fish samples downstream ranged from 0.11 mg/kg to 0.32 mg/kg wet weight; Aroclor 1260 was not detected in downstream filet or edible portion fish samples. The lipid percentages in the downstream fish samples ranged from 0.1% to 3.0%, and moisture percentages for the four samples in which it was measured ranged from 72.6% to 77.8%.

Carp and shiners are species which were analyzed on a whole fish basis in both 1985 and 1992. Data indicate lower concentrations of Aroclor 1248 in fish in 1992 than observed in 1985. Aroclor 1248 concentrations ranged from less than 0.3 mg/kg to 4.1 mg/kg in carp collected in 1985; concentrations of Aroclor 1248 in whole carp collected in 1992 were 0.47 mg/kg and 1.1 mg/kg. Aroclor 1254 was not detected in whole carp collected in 1992, but was detected in three of the four carp collected in 1985 at concentrations of 0.53 mg/kg, 1.2 mg/kg, and 2.7 mg/kg. Aroclor 1260 was detected in whole carp collected in 1992 at concentrations of 0.35 mg/kg and 0.7 mg/kg, but was not detected in carp collected in 1985.

As discussed in Section 6.03.2, the fish species observed in Ley Creek are stream dwellers which tend to migrate up and down the stream for up to several miles in response to water level fluctuations, habitat quality, and food availability (Creech, 1992). Comparisons of fish from upstream, outfall, and downstream sampling locations could not be made due to the tendency of the fish collected to migrate for several miles (Creech, 1992). Potential PCB transport pathways to Ley Creek in the study area (outfall discharge, ground water discharge, and surface runoff) likely contribute PCBs to fish; quantitative conclusions could not, however, be drawn related to the proportionate contribution by these pathways versus possible non-study area related sources to PCBs in fish. Because potential PCB transport pathways to Ley Creek are not fully related to the dredged material, quantitative conclusions could also not be drawn related to the contribution of the dredged material itself to PCBs in fish.

3.10 Outfall Investigation Results

3.10.1 1992 Remedial Investigation

Analytical data generated from the outfall storm sampling event during the RI, as well as field measurements of pH, specific conductance, and temperature, are presented in Table 15. Aroclor 1248 was detected in outfall discharge water samples taken during the first two sampling times, 2:30 p.m. and 3:00 p.m.; PCBs were not detected in outfall discharge water samples collected at 3:30 p.m. and 4:30 p.m. Aroclor 1248 concentrations in the sample and blind duplicate sample collected at 2:30 p.m. were 1.2 ug/l and 1.8 ug/l. The Aroclor 1248 concentration in the sample collected one-half hour later was 1.8 ug/l. These concentrations did not exceed GM-IFG's 4 ug/l effluent limit for Aroclor 1248 which was established pursuant to the 1985 SPDES discharge Consent Order. Aroclor 1248 was detected in the sediment sample collected from the outfall pipe at a concentration of 0.18 mg/kg. The results of the outfall sampling effort indicate that GM-IFG Outfall 003 is a potential source of PCBs to Ley Creek during storm events.

3.11 Air Investigation Results

3.11.1 1988/89 Field Investigation

PCB concentrations in the six air samples collected during the field investigation were less than detectable at a detection limit of 1 x 10^{-3} mg/m^3 (O'Brien & Gere Engineers, 1989). The National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Level (REL) for PCBs is 1 x 10^{-3} mg/m^3.

3.12 PCB Transport Pathways

Potential pathways for PCB transport to Ley Creek in the study area include outfall discharge, ground water discharge, and surface runoff. The proportionate contributions of PCBs to Ley Creek by these pathways is undefined. The degree to which the site, defined as dredged material in the NYS Registry of Inactive Hazardous Waste Disposal Sites, contributes to these transport pathways is also undefined.

Relative to the outfall discharge pathway, GM-IFG Outfall 003 is permitted, pursuant to a SPDES discharge Consent Order, to discharge 4 ug/l Aroclor 1248 and 2 ug/l Aroclor 1242 to Ley Creek. Storm sampling of GM-IFG Outfall 003 discharge water during the RI indicated that Aroclor 1248 is discharged to Ley Creek during storm events; detected Aroclor 1248 concentrations in outfall water samples were, however, less than the 4 ug/l effluent limit. GM-IFG Outfall 003 discharge water is not related to the dredged material but consists of stormwater runoff originating upgradient of the site.

Relative to the ground water discharge pathway, Aroclor 1248 was detected in unfiltered ground water samples from ten monitoring wells installed in the study area during the RI, and hydraulic data indicate that ground water in the study area discharges to Ley Creek. Aroclor 1248 therefore potentially discharges to Ley Creek via ground water transport. However, due to the chemical properties of PCBs and the absence of PCB detections in filtered ground water samples during the RI, it is likely that much of the PCBs are not dissolved in ground water but were adsorbed to particulate matter in the unfiltered ground water samples. Further, sorption interactions with aquifer solids retard the movement of dissolved PCBs relative to ground water flow to Ley Creek. Although some mass of PCBs likely discharges to the creek with ground water, it is potentially minimal, and the assumption that total PCBs detected in unfiltered ground water samples migrate to Ley Creek is conservative.

A conservative calculation of potential PCB mass discharge to Ley Creek via ground water flow based on RI data yielded a mass discharge rate of 0.06 lb/day. RI data were used for this calculation because they provide the most current representation of site conditions. The calculation was based on the conservative assumption that the mean PCB mass detected in unfiltered samples from study area monitoring wells during the RI migrates from the wells to Ley Creek. Calculations based on this potential mass transport and the average Ley Creek flowrate indicated that ground water discharge does not likely solely cause exceedence of the NYS Class B surface water standard (1 x 10^{-3} ug/l) in Ley Creek.

It cannot be concluded to what extent the dredged material acts as a source of dissolved PCBs in ground water. As just discussed, it is likely that much of the

PCBs detected in unfiltered ground water at the site are not dissolved phase PCBs. Further, PCBs have also been detected in ground water upgradient of the dredged material; it cannot be concluded the extent to which the dredged material acts as a source of PCBs in ground water as compared to upgradient PCB migration.

Relative to the surface runoff pathway, PCBs were detected in surface soil samples from the dredged material. The potential therefore exists for transport of PCBs to Ley Creek via erosion of dredged material. Evidence of erosion at the site, however, has not been observed, and the site is well vegetated.

Therefore, based on the following considerations, conclusions can not be drawn related to the extent that the site is contributing PCBs to Ley Creek surface water, sediments, and biota:

- GM-IFG Outfall 003 discharge is a continuing source of PCBs to the creek; PCBs in outfall discharge are not related to the dredged material;
- Uncertainties exist as to whether the dredged material acts as a source of dissolved PCBs in site ground water;
- The occurence of surface runoff is not likely due to heavy vegetation at the site and a lack of evidence of erosion of dredged material.

SECTION 4 - ENVIRONMENTAL FATE OF PCBS

Polychlorinated biphenyls (PCBs) is the generic term for a diverse family of synthetic chemicals produced by the reaction of biphenyl with anhydrous chlorine. Of the 209 possible chlorine-substituted biphenyl derivatives (congeners) possible through this process, about 100 individual compounds have been detected in the various commercial PCB products produced under the Aroclor trademark by the main U.S. manufacturer, the Monsanto Corporation (Hutzinger *et al.*, 1974). Several Aroclor product mixtures have been marketed, as denoted by a numerical designation. In general, the first two numerals refer to the biphenyl group and the second two numerals are an indicator of the degree of chlorination of the biphenyl mixture. Thus, Aroclor 1248 is a biphenyl mixture (identified by the prefix 12) with an approximate chlorine content by weight of 48%. It contains relatively fewer of the more highly chlorinated PCB congener groups than Aroclor 1260, which contains approximately 60% by weight of chlorine. The basic chemistry, production, and use of PCBs has been extensively reviewed elsewhere (Life Systems, 1983). Briefly, PCBs were first manufactured commercially in 1929. It was soon realized that the physical properties of the PCBs lent them to a wide variety of uses. As a class, PCBs are chemically inert, non-flammable, and have high dielectric constants. Thus, they became widely used as hydraulic and lubricating fluids, heat-exchanger and dielectric fluids, plasticizers, coatings, and a number of other useful applications. U.S. sales of PCBs peaked in 1970, with over 33,000 metric tons sold, at which time Monsanto suspended sales.

During the 1960's, attention began to focus on PCBs when they were first identified in environmental samples being studied due to concerns over the chemically similar pesticide DDT and its degradation products. Episodes of potential human and wildlife toxicity linked to PCB exposure during this time prompted voluminous research into the environmental chemistry and toxicity of the PCBs, as reviewed below. The results of these investigations became, in part, the basis for the establishment of specific legislation designed to regulate the use and disposal of PCBs. Regulations promulgated under the Toxic Substances Control Act in 1978 provided for the elimination or restriction on sales or uses of PCBs in the U.S.

4.01 Chemistry Properties of PCBs

Due to their persistence in disposed wastes and from accidental releases, PCBs continue to be detected in the environment on a worldwide basis. The dynamics, fate, and distribution of PCBs in the environment are a function of a number of chemical, physical, and biological properties and processes inherent to PCBs and their immediate environment. The major properties considered are water solubility, octanol/water partition coefficient (Kow), vapor pressure, Henry's Law constant, volatility from water, adsorption (sorption) to soils and sediments, bioaccumulation in fish and wildlife, atmospheric and aqueous oxidation and photolysis, hydrolysis, and biodegradation.

The major factor affecting the mobility, bioavailability, and bioaccumulation of PCBs is their low solubility in water. The water solubility of an organic compound is well correlated to its propensity to become accumulated in organisms, soils, sediments, and organic-rich media. Simply put, the lower the solubility of an organic compound in water, the greater it will partition into an organic-rich medium. A laboratory measurement commonly employed to describe this relationship is the Kow of the compound. The Kow is the ratio of the equilibrium concentration of the compound between a polar (water) and a non-polar (octanol) medium under a set of controlled laboratory conditions. The Kow is an important parameter because it is used in predicting biological uptake, lipophilic storage, and adsorption to sediments. Under environmental conditions, the partitioning behavior of a compound with a high Kow often leads to competition between two or more organic-rich media to which the compound is exposed. For instance, a lipophilic PCB mixture in a natural water system may favorably, but not exclusively, partition into suspended and bottom sediments rather than aquatic biota largely due to the greater mass and surface area of the sediment media.

The chemical properties of a PCB mixture are determined by the degree of chlorination of the individual components. Mixtures with higher degrees of chlorination have lower water solubilities and higher Kows than less chorinated mixtures. Measured water solubilities of PCBs range from a low of approximately 0.02 ug/l for an octachlorinated congener, 1 ug/l for a hexachlorinated congener, 60 ug/l for a tetrachlorinated congener, and about 800 ug/l for a dichlorinated congener (USEPA, 1983). It should be noted that different isomers within each of the congener groups can exhibit water solubilities which vary by an order of magnitude. The corresponding log Kow values for some of the PCB congener groups range from about 5.0 for a dichlorinated congener to about 7.0 for an octachlorinated congener. This indicates that at equilibrium, a 500,000- to 1,000,000-fold excess of PCBs would be partitioned into the organic phase over what might be present in the water. The high Kow for this class of compounds demonstrates that PCBs are strongly attracted to and favored in matrices high in organic carbon. The phenomenon of preferential partitioning explains why, although PCBs are rather volatile when dissolved in water (a property which has resulted in world-wide distribution via the atmosphere), they are virtually non-volatile in the adsorbed state.

4.02 Adsorption and Bioavailability in Soils and Sediments

The Kow values for PCBs outlined above can be applied to predict the degree and strength of adsorption of PCBs to soils and sediments. In general, the adsorption of PCBs to soils and sediments is a function of the water solubility and Kow of the particular PCB isomer and the organic carbon content of the soil adsorbent. That is, the greater the organic phase pool of the soil, the greater the equilibrium mass of PCB on the soil. The Freundlich isotherm equation describes the relationship between the amount of organic solute adsorbed per unit mass of soil as a function of the concentration of the solute in the overlying aqueous phase. This equation is:

$$x/m = (Kd)(C)(1/n)$$

where x/m is the ug of chemical adsorbed per gram of soil or sediment, Kd is the adsorption constant for the particular soil or sediment, C is the concentration of the solute in the aqueous solution, and n is a constant. In general, 1/n is close to 1 and the equation becomes:

$$x/m = (Kd)(C)$$

It has been demonstrated (Karickhoff, 1981) that the sorption of neutral organic compounds onto soils and sediments can be correlated with the organic carbon content of the soil or sediment. Thus, a term known as the soil adsorption coefficient, Koc, has gained utility over the Freundlich constant. The general relation between these two parameters is given by:

$$Koc = Kd/oc$$

and then:

$$x/m = Koc(oc)C$$

where oc is the percent organic carbon of the soil. This relationship demonstrates that the higher the organic carbon content of the soil, the greater the equilibrium amount of organic solute adsorbed onto the soil. It also allows the consideration of the organic content of the soil or sediment independently from the chemical characteristics of the solute. A number of empirical relationships between Koc and Kow have been experimentally established, as compiled in Lyman *et al.* (1982), which demonstrate that Koc is well-correlated to Kow and can be used to approximate the partitioning and binding of organic solutes to soils and sediments.

In addition to the observations that binding is a function of water solubility of the solute and organic content of soils, Shaw *et al.* (1984) have noted that adsorption of PCBs to soils is also strongly influenced by the planarity of the molecule. Although planarity can essentially be related back to water solubility, they determined that planar molecules are most efficiently adsorbed, and adsorption decreases as the molecule becomes less planar. This observation is of considerable importance, since the more toxic PCB congeners have been shown to be those with a planar configuration (Goldstein *et al.*, 1977; Poland and Glover, 1977).

Another consideration recently reported is the relationship between the organic content of soils to which hydrophobic solutes such as PCBs and chlorinated dioxins have become adsorbed, and the bioavailability of those adsorbed residues to humans and wildlife following ingestion. Kurachi and Mio (1983) reported that activated charcoal and other high organic content particulates containing PCBs inhibited the uptake and accumulation of PCBs by mice. They also demonstrated that activated charcoal and other high organic carbon particulates had a high affinity for systemic PCBs. This suggests that the bioavailability of PCBs adsorbed to soils and sediments is decreased by a factor reflected by the strength of adsorption, which appears to be a direct function of the organic content of the soil or sediment. This relationship is reasonable, in light of the known adsorptive behavior of PCBs on soils of varying organic content and the empirical relationships between water solubility, Kow, Koc, and soil binding presented above. It demonstrates that the measured residue concentration cannot be used directly to evaluate bioavailability or toxic potential without consideration of the organic content of the particle containing the residue.

In regard to the Ley Creek site, a determination of the organic content of the study area soil was not made. However, the soils present at the study area were originally bottom sediments dredged from Ley Creek. As such, they are believed to be high in organic matter since aquatic sediments are typically composed of both silty soil materials transported by runoff to the aquatic system and of decomposed biological materials. Further, total organic carbon concentrations in sediment samples collected during the RI ranged from 1.36% to 2.17%. Therefore, PCBs at the study area will be highly bound to the soil and consequently have a low degree of bioavailability.

Considerable research has been conducted on the bioavailability of other lipophilic organic molecules. Umbreit *et al.* (1986) have most recently presented the results of a study into the bioavailability of 2,3,7,8-TCDD adsorbed onto two different types of soils. 2,3,7,8-TCDD is a planar chlorinated aromatic hydrocarbon which has similar physicochemical properties and mode of action to the planar PCBs. It was demonstrated that the toxic potency of soils from Times Beach, Missouri, containing an average of 950 ug/kg of 2,3,7,8-TCDD and 8 ug/kg of 2,3,7,8-TCDF were of much higher toxic potency than the potency of soil collected from a facility in Newark, New Jersey, which contained 2,280 ug/kg of 2,3,7,8-TCDD, 135 ug/kg of 2,3,7,8-TCDF, and considerable amounts of other chlorinated dioxins and dibenzofurans. The 2,3,7,8-TCDD on Newark soils was determined to be much more strongly bound and less bioavailable than the 2,3,7,8-TCDD bound to the Times Beach soils or to freshly spiked laboratory soils. These characteristics were related back to the total organic content of the soils and clearly point out the influence of factors controlling adsorption on bioavailability.

A similar study was conducted by Varanasi *et al.* (1985), which investigated the bioavailability of aromatic hydrocarbons in estuarine sediments. Following comparison of the uptake of tritiated aromatic hydrocarbons applied to sediments to the uptake of aromatic hydrocarbons already adsorbed onto sediments, they concluded that only a fraction of the total aromatic hydrocarbon adsorbed onto the sediment was bioavailable, the rest being too tightly bound to particles for significant uptake by biota. As in the study by Umbreit *et al.*, they determined that extractable residues in soils or sediments, as analytically measured, overestimated the bioavailable residue of the measured residue.

In a notable study conducted by Fisher *et al.* (1983), the dynamics of PCBs on sediments collected from Waukegan Harbor, Illinois were monitored in a laboratory microcosm. The researchers monitored the ortho-substituted PCB congeners, those thought to represent the greatest potential for inducing toxic effects. They concluded that because of their strong adsorption onto sediments and low diffusivity within sediment pore water, PCBs in sediments are quickly removed from communication with overlying water. This is especially true if the sediments are not affected by physical resuspension, bioturbation, or bioaccumulation. The study measured extremely low PCB diffusivities and concluded that in an aquatic system to which PCB inputs are stopped, even low sedimentation rates would quickly immobilize the existing sediment-bound residues from diffusional communication with overlying waters.

4.03 Biodegradation and Other Dissipative Pathways

As reviewed in USEPA (1983), the microbial degradation of the PCBs in aquatic media such as natural waters, activated sludge systems, or in pure culture systems of microbes is relatively extensive. However, some of the data are contradictory, primarily due to the variety of different experimental approaches used.

The general trend which is observed is that PCBs, especially the mono-, di-, and trichloro-compounds could undergo biodegradation under aerobic conditions at rates which would give half-lives of 2 to 40 days. Half-lives for the tetra- and the pentachloro- (and higher) biphenyls were given as 1 week to 2 or more months, and greater than one year, respectively. Information on PCB degradation in soils is considerably more limited, but a comparable range of persistence in soil (under aerobic conditions) was estimated for the various PCB congener groups (USEPA, 1983). That is, mono- and dichlorobiphenyls would degrade in laboratory studies with approximate half-lives of 6 to 10 days, tri- and tetrachlorobiphenyls with half-lives of 12 to 30 days, and pentachloro- and biphenyls of higher substitution would be the most persistent, with half-lives of greater than a year or more.

Two reasons were given to explain this pattern of persistence. First, greater chlorine substitution reduces the opportunity for oxidative metabolism of the biphenyl rings, which may open the way for more extensive degradation. Secondly, as discussed above, increasing chlorine substitution results in a greater affinity for soil particles, which can decrease the bioavailability of the PCB molecule to microbes. For those microbes which must absorb the compound intracellularly prior to metabolizing it, the binding reduces the ability of the PCBs to become biodegraded. Based on recent studies (Unterman *et al.*, 1987), substantial aerobic biodegradation of soil-bound PCBs may be more extensive than previously thought. These laboratory and field studies indicate that certain soil microbes readily reduced PCB soil residues, including the more highly chlorinated congeners.

Until recently, PCBs under anaerobic soil conditions were believed to undergo biodegradation only to a negligible extent (USEPA, 1983). However, recent data presented by Brown *et al.* (1987) indicate that microbial communities can develop with time under anaerobic conditions which are capable of degrading even the more highly chlorinated congeners. In addition to the oxidation/reduction potential of the soil, other site-specific factors may limit or enhance the rate of soil biodegradation. These include the composition of the microbial community present, availability of other soil nutrients, climate and precipitation, and other physical/chemical parameters.

Results of a field study of biodegradation of PCBs in Hudson River sediments was recently released by General Electric Company (1992). It was concluded from this study that indigenous microorganisms can degrade the lightly chlorinated PCBs present in Hudson River sediments, that aerobic PCB biodegradation can be accelerated *in situ* by the addition of nutrients and supplemental oxygen, and that aerobic PCB degradation is occuring naturally in Hudson River sediments (General Electric Company, 1992). Therefore, although it is reasonable to expect that the PCB residues will dissipate at the study area by biodegradation, it is difficult to assess accurately the site-specific biodegradation rates of PCBs.

Several other physical and chemical mechanisms may also serve to dissipate PCBs (Callahan *et al.*, 1979). As discussed above, PCB volatilization from water is a significant process, but is negligible for PCBs bound to soil and sediment particles. Hydrolysis and oxidation also play minimal roles in degradation of PCBs. While there is experimental evidence that PCBs, including the more chlorinated congeners, may be photodegraded in the presence of ultraviolet light, there is no evidence that this event occurs under environmental conditions.

4.04 Bioaccumulation

As with adsorption phenomena, the tendency for a neutral organic substance such as PCBs to accumulate in aquatic and terrestrial biota is strongly correlated with its lipophilicity as defined by water solubility and Kow, with the additional consideration of the degree of metabolism within the organism to more water-soluble and more readily excreted structures. Thus, lipophilic compounds will, up to a point, be readily absorbed through gill tissue (in fish) and the gastrointestinal tract, and, once in the body, will favorably partition into adipose and other lipid-rich tissues while resisting excretory mechanisms. Thus, it has frequently been observed that residues of such compounds may accumulate to levels higher than found in the ambient environment, in continuously or intermittently exposed organisms (Spacie and Hamelink, 1984). Such an event is termed bioconcentration or bioaccumulation. Dietary uptake from residues in the food web can also contribute to accumulated residues as well as from ambient exposures. As in the preceding discussions, PCBs adsorbed to bottom and suspended sediments will have a reduced availability to biota as compared to residues in water, air, or food items. Therefore, in light of the lipophilic and relatively inert nature of the PCBs, they have a propensity to bioaccumulate in both aquatic and terrestrial organisms as discussed in detail by USEPA (1980). USEPA (1980) presents the results of a large number of bioconcentration studies of PCBs in both freshwater and saltwater species of vertebrates and invertebrates. Bioconcentration factors (or BCFs, the ratio of the tissue residue level to the residue level in the exposure medium) of up to 100,000 or more have been measured in fish and shellfish. For example, a BCF for Aroclor 1242 of 274,000 was reported for the freshwater fathead minnow based on whole body residues. In the edible fillets of the rainbow trout, an important food fish, a BCF of 9,550 was determined. Given the great variability of BCFs within fish species and between fish species, an estimate of a BCF for PCBs may aid in understanding the potential for the chemical to bioaccumulate.

SECTION 5 - RISK ASSESSMENT

5.01 Introduction

This section presents a baseline assessment of the potential human health risks which may be associated with chemical residues at the study area. This risk assessment is a revision of the risk assessment originally prepared for the study area in 1989 (O'Brien & Gere Engineers, 1989), and includes analytical data from recently conducted field activities at the study area. The assessment was conducted in accordance with USEPA guidelines and procedures, as presented in the following guidance documents:

- *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual* (Part A) (USEPA, 1989[a])
- *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual Supplemental Guidance "Standard Default Exposure Factors"* (USEPA, 1991[a]).
- *Guidance on Risk Characterization for Risk Managers and Risk Assessors* (USEPA, 1992[a]).
- *Guidelines for Exposure Assessment* (USEPA, 1992[b]).

Consistent with these guidelines, the assessment was conducted in the following five phases:

1. **Characterization of Exposure Setting** - The first step in the assessment process was to characterize the study area with respect to its physical

characteristics as well as those of the human populations on or near the study area. The output of this step was a descriptive evaluation of the study area and surrounding populations with respect to those characteristics that influence exposure.

2. **Data Evaluation** - The objective of the data evaluation step was to organize the data into a form appropriate for use in the assessment and to evaluate the quality of the data for risk assessment purposes.

3. **Exposure Assessment** - In the exposure assessment, the pathways by which receptors may be exposed to study area chemicals were identified, and exposure point concentrations of the chemicals were estimated. Exposure point concentrations were estimated directly from detected study area concentrations.

4. **Toxicity Assessment** - In the toxicity assessment, available toxicological data for study area related compounds were reviewed. Dose-response relationships between the extent of exposure and the potential occurrence/severity of potential adverse health effects were estimated.

5. **Risk Characterization** - In the risk characterization step, the toxicity and exposure assessments were integrated into quantitative expressions of potential human health risk. Potential carcinogenic and non-carcinogenic health effects were characterized using chemical specific toxicologic reference data.

The Study Area Characterization, Data Evaluation, Exposure Assessment, Toxicity Assessment, and Risk Characterization are presented and discussed in Sections 5.02, 5.03, 5.04, 5.05, and 5.06, respectively.

In the opinion of O'Brien & Gere Engineers, the risks calculated and presented in this assessment are not a realistic presentation of actual risks to human health represented by the study area. The calculated values are a reflection of the standardized risk assessment methodology recommended by the USEPA. The risk values calculated using the USEPA methods are likely to overestimate the actual human health risks due to the utilization of conservative exposure assumptions and dose response models. However, because they are generated by a "standardized" procedure, the risk values are useful as a basis for comparison between investigated sites, as well as a basis for identifying remedial objectives.

5.02 Study Area Characterization

5.02.1 Future Study Area Use

It is expected that the study area use in the foreseeable future will be the same as the current study area conditions.

5.02.2 Potential Receptor Populations

Due to the limited access to the study area, and the lack of recreational fishing at the study area, exposure to study area related compounds is expected to be low. However, it is possible that individuals may occasionally gain access to the study area. In addition, at the request of NYSDEC (Kelly, 1989), it was assumed that there may be some fish that were caught from the study area and eaten by a domestic household. Potential receptor populations were therefore identified as adult/child recreational users of Ley Creek, and adult/child consumers of recreationally caught fish.

5.03 Data Evaluation

The objectives of the data evaluation step are to evaluate the quality of analytical data for use in the risk assessment. The result of the data evaluation is a list of compounds and environmental media that may be of concern at the study area. The identified compounds are carried through the exposure assessment and risk characterization steps. Significant data gaps, if they exist, are also identified during the data evaluation. The sampling locations, sampled media, and analytical methods were examined for representativeness and accuracy in the data evaluation process.

5.03.1 Selection of Compounds of Potential Concern

PCBs were identified as the only compounds of potential concern for the study area. The volatile organic compounds detected in the surface water during previous investigations at the study area were eliminated from consideration as compounds of potential concern based on the low concentrations detected in the water, and compliance with NYS Class B surface water standards and guidance values.

5.04 Exposure Assessment

In the exposure assessment, the mechanisms by which receptors may be exposed to the chemicals of potential concern present at or migrating from the study area are identified and the concentrations of the chemicals to which receptors may be exposed are estimated. The exposure assessment was conducted in the following manner:

1. Characterize Exposure Setting
    a. Characterize physical environment
    b. Identify potentially exposed populations
2. Identify and Evaluate Exposure Pathways
    a. Exposure pathway analysis
3. Quantify Exposure
    a. Estimate exposure point concentrations
    b. Determine intake variables
    c. Calculate estimated chemical intakes by receptors

5.04.1 Characterization of Exposure Setting

The first step in evaluating exposure is to characterize the study area with respect to its physical characteristics, as well as those of the human populations on and near the study area. The output of this step is a qualitative evaluation of the study area and surrounding populations with respect to those characteristics that influence exposure. Information gathered during this step supports the identification of exposure pathways in Section 5.04.02.

The following summarizes the key aspects of the study area and its surroundings:

- The study area is located between the Town of Salina Garage and Townline Road and extends approximately 5,200 feet along Ley Creek. The portion of the study area which is listed as a Class 2 site in the New York State Registry of Inactive Hazardous Waste Disposal Sites is that parcel on the south bank of Ley Creek which starts at GM-IFG Outfall 003 and extends 1,000 feet west.
- The study area is in an urban area.
- The study area is fenced and therefore not accessible by the general public. However, it is possible that receptors may occasionally access the study area.
- There is no recreational use of the study area for fishing. However, at the request of NYSDEC (Kelly, 1989), the fish ingestion pathway was evaluated.

As discussed in Section 5.02.3, the following potential receptor populations were identified at the study area:

- Adults/children who may occasionally contact surface soils at the study area.
- Adults/children who may occasionally contact sediments at the study area.
- Adults/children who may occasionally consume fish containing PCBs.

5.04.2 Identification and Characterization of Exposure Pathways

An exposure pathway describes the course a chemical takes from the source to the exposed individual. An exposure pathway generally consists of four elements:

- A source and mechanism of chemical release
- A retention or transport medium
- A point of potential human contact with the contaminated medium (referred to as the exposure point)
- An exposure route (*e.g.* ingestion) at the contact point.

An exposure pathway analysis evaluates the sources, locations and types of environmental releases as well as population locations and activity patterns to determine the significant pathways of human exposure. A pathway is considered **complete** if there is:

- A source or chemical release from a source,
- A potentially exposed receptor population,
- An exposure point where contact of receptors may occur, and
- An intake mechanism for potentially exposed receptors.

If these conditions are not met, there is no means by which receptors may receive a dose of the chemical, and the pathway is classified as **incomplete**. Incomplete pathways are not considered further in the risk assessment.

An exposure pathway analysis was conducted for the study area. Soil, ground water, surface water, sediments, air, and biota were identified as potential receiving media for compounds of concern. Following the identification of potential receiving media, potential exposure pathways at the study area were classified as complete or incomplete. The results of the exposure pathway analysis are presented on Table 17 and summarized below.

5.04.2.1 Soil

Under current and future land uses, the soil exposure pathway via incidental ingestion and dermal adsorption was determined to be **complete** at study area locations. PCB residues are present in surface soils at the study area. There is a potential for individuals to come into contact with the PCB residues in surface soil. However, it should be noted that the likelihood that individuals may contact study area soil is low, since the study area is fenced and access is therefore limited.

5.04.2.2 Sediment

Under current and future land uses, the sediment exposure pathway via incidental ingestion and dermal adsorption was determined to be **complete** at study area locations. PCB residues are present in sediments at the study area. There is a potential for individuals to come into contact with the PCB residues in sediments. However, it should be noted that the likelihood that individuals may contact study area sediments is low, since the study area is fenced and access is therefore limited.

5.04.2.3 Ground Water

Under current and future land uses, it was determined that the ground water exposure pathway is **incomplete** at study area and surrounding locations. Although chemical residues were detected in study area ground water, the shallow ground water at the study area is not used for domestic or industrial purposes, since the local community is served by municipal water from the Onondaga County Water Authority (OCWA), which obtains its water from Otisco Lake, located approximately 16 miles from the study area.

5.04.2.4 Surface Water

Under current and future land uses, the surface water pathway was classified as **complete**. Low concentrations of PCBs were detected in surface water collected from the study area. There is a potential for individuals to come into contact with the PCB residues in surface water. However, it should be noted that the potential exposures to PCB residues via the surface water pathway is likely to be negligible compared to sediment/surface soil exposures since low concentrations of PCBs were detected in study area surface water, and access to the study area is limited. Therefore, the surface water pathway was not quantified further in the analysis.

5.04.2.5 Air

Under current and future land uses, the study area air pathway is classified as **incomplete**. Previous air monitoring at the study area did not detect PCB residues in the air at a detection limit of 1 x 10^{-3} mg/m^3 (O'Brien & Gere Engineers, 1989).

5.04.2.6 Biota

The foodchain pathway via ingestion of biota is classified as **complete**. PCB residues were detected in fish collected from the study area. While it is highly unlikely that fish from the study area would be eaten, at the request of NYSDEC (Kelly, 1989) it was assumed for this assessment that there may be some domestic consumption of fish caught from the study area.

5.04.3 Quantification of Exposure

The next step in the exposure assessment was to quantify the magnitude, frequency and duration of exposure for the complete exposure pathways. First, exposure concentrations were estimated, then pathway-specific intakes were quantified.

The methods and assumptions used in calculating the exposure point concentrations for soil, sediments, and fish are presented below.

5.04.3.1 Soil

Consistent with current USEPA guidance (USEPA, 1992[b]), average and upper bound exposure point concentrations were estimated. The average exposure point concentration was calculated as the mean detected PCB concentration from study area samples (Appendix F). The upper bound exposure point concentration was calculated as the upper 95% confidence level on the arithmetic mean for PCBs in surface soils (Appendix F).

5.04.3.2 Sediment

Consistent with current USEPA guidance (USEPA, 1992[b]), average and upper bound exposure point concentrations were estimated. Average exposure point concentrations were calculated as the mean detected PCB concentration from study area samples. Insufficient sediment samples were available to estimate the upper 95% confidence level on the mean for PCB concentrations in sediments. Therefore, as a conservative measure, the maximum PCB concentration detected in sediments was used as the upper bound exposure point concentration (Appendix F).

5.04.3.3 Fish

The maximum and mean PCB concentrations detected in the edible portion of fish collected from Ley Creek were used as an upper bound and average estimate, respectively, of PCBs in the fish (Appendix F). The maximum concentration of PCBs in fish was used as the upper bound exposure point concentration because insufficient fish samples were available to estimate the upper 95% confidence level on the mean. It should be noted that some of the fish were collected from an upgradient location from the study area. According to NYSDEC, the fish in Ley Creek have a home range that may extend up to two miles along the creek (Creech, 1992). Therefore, the PCB residues detected in the fish collected from Ley Creek likely represent the general discharge of PCB residues to the creek, and may overestimate the specific contribution of the study area to PCB concentrations in fish in Ley Creek. As discussed in Section 1.02, there are several potential upstream sources of PCBs to Ley Creek.

5.04.4 Calculation of Chronic Daily Intakes

Chronic Daily Intakes (CDIs) for receptors exposed via the following exposure pathways were calculated using the intake equations and parameter estimates given on Tables 19 through 21 and summarized below.

5.04.4.1 Contact with Study Area Soils

A summary of the exposure parameters used to evaluate potential direct contact exposures with soils is given on Table 19. As previously stated in this assessment, the exposure frequency for individuals at the study area is likely to be low since access to the study area is limited. It was assumed that an adult individual may contact surface soils during work related activities for a period of 10 days per year over the employment period. The upper bound and average employment periods at the plant were estimated at 19 and 4 years, respectively, based on US Bureau of Labor data (US Bureau of Labor, 1989). It was also assumed that an older child (> 6 years) may be present at the study area for a total of 2 days per year for a 6 year period (total of 12 days exposure).

For both children and adults, it was assumed that incidental ingestion of soils would be the dominant exposure route. Dermal uptake of PCB residues from the soils is likely to be negligible relative to incidental ingestion because the soils have a high organic matter content. As such, the PCB residues would be strongly bound to the soils and would not be extensively available for dermal uptake (according to data cited by USEPA (USEPA, 1992[c]), less than 0.2 % of the applied dose of TCDD, a structurally similar compound to PCB, is expected to be absorbed transdermally following dermal application of TCDD in high organic carbon soils).

Consistent with USEPA guidance for industrial exposures, adults were assumed to ingest 50 mg of soil per day exposed (USEPA, 1989). In addition, it was assumed that while at the study area, adults may be exposed to soils approximately 80 percent of the time, and sediments 20 percent of the time. For children, the estimated soil ingestion rate for outdoor play activities (250 mg/day) was used (USEPA, 1989). It was assumed that while at the study area, children may be exposed to soils 50 percent of the time, and sediments 50 percent of the time. In addition, it was assumed that the children that may trespass at the study area would be older children (> 6 years), and the average body weight for older children (>6 - 18 years) of 21 kg was used.

The estimated direct contact CDIs for PCBs based on the above exposure assumptions are given on Table 19.

5.04.4.2 Contact With Study Area Sediments

The exposure parameters used to estimate sediment incidental exposures were the same as the soil exposures except the sediment average and upper bound exposure point concentrations were used, and the fraction of total ingested material contributed by the sediments was assumed to be 20 percent and 50 percent for adults and children, respectively. The estimated CDIs and parameter values for sediment exposures based on the above exposure assumptions are given on Table 20.

5.04.4.3 Ingestion of Fish Containing PCBs

A summary of the exposure parameters used to evaluate the fish ingestion pathway is given on Table 21. As previously stated, recreational fishing in Ley Creek is minimal or nonexistent. In this assessment, it was assumed that an individual would fish in Ley Creek at a frequency of once per year. On that occasion, it was assumed that a total catch of 2,000 grams of edible fish would be caught. This figure was based on an assumed catch of two fish, each of 1,000 g mass. The 1,000 g mass was used for the purposes of calculation, based on an average mass of fish of sufficient size for consumption caught during the fish survey on July 16, 1992 (884 g); fish selected for this calculation are indicated in Table 2. It was assumed that a catch of 2,000 g would yield an edible portion of 500 grams (25% of total weight). It was further assumed that the edible portion would be consumed over the course of the year by a family of four (two adults and two children) for a total ingested quantity of 192 grams/adult and 58 grams/child.

The calculated CDIs via the fish ingestion pathway based on the above exposure assumptions are given on Table 21.

5.05 Toxicity Assessment

In the toxicity assessment, available toxicological data summaries for study area compounds are reviewed and the relationship between the extent of exposure to a specific contaminant and the increased likelihood and/or severity of adverse effects are estimated. The potential toxicologic effects induced by a given dose of a chemical are classified according to two criteria: carcinogenic effects and non-carcinogenic effects.

Exposures to chemicals which cause non-carcinogenic health effects are evaluated based on the notion that there is a dose level at and below which no adverse health effects would be expected to occur (threshold effect). Using animal and/or human dose response information, the USEPA estimates the dose for specific chemicals which would represent the dose at which the toxicity threshold for humans would occur. These dose levels are referred to as Reference Doses (RfD's). The ratio of the estimated CDI and the RfD is termed the Hazard Index (HI). If the HI is less than 1, then it is believed that there will be no adverse non-carcinogenic toxicologic effects related to the exposure.

The USEPA assumes that there is no threshold dose for carcinogenicity, i.e. there is no dose of a carcinogenic substance that is associated with zero risk. This is a conservative assumption that may or may not be valid, as the concept of no threshold for carcinogenic effects has not been demonstrated via laboratory animal studies or human epidemiological information. USEPA calculates cancer slope factors in order to quantify the potential excess cancer risk following exposure to a chemical. The excess cancer risk is defined as the probability of developing cancer from a specific exposure in excess of the background probability of developing cancer in general. For example, the average background risk of developing cancer over a lifetime is approximately 0.25 in the United States. The excess cancer risk would be the additional probability of developing cancer over the background incidence of 0.25.

A cancer slope factor is an upper-bound estimate of the probability of a cancer response per unit intake of a chemical over a lifetime. Slope factors incorporate safety factors which are designed to protect the public health. This means that expected excess cancer rates calculated using the USEPA's potency factors represent "worst case" estimates, i.e. the actual excess cancer rate is expected to be lower than the calculated estimate.

5.05.1 Toxicity Profiles

A brief discussion of the human toxicological effects of PCBs, including Rfd's and cancer slope factors published by USEPA, are presented below. The information was compiled from USEPA's Integrated Risk Information System (IRIS) database, as well as data published in the open literature.

5.05.1.1 Cancer

USEPA has classified PCBs as a group as B2 (probable human carcinogens), and have published an oral cancer slope factor of 7.8 $(mg/kg/day)^{-1}$. The classification of PCBs as probable human carcinogens by the Carcinogen Assessment Group of the USEPA is based upon reports that indicated that Aroclor 1260 produced liver tumors when fed to rats, and that Kaneclor 500 (a Japenese PCB mixture similar in composition to Aroclor 1260) produced a similar effect in mice. Kimbrough et al. (1975) exposed a group of 100 female Sherman strain rats to a diet containing Aroclor 1260 at a level of 100 mg/kg of feed for a period of approximately two years. When the surviving 184 animals were sacrificed and histologically examined, 26 were found to have hepatocellular carcinoma and 144 had neoplastic nodules of the liver. The results were statistically significant when compared to tumor incidence in a comparable control group. Neoplastic nodules are generally considered to be pathologically related to, and may precede development of, hepatocellular carcinoma. Ito et al. (1973) reported the occurrence of hepatocellular carcinoma in 5 of 12 male mice exposed to high levels (500 mg/kg feed) of dietary Kaneclor 500. Lower levels of Kaneclor 500 did not elicit the carcinogenic effect. Of special note was the observation that dosages of up to 500 mg/kg dietary Kaneclor 400 or Kaneclor 300 (less chlorinated PCBs) did not elicit this response, indicating that carcinogenicity may be related to the degree of chlorination.

According to USEPA (USEPA, 1992[d]), data from the National Cancer Institute study (NCI, 1978) suggested an apparent dose dependent relationship between Aroclor 1254 exposure and elevated cancer incidence in male or female Fischer 344 rats. However, the cancer incidence in treated animals was not statistically significantly greater than the cancer incidence in control animals. It is also of note that Aroclor 1248, which is the most prevalent aroclor detected at the study area, has not been demonstrated to be carcinogenic in laboratory bioassays.

There are numerous literature reviews which support the conclusion that lower chlorinated Aroclor mixtures are likely to be of lower potency than Aroclor 1260 (USEPA, 1991[b]; IEHR, 1991; and Chase *et al.*, 1989). USEPA's Risk Assessment Forum conducted a review of the possible use of toxic equivalence factors to evaluate the relative potencies of Aroclor mixtures (USEPA, 1991[b]). They presented data suggesting that Aroclor 1260 may be approximately 3 times more potent than Aroclor 1254, and 20 times more potent than Aroclor 1248 (USEPA, 1991[b]). Similarly, the Institute for Evaluating

Health Risks (IEHR) conducted a critical reassessment of five key rat PCB studies. Based on their assessment, it was concluded that there was no evidence to date that indicated that Aroclor 1254 and Aroclor 1242 were carcinogenic in animal studies. In addition, they suggested that, based on reclassification of the observed pathologic lesion according to current classification standards, and incorporation of dose response data from different rat species and sexes, an oral cancer potency factor of 1.9 $(mg/kg\text{-}day)^{-1}$ for Aroclor 1260 may be more appropriate than the current USEPA value, 7.8 $(mg/kg\text{-}day)^{-1}$ (IEHR, 1991). Another critical review summarized evidence suggesting that Aroclor 1260 may be expected to be approximately 20 times more potent than Aroclor 1232, 10 times more potent than Aroclor 1242, and approximately 3 times more potent than Aroclor 1248 (Chase *et al.*, 1989).

Available information reviewed in USEPA (1984) and in Life Systems (1983) indicates that several studies have failed to elicit a mutagenic or other genotoxic response to PCBs in a number of bacterial and animal test systems. Only one study, utilizing a modification of the Ames bacterial assay system, reported a positive response for 4-chlorobiphenyl and Aroclor 1221 (to a lesser degree). These data, indicating a lack of (or very low order of) mutagenicity, shed light on the possible mechanism by which certain PCB congeners induce liver tumors in rodents, and have an important bearing on the conduct of a quantitative cancer risk assessment of these materials.

There is very little data from which to directly infer the carcinogenicity of PCBs in humans. As reviewed in USEPA (1984), over 1000 people in Yusho, Japan received extensive exposure to high levels of PCBs due to consumption of rice cooked in an oil which was contaminated with a PCB-containing heat transfer agent. This incident, occurring in 1968, resulted in immediate and severe dermatological and respiratory effects. In 1979, it was reported that 11 of 33 deaths of Yusho patients were from malignant neoplasms of a variety of body sites. However, tumor incidence data from a concurrently exposed population were not available and, therefore, conclusions regarding the involvement of PCB exposure to these cancer deaths cannot be made. Interpretation of these data were further complicated by the fact that the exposures involved cooking the oil which produced a high level of toxic PCB byproducts, notably chlorinated dibenzofurans and dioxins.

Other studies examining the relationship between human PCB exposures and cancer incidence have yielded inconclusive results (USEPA, 1992[d]). As such, USEPA has determined that there is inadequate evidence for human carcinogenicity of PCB mixtures.

5.05.1.2 Subchronic and Reproductive Toxicity

Since PCBs have only a low order of acute toxicity to humans or animal test species, most investigations of the toxicity of PCBs have focused on potential toxicity from relatively low level, sub-chronic exposures. As reviewed in ATSDR (1991), PCBs have elicited a variety of subchronic toxic effects in humans and experimental animals, with a great deal of variation observed in the sensitivity of response among species.

A number of occupational and accidental exposures have provided some documentation on the non-carcinogenic effects of PCBs to humans. As discussed in USEPA (1984) and Life Systems (1983); exposures to residues of PCB components have resulted in chloracne and other skin disorders in exposed workers, and occasionally other effects including liver damage, and symptoms indicating neurological and gastrointestinal effects. Subchronic and chronic exposure studies in animals have largely confirmed these findings.

The most consistently affected organ system in experimental animals is the liver (USEPA, 1984). Among the most frequently observed signs of liver toxicity in rodents exposed to high levels of PCBs are enlarged hepatocytes with hypertrophy, fatty infiltration, bile duct proliferation, and elevation of microsomal enzyme activity. Longer term exposures may produce liver degeneration and necrosis in the most highly exposed groups. Mink and monkeys, compared to rodents, are highly susceptible to the effects of PCBs. Exposure of mink to long term diets containing PCBs at 20 mg/kg feed resulted in mortality, while levels of 2 mg/kg diet diminished reproductive performance. Monkeys exposed to low chronic levels of PCBs demonstrated a variety of skin lesions, edema, reduced birth weights of infants, fetal toxicity, hyperactivity, and diminished learning capacity.

Several studies have investigated the reproductive and teratogenic potential of the PCBs (USEPA, 1984). Marks *et al.* (1981) studied the ability of 3,3',4,4',5,5'-hexachlorobiphenyl to induce fetal malformations when fed to pregnant mice at up to 12 mg/kg body weight during gestation. Significant, dose-related increases of cleft palate and hydronephrosis were observed beginning with dosages of 2.0 mg/kg and up. Since maternal toxicity was observed beginning at 8.0 mg/kg, this hexachlorobiphenyl isomer is teratogenic under the conditions of the study. The relationship of this study to exposure to Aroclor mixtures is uncertain, since the particular PCB isomer tested is only one of the many hexachlorobiphenyls that constitute a portion of the total congener mix in the more highly chlorinated Aroclor mixtures. As reviewed in USEPA (1984), diminished reproductive success and various manifestations of fetotoxicity have been observed in rodents and monkeys exposed to PCB mixtures.

While reproductive impairment and other forms of subchronic and chronic toxicity have been demonstrated under certain test conditions with animals (particularly with the more chlorinated PCB congeners), there is no conclusive evidence that such effects have occurred in exposed humans, other than certain skin disorders. USEPA has published a chronic oral RfD for Aroclor 1016 based on a No Observed Adverse Effect Level (NOAEL) of 0.007 mg/kg/day for reproductive effects in monkeys, divided by an uncertainty factor of 100 for animal to human extrapolation and protection of sensitive subpopulations.

5.05.2 Toxicological Uncertainties

One significant source of uncertainty in evaluating the potential toxicologic effects of PCB mixtures is related to the use of toxicologic data from higher chlorinated PCB mixtures in evaluating lower chlorinated mixtures. Highly chlorinated PCB mixtures such as Aroclor 1260 have been shown to significantly increase cancer incidence rates when administered at high doses to laboratory animals. However, as discussed by USEPA (1992[d]), available data indicate that lower chlorinated PCB mixtures (such as Aroclor 1248) may be less potent with respect to potential carcinogenic effects as compared with higher chlorinated mixtures. Most of the PCB concentrations detected at the study area during the RI were Aroclor 1248, and only low concentrations of Aroclor 1260 were reported in three soil samples collected from the study area. Since the USEPA has derived a cancer slope factor for PCBs based on Aroclor 1260 data, use of USEPA's cancer slope for PCBs would likely result in a significant overestimation of potential cancer risks at the study area.

Additional uncertainty arises from the USEPA's use of the linearized multi-stage model for estimating the cancer slope factor for PCBs. The linearized multi-stage model is a mathematical model which may describe the carcinogenic process. As discussed above, the model assumes that at low doses, there is a linear relationship between the dose of a chemical and the excess cancer risk. In addition, the model assumes that there is no threshold dose for the induction of cancer. However, there are many instances in which this assumption may not hold true. Examples of such cases are chemicals that stimulate cell proliferation rates at high doses (Cohen and Ellwein, 1990; Ames and Gold, 1990), and non-gentoxic chemicals (Cohen and Ellwein, 1990). In such cases, the linearized multi-stage model may provide a "plausible upper limit" of potential cancer risk; though the calculated estimate "does not necessarily give a realistic prediction of the risk. The true value of the risk is unknown, and may be as low as zero" (51 FR 3398). The basic toxicologic effects of PCBs, (*i.e.* induction of cell injury at high doses, no significant mutagenic effects) suggest that use of the linearized multistage model may result in the overestimation of risks from low level exposures to PCBs.

5.06 Risk Characterization

In this section of the risk assessment, the toxicity and exposure assessments are summarized and integrated into quantitative and qualitative expressions of risk. To evaluate potential carcinogenic effects, the estimated Chronic Daily Intakes are multiplied by chemical specific slope factors published by the USEPA. The resultant product is a unitless value reflecting the theoretical risk of an individual developing cancer in excess of the cancer risk from other causes. The excess cancer risk is defined as the probability of developing cancer from a specific exposure in excess of the background probability of developing cancer. In general, excess cancer risks less than 10^{-4} to 10^{-6} are considered by the USEPA to be acceptable risk levels, depending on the specific circumstances of the study area.

Exposures to chemicals which cause non-carcinogenic health effects are evaluated based on the notion that there is a dose level at and below which no adverse health effects would be expected to occur (threshold effect). Using animal and/or human dose response information, the USEPA estimates the dose for specific chemicals which would represent the dose at which the toxicity threshold for humans would occur. These dose levels are referred to as Reference Doses (RfD's). If the ratio of the estimated CDI and the RfD (the HI) is less than 1, then it is believed that there will be no adverse non-carcinogenic toxicologic effects related to the exposure.

5.06.1 Quantifying Risks

Potential health risks were quantified for adult/child receptors potentially exposed via the following exposure pathways :

- Direct contact with study area soils
- Direct contact with study area sediments
- Ingestion of fish containing PCBs

A summary of the potential health risks to the potentially exposed receptor populations given above is presented in Tables 22 through 25 and discussed below.

5.06.1.1 Direct Contact with Study Area Soils

As shown on Table 22, the upper bound and average excess cancer risks for direct contact exposures of adults, based on the previously discussed exposure assumptions and USEPA's cancer slope factor are 5.0×10^{-7} and 7.5×10^{-8}, respectively. The upper bound and average HIs for adults are 3.4×10^{-3} and 2.4×10^{-3}, respectively (Table 23). The upper bound and average excess cancer risks for potentially exposed children are 3.3×10^{-7} and 2.3×10^{-7}, respectively (Table 24). The upper bound and average HIs for children are 7.2×10^{-3} and 5.1×10^{-3}, respectively (Table 25). These risks and HIs are within the Superfund site remediation goal in the NCP (10^{-4} to 10^{-6} for excess cancer risks and less than 1 for HIs) (40 CFR 300.430).

5.06.1.2 Direct Contact with Study Area Sediments

As shown on Table 22, the upper bound and average excess cancer risks for direct contact exposures of adults, based on the previously discussed exposure assumptions and USEPA's cancer slope factor are 7.0×10^{-8} and 2.3×10^{-9}, respectively. The upper bound and average HIs for adults are 4.8×10^{-4} and 7.3×10^{-5}, respectively (Table 23). The upper bound and average excess cancer risks for potentially exposed children are 1.8×10^{-7} and 2.8×10^{-8}, respectively (Table 24). The upper bound and average HIs for children are 4.0×10^{-3} and 6.1×10^{-4}, respectively (Table 25). These risks and HIs are within the

Superfund site remediation goal in the NCP (10^{-4} to 10^{-6} for excess cancer risks and less than 1 for HIs) (40 CFR 300.430).

5.06.1.3 Ingestion of Fish Containing PCBs

As shown on Table 22, the upper bound and average excess cancer risks for adults via the fish ingestion pathway are 6.0×10^{-5} and 6.0×10^{-6}, respectively. The upper bound and average HIs for adults are 2.6×10^{-1} and 8.6×10^{-2}, respectively (Table 23). The upper bound and average excess cancer risks for potentially exposed children are 1.6×10^{-5} and 5.2×10^{-6}, respectively (Table 24). The upper bound and average HIs for children are 3.4×10^{-1} and 1.1×10^{-1}, respectively (Table 25). These risks and HIs are within the Superfund site remediation goal in the NCP (10^{-4} to 10^{-6} for excess cancer risks and less than 1 for HIs) (40 CFR 300.430).

It should be noted that the calculated health risk estimates for the fish ingestion pathway were based on PCB residues detected in the fish collected from Ley Creek. As previously discussed, the detected concentrations likely represent the general discharge of PCB residues to the creek, and may overestimate the specific contribution of the study area to PCB concentrations in fish in Ley Creek. In addition, it should be noted that the maximum detected PCB concentration (2.4 mg/kg) only slightly exceeds the U.S. Food and Drug Administration (FDA) tolerance limit of 2 mg/kg for acceptable levels of PCB residues in edible fish. It should also be reiterated that the estimation of risk via the fish ingestion pathway is especially conservative due to the undesirability of Ley Creek as a fishing location. Aesthetic problems in Ley Creek resulting from raw discharges and combined sewer overflows preclude fishing in the creek (NYSDEC, 1992).

5.06.2 Uncertainties

The risk measures used in this risk assessment are not precise, deterministic estimates of risk, but conditional estimates controlled by a considerable number of consecutive *upper-bound* assumptions regarding exposure and toxicity, which are designed to *overestimate* the true risk value. This is done by convention, consistent with USEPA protocols. A general discussion of the uncertainties inherent in the exposure assessment and toxicity assessment is presented below.

5.06.2.1 Calculation of Chronic Daily Intake

There is considerable uncertainty regarding the CDIs calculated for potentially exposed populations. These uncertainties stem from uncertainties regarding representative exposure point concentrations and exposure assumptions. In order to minimize the potential for underestimating the potential health risks at a site, the risk assessment process incorporates various conservative parameters in the exposure assessment process. The following conservative assumptions were made in calculating the CDIs at the study area:

- The upper bound exposure point concentrations at the study area used were assumed to be the upper 95% confidence level on the mean or the maximum concentration detected in each medium at the study area. The actual representative exposure point concentrations are likely to be lower than the maximum detected concentration.
- It was assumed that the entire mass of PCBs in the ingested soils would be available for uptake following ingestion. However, it is likely that the intestinal absorption of PCB residues from soils/sediments would be less than 100%, since the PCB residues would be strongly adsorbed to organic material in the soils and sediments.

5.06.2.2 Toxicological Data

The uncertainties and conservative assumptions inherent in the toxicologic information used in this assessment have been discussed in Section 5.05.2 of this report.

5.06.2.3 Propagation of Conservative Estimates

The use of a series of upper bound conservative estimates in the calculation of the CDI has a multiplicative effect on the degree of conservatism of the calculated risk level, *i.e.* the degree of conservatism of the final estimate is far greater than the conservatism associated with the individual parameter. As stated by USEPA, "the actual probability that any individual in the population would be subject to the calculated risk estimate is extremely small, and usually so small as to be a practical impossibility" (USEPA, 1992[b]). Therefore, the final cancer risk estimate is likely to significantly overestimate the actual excess cancer risks.

5.07 Summary

A baseline risk assessment was performed using available analytical data generated by O'Brien & Gere Engineers, Inc. The risk estimates were calculated to highlight potential sources of risk so that they may be considered for inclusion in the remedial process as remedial objectives. In summary, the following conclusions may be made. Upper bound and average excess cancer risks and hazard indices for direct contact with soils, direct contact with sediments, and ingestion of PCB residues in fish are as follows:

Exposure Pathway	Receptor	Average Excess Cancer Risk	Average HI	Upper Bound Excess Cancer Risk	Upper Bound HI
Direct Contact With Study Area Soil	Adults	7.5×10^{-8}	2.4×10^{-3}	5.0×10^{-7}	3.4×10^{-3}
	Children	2.3×10^{-7}	5.1×10^{-3}	3.3×10^{-7}	7.2×10^{-3}
Direct Contact With Study Area Sediments	Adults	2.3×10^{-9}	7.3×10^{-5}	7.0×10^{-8}	4.8×10^{-4}
	Children	2.8×10^{-8}	6.1×10^{-4}	1.8×10^{-7}	4.0×10^{-3}
Ingestion of PCB Residues in Fish	Adults	6.0×10^{-6}	8.6×10^{-2}	6.0×10^{-5}	2.6×10^{-1}
	Children	5.2×10^{-6}	1.1×10^{-1}	1.6×10^{-5}	3.4×10^{-1}

SECTION 6 - FISH AND WILDLIFE IMPACT ANALYSIS

6.01 Introduction

This section of the RI Report presents the results of a Step I Fish and Wildlife Impact Analysis (FWIA) for the study area. The FWIA was prepared in accordance with *Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites* (NYSDEC, 1991[a]) and the RI/FS Work Plan (O'Brien & Gere, 1992). The purpose of Step I of the FWIA is to identify potential ecological receptors inhabiting the study area and vicinity and to examine the potential for impact to these resources based on an evaluation of exposure pathways and study area-related contaminant concentrations in the environmental media.

The FWIA report is organized into three sections: Section 6.02 - Study Area Description, Section 6.03 - Applicable Fish and Wildlife Criteria, Section 6.04 - Exposure Pathway Analysis, and Section 6.05 - Results and Discussion. Section 6.02 describes the physical characteristics of identified covertypes to evaluate use and value to fish and wildlife. Section 6.03 identifies applicable Fish and Wildlife Regulatory Criteria (FWRC) for comparison with contaminant concentrations in the environmental media. Section 6.04 presents an exposure pathway analysis. Section 6.05 presents the results of the FWIA, discusses potential ecological exposures within the study area, and addresses whether additional ecological assessment steps should be performed. The tasks which were performed for the Step I FWIA, and the results of these tasks, are discussed in the following sections.

6.02 Study Area Description

The Study Area Description section is divided into five subsections:

1) General Study Area Description - presents a general discussion of the environmental setting and the history of study area activities,
2) Covertype Delineation - discusses the division of the study area and vicinity according to ecological covertypes,
3) Fish and Wildlife Resources - evaluates the quality of the covertypes as wildlife habitat and identifies typical wildlife inhabitants,
4) Observations of Study Area-Related Stress - discusses observations of stressed vegetation related to chemical or physical impacts, and
5) Other Resources - discusses other study area resources such as state regulated wetlands and rare, threatened, and endangered species.

6.02.1 General Study Area Description

The study area consists of approximately one mile of Ley Creek and its southern shoreline. The site comprises the easternmost 1000 ft of the study area. The shoreline consists of primarily material that has been dredged from Ley Creek in the past for drainage improvements and is currently vegetated with primarily reedgrass. Ley Creek continues downgradient of the study area, with a more natural shoreline, for approximately 3 miles, where it enters Onondaga Lake. Onondaga Lake has received industrial and municipal discharges for many years, resulting in poor water quality, contaminated sediments, and a resultant ban on the consumption of fish from the lake. Fish may migrate from the lake into tributaries which makes interpretation of fish contaminant data difficult when trying to identify tributary inputs. The vegetative corridor provided by Ley Creek and its shorelines, wetland areas adjacent to the creek, and preserved natural forest areas such as the Marine Corps Reserve Training Center, provide migration routes and cover for terrestial wildlife in a highly developed environment. The site comprises a small part of this available habitat.

6.02.2 Covertype Delineation

In the context of this report, a "covertype" is defined as an area characterized by a distinct pattern of natural (*e.g.* forest) or cultural (*e.g.* residential) land use. Covertype designations were applied to the study area and surrounding areas within 0.5 miles (the study area) based on the observed physical and vegetative features. Covertype designations and delineations for the study area were developed from a 1991 aerial photograph and a field reconnaissance conducted on September 25, 1992. Each covertype designation was selected based on a comparison of observed characteristics with the ecological community descriptions presented in the NYSDEC Natural Heritage Program (NHP) document *Ecological Communities of New York State* (NYSDEC, 1990).

For each covertype and/or aquatic habitat identified in the covertype delineation, dominant vegetative species observed during the field reconnaissance are listed. For aquatic habitats, data are presented regarding aquatic vegetation and water quality parameters such as dissolved oxygen, temperature, specific conductivity, and pH.

A covertype map was developed for the study area which includes six identified covertypes (Figure 9). Of these covertypes, three are considered natural covertypes and three are considered cultural covertypes (NYSDEC, 1990), reflecting the extent of human disturbance to the study area for land uses such as residences, parks, roadways, and industrial areas. All of the identified covertypes have a secure global and state ranking, meaning they are not rare ecological communities requiring preservation (NYSDEC, 1990). Below are descriptions of each of the covertypes identified within the study area.

Natural Covertype Designations

Floodplain Forest

The largest single covertype in the study area is the floodplain forest, the majority of which is present within the Marine Corps Training Reserve Center (MCTRC) located just north of the study area, across the NYS Thruway. The floodplain forest community was likely formed by flooding of Ley Creek prior to the construction of the NYS Thruway. The MCTRC forest occupies approximately 200 fenced-in acres bordered by the NYS Thruway and industrial and residential areas. Dominant canopy species observed in this community consist of quaking aspen (*Populus tremuloides*), bigtooth aspen (*Populus grandidentata*), silver maple (*Acer saccharinum*), American elm (*Ulmus americana*), red maple (*Acer rubrum*), speckled alder (*Alnus rugosa*), dogwoods (*Cornus* sp.), willows (*Salix* sp.), and honey locust

(*Gleditsia triacanthos*). Ground indicators such as standing water, water staining, and debris lines indicate portions of this community are inundated during parts of the year. Smaller remnant communities of this covertype are also present between the NYS Thruway and Ley Creek, in forested areas south of Factory Avenue, and east of Townline Road north and south of the NYS Thruway (Figure 9).

Successional Northern Hardwoods

A small forested area at the southern portion of the study area, just east of Syracuse China Corporation and north of Route 298 contains a mixture of hardwood tree species in a rolling, somewhat dry community which is considered a successional northern hardwoods covertype. Dominant canopy species observed in this area consist of red maple, white ash (*Fraxinus americana*), green ash (*Fraxinus pennsylvanica*), cottonwood (*Populus deltoides*), dogwoods, staghorn sumac (*Rhus typhina*), and hawthorne (*Crataegus* sp.). This area is bordered to the east and west by industrial areas, and to the north by the CONRAIL railroad lines.

Main Channel Stream

Ley Creek can best be classified as a main channel stream in the study area because of the lack of riffle areas and the clearly distinguished meanders. Water levels in Ley Creek fluctuate from less than three inches to approximately four feet, depending on the time of year and quantity of rainfall. Flow rates also vary greatly ranging from less than one foot per second to greater than four feet per second (NYSDEC, 1992). Turbidity increases with rainfall. The substrate is predominantly gravel and fine inorganic material with very little to no submerged or emergent aquatic vegetation. Observed vegetation consisted of pondweed (*Potamogeton epihydrus*), bullrushes (*Scirpus* sp.), cattails (*Typha angustifolia*) and filamentous algae. Ley Creek varies in width from less than ten feet to more than thirty feet. The majority of the creek is not shaded by a tree canopy as the majority of the shoreline vegetation is dominated by reeds (*Phragmites* sp.). Water quality measurements collected in November, 1992 are presented below.

Parameter	Value
pH	9.3
Dissolved oxygen (mg/l)	11
Temperature (°C)	5
Conductivity (umhos)	1170

Cultural Covertype Designations

The majority of the remaining covertypes in the study area are heavily influenced by urbanization. Industrial and residential areas have eliminated much of the natural habitat in the area and replaced it with urban wildlife habitats consisting primarily of mowed lawns, mowed lawns with trees, paved roads, parking lots, landfills, and urban structure exteriors. These areas are considered covertypes by NYSDEC since they do provide suitable habitat for urban wildlife. However, since wildlife diversity is likely low in these areas, and similar habitats and wildlife inhabitants would frequent these areas, these covertypes have been included into a single covertype designated as cultural. Other cultural covertypes exist within the study area that provide significant wildlife habitat. These other cultural covertypes are discussed below.

Dredged Spoil Wetlands

The area between the southern bank of Ley Creek and Factory Avenue between Townline Road and the Town of Salina Highway Garage can be classified as dredged spoil wetlands. Dredged spoil wetlands are defined by NHP as wetlands of dredge spoil substrate characteristically consisting of reedgrass stands. This area was used for the deposition of dredged spoils from Ley Creek for flood control over the past two decades. Reeds exist in almost monotypic stands along Ley Creek with much smaller amounts of purple loosestrife (*Decodon verticillatus*) intermixed. Some young trees also exist in this area consisting primarily of sumac, box elder (*Acer negundo*), and ash.

Reedgrass/Purple Loosestrife Marsh

Reedgrass/purple loosestrife marsh covertypes exist in areas south of Factory Avenue, south of the study area. These areas are dominated by reeds and purple loosestrife in a saturated soil environment. A characteristic of this covertype is that it was formed as the result of a disturbance such as the construction of Factory Avenue. Road construction may have altered the hydrology to favor the existing vegetation.

6.02.3 Description of Fish and Wildlife Resources

The objectives of the description of fish and wildlife resources were to:

1) list wildlife observed within the study area,
2) describe the quality of the terrestrial and aquatic covertypes present within the study area,
3) identify fauna expected to inhabit each covertype or aquatic habitat, and
4) document instances on the study area where contaminants may have produced visible signs of stress to vegetation or wildlife.

The tasks performed to meet each of these objectives and the results of the tasks are discussed in the following sections.

Observed Fish and Wildlife

Fish and wildlife observed during the study area reconnaissance were identified and are listed in this section. Included in the list of observed species are species for which evidence (*e.g.* tracks or scat) was observed within the study area.

Terrestrial Wildlife

The majority of the wildlife observed in the study area were birds along Ley Creek and in the Floodplain Forest. Great-blue heron (*Ardea* *herodias*), green heron (*Butorides striatus*), mallard (*Anas platyrhynchos*), and spotted sandpiper (*Actitus macularia*) were observed along Ley Creek. Bird species observed in the floodplain forest consisted of red-tailed hawk (*Buteo jamaicensis*), great horned owl (*Bubo virginianus*), mourning dove (*Zenaidura macroura*), flicker (*Colaptes auratus*), downy woodpecker (*Picoides pubescens*), blue jay (*Cyanocitta cristata*), cedar waxwing (*Bombycilla cedrorum*), several winter plumage warblers (Parulidae), house sparrow (*Passer domesticus*), tree sparrow (*Spizella arborea*), song sparrow (*Melospiza melodia*), American crow (*Corvus brachyrhynchos*), belted kingfisher (*Megaceryle alcyon*), rock dove (*Columba livia*), barn swallow (*Hirundo rustica* (nests)), black-capped chickadee (*Parus atricapillus*), and white breasted nuthatch (*Sitta carolinensis*).

Although no terrestrial mammals were observed, indicators of study area use by white-tailed deer (*Odocoileus virginianus*), Eastern cottontail rabbit (*Sylvilagus floridanus*), gray squirrel (*Sciurus carolinensis*), and raccoon (*Procyon lotor*) were observed.

Aquatic Wildlife

Fish sampling by electroshocking was performed on Ley Creek as part of the RI activities in July 1992. Samples were collected from 0.5 miles upstream, 0.5 miles downstream, and adjacent to GM-IFG's outfall. The species observed during the sampling activities consisted of pumpkinseed (*Lepomis gibbosus*), Eastern mudminnow (*Umbra pygmaea*), brook stickleback (*Culaea inconstans*), banded killifish (*Fundulus diaphanus*), longnose dace

(*Rhinichthys cataractae*), white sucker (*Catastomus commersoni*), golden shiner (*Notemigonus crysoleucas*), European carp (*Cyprinus carpio*), and crayfish (*Cambarus* sp.).

A fish survey of Ley Creek, conducted by NYSDEC personnel in 1971, revealed the presence of carp, bullhead (*Ictalurus nebulosus*), bluegill (*Lepomis macrochirus*), pumpkinseed, and shiners (*Notemigonous* sp.). Fish samples were also collected by EDI Engineering & Science in 1985 as part of previous investigation activities. Collected fish species were the same as those collected by NYSDEC in 1971 (EDI, 1985[b]).

Fauna Expected Within Each Covertype and Aquatic Habitat

Aquatic Habitat

According to NHP's covertype document, characteristic fish species of a main channel stream habitats consist of sucker, sturgeon (*Acipenser* sp.), shad (*Dorosoma cepedianum*), pickerel (*Esox* sp.), northern pike (*Esox lucius*), largemouth bass (*Micropterus salmoides*), and smallmouth bass (*Micropterus dolomieu*). Based on the results of the fish sampling efforts discussed above, it can be concluded that most of the typical main channel stream fish species are not present in Ley Creek.

Terrestrial Habitats

Wildlife potentially inhabiting the terrestrial covertypes in the vicinity of the study area were evaluated using available published information regarding habitat preference and geographic range data for New York State wildlife compiled by Chambers (1983) and Niering (1988). Lists of avian, mammalian, amphibious, and reptilian wildlife species potentially inhabiting the identified covertypes are presented in Exhibit D.

Value of Fish and Wildlife Resources

The value of each covertype as habitat was qualitatively evaluated based on field observations of physical characteristics. For surface waters, physical characteristics and water quality were examined to evaluate the value of aquatic resources as fish habitat. For terrestrial covertype wildlife habitat evaluations, resident wildlife species requirements for food sources, home range, breeding requirements, and cover were examined. Additional information used in the evaluation of habitat quality included:

1) the nature, extent and diversity of observed wildlife,
2) the availability of similar habitats in the immediate vicinity,
3) the size of the habitat, and
4) adjacent land use patterns.

Floodplain Forest

The floodplain forest covertype represents an important habitat for a variety of wildlife species. The covertype's existence amidst a rapidly urbanizing area and its large size make it a refuge for forest wildlife forced out of recently developed similar habitats. The added benefit of restricted access on the MCRTC property provides seclusion from human interference.

The canopy species provide abundant food sources for mast and fruit consuming birds as well as squirrel and deer. Other terrestrial mammals such as rabbit, raccoon, fox, and small rodents would find suitable food and cover in this covertype. Inundated areas of the wetlands provide suitable habitat for aquatic furbearers and may serve as migratory stopovers and wintering areas for waterfowl.

Successional Northern Hardwoods

Although this covertype would normally support a diversity of wildlife species, its location and size in the study area likely limit its use by wildlife. It is bordered to the east and west by large industrial facilities and to the south by a residential neighborhood. The area is capable of supporting a variety of birds and small mammals because of the high productivity of this early succession mast producing forest. Use of this covertype by larger mammals such as deer is possible due to the contiguous connection with wetland areas to the north and the available food sources.

Main Channel Stream

Ley Creek is a poor quality aquatic habitat for several physical and chemical reasons. Dredging activities and scouring during high flow storm events have left little organic material in the sediments of the creek to promote aquatic vegetation, macroinvertebrate production, and other fish food and cover sources. In addition, there are no pool or riffle areas in the creek which would provide suitable habitat for a greater diversity of aquatic species.

NYSDEC has evaluated the water quality in Ley Creek under the Rotating Intensive Basin Studies (RIBS) Water Quality Assessment Program (NYSDEC, 1992). RIBS included the sampling and analysis of surface water, sediments, and the macroinvertebrate community, as well as toxicity testing and limited fish tissue analyses in Ley Creek, approximately one mile from its confluence with Onondaga Lake. Based on the RIBS water quality rating criteria of very poor, poor, fair, good, or excellent, the water quality in Ley Creek was concluded to be very poor for the following reasons (NYSDEC, 1992):

1) Macroinvertebrate sampling showed a severely impacted community dominated by pollution tolerant species.
2) Crayfish collected from a Lemoyne Avenue sampling site contained concentrations of PCBs (5 mg/kg) and copper.
3) Exceedances of water quality assessment criteria were observed for iron, mercury, lead, zinc, dissolved solids, total and fecal coliform, and trichloroethylene.
4) Concentrations of cadmium, iron, copper, mercury, lead, nickel, zinc, and PCBs were detected in sediments (Aroclor 1016/1242 at 580 ug/kg, Aroclor 1254 at 50 ug/kg, and Aroclor 1260 at 40 ug/kg at a Park Avenue sampling site).
5) Raw discharges into the Creek and combined sewer overflows cause aesthetic problems which preclude fishing.

Based on the results of RIBS, it appears that water quality in Ley Creek has been impacted, resulting in a reduction of macroinvertebrate diversity, and an overall decrease in habitat quality for aquatic life. These impacts are likely the result of urbanization and industrial development of the areas surrounding Ley Creek.

Fish in Ley Creek provide a food source for piscivorous wildlife. Several great blue heron and green heron were observed feeding along the banks of the creek. These birds find the dense shoreline cover afforded by the reeds attractive for isolation from predators and humans and for feeding. However, the quantity of fish and the minimal amount of aquatic vegetation would not make Ley Creek a prime feeding area.

Dredged Spoil Wetlands

Wildlife habitat quality of the dredged spoil wetlands is relatively low. The reeds and purple loosestrife, which are not food sources, have dominated the habitat and prevent preferred wildlife plant species from germinating. However, the dense cover provided by this covertype is limited in the highly developed adjacent areas. Therefore, mobile terrestial wildlife, such as the whitetail deer, likely utilize this habitat as a corridor through the developed areas to travel between feeding areas such as the floodplain forests of the Marine Corps Reserve Training Center north of the site and forested areas south of the site. The site comprises only a small amount of this covertype between Onondaga Lake and the splitting of Ley Creek into the North Branch and the South Branch.

Reedgrass/Purple Loosestrife Marsh

This covertype is very similar to the dredged spoil wetland covertype and has the same low food source quality rating but provides cover and migration corridors.

Other Cultural Covertypes

Urban and industrial areas, with their mowed lawns, ornamental trees, and building exteriors provide habitat for urbanized bird and mammal species. As natural habitat communities diminish in size and quality, wildlife are forced to adapt to the more urban environment. However, urbanization is not practical for the majority of wildlife species. This analysis acknowledges the need and use of urban areas by many wildlife species, but does not consider these habitats to be impacted by the study area.

Value of Resources to Humans

In general, fish and wildlife resources are valuable to humans for recreational and aesthetic reasons. Many sportsmen hunt, fish and consume their catches. Wildlife resources are also enjoyed by naturalists which enjoy observations of wildlife during hiking and camping. However, the value of wildlife inhabiting the study area to humans is very limited. Access to Ley Creek and the MCRTC are restricted by fences; there is no hunting allowed within the City of Syracuse; and water quality and lack of fish preclude fishing in the creek. For these reasons the value of wildlife in the study area for humans is considered to be low.

6.02.4 Observations of Study Area-Related Stress

During the study area reconnaissance of September 25, 1992, the study area was examined for evidence of stress to biota potentially attributable to chemical residues of the study area. No signs of stress were observed on or in the vicinity of the study area.

6.02.5 Other Resources

Freshwater Wetlands

Based on a review of the NYSDEC Freshwater Wetlands Maps for the Syracuse East and Syracuse West Quadrangles, six state wetlands are located within 2-miles of the study area (Figure 10). The study area is considered a portion of Wetland SYE 6, which occurs north and south of the NYS Thruway, north and south side of Factory Avenue, and east and west of Townline Road.

Significant Habitats

The NYS NHP was contacted for information regarding the presence of significant wildlife habitats on or within two miles of the study area. According to NYSDEC, no significant habitats are present on or within two miles of the study area (Buffington, 1992).

Wild, Scenic and Recreational Rivers

No surface waters of the study area and vicinity are designated as Wild, Scenic or Recreational in accordance with the Wild, Scenic and Recreational Rivers Act.

Rare, Endangered or Threatened Plant and Animal Species

Information regarding the presence of rare, threatened or endangered (RTE) plant or animal species on or within two miles of the study area was requested from NHP. No RTE animal species or habitats were identified. However, NHP identified a rare plant, the cornel-leaved aster (Asterifirmus), which historically occurred in the vicinity of the study area (Buffington, 1992). The last survey during which the rare plant was identified was in 1949. Rare plants are not regulated.

6.03 Applicable Fish and Wildlife Regulatory Criteria

In accordance with NYSDEC guidance for the performance of a FWIA, applicable Fish and Wildlife Regulatory Criteria (FWRC) were identified for this analysis. FWRC are classified as either location-specific or chemical-specific. Location-specific FWRC apply to features such as wetlands or streams potentially impacted by the study area. A chemical-specific FWRC is a media-specific regulatory contaminant concentration threshold. Examples of chemical-specific FWRC are the NYS Ambient Water Quality Standards and NYS sediment criteria.

6.03.1 Location-Specific FWRC

Location-specific FWRC are qualitative examinations of significant features, protected by the State or Federal government, that might be affected by current conditions at the study area or future remedial activities. Location-specific FWRC are regulations that apply to freshwater wetlands; tidal wetlands; regulated streams; navigable waterbodies; coastal zones; significant fish and wildlife habitats; wild, scenic and recreational rivers; and rare, endangered or threatened plant and animal species. The Coastal Zone Management and the tidal wetland FWRC were not required to be addressed because the study area is located inland.

Freshwater wetlands were identified through a review of NYSDEC Freshwater Wetlands Maps which present the boundaries of regulated wetlands in New York State. Regulated streams and navigable water bodies were identified through a review of 6 NYCRR Part 701. Rare, endangered, and threatened plant and animal species as well as significant habitats were identified through a file search by the NYS NHP performed at the request of O'Brien & Gere Engineers, Inc. FWRC were addressed for a distance of two miles surrounding the study area perimeter and nine miles downstream of the study area.

Freshwater Wetlands

The New York State Freshwater Wetlands Act (Article 24 of New York State Conservation Law) was promulgated in 1975 by the State of New York to preserve, protect, and conserve freshwater wetlands. Under the Act, NYSDEC was required to map the boundaries of wetlands greater than five hectares (12.4 acres) in size and to regulate the activities which can be conducted in these areas. Activities are also regulated within a 100 feet buffer zone around each wetland boundary depicted on the wetland map. The discharge of contaminants into NYS wetlands is a regulated activity under NYS Wetlands Laws.

The regulated wetland boundaries are presented on NYSDEC Freshwater Wetlands Maps for each topographic quadrangle in the state. Based on a review of the wetland map for the Syracuse East quadrangle, there are six State-regulated wetlands within two miles of the study area (Figure 10). The study area is considered a portion of Wetland SYE 6 (Class II), which occurs north and south of the NYS Thruway, north and south side of Factory Avenue, and east and west of Townline Road (Figure 10). The other wetlands within 2-miles of the study area are designated SYE-1 (Class III), SYE-2 (Class II), SYE-29 (Class II), SYW-5 (Class II), SYW-8 (Class II).

NYS wetlands are classified according to the functions and values of the wetlands. Class I wetlands provide the most critical of the State's wetland benefits and are the most difficult to obtain permits for. Class II wetlands provide important wetland benefits and are also limited in permitted activites. Class III wetlands supply wetland benefits but have less stringent permit requirements. Class IV wetlands provide some wildlife and open space benefits, and activites may be permitted under certain circumstances. The study area comprises a portion of wetland SYE-6, a Class II wetland. Permits are issued in these wetlands if the activity satisfies a pressing economic or social need that clearly outweighs the loss of or detriment to the benefits of the wetland.

Regulated Streams

Disturbances to streams are regulated based on the classification of the stream. Stream classifications are presented in 6 NYCRR Section 895. According to NYCRR, the stretch of Ley Creek within the study area is a class "B" surface water. Class "B" waters are suitable for primary contact recreation and any other uses except as a source of water supply for drinking, culinary, or food processing purposes. Class "B" streams are protected by a permit system under 6 NYCRR Section 608, which regulates physical modifications or disturbances to protected streams, its bed, or banks. The study area, as it currently exists, presents no physical disturbance to these streams such as those governed by Article 15 ECL. However, the stream classifications drive water quality criteria for chemical contaminants. A discussion of surface water chemicals is presented in the chemical-specific FWRC section.

Navigable Waterbodies

According to New York State Conservation Law, activities affecting navigable waterbodies are governed by 6 NYCRR Part 608. As defined by this Part, a navigable waterbody is one "upon which vessels with a capacity of one or more persons can be operated." Ley Creek qualifies as a navigable waterbody according to this definition. The study area in its present condition does not present a disturbance to the course or flow of the stream as governed by this regulation. However, remedial activity will be subject to these requirements, and activities causing a disturbance to one of the streams may require a permit as per Part 608.

6.03.2 Chemical-Specific FWRC

In accordance with the NYSDEC FWIA guidance document, chemical-specific FWRC related to fish and wildlife are the New York State Ambient Water Quality Standards and Guidance Values (AWQS/GV) and the NYSDEC proposed sediment criteria (NYSDEC, 1991[b]). As an initial screening method, surface water and sediment quality were evaluated through a comparison of maximum contaminant detections in surface water and sediment samples with AWQS/GV and the proposed sediment criteria published by NYSDEC (1991[b]). The data used in the comparison were generated by O'Brien & Gere Engineers during the 1988/1989 Field Investigation and the 1992 RI. The criteria comparisons are discussed in the following sections.

NYS Ambient Water Quality Standards/Guidance Values

Surface water samples were collected twice from three locations in Ley Creek during the 1988/89 field investigation. PCBs were only detected once at one location in April 1989; PCBs were not detected at that location in January 1988. The detection exceeded the NYS AWQC for a Class B stream (1×10^{-3} ug/l). The detection limits achieved for PCBs in the surface water samples were the lowest defensible detection limits available from the laboratory. The detection limits exceeded the PCB criterion in the five non-detect samples. Based on the detected exceedance, PCBs were present in surface water on one occasion at a concentration that exceeded the screening criterion.

NYS Proposed Sediment Quality Criteria

NYS proposed sediment quality criteria are based on ambient water quality within the interstitial space of sediments. These criteria were prepared as an attempt to describe the behavior of non-polar organic compounds and metals only. Sediment criteria are calculated as follows (NYSDEC, 1991[b]):

$$SC=AWQS/GV\times K_{ow}\times F_{oc} \tag{1}$$

where:

SC - Sediment Criteria (ppb)

AWQS/GV - Water Quality Standard (NYSDEC, 1990)

Kow - Octanol/Water Partition Coefficient (U.S. EPA, 1986)

Foc - Fraction Organic Carbon in Sediment as a percent.

The total organic carbon measurements for sediment samples were used to calculate the NYS proposed sediment criteria for the aquatic toxicity basis and the wildlife residue basis. Calculated criteria for the sample locations at which PCBs were detected in sediments are as follows:

Sample Loca-tion	PCBs (ug/kg)	TOC (g/kg)	Aquatic Toxicity Criteria (ug/g OC)	Wildlife Residue Criteria (ug/g OC)	Aquatic Toxicity Criteria (ug/kg)	Wildlife Residue Criteria (ug/kg)
SED-6	340 J	13.9	276 2760 acute 19.3 chronic	✓1.4	268 3,840	19.5
SED-6 DUP	230 J	18.2			351 5020	25.5
SED-7	190	15.6			301 4,310	21.8
SED-8	710	21.1			407 5,820	29.5
SED-9	810	15.9			307 4,390	22.3

None of the detected sediment concentrations exceed the proposed aquatic toxicity based sediment criteria. These sediment PCB concentrations exceed the proposed wildlife residue based sediment criteria.

It should be noted that sediment concentrations were compared to calculated proposed NYS sediment criteria for a general screening of sediment quality. NYSDEC's *Draft Cleanup Policy and Guidelines* (NYSDEC, 1991[b]) has undergone substantial review; proposed sediment criteria have been derived on theoretical grounds and are not standards. They are useful not as cleanup criteria but as a point of reference for further evaluation.

Fish PCB Concentrations

During the RI, fish samples were collected from locations 0.5 miles upstream, 0.5 miles downstream, and adjacent to GM-IFG Outfall 003 and analyzed on a whole fish or edible portion basis. Table 14 summarizes the analytical results of the RI fish sampling effort.

In 1985, fish were collected over a 4,000 feet length of Ley Creek extending from 1,000 feet upgradient to 3,000 feet downgradient of GM-IFG Outfall 003. Species collected in 1985 were consistent with those collected during the RI. Table 13 summarizes the analytical results of the 1985 fish sampling effort.

The fish species collected from Ley Creek during the RI are stream dwellers which tend to migrate up and down the stream for up to several miles in response to water level fluctuations, habitat quality, and food availability (Creech, 1992). Although PCB transport pathways in the study area likely contribute PCBs to fish, because of the ranges in fish distribution, a quantitative correlation between the study area and fish contaminant body burdens can not be made, nor can a quantitative correlation between the dredged material and fish PCB concentrations be made. However, a potential exposure route for piscivorous wildlife species utilizing Ley Creek exists.

6.04 Exposure Pathway Analysis

The FWIA was designed to identify potential ecological receptors at, or in the vicinity of a study area, which could be exposed to study area-related contaminants during normal life activities. Some covertypes in the vicinity of the study area provide quality wildlife habitat for a variety of mammalian, avian, reptilian, and amphibious species. In addition to the wildlife, a rare plant (potentially) and regulated wetlands (rare plants are not regulated) comprise the ecological receptors for contaminants migrating from the study area.

Once the receptors are established, exposure pathways are evaluated to determine if a mechanism exists for the receptors to be exposed to the study area-related contaminants. Exposure is defined as the contact of a receptor with a chemical or physical agent. An exposure pathway is a mechanism by which a receptor may be exposed to a chemical or physical agent at or originating from a source. A complete pathway is an exposure pathway in which exposure of receptors may occur, under site specific conditions. An incomplete exposure pathway is an exposure pathway for which it is determined that receptors would not be exposed under the specified conditions.

During the RI, PCBs were detected in surface water, sediments, soils, and fish flesh. Based on the fact that PCBs are present in various media, and ecological receptors are present in areas of contaminated media, several complete exposure pathways exist. Exposure pathways for ecological receptors in the study area are discussed, according to environmental media, in the following sections.

Soils

Dermal contact and ingestion of surface soils in the study area is considered complete for terrestrial wildlife. Surface soils in the study area were analyzed and found to contain PCBs. Terrestrial wildlife which frequent the study area could come in contact with PCBs which would adhere to parts of their bodies and be incidentally ingested during grooming activities. The effect of the exposure on the receptor is a function of the contaminant concentration in the soil, the amount of soil consumed, and the frequency of the soil consumption. Based on the PCB concentrations in the soil and the infrequent use of the study area by terrestrial wildlife, it is likely that this pathway does not significantly contribute to PCB exposures for terrestrial wildlife.

Air

The exposure pathway of inhalation of PCBs from air is considered to be incomplete. Analytical results of air samples collected from the study area indicated PCBs were not detected at a detection limit of 1 x 10^{-3} mg/m^3. Since a source is not present in the air, no exposures can result from this pathway.

Ground Water

The exposure pathway of dermal contact or ingestion of ground water for ecological receptors is considered to be incomplete. Terrestrial wildlife do not live below ground in saturated soils nor is there a mechanism for their ingestion of ground water.

Surface Water

The exposure pathway of ingestion and dermal contact with surface water is considered complete for ecological receptors of the study area. PCBs were detected in Ley Creek surface water during 1985 and 1989 sampling events. Terrestrial and aquatic organisms can be exposed to PCB containing surface water by drinking and metabolic uptake, respectively. Comparison of surface water detections to NYS AWQS indicates that 8 of 15 samples exceeded the conservative criteria. However, in 1989, PCBs were detected at only one sampling location and were not detected at that same location in 1988. The detection limit for the samples was higher than the

NYS AWCS but as low as currently possible using standard analytical methods. The use of modified or special analytical methods to reach the extreme detection limit was not required in the approved work plan for this investigation. It should be noted that the Federal Ambient Water Quality Criterion for protection of aquatic life (freshwater acute) is 2 ug/l, higher than the NYS Class B AWQS, 1 x 10^{-3} ug/l.

Based on the low concentration of PCBs detected in Ley Creek and NYSDEC's assessment of the overall water quality in Ley Creek as very poor (NYSDEC, 1992), as discussed in Section 6.02.3, it is expected that ecological impacts related to surface water PCB exposures are likely to be low.

Sediments

The sediment exposure pathway is considered to be complete for aquatic organisms in Ley Creek. PCBs were detected in sediments downstream of GM-IFG Outfall 003 in areas frequented by bottom-feeding fish species. Detected Ley Creek sediment PCB concentrations were compared with the NYSDEC proposed sediment criteria (NYSDEC, 1991[b]) and were found not to exceed the aquatic toxicity based criteria but to exceed the wildlife residue based criteria. However, the detected sediment PCB concentrations only exceeded the wildlife residue criteria by one or two orders of magnitude and all sediment PCB concentrations during the RI were less than 1 ppm.

The proposed NYS sediment criteria are conservative estimates of levels of PCBs which may result in exposures to wildlife. These values have been derived on theoretical grounds, and are not standards. However, they are useful as a point of reference for further evaluation. The wildlife residue criterion is considered by

NYSDEC to be the amount of PCBs in the sediments that could result in PCB concentrations in wildlife inhabiting or consuming biota from that location. The wildlife residue criterion is used as a screening tool to evaluate the need for remediation and is not used as an action or cleanup level.

Food Chain Bioaccumulation

The food chain pathway is considered to be complete for Ley Creek because PCBs were detected in fish in the creek and piscivorous wildlife were observed in the study area. Because the potential PCB transport pathways to Ley Creek from the study area (outfall discharge, ground water discharge, and surface runoff) likely contribute PCBs to fish, as discussed in Section 3.09.2, these transport pathways likely contribute to food chain bioaccumulation of PCBs. However, quantitative conclusions could not be reached regarding the food chain exposure pathway related to PCB concentrations observed in the study area or PCBs in the dredged materials. The fish analytical results indicate that there is no spatial trend which can proportionately attribute PCB fish concentrations to the study area. PCBs were detected in fish at locations upstream, downstream and adjacent to GM-IFG Outfall 003 with the highest concentrations found at the upstream location. The fish species collected are known to migrate in the creek and therefore, could have been exposed to PCBs from Onondaga Lake or other industrial discharge points along Ley Creek. Although the food chain exposure pathway is considered complete for piscivorous wildlife, a quantitative evaluation of inputs solely from the study area cannot be performed.

6.05 Results and Discussion

This section summarizes the results and conclusions of the Step I FWIA performed for the Ley Creek Dredged Material Area.

Results

- Three natural covertypes and three cultural covertypes exist within the study area.
- The Floodplain Forest and Successional Southern Hardwoods covertypes provide a quality habitat for a variety of wildlife species.
- Cultural covertypes do not provide significant habitats which are capable of supporting a diversity of wildlife species.
- Ley Creek water quality is considered very poor on a scale of criteria defined by NYSDEC in the RIBS report (NYSDEC, 1992).
- The study area is a portion of a NYS regulated wetland.
- A rare plant potentially exists within the study area.
- The soil exposure pathway is complete but considered to have minimal impact on study area biota.
- The air exposure pathway is incomplete.
- The ground water exposure pathway is incomplete.
- The surface water exposure pathway is complete.
- The sediment exposure pathway is complete.
- The food chain exposure pathway is complete.

Discussion

The evaluation of PCB discharge impacts to aquatic organisms which reside in Ley Creek must consider the quality of the habitat in which the discharge occurs. As previously discussed, water quality in Ley Creek is documented to be very poor on a scale of criteria defined by NYSDEC in the RIBS report (NYSDEC, 1992). NYSDEC has also reported fish kills in Ley Creek related to toxic discharges from unidentified sources (Creech, 1992).

Due to industrial discharges, combined sewer overflows, and other urban impacts (NYSDEC, 1992), water quality impacts on Ley Creek are likely to remain after PCBs associated with the dredged material are addressed. The resulting habitat and water quality are not likely to improve sufficiently to promote vegetative, macroinvertebrate, and fish populations typical of a main channel stream habitat. The sediment quality in Ley Creek in the vicinity of the site has been influenced by the site and other industrial inputs into the creek. However, current PCB sediment concentrations are less than 1 ppm. Current exceedances of wildlife residue criteria for PCBs reflect the impact of continuing sources of PCBs to the creek such as potential discharges, ground water discharges, and erosional inputs. Remedial goals for sediment quality need to focus on the reduction of PCB inputs to the creek which could accumulate in the sediments.

The exposure pathways identified in this FWIA will be reviewed during the FS process to determine if the remedy eliminates the potential for exposure. If the exposure will be eliminated, there would not be a need to quantify the effect of the exposure. If the proposed remedy does not address a particular exposure route identified in this Step 1 FWIA, the effect of the exposures on the receptors should be quantified to evaluate whether the proposed remedy should be modified to include measures which are protective of ecological receptors as well as human health.

SECTION 7 - CONCLUSIONS

Investigatory activities conducted during the RI provided data related to the concentrations of PCBs present in ground water, soil, sediment, fish, and outfall discharge water. These analytical data indicate that Aroclor 1248 is the prevalent aroclor present in study area media. Previous investigatory activities provided data related to PCB concentrations in surface water and air, as well as ground water, soil, sediment, and fish.

Ground water elevation data at the study area indicate that shallow ground water flows in a northerly direction and discharges from the study area to Ley Creek. An upward potential exists between the upper fluvial deposits and the underlying till; PCBs do not extend vertically to ground water in the glacial till. PCB concentrations detected in ground water during the RI indicate that the areal extent of ground water containing PCBs is less than that indicated by previous data. PCB concentrations in ground water west of well OBG-5 are generally lower than those detected in past investigations, and PCB concentrations detected in ground water east of well OBG-5 are generally similar or slightly higher than those detected in previous investigations. PCB concentrations detected in ground water during the RI, which represent the maximum potential concentration of PCBs present due to equipment blank contamination, as discussed in Section 3.05.3, exceeded the NYS Class GA ground water standard. PCB data from filtered ground water samples indicate that PCBs may not be dissolved but are potentially associated with sediment in the ground water samples. Calculation of the estimated PCB concentration in Ley Creek surface water resulting solely from ground water discharge from the study area, using the average 1992 PCB concentration in ground water, indicated that, although ground water discharge contributes PCBs to Ley Creek, ground water discharge is likely not solely causing exceedence of the NYS Class B surface water standard.

Soil borings installed during the RI did not indicate the presence of the former drainage ditch on the north side of Factory Avenue. Data from soil borings installed during the RI indicated that PCBs are present on the north side of Factory Avenue at lower concentrations than those detected across Factory Avenue on the south side, outside the IRM work area. Surface soil sampling data indicate that PCBs are present in surface soils in the area of the study area directly north of Factory Avenue, although generally at low concentrations. The compilation of historical data indicates that PCBs are dispersed across the study area. PCB concentrations elevated above 25 mg/kg dry weight in soil, however, are limited to the 1,000 feet length of the study area in the vicinity of GM-IFG Outfall 003 between boring B-4 and well OBG-3, with the exception of borings B-6, located further west and B-19, located north of Ley Creek.

RI data indicate that concentrations of PCBs in Ley Creek sediments are not highest in the vicinity of GM-IFG Outfall 003, but further downstream of the outfall. Concentrations of PCBs in sediments detected in each of the three historical sampling events are variable; 1992 concentrations are generally lower than, or similar to, those detected in the past. 1992 data do not provide evidence of the presence of aroclors other than Aroclor 1248 in Ley Creek sediments.

RI data indicate that Aroclors 1248 and 1260 are present in fish in Ley Creek. 1992 data do not provide evidence of the presence of Aroclor 1254 in fish, as detected in 1985. Although potential PCB transport pathways in the study area likely contribute PCBs to fish, quantitative conclusions can not be drawn related to the proportionate contribution by the study area or the dredged material to PCBs in fish, nor can comparisons of fish from upstream, outfall, and downstream sampling locations be made due to the tendency of the fish collected to migrate for several miles (Creech, 1992). There are several potential upstream sources of PCBs to Ley Creek. The fish investigation was performed to comply with NYSDEC's requirement that fish sampling and analyses be performed at the site for the purposes of comparison to previous data and use in the risk assessment (Kelly, 1989).

Storm sampling data indicate that GM-IFG Outfall 003 discharge water is a potential source of Aroclor 1248 to Ley Creek during storm events. Data generated during the 1988/89 field investigation indicate that the study area is not impacting air quality in the vicinity of the site.

Potential PCB transport pathways to Ley Creek in the study area include ground water discharge, outfall discharge, and surface runoff. Related to the ground water discharge pathway, Aroclor 1248 transport to Ley Creek from the study area was estimated to be 0.06 lb/day, based on RI data. RI data were used for this calculation because they provide the most current representation of site conditions. This calculation is conservative because it is based on the assumption that total PCBs detected in unfiltered ground water samples migrate to Ley Creek. It is likely that much of the PCBs detected in unfiltered ground water samples were not dissolved but were adsorbed to particulates in the samples; sorption interactions with aquifer solids also retard the migration of PCBs from the vicinity of the wells to the creek. Related to the outfall discharge pathway, RI data also indicated that Aroclor 1248 is discharged to Ley Creek during storm events; the concentrations detected in outfall water samples, however, were less than GM-IFG's effluent limit for Aroclor 1248 (4 ug/l) established pursuant to the 1985 SPDES discharge Consent Order. Related to the surface runoff pathway, PCBs are present in study area soils, although the study area is well vegetated and evidence of erosion was not observed. The proportionate contributions of PCBs to Ley Creek by these pathways is undefined. The degree to which the dredged material contributes to these pathways is also undefined based on the following considerations:

- GM-IFG Outfall 003 discharge is a continuing source of PCBs to Ley Creek; PCBs in outfall discharge are not related to the dredged material;
- Uncertainties exist as to whether the dredged material acts as a source of dissolved PCBs in site ground water; and
- The occurence of surface runoff is not likely due to heavy vegetation at the site and a lack of evidence of erosion of dredged material.

PCBs have a low solubility in water and are strongly attracted to and favored in matrices high in organic carbon. Both anaerobic and aerobic biodegradation are potential PCB degradation mechanisms; volatilization, hydrolysis, and oxidation also provide degradation of PCBs. Due to the lipophilic and relatively inert nature of PCBs, they have a propensity to bioaccumulate in aquatic and terrestrial organisms.

Based on the human health risk assessment, complete exposure pathways at the study area include direct contact of sediments and surface soils and ingestion of fish. Upper bound and average excess cancer risks and hazard indices for direct contact with soils, direct contact with sediments, and ingestion of PCB residues in fish are as follows:

Exposure Pathway	Receptor	Average Excess Cancer Risk	Average HI	Upper Bound Excess Cancer Risk	Upper Bound HI
Direct Contact With Study Area Soil	Adults	7.5×10^{-8}	2.4×10^{-3}	5.0×10^{-7}	3.4×10^{-3}
	Children	2.3×10^{-7}	5.1×10^{-3}	3.3×10^{-7}	7.2×10^{-3}
Direct Contact With Study Area Sediments	Adults	2.3×10^{-9}	7.3×10^{-5}	7.0×10^{-8}	4.8×10^{-4}
	Children	2.8×10^{-8}	6.1×10^{-4}	1.8×10^{-7}	4.0×10^{-3}
Ingestion of PCB Residues in Fish	Adults	6.0×10^{-6}	8.6×10^{-2}	6.0×10^{-5}	2.6×10^{-1}
	Children	5.2×10^{-6}	1.1×10^{-1}	1.6×10^{-5}	3.4×10^{-1}

These risks are not a numerical presentation of actual study area risks to human health; they likely overestimate actual human health risks due to utilization of conservative exposure assumptions and dose response models as recommended by USEPA's standardized risk assessment methodology. The calculated risks for the fish ingestion pathway are especially unrealistic because of the undesirability of Ley Creek as a fishing location due to the nature, size, and quantity of fish present in the creek in the vicinity of the study area. Aesthetic problems in Ley Creek resulting from raw discharges and combined sewer overflows preclude fishing in the creek (NYSDEC, 1992). Risk calculations were performed to comply with NYSDEC's requirement that the fish ingestion pathway be evaluated (Kelly, 1989).

Three natural and three cultural covertypes exist in the study area; two natural covertypes provide good quality habitat for a variety of wildlife species. Cultural covertypes do not provide significant habitats which are capable of supporting a diversity of wildlife species. The study area is located within a NYS regulated wetland. Ley Creek water quality is considered very poor on a scale of criteria defined by NYSDEC in the RIBS report (NYSDEC, 1992). NYSDEC's assessment was based on a severely impacted macroinvertebrate community at a Lemoyne

Avenue sampling site, water column quality (parameters of concern include iron, mercury, lead, zinc, dissolved solids, total and fecal coliform, and trichloroethene), sediment quality (parameters of concern include cadmium, iron, copper, mercury, lead, nickel, zinc, and PCB Aroclors 1016, 1242, 1254, and 1260), and raw discharges and combined sewer overflows into Ley Creek. Complete exposure pathways include soil, considered to have minimal impact on site biota; surface water; and sediment. The food chain exposure pathway is considered complete, but can not be attributed exclusively to study area inputs.

In conclusion, the site has been adequately characterized to allow for the performance of the FS.

Respectfully Submitted,

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Tables

TABLE 1

WELL SPECIFICATION AND ELEVATION DATA
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
LEY CREEK DREDGED MATERIAL AREA

WELL NO.	CASING ELEV. (FT)	GROUND ELEV. (FT)	WELL DEPTH (FT)	SCREENED INTERVAL (FT)	HYDRAULIC CONDUCTIVITY (CM/SEC)	GROUND WATER ELEVATIONS 10/6/88	4/4/89	7/29/92			
OBG-1	379.18	376.67	9.8	371.87 – 366.87	2.65 X 10 –6 [illegible]	369.98 6.7	372.76 3.91	370.05 6.6			
OBG-2	378.34	375.34	9.0	371.34 – 366.34	1.66 X 10 –5 4.71x10-2	370.04 5.3	373.06 2.28	370.85 4.49			
OBG-3	379.38	376.76	9.75	372.01 – 367.01	3.74 X 10 –6 1.06x10-2	368.58 8.18	373.38 3.38	370.18 6.58			
OBG-3D	379.11	376.50	35.0	346.50 – 341.50	———			375.75			
OBG-4	379.54	377.24	10.4	371.85 – 366.85	6.69 X 10 –5 [illegible]	369.29 7.95	374.92 2.32	371.61 5.63			
OBG-5	379.07	376.74	9.8	371.95 – 366.95	2.15 X 10 –5 6.09x10-2	370.05 6.69	373.58 3.16	371.75 4.99			
OBG-6	381.52	379.15	18.1	366.02 – 361.02	4.45 X 10 –5 [illegible]	371.02 8.13	374.51 4.64	372.02 7.13			
OBG-7A	378.69	376.12	9.6	371.52 – 366.52	2.84 X 10 –4 [illegible]	369.04	374.53	371.58	7.08	1.59	4.54
OBG-7B	379.40	376.96	9.4	372.56 – 367.56	1.87 X 10 –4 5 [illegible]	368.40	373.33	371.27	8.56	3.63	5.69
OBG-7C	380.70	378.08	9.9	373.18 – 368.18	2.15 X 10 –5 6 [illegible]	368.50	373.37	371.62	9.58	4.71	6.46
MW-8	381.66	379.90	15.2	374.70 – 364.70	7.68 X 10 –5 [illegible]	369.96	374.99	372.01	9.94	4.91	7.89
MW-9	375.36	373.60	15.1	368.50 – 358.50	2.49 X 10 –4 [illegible]	370.06	373.66	372.45	3.54	0.06	1.15
MW-9D	377.56	374.20	31.9	347.30 – 342.30	———	(1)					
MW-10	379.24	377.40	15.1	372.30 – 362.30	3.90 X 10 –4 1.1	370.14	373.17	371.68	7.26	4.23	5.72
MW-11	380.26	378.40	15.1	373.30 – 363.30	2.63 X 10 –3 946	375.96	377.46	(2)	2.44	.94	across street
MW-12	382.89	381.20	17.1	374.14 – 364.14	1.36 X 10 –4 [illegible]	373.69	372.70	370.37	7.51	8.5	10.83
MW-13	379.83	378.00	11.2	371.85 – 366.85	7.22 X 10 –5 [illegible]	369.03	374.80	372.46	8.97	3.2	5.54

NOTES: (1) – Monitoring well exhibits artesian conditions, piezometric surface higher than the top casing elevation

(2) – Well not located, suspected well was destroyed during 1991 installation of Onondaga County interceptor sewer on south side of Factory Ave.

TME:kjf/GM078.6

September 16, 1993

Table 2
Fish Sampling Information - 1992 Remedial Investigation

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

FISH COLLECTED FROM LEY CREEK ON JULY 16, 1992					
Species	#	Length (mm)	Mass (g)	Portion Analyzed	Purpose
UPSTREAM					
Pumpkinseed	1	95	11	EP	HHRA
Pumpkinseed	1	77	8.5	EP	HHRA
Pumpkinseed	1	84	9.5	EP	HHRA
Mudminnow	1	86	6	-	-
Stickleback	9	28-41	3.5	-	-
Banded Killifish	1	27	0.5	-	-
Dace	20	17-61	10	WF	FWIA
White Sucker	26	32-47	19	WF	FWIA
Golden Shiner	3	65	7	WF	CWPD
OUTFALL					
White Sucker *	1	286	250	-	-
White Sucker *	1	314	300	-	-
White Sucker *	1	120	17	WF	FWIA
Golden Shiner *	1	186	83	WF	CWPD
Golden Shiner	1	96	12	WF	CWPD
Golden Shiner	1	87	9	-	-
Golden Shiner	2	61	6	-	-
Creek Chub	2	68	7	-	-
Dace	25	30-61	25	WF	FWIA
Stickleback	5	34	2	-	-

EP = Edible Portion
WF = Whole Fish
HHRA = Human Health Risk Assessment
FWIA = Fish and Wildlife Impact Analysis
CWPD = Comparison with Previous Data
* = Fish included in average edible fish mass calculation for risk assessment.

Table 2
Fish Sampling Information - 1992 Remedial Investigation

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

FISH COLLECTED FROM LEY CREEK ON JULY 16, 1992

Species	#	Length (mm)	Mass (g)	Portion Analyzed	Purpose
DOWNSTREAM					
Carp *	1	550	2,727	WF	CWPD
Carp *	1	545	2,727	Fillet	HHRA
Carp *	1	660	4,091	Fillet	HHRA
Carp *	1	508	2,386	WF	CWPD
White Sucker *	1	227	120	-	-
White Sucker *	1	276	240	-	-
White Sucker *	1	256	180	-	-
White Sucker *	1	174	54	-	-
White Sucker *	1	151	35	-	-
White Sucker *	1	120	19	WF	FWIA
Pumpkinseed *	1	120	24	EP	HHRA
Banded Killifish	2	37	4	-	-
Dace	14	32-80	22	WF	FWIA

EP = Edible Portion
WF = Whole Fish
HHRA = Human Health Risk Assessment
FWIA = Fish and Wildlife Impact Analysis
CWPD = Comparison with Previous Data
* = Fish included in average edible fish mass calculation for risk assessment.

Table 3
Historical Analytical Ground Water Data

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Well	Sample Date	Total PCBs ug/l	Aroclor	Oil & Grease mg/l
OBG-1	12-3-86	<0.5		<1
	10-6-88	0.4	1242/1248	
	4-5-89	0.18	1248	
	7-24-92 (unfiltered)	<1.2 *	1248	
	7-24-92 (filtered)	LTD		
OBG-2	12-3-86	<0.1		<1
	10-6-88	0.3	1242/1248	
	4-5-89	0.1	1248	
	7-24-92 (unfiltered)	<0.6 *	1248	
	7-24-92 (filtered)	LTD		
OBG-3	12-3-86	5.3	1016/1242/1248	<1
	10-6-88	**		
	4-5-89	0.64	1248	
	7-24-92 (unfiltered)	<0.9 *	1248	
	7-24-92 (filtered)	LTD		
	7-24-92 (unfiltered)	<0.9 *	1248	
	7-24-92 (filtered)	LTD		
OBG-3D	7-29-92 (unfiltered)	LTD		
	7-29-92 (filtered)	LTD		
OBG-4	12-3-86	0.5	1016/1242/1248	<1
	10-7-88	1.6	1242/1248	
	4-5-89	3	1248	
	7-24-92 (unfiltered)	<3.0 *	1248	
	7-24-92 (filtered)	LTD		
OBG-5	12-3-86	0.5	1016/1242/1248	<1
	10-7-88	0.7	1242/1248	
	4-4-89	0.07	1248	
	7-24-92 (unfiltered)	<0.6 *	1248	
	7-24-92 (filtered)	LTD		
OBG-6	12-3-86	3	1016/1242/1248	3
	10-6-88	0.2	1242/1248	
	4-4-89	0.36	1248	
	9-17-92 (unfiltered)	LTD		
	9-17-92 (filtered)	LTD		
OBG-7A	12-3-86	0.8	1016/1242/1248	2
	10-7-88	3.4	1242/1248	
	4-5-89	6.3	1248	
	7-24-92 (unfiltered)	4.2	1248	
	7-24-92 (filtered)	LTD		

Table 3
Historical Analytical Ground Water Data

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Well	Sample Date	Total PCBs ug/l	Aroclor	Oil & Grease mg/l
OBG-7B	12-3-86	0.5	1016/1242/1248	<1
	10-7-88	0.7	1242/1248	
	4-5-89	0.38	1248	
	7-24-92 (unfiltered)	<1.9 *	1248	
	7-24-92 (filtered)	LTD		
OBG-7C	12-3-86	1	1016/1242/1248	<1
	10-6-88	**		
	4-5-89	0.21	1248	
	7-24-92 (unfiltered)	<1.4 *	1248	
	7-24-92 (filtered)	LTD		
MW-8	10-6-88	13	1248	
	4-4-89	8.9	1248	
	7-24-92 (unfiltered)	LTD		
	7-24-92 (filtered)	LTD		
MW-9	10-6-88	18	1248	
	4-4-89	21	1248	
	7-24-92 (unfiltered)	LTD		
	7-24-92 (filtered)	LTD		
MW-9D	7-29-92 (unfiltered)	LTD		
	7-29-92 (filtered)	LTD		
MW-10	10-6-88	3.3	1248	
	4-4-89	1.2	1248	
	7-24-92 (unfiltered)	<0.5 *	1248	
	7-24-92 (filtered)	LTD		
MW-11	10-6-88	0.2	1242/1248	
	4-4-89	<0.065		
	4-4-89	0.085	1248	
MW-12	10-6-88	7.3	1248	
	4-4-89	6.9	1248	
	7-24-92 (unfiltered)	<1.1 *	1248	
	7-24-92 (filtered)	LTD		
MW-13	10-6-88	8.8	1248	
	4-4-89	0.31	1248	
	7-24-92 (unfiltered)	LTD		
	7-24-92 (filtered)	LTD		

* Aroclor 1248 detected at concentration equal to indicated detection limit; qualified as less than that concentration due to equipment blank contamination.

LTD Each Aroclor was less than detectable at detection limits of 0.5 ug/l (1016, 1232, 1242, 1248, 1254, and 1260) and 1.0 ug/l (1221).

** Well dry; sample not collected.

Table 4
Ground Water Analytical Data - 1992 Remedial Investigation

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Well	Concentration (ug/l)						
	Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
NYS Class GA Ground Water Standard = 0.1 ug/l							
OBG-1 (unfiltered)	0.5 U	1.0 U	0.5 U	0.5 U	1.2 U*	0.5 U	0.5 U
OBG-1 (filtered)	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
OBG-2 (unfiltered)	0.5 U	1.0 U	0.5 U	0.5 U	0.6 U*	0.5 U	0.5 U
OBG-2 (filtered)	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
OBG-3 (unfiltered)	0.5 U	1.0 U	0.5 U	0.5 U	0.9 U*	0.5 U	0.5 U
OBG-3 (filtered)	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
OBG-3 Blind Duplicate (unfiltered)	0.5 U	1.0 U	0.5 U	0.5 U	0.9 U*	0.5 U	0.5 U
OBG-3 Blind Duplicate (filtered)	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
OBG-3D (unfiltered)	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
OBG-3D (filtered)	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
OBG-4 (unfiltered)	0.5 U	1.0 U	0.5 U	0.5 U	3.0 U*	0.5 U	0.5 U
OBG-4 (filtered)	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
OBG-5 (unfiltered)	0.5 U	1.0 U	0.5 U	0.5 U	0.6 U*	0.5 U	0.5 U
OBG-5 (filtered)	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Table 4
Ground Water Analytical Data - 1992 Remedial Investigation

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Well	Concentration (ug/l)						
	Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
NYS Class GA Ground Water Standard = 0.1 ug/l							
OBG-6 (unfiltered)	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
OBG-6 (filtered)	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
OBG-7A (unfiltered)	0.5 U	1.0 U	0.5 U	0.5 U	4.2	0.5 U	0.5 U
OBG-7A (filtered)	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
OBG-7B (unfiltered)	0.5 U	1.0 U	0.5 U	0.5 U	1.9 U*	0.5 U	0.5 U
OBG-7B (filtered)	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
OBG-7C (unfiltered)	0.5 U	1.0 U	0.5 U	0.5 U	1.4 U*	0.5 U	0.5 U
OBG-7C (filtered)	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW-8 (unfiltered)	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW-8 (filtered)	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW-9 (unfiltered)	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW-9 (filtered)	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW-9D (unfiltered)	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW-9D (filtered)	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW-10 (unfiltered)	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U*	0.5 U	0.5 U
MW-10 (filtered)	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Table 4
Ground Water Analytical Data - 1992 Remedial Investigation

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Well	Concentration (ug/l)						
	Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
NYS Class GA Ground Water Standard = 0.1 ug/l							
MW-12 (unfiltered)	0.5 U	1.0 U	0.5 U	0.5 U	**1.1 U***	0.5 U	0.5 U
MW-12 (filtered)	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW-13 (unfiltered)	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
MW-13 (filtered)	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Equipment Blank	0.5 U	1.0 U	0.5 U	0.5 U	**0.8**	0.5 U	0.5 U
Equipment Blank (MW-6)	0.5 U	1.0 U	0.5 U	0.5 U	**0.5 U**	0.5 U	0.5 U

U Not detected at the indicated quantitation limit.
U* Elevated detection limit due to equipment blank sample contamination.

Table 5
Subsurface Soil Analytical Data – 1986/87 Hydrogeologic Investigation

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Well	Depth (ft)	Total PCBs (mg/kg dry weight)	Aroclor	Oil & Grease (mg/kg dry weight)	Percent Solids
OBG-1	0-2	5.6	1016/1242/1248	550	85
	2-4	<0.5	1016/1242/1248	60	84
	4-6	<0.5	1016/1242/1248	180	48
	6-8	<0.5	1016/1242/1248	<10	68
	8-10	<0.5	1016/1242/1248	190	65
	10-12	<0.5	1016/1242/1248	<10	76
OBG-2	0-2	9.9	1016/1242/1248	1,000	72
	2-4	2.4	1016/1242/1248	320	76
	6-8	<0.5	1016/1242/1248	700	76
OBG-3	0-2	81	1016/1242/1248	1,640	83
	2-4	58	1016/1242/1248	4,510	83
	4-6	30	1016/1242/1248	5,440	84
	6-8	<0.5	1016/1242/1248	<10	83
	8-10	7.1	1016/1242/1248	490	79
	10-12	1.5	1016/1242/1248	1,200	78
OBG-4	0-2	1.9	1016/1242/1248	8,310	85
	2-4	<0.5	1016/1242/1248	2,100	82
	4-6	240	1016/1242/1248	<10	79
	6-8	<0.5	1016/1242/1248	52	82
	8-10	1.1	1016/1242/1248	440	82
	10-12	<0.5	1016/1242/1248	<10	76
OBG-5	0-2	100	1016/1242/1248	110	83
	2-4	<0.5	1016/1242/1248	370	81
	4-6	<0.5	1016/1242/1248	79	56
	6-8	<0.5	1016/1242/1248	32	77
	8-10	<0.5	1016/1242/1248	<10	76
	10-12	<0.5	1016/1242/1248	57	76
OBG-6	0-2	12	1016/1242/1248	620	82
	2-4	61	1016/1242/1248	920	79
	4-6	470	1016/1242/1248	8,890	75
	6-8	190	1016/1242/1248	3,490	75
	8-10	89	1016/1242/1248	1,810	72
	10-12	<0.5	1016/1242/1248	480	75
	12-14	<0.5	1016/1242/1248	420	81
	14-16	<0.5	1016/1242/1248	560	77
	16-18	<0.5	1016/1242/1248	480	79

from: O'Brien & Gere Engineers, Inc. "Hydrogeologic Investigation of Fill Area Along Ley Creek." April 1987.

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Table 5
Subsurface Soil Analytical Data - 1986/87 Hydrogeologic Investigation

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Well	Depth (ft)	Total PCBs (mg/kg dry weight)	Aroclor	Oil & Grease (mg/kg dry weight)	Percent Solids
OBG-7A	0-2	2.6	1016/1242/1248	280	81
	2-4	75	1016/1242/1248	2,650	80
	4-6	11	1016/1242/1248	520	73
	6-8	<0.5	1016/1242/1248	220	79
	8-10	0.77	1016/1242/1248	290	81
	10-12	8.3	1016/1242/1248	220	77
OBG-7B	0-2	<0.5	1016/1242/1248	260	80
	2-4	<0.5	1016/1242/1248	62	82
	4-6	<0.5	1016/1242/1248	99	84
	6-8	220	1016/1242/1248	5,460	74
	8-10	<0.5	1016/1242/1248	45	78
	10-12	3.1	1016/1242/1248	210	78
OBG-7C	0-2	<0.5	1016/1242/1248	<10	83
	2-4	21	1016/1242/1248	670	84
	4-6	16	1016/1242/1248	820	76
	6-8	37	1016/1242/1248	56	84
	8-10	<0.5	1016/1242/1248	170	82
	10-12	<0.5	1016/1242/1248	<10	80

from: O'Brien & Gere Engineers, Inc. "Hydrogeologic Investigation of Fill Area Along Ley Creek." April 1987. September 16, 1993

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Table 6
Subsurface Soil Analytical Data - 1988/89 Field Investigation

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Boring	Depth	Total PCBs (mg/kg dry weight)	Aroclor	Percent Solids
B1	0-4'	<1		85
B1	4-8'	53	1248	77
B1	8-10'	32	1248	76
B2	0-4'	22	1248	81
B2	4-8'	20	1248	75
B2	8-12'	4.7	1248	81
B2	12-14'	<1		83
B3	0-4'	15	1248	78
B3	4-8'	<1		78
B3	8-10'	<1		78
B4	0-4'	27	1248	78
B4	4-8'	<1		82
B5	0-4'	11	1248	79
B5	4-8'	<1		63
B5	8-10'	<1		77
B6	0-4'	59	1248	73
B6	4-8'	180	1248	66
B6	8-12'	28	1248	69
B7	0-4'	4.4	1248	77
B7	4-8'	<1		76
B7	8-12'	7.8	1016/1242/1248	79
B7	12-16'	4.4	1016/1242/1248	62
B8	0-4'	2.1	1248	81
B8	4-8'	8.6	1016/1242/1248	77
B8	8-12'	<1		74
B8	12-14'	<1		80
B9	0-4'	15	1248	80
B9	4-8'	5.8	1248	71
B9	8-12'	5.7	1248	81
B10	0-4'	5.6	1248	79
B10	4-8'	16	1248	76
B10	8-12'	2.6	1248	80
B11	0-2'	4.9	1248	81
B11	6-10'	1.3	1248	77
B11	10-12'	<1		90
B12	0-2'	<1		70
B12	4-8'	<1		77
B12	8-10'	<1		89
B13	0-4'	<1		83
B13	4-8'	<1		83
B13	8-12'	<1		82
B13	12-14'	<1		82

from: O'Brien & Gere Engineers, Inc. "Field Investigation; Ley Creek Dredged Material Area." July 1989.

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Table 6
Subsurface Soil Analytical Data - 1988/89 Field Investigation

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Boring	Depth	Total PCBs (mg/kg dry weight)	Aroclor	Percent Solids
B14	0-4'	<1		85
B14	4-8'	<1		84
B14	8-12'	<1		79
B15	0-2'	<1		85
B15	2-4'	<1		79
B15	4-8'	<1		82
B15	8-12'	<1		79
B16	0-4'	<1		79
B16	4-8'	<1		79
B16	8-12'	<1		79
B17	0-2'	<1		89
B17	2-4'	<1		63
B17	4-8'	<1		81
B17	8-12'	<1		80
B18	0-2'	<1		91
B18	2-4'	<1		94
B18	4-8'	<1		77
B19	0-4'	27	1248	74
B19	4-8'	<1		72
B20	0-4'	<1		76
B20	4-8'	<1		71
B21	0-4'	3.5	1248	74
B21	4-8'	<1		81
B22	0-4'	2	1248	81
B22	4-8'	<1		84
B23	0-2'	<1		80
B23	2-4'	<1		74
B23	4-6'	<1		71
B23	6-8'	<1		81

from: O'Brien & Gere Engineers, Inc. "Field Investigation; Ley Creek Dredged Material Area." July 1989. September 16, 1993

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Table 7
Subsurface Soil Analytical Data - 1992 Remedial Investigation

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Boring	Depth	Dry Weight Concentration (mg/kg)							Percent Solids
		Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260	
B-25	0' - 4'	4 U	8 U	4 U	4 U	48	4 U	4 U	80.6
	4' - 8'	0.8 U	1.6 U	0.8 U	0.8 U	5.4 J	0.8 U	0.8 U	80.3
	8' - 12'	0.041 U	0.082 U	0.041 U	0.041 U	0.28	0.041 U	0.041 U	80.5
B-26	0' - 4'	0.83 U	1.66 U	0.83 U	0.83 U	4.2 J	0.83 U	0.83 U	79.4
	4' - 8'	0.04 U	0.08 U	0.04 U	0.04 U	0.15 J	0.04 U	0.04 U	81.7
	8' - 10'	0.042 U	0.084 U	0.042 U	0.042 U	0.043 J	0.042 U	0.042 U	78.5
B-27	0' - 4'	0.85 U	1.7 U	0.85 U	0.85 U	5.5	0.85 U	0.85 U	77.3
	4' - 8'	0.2 U	0.4 U	0.2 U	0.2 U	1.2 JN	0.2 U	0.2 U	81.7
B-28	0' - 4'	4 U	8 U	4 U	4 U	38	4 U	4 U	84.3
	4' - 8'	2 U	4 U	2 U	2 U	19	2 U	2 U	79.3
	8' - 12'	4.5 U	9 U	4.5 U	4.5 U	47 J	4.5 U	4.5 U	73.5
B-29	0' - 4'	3.95 U	7.9 U	3.95 U	3.95 U	33	3.95 U	3.95 U	83.6
	4' - 8'	2 U	4 U	2 U	2 U	16	2 U	2 U	80.6
	8' - 10'	0.2 U	0.4 U	0.2 U	0.2 U	2.1	0.2 U	0.2 U	79.5

Table 7
Subsurface Soil Analytical Data - 1992 Remedial Investigation

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Boring	Depth	Dry Weight Concentration (mg/kg)							Percent Solids
		Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260	
B-30	0' - 4'	4.2 U	8.4 U	4.2 U	4.2 U	24 J	4.2 U	4.2 U	78.1
	4' - 8'	0.04 U	0.08 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	82.2
	8' - 10'	0.04 U	0.08 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	81.3
B-31	0' - 4'	4 U	8 U	4 U	4 U	48	4 U	4 U	83.8
	6' - 8'	2.4 U	4.8 U	2.4 U	2.4 U	20	2.4 U	2.4 U	69.3
	8' - 10'	0.04 U	0.08 U	0.04 U	0.04 U	0.08	0.04 U	0.04 U	84.4
B-34	0' - 4'	0.04 U	0.08 U	0.04 U	0.04 U	0.15 J	0.04 U	0.04 U	83.1
	0' - 4' Blind Duplicate	0.04 U	0.08 U	0.04 U	0.04 U	0.4 J	0.04 U	0.04 U	84.2
	4' - 8'	0.042 U	0.084 U	0.042 U	0.042 U	0.056	0.042 U	0.042 U	79.4
	8' - 10'	0.042 U	0.084 U	0.042 U	0.042 U	0.042 U	0.042 U	0.042 U	79.4
B-35	0' - 4'	0.042 U	0.084 U	0.042 U	0.042 U	0.16 JN	0.042 U	0.042 U	77.8
	4' - 8'	0.04 U	0.08 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	83.1
Field Blank		0.5 ug/l U	1.0 ug/l U	0.5 ug/l U	0.5 ug/l U	0.5 ug/l U	0.5 ug/l U	0.5 ug/l U	-

Table 7
Subsurface Soil Analytical Data - 1992 Remedial Investigation

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Boring	Depth	Dry Weight Concentration (mg/kg)							Percent Solids
		Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260	
B-37	4' - 8'	9.2 U	18 U	9.2 U	9.2 U	140	9.2 U	9.2 U	71.4
	8' - 12'	0.91 U	1.8 U	0.91 U	0.91 U	11	0.91 U	0.91 U	72.4
B-38	4' - 8'	0.41 U	0.82 U	0.41 U	0.41 U	2.3	0.41 U	0.41 U	81.2
B-41	4' - 8'	0.17 U	0.33 U	0.17 U	0.17 U	1.6	0.17 U	0.17 U	79.4
	4' - 8' Blind Duplicate	0.17 U	0.34 U	0.17 U	0.17 U	1.1	0.17 U	0.17 U	79.8
B-42	0' - 4'	2 U	4 U	2 U	2 U	6.8	2 U	2 U	83.8
	4' - 8'	0.39 U	0.8 U	0.39 U	0.39 U	5.1	0.39 U	0.39 U	83.8
	8' - 10'	0.16 U	0.32 U	0.16 U	0.16 U	0.87	0.16 U	0.16 U	82.2
B-43	4' - 8'	0.83 U	1.7 U	0.83 U	0.83 U	3.8	0.83 U	0.83 U	79.7
Field Blank		0.5 ug/l UJ	1.0 ug/l UJ	0.5 ug/l UJ	0.5 ug/l UJ	0.5 ug/l UJ	0.5 ug/l UJ	0.5 ug/l UJ	-

Table 7
Subsurface Soil Analytical Data - 1992 Remedial Investigation

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Boring	Depth	Dry Weight Concentration (mg/kg)							Percent Solids
		Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260	
B-6M	0' - 2'	2.2 U	4.4 U	2.2 U	2.2 U	18	2.2 U	2.2 U	75.8
	2' - 4'	0.2 U	0.4 U	0.2 U	0.2 U	1.6	0.2 U	0.2 U	83.0
	4' - 6'	0.042 U	0.084 U	0.042 U	0.042 U	0.049	0.042 U	0.12	78.7
	6' - 8'	0.041 U	0.082 U	0.041 U	0.041 U	0.067	0.041 U	0.041 U	79.6
	8' - 10'	0.042 U	0.084 U	0.042 U	0.042 U	0.053 J	0.042 U	0.12 J	77.7
	10' - 12'	0.045 U	0.09 U	0.045 U	0.045 U	0.13	0.045 U	0.045 U	71.8
OBG-3DM	0' - 2'	0.4 U	0.8 U	0.4 U	0.4 U	3.3	0.4 U	0.4 U	84.5
	2' - 4'	0.048 U	0.096 U	0.048 U	0.048 U	0.98	0.048 U	0.048 U	69.3
	4' - 6'	0.04 U	0.18 U	0.04 U	0.06 U	0.099	0.04 U	0.04 U	82.0
	6' - 8'	0.041 U	0.082 U	0.041 U	0.041 U	0.041 U	0.041 U	0.041 U	79.9
	8' - 10'	0.041 U	0.082 U	0.041 U	0.041 U	0.052	0.041 U	0.041 U	81.3
	10' - 12'	0.042 U	0.084 U	0.042 U	0.042 U	0.042 UJ	0.042 U	0.042 U	79.4
	10' - 12' Blind Duplicate	0.042 U	0.084 U	0.042 U	0.042 U	0.15 J	0.042 U	0.042 U	78.4

Table 7
Subsurface Soil Analytical Data - 1992 Remedial Investigation

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Boring	Depth	Dry Weight Concentration (mg/kg)							Percent Solids
		Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260	
OBG-6M	0' - 2'	0.39 U	0.78 U	0.39 U	0.39 U	4.3	0.39 U	0.39 U	84.3
	2' - 4'	0.04 U	0.08 U	0.04 U	0.04 U	0.28 J	0.04 U	0.04 U	82.1
	4' - 6'	0.4 U	0.8 U	0.4 U	0.4 U	5.5	0.4 U	0.4 U	84.2
	6' - 8'	6 U	12 U	6 U	6 U	40	6 U	6 U	58.3
	8' - 10'	0.5 U	1.0 U	0.5 U	0.5 U	3.5	0.5 U	0.5 U	63.1
	10' - 12'	0.06 U	0.12 U	0.06 U	0.06 U	0.1	0.06 U	0.06 U	54.1
Field Blank		0.5 ug/l U	1.0 ug/l U	0.5 ug/l U	0.5 ug/l U	0.5 ug/l U	0.5 ug/l U	0.5 ug/l U	-

U	Not detected at the indicated quantitation limit.
J	Detected results are estimated.
UJ	Detection limits are estimated.
JN	Detected results are presumptively present at an approximated quantity.

54 total
187 SCGs

Table 8
Surface Soil Analytical Data - 1992 Remedial Investigation

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Sample Location	Dry Weight Concentration (mg/kg)							Percent Solids
	Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260	
LCSS-1	4.5 U	9 U	4.5 U	4.5 U	16 J	4.5 U	4.5 U	74.0
LCSS-2	0.85 U	1.7 U	0.85 U	0.85 U	4.7 J	0.85 U	0.85 U	78.1
LCSS-3	0.39 U	0.78 U	0.39 U	0.39 U	2.7 J	0.39 U	0.39 U	84.8
LCSS-3 Blind Duplicate	0.4 U	0.8 U	0.4 U	0.4 U	5.2 J	0.4 U	0.4 U	82.7
LCSS-4	0.043 UJ	0.086 UJ	0.043 UJ	0.043 UJ	0.11 JN	0.043 UJ	0.061 J	76.9
LCSS-5	0.039 U	0.078 U	0.039 U	0.039 U	0.048 J	0.039 U	0.039 U	85.0
Field Blank	10 ug/l U	20 ug/l U	10 ug/l U	10 ug/l U	10 ug/l U	10 ug/l U	10 ug/l U	-

U	Not detected at the indicated quantitation limit.
J	Detected results are estimated.
UJ	Detection limits are estimated.
JN	Detected results are presumptively present at an approximated quantity.

6-total
47 SCGs

September 16, 1993

Table 9
Historical Surface Water Data

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

1985 Ley Creek Sampling[1]

Sample Distance from Outfall (ft)	Aroclor 1248 (ug/l)	Freon Extractable Oil (mg/l)	Total Nonfilterable Residue (mg/l)
1000 Upstream	< 0.2	< 5	5.8
500 Upstream	< 0.2	< 5	6.2
10 Downstream	2.3	< 5	5.8
500 Downstream	0.27	< 5	8.4
1000 Downstream	0.34	< 5	9.4
1500 Downstream	0.41	< 5	7.4
2000 Downstream	0.42	< 5	11
2500 Downstream	0.44	< 5	84
3000 Downstream	0.29	< 5	18

1985 Hydrogeological Investigation[2]

11 (GW)

Sample Number	Approximate Distance from Outfall (ft)[3]	t-1,2-Dichloroethene (mg/l)	Trichloroethene (mg/l)	Toluene (mg/l)	Chloroform (mg/l)
ST 1	70 Upstream	0.003	0.008	0.003	0.001
ST 2	530 Upstream	0.003	0.007	0.002	-
ST 3	1,280 Upstream	0.003	0.006	-	-
ST 4	220 Downstream	0.003	0.006	-	-
ST 5	570 Downstream	0.003	0.006	-	-
ST 6	800 Downstream	0.003	0.007	-	-

1988/89 Field Investigation[4]

Sample Location	Date	Total PCBs (ug/l)
SW-1	1/15/88	< 0.1
	4/4/89	< 0.065
SW-2	1/15/88	< 0.1
	4/4/89	1.4 (Aroclor 1248)
SW-3	1/15/88	< 0.1
	4/4/89	< 0.065

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1 EDI Engineering & Science. "Oil and PCB Sampling and Analyses of Portions of Ley Creek." September 1985.
2 EDI Engineering & Science. "Hydrogeological Investigation." September 1985.
3 Distances approximated from figure indicating sample locations in "Hydrogeological Investigation" report.
4 O'Brien & Gere Engineers, Inc. "Report; Field Investigation; Ley Creek Dredged Material Area." July 1989.

Table 10
Sediment Analytical Data - 1985 Ley Creek Sampling

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Distance from Outfall (feet)	Position	Depth Interval (inches)	PCB Concentration (mg/kg, dry wt) Aroclor 1248	PCB Concentration (mg/kg, dry wt) Aroclor 1260	Total PCB (mg/kg, dry wt)	Freon Extractable Oil (mg/kg)	Texture	Dry Weight (%)
1000-Upstream	North Bank	0-6	≤0.1	0.42	0.42	3,820	Sandy Clay	71.1
1000-Upstream	North Bank	6-12	-	<0.01	<0.01	<500	Clay	83.2
1000-Upstream	North Bank	12-18	<0.01	-	<0.01	1,610	Clay	77.2
1000-Upstream	Center	0-6	-	<0.02	<0.02	<500	Clay	83.3
1000-Upstream	Center	6-12	<0.04	-	<0.04	<500	Clay	76.4
1000-Upstream	Center	12-18	<0.02	-	<0.02	<500	Clay	74.9
1000-Upstream	South Bank	0-6	-	0.016	0.016	<500	Clay	80.5
1000-Upstream	South Bank	6-12	-	<0.02	<0.02	<500	Clay	75.4
1000-Upstream	South Bank	12-18	<0.02	-	<0.02	<500	Clay	81.6
500-Upstream	North Bank	0-6	0.83	-	0.83	3,010	Mucky Sand	64.9
500-Upstream	North Bank	6-12	≤0.05	0.10	0.10	4,690	Mucky Sand	78.8
500-Upstream	Center	0-6	-	0.065	0.065	806	Sand	80.8
500-Upstream	Center	6-12	-	0.45	0.45	4,480	Mucky Sand	63.3
500-Upstream	South Bank	0-6	0.15	-	0.15	1,760	Sandy Clay	78.1
0-Downstream	North Bank	0-6	0.45	0.10	0.55	3,030	Mucky Clay	69.8
0-Downstream	North Bank	6-12	<0.01	-	<0.01	<500	Clay	76.1
0-Downstream	Center	0-6	0.049	0.037	0.086	870	Clay	73.7
0-Downstream	Center	6-12	<0.01	-	<0.01	<500	Clay	80.0
0-Downstream	South Bank	0-6	1.4	-	1.4	3,850	Mucky Clay	77.9
0-Downstream	South Bank	6-12	<0.02	-	<0.02	503	Clay	81.5
500-Downstream	North Bank	0-6	5.7	≤0.46	5.7	3,050	Silt	67.6
500-Downstream	North Bank	6-12	34	-	34	2,670	Mucky Clay	73.8
500-Downstream	North Bank	12-18	<0.02	-	<0.02	6,880	Clay	80.4
500-Downstream	Center	0-6	<0.01	-	<0.01	<500	Clay	80.4
500-Downstream	Center	6-12	<0.01	-	<0.01	<500	Clay	77.4
500-Downstream	South Bank	0-6	4.2	0.38	4.6	8,650	Clay	60.7
500-Downstream	South Bank	6-12	-	0.01	0.01	<500	Clay	82.0
500-Downstream	South Bank	12-18	<0.01	-	<0.01	<500	Clay	77.4

from: EDI Engineering & Science. "Oil and PCB Sampling and Analyses of Portions of Ley Creek." September 1985.

Table 10
Sediment Analytical Data - 1985 Ley Creek Sampling
Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Distance from Outfall (feet)	Position	Depth Interval (inches)	PCB Concentration (mg/kg, dry wt) Aroclor 1248	Aroclor 1260	Total PCB (mg/kg, dry wt)	Freon Extractable Oil (mg/kg)	Texture	Dry Weight (%)
750-Downstream	South Bank	0-6	0.47	0.063	0.53	7,930	Mucky Sand	54.2
750-Downstream	South Bank	6-12	0.55	-	0.55	908	Mucky Sand	79.7
750-Downstream	South Bank	12-18	<0.05	-	<0.05	<500	Mucky Sand	69.6
1000-Downstream	North Bank	0-6	<0.01	-	<0.01	2,090	Clay	71.1
1000-Downstream	North Bank	6-12	<0.025	-	<0.025	<500	Clay	83.2
1000-Downstream	Center	0-5.5	0.046	0.015	0.061	<500	Clay	83.2
1000-Downstream	Center	5.5-11	<0.01	-	<0.01	1,930	Clay	79.3
1000-Downstream	South Bank	0-6	<0.01	-	<0.01	<500	Clay	80.3
1000-Downstream	South Bank	6-12	<0.01	-	<0.01	551	Clay	78.6
1500-Downstream	North Bank	0-6	<0.02	-	<0.02	<500	Clay	79.1
1500-Downstream	North Bank	6-12	<0.01	-	<0.01	<500	Clay	76.1
1500-Downstream	Center	0-6	0.051	-	0.051	9,520	Sandy Clay	79.3
1500-Downstream	Center	6-12	<0.01	-	<0.01	6,570	Clay	79.0
1500-Downstream	South Bank	0-8	0.039	-	0.039	7,550	Clay	78.4
1500-Downstream	South Bank	8-16	<0.05	-	<0.05	1,580	Clay	74.9
2000-Downstream	North Bank	0-6	10	0.75	11	7,640	Muck	59.7
2000-Downstream	North Bank	6-12	0.047	<0.01	0.047	1,300	Clay	69.2
2000-Downstream	North Bank	12-18	<0.01	-	<0.01	2,410	Clay	77.1
2000-Downstream	Center	0-7	0.68	0.16	0.84	<500	Sandy Clay	78.1
2000-Downstream	Center	7-13.5	≤0.03	-	≤0.03	<500	Clay	73.9
2000-Downstream	South Bank	0-5.5	1.5	-	1.5	<500	Mucky Clay	65.2
2000-Downstream	South Bank	5.5-11	≤0.03	-	≤0.03	<500	Clay	78.3
2000-Downstream	South Bank	11-17	<0.1	-	<0.01	<500	Clay	76.0
2500-Downstream	North Bank	0-6	8.1	-	8.1	1,760	Mucky Sand	57.5
2500-Downstream	North Bank	6-12	7.2	-	7.2	<500	Clay	86.8
2500-Downstream	Center	0-5	-	-	1.7*	<500	Mucky Sand	76.8
2500-Downstream	Center	5-10	≤0.03	-	≤0.03	<500	Clay	84.2
2500-Downstream	South Bank	0-8	6.8	-	6.8	<500	Mucky Clay	54.8
3000-Downstream	North Bank	0-6	5.9	-	5.9	1,810	Sandy Silt	57.3
3000-Downstream	North Bank	6-12	1.3	-	1.3	<500	Gravely Sand	73.1
3000-Downstream	Center	0-5	0.062	-	0.062	2,980	Mucky Clay	79.9
3000-Downstream	South Bank	0-4	3.5	≤0.2	3.5	5,760	Mucky Clay	40.9
3000-Downstream	South Bank	4-8.5	1.1	≤0.08	1.1	725	Clay	76.0

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* Aroclor 1254

from: EDI Engineering & Science. "Oil and PCB Sampling and Analyses of Portions of Ley Creek." September 1985.

Table 11
Sediment Analytical Data – 1988/89 Field Investigation

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Sample	Total PCBs (mg/kg dry weight)	Aroclor	Percent Solids
SS–1	< 1		88
SS–2	8.6	1016/1242/1248	70
SS–3	1.9	1016/1242/1248	68
SS–4	3.3	1242	75
SS–5	3.8	1242	74
SS–6	< 1		69

from: O'Brien & Gere Engineers, Inc. "Field Investigation; Ley Creek Dredged Material Area." July 1989.

Table 12
Sediment Analytical Data - 1992 Remedial Investigation

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Sample Location	Dry Weight Concentration (mg/kg)								Percent Solids
	Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260	TOC	
SED-1	0.043 U	0.086 U	0.043 U	0.043 U	0.043 U	0.043 U	0.043 U	14,300	76.6
SED-2	0.04 U	0.08 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	21,700	83.3
SED-3	0.039 U	0.078 U	0.039 U	0.039 U	0.039 U	0.039 U	0.039 U	19,100	85.5
SED-4	0.045 U	0.09 U	0.045 U	0.045 U	0.045 U	0.045 U	0.045 U	13,600	74.2
SED-5	0.045 U	0.09 U	0.045 U	0.045 U	0.045 U	0.045 U	0.045 U	15,000	73.2
SED-6	0.046 U	0.092 U	0.046 U	0.046 U	0.23 J	0.046 U	0.046 U	18,200	71.5
SED-6 Blind Duplicate	0.045 U	0.09 U	0.045 U	0.045 U	0.34 J	0.045 U	0.045 U	13,900	73.8
SED-7	0.047 U	0.094 U	0.047 U	0.047 U	0.19	0.047 U	0.047 U	15,600	71.1
SED-8	0.065 U	0.13 U	0.065 U	0.065 U	0.71	0.065 U	0.065 U	21,100	51.0
SED-9	0.066 U	0.13 U	0.066 U	0.066 U	0.81	0.066 U	0.066 U	15,900	50.1
Equipment Blank	0.5 ug/l U	1.0 ug/l U	0.5 ug/l U	0.5 ug/l U	0.5 ug/l U	0.5 ug/l U	0.5 ug/l U	1.0 mg/l U	-

U	Not detected at the indicated quantitation limit.
J	Detected results are estimated.

Table 13
Fish Analytical Data - 1985 Ley Creek Sampling

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Species	Aroclor 1248 (ug/g)	Aroclor 1254 (ug/g)	Total PCB (ug/g)	Dry Weight (%)	Lipid Weight (%)	Total Weight (g)
Bluegill	≤0.2	-	≤0.2	25	0.25	60
Bluegill	≤0.3	-	≤0.3	27.4	0.26	62
Bluegill	≤0.2	-	≤0.2	26.0	0.85	64
Bluegill	≤0.4	-	≤0.4	26.5	1.1	86
Bluegill	≤0.2	-	≤0.2	25.1	0.40	59
Pumpkinseed	≤0.3	-	≤0.3	26.0	0.10	65
Shiners	<3	-	<3	25.6	1.6	11
Brown Bullhead	≤0.2	-	≤0.2	19.4	0.07	134
Carp	4.1	2.7	6.8	31.2	7.3	2,680
Carp	≤0.3	-	<0.3	20.9	0.17	2,885
Carp	2.2	1.2	3.4	30.9	4.8	1,884
Carp	0.55	0.53	1.1	21.7	0.24	3,481

from: EDI Engineering & Science. "Oil and PCB Sampling and Analyses of Portions of Ley Creek." September 1985.

Table 14
Fish Analytical Data - 1992 Remedial Investigation

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Fish Sample	#	Length (mm)	Mass (g)	Percent Lipids	Percent Moisture	Wet Weight Concentration (mg/kg)						
						Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
UPSTREAM												
Golden Shiner (Whole Fish)	3	65	7	0.5 %	N/A	0.1 U	0.2 U	0.1 U	0.1 U	0.86 JN	0.1 U	0.1 U
Longnose Dace (Whole Fish)	20	17 - 61	10	0.1 %	N/A	0.1 U	0.2 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
White Sucker Juv. (Whole Fish)	26	32 - 47	19	0.1 %	N/A	0.1 U	0.2 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Pumpkinseed #1 (Edible Portion)	1	95	11	0.1 %	N/A	0.5 U	1.0 U	0.5 U	0.5 U	2.4	0.5 U	0.5 U
Pumpkinseed #2 (Edible Portion)	1	77	8.5	0.1 %	N/A	0.1 U	0.2 U	0.1 U	0.1 U	1.7	0.1 U	0.1 U
Pumpkinseed #3 (Edible Portion)	1	84	9.5	0.1 %	N/A	0.1 U	0.2 U	0.1 U	0.1 U	0.11 J	0.1 U	0.1 U
OUTFALL												
Golden Shiner #1 (Whole Fish)	1	186	83	0.1 %	79.7 %	0.1 U	0.2 U	0.1 U	0.1 U	0.19	0.1 U	0.1 U
Golden Shiner #2 (Whole Fish)	1	96	12	0.5 %	N/A	0.1 U	0.2 U	0.1 U	0.1 U	0.38	0.1 U	0.1 U
Dace (Whole Fish)	25	30 - 61	25	0.2 %	N/A	0.1 U	0.2 U	0.1 U	0.1 U	0.24	0.1 U	0.1 U
White Sucker #3 (Whole Fish)	1	120	17	0.2 %	N/A	0.1 U	0.2 U	0.1 U	0.1 U	0.82	0.1 U	0.23 JN

Table 14
Fish Analytical Data - 1992 Remedial Investigation

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Fish Sample	#	Length (mm)	Mass (g)	Percent Lipids	Percent Moisture	Wet Weight Concentration (mg/kg)						
						Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
DOWNSTREAM												
Dace (Whole Fish)	14	32 - 80	22	0.5 %	N/A	0.1 U	0.2 U	0.1 U	0.1 U	0.87	0.1 U	0.33 JN
White Sucker #6 (Whole Fish)	1	120	19	0.1 % J	N/A	0.1 U	0.2 U	0.1 U	0.1 U	0.46 J	0.1 U	0.1 U
Carp #1 (Whole Fish)	1	550	2,727	2.3 %	76.0 %	0.1 U	0.2 U	0.1 U	0.1 U	0.47	0.1 U	0.7 J
Carp #4 (Whole Fish)	1	508	2,386	1.2 %	77.8 %	0.1 U	0.2 U	0.1 U	0.1 U	1.1	0.1 U	0.35
Carp #2 (Filet)	1	545	2,727	1.1 %	73.3 %	0.1 U	0.2 U	0.1 U	0.1 U	0.11	0.1 U	0.1 U
Carp #3 (Filet)	1	660	4,091	3.0 %	72.6 %	0.1 U	0.2 U	0.1 U	0.1 U	0.2	0.1 U	0.1 U
Pumpkinseed #1 (Edible Portion)	1	120	24	0.1 %	N/A	0.1 U	0.2 U	0.1 U	0.1 U	0.32	0.1 U	0.1 U

N/A	Insufficient sample volume for analysis.
U	Not detected at the indicated quantitation limit.
J	Detected results are estimated.
UJ	Detection limits are estimated.
JN	Detected results are presumptively present at an approximated quantity.

Table 15
Outfall Water and Sediment Analytical Data - 1992 Remedial Investigation

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Sample	pH	Specific Conductance (μmhos)	Temperature (°F)	Concentration (ug/l)						
				Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
Outfall Water 8/13/92 14:30	6.93	1,168	64	0.5 U	1.0 U	0.5 U	0.5 U	1.2 JN	0.5 U	0.5 U
Outfall Water 8/13/92 14:30 Blind Duplicate				0.5 U	1.0 U	0.5 U	0.5 U	1.8 J	0.5 U	0.5 U
Outfall Water 8/13/92 15:00	6.98	1,106	62.5	0.5 U	1.0 U	0.5 U	0.5 U	1.8	0.5 U	0.5 U
Outfall Water 8/13/92 15:30	7.47	477	62.4	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Outfall Water 8/13/92 16:30	7.22	345	61.3	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Outfall Sediment				0.043 mg/kg U	0.086 mg/kg U	0.043 mg/kg U	0.043 mg/kg U	0.18 mg/kg	0.043 mg/kg U	0.043 mg/kg U
Equipment Blank	7.11	23	65.5	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

U	Not detected at the indicated quantitation limit.
J	Detected results are estimated.
JN	Detected results are presumptively present at an approximated quantity.

Table 16
Physical and Chemical Properties of Some PCB Mixtures[a]

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Chemical Property	Aroclor 1016	Aroclor 1248	Aroclor 1260
Molecular Weight[b]	257.9	299.5	375.7
Solubility in Water (mg/l)	0.42	0.054	0.0027
Log K_{ow}[c]	5.6	6.2	6.8
Vapor Pressure (mm Hg at 25 °C)	4.0E-04	4.9E-04	4.05E-05
Henry's Law constant (atm-m^3/mol at 25 °C)	2.9E-04	2.8E-03	4.6E-03

a - Data summarized from ATSDR 1992

b - Average weight based on typical congoner concentrations

c - The Log Kow values represent an average value for the major components of the individual Aroclor

Table 17
Exposure Pathway Analysis Summary

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Exposure Pathway	Pathway Status	Exposure Routes	Comment
Soils	Complete	Incidental Ingestion, Dermal Contact	PCB residues are present in surface soils at the site. There is a potential for individuals to contact surface soils at the site. However, it should be noted that the exposure frequency at the site is expected to be low, since site access is limited.
Sediments	Complete	Incidental Ingestion, Dermal Contact	PCB residues are present in sediments at the site. There is a potential for individuals to contact sediments at the site. However, it should be noted that the exposure frequency at the site is expected to be low, since site access is limited.
Groundwater	Incomplete		There is no industrial or domestic use of the shallow groundwater at the site. Industrial and domestic water in the area is supplied by the Onondaga County Water Authority which draws its water from Otisco Lake.
Surface Water	Complete	Incidental Ingestion, Dermal Contact	PCB residues are present in surface water at the site. There is a potential for individuals to contact surface water at the site. However, it should be noted that the exposure frequency at the site is expected to be low, since site access is limited.
Air	Incomplete		PCBs were not detected in ambient air at a detection limit of 0.001 mg/m^3.
Fish	Complete	Ingestion	PCB residues were detected in fish collected from the outfall area and downstream of the outfall area. At the request of NYSDEC, it was assumed for this assessment that there may be domestic consumption of fish caught from the site. However, it should be noted that there is no known recreational fishing at the site, and domestic consumption of fish that may be caught from the site is highly unlikely.

Table 18
Summary of Chemicals Detected at the Study Area

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Compound	Frequency of Detection	Detection Limits	Detected Concentration Range	Units
SURFACE SOILS				
O'Brien & Gere Engineers 1989				
Aroclor 1248	13/23	1.0	1.9 - 59	mg/kg
O'Brien & Gere Engineers 1992				
Aroclor 1248	18/18	0.04	0.043 - 48	mg/kg
Aroclor 1260	1/18	0.04	0.061	mg/kg
SUB-SURFACE SOILS				
O'Brien & Gere Engineers 1989				
Aroclor 1248	14/48	1.0	2.6 - 180	mg/kg
O'Brien & Gere Engineers 1992				
Aroclor 1248	28/31	0.04	0.04 - 47	mg/kg
SEDIMENTS				
O'Brien & Gere Engineers 1989				
Aroclor 1242/1248	4/6	1.0	1.9 - 8.6	mg/kg
O'Brien & Gere Engineers 1992				
Aroclor 1248	4/9	0.04 - 0.045	0.19 - 0.81	mg/kg
GROUNDWATER				
O'Brien & Gere Engineers 1989				
Aroclor 1248	28/29	0.065	0.07 - 8.9	ug/l
O'Brien & Gere Engineers 1992				
Aroclor 1248	10/16	0.5	0.5 - 4.2	ug/l
SURFACE WATER				
EDI 1985				
t-1,2-dichloroethene	6/6		3	ug/l
Trichloroethene	6/6		6 - 8	ug/l
Toluene	2/6		2 - 3	ug/l
Chloroform	1/6		1	ug/l
O'Brien & Gere Engineers 1992				
Aroclor 1248	1/6	0.065 - 0.1	1.4	ug/l
FISH (Edible Portion)				
O'Brien & Gere Engineers 1992				
Aroclor 1248	6/6	0.1	0.2 - 2.4	mg/kg

* - Arithmetic mean calculated using 1/2 detection limit for reported Non-Detect values (U.S.EPA 1989)

Table 19
Intakes From Incidental Ingestion of Chemicals in Surface Soil

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Chemical	CS (mg/kg soil)		IR (mg/day)	CF (kg/mg)	FI	EF (dy/yr)	ED (yrs)		BW (kg)	Non–Cancer AT (yrs)*		Non–carc. Effects CDI (mg/kg–day)		Cancer AT (yrs)*	Carc. Effects CDI (mg/kg–day)	
	Upper Bound (1)	Average (2)					Upper Bound	Average		Upper Bound	Average	Upper Bound	Average		Upper Bound	Average
<u>Adult</u>																
Total PCBs	15.42	10.84	50	1.00E–06	0.8	10	19	4	70	19	4	2.4E–07	1.7E–07	70	6.6E–08	9.7E–09
<u>Child</u>																
Total PCBs	15.42	10.84	250	1.00E–06	0.5	2	6	6	21	6	6	5.0E–07	3.5E–07	70	4.3E–08	3.0E–08

Chronic Daily Intake (CDI) = $\frac{Cs \times IR \times CF \times FI \times EF \times ED}{BW \times (AT * 365)}$

Parameter	Definition	Reference	Comment
CS	Concentration in Soil	Appendix F	(1) The upper 95 % confidence levels on the arithmetic mean soil concentration was used (2) The arithmetic mean concentration given on Appendix F was used
IR	Soil ingestion rate	U.S.EPA 1991	For adults, the incidental ingestion rates reflects the U.S.EPA recommended value for incidental ingestion of soil in an industrial setting
		U.S.EPA 1989	For children, the incidental ingestion rate reflects the average estimated ingestion rate for children engaged in outdoor play activities
CF	Conversion Factor		
FI	Fraction Ingested from Contaminated Source		For adults, it was assumed that while on site, 80 % of the soil/sediment exposure would be related to soil, and 20 % to sediments at the site For children, it was assumed that while on site, 50 % of the soil/sediment exposure would be related to soil, and 50 % to sediments at the site
EF	Exposure Frequency	Site Specific Estimate	
ED	Exposure Duration	U.S.Bureau of Labor	For adults, estimated upper 90 th percentile and median duration of employment at a single location respectively
BW	Body Weight	U.S.EPA 1989	Estimated median body weight for adults and older children respectively
AT	Averaging Time	U.S.EPA 1989	As per U.S.EPA guidance

Table 20
Intakes From Incidental Ingestion of Chemicals in Sediments

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Chemical	CS (mg/kg soil)		IR (mg/day)	CF (kg/mg)	FI	EF (dy/yr)	ED (yrs)		BW (kg)	Non-Cancer AT (yrs)*		Non-carc. Effects CDI (mg/kg-day)		Cancer AT	Carc. Effects CDI (mg/kg-day)	
	Upper Bound (1)	Average (2)					Upper Bound	Average		Upper Bound	Average	Upper Bound	Average	(yrs)*	Upper Bound	Average
Adult																
Total PCBs	8.6	1.31	50	1.00E-06	0.2	10	19	4	70	19	4	3.4E-08	5.1E-09	70	9.1E-09	2.9E-10
Child																
Total PCBs	8.6	1.31	250	1.00E-06	0.5	2	6	6	21	6	6	2.8E-07	4.3E-08	70	2.4E-08	3.7E-09

$$\text{Chronic Daily Intake (CDI)} = \frac{Cs \times IR \times CF \times FI \times EF \times ED}{BW \times (AT * 365)}$$

Parameter	Definition	Reference	Comment
CS	Concentration in Sediments	Appendix F	(1) The maximum detected sediment concentration was used (2) The arithmetic mean concentration given in Appendix F was used
IR	Sediment ingestion rate	U.S.EPA 1991 U.S.EPA 1989	For adults, the incidental ingestion rates reflects the U.S.EPA recommended value for incidental ingestion of soil in an industrial setting For children, the incidental ingestion rate reflects the average estimated ingestion rate for children engaged in outdoor play activities
CF	Conversion Factor		
FI	Fraction Ingested from Contaminated Source		For adults, it was assumed that while on site, 80 % of the soil/sediment exposure would be related to soil, and 20 % to sediments at the site For children, it was assumed that while on site, 50 % of the soil/sediment exposure would be related to soil, and 50 % to sediments at the site
EF	Exposure Frequency	Site Specific Estimate	
ED	Exposure Duration	U.S.Bureau of Labor	For adults, estimated upper 90 th percentile and median duration of employment at a single location respectively
BW	Body Weight	U.S.EPA 1989	Estimated median body weight for adults and older children respectively
AT	Averaging Time	U.S.EPA 1989	As per U.S.EPA guidance

Table 21
Intakes From Incidental Ingestion of PCB Residues in Edible Fish

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Chemical	Cf (mg/kg)		IR (g/day)	CF (kg/g)	FI	EF (dy/yr)	ED (yrs)		BW (kg)	Non Cancer AT (yrs)*		Non-Canc CDI (mg/kg-day)		Cancer AT (yrs)*	Cancer CDI (mg/kg-day)	
	Upper Bound (1)	Average (2)					Upper Bound	Average		Upper Bound	Average	Upper Bound	Average		Upper Bound	Average
Adult																
Total PCBs*	2.4	0.8	192	1.00E-03	1	1	30	9	70	30	9	1.8E-05	6.0E-06	70	7.7E-06	7.7E-07
Child																
Total PCBs*	2.4	0.8	58	1.00E-03	1	1	6	6	16	6	6	2.4E-05	7.9E-06	70	2.0E-06	6.8E-07

$$\text{Chronic Daily Intake (CDI)} = \frac{\text{Cf x IR x CF x FI x EF x ED}}{\text{BW x (AT *365)}}$$

Parameter	Definition	Units	Comment
Cf	Concentration in Fish	Appendix F	(1) – The maximum detected concentration in edible fish was used (2) – The mean concentration in edible fish was used
IR	Fish ingestion rate	Refer to Section 5.04.03	
CF	Conversion Factor		(kg/g)
FI	Fraction Ingested from Contaminated Source		
EF	Exposure Frequency	Site Specific Estimate	
ED	Exposure Duration	Site Specific Estimate	
BW	Body Weight	USEPA 1989	Estimated median body weight for adults and children respectively
AT	Averaging Time	USEPA 1989	As per USEPA guidance

Table 22
Cancer Risks for Potentially Exposed Adults

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Exposure Pathway	Upper Bound CDI * (mg/kg/day)	Average CDI * (mg/kg/day)	Cancer Slope Factor ** 1/(mg/kg/day)	Upper Bound Pathway Specific Risk	Average Pathway Specific Risk	Upper Bound Total Risk	Average Total Risk
Incidental Ingestion of Surface Soils						6.0E-05	6.0E-06
PCBs	6.6E-08	9.7E-09	7.7	5.0E-07	7.5E-08		
Incidental Ingestion of Sediments							
PCBs	9.1E-09	2.9E-10	7.7	7.0E-08	2.3E-09		
Ingestion of Edible Fish							
PCBs	7.7E-06	7.7E-07	7.7	6.0E-05	6.0E-06		

* – Refer to Tables 19, 20 and 21

** – Oral cancer slope factor for PCBs (U.S.EPA 1992[d])

Table 23
Hazard Index for Potentially Exposed Adults

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Exposure Pathway	Upper Bound CDI * (mg/kg/day)	Average CDI * (mg/kg/day)	Reference Dose ** (mg/kg/day)	Upper Bound Pathway Specific HI ***	Average Pathway Specific HI **	Upper Bound Total HI	Average Total HI
Incidental Ingestion of Surface Soils						2.6E-01	8.8E-02
PCBs	2.4E-07	1.7E-07	7.0E-05	3.4E-03	2.4E-03		
Incidental Ingestion of Sediments							
PCBs	3.4E-08	5.1E-09	7.0E-05	4.8E-04	7.3E-05		
Ingestion of Edible Fish							
PCBs	1.8E-05	6.0E-06	7.0E-05	2.6E-01	8.6E-02		

* - Refer to Tables 19, 20 and 21
** - Oral RfD for Aroclor 1016 (U.S.EPA 1992[d])
*** - HI = Hazard Index

Table 24
Cancer Risks for Potentially Exposed Children

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Exposure Pathway	Upper Bound CDI * (mg/kg/day)	Average CDI * (mg/kg/day)	Cancer Slope Factor ** 1/(mg/kg/day)	Upper Bound Pathway Specific Risk	Average Pathway Specific Risk	Upper Bound Total Risk	Average Total Risk
Incidental Ingestion of Surface Soils							
PCBs	4.3E-08	3.0E-08	7.7	3.3E-07	2.3E-07		
Incidental Ingestion of Sediments:							
PCBs	2.4E-08	3.7E-09	7.7	1.8E-07	2.8E-08		
Ingestion of Edible Fish							
PCBs	2.0E-06	6.8E-07	7.7	1.6E-05	5.2E-06	1.6E-05	5.5E-06

* – Refer to Tables 19, 20 and 21

** – Oral Cancer Slope factor published by U.S.EPA (U.S.EPA 1992[d])

Table 25
Hazard Index for Potentially Exposed Children

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

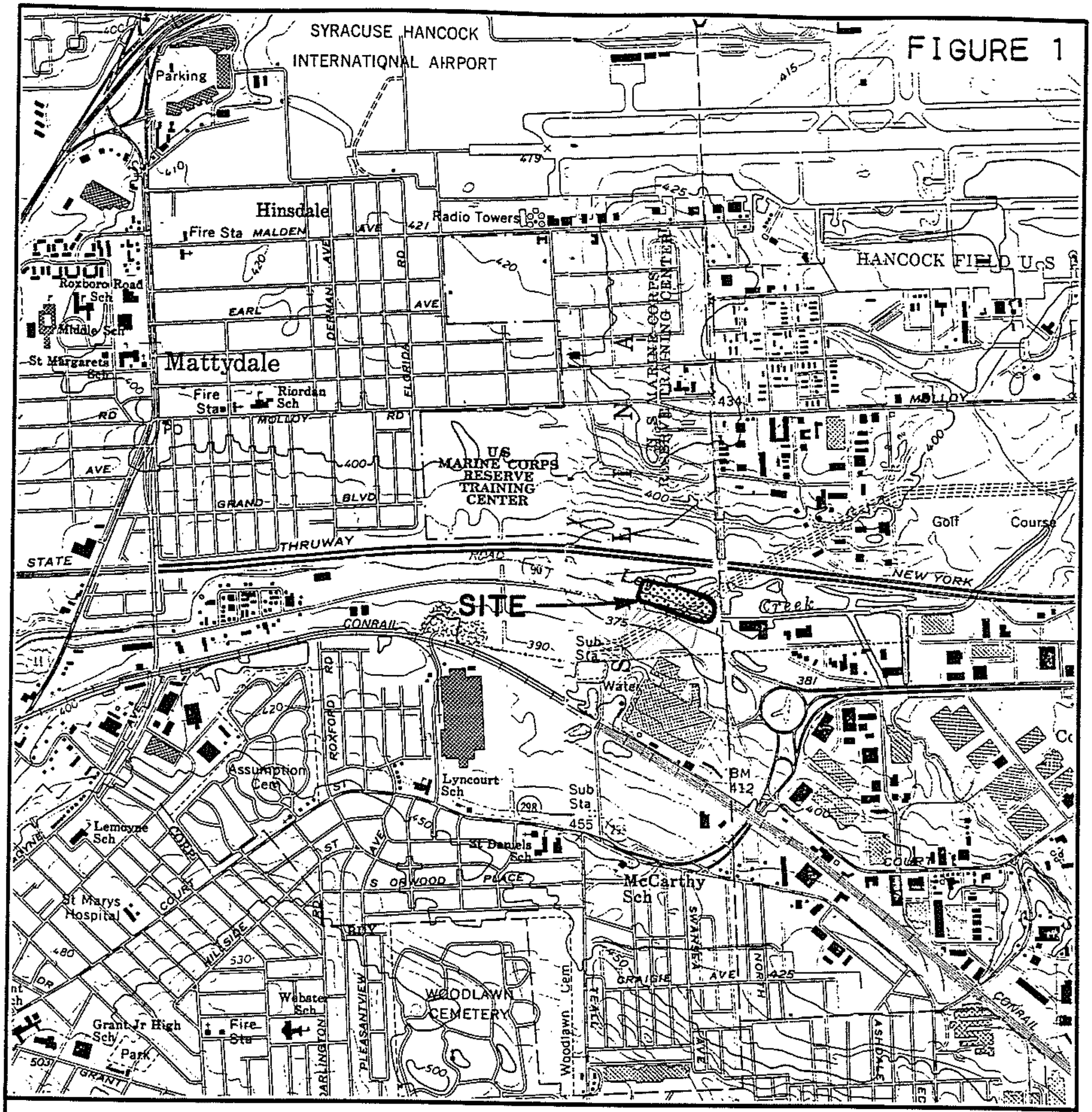
Exposure Pathway	Upper Bound CDI * (mg/kg/day)	Average CDI * (mg/kg/day)	Reference Dose ** (mg/kg/day)	Upper Bound Pathway Specific HI ***	Average Pathway Specific HI **	Upper Bound Total HI	Average Total HI
Incidental Ingestion of Surface Soils						3.5E-01	1.2E-01
PCBs	5.0E-07	3.5E-07	7.0E-05	7.2E-03	5.1E-03		
Incidental Ingestion of Sediments							
PCBs	2.8E-07	4.3E-08	7.0E-05	4.0E-03	6.1E-04		
Ingestion of Edible Fish							
PCBs	2.4E-05	7.9E-06	7.0E-05	3.4E-01	1.1E-01		

* - Refer to Tables 19, 20 and 21
** - Oral RfD for Aroclor 1016 (U.S.EPA 1992[d])
*** - HI = Hazard Index

September 16, 1993

Figures

FIGURE 1

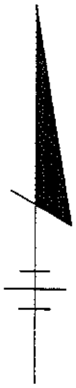


GENERAL MOTORS CORPORATION
INLAND FISHER GUIDE DIVISION
LEY CREEK DREDGED
MATERIAL AREA SITE
SYRACUSE, NEW YORK

SITE LOCATION MAP

0 2000 4000

SCALE IN FEET



ADAPTED FROM U.S.G.S. SYRACUSE EAST, NEW YORK QUADRANGLE

2/8/93

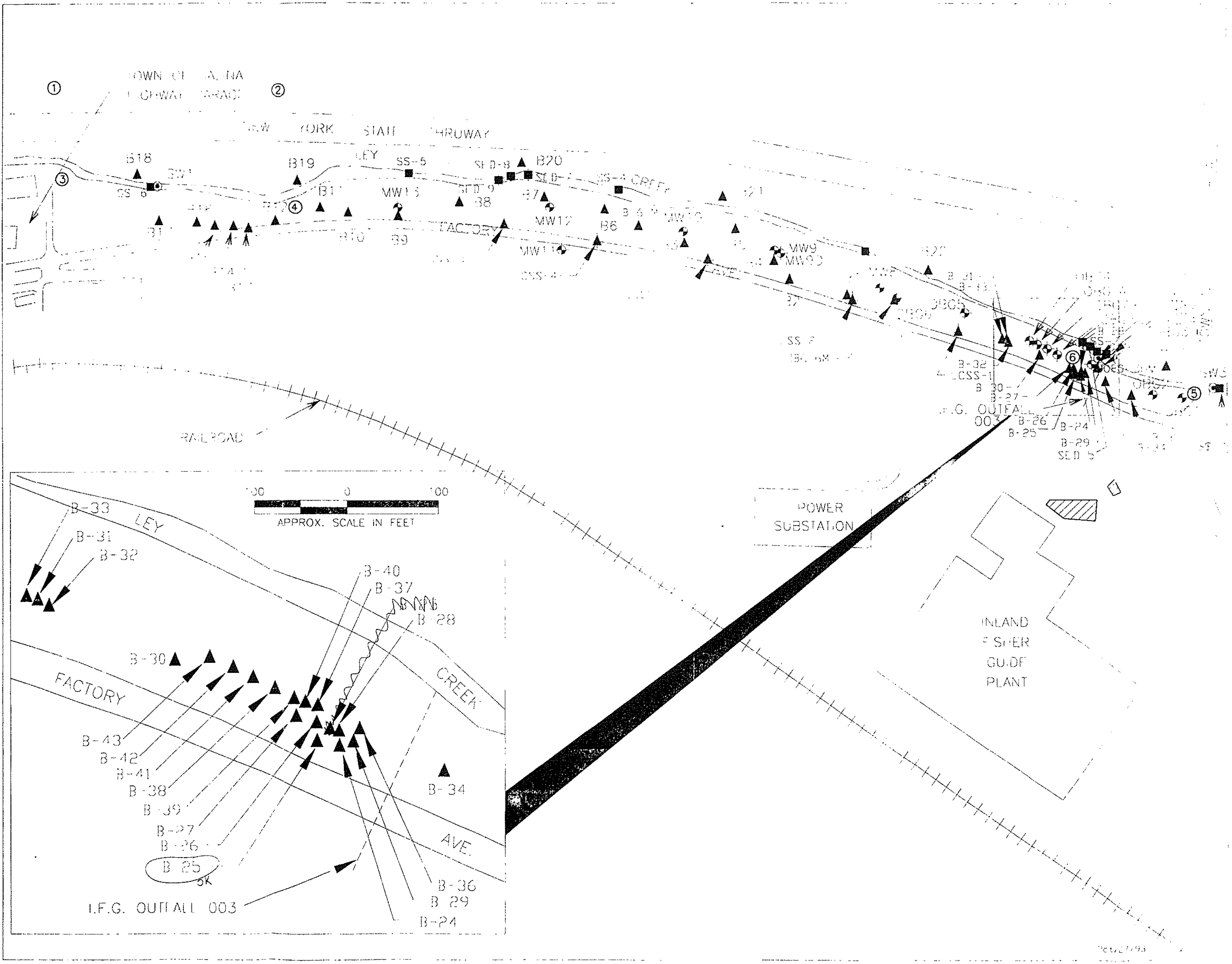
3247.035.130

GMS

O'BRIEN & GERE

FIGURE 2

GENERAL MOTORS CORPORATION
INLAND FISHER GUIDE DIVISION
LEY CREEK DREDGED
MATERIAL AREA SITE
SYRACUSE, NEW YORK



LEGEND

- ◐ MONITORING WELL
- ▲ SOIL BORING LOCATION
- ◇ CLOSED SURFACE IMPOUNDMENT
- • SURFACE WATER SAMPLE
- ⑤ AIR SAMPLE
- ■ SEDIMENT SAMPLE
- ▲ SURFACE SOIL SAMPLE
- ■ SEDIMENT SAMPLE

NOTE: BLOWUP ILLUSTRATES SOIL BORINGS INSTALLED FROM 7/92 THRU 12/92. THE 12/92 SOIL BORINGS NOT SHOWN IN THE 1"=400' SCALE DUE TO SYMBOL DENSITY.

STUDY AREA MAP

400 0 400

APPROX. SCALE IN FEET

3247.078.312

NGINEERS,INC

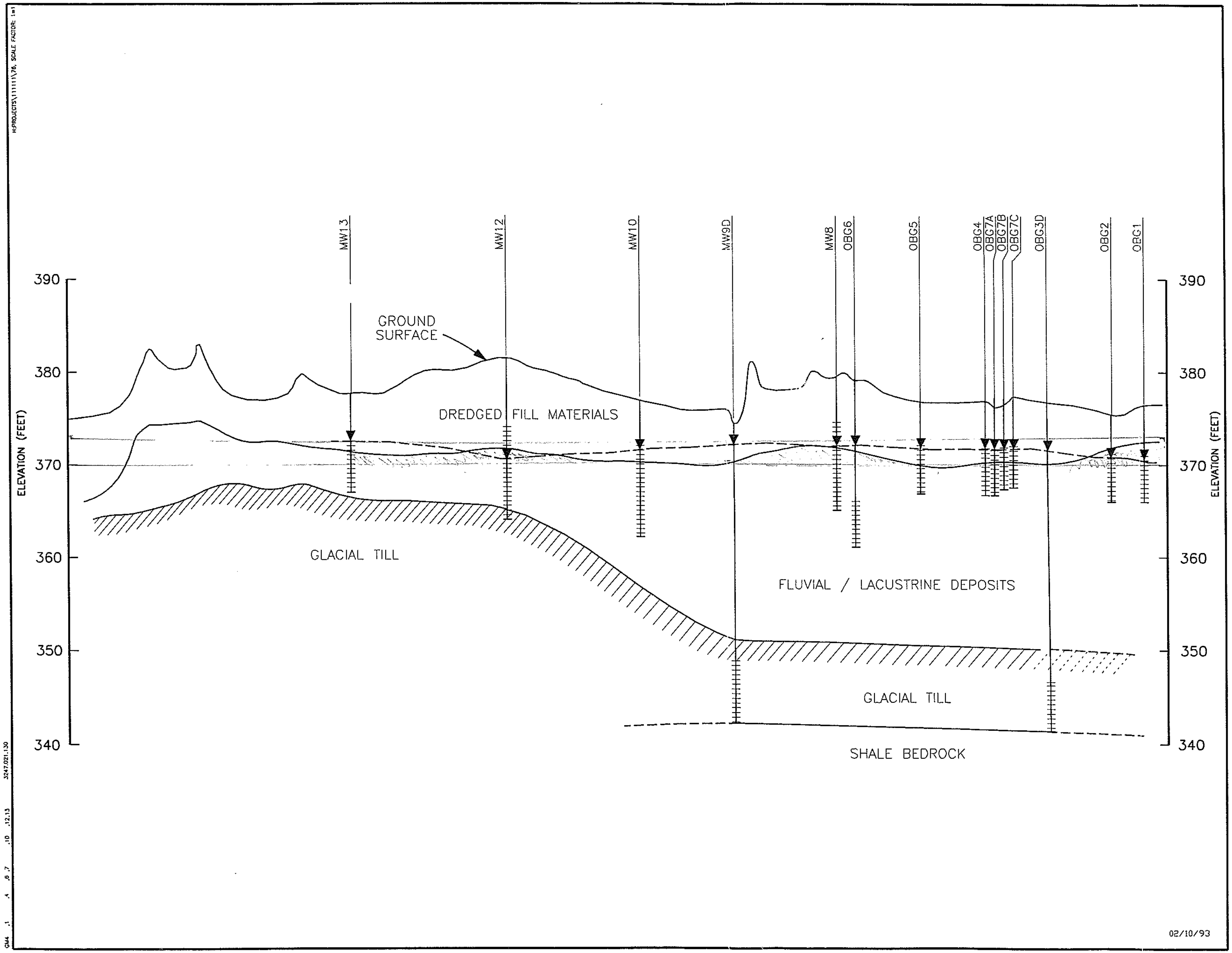


FIGURE 3

GENERAL MOTORS CORPORATION
INLAND FISHER GUIDE DIVISION
LEY CREEK DREGDED
MATERIAL AREA SITE
SYRACUSE, NEW YORK

GEOLOGIC CROSS SECTION 7/29/92

LEGEND

O'BRIEN & GERE
ENGINEERS, INC.

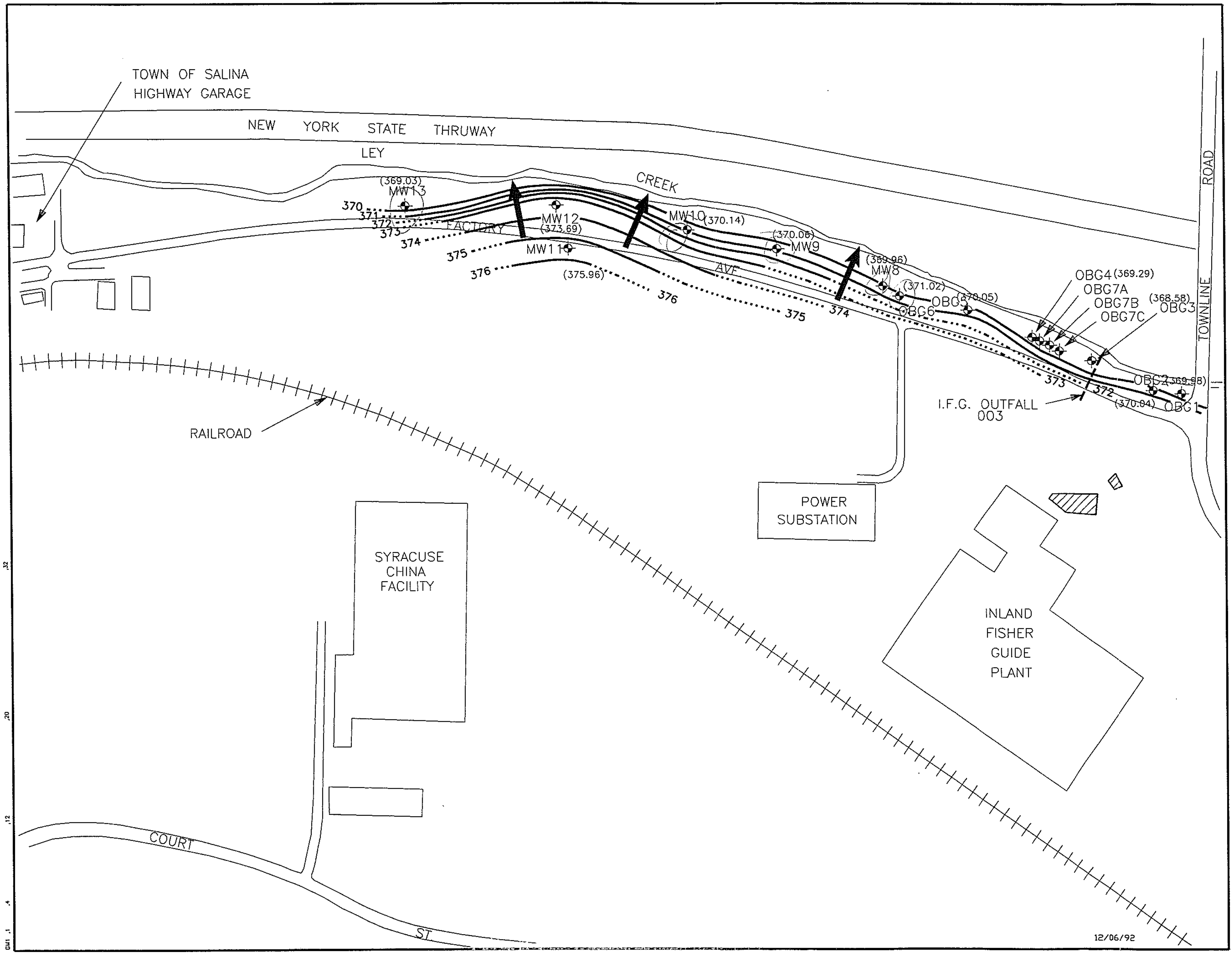


FIGURE 4

GENERAL MOTORS CORPORATION
INLAND FISHER GUIDE DIVISION
LEY CREEK DREDGED
MATERIAL AREA SITE
SYRACUSE, NEW YORK

⊕ MONITORING WELL LOCATION

(370.04) GROUND WATER ELEVATION (10/6/88)

◇ CLOSED SURFACE IMPOUNDMENTS

↗ GROUND WATER FLOW DIRECTION

SHALLOW GROUND WATER CONTOUR MAP 10/6/88

400 0 400

APPROX. SCALE IN FEET

3247.078.212

O'BRIEN & GERE
ENGINEERS, INC.

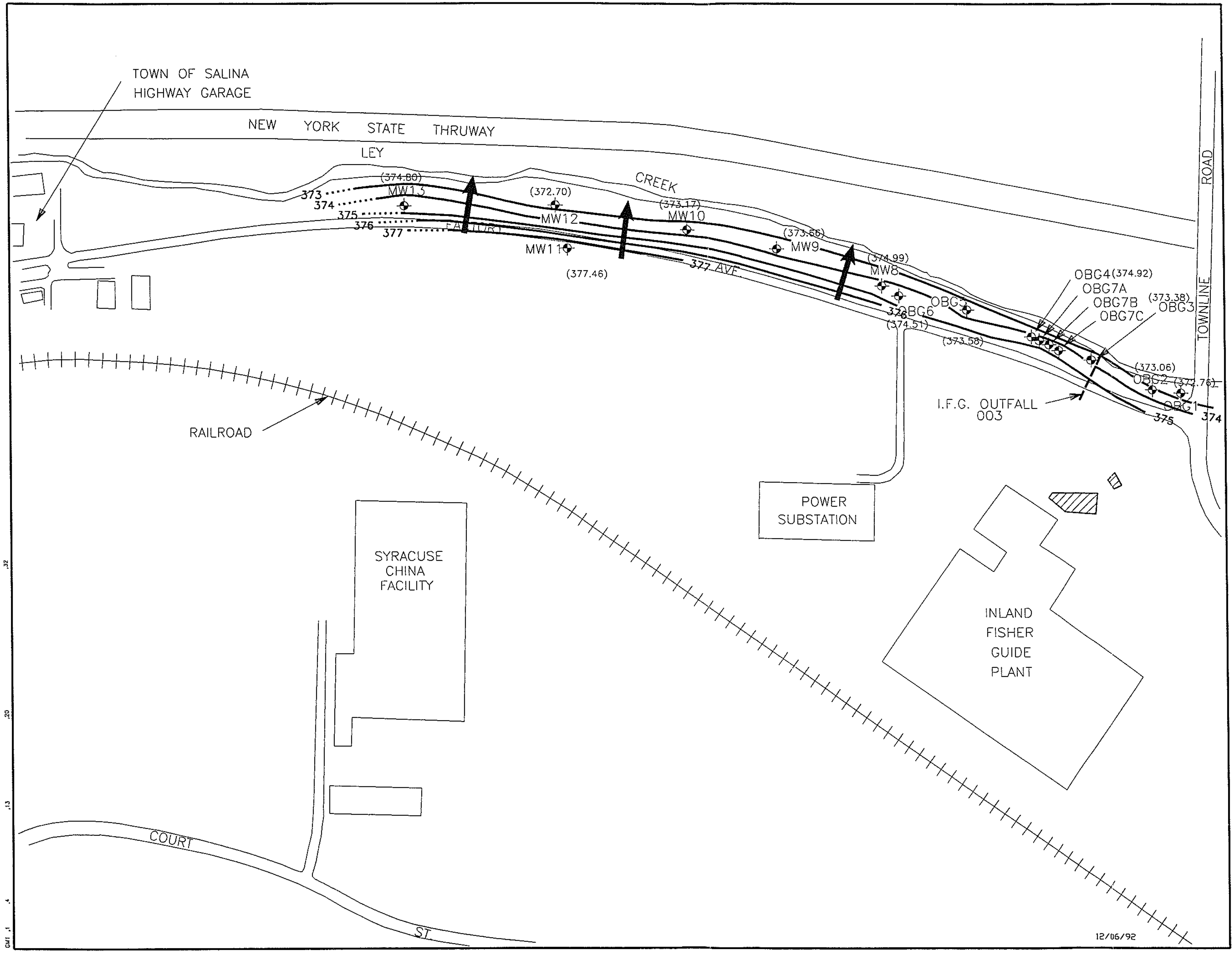


FIGURE 5

GENERAL MOTORS CORPORATION
INLAND FISHER GUIDE DIVISION
LEY CREEK DREDGED
MATERIAL AREA SITE
SYRACUSE, NEW YORK

LEGEND

⊕	MONITORING WELL LOCATION
(373.38)	GROUND WATER ELEVATION (4/4/89)
▨	CLOSED SURFACE IMPOUNDMENTS
↗	GROUND WATER FLOW DIRECTION

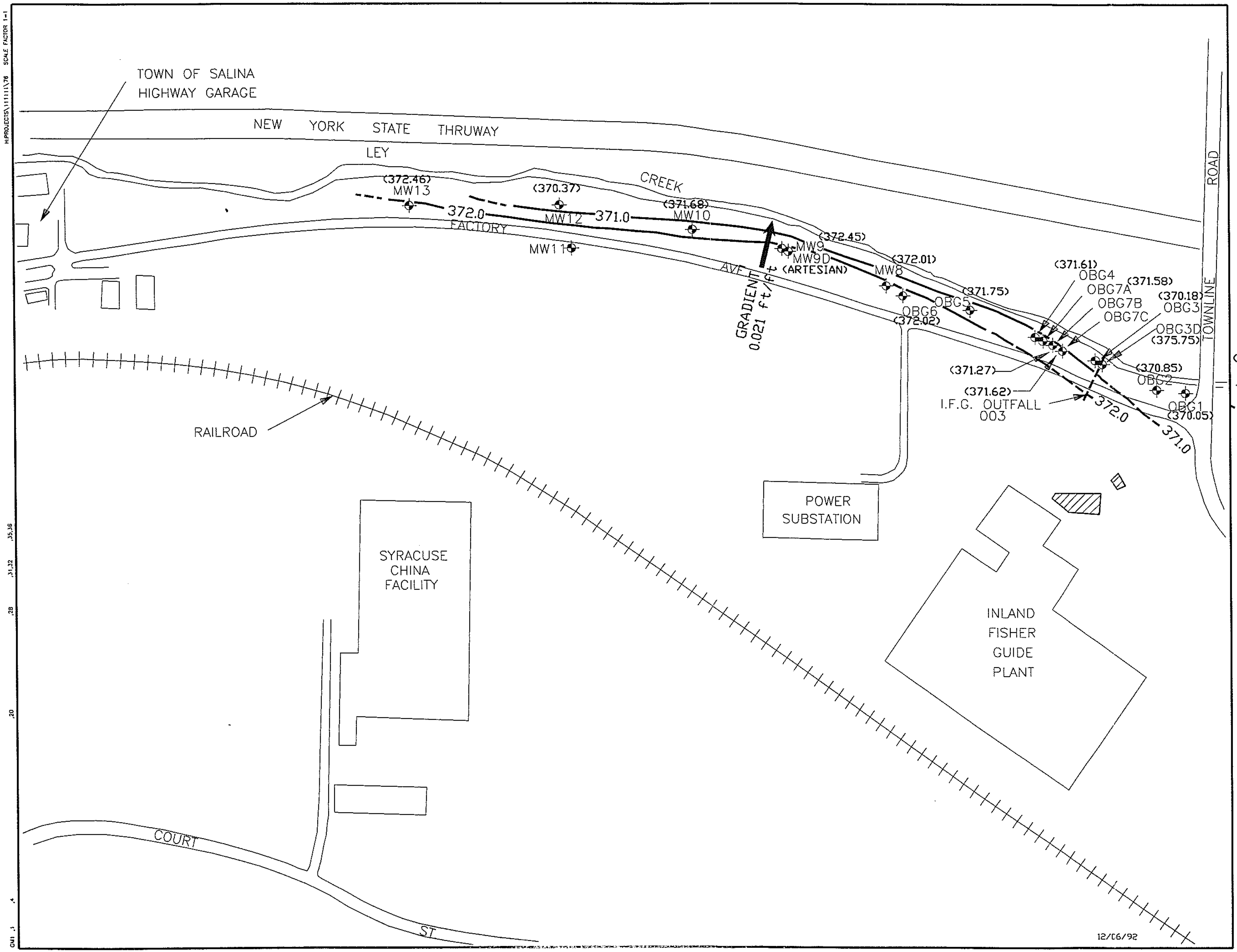
SHALLOW GROUND WATER CONTOUR MAP 4/4/89

400 0 400
APPROX. SCALE IN FEET

3247.078.212

O'BRIEN & GERE
ENGINEERS, INC.

FIGURE 6
GENERAL MOTORS CORPORATION
INLAND FISHER GUIDE DIVISION
LEY CREEK DREDGED
MATERIAL AREA SITE
SYRACUSE, NEW YORK



MONITORING WELL
(371.75) GROUND WATER ELEVATION
GROUND WATER FLOW DIRECTION
372.0 GROUND WATER ELEVATION CONTOUR
CLOSED SURFACE IMPOUNDMENT

GROUND WATER
FLOW MAP
JULY 1992

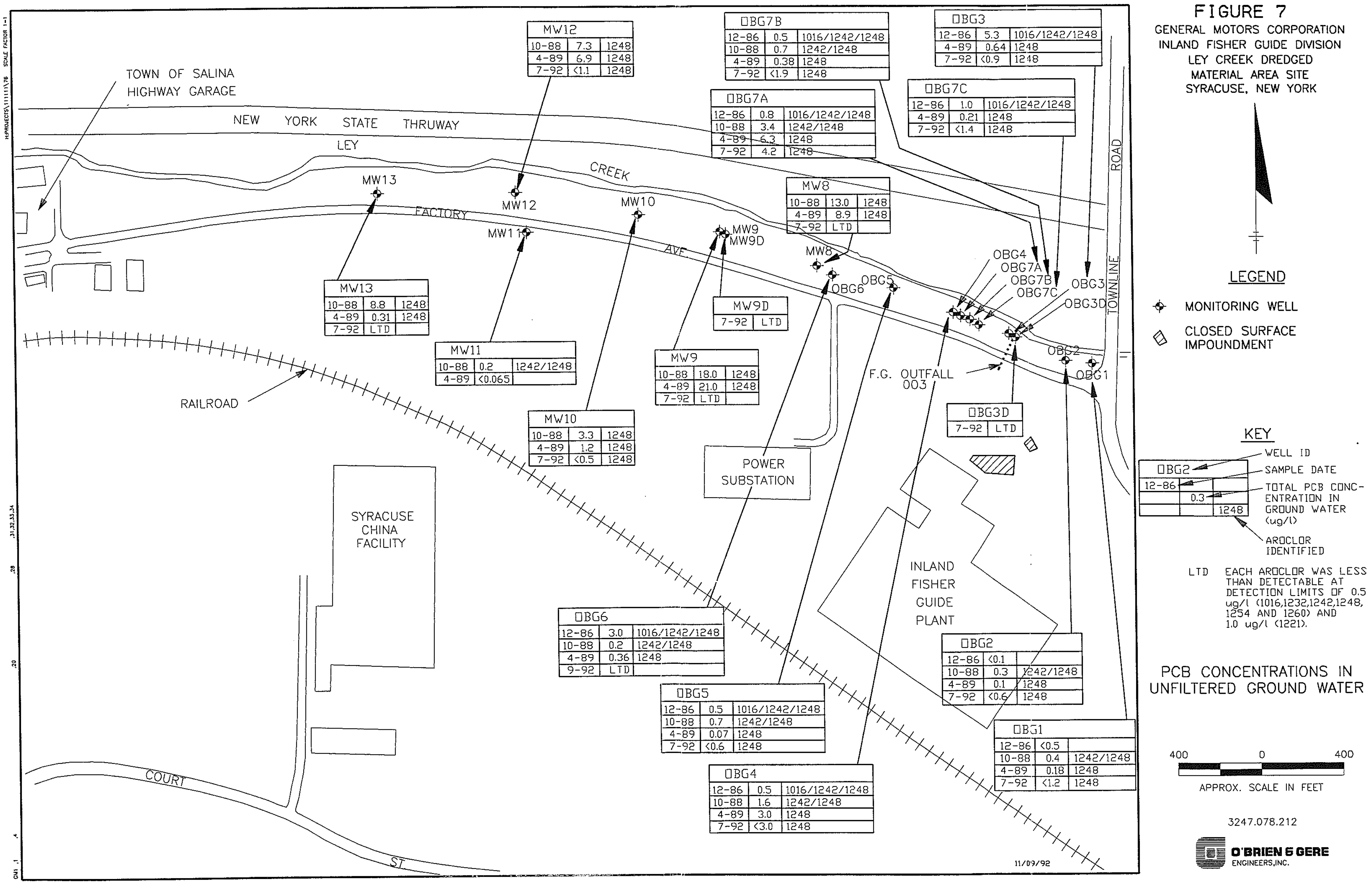
400 0 400
APPROX. SCALE IN FEET

3247.078.212

O'BRIEN & GERE
ENGINEERS, INC.

FIGURE 7

GENERAL MOTORS CORPORATION
INLAND FISHER GUIDE DIVISION
LEY CREEK DREDGED
MATERIAL AREA SITE
SYRACUSE, NEW YORK



MW12		
10-88	7.3	1248
4-89	6.9	1248
7-92	<1.1	1248

OBG7B		
12-86	0.5	1016/1242/1248
10-88	0.7	1242/1248
4-89	0.38	1248
7-92	<1.9	1248

OBG3		
12-86	5.3	1016/1242/1248
4-89	0.64	1248
7-92	<0.9	1248

OBG7A		
12-86	0.8	1016/1242/1248
10-88	3.4	1242/1248
4-89	6.3	1248
7-92	4.2	1248

OBG7C		
12-86	1.0	1016/1242/1248
4-89	0.21	1248
7-92	<1.4	1248

MW8		
10-88	13.0	1248
4-89	8.9	1248
7-92	LTD	

MW13		
10-88	8.8	1248
4-89	0.31	1248
7-92	LTD	

MW9D	
7-92	LTD

MW11		
10-88	0.2	1242/1248
4-89	<0.065	

MW9		
10-88	18.0	1248
4-89	21.0	1248
7-92	LTD	

OBG3D	
7-92	LTD

MW10		
10-88	3.3	1248
4-89	1.2	1248
7-92	<0.5	1248

OBG6		
12-86	3.0	1016/1242/1248
10-88	0.2	1242/1248
4-89	0.36	1248
9-92	LTD	

OBG2		
12-86	<0.1	
10-88	0.3	1242/1248
4-89	0.1	1248
7-92	<0.6	1248

OBG5		
12-86	0.5	1016/1242/1248
10-88	0.7	1242/1248
4-89	0.07	1248
7-92	<0.6	1248

OBG1		
12-86	<0.5	
10-88	0.4	1242/1248
4-89	0.18	1248
7-92	<1.2	1248

OBG4		
12-86	0.5	1016/1242/1248
10-88	1.6	1242/1248
4-89	3.0	1248
7-92	<3.0	1248

OBG2		
12-86		
	0.3	
		1248

LTD EACH AROCLOR WAS LESS THAN DETECTABLE AT DETECTION LIMITS OF 0.5 ug/l (1016,1232,1242,1248, 1254 AND 1260) AND 1.0 ug/l (1221).

PCB CONCENTRATIONS IN UNFILTERED GROUND WATER

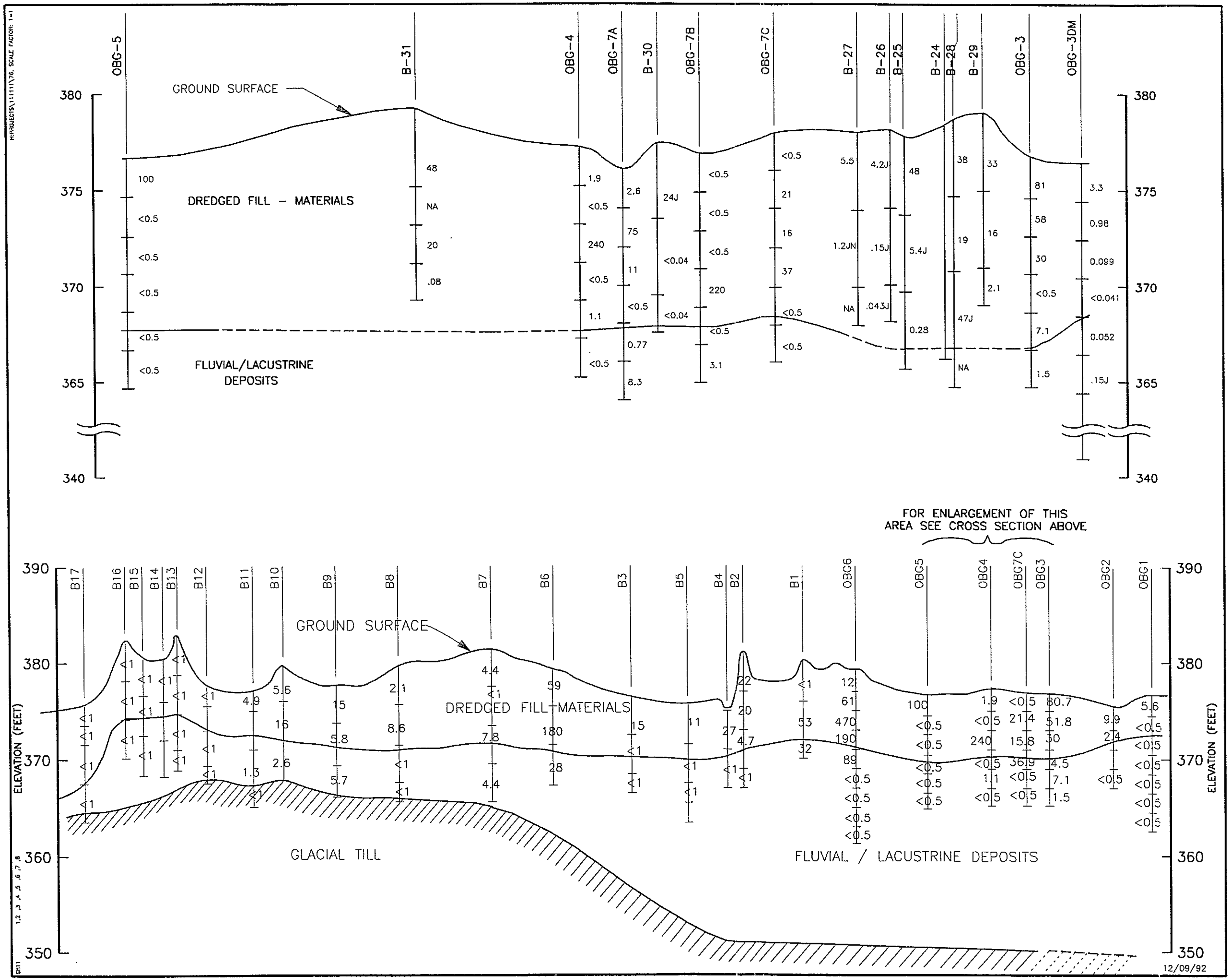
11/09/92

3247.078.212

O'BRIEN & GERE ENGINEERS, INC.

FIGURE 8

GENERAL MOTORS CORPORATION
INLAND FISHER GUIDE DIVISION
LEY CREEK DREDGED
MATERIAL AREA SITE
SYRACUSE, NEW YORK



LEGEND

|	SOIL BORING LOCATION
.08	TOTAL PCB CONCENTRATION IN mg/Kg (ppm) DRY WEIGHT
4.2J	DETECTED CONCENTRATION ESTIMATED
1.2JN	DETECTED CONCENTRATION PRESUMPTIVELY PRESENT AT APPROXIMATED QUANTITY
NA	NOT ANALYZED

PCB CONCENTRATIONS IN SOILS CROSS SECTION

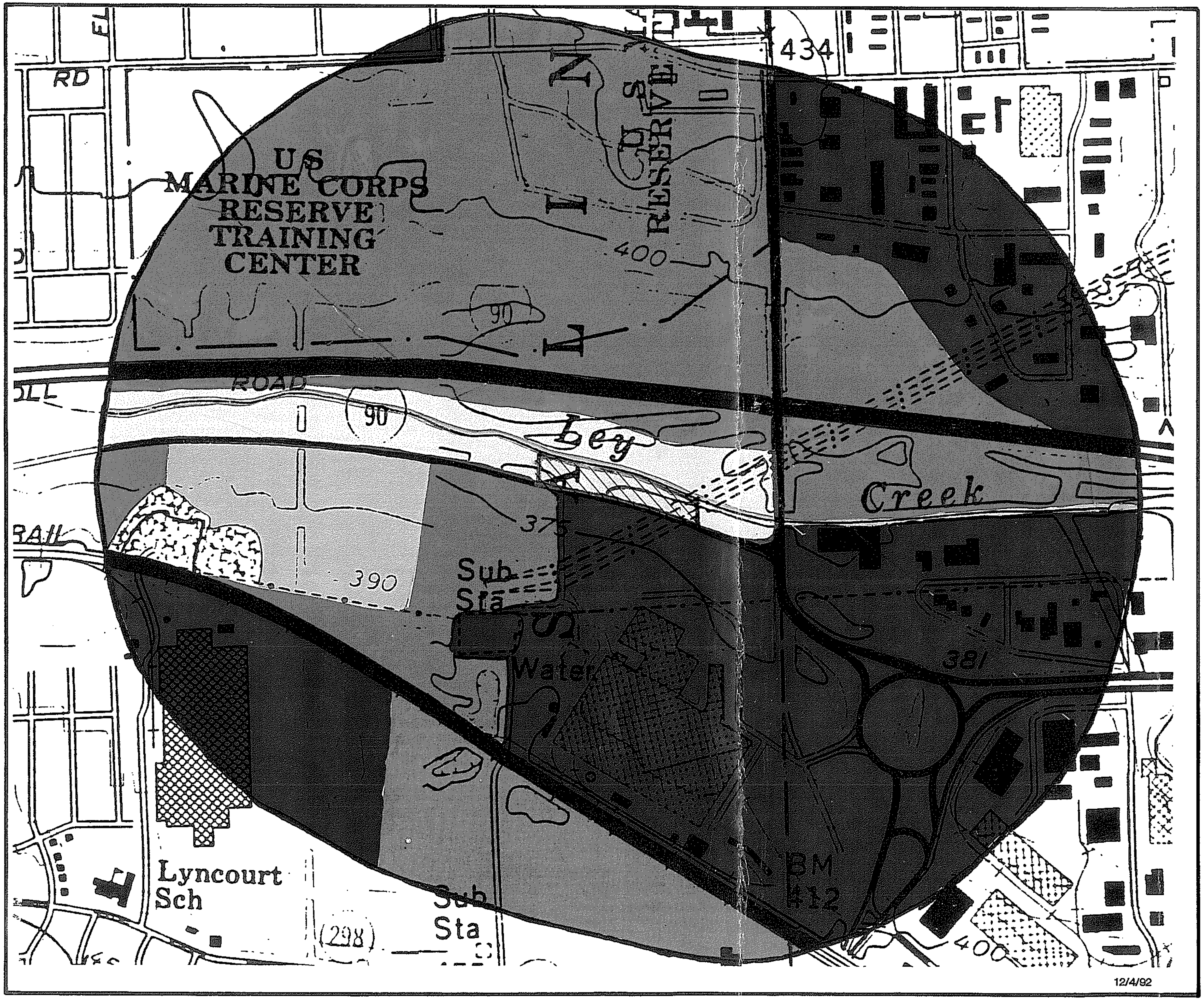
60 0 60
HORIZ. SCALE IN FEET
FOR TOP CROSS SECTION

400 0 400
HORIZ. SCALE IN FEET
FOR BOTTOM CROSS SECTION

3247.078.212

O'BRIEN & GERE
ENGINEERS, INC.

FIGURE 9



LEGEND

- ░ MIDREACH STREAM
- DREDGE SPOIL WETLAND
- ▨ FLOODPLAIN FOREST
- ░ REEDGRASS/PURPLE LOOSESTRIFE MARSH
- ▨ SUCCESSIONAL NORTHERN HARDWOOD FOREST
- ▩ LANDFILL/DUMP
- ■ CULTURAL
- ■ PAVED AREAS
- ▧ SITE

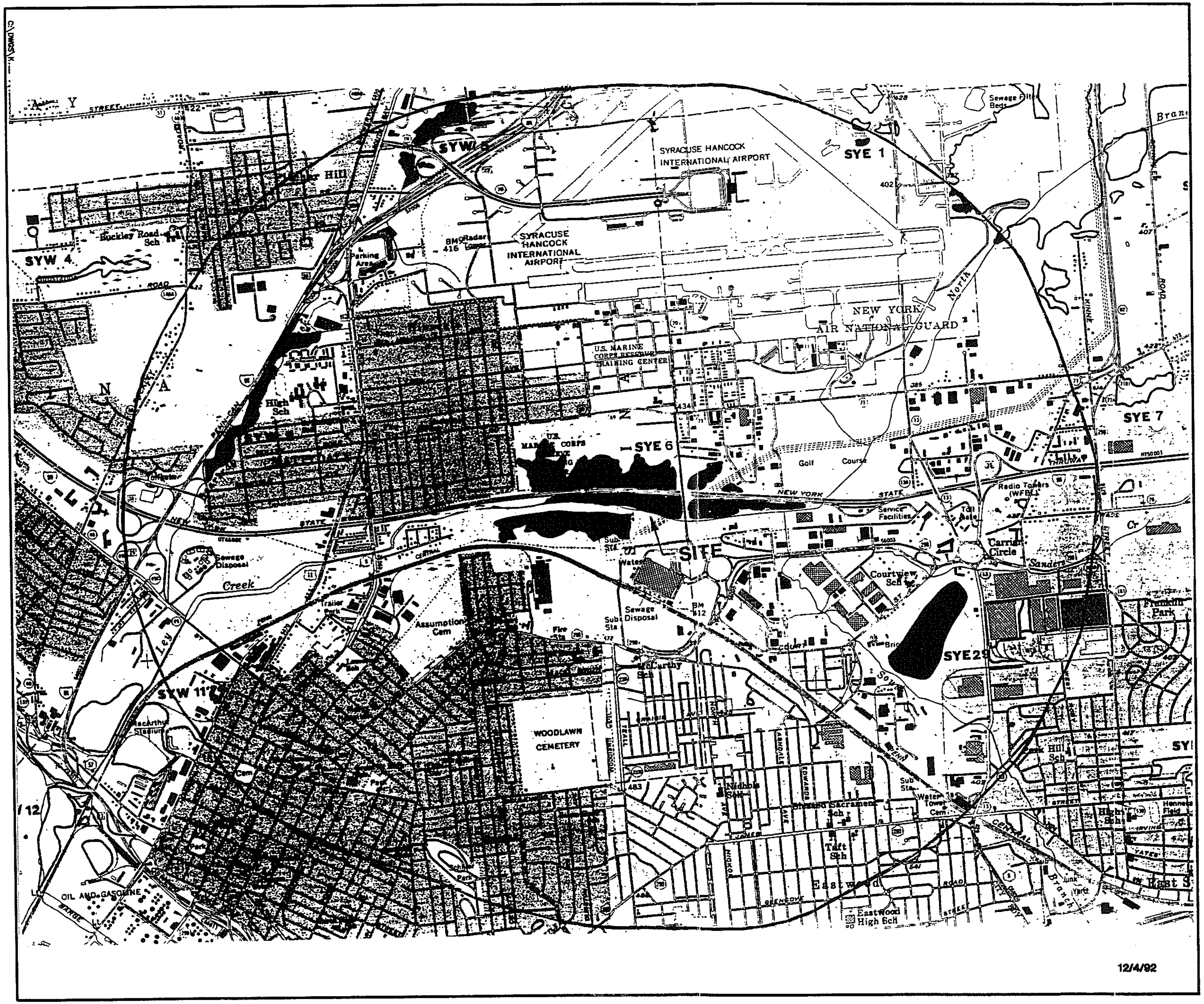
LEY CREEK SITE
SYRACUSE, NEW YORK

COVERTYPE
MAP

600 0 600
APPROXIMATE SCALE IN FEET

O'BRIEN & GERE

FIGURE 10



12/4/92

LEGEND

▇ NEW YORK STATE REGULATED WETLANDS CLASSIFICATION

⌒ 2 MILES FROM SITE

LEY CREEK SITE
SYRACUSE, NEW YORK

N.Y.S. WETLAND MAP

SOURCE: U.S.G.S. TOPO QUAD

2500 0 2500

3247.078

O'BRIEN & GERE

Appendices

APPENDIX A

BORING LOGS AND WELL CONSTRUCTION DETAILS

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No.: B-1
Sheet 1 of 1

Project Location: LEY CREEK SITE

Client: GENERAL MOTORS

SAMPLER
Type: SPLIT SPOON
Hammer: 140 LBS Fall: 30 INCHES

Ground Water Depth Date
Depth Date
File No.: 3247.021.130

Boring Co.: PARRATT-WOLFF
Foreman: GLENN LANSING
OBG Geologist: WILLIAM GABRIEL

Boring Location:
Ground Elevation: 380.0
Dates: Started:01/12/88 Ended:01/12/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			Rmks*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Value				pH	Sp Cond	HNU	
	1	0-2	2-3-3-5			Light brown, very loose, very moist, fine-medium SAND, layers of dark brown clay and silt, some black organic stains.						
	2	2-4	5-5-5-4			Same as 0-2', with some grass and plant stems.						
	3	4-6	2-3-3-4			Medium brown, very loose, saturated, fine-medium SAND, some silt and clay layers with black organic stains, plant stems, (peat).						
	4	6-8	5-6-6-11			Same as 4-6'.						
	5	8-10	4-5-7-6			Dark gray to black, medium stiff, saturated CLAY and SILT, some peat, little fine-medium sand, trace of gravel.						

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No.: B-2
Sheet 1 of 1

Project Location: LEY CREEK SITE

Client: GENERAL MOTORS

SAMPLER
Type: SPLIT SPOON
Hammer: 140 LBS
Fall: 30 INCHES

Ground Water Depth
Date
Depth
Date
File No.: 3247.021.130

Boring Co.: PARRATT-WOLFF
Foreman: GLENN LANSING
OBG Geologist: WILLIAM GABRIEL

Boring Location:
Ground Elevation: 381.0'
Dates: Started:01/12/88
Ended:01/12/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			Rmks*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Value				pH	Sp Cond	HNU	
	1	0-2	2-2-2-2			Dark brown, moist, loose, fine-medium SAND, some, silt, and peat.						
	2	2-4	2-3-3-6			Same as 0-2', with wood fragments and root hairs, etc.						
	3	4-6	4-5-5-6			Dark brown, loose, moist, SILT, some fine sand, little clay, many plant fibers, root hairs, etc.						
	4	6-8	9-8-8-7			Dark brown, loose, moist, SILT, some light brown clay, little very fine-fine sand, few root hairs and plant stems.						
	5	8-10	2-2-3-5			First 6" same as 6-8' (pieces of ceramic tile). At 8.5' change to Light gray, very moist, loose, fine SAND, some silt, little clay, iron stains and mottles.						
	6	10-12	3-4-5-5			Medium brown to yellowish brown soft, moist, SILT, some very fine-fine sand, little clay, trace coarse sand, few iron stains and light gray mottles.						
	7	12-14	2-3-4-4			Light gray to yellowish brown, loose, saturated, fine SAND, little silt and clay.						

O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG	Report of Boring No.: B-3 Sheet 1 of 1
Project Location: LEY CREEK SITE Client: GENERAL MOTORS	SAMPLER Type: SPLIT SPOON Hammer: 140 LBS Fall: 30 INCHES	Ground Water Depth Date Depth Date File No.: 3247.021.130

Boring Co.: PARRATT-WOLFF
Foreman: GLENN LANSING
OBG Geologist: WILLIAM GABRIEL

Boring Location:
Ground Elevation: 376.6'
Dates: Started:01/12/88 Ended:01/12/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			Rmks*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Value				pH	Sp Cond	HNU	
	1	0-2	4-5-7-6			Dark brown to reddish brown, medium stiff, moist, SILT and fine SAND, some clay, trace gravel, root hairs, plant stems, etc.						
	2	2-4	4-4-4-5			Dark brown to reddish brown, loose, moist, fine SAND, some silt, little clay, little fine-coarse gravel, many wood fragments and stems, etc.						
	3	4-6	6-7-5-5			Dark brown to black, medium stiff, very moist, SILT, some fine sand, little clay, change to light gray to brown, fine-medium sand, saturated.						
	4	6-8	3-4-4-4			Brown to reddish brown, very loose, saturated, fine-medium SAND, little silt and yellowish brown clay.						
	5	8-10	4-2-3-4			Brown-yellowish brown, soft, saturated CLAY and SILT, some fine sand, and black organic matter, (wood, plants, etc.)						

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No.: B-4
Sheet 1 of 1

Project Location: LEY CREEK SITE

Client: GENERAL MOTORS

SAMPLER
Type: SPLIT SPOON
Hammer: 140 LBS Fall: 30 INCHES

Ground Water Depth Date
Depth Date
File No.: 3247.021.130

Boring Co.: PARRATT-WOLFF
Foreman: GLENN LANSING
OBG Geologist: WILLIAM GABRIEL

Boring Location:
Ground Elevation: 375.0'
Dates: Started:01/12/88 Ended:01/12/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			R m k s*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Value				pH	Sp Cond	HNU	
	1	0-2	2-3-3-4			Medium-dark brown, soft, moist, SILT, some clay and fine sand, trace fine-medium gravel, plant stems, root hairs, wood fragments, etc.						
	2	2-4	4-6-7-12			Dark brown, loose, moist, very fine SAND, silt, trace clay, root hairs, wood fragments, few light gray mottles.						
	3	4-6	5-5-5-6			Reddish brown, loose, very moist to saturated, very fine-fine SAND, some clay and silt, few fine root hairs and plant stems.						
	4	6-8	7-5-5-6			Same as 4-6', with increasing silt and clay content (saturated).						

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No.: B-5
Sheet 1 of 1

Project Location: LEY CREEK SITE

Client: GENERAL MOTORS

SAMPLER
Type: SPLIT SPOON
Hammer: 140 LBS Fall: 30 INCHES

Ground Water Depth Date
Depth Date
File No.: 3247.021.130

Boring Co.: PARRATT-WOLFF
Foreman: GLENN LANSING
OBG Geologist: WILLIAM GABRIEL

Boring Location:
Ground Elevation: 375.3'
Dates: Started:01/13/88 Ended:01/13/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			Rmks*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Value				pH	Sp Cond	HNU	
	1	0-2	1-2-2-2			Dark brown to yellowish brown, very loose, moist, very fine SAND and SILT, little clay, wood fragments, plant stems, etc.						
	2	2-4	6-7-11-9			Dark brown to reddish brown, loose, moist, very fine-fine SAND and SILT, some clay, wood fragments, plant stems, etc. Iron mottles?						
	3	4-6	3-3-5-4			Medium brown, loose, moist, fine SAND, some dark gray silt and medium gray clay, wood fragments, plant stems, etc.						
	4	6-8	5-4-3-3			Light gray, loose, very moist, fine-medium SAND, some dark gray silt, and reddish brown clay, few root hairs and plant stems.						
	5	8-10	2-2-2-3			Same as at 6-8', at 8.5' change to - Light brown to gray, soft, saturated CLAY, some silt and very fine sand.						
	6	10-12	WH-1-2-2			Brownish-gray, very soft, saturated, CLAY, some silt, little very fine sand.						

O'BRIEN & GERE
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TEST BORING LOG

Report of Boring No.: B-6
Sheet 1 of 1

Project Location: LEY CREEK SITE

Client: GENERAL MOTORS

SAMPLER
Type: SPLIT SPOON
Hammer: 140 LBS Fall: 30 INCHES

Ground Water Depth Date
Depth Date
File No.: 3247.021.130

Boring Co.: PARRATT-WOLFF
Foreman: GLENN LANSING
OBG Geologist: WILLIAM GABRIEL

Boring Location:
Ground Elevation: 379.3
Dates: Started:01/13/88 Ended:01/13/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			Rmks*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Value				pH	Sp Cond	HNU	
	1	0-2	1-2-2-4			Dark brown, very loose, moist, fine SAND, some silt, little clay, root hairs and plant stems.						
	2	2-4	8-4-5-6			Dark brown to reddish brown, loose, moist, fine SAND and SILT, some clay, trace fine gravel, wood fragments, plant stems, etc.						
	3	4-6	2-2-2-2			Dark brown, moist, soft, SILT and fine SAND, some light brown clay, few root hairs and plant stems, etc.						
	4	6-8	1-2-3-3			Dark brown to black, soft, very moist, SILT, some fine sand and clay, plant stems, wood fragments, etc.						
	5	8-10	2-4-6-5			Dark brown-black, loose, saturated, fine SAND, some silt and clay, plant stems, wood fragments, etc. (bottom of fill at ~8.5)						
	6	10-12	1-WH-1-1			Same as 8.5-10.0'.						

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No.: B-7
Sheet 1 of 1

Project Location: LEY CREEK SITE

Client: GENERAL MOTORS

SAMPLER
Type: SPLIT SPOON
Hammer: 140 LBS Fall: 30 INCHES

Ground Water Depth Date
Depth Date
File No.: 3247.021.130

Boring Co.: PARRATT-WOLFF
Foreman: GLENN LANSING
OBG Geologist: WILLIAM GABRIEL

Boring Location:
Ground Elevation: 381.6'
Dates: Started:01/13/88 Ended:01/13/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			R m k s*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Value				pH	Sp Cond	HNU	
	1	0-2	1-1-2-3			Dark brown-black, very loose, moist, fine SAND, some silt, little clay, plant stems, etc.						
	2	2-4	2-3-4-5			Brown-reddish brown, loose, moist SAND, little silt, few black mottles, some ceramic tiles and wood fragments.						
	3	4-6	3-3-3-2			Same as 2-4'.						
	4	6-8	4-4-5-6			Dark brown-light brown, loose, moist, fine-medium SAND, little silt, wood fragments, and plant stems.						
	5	8-10	6-7-6-5			Same as 6-8', some white ceramic tile in sample.						
	6	10-12	1-WH-2-1			Dark brown to black, very loose, saturated, fine SAND, some silt and clay, wood fragments, plant stems, etc.						
	7	12-14	3-2-3-3			Light gray to black, very loose, saturated, fine-medium SAND, some silt and clay, layers of peat, (plant stems, wood fragments, etc.)						
	8	14-16	3-3-3-3			Light brown to reddish brown, soft, saturated, CLAY, some silt, little fine sand, and black organic peat (wood fragments, plant stems.)						

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No.: B-8
Sheet 1 of 1

Project Location: LEY CREEK SITE

Client: GENERAL MOTORS

SAMPLER
Type: SPLIT SPOON
Hammer: 140 LBS
Fall: 30 INCHES

Ground Water Depth
Depth
Date
Date
File No.: 3247.021.130

Boring Co.: PARRATT-WOLFF
Foreman: GLENN LANSING
OBG Geologist: WILLIAM GABRIEL

Boring Location:
Ground Elevation: 379.9'
Dates: Started:01/15/88
Ended:01/15/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			Rmks*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Value				pH	Sp Cond	HNU	
	1	0-2	8-4-3-3			Medium brown to yellowish brown, loose, moist, fine SAND, some silt, little clay, trace fine-medium gravel, few wood fragments and root hairs.						
	2	2-4	3-4-4-4			Yellowish brown to light gray, loose, very moist, very fine-fine SAND, some silt and clay, few fine root hairs.						
	3	4-6	5-5-7-8			Same as 2-4'.						
	4	6-8	8-11-50-2			Reddish brown to dark gray, medium dense, very moist, fine SAND, some silt and clay, few wood fragments, plant stems, etc.						
	5	8-10	5-4-3-3			Light brown, medium stiff, very moist, SILT, and very fine sand, little clay, few plant stems and root hairs.						
	6	10-12	1-3-3-4			Dark brown to black, soft, very moist, SILT, very fine sand, little clay, high organic content (peat). At 11' chaange to gray fine sand and silt.						
	7	12-14	3-6-11-26			Medium gray, loose to medium dense, saturated fine SAND and SILT, some clay. At 13' change to- reddish brown, fine sand, silt, trace clay, with some fine to medium gravel (TILL).						

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No.: B-9
Sheet 1 of 1

Project Location: LEY CREEK SITE
Client: GENERAL MOTORS

SAMPLER
Type: SPLIT SPOON
Hammer: 140 LBS Fall: 30 INCHES

Ground Water Depth Date
Depth Date
File No.: 3247.021.130

Boring Co.: PARRATT-WOLFF
Foreman: GLENN LANSING
OBG Geologist: DONALD T. BUSSEY

Boring Location:
Ground Elevation: 377.8'
Dates: Started:01/18/88 Ended:01/18/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			Rmks*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Value				pH	Sp Cond	HNU	
	1	0-2	1-2-2-4			Dark brown, moist, loose, fine SAND, some silt, trace clay, roots, plant stems, etc.						
	2	2-4	7-7-8-9			Dark brown, loose, moist, fine SAND, little silt, trace clay, plant stems, brick fragments, etc.						
	3	4-6	6-8-9-7			Same as 2-4'.						
	4	6-8	4-6-7-7			Dark gray, medium stiff, moist, SILT, some fine sand, little clay, few orange mottles. At 7-8' change to dark brown to black.						
	5	8-10	4-4-5-8			Dark brown, fine SAND, some silt, trace clay, poor recovery.						
	6	10-12	3-4-20-33			Same as 10-12'. change at 11.5' to: Reddish-brown, medium dense, moist, SILT and clay, some fine sand, trace coarse sand. (TILL).						

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No.: B-10
Sheet 1 of 1

Project Location: LEY CREEK SITE

Client: GENERAL MOTORS

SAMPLER
Type: SPLIT SPOON
Hammer: 140 LBS
Fall: 30 INCHES

Ground Water Depth Date
Depth Date
File No.: 3247.021.130

Boring Co.: PARRATT-WOLFF
Foreman: GLENN LANSING
OBG Geologist: DONALD T. BUSSEY

Boring Location:
Ground Elevation: 379.9'
Dates: Started:01/18/88 Ended:01/18/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			Rmks*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Value				pH	Sp Cond	HNU	
	1	0-2	1-1-2-2			Light brown to dark brown, moist, loose, fine SAND, some silt, little clay, plant fragments, roots, few orange mottles.						
	2	2-4	3-3-3-5			Dark brown, moist, loose, fine to coarse SAND, some silt and clay, wood fragments.						
	3	4-6	3-5-5-7			Light brown to orange, moist, loose, fine SAND, some silt, trace clay, wood fragments.						
	4	6-8	5-7-8-9			Dark brown to black, loose, moist, fine SAND, some silt, wood fragments and plant stems.						
	5	8-10	5-5-7-9			Light brown to dark brown, very moist, loose, fine SAND, some silt, trace clay, fine gravel, few orange mottles.						
	6	10-12	5-6-7-8			Light brown, SILT, some fine sand, little clay.						

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No.: B-11
Sheet 1 of 1

Project Location: LEY CREEK SITE
Client: GENERAL MOTORS

SAMPLER
Type: SPLIT SPOON
Hammer: 140 LBS Fall: 30 INCHES

Ground Water Depth Date
Depth Date
File No.: 3247.021.130

Boring Co.: PARRATT-WOLFF
Foreman: GLENN LANSING
OBG Geologist: DONALD T. BUSSEY

Boring Location:
Ground Elevation: 377.1'
Dates: Started:01/18/88 Ended:01/18/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			R m k s*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Value				pH	Sp Cond	HNU	
	1	0-2	2-2-8-3			Dark brown, loose, saturated, fine SAND, some silt, trace clay, coarse sand, very fine gravel.						
	2	2-4	5-6-8-4			No recovery.						
	3	4-6	4-5-6-5			No recovery.						
	4	6-8	3-5-5-4			Dark brown, loose, saturated, very fine SAND, some silt, little fine-coarse gravel, trace coarse sand.						
	5	8-10	3-9-15-13			Light brown, loose to medium dense, saturated, fine SAND, some silt, clay and coarse sand, little medium gravel.						
	6	10-12	13-17-29- 31			Light brown, medium dense, moist, SILT, some clay, little fine sand and gravel (TILL).						

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No.: B-12
Sheet 1 of 1

Project Location: LEY CREEK SITE

Client: GENERAL MOTORS

SAMPLER
Type: SPLIT SPOON
Hammer: 140 LBS
Fall: 30 INCHES

Ground Water Depth Date
Depth Date
File No.: 3247.021.130

Boring Co.: PARRATT-WOLFF
Foreman: GLENN LANSING
OBG Geologist: DONALD T. BUSSEY

Boring Location:
Ground Elevation: 377.0'
Dates: Started:01/19/88
Ended:01/19/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			Rmks*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Value				pH	Sp Cond	HNU	
	1	0-2	2-3-4-5			Dark brown, very loose, moist, fine SAND, some silt, little clay, trace medium-coarse sand, plant fragments and roots, wood, etc.						
	2	2-4	8-9-8-6			No recovery.						
	3	4-6	3-3-4-3			Dark brown, very loose, moist, fine SAND, some silt, little clay, trace medium sand.						
	4	6-8	3-4-3-11			Light brown, soft, moist, SILT, some clay and fine sand, trace medium gravel.						
	5	8-10	3-6-26-32			Reddish brown, soft to very stiff, moist, CLAY, some silt and fine sand, little coarse sand and fine gravel (TILL).						

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No.: B-13
Sheet 1 of 1

Project Location: LEY CREEK SITE
Client: GENERAL MOTORS

SAMPLER
Type: SPLIT SPOON
Hammer: 140 LBS
Fall: 30 INCHES

Ground Water Depth
Date
Depth
Date
File No.: 3247.021.130

Boring Co.: PARRATT-WOLFF
Foreman: GLENN LANSING
OBG Geologist: DONALD T. BUSSEY

Boring Location:
Ground Elevation: 383.0'
Dates: Started:01/19/88
Ended:01/18/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			Rmks*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Value				pH	Sp Cond	HNU	
	1	0-2	2-3-3-4			Light brown, very loose, moist, fine SAND, little silt, trace clay and coarse sand, root hairs, plant stems, few dark brown, orange and black mottles.						
	2	2-4	4-6-7-6			Same as 0-2'.						
	3	4-6	2-4-6-9			Dark brown to black, loose, moist, fine SAND, some silt, trace clay, wood fragments, plant stems, etc.						
	4	6-8	9-12-12-16			Same as 2-4'.						
	5	8-10	16-15-14-10			Medium brown, medium dense, moist, fine SAND, little silt, trace clay.						
	6	10-12	8-7-5-5			Light brown to orange, loose, moist, very fine to fine SAND, some silt, trace clay.						
	7	12-14	3-4-5-8			Light brown, loose, moist, very fine to fine SAND, some silt, little fine gravel, trace clay.						

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No.: B-14
Sheet 1 of 1

Project Location: LEY CREEK SITE

Client: GENERAL MOTORS

SAMPLER
Type: SPLIT SPOON
Hammer: 140 LBS Fall: 30 INCHES

Ground Water Depth Date
Depth Date
File No.: 3247.021.130

Boring Co.: PARRATT-WOLFF
Foreman: GLENN LANSING
OBG Geologist: DONALD T. BUSSEY

Boring Location:
Ground Elevation: 380.1'
Dates: Started:01/19/88 Ended:01/19/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			Rmks*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Value				pH	Sp Cond	HNU	
	1	0-2	2-3-2-5			Gray to brown, very loose, moist, fine SAND, some silt, little clay, trace coarse sand and gravel.						
	2	2-4	3-3-4-3			Light brown to dark brown, very loose, moist, fine SAND, some silt, little clay, trace coarse sand.						
	3	4-6	16-6-8-8			Dark brown black, medium dense to loose, moist fine SAND, trace silt and clay, wood fragments.						
	4	6-8	7-6-6-8			Light brown to dark brown, loose, moist, fine SAND, some silt and clay.						
	5	8-10	4-4-3-4			Light brown to dark brown, very loose, moist, fine SAND, little silt, trace clay.						
	6	10-12	3-3-2-4			Light brown, very loose, moist, CLAY and SILT, some fine sand.						

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No.: B-15
Sheet 1 of 1

Project Location: LEY CREEK SITE

Client: GENERAL MOTORS

SAMPLER
Type: SPLIT SPOON
Hammer: 140 LBS
Fall: 30 INCHES

Ground Water Depth
Date
Depth
Date
File No.: 3247.021.130

Boring Co.: PARRATT-WOLFF
Foreman: GLENN LANSING
OBG Geologist: DONALD T. BUSSEY

Boring Location:
Ground Elevation: 380.3'
Dates: Started:01/20/88
Ended:01/20/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			Rmks*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Value				pH	Sp Cond	HNU	
	1	0-2	2-3-4-6			Medium brown, loose, saturated, fine SAND, some silt, trace clay, root hairs and plant stems.						
	2	2-4	7-7-5-6			Same as 0-2', trace coarse sand.						
	3	4-6	3-4-4-5			Medium brown, loose, saturated, fine SAND, some silt, little medium sand, trace clay, plant fibers.						
	4	6-8	4-5-4-5			Dark brown to black, loose, saturated, fine-medium coarse SAND, trace silt and clay, plant fragments, root hairs, etc.						
	5	8-10	5-5-13-16			Dark brown to black, loose to medium dense, saturated fine SAND, little silt and clay.						
	6	10-12	3-3-12-14			Medium brown, soft to stiff, saturated, SILT, some clay and fine sand.						

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No.: B-16
Sheet 1 of 1

Project Location: LEY CREEK SITE

Client: GENERAL MOTORS

SAMPLER
Type: SPLIT SPOON
Hammer: 140 LBS
Fall: 30 INCHES

Ground Water Depth
Date
Depth
Date
File No.: 3247.021.130

Boring Co.: PARRATT-WOLFF
Foreman: GLENN LANSING
OBG Geologist: WILLIAM GABRIEL

Boring Location:
Ground Elevation:
Dates: Started: / /
Ended: / /

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			Rmks*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Value				pH	Sp Cond	HNU	
	1	0-2	1-2-2-1			Light brown, very loose, saturated, fine SAND, some silt and clay, wood fragments, root hairs.						
	2	2-4	2-3-3-4			Same as 0-2'.						
	3	4-6	2-6-3-3			Light brown, loose, saturated, fine SAND, some silt and clay, wood fragments, roots, etc., few black streaks.						
	4	6-8	3-3-3-3			Same as 4-6, dark brown.						
	5	8-10	4-5-5-3			Dark brown to black, loose, saturated, fine SAND, some silt and clay.						
	6	10-12	3-6-4-4			Dark brown, loose, saturated, fine SAND, some silt and clay, few black streaks.						

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No.: B-17
Sheet 1 of 1

Project Location: LEY CREEK SITE

Client: GENERAL MOTORS

SAMPLER
Type: SPLIT SPOON
Hammer: 140 LBS Fall: 30 INCHES

Ground Water Depth Date
Depth Date
File No.: 3247.021.130

Boring Co.: PARRATT-WOLFF
Foreman: GLENN LANSING
OBG Geologist: WILLIAM GABRIEL

Boring Location:
Ground Elevation: 375.8'
Dates: Started:01/21/88 Ended:01/21/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			Rmks*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Value				pH	Sp Cond	HNU	
	1	0-2	2-3-4-5			Medium brown, yellowish brown, and reddish brown, soft, moist, SILT, very fine sand and some clay, few plant stems, root hairs, etc.						
	2	2-4	6-5-8-7			Same as 0-2', medium stiff, (saturated).						
	3	4-6	5-5-5-6			Medium to reddish brown, loose, saturated, fine SAND, little silt and clay.						
	4	6-8	3-3-3-5			Medium brown, very loose, saturated, fine SAND, some silt and clay-(yellowish brown "oily" stains on sample.)						
	5	8-10	2-3-3-4			Medium brown, soft, saturated, SILT and CLAY, some fine sand, wood fragments, plant stems, etc. Fill at 8.5'.						
	6	10-12	4-5-19-23			Medium brown, medium stiff to very stiff, saturated, fine-medium SAND, some silt and clay. At 11' change to - Reddish brown, very firm, moist, clay and silt, some very fine to fine gravel. (TILL)						

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No.: B-18
Sheet 1 of 1

Project Location: LEY CREEK SITE

Client: GENERAL MOTORS

SAMPLER
Type: SPLIT SPOON
Hammer: 140 LBS Fall: 30 INCHES

Ground Water Depth Date
Depth Date
File No.: 3247.021.130

Boring Co.: PARRATT-WOLFF
Foreman: GLENN LANSING
OBG Geologist: WILLIAM GABRIEL

Boring Location:
Ground Elevation:
Dates: Started:02/03/88 Ended:02/03/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			R m k s*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Value				pH	Sp Cond	HNU	
	1	0-2	15-27-35-			Light gray, hard (frozen), dry, SILT and medium coarse GRAVEL. (FILL)						
			44									
	2	2-4	41-17-11-			Same as 0-2'. (Poor recovery).						
			8									
	3	4-6	5-5-6-6			Dark gray, stiff, saturated, SILT and CLAY, some fine sand, and medium gravel, few black organic streaks.						
	4	6-8	5-4-6-7			Same as 4-6'. (No gravel).						

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No.: B-19
Sheet 1 of 1

Project Location: LEY CREEK SITE

Client: GENERAL MOTORS

SAMPLER
Type: SPLIT SPOON
Hammer: 140 LBS
Fall: 30 INCHES

Ground Water Depth
Date
Depth
Date
File No.: 3247.021.130

Boring Co.: PARRATT-WOLFF
Foreman: GLENN LANSING
OBG Geologist: WILLIAM GABRIEL

Boring Location:
Ground Elevation: 373.4'
Dates: Started:02/03/88
Ended:02/03/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			Rmks*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Value				pH	Sp Cond	HNU	
	1	0-2	2-3-5-7			Dark gray, soft to medium stiff, moist, SILT, clay and very fine sand, with plant stems, root hairs, etc.						
	2	2-4	5-5-7-7			Light brown-reddish brown, loose, very moist, fine to medium SAND, some silt and clay, few root hairs and plant stems, few iron mottles.						
	3	4-6	3-3-9-13			Same as 2-4', changing to dark brown to reddish brown peat (plant stems, root hairs etc.) banded with bedded fine to medium sand, (very moist to saturated).						
	4	6-8	10-22-39-			Medium gray, stiff, saturated, very fine SAND and SILT, some clay, little fine-medium gravel. At 7.5' change to - Reddish brown, very fine sand, medium silt, some clay, little fine-fine medium gravel (TILL)						
			54									

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No.: B-20
Sheet 1 of 1

Project Location: LEY CREEK SITE

Client: GENERAL MOTORS

SAMPLER
Type: SPLIT SPOON
Hammer: 140 LBS Fall: 30 INCHES

Ground Water Depth Date
Depth Date
File No.: 3247.021.130

Boring Co.: PARRATT-WOLFF
Foreman: GLENN LANSING
OBG Geologist: WILLIAM GABRIEL

Boring Location:
Ground Elevation: 374.8'
Dates: Started:02/04/88 Ended:02/04/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			Rmks*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Value				pH	Sp Cond	HNU	
	1	0-2	2-3-4-6			Light brown-gray, soft, moist, SILT and fine SAND, some clay, plant stems, root hairs, etc.						
	2	2-4	4-4-6-10			Same as 0-2', with some iron stains and banding.						
	3	4-6	12-15-18-			Dark brown to reddish brown, medium stiff, moist, fine SAND, some silt and clay. (Black stained sand present in sample, fuel oil odor)						
			17									
	4	6-8	12-17-54-			Light gray, stiff, saturated, fine SAND, SILT and CLAY, with some fine to coarse gravel. (Black organic oily streaks present. At 6-6.5', change to - Reddish brown, hard, fine SAND, SILT and CLAY with some fine to coarse gravel. (Till 6.5-8').						
			85									

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No.: B-21
Sheet 1 of 1

Project Location: LEY CREEK SITE

Client: GENERAL MOTORS

SAMPLER
Type: SPLIT SPOON
Hammer: 140 LBS Fall: 30 INCHES

Ground Water Depth Date
Depth Date
File No.: 3247.021.130

Boring Co.: PARRATT-WOLFF
Foreman: GLENN LANSING
OBG Geologist: WILLIAM GABRIEL

Boring Location:
Ground Elevation: 375.4'
Dates: Started:02/04/88 Ended:02/04/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			Rmks*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Value				pH	Sp Cond	HNU	
	1	0-2	2-3-4-4			Dark brown, very loose, moist, very fine SAND and SILT, trace clay, plant stems, few roots, etc.						
	2	2-4	3-2-4-5			Same as 0-2'.						
	3	4-6	11-15-12-			Light brown to reddish brown, medium dense, saturated, fine SAND, some silt and clay, few plant stems and fine root hairs.						
			11									
	4	6-8	6-5-8-8			Same as 4-6'. At 6.5' change to - Medium gray, medium stiff, saturated, SILT, CLAY, and very fine SAND, few roots and limonite stains.						

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No.: B-22
Sheet 1 of 1

Project Location: LEY CREEK SITE

Client: GENERAL MOTORS

SAMPLER
Type: SPLIT SPOON
Hammer: 140 LBS Fall: 30 INCHES

Ground Water Depth Date
Depth Date
File No.: 3247.021.130

Boring Co.: PARRATT-WOLFF
Foreman: GLENN LANSING
OBG Geologist: WILLIAM GABRIEL

Boring Location:
Ground Elevation: 376.6'
Dates: Started:02/04/88 Ended:02/04/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			Rmks*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Value				pH	Sp Cond	HNU	
	1	0-2	2-4-11-13			Medium gray to light brown, loose to medium dense, moist, fine SAND and SILT, little clay, plant stems, root hairs, etc.						
	2	2-4	9-11-19-			Same as 0-2', with iron and limonite stains and black organic stains.						
			27									
	3	4-6	25-24-35-			Yellowish to reddish brown, medium dense to dense, moist, fine-medium SAND, little silt and gray clay.						
			18									
	4	6-8	9-8-8-10			Medium brown-gray, stiff, saturated CLAY and SILT, with few limonite streaks and mottles.						

O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG	Report of Boring No.: B-23 Sheet 1 of 1
Project Location: LEY CREEK SITE Client: GENERAL MOTORS	SAMPLER Type: SPLIT SPOON Hammer: 140 LBS Fall: 30 INCHES	Ground Water Depth Date Depth Date File No.: 3247.021.130

Boring Co.: PARRATT-WOLFF
Foreman: GLENN LANSING
OBG Geologist: WILLIAM GABRIEL

Boring Location:
Ground Elevation: 376.8'
Dates: Started:02/05/88 Ended:02/05/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			Rmks*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Value				pH	Sp Cond	HNU	
	1	0-2	2-6-8-9			Dark brown-gray, loose, moist, very fine-fine SAND, some silt and clay, plant stems and roots, etc.						
	2	2-4	5-6-7-8			Same as 0-2', with light gray mottles and wood fragments.						
	3	4-6	7-8-8-7			Light gray to dark gray, medium stiff, very moist, SILT and CLAY, some light gray fine sand, few iron mottles and root hairs.						
	4	6-8	6-5-4-5			Light gray-brown, loose, saturated, fine SAND, some silt and clay, with iron and limonite mottles.						

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG
[redacted]

REPORT OF BORING NO. OBG-6 SHEET 1 OF

PROJECT LOCATION: Syracuse, N.Y.

CLIENT: GM - Fisher Guide

SAMPLER
TYPE: Split-Spoon 2"x2'
HAMMER: 140 lbs.
FALL: 30"

GROUND WATER
DEPTH DATE ELEV.
DEPTH DATE ELEV.

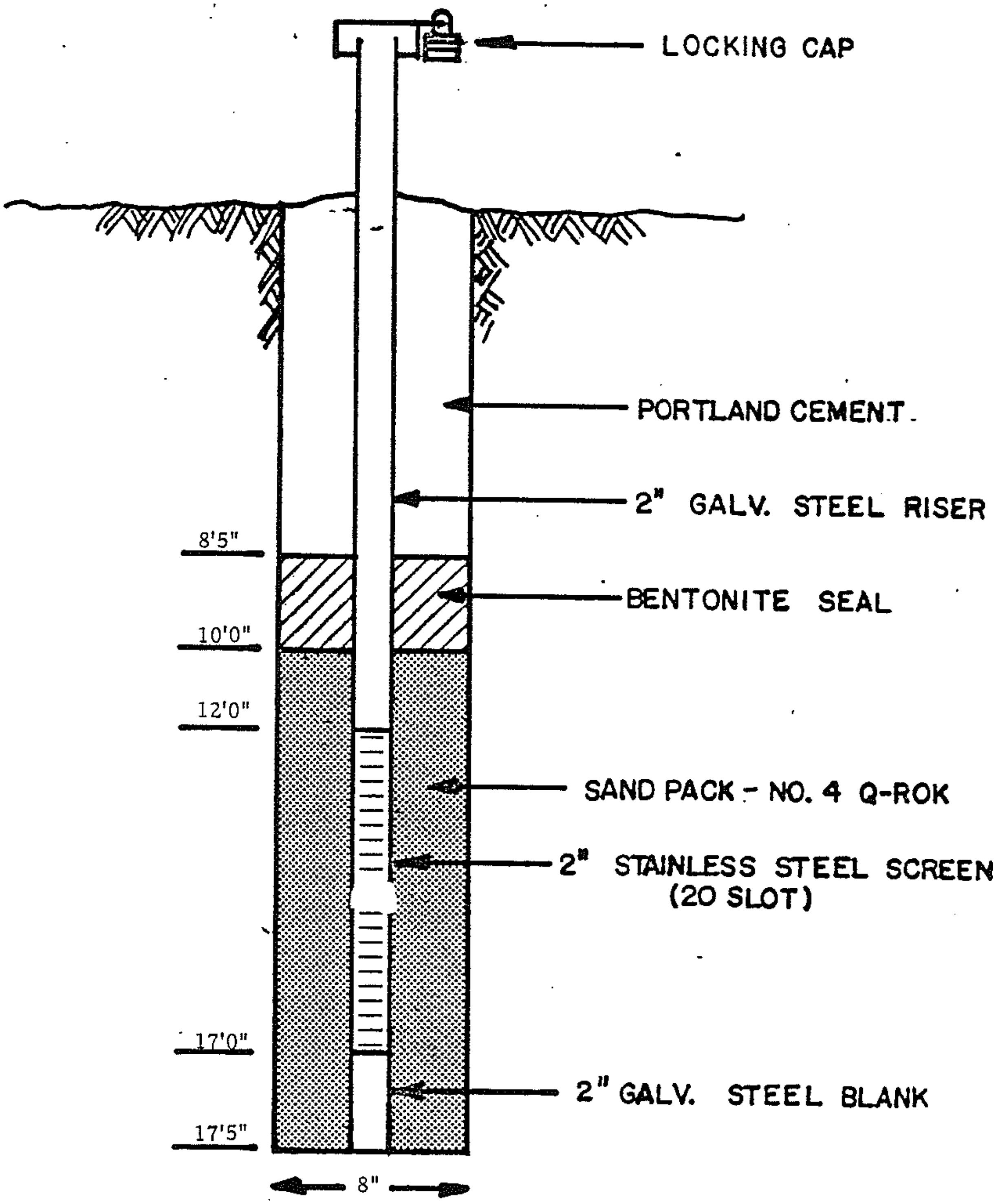
FILE NO.: 3247.007

BORING CO.: Parratt Wolff
FOREMAN: Butch Stevens
OBG GEOLOGIST: John Brod

BORING LOCATION:
GROUND ELEVATION:
DATES: STARTED: 11/10/86 ENDED: 11/10/8

DEPTH	SAMPLE					SAMPLE DESCRIPTION	STRTUM CHANGE DEPTH	EQUIPMENT INSTALLED	FIELD TESTING		
	No.	DEPTH	BLOWS /6"	PENETRN/ RECOVERY	"N" VALUE				SAL. 0/00	SP. COND.	HNU
0	1	0-2	3-5	24/9	9	Med. brown silt, little clay (isolated lense), trace organics near surface, trace fine sand (in layers), moist, stiff.		See Well Construction Diagram			
			4-4								
2	2	2-4	6-6	24/9	11	Same, grading to med. stiff.					
			5-4								
4	3	4-6	3-3	24/9	7						
			4-3			Brownish gray with black mottling clay, little silt, little black organic material. Moist, med. stiff.	5.0'				
6	4	6-8	3-3	24/21	6						
			3-2								
8	5	8-10	3-2	24/10	4	Same, with more organics, soft.					
			2-3				10.0'				
10	6	10-12	3-2	24/24	5	Dark gray silt, little fine sand. Trace clay, moist, soft.					
			3-3								
12	7	12-14	3-2	24/24	5	Same					
			3-3								
14	8	14-16	1-3	24/14	6	Same, grading to wet.					
			3-3								
16	9	16-18	2-2	24/24	4						
			2-1			Reddish gray clay, trace silt, moist, very soft.	17.0'				
						Bottom of Hole @ 18 ft.					

*



WELL CONSTRUCTION DIAGRAM

WELL NO. OBG-6

O'BRIEN & GERE ENGINEERS, INC.

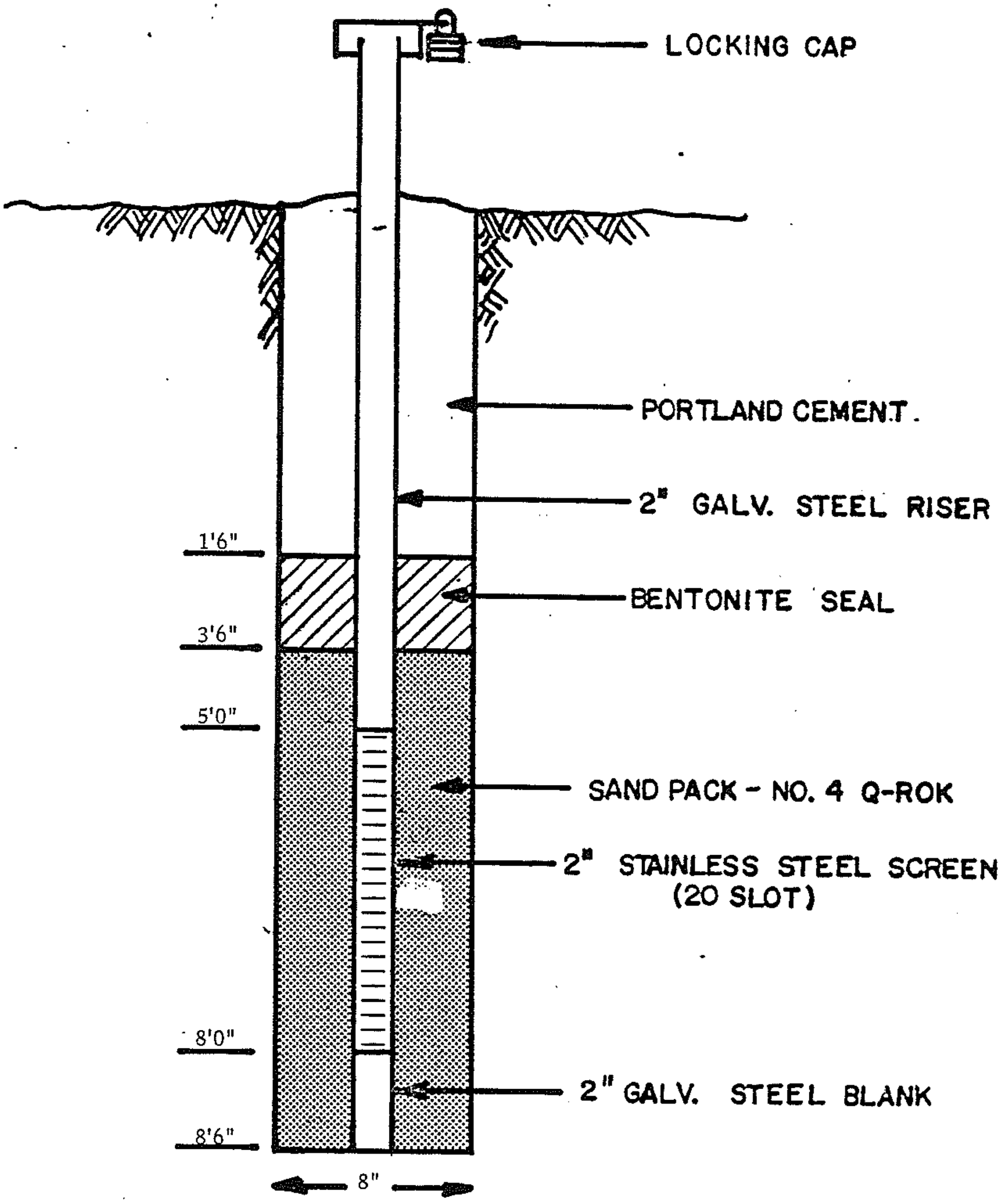
O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG [redacted]	REPORT OF BORING NO. OBG-7A SHEET 1 OF
PROJECT LOCATION: Syracuse, N.Y. CLIENT: GM - Fisher Guide	SAMPLER TYPE: Split-Spoon 2"x2' HAMMER: 140 lbs. FALL: 30'	GROUND WATER DEPTH DATE ELEV. DEPTH DATE ELEV. FILE NO.: 3247.007

BORING CO.: Parratt Wolff
FOREMAN: Paul LeClair
OBG GEOLOGIST: John Brod

BORING LOCATION:
GROUND ELEVATION:
DATES: STARTED: 11/21/86 ENDED: 11/21/8

DEPTH	SAMPLE					SAMPLE DESCRIPTION	STRATUM CHANGE DEPTH	EQUIPMENT INSTALLED	FIELD TESTING		
	No.	DEPTH	BLOWS /6"	PENETRN/ RECOVERY	"N" VALUE				SAL. 0/00	SP. COND.	HNU
0	1	0-2	1-4	24/11	8	Mottled grayish brown silt, some clay, little fine sand in thin layers, trace organics, damp, stiff.		See Well Construction Diagram			
			4-8								
2	2	2-4	5-5	24/18	10	Same with red and black mottling.					
			5-4			6" lense of black organic silt and clay @ 3.6'					
4	3	4-6	7-6	24/12	11	Same with layering of fine sand.					
			5-7								
6	4	6-8	3-4	24/24	7	Same					
			3-3								
8	5	8-10	2-2	24/16	4	Mottled grayish brown clay. Trace silt, very moist, soft.	8.0'				
			2-2								
10	6	10-12	1-2	24/10	3	Same					
			1-1								
						Bottom of Hole @ 12 ft.					

*



WELL CONSTRUCTION DIAGRAM

WELL NO. OBG-7A

O'BRIEN & GERE ENGINEERS, INC.

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

[redacted]

REPORT OF BORING NO. OBG-7B SHEET 1 OF

PROJECT LOCATION: Syracuse, N.Y.

CLIENT: GM - Fisher Guide

SAMPLER
TYPE: Split-Spoon 2"x2'
HAMMER: 140 lbs.
FALL: 30"

GROUND WATER
DEPTH DATE ELEV.
DEPTH DATE ELEV.

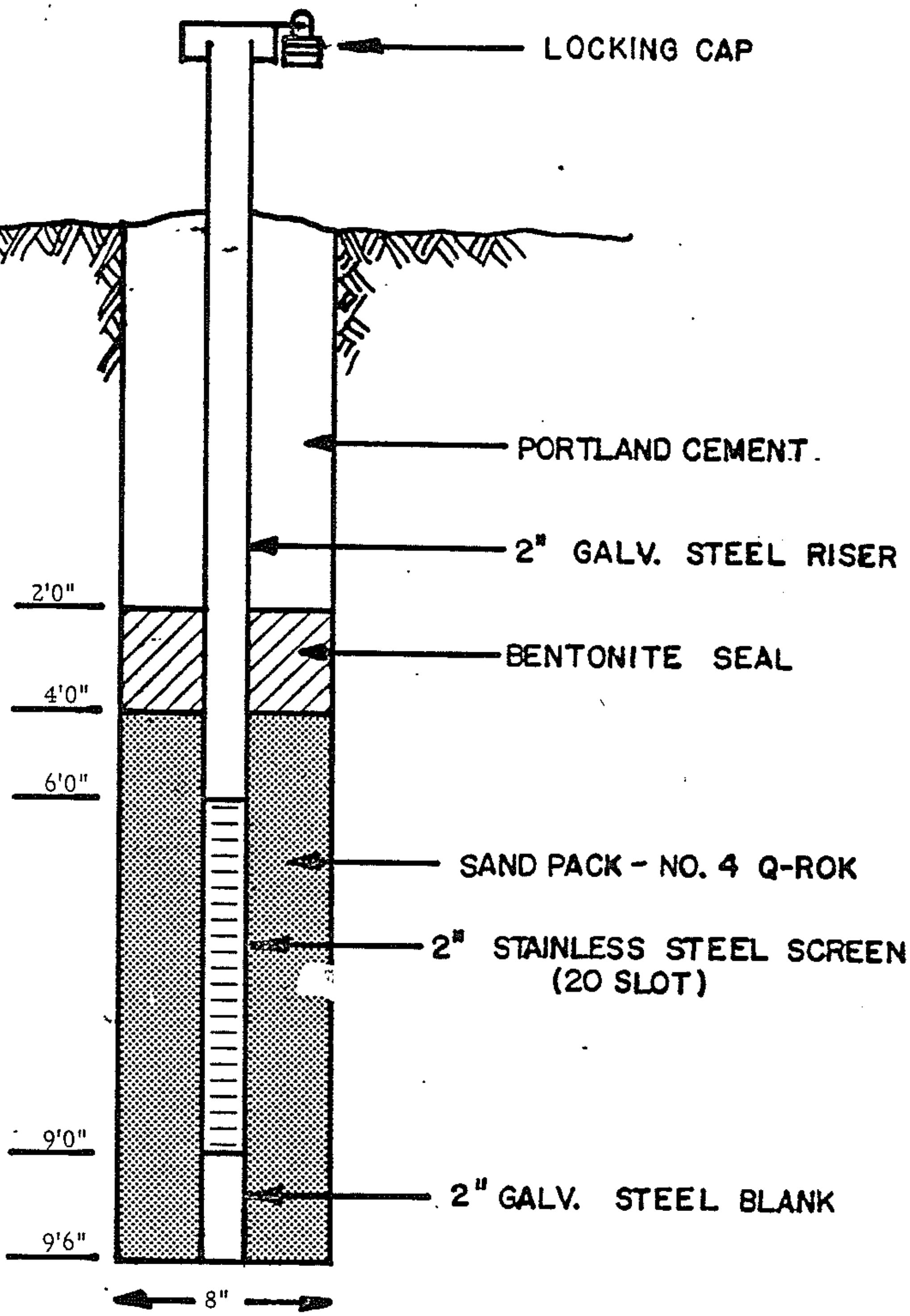
FILE NO.: 3247.007

BORING CO.: Parratt Wolff
FOREMAN: Paul LeClair
OBG GEOLOGIST: John Brod

BORING LOCATION:
GROUND ELEVATION:
DATES: STARTED: 11/21/86 ENDED: 11/21/8

DEPTH	SAMPLE					SAMPLE DESCRIPTION	STRTUM CHANGE DEPTH	EQUIPMENT INSTALLED	FIELD TESTING		
	No.	DEPTH	BLOWS /6"	PENETRN/ RECOVERY	"N" VALUE				SAL. 0/00	SP. COND.	HNU
0	1	0-2	1-3	24/12	8	Mottled brown silt, little fine sand and clay, trace organics, damp, stiff.		See Well Construction Diagram			
			5-5								
2	2	2-4	5-5	24/15	12	Same, no organics					
			7-7								
4	3	4-6	2-6	24/17	16	Same with 5" lense of reddish brown fine sand, little silt.					
			10-10								
6	4	6-8	5-6	24/14	12	Same with 8" lense of black organic silt and clay.					
			6-7								
8	5	8-10	3-2	24/24	5						
			3-3			Mottled grayish brown clay, little silt, very moist, very soft.	9.0'				
10	6	10-12	1-1	24/10	—						
			WOH								
						Bottom of Hole @ 12 ft.					

* WOH - Weight of Hammer



WELL CONSTRUCTION DIAGRAM

WELL NO. OBG-7B

O'BRIEN & GERE ENGINEERS, INC.

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING NO. OBG-7C SHEET 1 OF

PROJECT LOCATION: Syracuse, N.Y.
CLIENT: GM - Fisher Guide

SAMPLER
TYPE: Split-Spoon 2"x2'
HAMMER: 140 lbs.
FALL: 30'

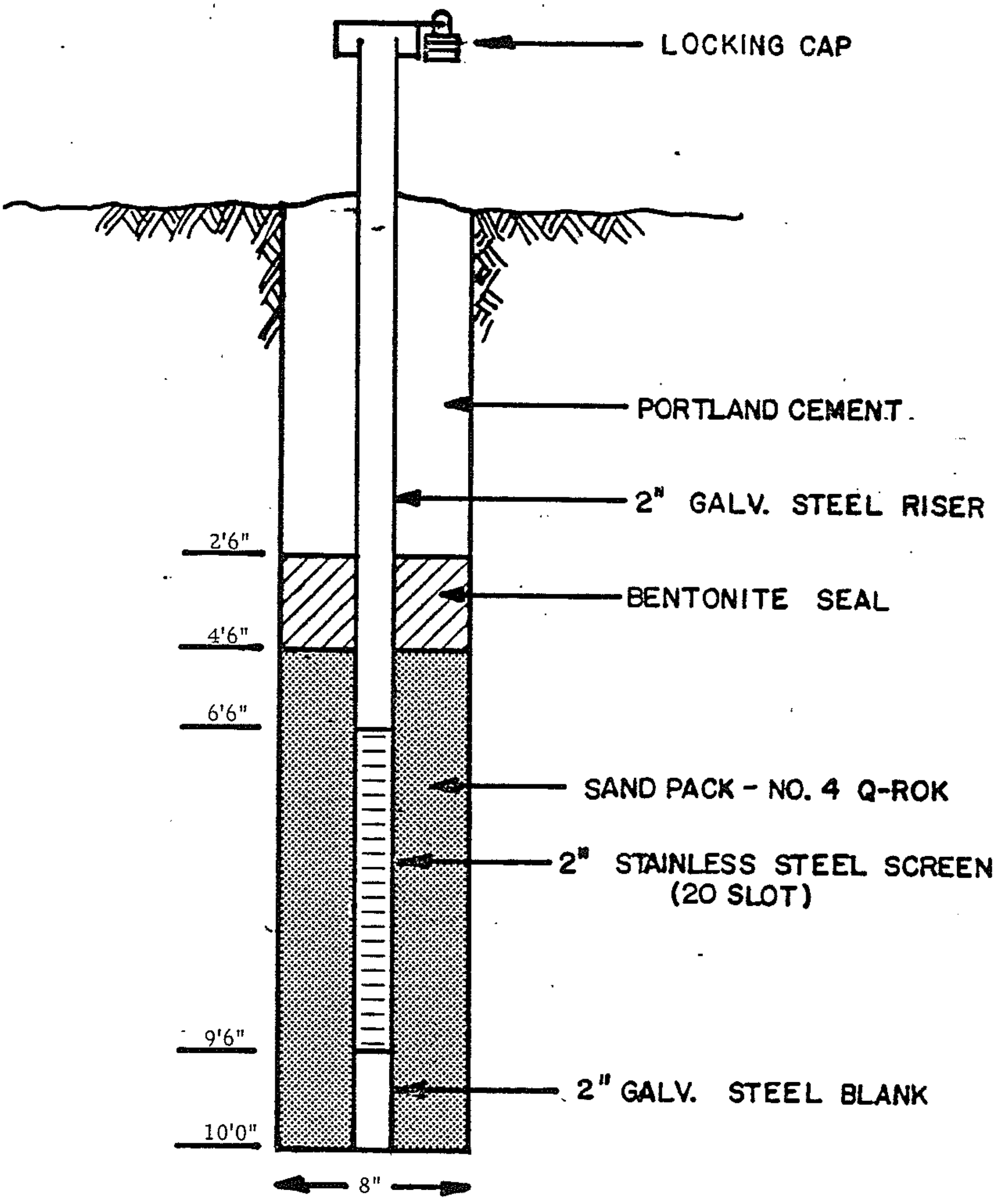
GROUND WATER
DEPTH DATE ELEV.
DEPTH DATE ELEV.

FILE NO.: 3247.007

BORING CO.: Parratt Wolff
FOREMAN: Paul LeClair
OBG GEOLOGIST: John Brod

BORING LOCATION:
GROUND ELEVATION:
DATES: STARTED: 11/21/86 ENDED: 11/21/8

DEPTH	SAMPLE					SAMPLE DESCRIPTION	STRTUM CHANGE DEPTH	EQUIPMENT INSTALLED	FIELD TESTING		
	No.	DEPTH	BLOWS /6"	PENETRN/ RECOVERY	"N" VALUE				SAL. 0/00	SP. COND.	HNU
0	1	0-2	2-3	24/12	9	Med. brown with some gray mottling, silt, some clay, trace fine sand and organics, damp, stiff, some layering of silt, and clay.		See Well Construction Diagram			
			6-6								
2	2	2-4	7-5	24/17	10	Same					
			5-4								
4	3	4-6	2-5	24/18	12	Same with some fine sand, little clay, 4" lense of organic black silt and clay @ 3'.					
			7-9								
6	4	6-8	8-7	24/7	12	Same					
			5-6								
8	5	8-10	4-6	24/18	10	Same with some clay, layering of silt and clay					
			4-4								
10	6	10-12	1-1	24/20	3	Gray with brown mottling clay, little silt, very moist, soft.	9.6'				
			2-1								
						Bottom of Hole @ 12 ft.					



WELL CONSTRUCTION DIAGRAM

WELL NO. OBG-7C

O'BRIEN & GERE ENGINEERS, INC.

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No. MW-8
Sheet 1

Project Location: Ley Creek

Client: General Motors - Fisher Guide

SAMPLER
Type: Split Spoon
Hammer: 140 lbs.
Fall: 30 inches

Ground Water Depth
Depth
Date
Date
File No.: 3247.021.130

Boring Co.: Parratt & Wolff
Foreman: N. Thurston
OBG Geologist: W.J. Gabriel

Boring Location:
Ground Elevation:
Dates: Started: 9/13/88
Ended: 9/13/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			Rmks*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Valve				pH	Sp Cond	HNU	
0	1	0-1.5	3-4-5			Moist, very loose to loose, light-medium brown, fine SAND, little silt, few black organic streaks and orange mottling, roots and plant stems.						
5	2	5-6.5	6-8-7			Moist, loose, yellowish-brown-medium brown fine SAND, trace silt, black organic stains (many) and iron stains, few plant fragments						
10	3	10-11.5	3-4-4			Very moist-saturated, loose, medium brown, fine-medium SAND, some silt, little clay (gray), iron mottling, few plant stems. W.T. at 10.5'-11.0'						
15	4	15-16.5	WOH-1-1			Saturated, very soft, medium-reddish brown SILT, some clay, trace very fine sand, few iron stains and mottling and black organic streaks.						

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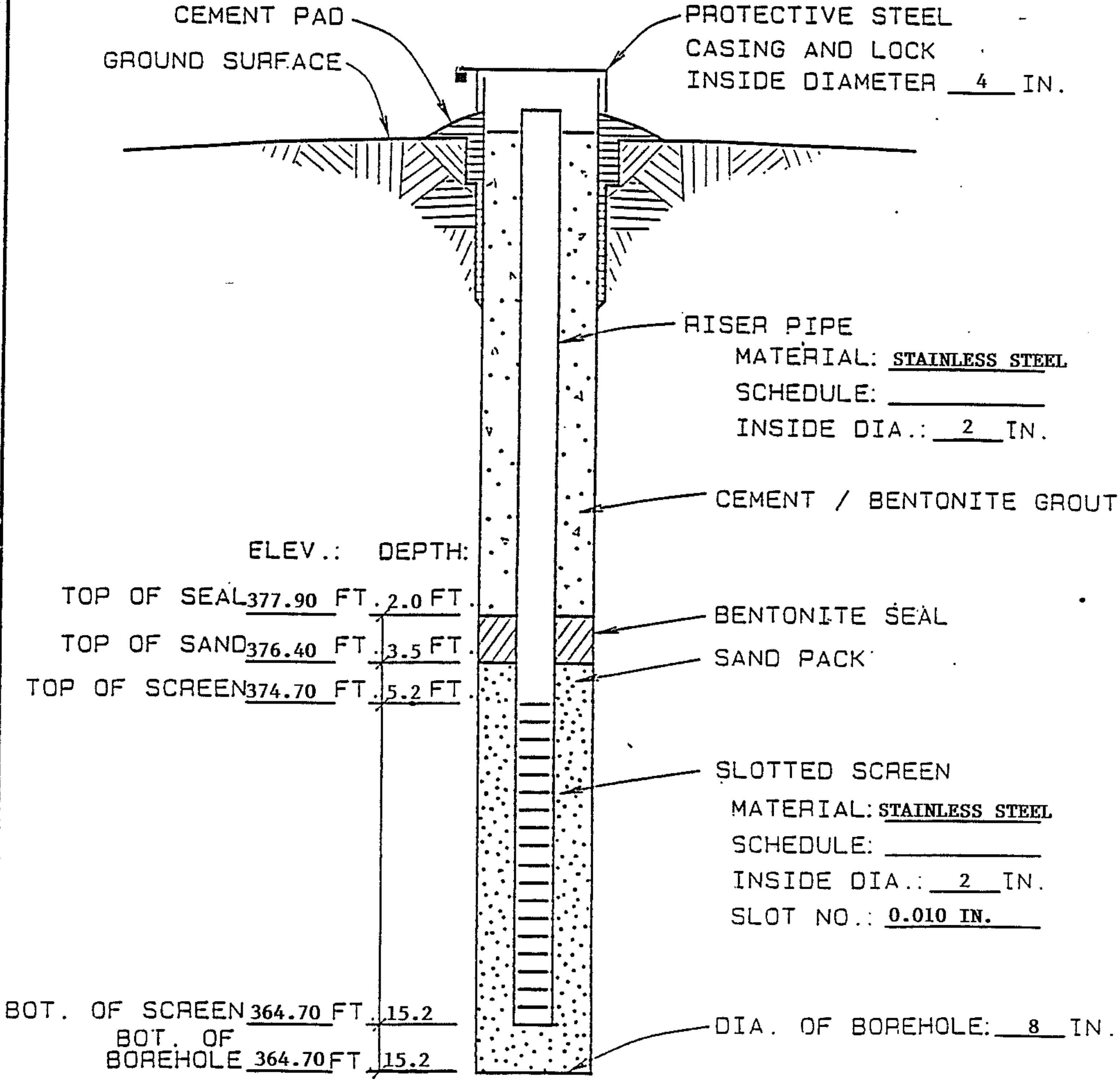


PROTECTIVE STEEL CASING AND LOCK INSIDE DIAMETER 4 IN.

RISER PIPE
MATERIAL: STAINLESS STEEL
SCHEDULE:
INSIDE DIA.: 2 IN.

SLOTTED SCREEN
MATERIAL: STAINLESS STEEL
SCHEDULE:
INSIDE DIA.: 2 IN.
SLOT NO.: 0.010 IN.

DIA. OF BOREHOLE: 8 IN.

	ELEV.:	DEPTH:
TOP OF SEAL	377.90 FT.	2.0 FT.
TOP OF SAND	376.40 FT.	3.5 FT.
TOP OF SCREEN	374.70 FT.	5.2 FT.
BOT. OF SCREEN	364.70 FT.	15.2
BOT. OF BOREHOLE	364.70 FT.	15.2

TYPICAL OVERBURDEN MONITORING WELL

N.T.S.

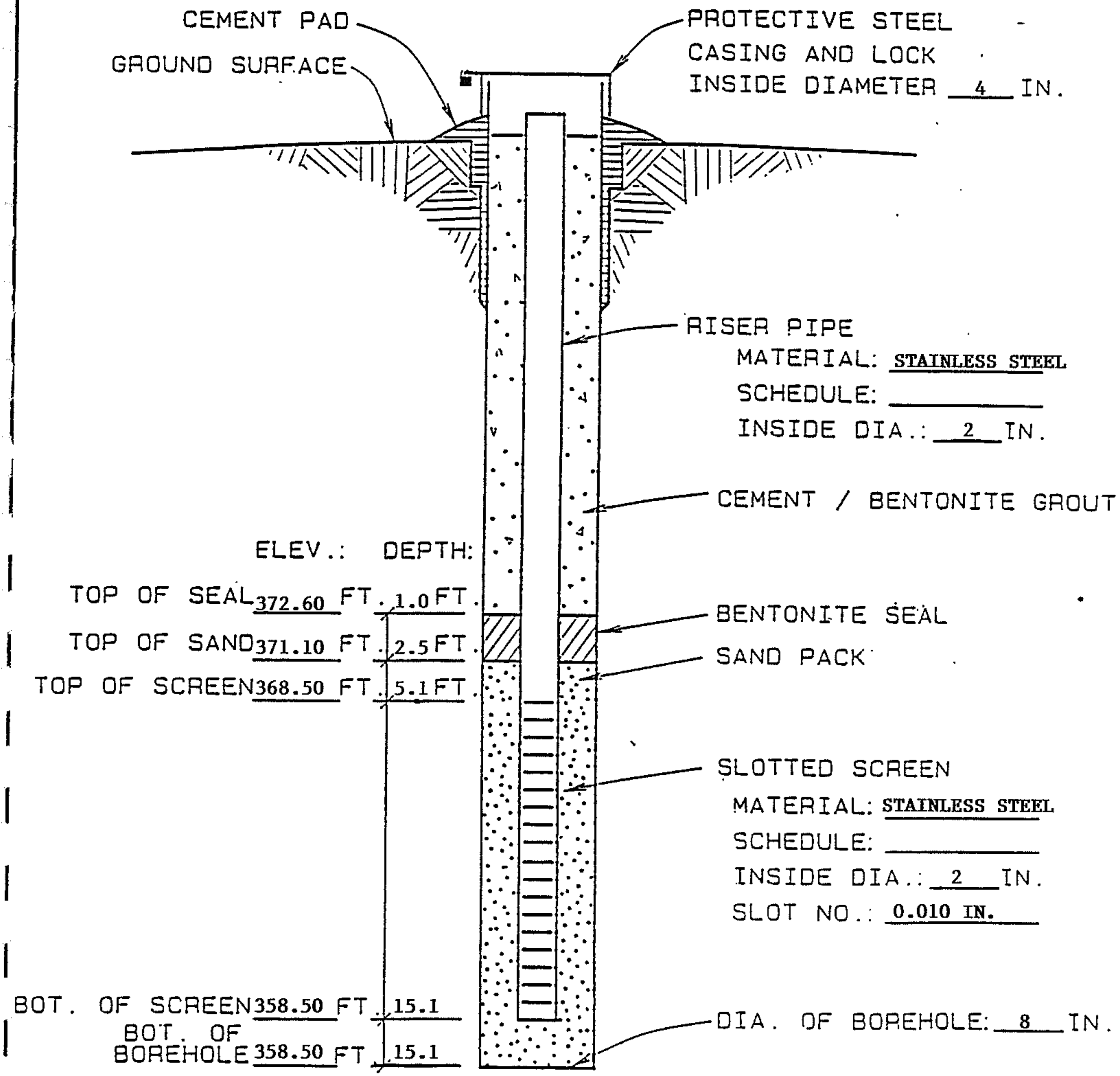
GM - IFG LEY CREEK
MW-8

O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG	Report of Boring No. MW-9 Sheet 1
Project Location: Ley Creek Client: General Motors - Fisher Guide	SAMPLER Type: Split Spoon Hammer: 140 lbs. Fall: 30 inches	Ground Water Depth Date Depth Date File No.: 3247.021.130

Boring Co.: Parratt & Wolff
Foreman: N. Thurston
OBG Geologist: W.J. Gabriel

Boring Location:
Ground Elevation:
Dates: Started: 9/13/88 Ended: 9/13/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			Rmks*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Valve				pH	Sp Cond	HNU	
0	1	0-1.5	2-3-5			Moist, very loose to loose, medium brown, fine SAND, some silt, trace clay, few iron stains, plant stems and roots, many pores.						
5	2	5-6.5	1-2-3			Moist, very loose, medium-dark, brown, fine SAND, little silt, trace clay, few roots and plant stems, pores. Peat @ ~7.0 ft, W.T. ~ 7.0'-8.0'.						
10	3	10-11.5	1-0-1			Very moist, very loose, light gray-black, fine-medium SAND, some peat. Change to: @ 11 ft. Saturated, very soft, medium gray-brown SILT, some clay, trace fine sand, few iron stains.						
15	4	15-16.5	11-7-8			Saturated, medium stiff to stiff, medium gray SILT, some clay, little very fine sand Change to: Saturated, dense, reddish brown, fine-medium SAND, little fine-medium-coarse gravel. (reworked till)						



PROTECTIVE STEEL CASING AND LOCK INSIDE DIAMETER 4 IN.

RISER PIPE
MATERIAL: STAINLESS STEEL
SCHEDULE:
INSIDE DIA.: 2 IN.

SLOTTED SCREEN
MATERIAL: STAINLESS STEEL
SCHEDULE:
INSIDE DIA.: 2 IN.
SLOT NO.: 0.010 IN.

DIA. OF BOREHOLE: 8 IN.

	ELEV.:	DEPTH:
TOP OF SEAL	372.60 FT.	1.0 FT.
TOP OF SAND	371.10 FT.	2.5 FT.
TOP OF SCREEN	368.50 FT.	5.1 FT.
BOT. OF SCREEN	358.50 FT.	15.1
BOT. OF BOREHOLE	358.50 FT.	15.1

TYPICAL OVERBURDEN MONITORING WELL

N.T.S.
GM - IFG LEY CREEK
MW-9

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No. MW-10
Sheet 1

Project Location: Ley Creek

Client: General Motors - Fisher Guide

SAMPLER
Type: Split Spoon
Hammer: 140 lbs. Fall: 30 inches

Ground Water Depth Date
Depth Date
File No.: 3247.021.130

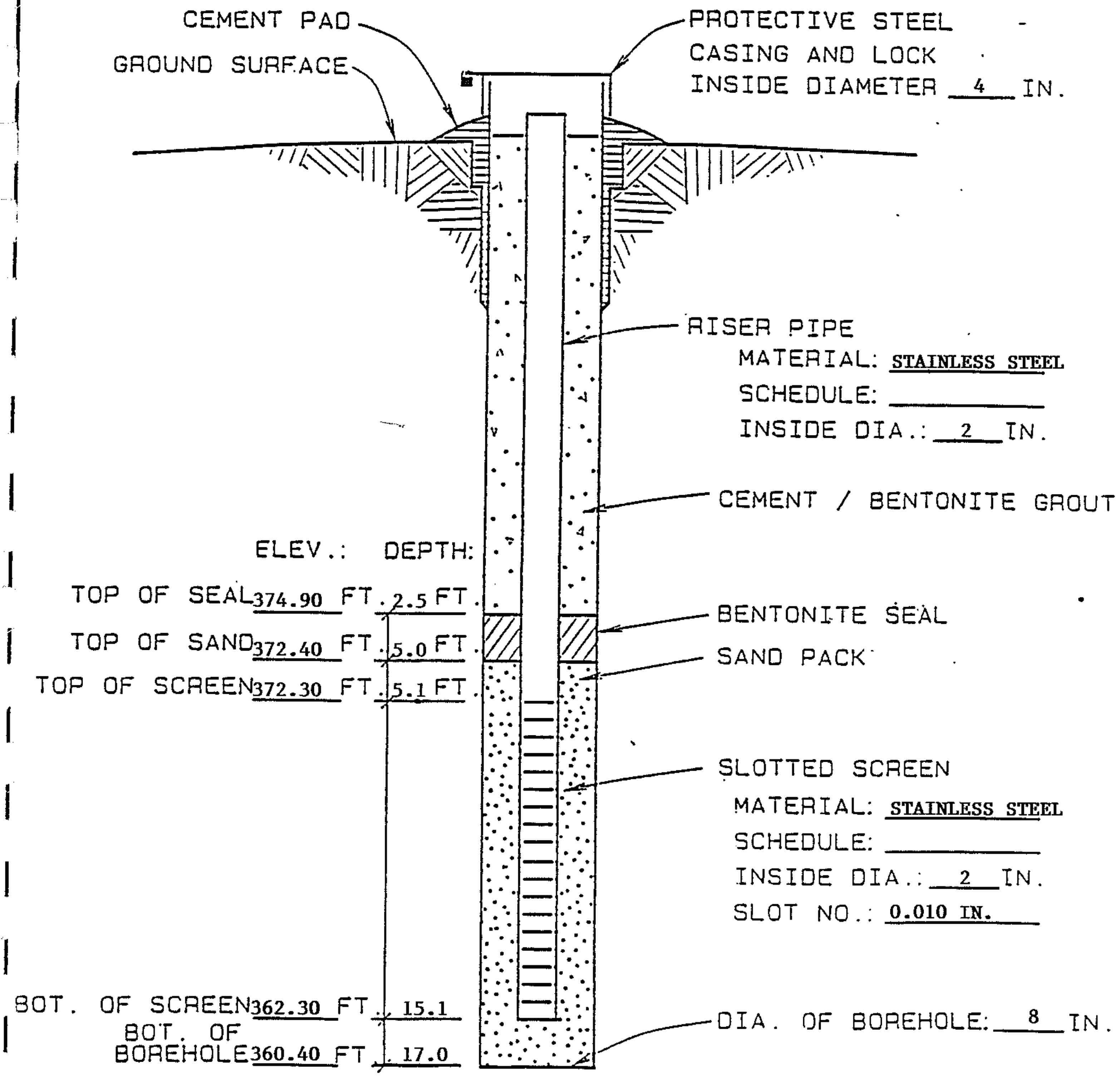
Boring Co.: Parratt & Wolff
Foreman: N. Thurston
OBG Geologist: W.J. Gabriel

Boring Location:
Ground Elevation:
Dates: Started: 9/13/88 Ended: 9/13/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			R m k s*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Valve				pH	Sp Cond	HNU	
0	1	0-1.5	4-7-7			Moist, loose, medium brown-gray, very fine SAND, some silt, trace clay, many pores, root hairs and plant fragments.						
5	2	5-6.5	2-2-4			Moist, soft, medium brown-gray, fine SAND, some SILT, trace clay. Change to: Fine-medium gray-dark gray, fine-medium SAND, little silt.						
10	3	10-11.5	2-3-3			Moist, loose, black, fine SAND, some silt (peat like). Change to: Very moist, light brown, very fine-fine SAND and SILT, little clay, some iron stains and light gray mottles. W.T. @ ~11'-12'.						
15	4	15-16.5	2-1-2			Saturated, very loose, light-medium gray, very fine SAND and SILT, little clay.						
18	5	18.5-20	13-24-24			Saturated, very stiff dark brown-gray, SILT some clay, little fine sand. Change to: Very frim, reddish-brown, fine SAND and silt, some fine-medium gravel, trace clay. (Till).						

* Hole backfilled with pellets to 17.5 ft., then 0.5 ft. of sand to 17.0 ft.

File Name: FISHER10.KJK



PROTECTIVE STEEL CASING AND LOCK
INSIDE DIAMETER 4 IN.

RISER PIPE
MATERIAL: STAINLESS STEEL
SCHEDULE: ________
INSIDE DIA.: 2 IN.

SLOTTED SCREEN
MATERIAL: STAINLESS STEEL
SCHEDULE: ________
INSIDE DIA.: 2 IN.
SLOT NO.: 0.010 IN.

DIA. OF BOREHOLE: 8 IN.

	ELEV.:	DEPTH:
TOP OF SEAL	374.90 FT.	2.5 FT.
TOP OF SAND	372.40 FT.	5.0 FT.
TOP OF SCREEN	372.30 FT.	5.1 FT.
BOT. OF SCREEN	362.30 FT.	15.1
BOT. OF BOREHOLE	360.40 FT.	17.0

TYPICAL OVERBURDEN MONITORING WELL

N.T.S.
GM - IFG LEY CREEK
MW-10

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No. MW-11
Sheet 1

Project Location: Ley Creek
Client: General Motors - Fisher Guide

SAMPLER
Type: Split Spoon
Hammer: 140 lbs. Fall: 30 inches

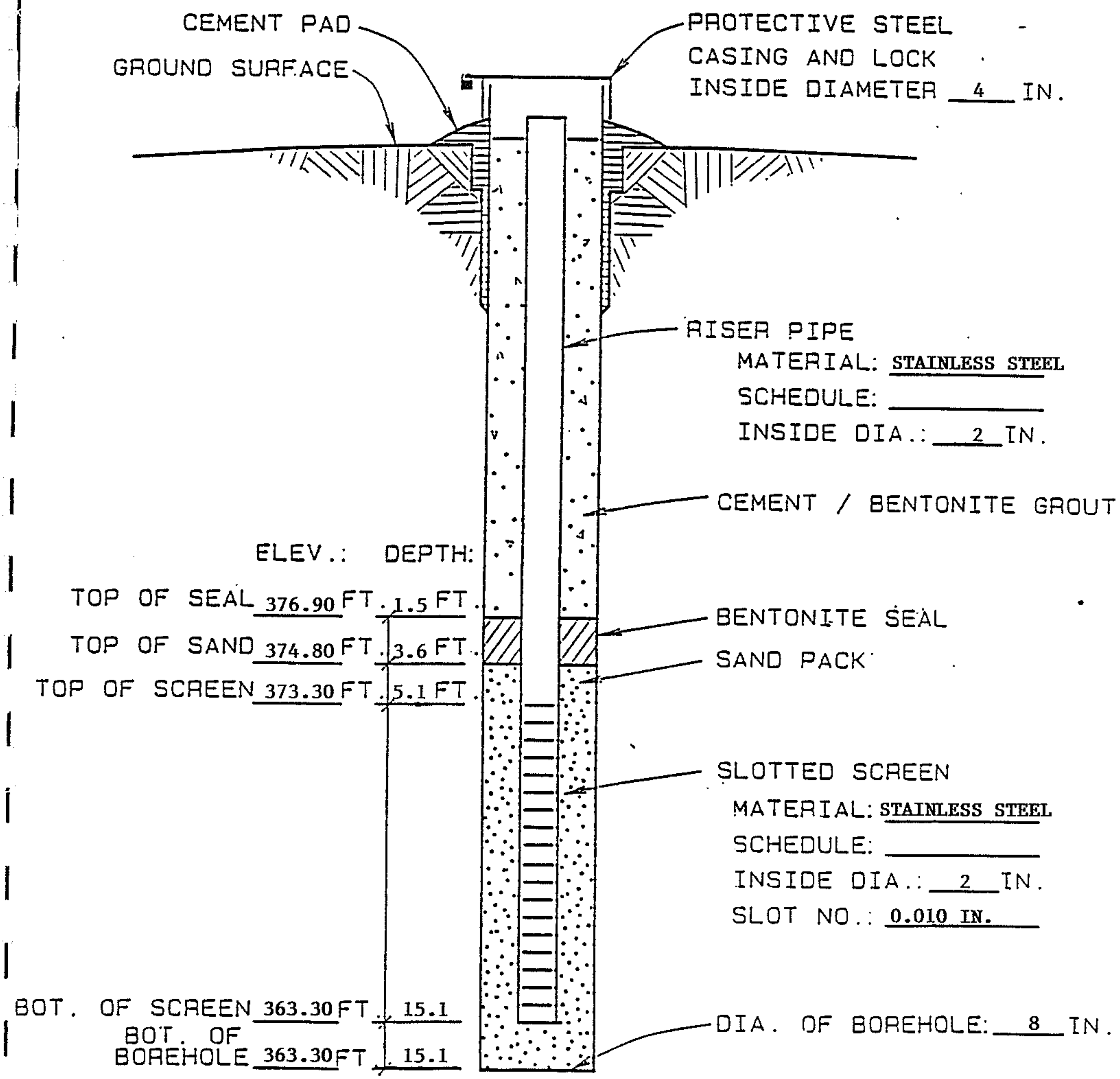
Ground Water Depth Date
Depth Date
File No.: 3247.021.130

Boring Co.: Parratt & Wolff
Foreman: N. Thurston
OBG Geologist: W.J. Gabriel

Boring Location:
Ground Elevation:
Dates: Started: 9/14/88 Ended: 9/14/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			R m k s*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Valve				pH	Sp Cond	HNU	
0	1	0-1.5	1-1-1			Moist, medium brown, fine SAND, little silt few roots and plant stems.						
5	2	5-6.5	2-4-6			Dry, medium brown, fine-medium SAND, little medium-coarse gravel, trace silt, few porcelain fragments. (Misc. fill)						
10	3	10-11.5	1-2-2			Very moist, loose, medium-dark brown, fine SAND and SILT, wood fragments and plant stems, porcelain fragments. Change to: at~11 ft. Saturated, loose, dark gray-black fine-medium SAND, wood and plant fragments (peat) W.T. ~11-11.5 ft.						
15	4	15-16.5	0-1-1			Saturated, very loose, dark brown-black, fine SAND, silt, wood fragments, plant stems, (peat). Change to ~16 ft. Saturated, very loose, dark gray, very fine SAND, some silt and clay.						
17	5	17-18.5				Saturated, soft, medium-dark gray, SILT, very fine sand, some clay, plant stems. Change to @ ~17 ft. Moist, dense, reddish-brown, fine SAND, some fine-medium gravel, little silt and clay. (Till)						

File Name: FISHER11.KJK



PROTECTIVE STEEL
CASING AND LOCK
INSIDE DIAMETER 4 IN.

RISER PIPE
MATERIAL: STAINLESS STEEL
SCHEDULE: ____
INSIDE DIA.: 2 IN.

	ELEV.:	DEPTH:
TOP OF SEAL	376.90 FT	1.5 FT
TOP OF SAND	374.80 FT	3.6 FT
TOP OF SCREEN	373.30 FT	5.1 FT
BOT. OF SCREEN	363.30 FT	15.1
BOT. OF BOREHOLE	363.30 FT	15.1

SLOTTED SCREEN
MATERIAL: STAINLESS STEEL
SCHEDULE: ____
INSIDE DIA.: 2 IN.
SLOT NO.: 0.010 IN.

DIA. OF BOREHOLE: 8 IN.

TYPICAL OVERBURDEN MONITORING WELL

N.T.S.
GM – IFG LEY CREEK
MW–11

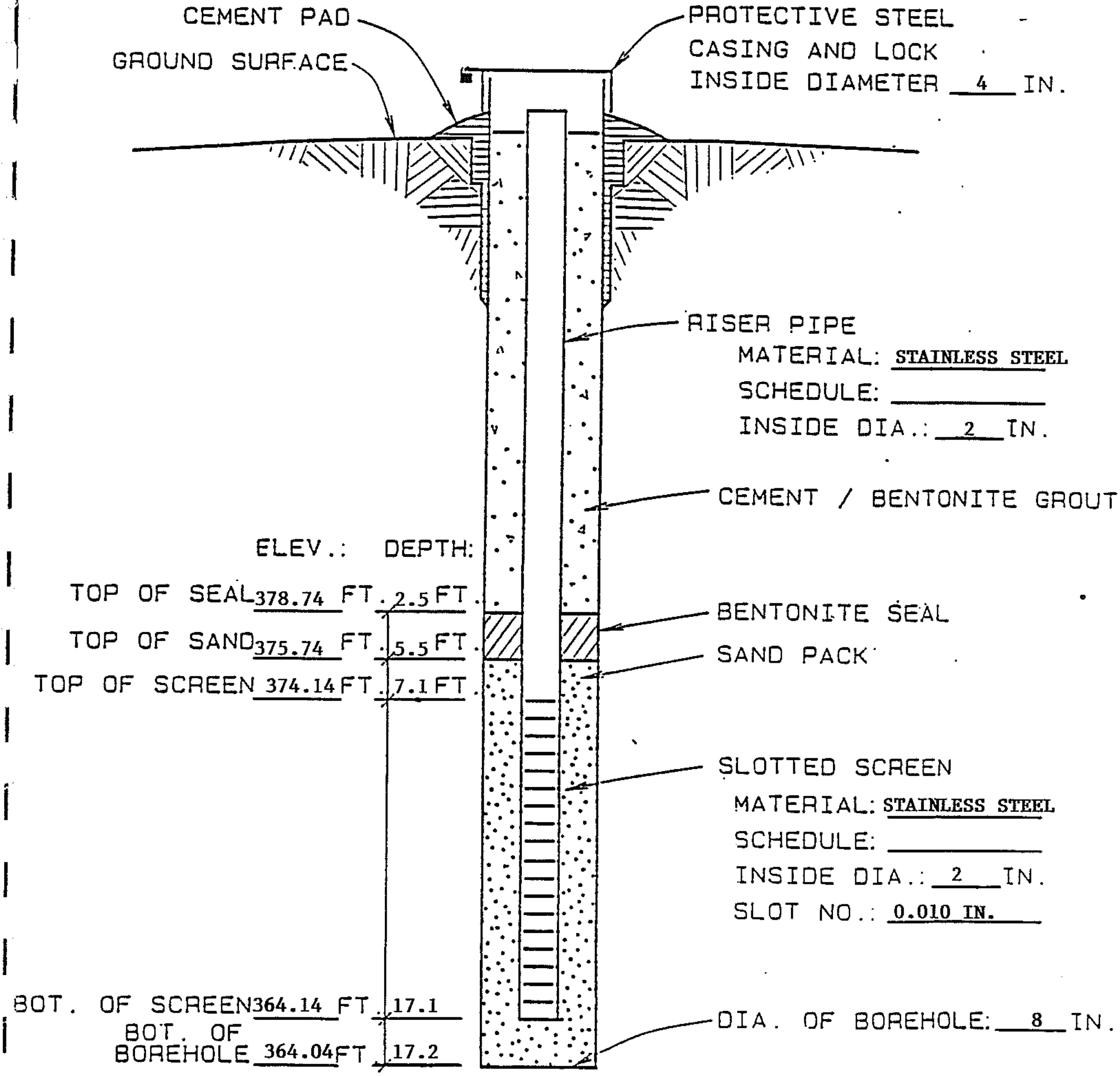
O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG	Report of Boring No. MW-12 Sheet 1
Project Location: Ley Creek Client: General Motors - Fisher Guide	SAMPLER Type: Split Spoon Hammer: 140 lbs. Fall: 30 inches	Ground Water Depth Date Depth Date File No.: 3247.021.130

Boring Co.: Parratt & Wolff
Foreman: N. Thurston
OBG Geologist: W.J. Gabriel

Boring Location:
Ground Elevation:
Dates: Started: 9/14/88 Ended: 9/14/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			R m k s*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Valve				pH	Sp Cond	HNU	
0	1	0-1.5	GRAB			Dry, medium brown, very fine SAND, little silt and fine-medium gravel, plant stems and roots.						
5	2	5-6.5	5-3-4			Dry-moist, medium brown-reddish brown, fine SAND, PEAT and some fine-medium gravel, plant stems, wood fragments, (Unsorted misc fill).						
10	3	10-11.5	3-15-14			Saturated, dense, medium brown-gray, fine SAND, some silt, little clay. Change to @ 11 ft. Moist, dense, reddish brown, fine SAND, fine-medium gravel, little silt and clay.						
13	4	13-13.5				Reddish brown till, same as @ 11 ft.						

File Name: FISHER12.KJK



PROTECTIVE STEEL CASING AND LOCK
INSIDE DIAMETER 4 IN.

RISER PIPE
MATERIAL: STAINLESS STEEL
SCHEDULE: ________
INSIDE DIA.: 2 IN.

SLOTTED SCREEN
MATERIAL: STAINLESS STEEL
SCHEDULE: ________
INSIDE DIA.: 2 IN.
SLOT NO.: 0.010 IN.

DIA. OF BOREHOLE: 8 IN.

	ELEV.:	DEPTH:
TOP OF SEAL	378.74 FT.	2.5 FT.
TOP OF SAND	375.74 FT.	5.5 FT.
TOP OF SCREEN	374.14 FT.	7.1 FT.
BOT. OF SCREEN	364.14 FT.	17.1
BOT. OF BOREHOLE	364.04 FT.	17.2

TYPICAL OVERBURDEN MONITORING WELL

N.T.S.

GM – IFG LEY CREEK

MW-12

O'BRIEN & GERE
ENGINEERS, INC.

TEST BORING LOG

Report of Boring No. MW-13
Sheet 1

Project Location: Ley Creek

Client: General Motors - Fisher Guide

SAMPLER
Type: Split Spoon
Hammer: 140 lbs. Fall: 30 inches

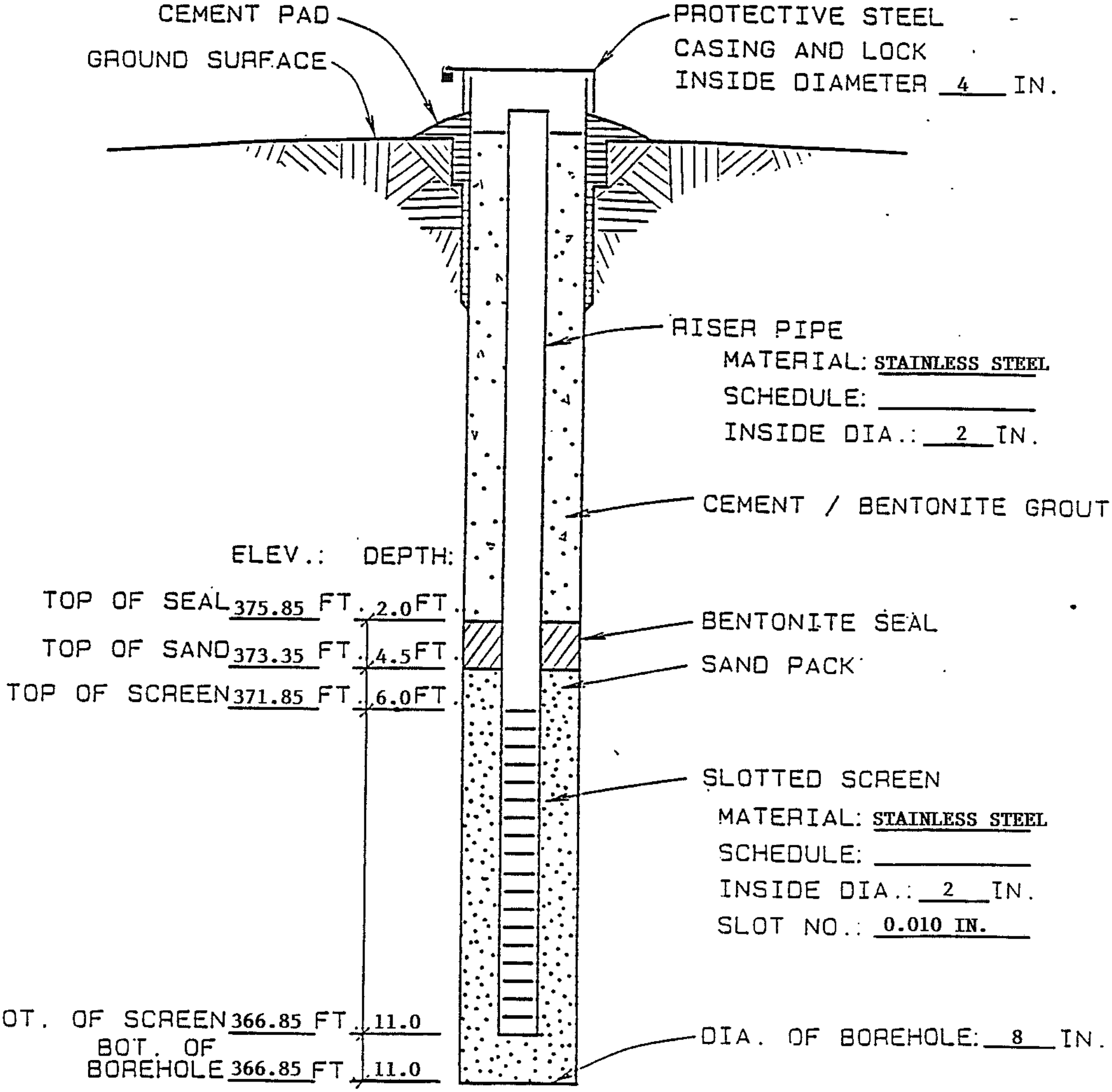
Ground Water Depth Date
Depth Date
File No.: 3247.021.130

Boring Co.: Parratt & Wolff
Foreman: N. Thurston
OBG Geologist: W.J. Gabriel

Boring Location:
Ground Elevation:
Dates: Started: 9/14/88 Ended: 9/14/88

Depth	Sample					Sample Description	Stratum Change General Descript	Equipment Installed	Field Testing			R m k s*
	No	Depth	Blows /6"	Penetr/ Recovry	"N" Valve				pH	Sp Cond	HNU	
0	1	0-1.5	4-6-6			Very moist, medium dense, light brown-gray, fine SAND, some fine-medium-coarse gravel, little silt. W.T. ~1.5-2.0'						
5	2	5-6.5	1-1-3			Saturated, very loose, light gray, fine SAND, little silt, trace clay.						
10	3	10-11.5	2-1-1			Saturated, very soft, light-medium gray, SILT, some clay, trace very fine-fine sand.						
15	4	15-16.5	3-6-5			- Same as above @ 10-11.5' Change to @ 15.5' Saturated, medium dense, reddish brown, fine-medium SAND, little fine-medium gravel. (Layer of gravel between silt and clay and sand).						

File Name: FISHER13.KJK



TYPICAL OVERBURDEN MONITORING WELL

N.T.S.

GM – IFG LEY CREEK

MW-13

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING B-24
PAGE 1 OF 1

CLIENT: GM - Inland Fisher Guide
PROJECT LOCATION: Ley Creek, Factory Ave.
Syracuse, NY
FILE NO.: 3247.078

SAMPLER: Split Spoon
HAMMER: 140 lbs
FALL: 30"

LOCATION: North side Factory Ave., ~100' West of outfall
START DATE: 7/20/92
END DATE: 7/20/92

BORING COMPANY: Parratt-Wolff, Inc.
FOREMAN: Barney Waters
OBG GEOLOGIST: Tim Eddy

LEGEND: ▨ Grout ▨ Sand Pack ■ Pellets == Screen ☐ Riser

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING	
									PID	HEAD-SPACE
0	1	0–2	1–6–8–5	2'/0.8'	14	Moist, brown, medium stiff SILT, little clay, trace fine sand, thin bedding noted at 0.8'				
1										
2	2	2–4	6–5–7–5	2'/1.5'	12	Moist, brown–dark brown, medium stiff SILT, little clay, trace fine sand, weathered wood at 2'				
3										
4	3	4–6	1–2–4–5	2'/1.5'	6	As above to 4.7', then moist, soft CLAY, some silt, grading to brown–greenish tinge, fine SAND, some silt at 5.2'				
5										
6	4	6–8	4–3–2–2	2'/1.5'	5	First sample no recovery, push another spoon Wet, brown, soft, fine, sandy SILT				
7										
8	5	8–10	1–1–0–0	2'/1.5'	1	Wet, brown, very soft SILT and fine SAND, grading to SILT, some fine sand at 9.3'				
9										
10	6	10–12	0–1–0–0	2'/1'	1	As above to 10.5', then wet, very soft CLAY, trace silt				
11										
12						Bottom of boring 12'				
13										
14										
15										
16										
17										
18										
19										
20										

Drillers measure water at 6 ft. in hole.

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING B-25
PAGE 1 **OF** 1

CLIENT: GM - Inland Fisher Guide
PROJECT LOCATION: Ley Creek, Factory Ave.
Syracuse, NY
FILE NO.: 3247.078

SAMPLER: Split Spoon
HAMMER: 140 lbs
FALL: 30"

LOCATION: ~20' West of B-24
START DATE: 7/20/92
END DATE: 7/20/92

BORING COMPANY: Parratt-Wolff, Inc.
FOREMAN: Barney Waters
OBG GEOLOGIST: Tim Eddy

LEGEND: ░ Grout ▒ Sand Pack ▓ Pellets == Screen ☐ Riser

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING	
									PID	HEAD-SPACE
0	1	0-2	2-3-5-5	2'/2'	8	Moist, brown, medium stiff SILT, some fine to medium sand, little clay, trace organics, 1 piece angular, coarse gravel				
1										
2	2	2-4	5-5-7-8	2'/2'	12	As above, stiff				
3										
4	3	4-6	3-5-8-8	2'/1.3'	13	Moist, brown, stiff SILT, little clay, little fine to medium sand, grading to dark brown at 5'				
5										
6	4	6-8	6-6-4-5	2'/1.3'	10	As above, trace black, becoming wet at 6.5', brown, fine to medium SAND, some silt at 6.7', grading to SILT at 6.9'				
7										
8	5	8-10	3-2-3-1	2'/1.5'	5	Wet, brown-dark brown SILT, little fine sand to 9', then brown-purplish tinge SILT, trace fine sand				
9										
10	6	10-12	WOH-	2'/2'	3	Wet, brown with green-brown streak, very soft SILT, grading to CLAY, little silt at 10'				
			WOH-3-1							
11										
12						Bottom of boring 12'				
13										
14										
15										
16										
17										
18										
19										
20										

WOH – Weight of Hammer

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING B-26
PAGE 1 OF 1

CLIENT: GM - Inland Fisher Guide
PROJECT LOCATION: Ley Creek, Factory Ave.
Syracuse, NY
FILE NO.: 3247.078

SAMPLER: Split Spoon
HAMMER: 140 lbs
FALL: 30"

LOCATION: ~20' West of B-25
START DATE: 7/20/92
END DATE: 7/20/92

BORING COMPANY: Parratt-Wolff, Inc.
FOREMAN: Barney Waters
OBG GEOLOGIST: Tim Eddy

LEGEND: ░ Grout ▒ Sand Pack ■ Pellets ═ Screen ☐ Riser

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING	
									PID	HEAD-SPACE
0	1	0-2	1-3-5-7	2'/1.5'	8	Moist, dark brown, medium stiff SILT, slightly mottled, little fine to medium sand				
1										
2	2	2-4	6-8-8-9	2'/1'	16	As above, stiff				
3										
4	3	4-6	3-2-5-6	2'/1'	7	As above to 4.3', then very moist, silty, fine to medium SAND, brown-reddish orange mottled appearance				
5										
6	4	6-8	6-5-5-5	2'/1'	10	Very moist, orange-brown, silty, fine to medium SAND, grading to SILT at 6.8', little fine to medium sand, trace clay				
7										
8	5	8-10	2-3-3-2	2'/1.2'	6	Wet, brown-orange bands, purplish SILT, some fine sand, trace clay				
9										
10						Bottom of boring 10'				
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING B-27
PAGE 1 OF 1

CLIENT: GM - Inland Fisher Guide
PROJECT LOCATION: Ley Creek, Factory Ave.
Syracuse, NY
FILE NO.: 3247.078

SAMPLER: Split Spoon
HAMMER: 140 lbs
FALL: 30"

LOCATION: ~20' West of B-26
START DATE: 7/21/92
END DATE: 7/21/92

BORING COMPANY: Parratt-Wolff, Inc.
FOREMAN: Barney Waters
OBG GEOLOGIST: Tim Eddy

LEGEND:
- ☐ Grout
- ▨ Sand Pack
- ■ Pellets
- == Screen
- ☐ Riser

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING	
									PID	HEAD-SPACE
0	1	0-2	WOH-2	2'/1.2'	5	Moist, dark brown, medium stiff SILT, little fine sand, trace clay and organics, poorly sorted				
			-3-5							
1										
2	2	2-4	8-6-5-7	2'/1'	11	As above				
3										
4	3	4-6	4-4-5-7	2'/1.8'	9	Moist, light brown, medium stiff SILT, some fine sand, grading to dark brown, slight orange tinge SILT, some clay, trace fine sand				
5										
6	4	6-8	8-12-7-6	2'/1.5'	19	As above to 6.5', then wet, light brown, fine SAND, some silt, grading to purplish at 7.3'				
7										
8	5	8-10	WOH-3	2'/1.3'	5	Wet, purplish with orange-brown bands, soft, fine SAND, some silt, sorted, somewhat stratified				
			-2-2							
9										
10						Bottom of boring 10'				
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

WOH – Weight of Hammer

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING B-28
PAGE 1 OF 1

CLIENT: GM - Inland Fisher Guide
PROJECT LOCATION: Ley Creek, Factory Ave.
Syracuse, NY
FILE NO.: 3247.078

SAMPLER: Split Spoon
HAMMER: 140 lbs
FALL: 30"

LOCATION: ~10' West of B-24 and
~10' East of B-25
START DATE: 7/21/92
END DATE: 7/21/92

BORING COMPANY: Parratt-Wolff, Inc.
FOREMAN: Barney Waters
OBG GEOLOGIST: Tim Eddy

LEGEND: ░ Grout ▒ Sand Pack ■ Pellets == Screen ☐ Riser

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING	
									PID	HEAD-SPACE
0	1	0-2	3-3-7-5	2'/1'	10	Moist, brown, medium stiff SILT, little fine sand, trace clay and organics				
1										
2	2	2-4	7-7-7-6	2'/2'	14	Piece of ceramic, moist, brown-grayish appearance, stiff SILT, some fine sand, blackish streaks at 3.8'				
3										
4	3	4-6	3-4-5-4	2'/1.5'	9	Moist, brown-black, purplish mottled appearance, medium stiff SILT, little fine sand, little clay				
5										
6	4	6-8	6-8-7-8	2'/1.2'	15	As above				
7										
8	5	8-10	WOH-WOH -WOH-4	2'/0.5'	---	Moist, dark brown-blackish, very soft CLAY, some silt, trace fine sand				
9										
10	6	10-12	2-2-2-2	2'/0.5'	4	As above				
11										
12	7	12-14	WOH-WOH -WOH-4	2'/2'	---	Wet, brown with purplish tinge, soft CLAY, little silt grading to some silt at 13.5'				
13										
14						Bottom of boring 14'				
15										
16										
17										
18										
19										
20										

WOH - Weight of Hammer

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING B-29
PAGE 1 OF 1

CLIENT: GM - Inland Fisher Guide
PROJECT LOCATION: Ley Creek, Factory Ave.
Syracuse, NY
FILE NO.: 3247.078

SAMPLER: Split Spoon
HAMMER: 140 lbs
FALL: 30"

LOCATION: ~18' East of B-24
START DATE: 7/21/92
END DATE: 7/21/92

BORING COMPANY: Parratt-Wolff, Inc.
FOREMAN: Barney Waters
OBG GEOLOGIST: Tim Eddy

LEGEND:
░ Grout
▒ Sand Pack
▓ Pellets
== Screen
☐ Riser

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING	
									PID	HEAD-SPACE
0	1	0–2	2–3–3–5	2'/1.5'	6	Moist, brown–dark brown, medium stiff SILT, little fine to medium sand, trace clay				
1										
2	2	2–4	7–8–8–9	2'/2'	16	As above, stiff with brown to dark brown mottled appearance				
3										
4	3	4–6	4–5–4–5	2'/1'	9	Moist, orange brown, dark brown and black mottled appearance, stiff SILT, little fine sand, trace clay				
5										
6	4	6–8	4–7–8–7	2'/1.3'	15	Moist, black–dark brown, stiff SILT, little clay, little fine to medium sand to 6.9', then wet, purplish tinge, grayish, fine SAND, some silt, some gray mottling				
7										
8	5	8–10	3–2–2–3	2'/2'	4	Wet, brown–purplish appearance, some black mottling, loose, fine SAND, some silt to 9.8', then CLAY, some silt				
9										
10						Bottom of boring 10'				
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING B-30
PAGE 1 OF 1

CLIENT: GM - Inland Fisher Guide
PROJECT LOCATION: Ley Creek, Factory Ave.
Syracuse, NY
FILE NO.: 3247.078

SAMPLER: Split Spoon
HAMMER: 140 lbs
FALL: 30"

LOCATION: ~280' West of Outfall
START DATE: 7/21/92
END DATE: 7/21/92

BORING COMPANY: Parratt-Wolff, Inc.
FOREMAN: Barney Waters
OBG GEOLOGIST: Tim Eddy

LEGEND:
☐ Grout
▨ Sand Pack
■ Pellets
== Screen
☐ Riser

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING	
									PID	HEAD-SPACE
0	1	0–2	1–3–4–5	2'/1.3'	7	Moist, brown to dark brown, medium stiff SILT, little fine sand, trace clay, trace organics				
1										
2	2	2–4	2–3–6–6	2'/1.3'	9	As above				
3										
4	3	4–6	4–3–4–5	2'/1.5'	7	Moist, brown, medium stiff SILT, gray brown 4–4.3', fine to medium SAND, some silt from 5–5.5', wet at 5.5'				
5										
6	4	6–8	5–3–3–2	2'/2'	6	As above to 7.7', then more silt than fine sand, brown–orange brown mottled appearance				
7										
8	5	8–10	2–1–1–1	2'/2'	2	Wet, brown with orange brown mottling, soft SILT, some fine sand to 9.8', then wet, purplish–gray CLAY, some silt, trace fine sand				
9										
10						Bottom of boring 10'				
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING B-31
PAGE 1 OF 1

CLIENT: GM - Inland Fisher Guide
PROJECT LOCATION: Ley Creek, Factory Ave.
Syracuse, NY
FILE NO.: 3247.078

SAMPLER: Split Spoon
HAMMER: 140 lbs
FALL: 30"

LOCATION: ~450' West of Outfall
START DATE: 7/21/92
END DATE: 7/21/92

BORING COMPANY: Parratt-Wolff, Inc.
FOREMAN: Barney Waters
OBG GEOLOGIST: Tim Eddy

LEGEND: ☐ Grout ▨ Sand Pack ■ Pellets == Screen ☐ Riser

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING PID	FIELD TESTING HEAD-SPACE
0	1	0–2	2–3–7–10	2'/1'	10	Moist, brown, stiff SILT, grading to dark brown–black at 1.5', trace ceramic at 0.5', trace brick at 1', little fine sand				
1										
2	2	2–4	7–10– 10–12	2'/1.3'	20	As above, black discoloration, trace weathered cement, trace medium gravel				
3										
4	3	4–6	6–45– 13–5	2'/0.3'	58	Dry, gray WOOD piece				
5										
6	4	6–8	6–7– 11–10	2'/1.1'	18	Moist, black, stiff CLAY, some silt, trace fine to medium sand and wood, grading to olive brown, fine, silty SAND at 7.6'				
7										
8	5	8–10	6–4–5–3	2'/1.7'	9	Moist, black, stiff SILT, some clay, trace fine sand and stringy material (wood, rope?) to 8.7', then grayish brown with purple tinge, fine SAND, some silt, wet at 8.7'				
9										
10						Bottom of boring 10'				
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING B-32
PAGE 1 OF 1

CLIENT: GM - Inland Fisher Guide
PROJECT LOCATION: Ley Creek
Factory Ave.
FILE NO.: 3247.078

SAMPLER: Split Spoon
HAMMER: 140 lbs
FALL: 30"

LOCATION: ~15 ft. East of B-31
START DATE: 7/23/92
END DATE: 7/23/92

BORING COMPANY: Parratt-Wolff, Inc.
FOREMAN: Mark Beck
OBG GEOLOGIST: Tim Eddy

LEGEND:
▨ Grout
▨ Sand Pack
■ Pellets
== Screen
☐ Riser

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING	
									PID	HEAD-SPACE
0	1	0-2	3-4-5-7	2'/1'	9	Brown, wet, medium stiff CLAY, little silt, grading to blackish dark brown silt, little clay, trace organics, trace ceramic pieces				
1										
2	2	2-4	4-3-4-3	2'/0	7	No sample recovery Black stained, drill cuttings at ~ 3 ft.				
3										
4	3	4-6	2-1-3-4	2'/1.5'	4	Wet, soft, brown with black stained mottled appearance, odorous, SILT, little clay, trace fine sand, trace organics				
5										
6	4	6-8	8-6-7-7	2'/1.4'	13	Brown with purplish and olive hues, moist, silty, fine SAND, sorted				
7										
8	5	8-10	4-3-	2'/2'	3	As above, to 9.5 ft., then, very soft, brown purple, wet SILT, little fine sand, little clay				
			WOH-2							
9										
10						Bottom of boring 10'	10'			
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

WOH – Weight of Hammer

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING B-33
PAGE 1 OF 1

CLIENT: GM - Inland Fisher Guide
PROJECT LOCATION: Ley Creek
Factory Ave.
FILE NO.: 3247.078

SAMPLER: Split Spoon
HAMMER: 140 lbs
FALL: 30"

LOCATION: ~15 ft. West of B-31
START DATE: 7/23/92
END DATE: 7/23/92

BORING COMPANY: Parratt-Wolff, Inc.
FOREMAN: Mark Beck
OBG GEOLOGIST: Tim Eddy

LEGEND: ░ Grout ▒ Sand Pack ■ Pellets ═ Screen ☐ Riser

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING	
									PID	HEAD-SPACE
0	1	0-2	2-3-6-7	2'/2'	9	Moist, brown, medium stiff SILT, little fine sand, trace clay, trace organics, black stained at 2 ft.				
1										
2	2	2-4	3-4-4-4	2'/1'	8	Moist, black stained and brown, medium stiff, SILT, little fine sand, trace clay				
3										
4	3	4-6	3-16-5-4	2'/1.4'	21	Moist, brown, stiff SILT, some clay, little fine sand, trace organics, blackish green wood pieces in tip of spoon at 5.8 ft.				
5										
6	4	6-8	3-4-10-9	2'/0.5'	14	Moist, brown, stiff, fine sandy SILT				
7										
8	5	8-10	5-4-5-4	2'/2'	9	Wet, brown-purple, fine sandy SILT, somewhat stratified, poorly sorted				
9										
10						Bottom of boring 10'				
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING B-34
PAGE 1 OF 1

CLIENT: GM - Inland Fisher Guide
PROJECT LOCATION: Ley Creek
Factory Ave.
FILE NO.: 3247.078

SAMPLER: Split Spoon
HAMMER: 140 lbs
FALL: 30"

LOCATION:
START DATE: 7/24/92
END DATE: 7/24/92

BORING COMPANY: Parratt-Wolff, Inc.
FOREMAN: Mark Beck
OBG GEOLOGIST: Tim Eddy

LEGEND: ░ Grout ▒ Sand Pack ■ Pellets == Screen ☐ Riser

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING	
									PID	HEAD-SPACE
0	1	0-2	2-4-6-14	2'/2'	10	Brown, stiff, moist SILT, little fine sand, trace fine gravel, trace clay, trace organics				
1										
2	2	2-4	10-10-	2'/2'	19	Brown-dark brown, mottled appearance, moist, stiff SILT, some fine sand, trace clay, trace wood at 4 ft.				
			9-10							
3										
4	3	4-6	2-3-3-3	2'/0.6'	6	Dark brown, moist, medium stiff SILT, little clay, little fine sand, 1" green layer at 4.6'				
5										
6	4	6-8	6-7-7-9	2'/0.9'	14	Very moist, brown, medium stiff CLAY, some silt, little fine sand to 6.5', then gray grading to purplish silty fine sand				
7										
8	5	8-10	3-3-2-2	2'/2'	5	Brown with purplish hue, wet, loose, silty fine SAND to 9.5', then silt with some fine sand				
9										
10						Bottom of Boring 10'				
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING B-35
PAGE 1 OF 1

CLIENT: GM - Inland Fisher Guide
PROJECT LOCATION: Ley Creek
Factory Ave.
FILE NO.: 3247.078

SAMPLER: Split Spoon
HAMMER: 140 lbs
FALL: 30"

LOCATION:
START DATE: 7/24/92
END DATE: 7/24/92

BORING COMPANY: Parratt-Wolff, Inc.
FOREMAN: Mark Beck
OBG GEOLOGIST: Tim Eddy

LEGEND: ▨ Grout ▨ Sand Pack ■ Pellets == Screen ☐ Riser

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING	
									PID	HEAD-SPACE
0	1	0-2	1-3-4-6	2'/0.7'	7	Moist, dark brown, medium stiff SILT, little clay grading to interbedded brown SILT and orangish fine SAND layers at 4.5', trace medium to coarse gravel				
1										
2	2	2-4	9-6-7-9	2'/2'	13	Moist, dark brown, stiff SILT, little fine sand, trace clay, small mottled areas of orange fine sand				
3										
4	3	4-6	6-8-8-7	2'/0.8'	16	Moist, purplish-brown-orange, medium dense, silty, fine SAND				
5										
6	4	6-8	6-4-4-4	2'/2'	8	As above to 6.5', then wet, orange-brown mottled appearance, fine SAND, some silt, grading to olive green SILT, little fine sand, trace clay at 7.5'				
7										
8						Bottom of boring 8.0'				
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING B-36
PAGE 1 **OF** 1

CLIENT: GM - Inland Fisher Guide
PROJECT LOCATION: Ley Creek, Factory Ave.
FILE NO.: 3247.078.222

SAMPLER: 2" Split Spoon
HAMMER: 140 lbs
FALL: 30"

LOCATION: Approximately 75 ft. West of outfall
START DATE: 12/4/92
END DATE: 12/4/92

BORING COMPANY: Parratt-Wolff, Inc.
FOREMAN: Barney Waters
OBG GEOLOGIST: Timothy M. Eddy

LEGEND:

☐	Grout	==	Screen
▨	Sand Pack	☐	Riser
■	Pellets		

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING PID	FIELD TESTING HEAD-SPACE
0	1	0–2	WOH–3– 3–6	2'/0.5'	6	Moist, brown, medium stiff SILT, trace clay, trace fine sand, organics in first 3"				
1										
2	2	2–4	6–8–8–9	2'/1.2'	16	Moist, brown–orange, trace black mottled, appearance, stiff SILT, trace fine sand, trace clay				
3										
4	3	4–6	4–5–5–6	2'/2'	10	Moist, dark brown with olive green and slight blackish appearance, mottled, possible layering, medium stiff SILT, grading to purplish with olive mottling, moist at 5.7 ft., trace fine sand				
5										
6	4	6–8	4–5–8–8	2'/1'	13	As above to 6.4 ft., then moist, brown–gray SILT, little fine sand, trace clay				
7										
8	5	8–10	4–4–5–5	2'/0.9'	9	As above to 8.3 ft., then wet, reddish brown, medium stiff SILT, little fine to medium sand, trace clay, blackish band at 8.7 ft.				
9										
10	6	10–12	WOH–3– 3–3	2'/2'	6	Wet, brownish–purple olive brown mottled appearance, soft SILT, little fine sand, trace clay				
11										
12						Bottom of boring 12 ft.				
13										
14										
15										
16										
17										
18										
19										
20										

WOH – weight of hammer

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING B–37
PAGE 1 OF 1

CLIENT: GM - Inland Fisher Guide
PROJECT LOCATION: Ley Creek, Factory Ave.
FILE NO.: 3247.078.222

SAMPLER: 2" Split Spoon
HAMMER: 140 lbs
FALL: 30"

LOCATION: Approximately 50 ft. West of B–36
START DATE: 12/4/92
END DATE: 12/4/92

BORING COMPANY: Parratt–Wolff, Inc.
FOREMAN: Barney Waters
OBG GEOLOGIST: Timothy M. Eddy

LEGEND:
☐ Grout
▨ Sand Pack
■ Pellets
▬ Screen
☐ Riser

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING	
									PID	HEAD-SPACE
0	1	0–2	WOH–2–	2'/1'	7	Moist, brown, medium stiff SILT, little fine sand, trace organics				
			5–5							
1										
2	2	2–4	6–6–9–9	2'/1'	15	As above, some bright orange, blackish brown mottled appearance at 3.3 ft., ceramic piece at 2.5 ft.				
3										
4	3	4–6	3–4–5–3	2'/1'	9	As above to 5 ft., then moist, black appearance				
5										
6	4	6–8	3–4–3–3	2'/2'	7	Moist, black, medium stiff SILT, some fine sand, trace clay, odorous				
7										
8	5	8–10	3–3–3–4	2'/2'	6	Saturated, black, soft SILT, little fine sand to 9.2 ft., then wet, brown, orangish–olive green mottled SILT, little fine to medium sand, little purplish hue at 10 ft.				
9										
10	6	10–12	WOH–WOH–	2'/2'	WOH	Wet, orange–brown purplish hue with 1/8" vertically oriented conduit, very soft SILT, trace fine sand				
			WOH–4							
11										
12						Bottom of boring 12 ft.				
13										
14										
15										
16										
17										
18										
19										
20										

WOH – weight of hammer

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING B-38
PAGE 1 OF 1

CLIENT: GM - Inland Fisher Guide
PROJECT LOCATION: Ley Creek, Factory Ave.
FILE NO.: 3247.078.222

SAMPLER: 2" Split Spoon
HAMMER: 140 lbs
FALL: 30"

LOCATION: Approximately 50 ft. West of B-37
START DATE: 12/4/92
END DATE: 12/4/92

BORING COMPANY: Parratt-Wolff, Inc.
FOREMAN: Barney Waters
OBG GEOLOGIST: Timothy M. Eddy

LEGEND: ░ Grout ▒ Sand Pack ▓ Pellets == Screen ☐ Riser

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING PID	HEAD-SPACE
0	1	0-2	WOH-3-	2'/1'	7	Moist, brown-orange brown, purplish hue SILT, little fine sand, trace clay, trace organics				
			4-6							
1										
2	2	2-4	5-5-5-7	2'/1'	10	As above to 3 ft., then moist, grayish brown, trace organics				
3										
4	3	4-6	2-3-4-5	2'/2'	7	Moist, black-grayish, medium stiff SILT, little fine sand, trace clay				
5										
6	4	6-8	4-6-5-6	2'/1.3'	11	Moist, brown with purplish hue, some banding SILT, some fine to medium sand				
7										
8						Bottom of boring 8 ft.				
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

WOH - weight of hammer

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING B-39
PAGE 1 OF 1

CLIENT: GM - Inland Fisher Guide

PROJECT LOCATION: Ley Creek, Factory Ave.

FILE NO.: 3247.078.222

SAMPLER: 2" Split Spoon

HAMMER: 140 lbs

FALL: 30"

LOCATION: Approximately 25 ft. East of B-38

START DATE: 12/4/92
END DATE: 12/4/92

BORING COMPANY: Parratt-Wolff, Inc.
FOREMAN: Barney Waters
OBG GEOLOGIST: Timothy M. Eddy

LEGEND:
☐ Grout
▨ Sand Pack
■ Pellets
== Screen
☐ Riser

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING	
									PID	HEAD-SPACE
0	1	0-2	3-4-5-7	2'/2'	9	Moist, brown, orange and purplish hue mottling, medium stiff SILT, little fine sand, trace clay				
1										
2	2	2-4	6-7-6-8	2'/1'	13	As above, blackish banding at 3.2 ft.				
3										
4	3	4-6	2-2-3-6	2'/2'	5	Moist, dark brown-blackish, medium stiff SILT, litte fine to medium sand				
5										
6	4	6-8	4-8-9-11	2'/1'	17	As above to 6.8 ft., then light brown-tannish SILT, some fine to medium sand				
7										
8	5	8-10	3-4-6-7	2'/2'	10	Wet at 9.5 ft., brown-orange purplish hue SILT, little fine sand				
9										
10						Bottom of boring 10 ft.				
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING B-40
PAGE 1 **OF** 1

CLIENT: GM - Inland Fisher Guide
PROJECT LOCATION: Ley Creek, Factory Ave.
FILE NO.: 3247.078.222

SAMPLER: 2" Split Spoon
HAMMER: 140 lbs
FALL: 30"

LOCATION: 12.5 ft. E of B-39
12.5 ft. W of B-37
START DATE: 12/4/92
END DATE: 12/4/92

BORING COMPANY: Parratt-Wolff, Inc.
FOREMAN: Barney Waters
OBG GEOLOGIST: Timothy M. Eddy

LEGEND:
░ Grout
▒ Sand Pack
■ Pellets
▬ Screen
☐ Riser

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING PID	FIELD TESTING HEAD-SPACE
0	1	0-2	WOH-2-	2'/1.5'	7	Moist, brown, medium stiff SILT, trace fine sand, trace organics				
			5-7							
1										
2	2	2-4	4-5-8-8	2'/2'	13	As above, dark brown to light brown mottled appearance, trace organics at 4 ft.				
3										
4	3	4-6	3-5-6-6	2'/2'	11	Moist, brown-dark brown, medium stiff SILT, trace fine sand, organics throughout, light brown, fine sandy zone at 5.3 to 5.5 ft.				
5										
6	4	6-8	7-11-9-7	2'/1'	20	As above to 7.5 ft., then wet, light brown-tannish SILT, some fine to medium sand				
7										
8	5	8-10	4-6-8-6	2'/2'	14	Wet, purplish hue grading to orange-brown-purplish mottled appearance, stiff SILT, little fine sand				
9										
10						Bottom of boring 10 ft.				
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

WOH - weight of hammer

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING B-41
PAGE 1 OF 1

CLIENT: GM - Inland Fisher Guide
PROJECT LOCATION: Ley Creek, Factory Ave.
FILE NO.: 3247.078.222

SAMPLER: 2" Split Spoon
HAMMER: 140 lbs
FALL: 30"

LOCATION: Approximately 25 ft. West of B-38
START DATE: 12/4/92
END DATE: 12/4/92

BORING COMPANY: Parratt-Wolff, Inc.
FOREMAN: Barney Waters
OBG GEOLOGIST: Timothy M. Eddy

LEGEND: ▨ Grout ▨ Sand Pack ■ Pellets ▬ Screen ☐ Riser

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING	
									PID	HEAD-SPACE
0	1	0-2	WOH-3- 4-4	2'/2'	7	Moist, brown-light brown, mottled appearance, medium stiff SILT, little fine sand, trace clay, trace organics				
1										
2	2	2-4	7-8-9-9	2'/1.9'	17	As above, less mottling effect, stiff				
3										
4	3	4-6	2-3-5-6	2'/2'	8	Moist, blackish, brown, thin interbedded black layers, medium stiff SILT, little fine sand				
5										
6	4	6-8	6-7-6-4	2'/1'	13	As above grading to brown with orange tinge SILT, little fine to medium sand at 6.8 ft.				
7										
8	5	8-10	7-8-8-9	2'/2'	16	Wet, brown-olive brown-purplish hue SILT, little fine sand				
9										
10						Bottom of boring 10 ft.				
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

WOH - weight of hammer

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING B-42
PAGE 1 OF 1

CLIENT: GM - Inland Fisher Guide
PROJECT LOCATION: Ley Creek, Factory Ave.
FILE NO.: 3247.078.222

SAMPLER: 2" Split Spoon
HAMMER: 140 lbs
FALL: 30"

LOCATION: Approximately 25 ft. West of B-41
START DATE: 12/4/92
END DATE: 12/4/92

BORING COMPANY: Parratt-Wolff, Inc.
FOREMAN: Barney Waters
OBG GEOLOGIST: Timothy M. Eddy

LEGEND: ░ Grout ▒ Sand Pack ■ Pellets == Screen □ Riser

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING	
									PID	HEAD-SPACE
0	1	0-2	2-3-5-5	2'/1.3'	8	Moist, brown-dark brown-purplish hue mottled appearance, stiff SILT, little fine sand, trace clay				
1										
2	2	2-4	5-6-6-6	2'/2'	12	As above grading to orange color at 2.8 ft., the olive brown-black at 3.5 ft.				
3										
4	3	4-6	2-2-3-3	2'/1.3'	5	Moist, brown and black, thin interbedded black layers, medium stiff SILT, little fine sand, trace organics				
5										
6	4	6-8	6-5-6-5	2'/1'	11	As above, interbedding not as prevalent, trace clay, grading to moist, brown SILT, some fine to medium sand at 6.8 ft.				
7										
8	5	8-10	3-5-3-3	2'/2'	8	As above to 8.4 ft., then wet, brown, medium stiff SILT, little fine sand				
9										
10						Bottom of boring 10 ft.				
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING B-43
PAGE 1 OF 1

CLIENT: GM - Inland Fisher Guide
PROJECT LOCATION: Ley Creek, Factory Ave.
FILE NO.: 3247.078.222

SAMPLER: 2" Split Spoon
HAMMER: 140 lbs
FALL: 30"

LOCATION: ~ 25 ft. West of B-42
~ 35 ft. East of B-30
START DATE: 12/4/92
END DATE: 12/4/92

BORING COMPANY: Parratt-Wolff, Inc.
FOREMAN: Barney Waters
OBG GEOLOGIST: Timothy M. Eddy

LEGEND: ▨ Grout ▒ Sand Pack ■ Pellets ▬ Screen ☐ Riser

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING PID	FIELD TESTING HEAD-SPACE
0	1	0-2	2-3-3-4	2'/2'	6	Moist, brown, medium stiff SILT, little fine sand, trace clay, trace organics				
1										
2	2	2-4	5-4-5-6	2'/1.5'	9	As above with root system, orange-brown color at 3.5 ft., blackish at 3.8 ft.				
3										
4	3	4-6	3-3-4-5	2'/2'	7	Moist, blackish brown mottled appearance, medium stiff SILT, little fine sand, trace clay				
5										
6	4	6-8	WOH-6- 6-6	2'/1'	12	AS above to 6.9 ft., then orangish brown, stiff SILT, some fine to medium sand				
7										
8	5	8-10	3-5-7-6	2'/1.3'	12	Wet, brownish-purplish hue with olive green SILT, little fine sand				
9										
10						Bottom of boring 10 ft.				
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

WOH - weight of hammer

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING OBG-6M
PAGE 1 OF 1

CLIENT: GM - Inland Fisher Guide
PROJECT LOCATION: Ley Creek
Factory Ave.
FILE NO.: 3247.078

SAMPLER: Split Spoon
HAMMER: 140 lbs
FALL: 30"

LOCATION:
START DATE: 7/22/92
END DATE: 7/22/92

BORING COMPANY: Parratt-Wolff, Inc.
FOREMAN: Mark Beck
OBG GEOLOGIST: Tim Eddy

LEGEND:
- ▨ Grout
- ▨ Sand Pack
- ■ Pellets
- ▬ Screen
- ☐ Riser

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING PID	HEAD-SPACE
0	1	0-2	3-4-5-5	2'/0.8'	9	Moist, brown, stiff SILT, little fine sand, trace clay, trace organics				
1										
2	2	2-4	5-5-4-4	2'/1'	9	Moist, brown, medium dense, fine to medium SAND, little silt, black staining at 2.3 ft. Brown, stiff, silt, little clay at 2.7 ft.				
3										
4	3	4-6	1-2-3-3	2'/0.8'	5	Moist, dark brown, soft SILT, little clay, trace fine sand, grading to black mottled appearance at 4.8'				
5										
6	4	6-8	3-2-2-2	2'/2'	4	Moist, dark brown with black, soft, SILT, little clay, trace fine sand, trace sub rounded medium gravel, trace organics				
7										
8	5	8-10	WOH-2- 3-3	2'/2'	5	As above				
9										
10	6	10-12'	WOH- WOH-2-1	2'/2'	2	Wet at 10 ft. As above to 11 ft., then, fine to medium light gray sand with darker bands grading to dark brown black fine sand, some silt				
11										
12						Bottom of boring 12'				
13										
14										
15										
16										
17										
18										
19										
20										

WOH - Weight of Hammer

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING B-6M
PAGE 1 OF 1

CLIENT: GM - Inland Fisher Guide
PROJECT LOCATION: Ley Creek
Factory Ave.
FILE NO.: 3247.078

SAMPLER: Split Spoon
HAMMER: 140 lbs
FALL: 30"

LOCATION:
START DATE: 7/22/92
END DATE: 7/22/92

BORING COMPANY: Parratt-Wolff, Inc.
FOREMAN: Mark Beck
OBG GEOLOGIST: Tim Eddy

LEGEND: ▨ Grout ▨ Sand Pack ■ Pellets == Screen ☐ Riser

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING	
									PID	HEAD-SPACE
0	1	0-2	2-1-2-2	2'/0.5'	3	Moist, brown to dark brown, soft SILT, little fine sand, trace clay, trace organics				
1										
2	2	2-4	1-3-2-3	2'/0.6'	5	As above, some fine sand to 3 ft., then purplish gray SILT, trace fine sand, trace clay				
3										
4	3	4-6	2-3-7-5	2'/1.8'	10	Moist, dark brown, orange stiff SILT, little organics (peat?) to 5.2 ft., then gray brown, fine sand, silt, trace clay				
5										
6	4	6-8	4-3-3-3	2'/1.5'	6	As above to 6.4 ft., then gray olive, moist, medium stiff, clay, some silt				
7										
8	5	8-10	WOH-3-3-3	2'/1.3'	6	Very moist, brown gray to dark brown SILT, some clay, trace fine sand, some layering Wet at 9.8 ft.				
9										
10	6	10-12	WOH-WOH-1-2	2'/1.8'	1	Wet, brown gray, purple, very soft CLAY, some silt, trace organics				
11										
12						Bottom of borinf 12'				
13										
14										
15										
16										
17										
18										
19										
20										

WOH – Weight of Hammer

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING OBG-3D/ OBG-3DM
PAGE 1 OF 2

CLIENT: GM - Inland Fisher Guide
PROJECT LOCATION: Ley Creek
Factory Ave.
FILE NO.: 3247.078

SAMPLER: Split Spoon
HAMMER: 140 lbs
FALL: 30"

LOCATION:
START DATE: 7/23/92
END DATE: 7/24/92

BORING COMPANY: Parratt-Wolff, Inc.
FOREMAN: Mark Beck
OBG GEOLOGIST: Tim Eddy

LEGEND:
▨ Grout
▨ Sand Pack
■ Pellets
== Screen
☐ Riser

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING	
									PID	HEAD-SPACE
0	1	0–2	WOH-	2'/1'	8	Moist, brown, medium stiff SILT, little clay, trace organics, black streaks				
			4-4-5							
1										
2	2	2–4	3-3-6-7	2'/1.3'	9	Moist, brown–dark brown from 2.3–2.9', medium stiff SILT, little clay, little fine sand, grading to grayish color at 3'				
3										
4	3	4–6	3-4-3-4	2'/2'	7	Very moist, brown–orange brown, fine, sandy SILT, trace clay				
5										
6	4	6–8	4-5-5-10	2'/2'	10	Wet, brown–orange purple hue, medium stiff SILT, little fine sand, trace clay				
7										
8	5	8–10	WOH-WOH	2'/1'	2	Wet, brown–purple, very soft CLAY, little silt, grading to some silt at 8.7'				
			-2-1							
9										
10	6	10–12	WOH-WOH-	2'/2'	0	Wet, purplish–gray, very soft CLAY, trace silt				
			WOH-WOH							
11										
12	7	12–14	WOH-WOH-	2'/1.4'	0	Wet, grayish with purple hue, very soft CLAY				
			WOH-WOH							
13										
14	8	14–16	WOH-WOH-	2'/2'	0	As above				
			WOH-WOH							
15										
16	9	16–18	WOH-WOH-	2'/2'	0	As above				
			WOH-WOH							
17										
18	10	18–20	WOH-WOH-	2'/2'	0	As above to 18.7', then interbedded thin layers of gray SILT				
			WOH-WOH							
19										

WOH – Weight of Hammer

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING OBG-3D/ OBG-3DM
PAGE 2 OF 2

CLIENT: GM - Inland Fisher Guide
PROJECT LOCATION: Ley Creek
Factory Ave.
FILE NO.: 3247.078

SAMPLER: Split Spoon
HAMMER: 140 lbs
FALL: 30"

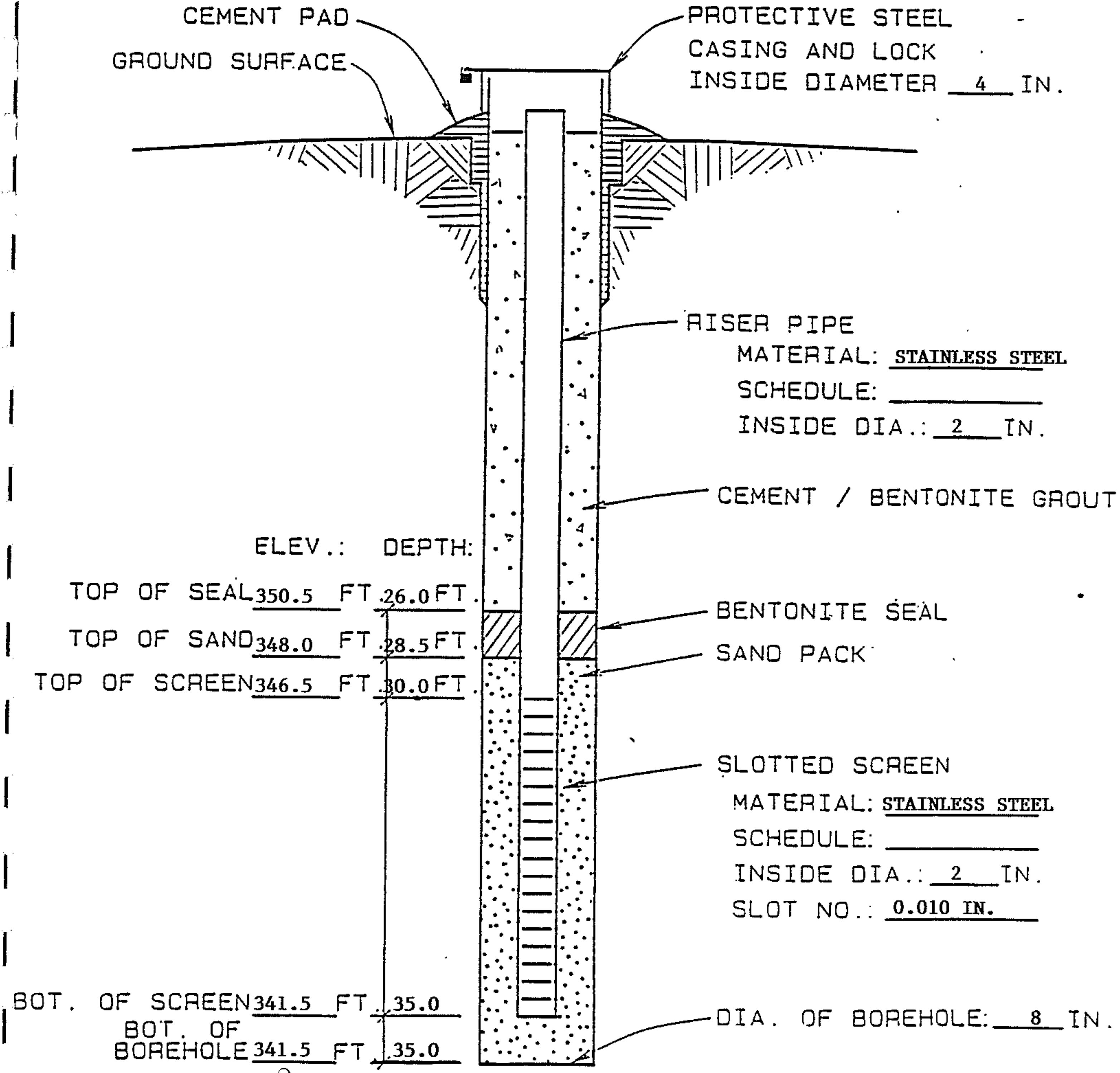
LOCATION:
START DATE: 7/23/92
END DATE: 7/24/92

BORING COMPANY: Parratt-Wolff, Inc.
FOREMAN: Mark Beck
OBG GEOLOGIST: Tim Eddy

LEGEND: ▨ Grout ▨ Sand Pack ■ Pellets == Screen ☐ Riser

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING PID	HEAD-SPACE
20	11	20–22	WOH–	2'/2'	0	Wet, grayish purple hues, very soft CLAY,				
			WOH–			little silt, grading to gray clay at 21.7'				
21			WOH–3							
22	12	22–24	WOH–1–	2'/2'	2	Wet, gray, very soft SILT, little clay,				
			1–WOH			trace fine sand				
23										
24	13	24–26	1–WOH–	2'/1'	1	As above to 25.8', then reddish, fine to				
			1–WOH			coarse, clayey SAND, little silt, little fine				
25						to medium gravel				
26	14	26–28	1–7–	2'/1.3'	19	Wet, grayish, medium dense, fine to coarse				
			12–12			SAND, little silt to 27', then moist, reddish,				
27						stiff SILT, little fine sand, little fine to				
						coarse gravel, trace clay, poorly sorted,				
28	15	28–30	3–16–	2'/1.3'	45	non–stratified				
			29–30			Moist, red, very stiff SILT, some fine sand,				
29						little fine to medium gravel, poorly sorted,				
						non–stratified				
30	16	30–32	12–18–	2'/1.2'	36	As above, trace of cobble				
			18–20							
31										
32	17	32–34	45–48–	2'/1'	99	As above				
			51–45							
33										
34	18	34–35.5	30–32–55	1.5/1.5'	87	As above to 35.5', then green SHALE				
35										
						Bottom of boring 35.5'				
36										
37										
38										
39										
40										

WOH – Weight of Hammer



PROTECTIVE STEEL CASING AND LOCK INSIDE DIAMETER 4 IN.

RISER PIPE
MATERIAL: STAINLESS STEEL
SCHEDULE: ______
INSIDE DIA.: 2 IN.

SLOTTED SCREEN
MATERIAL: STAINLESS STEEL
SCHEDULE: ______
INSIDE DIA.: 2 IN.
SLOT NO.: 0.010 IN.

DIA. OF BOREHOLE: 8 IN.

	ELEV.:	DEPTH:
TOP OF SEAL	350.5 FT	26.0 FT
TOP OF SAND	348.0 FT	28.5 FT
TOP OF SCREEN	346.5 FT	30.0 FT
BOT. OF SCREEN	341.5 FT	35.0
BOT. OF BOREHOLE	341.5 FT	35.0

344.48 according to field log (2.98' diff)

TYPICAL OVERBURDEN MONITORING WELL

N.T.S.

GM – IFG LEY CREEK
OBG–3D

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING MW-9D
PAGE 1 OF 2

CLIENT: GM - Inland Fisher Guide
PROJECT LOCATION: Ley Creek
Factory Ave.
FILE NO.: 3247.078

SAMPLER: Split Spoon
HAMMER: 140 lbs
FALL: 30"

LOCATION:
START DATE: 7/21/92
END DATE: 7/21/92

BORING COMPANY: Parratt-Wolff, Inc.
FOREMAN: Mark Beck
OBG GEOLOGIST: Tim Eddy

LEGEND:
▨ Grout
▨ Sand Pack
■ Pellets
== Screen
☐ Riser

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING	
									PID	HEAD-SPACE
0	1	0–2	WOH–2–	2'/1.8'	6	Moist, dark brown, medium stiff SILT, little clay, trace fine sand				
			4–5							
1										
2	2	2–4	4–4–6–4	2'/0.6'	10	As above, some orange mottling 0.3' of black wood at tip of spoon				
3										
4	3	4–6	WOH	2'/1.8'	—	Moist, very soft, dark brown with orange tinge SILT, decayed organics, poorly formed peat				
5										
6	4	6–8	WOH	2'/2'	—	Wet, blackish gray, very loose, fine to coarse SAND grading to soft purplish gray clay, little silt				
7										
8	5	8–10	WOH	2'/2'	—	Wet, very soft, grayish with purple hue CLAY, little silt				
9										
10	6	10–12'	WOH	2'/2'	—	As above				
11										
12	7	12–14'	WOH	2'/2'	—	As above				
13										
14	8	14–16'	WOH–5–	2'/2'	11	As above to 15.8', then medium dense, fine to medium SAND, some silt, trace fine to medium gravel				
			6–5							
15										
16	9	16–18'	3–7–8–9	2'/2'	15	As above				
17										
18	10	18–20'	6–14–	2'/2'	38	Wet, very dense, grayish with purple hue, fine to medium SAND to 19.2 ft., then hard, reddish, fine silty sand, trace greenish, angular shale				
			24–16							
19										
20	11	20–22'	WOH–	2'/2'	1	Wet, very loose, reddish, fine to medium SAND, some silt				
			1–1							

WOH – Weight of Hammer

O'BRIEN & GERE ENGINEERS, INC.

TEST BORING LOG

REPORT OF BORING MW-9D
PAGE 2 OF 2

CLIENT: GM - Inland Fisher Guide
PROJECT LOCATION: Ley Creek
Factory Ave.
FILE NO.: 3247.078

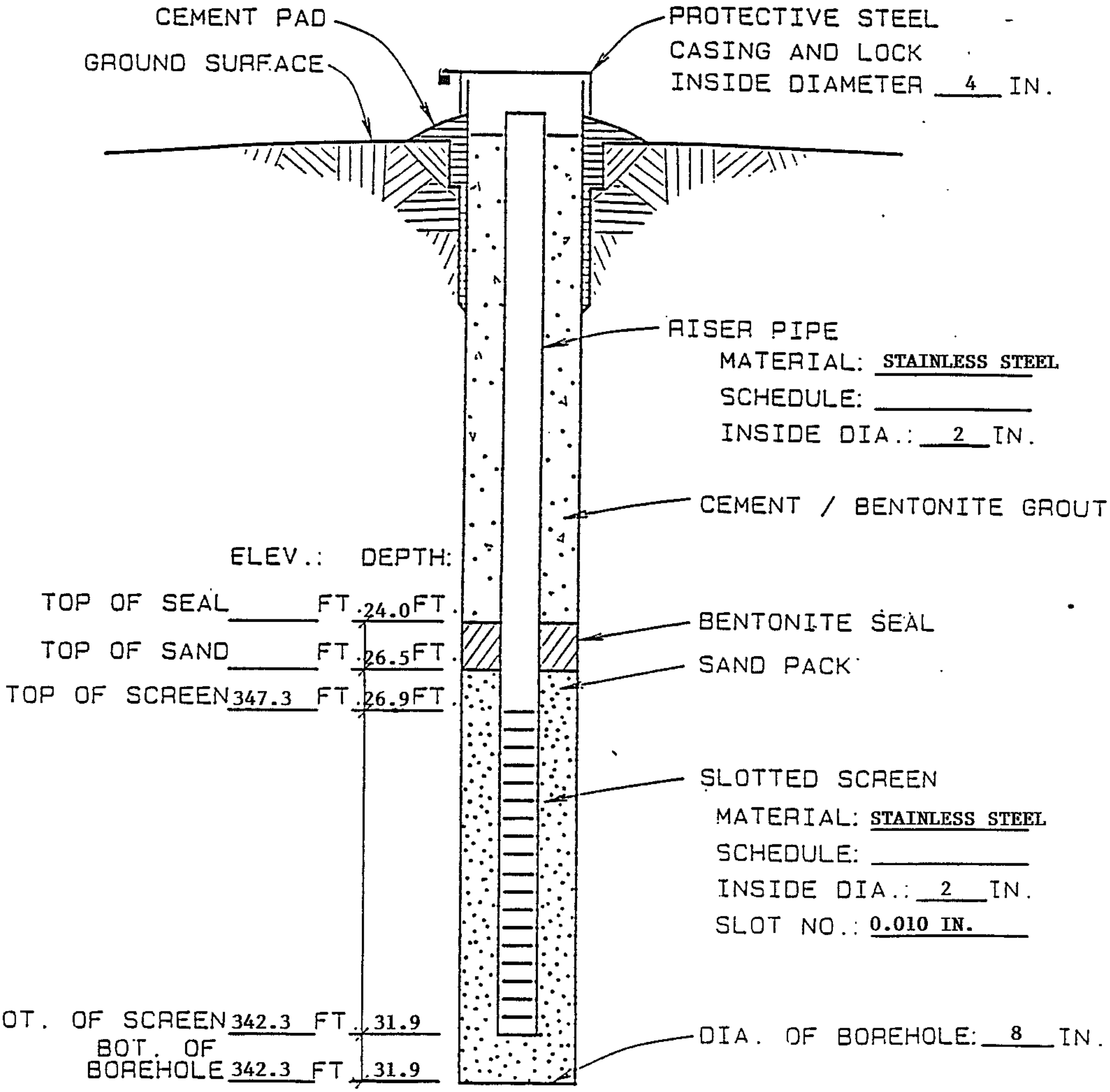
SAMPLER: Split Spoon
HAMMER: 140 lbs
FALL: 30"

LOCATION:
START DATE: 7/21/92
END DATE: 7/21/92

BORING COMPANY: Parratt-Wolff, Inc.
FOREMAN: Mark Beck
OBG GEOLOGIST: Tim Eddy

LEGEND:
▨ Grout
▨ Sand Pack
■ Pellets
== Screen
☐ Riser

DEPTH BELOW GRADE	NO.	DEPTH (FEET)	BLOWS /6"	PENETR/ RECOVERY	"N" VALUE	SAMPLE DESCRIPTION	STRATUM CHANGE GENERAL DESCRIPT	EQUIPMENT INSTALLED	FIELD TESTING	
									PID	HEAD-SPACE
22	12	22–24'	5–8–	2'/0.5'	19	Wet, stiff, green SILT, little fine to medium sand, trace gravel fragments, poorly sorted, non-stratified				
			11–15							
23										
24	13	24–26'	14–44–	1.4'/1'	94	Cobble fragment at 24 ft. Moist, green, hard SILT, some angular, fine to medium gravel, trace fine to medium gravel				
			50/0.4'							
25										
26	14	26–28'	38–14–	2'/2'	43	Very dense, gray–greenish tinge, fine to coarse SAND, little silt grading to red, dry, hard silt, little fine to medium angular shale pieces, trace clay at 27.8 ft.				
			29–26							
27										
28	15	28–30'	12–15–	2'/2'	31	Very moist, very stiff, red SILT, little fine to medium angular shale pieces, fissle appearance				
			16–24							
29										
30	16	30–31.9'	27–47–	1.9'/0.5'	64	Moist, green, hard, weathered SHALE, then competent green shale				
			17–50/0.4							
						Bottom of boring 31.9'				



PROTECTIVE STEEL CASING AND LOCK
INSIDE DIAMETER 4 IN.

RISER PIPE
MATERIAL: STAINLESS STEEL
SCHEDULE:
INSIDE DIA.: 2 IN.

SLOTTED SCREEN
MATERIAL: STAINLESS STEEL
SCHEDULE:
INSIDE DIA.: 2 IN.
SLOT NO.: 0.010 IN.

DIA. OF BOREHOLE: 8 IN.

	ELEV.:	DEPTH:
TOP OF SEAL	FT	24.0 FT
TOP OF SAND	FT	26.5 FT
TOP OF SCREEN	347.3 FT	26.9 FT
BOT. OF SCREEN	342.3 FT	31.9
BOT. OF BOREHOLE	342.3 FT	31.9

TYPICAL OVERBURDEN MONITORING WELL

N.T.S.

GM - IFG LEY CREEK

MW-9D

APPENDIX B

HYDRAULIC CONDUCTIVITY DATA

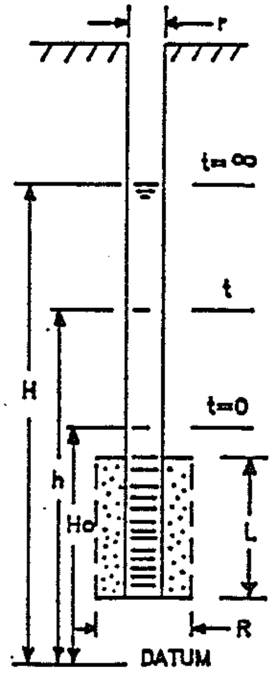
O'BRIEN & GERE

IN-SITU PERMEABILITY TEST
FIELD LOG

PROJECT GM-Fisher Guide
WELL NUMBER OBG-1
DATE 11/25/86

LOCATION Factory Ave, Syracuse
ELEVATION ______

SWL: 6.88' TOC (12/3/86)
4.37 GS



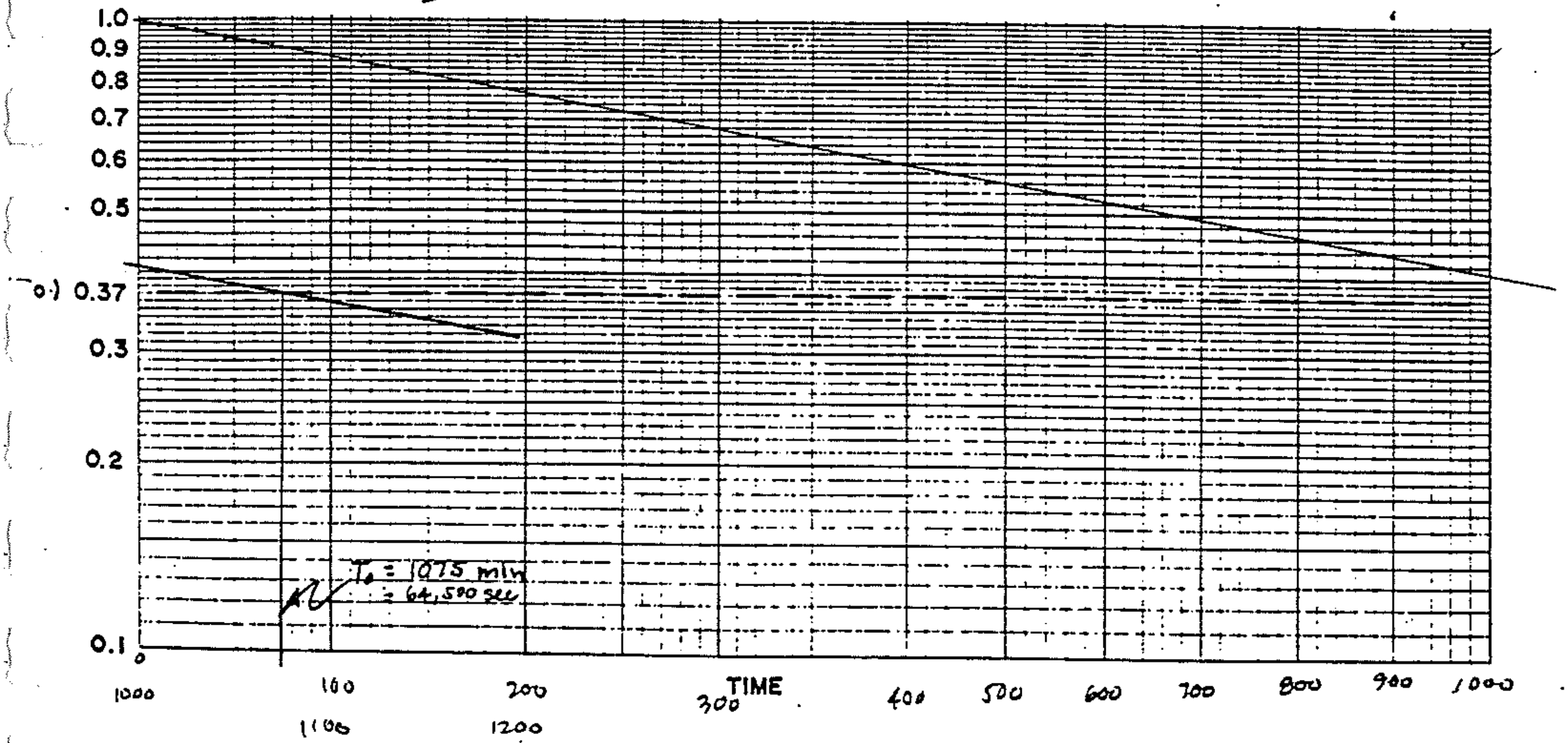
STATIC HEAD (H) 6.13
PIPE RADIUS (r) 0.167
SCREEN RADIUS (R) 0.667
SCREEN LENGTH (L) 5.0
INITIAL HEAD (Ho) 1.72
HYDRAULIC CONDUCTIVITY :

$$K=\frac{r^2 \ln(L/R)}{2LT_o}$$

$$K= 8.68 \times 10^{-8} \text{ ft/sec}$$

$$= 2.65 \times 10^{-6} \text{ cm/sec}$$

TIME	WATER DEPTH	t	h	$\frac{H-h}{H-Ho}$
4:11	11.29	0	1.72	1.0
4:12	11:29	1:00	1.72	1.0
4:13	11:27	2:00	1.74	0.99
4:15	11:25	4:00	1.76	0.99
4:21	11.24	10:00	1.77	0.98
4:41	11.12	30:00	1.89	0.96
4:56	10.98	45:00	2.03	0.93
4:11	10.92	60:00	2.09	0.92



O'BRIEN & GERE

IN–SITU PERMEABILITY TEST
FIELD LOG

PROJECT GM-Fisher Guide

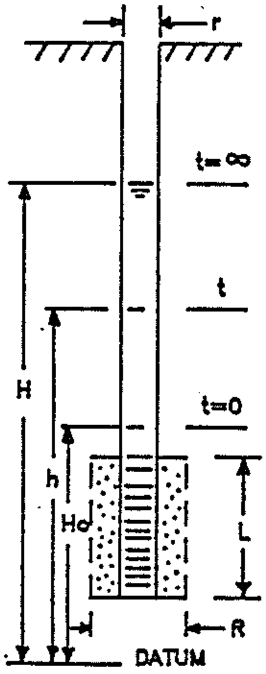
WELL NUMBER OBG-2

DATE 11/25/86

LOCATION Factory Ave, Syracuse

ELEVATION

SWL: 5.03' TOC (12/3/86)
2.03' GS



STATIC HEAD (H) 6.97

PIPE RADIUS (r) 0.167

SCREEN RADIUS (R) 0.167

SCREEN LENGTH (L) 5.0

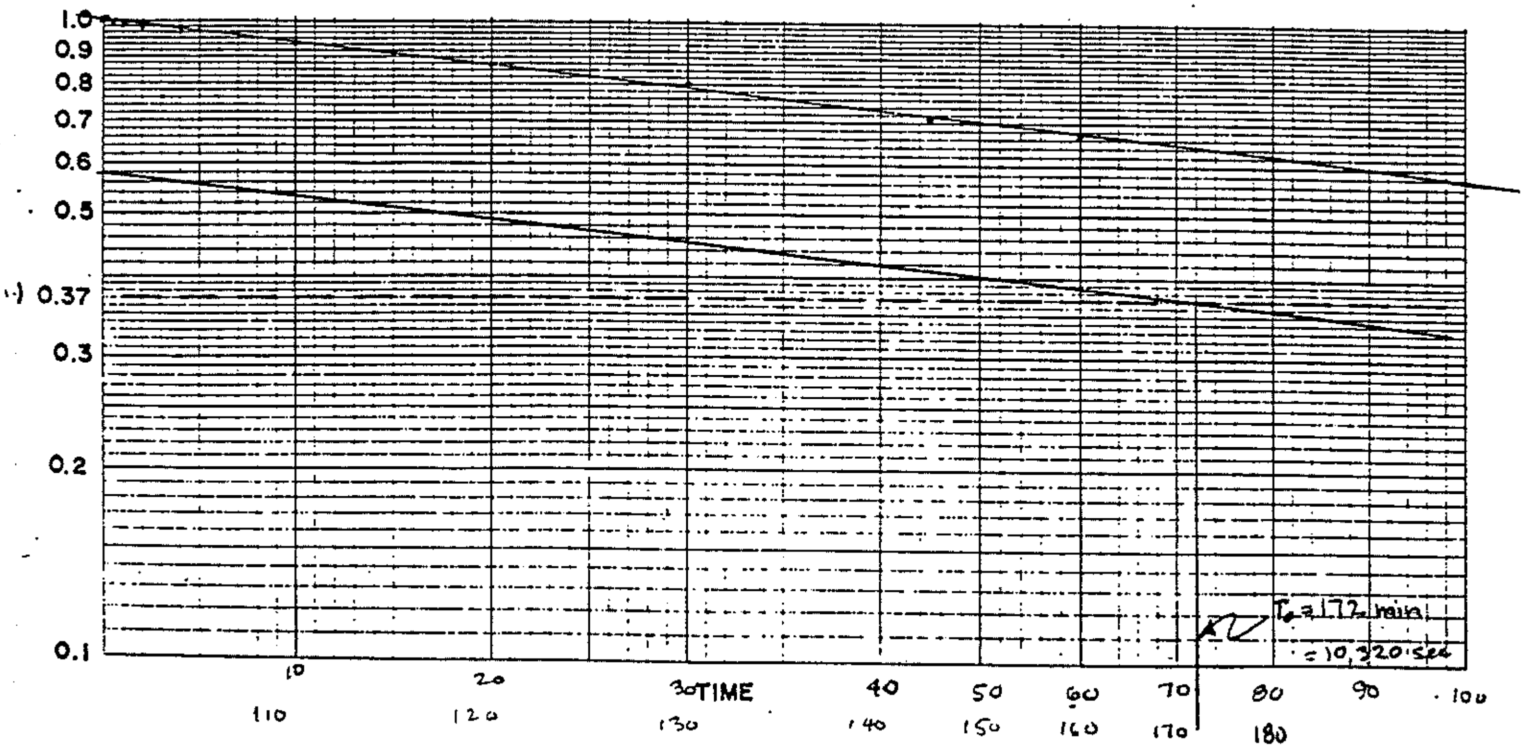
INITIAL HEAD (Ho) 3.21

HYDRAULIC CONDUCTIVITY :

$$K=\frac{r^2\ln(L/R)}{2LT_o}$$

K= 5.43 x10^{-7} ft/sec
= 1.66 x 10^{-5} cm/sec

TIME	WATER DEPTH	t	h	$\frac{H-h}{H-Ho}$
3:31:00	8.79	0	3.21	1.00
3:31:30	8.78	:30	3.22	0.99
3:32	8.73	1:00	3.27	0.98
3:33	8.71	2.00	3.29	0.97
3:35	8.66	4.00	3.34	0.96
3:41	8.50	10:00	3.50	0.92
3:46	8.40	15:00	3.60	0.89
3:51	8.28	20:00	3.72	0.86
4:01	8.05	30:00	3.95	0.80
4:16	7.72	45:00	4.28	0.71
4:31	7.56	60:00	4.44	0.67

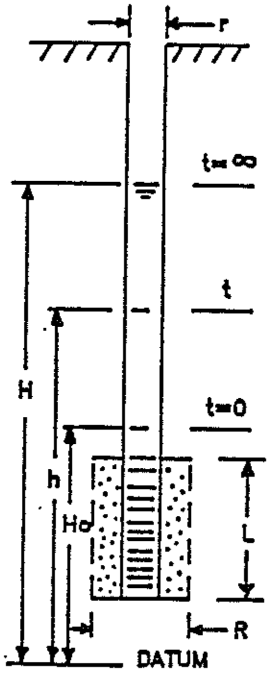


O'BRIEN & GERE

IN-SITU PERMEABILITY TEST
FIELD LOG

PROJECT GM- Fisher Guide
WELL NUMBER 0BG-3
DATE 11/25/86

LOCATION Syracuse NY
ELEVATION
SWL: 6.19' TOG (12/3/86)
3.57' GS



STATIC HEAD (H) 5.93

PIPE RADIUS (r) 0.167

SCREEN RADIUS (R) 0.667

SCREEN LENGTH (L) 5.0

INITIAL HEAD (Ho) 2.89

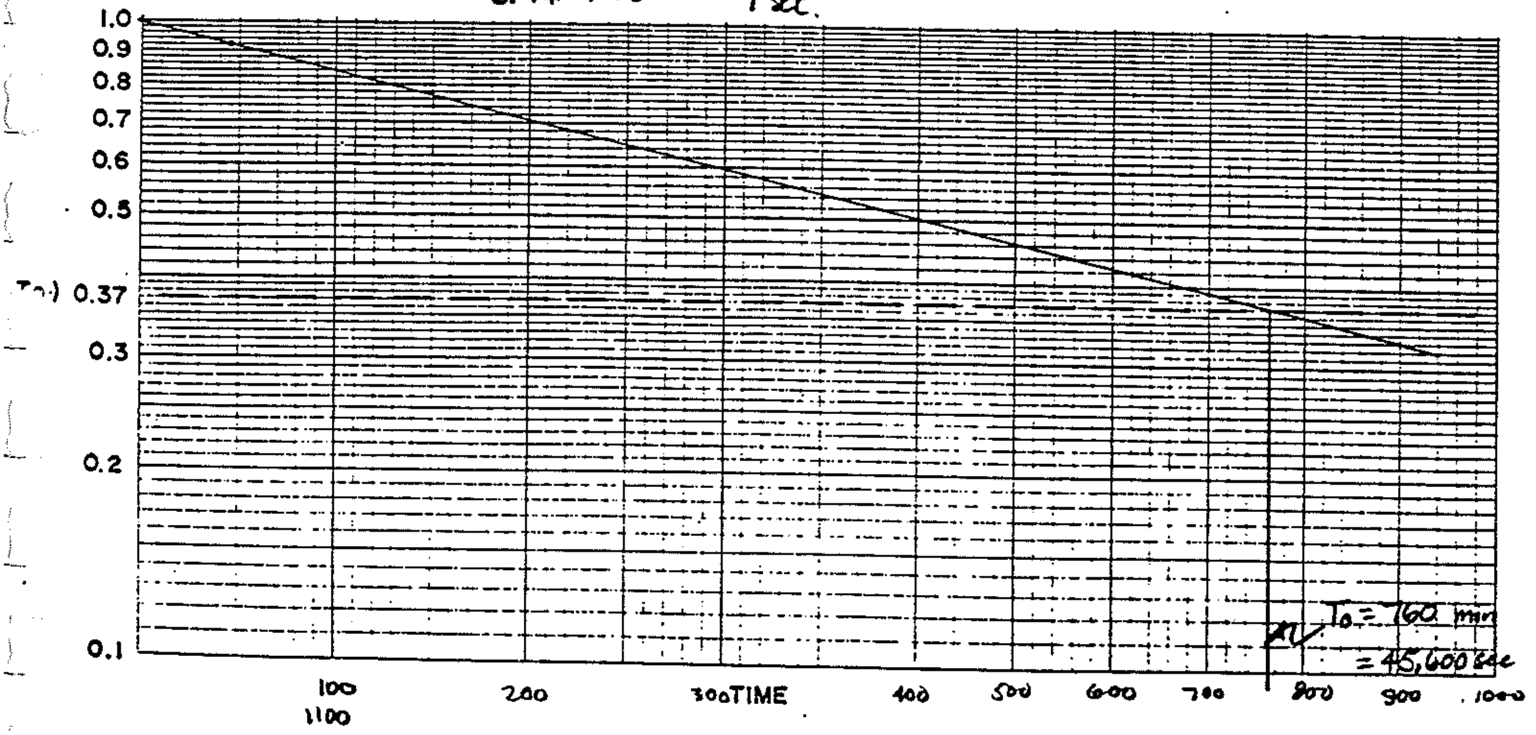
HYDRAULIC CONDUCTIVITY :

$$K=\frac{r^2\ln(L/R)}{2LT_o}$$

K= 1.23 X 10^{-7} ft/sec

3.74 X 10^{-6} cm/sec.

TIME	WATER DEPTH	t	h	$\frac{H-h}{H-Ho}$
1:22:00	9.23	0	2.89	1
1:22:30	9.21	:30		
1:23:00	9.20	1:00		
1:24	9.19	2:00		
1:27	9.16	5:00		
1:32	9.11	10:00		
1:42	9.09	20:00		
2:07	8.99	45:00	3.13	0.92

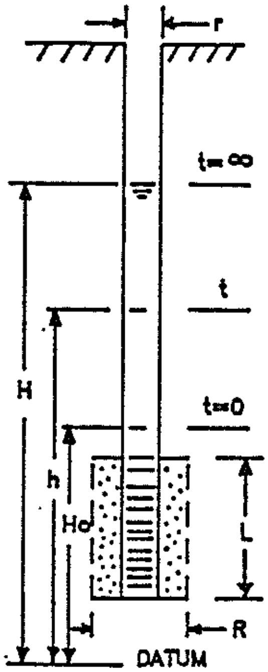


IN-SITU PERMEABILITY TEST
FIELD LOG

PROJECT GM-Fisher Guide
WELL NUMBER OBG-4
DATE 11/25/86

LOCATION Factory Ave, Syracuse.
ELEVATION ______

SWL = 5.73 TOC
3.43 GS



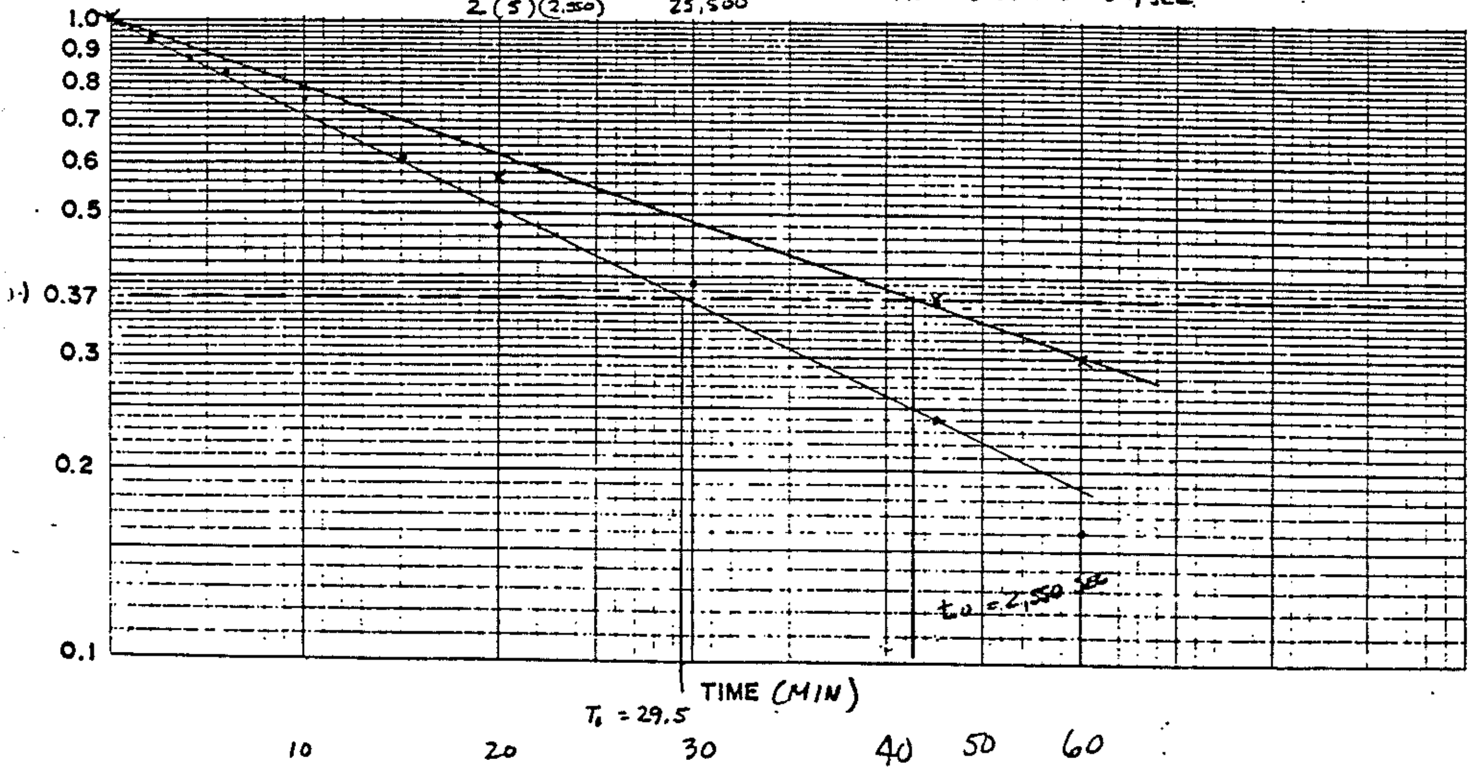
STATIC HEAD (H) 6.07
PIPE RADIUS (r) 0.167'
SCREEN RADIUS (R) 0.667'
SCREEN LENGTH (L) 5.0
INITIAL HEAD (Ho) 3.21
HYDRAULIC CONDUCTIVITY :

$$K=\frac{r^2\ln(L/R)}{2LTo}$$

K= 3.0 x10⁻⁶ ft/sec $= \frac{.167^2 \text{ LN } (5.57/.67)}{2\ (5.57)(1,770)_3} = \frac{5.906 \times 10^{-2}}{1.9717 \times 10^{4}} = 2.99 \times 10^{-6}$ ✓

$K = \frac{.167^2 \text{ LN} (5/.67)}{2(5)(2,550)} = \frac{.056}{25,500} = 2.19 \times 10^{-6}$ ft/sec $= 6.69 \times 10^{-5}$ cm/sec

TIME	WATER DEPTH	t	h	$\frac{H-h}{H-Ho}$	X 2.36
10:11:00	8.09	0	3.21	1	$\frac{6.07-3.2}{6.07-3.21}$
10:11:30	8.04	1:30	3.26	0.98	$\frac{6.07-3.26}{6.07-3.27}$
10:12:00	8.01	1:00	3.29	0.97	
10:13:00	7.91	2:00	3.39	0.92	.93
10:15	7.79	4:00	3.51	0.87	
10:17	7.68	6:00	[illegible]	0.83	
10:21	7.49	10:00	3.81	0.75	.79
10:26	7.18	15:00	[illegible]	0.61	
10:31	6.87	20:00	4.43	0.48	.57
10:41	6.64	30:00	[illegible]	0.39	
10:56	6.29	45:00	5.01	0.24	.37
11:11	6.11	60:00	5.19	0.16	.30

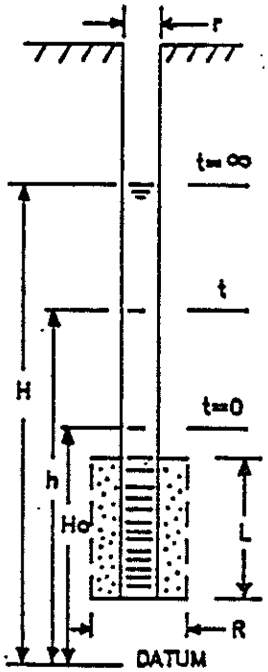


O'BRIEN & GERE

IN-SITU PERMEABILITY TEST
FIELD LOG

PROJECT GM- Fisher Guide
WELL NUMBER OBG-5
DATE 11/25/86

LOCATION Factory Ave, Syracuse
ELEVATION
SWL: 5.01' TOC (12/3/86)
2.68' GS



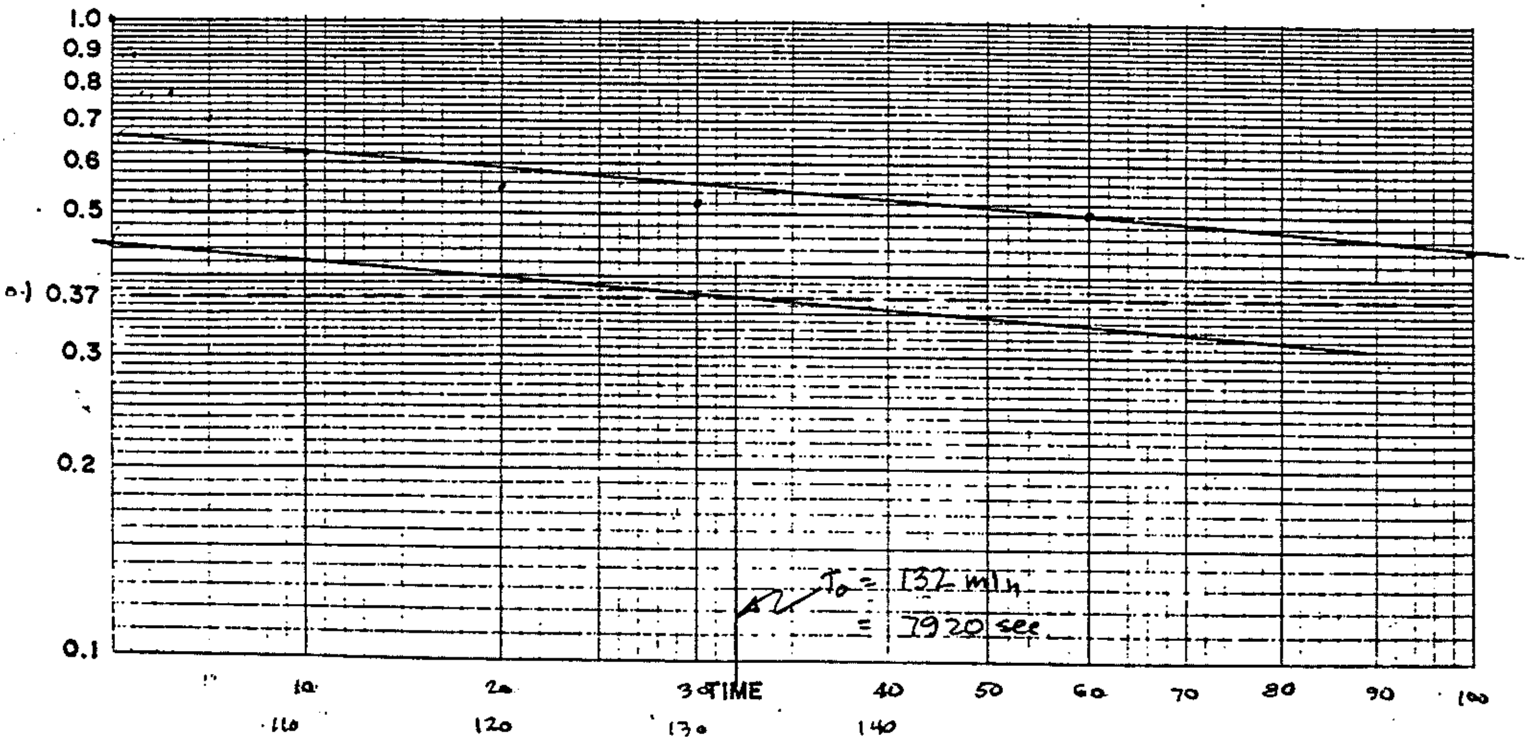
STATIC HEAD (H) 6.32
PIPE RADIUS (r) 0.167
SCREEN RADIUS (R) 0.667
SCREEN LENGTH (L) 5.0
INITIAL HEAD (Ho) 4.24

HYDRAULIC CONDUCTIVITY :

$$K=\frac{r^2\ln(L/R)}{2LTo}$$

K= 7.07 X10^{-7} ft/sec
= 2.15 X10^{-5} cm/sec.

TIME	WATER DEPTH	t	h	$\frac{H-h}{H-Ho}$
2:20:00	7.09	0	4.24	1.0
2:20:30	6.96	:30	4.37	0.94
2:21	6.84	1:00	4.49	0.88
2:23	6.62	3:00	4.71	0.77
2:25	6.47	5:00	4.86	0.70
2:30	6.29	10:00	5.04	0.62
2:40	6.15	20:00	5.18	0.55
2:50	6.09	30:00	5.24	0.52
3:20	6.06	60:00	5.27	0.50



T_o = 132 min
= 7920 sec

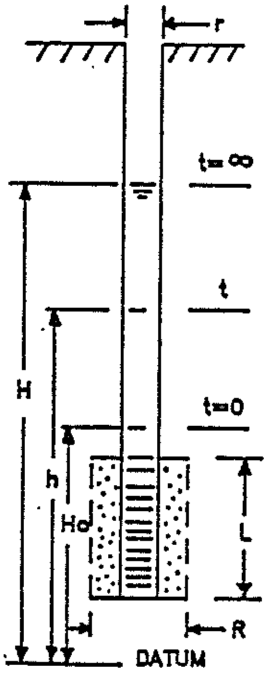
O'BRIEN & GERE

IN-SITU PERMEABILITY TEST
FIELD LOG

PROJECT GM- Fisher Guide
WELL NUMBER OBG-6
DATE 11/25/86

LOCATION Factory Ave, Syracuse.
ELEVATION

SWL: 6.14' TOC (12/3/86)
3.77' GS



STATIC HEAD (H) 13.73

PIPE RADIUS (r) 0.167

SCREEN RADIUS (R) 0.667

SCREEN LENGTH (L) 5.0

INITIAL HEAD (Ho) 9.78

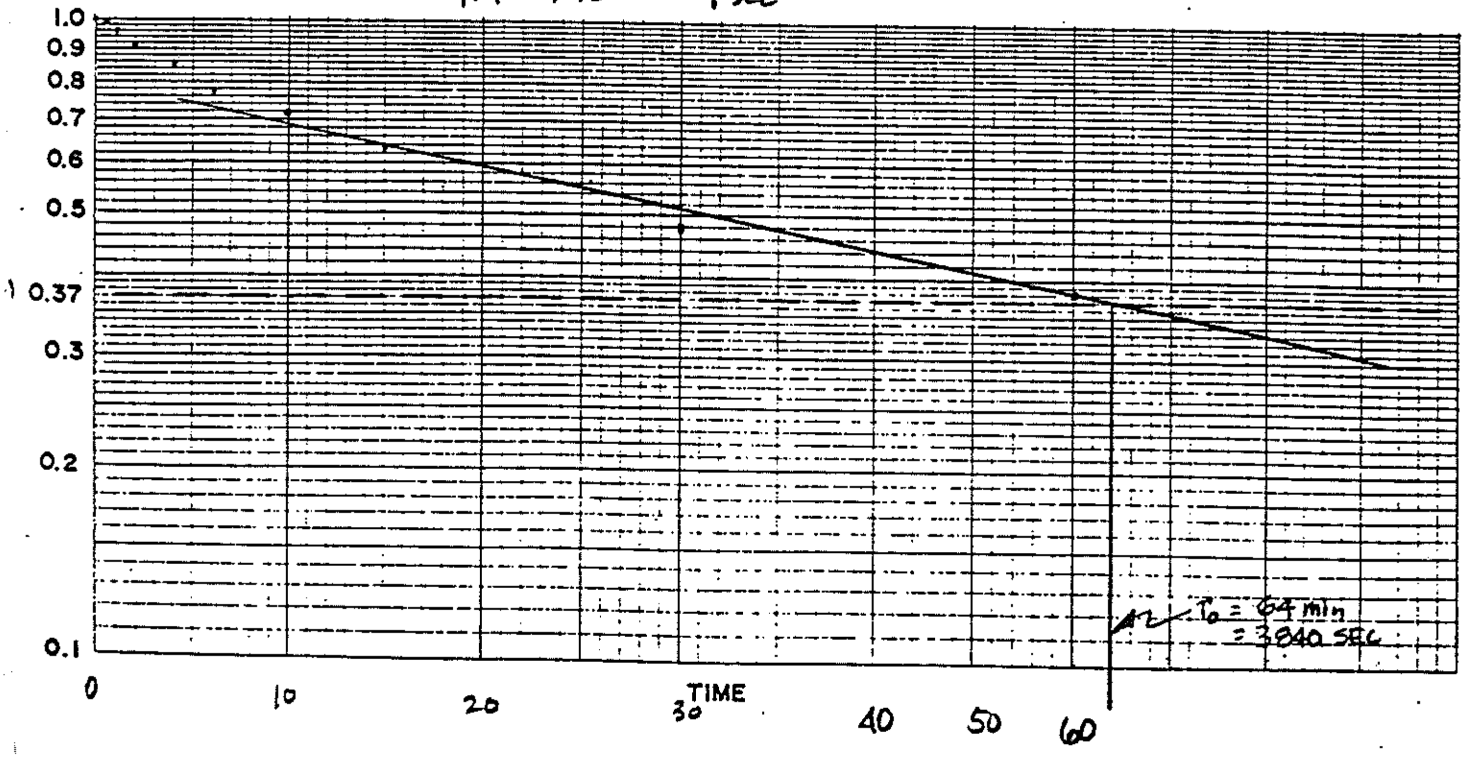
HYDRAULIC CONDUCTIVITY :

$$K=\frac{r^2\ln(L/R)}{2LTo}$$

K= 1.46 x 10⁻⁶ ft/sec

= 4.45 x 10⁻⁵ cm/sec

TIME	WATER DEPTH	t	h	$\frac{H-h}{H-Ho}$
2:52:00	10.09		9.78	1.00
2:52:30	10.05	:30	9.82	0.99
2:53:00	9.95	1:00	9.92	0.96
2:54:00	9.75	2:00	10.12	0.91
2:56:00	9.48	4:00	10.39	0.85
2:58	9.22	6:00	10.65	0.77
3:02	8.99	10:00	10.88	0.72
3:07	8.62	15:00	11.25	0.63
3:22	8.04	30:00	11.83	0.48
3:52	7.66	60:00	12.21	0.38

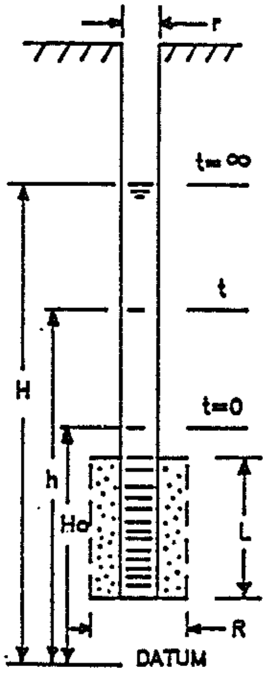


OBRIEN & GERE

IN–SITU PERMEABILITY TEST
FIELD LOG

PROJECT GM- FisherGuide
WELL NUMBER OBG-7A
DATE 11/25/86

LOCATION Factory Ave, Syracuse NY
ELEVATION ______
SWL: 4.82' TOC
2.25' GS



STATIC HEAD (H) 6.25

PIPE RADIUS (r) 0.167

SCREEN RADIUS (R) 0.667

SCREEN LENGTH (L) 3.0

INITIAL HEAD (Ho) 3.22

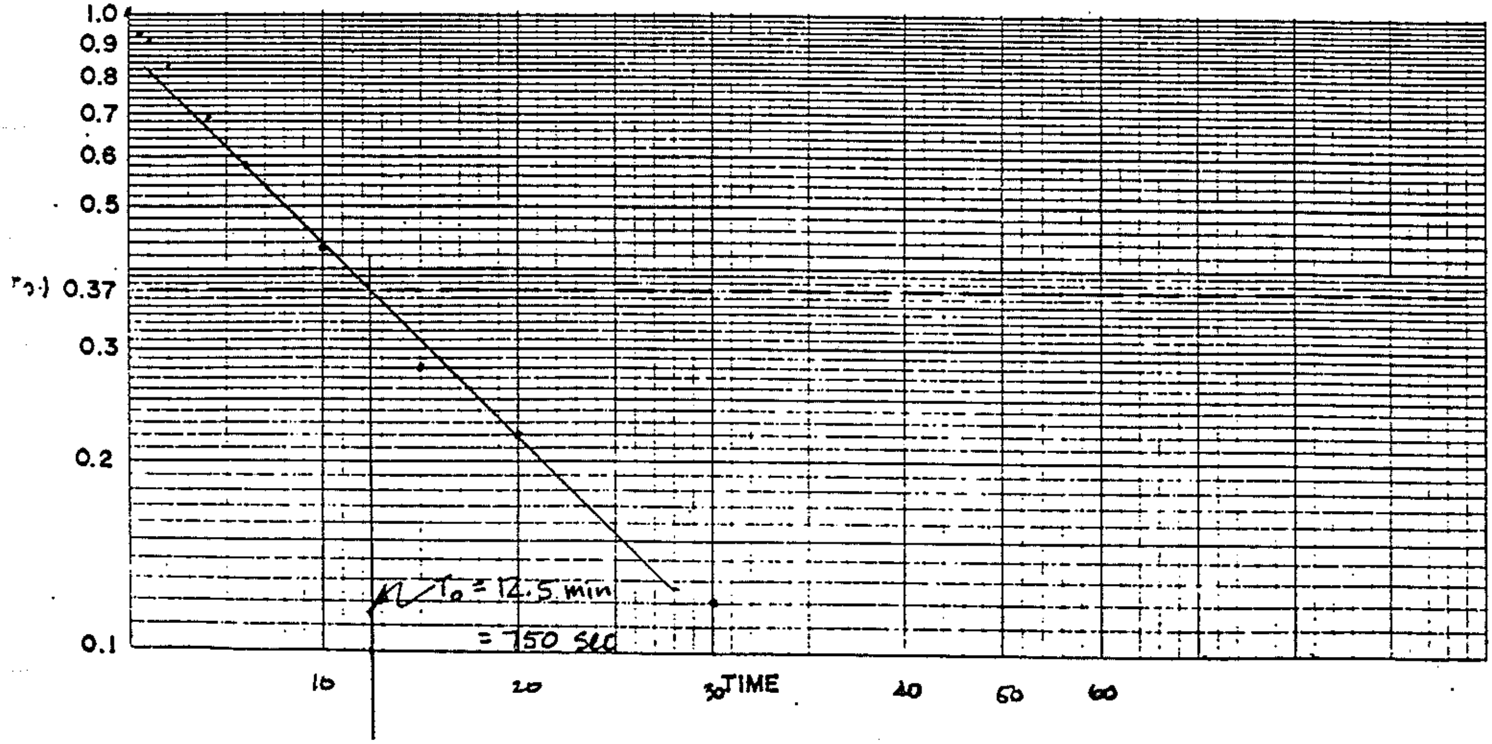
HYDRAULIC CONDUCTIVITY :

$$K=\frac{r^2\ln(L/R)}{2LTo}$$

$K = 9.33\times10^{-6}$ ft/sec

$= 2.84\times10^{-4}$ cm/sec

TIME	WATER DEPTH	t	h	$\frac{H-h}{H-Ho}$
9:32:00	7.85	0	3.22	1.00
9:32:30	7.63	:30	3.44	0.93
9:33:00	7.60	1:00	3.47	0.91
9:34:00	7.33	2:00	3.74	0.83
9:36:00	6.91	4:00	4.16	0.69
9:38:00	6.59	6:00	4.48	0.58
9:42:00	6.11	10:00	4.96	0.43
9:47	5.68	15:00	5.39	0.28
9:52	5.49	20:00	5.58	0.22
10:02	5.19	30:00	5.88	0.12



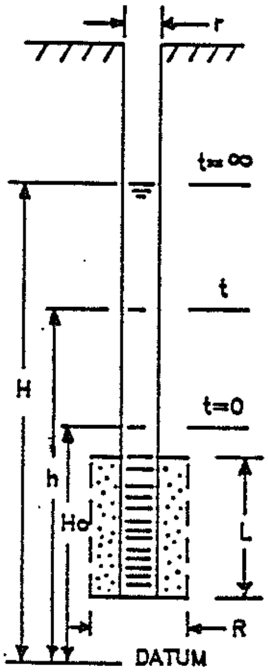
T_o = 12.5 min
= 750 sec

O'BRIEN & GERE

IN–SITU PERMEABILITY TEST
FIELD LOG

PROJECT GM-Fisher Guide
WELL NUMBER OBG-7B
DATE 11/25/86

LOCATION Factory Ave, Syracuse.
ELEVATION
SWL: 6.21' TOC
3.77' GS

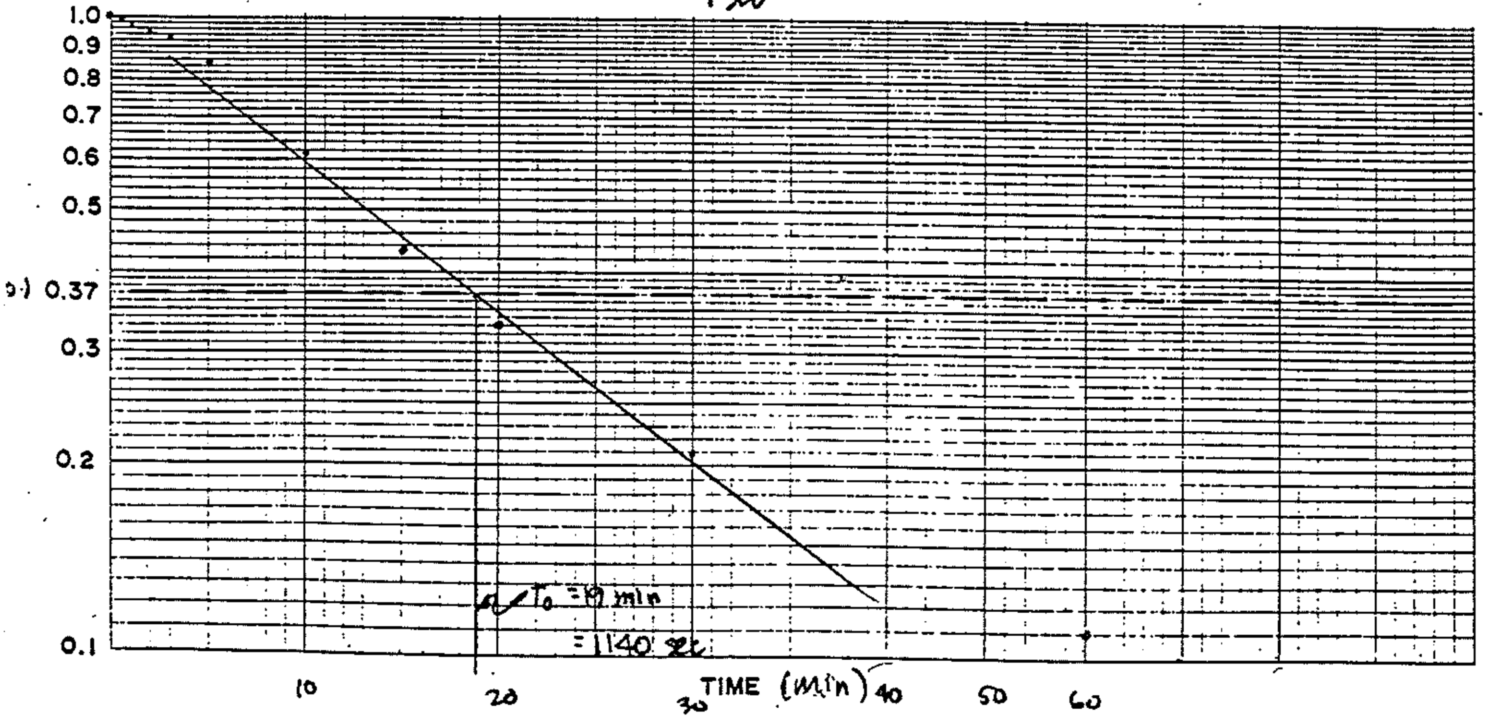


STATIC HEAD (H) 5.73
PIPE RADIUS (r) 0.167
SCREEN RADIUS (R) 0.667
SCREEN LENGTH (L) 3.0
INITIAL HEAD (Ho) 3.53
HYDRAULIC CONDUCTIVITY :

$$K=\frac{r^2\ln(L/R)}{2LT_o}$$

K= 6.14 X 10⁻⁶ ft/sec
= 1.87 × 10⁻⁴ cm/sec

TIME	WATER DEPTH	t	h	$\frac{H-h}{H-Ho}$
8:40:00	8.41	0	3.53	1.00
8:40:30	8.38	:30	3.56	0.99
8:41:00	8.34	1:00	3.60	0.97
8:42:00	8.31	2:00	3.63	0.95
8:43:00	8.26	3:00	3.68	0.93
8:45	8.07	5:00	3.87	0.85
8:50	7.56	10:00	4.38	0.61
8:55	7.16	15:00	4.78	0.43
9:00	6.93	20:00	5.01	0.33
9:10	6.67	30:00	5.27	0.21
9:40:00	6.45	60:00	5.49	0.11

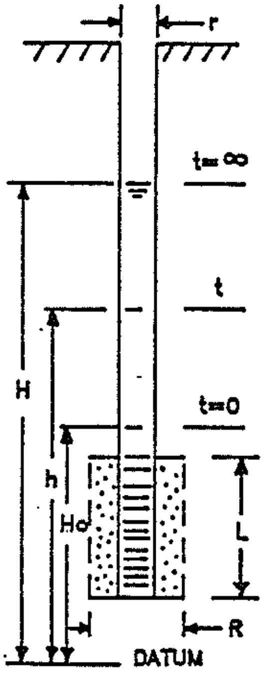


O'BRIEN & GERE

IN-SITU PERMEABILITY TEST
FIELD LOG

PROJECT GM- Fisher Guide
WELL NUMBER OBG-7C
DATE 11/25/86

LOCATION Factory Ave, Syracuse
ELEVATION ____
SWL: 6.66' TOC (12/3/86)
4.04' GS



STATIC HEAD (H) 5.96

PIPE RADIUS (r) 0.167

SCREEN RADIUS (R) 0.667

SCREEN LENGTH (L) 3.0

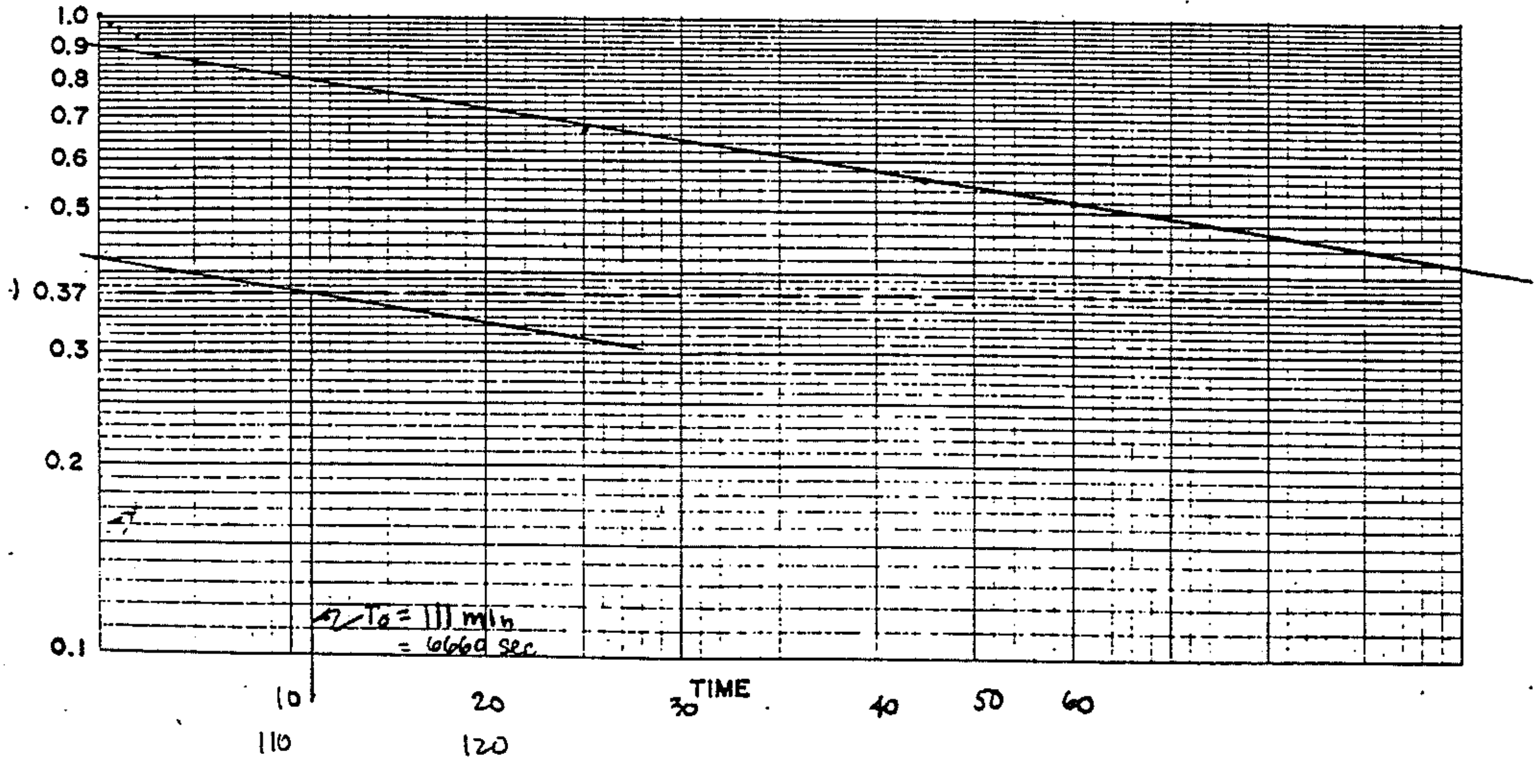
INITIAL HEAD (Ho) 3.68

HYDRAULIC CONDUCTIVITY :

$$K = \frac{r^2 \ln(L/R)}{2LT_o}$$

K= 7.07 x10^{-7} ft/sec
= 2.15 x10^{-5} cm/sec.

TIME	WATER DEPTH	t	h	$\frac{H-h}{H-Ho}$
1:05:00	8.94	0	3.68	1.00
1:05:30	8.87	:30	3.75	0.97
1:06	8.85	1:00	3.77	0.96
1:07	8.77	2:00	3.85	0.93
1:08	8.65	3:00	3.97	0.87
1:10	8.60	5:00	4.02	0.85
1:15	8.49	10:00	4.13	0.80
1:30	8.19	25:00	4.43	0.67
1:50	7.95	46:00	4.67	0.56
2:05	7.86	60:00	4.76	0.52



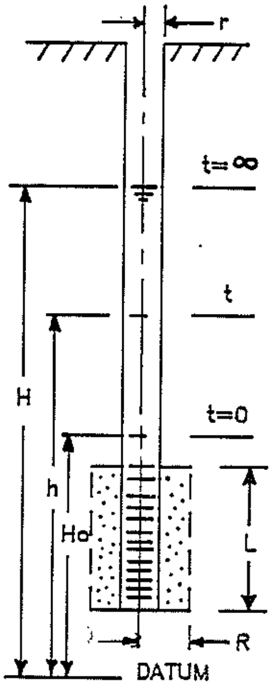
O'BRIEN & GERE

IN-SITU PERMEABILITY TEST
FIELD LOG

PROJECT GM FISHER GUIDE
WELL NUMBER MW-8
DATE 4/4/89

LOCATION FACTORY AVE, SYRACUSE
ELEVATION

TOLD = 15.1 SWL = 6.67

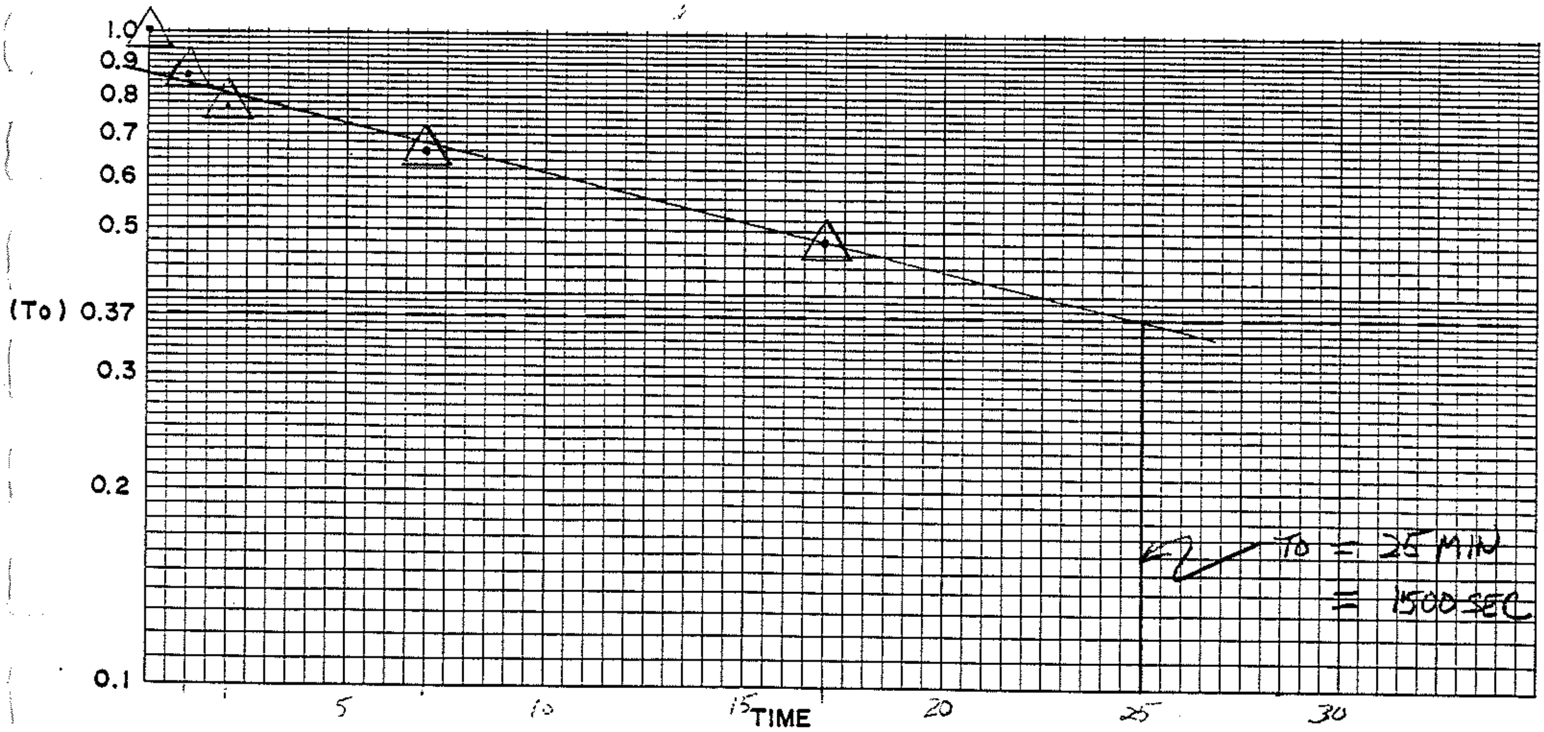


STATIC HEAD (H) 8.43
PIPE RADIUS (r) 0,167'
SCREEN RADIUS (R) 0.667'
SCREEN LENGTH (L) 10.0
INITIAL HEAD (Ho) 2.53
5.90
HYDRAULIC CONDUCTIVITY :

$$K=\frac{r^2\ln(L/R)}{2LT_o}$$

K= 2.52 × 10^{-6} ft/sec
7.68 × 10^{-5} cm/sec

TIME	WATER DEPTH	t	h	$\frac{H-h}{H-Ho}$
12:23	12.57	0	2.53	1.0
12:24	11.76	1:00	3.34	.86
12:25	11.20	2:00	3.90	.77
12:30	10.59	7:00	4.51	.66
12:40	9.57	17:00	5.59	.48



To = 25 MIN
= 1500 SEC

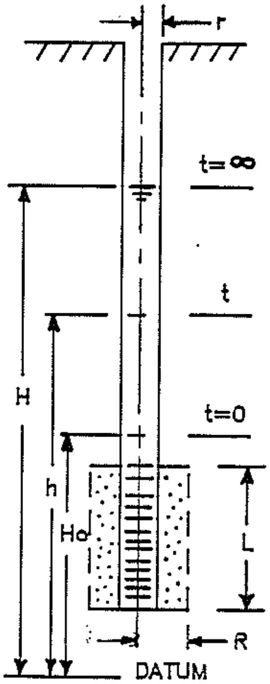
O'BRIEN & GERE

IN–SITU PERMEABILITY TEST
FIELD LOG

PROJECT GM FISHER GUIDE
WELL NUMBER MW-9
DATE 4/4/89

LOCATION FACTORY AVE, SYRACUSE
ELEVATION ______

Tod = 15.1 SWL = 1.70

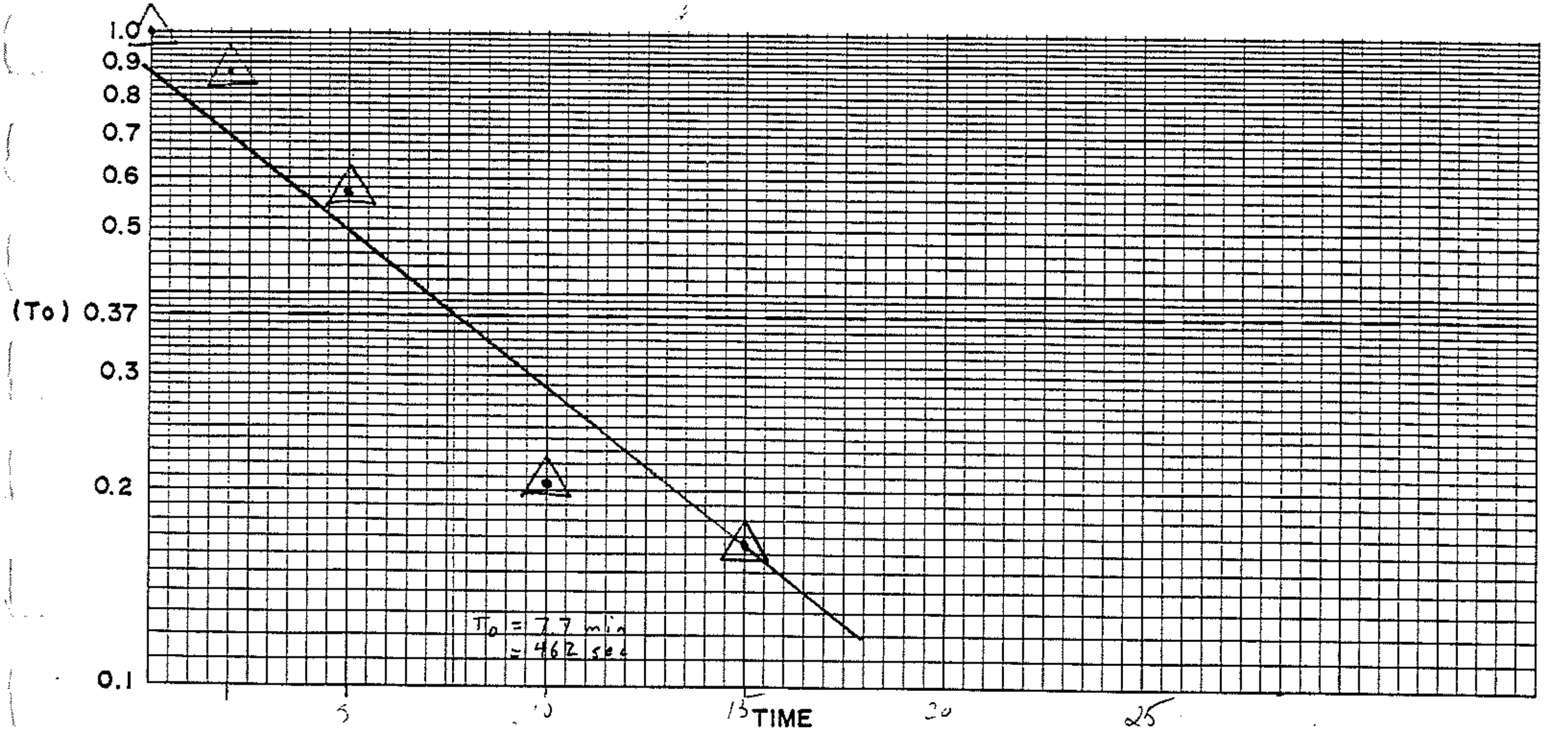


STATIC HEAD (H) 13.4
PIPE RADIUS (r) 0.167'
SCREEN RADIUS (R) 0.667'
SCREEN LENGTH (L) 10.0'
INITIAL HEAD (Ho) 5.08
8.32
HYDRAULIC CONDUCTIVITY :

$$K=\frac{r^2\ln(L/R)}{2LT_o}$$

$$K=\frac{8.17\times10^{-6}\text{ ft/sec}}{2.49\times10^{-4}\text{ cm/sec}}$$

TIME	WATER DEPTH	t	h	$\frac{H-h}{H-Ho}$
11.35	10.02	0	5.08	1.0
11.37	8.96	2:00	6.14	.97
11.40	6.41	5.00	8.69	.57
11.45	3.47	10:00	11.63	.21
11.50	2.74	15.00	12.36	.13



T_o = 7.7 min
= 462 sec

O'BRIEN & GERE

IN-SITU PERMEABILITY TEST
FIELD LOG

PROJECT GM FISHER GUIDE

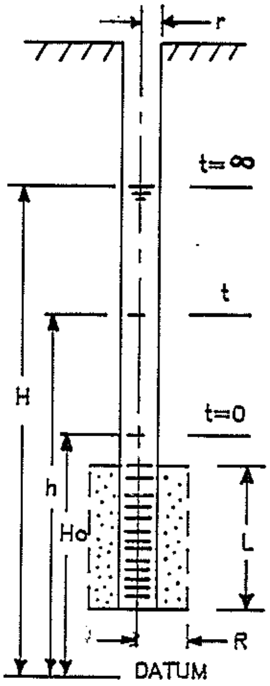
WELL NUMBER MW-10

DATE 4/4/89

LOCATION FACTORY AVE., SYRACUSE

ELEVATION ______

TOLD = 15.0 SWL = 6.07



STATIC HEAD (H) 8.93

PIPE RADIUS (r) 0.167

SCREEN RADIUS (R) 0.337

SCREEN LENGTH (L) 10.0

INITIAL HEAD (Ho) 4.88

H-H, 4.05

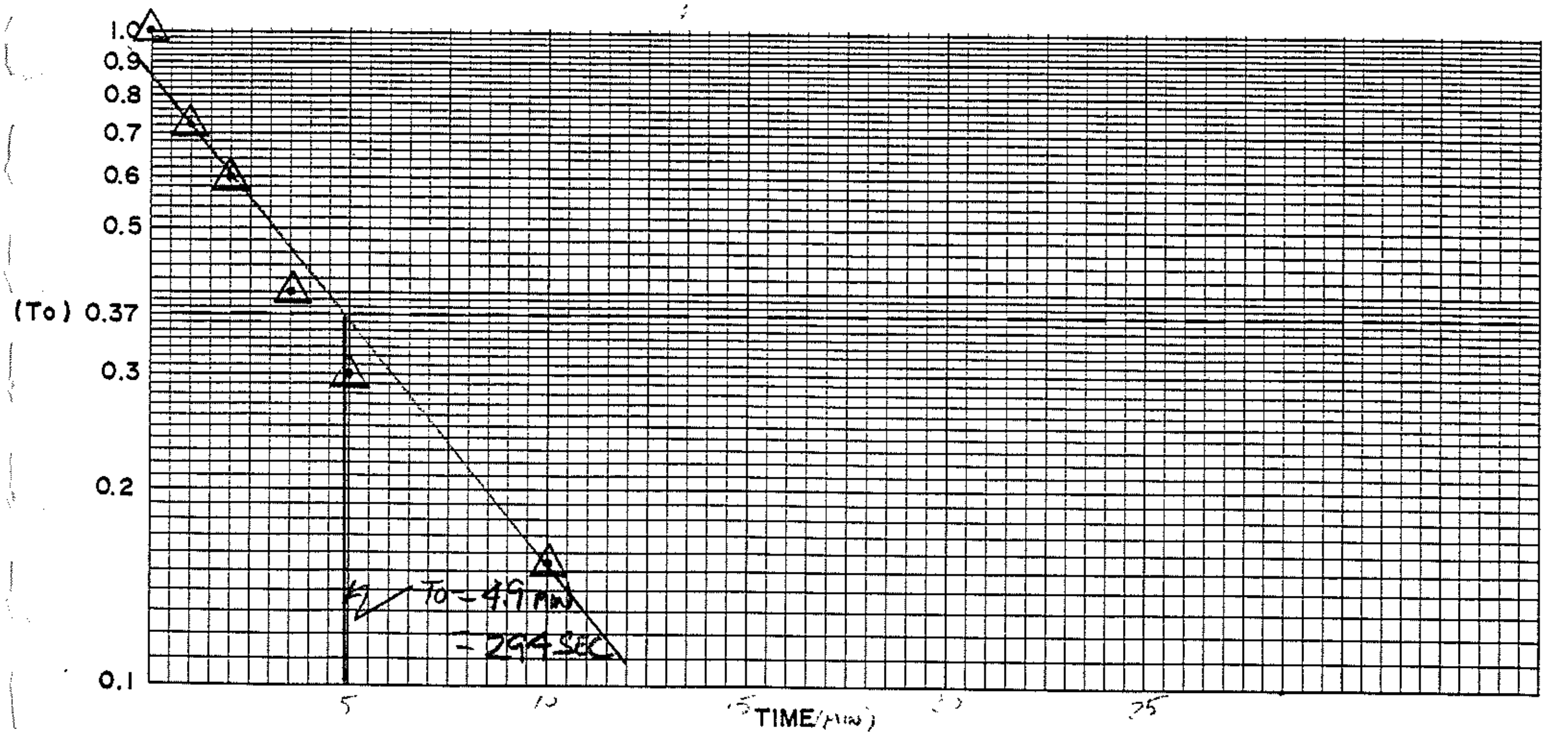
HYDRAULIC CONDUCTIVITY :

$$K=\frac{r^2\ln(L/R)}{2LTo}$$

K= 1.28 × 10⁻⁵ ft/sec

3.90 × 10⁻⁴ cm/sec

TIME	WATER DEPTH	t	h	$\frac{H-h}{H-Ho}$ 4.05
11:00	10.12	0	4.88	1.0
11'01	9.00	1:00	6.00	.72
11.02	8.51	2:00	6.49	.60
11'03.5	7.76	3:50	7.29	.40
11:05	7.27	5:00	7.73	.30
11'10	6.52	10:00	8.48	.11



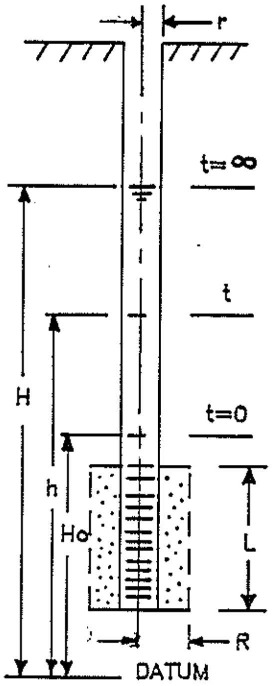
O'BRIEN & GERE

IN-SITU PERMEABILITY TEST
FIELD LOG

PROJECT 6M FISHER GUIDE
WELL NUMBER MW-11
DATE 4/5/89

LOCATION FACTORY AVE, SYRACUSE
ELEVATION ______

TOC = 13.20   SWL = .84



STATIC HEAD (H) 12.36
PIPE RADIUS (r) 0.167
SCREEN RADIUS (R) 0.667
SCREEN LENGTH (L) 10.0
INITIAL HEAD (Ho) 8.89

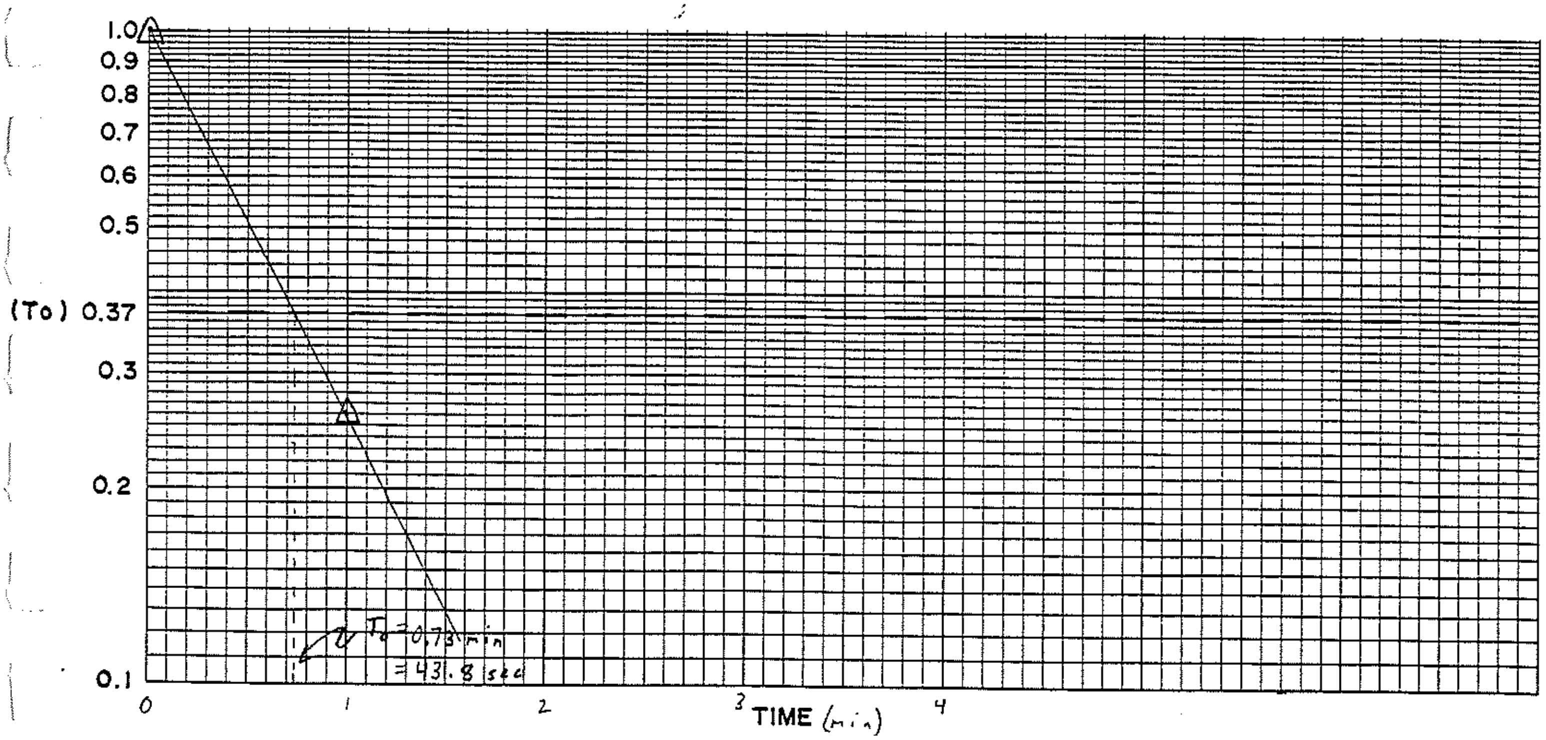
H - Ho 3.47

HYDRAULIC CONDUCTIVITY :

$$K = \frac{r^2 \ln(L/R)}{2LT_o}$$

K= 8.62×10^{-5} ft/sec
2.63×10^{-3} cm/sec

TIME	WATER DEPTH	t	h	$\frac{H-h}{H-Ho}$
8:02	4.31	0.0	8.89	1.0
8:03	1.46	1.0	11.74	0.26
8:05	0.92	3.0	12.28	0.02



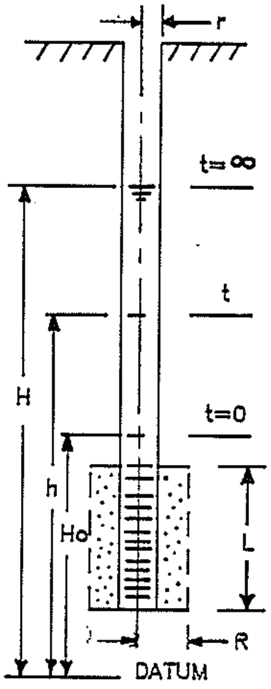
O'BRIEN & GERE

IN–SITU PERMEABILITY TEST
FIELD LOG

PROJECT GM FISHER GUIDE
WELL NUMBER MW-12
DATE 4/4/89

LOCATION FACTORY AVE, SYRACUSE
ELEVATION ______

TOC D = 18.86   SWL = 10.19



STATIC HEAD (H) 8.67

PIPE RADIUS (r) 0.167

SCREEN RADIUS (R) 0.667

SCREEN LENGTH (L) 10.0

INITIAL HEAD (Ho) 4.34

H - Ho 4.33

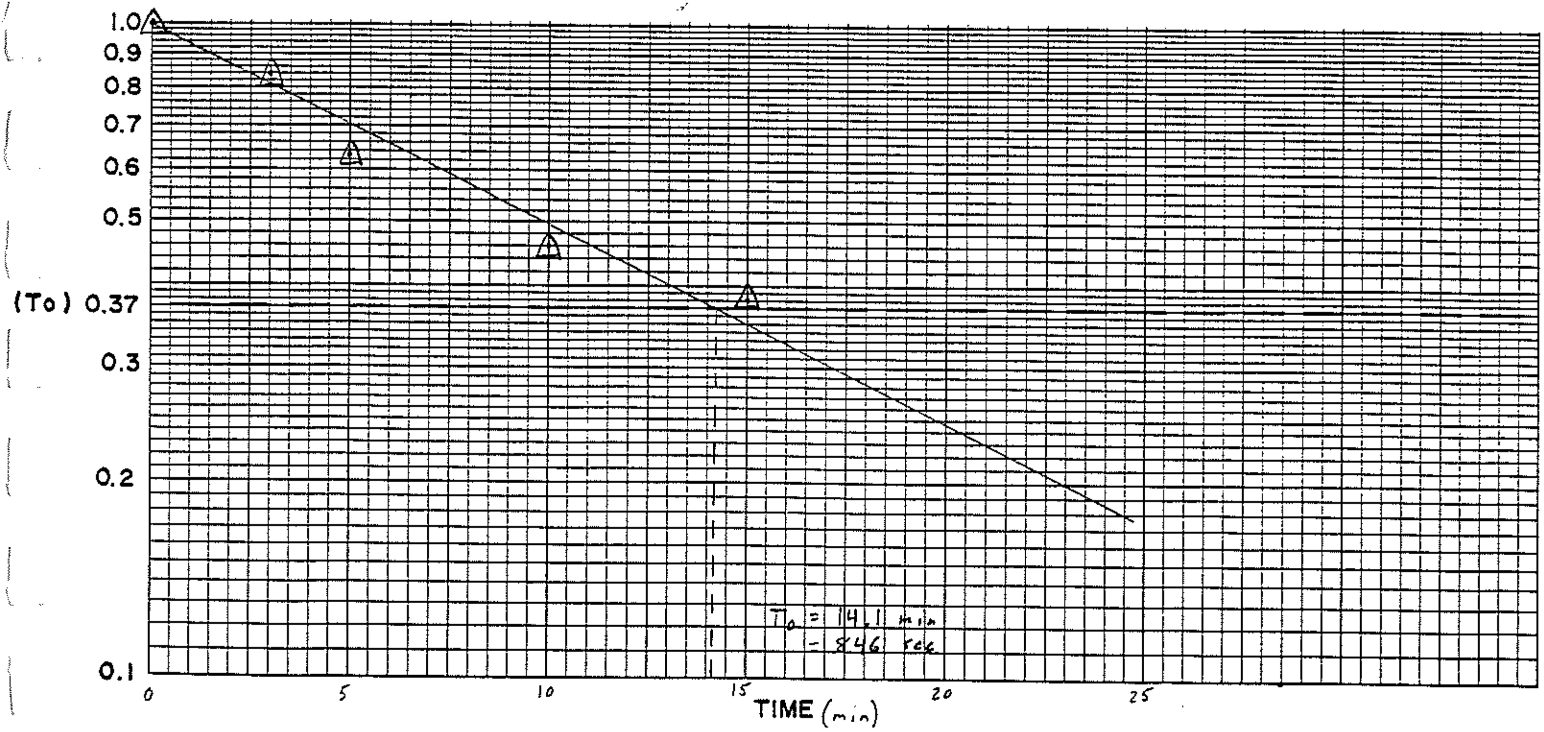
HYDRAULIC CONDUCTIVITY :

$$K=\frac{r^2\ln(L/R)}{2LT_o}$$

K= 4.46 × 10^{-6} ft/sec

1.36 × 10^{-4} cm/sec

TIME	WATER DEPTH	t	h	$\frac{H-h}{H-Ho}$
9:25	14.52	0.0	4.34	1.0
9:28	13.82	3.0	5.04	0.84
9:30	12.93	5.0	5.93	0.63
9:35	12.19	10.0	6.67	0.46
9:40	11.84	15.0	7.02	0.38



To = 14.1 min
= 846 sec

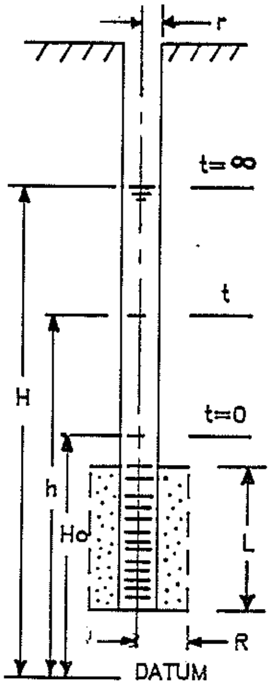
O'BRIEN & GERE

IN–SITU PERMEABILITY TEST FIELD LOG

PROJECT GM FISHER GUIDE
WELL NUMBER MW-13
DATE 4/4/89

LOCATION FACTORY AVE, SYRACUSE
ELEVATION

TOL D = 12.6 SWL = 5.03

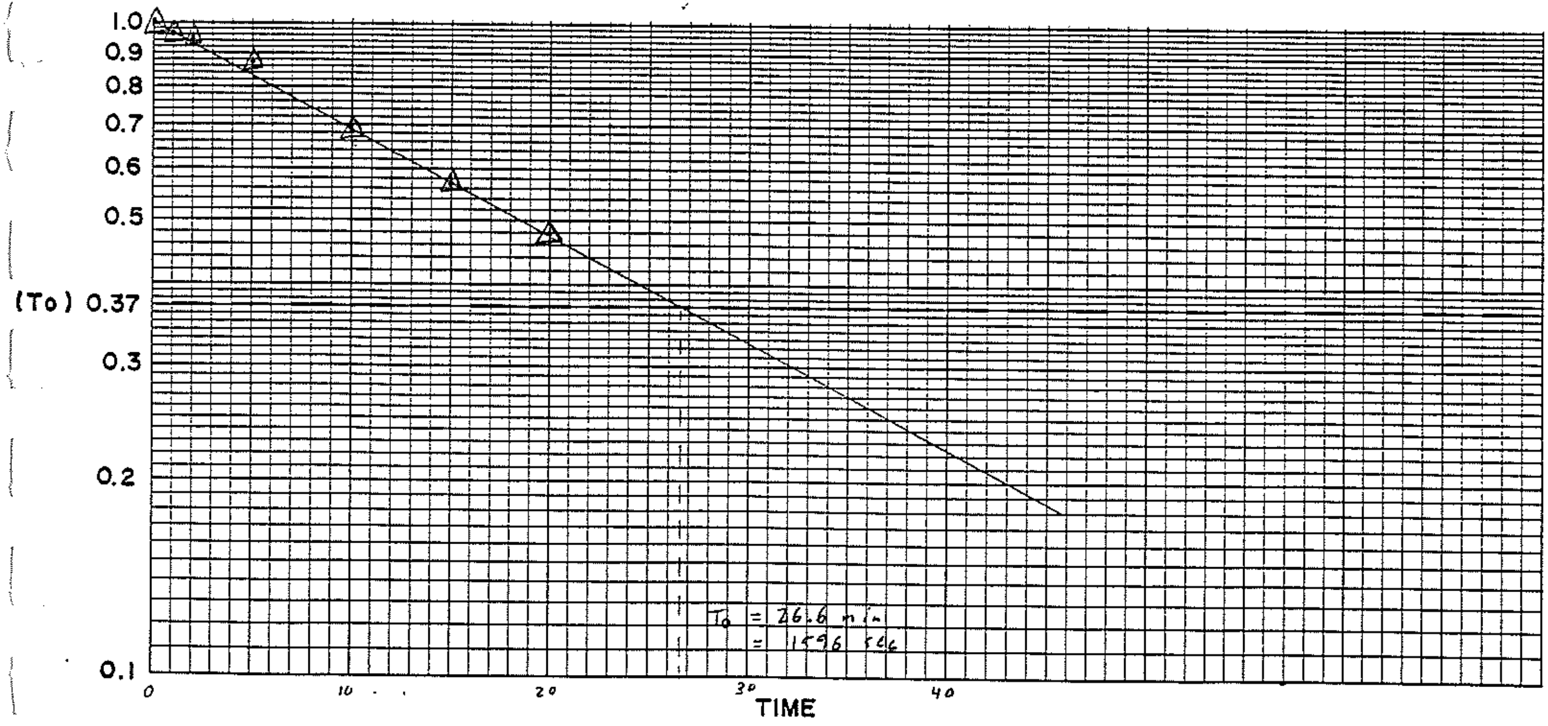


STATIC HEAD (H) 7.57
PIPE RADIUS (r) 0.167
SCREEN RADIUS (R) 0.667
SCREEN LENGTH (L) 10.0
INITIAL HEAD (Ho) 4.74
$H - H_0$ 2.83
HYDRAULIC CONDUCTIVITY :

$$K = \frac{r^2 \ln(L/R)}{2LT_o}$$

K= 2.37 × 10^{-6} ft/sec
7.22 × 10^{-5} cm/sec

TIME	WATER DEPTH	t	h	$\frac{H-h}{H-Ho}$
8:25	7.86	0.0	4.74	1.0
8:26	7.75	1.0	4.85	0.96
8:27	7.72	2.0	4.88	0.95
8:30	7.49	5.0	5.11	0.87
8:35	6.98	10.0	5.62	0.69
8:40	6.65	15.0	5.95	0.57
8:45	6.38	20.0	6.22	0.48



T_o = 26.6 min
= 1596 sec

APPENDIX C

GROUND WATER SAMPLING FIELD LOGS

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK Well No. MW-1

Sampled By JAMES A. MOORE Date 10-6-88 Time 4:00 PM

Weather CLOUDY / SUNNY Sampled with Bailer ✓ Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 13 ft. Well elevation: (top of casing) ____ ft.

Depth to water table: (below top of casing) 9.2 ft. Water table elevation: ____ ft.

Length of water column (LWC) 3.8 ft.

Volume of water in well:

2" diameter wells = 0.163 x (LWC) = .61 gallons 1.85

4" diameter wells = 0.653 X (LWC) = ____ gallons

6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color CLEAR Odor YES Turbidity SLIGHT

Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 1.85 gallons.

Did well go dry? YES

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color ~~Clear~~ BROWN Odor YES Turbidity SLIGHT

Was an oil film or layer apparent? NO

E. CONDUCTIVITY ____

F. pH ____

G. TEMPERATURE ____

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK Well No. MW-2

Sampled By JAMES A. MOORE Date 10-6-88 Time 4:16

Weather CLOUDY, SUNNY Sampled with Bailer ✓ Pump ______

A. WATER TABLE:

Well depth: (below top of casing) 12 ft.

Well elevation: (top of casing) ______ ft.

Depth to water table: (below top of casing) 8.3 ft.

Water table elevation: ______ ft.

Length of water column (LWC) 3.7 ft.

Volume of water in well:

2" diameter wells = 0.163 x (LWC) = .60 gallons 1.80

4" diameter wells = 0.653 X (LWC) = ______ gallons

6" diameter wells = 1.469 X (LWC) = ______ gallons

B. PHYSICAL APPEARANCE AT START:

Color CLEAR Odor YES Turbidity SLIGHT

Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 1.80 gallons.

Did well go dry? YES

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color BROWN Odor YES Turbidity SLIGHT

Was an oil film or layer apparent? NO

E. CONDUCTIVITY ______

F. pH ______

G. TEMPERATURE ______

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK , GM FISHER GUIDE Well No. MW-3
Sampled By JAMES A MOORE Date 10-6 Time 11:35
Weather ______ Sampled with Bailer ✓ Pump ______

A. WATER TABLE:

Well depth: (below top of casing) 11.4 ft.
Well elevation: (top of casing) ______ ft.
Depth to water table: (below top of casing) 10.8 ft. 10.9
Water table elevation: ______ ft.
Length of water column (LWC) .60 .50 ft.
Volume of water in well:

2" diameter wells = 0.163 x (LWC) = .0815 gallons .24
4" diameter wells = 0.653 X (LWC) = ______ gallons
6" diameter wells = 1.469 X (LWC) = ______ gallons

B. PHYSICAL APPEARANCE AT START:

Color BLACK Odor Sulfur Turbidity HIGH
Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 6 OUNCES gallons. 3 ounces
Did well go dry? YES

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color BLACK Odor Sulfur Turbidity HIGH
Was an oil film or layer apparent? NO

E. CONDUCTIVITY ______

F. pH ______

G. TEMPERATURE ______

H. WELL SAMPLING NOTES:

~~[illegible]~~ WELL BAILED DRY, NO RECHARGE, INSEGNIFIANT SAMPLE

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK GM FISHER GUIDE Well No. MW-4
Sampled By JAMES A. MOORE Date 10-6-88 Time 10:15
Weather CLOUDY SUNNY Sampled with Bailer ✓ Pump ____

A. WATER TABLE:

Well depth:
(below top of casing) 11.9 ft.

Well elevation:
(top of casing) ____ ft.

Depth to water table:
(below top of casing) 10.25 ft.

Water table elevation: ____ ft.

Length of water column (LWC) 1.65 ft.

Volume of water in well:

2" diameter wells = 0.163 x (LWC) = .26 gallons .80
4" diameter wells = 0.653 X (LWC) = ____ gallons
6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color BLACK Odor Sulfur Turbidity HIGH
Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 1.00 gallons.
Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color BLACK Odor Sulfur Turbidity MED.
Was an oil film or layer apparent? NO

E. CONDUCTIVITY ____

F. pH ____

G. TEMPERATURE ____

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK GM FISHER GUIDE Well No. MW-5
Sampled By JAMES A MOORE Date 10-6-88 Time 12:15
Weather CLOUDY SUNNY Sampled with Bailer ✓ Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 12.2 ft.
Well elevation: (top of casing) ____ ft.
Depth to water table: (below top of casing) 9.65 ft.
Water table elevation: ____ ft.
Length of water column (LWC) 2.55 ft.
Volume of water in well:

2" diameter wells = 0.163 x (LWC) = .41 gallons 1.24
4" diameter wells = 0.653 X (LWC) = ____ gallons
6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color BLACK Odor Sulfur Turbidity HIGH
Was an oil film or layer apparent? ____

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 25 GAL gallons.
Did well go dry? YES

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color BLACK Odor Sulfur Turbidity HIGH
Was an oil film or layer apparent? ____

E. CONDUCTIVITY ____

F. pH ____

G. TEMPERATURE ____

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK GM FISHER GUIDE Well No. MW-6

Sampled By JAMES A. MOORE Date 10/16/88 Time 3:30

Weather CLOUDY SUNNY Sampled with Bailer ✓ Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 20. ft.

Well elevation: (top of casing) ____ ft.

Depth to water table: (below top of casing) 10.5 ft.

Water table elevation: ____ ft.

Length of water column (LWC) 9.5 ft.

Volume of water in well:

2" diameter wells = 0.163 x (LWC) = 1.54 gallons 4.64

4" diameter wells = 0.653 X (LWC) = ____ gallons

6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color CLEAR Odor YES Turbidity SLIGHT

Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 4.64 gallons.

Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color BROWN Odor YES Turbidity SLIGHT

Was an oil film or layer apparent? NO

E. CONDUCTIVITY ____

F. pH ____

G. TEMPERATURE ____

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK, GM FISHER GUIDE Well No. MW-7A

Sampled By JAMES A. MOORE Date 10-6-88 Time 10:30

Weather CLOUDY Sampled with Bailer ✓ Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 11.0 ft.

Well elevation: (top of casing) ____ ft.

Depth to water table: (below top of casing) 9.65 ft.

Water table elevation: ____ ft.

Length of water column (LWC) 1.35 ft.

Volume of water in well:

2" diameter wells = 0.163 x (LWC) = .22 gallons .66

4" diameter wells = 0.653 X (LWC) = ____ gallons

6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color BLACK Odor Sulfur Turbidity HIGH

Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling .75 gallons.

Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color BLACK Odor Sulfur Turbidity HIGH

Was an oil film or layer apparent? NO

E. CONDUCTIVITY ____

F. pH ____

G. TEMPERATURE ____

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK GM FISHER GUIDE Well No. MW-7B
Sampled By JAMES A. MOORE Date 10-6-88 Time 12:10
Weather CLOUDY Sampled with Bailer ✓ Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 11.8 ft.
Well elevation: (top of casing) ____ ft.

Depth to water table: (below top of casing) 11.0 ft.
Water table elevation: ____ ft.

Length of water column (LWC) .80 ft.

Volume of water in well:

2" diameter wells = 0.163 x (LWC) = .13 gallons .39
4" diameter wells = 0.653 X (LWC) = ____ gallons
6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color BLACK Odor SulFur Turbidity HIGH
Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling .2 GAL gallons.
Did well go dry? YES

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color GRAY Odor Sulfur Turbidity MED.
Was an oil film or layer apparent? NO

E. CONDUCTIVITY ____

F. pH ____

G. TEMPERATURE ____

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK, GM FISHER GUIDE Well No. MW-7C

Sampled By JAMES A. MOORE Date 10-6-88 Time 11:30

Weather CLOUDY, SUNNY Sampled with Bailer ✓ Pump ____

A. WATER TABLE:

Well depth:
(below top of casing) 12.6 ft.

Well elevation:
(top of casing) ____ ft.

Depth to water table:
(below top of casing) 12.2 ft. 12.5

Water table elevation: ____ ft.

Length of water column (LWC) .40 .10 ft.

Volume of water in well:

2" diameter wells = 0.163 x (LWC) = .0163 gallons .04
4" diameter wells = 0.653 X (LWC) = ____ gallons
6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color BLACK Odor Sulfur Turbidity HIGH

Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling .04 OUCES gallons. .02 ounces

Did well go dry? ~~B~~ YES

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color BLACK Odor Sulfur Turbidity HIGH

Was an oil film or layer apparent? NO

E. CONDUCTIVITY ____

F. pH ____

G. TEMPERATURE ____

H. WELL SAMPLING NOTES:

WELL BAILED DRY, NO RECHARGE, INSIGNIFICANT SAMPLE

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK GM FISHER GUIDE Well No. MW-8
Sampled By JAMES A. MOORE Date 10-7-88 Time 9:00
Weather CLOUDY, MIST Sampled with Bailer ✓ Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 15.7 ft.
Well elevation: (top of casing) ____ ft.
Depth to water table: (below top of casing) 11.7 ft.
Water table elevation: ____ ft.
Length of water column (LWC) 4 ft.
Volume of water in well:

2" diameter wells = 0.163 x (LWC) = .65 gallons 1.95
4" diameter wells = 0.653 X (LWC) = ____ gallons
6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color CLEAR Odor YES Turbidity NO
Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 2.00 gallons.
Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color BROWN Odor YES Turbidity NO
Was an oil film or layer apparent? NO

E. CONDUCTIVITY ____

F. pH ____

G. TEMPERATURE ____

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK, GM FISHER GUIDE Well No. MW-9

Sampled By JAMES A. MOORE Date 10-7-88 Time 10:00

Weather CLOUDY, MIST Sampled with Bailer ✓ Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 16.1 ft.

Well elevation: (top of casing) ____ ft.

Depth to water table: (below top of casing) 5.3 ft.

Water table elevation: ____ ft.

Length of water column (LWC) 9.8 ft.

Volume of water in well:

2" diameter wells = 0.163 x (LWC) = 1.59 gallons 4.79

4" diameter wells = 0.653 X (LWC) = ____ gallons

6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color CLEAR Odor YES Turbidity SLIGHT

Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 5.00 gallons.

Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color BROWN Odor YES Turbidity SLIGHT

Was an oil film or layer apparent? NO

E. CONDUCTIVITY ____

F. pH ____

G. TEMPERATURE ____

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK, GM FISHER GUIDE Well No. MW-10
Sampled By JAMES A. MOORE Date 10-7-88 Time 11:00
Weather CLOUDY Sampled with Bailer ✓ Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 15.0 ft.
Well elevation: (top of casing) ____ ft.
Depth to water table: (below top of casing) 9.1 ft.
Water table elevation: ____ ft.
Length of water column (LWC) 5.9 ft.
Volume of water in well:

2" diameter wells = 0.163 x (LWC) = .96 gallons 2.88
4" diameter wells = 0.653 X (LWC) = ____ gallons
6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color CLEAR Odor YES Turbidity SLIGHT
Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 3.0 gallons.
Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color BROWN Odor YES Turbidity SLIGHT
Was an oil film or layer apparent? NO

E. CONDUCTIVITY ____

F. pH ____

G. TEMPERATURE ____

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK, GM FISHER GUIDE Well No. MW-11
Sampled By JAMES A. MOORE Date 10-7-88 Time 12:30
Weather CLOUDY Sampled with Bailer ✓ Pump ______

A. WATER TABLE:

Well depth: (below top of casing) 15.20 ft.
Well elevation: (top of casing) ______ ft.
Depth to water table: (below top of casing) 4.1 ft.
Water table elevation: ______ ft.
Length of water column (LWC) 10.9 ft.
Volume of water in well:

2" diameter wells = 0.163 x (LWC) = 1.77 gallons 5.33
4" diameter wells = 0.653 X (LWC) = ______ gallons
6" diameter wells = 1.469 X (LWC) = ______ gallons

B. PHYSICAL APPEARANCE AT START:

Color CLEAR Odor YES Turbidity NO
Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 5.50 gallons.
Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color BROWN Odor YES Turbidity NO
Was an oil film or layer apparent? NO

E. CONDUCTIVITY ______

F. pH ______

G. TEMPERATURE ______

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK GM FISHER GUIDE Well No. MW-12
Sampled By JAMES A. MOORE Date 10-7-88 Time 1430
Weather COUDY Sampled with Bailer ✓ Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 16.3 ft.
Well elevation: (top of casing) ____ ft.
Depth to water table: (below top of casing) 9.2 ft.
Water table elevation: ____ ft.
Length of water column (LWC) 7.1 ft.
Volume of water in well:

2" diameter wells = 0.163 x (LWC) = 1.15 gallons 3.47
4" diameter wells = 0.653 X (LWC) = ____ gallons
6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color CLEAR Odor YES Turbidity NO
Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 3.5 gallons.
Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color BROWN Odor YES Turbidity NO
Was an oil film or layer apparent? NO

E. CONDUCTIVITY ____

F. pH ____

G. TEMPERATURE ____

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK, GM FISHER GUIDE Well No. MW-13

Sampled By JAMES A. MOORE Date 10-7-88 Time 2:00

Weather CLOUDY, SUN Sampled with Bailer ✓ Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 17.6 ft.

Well elevation: (top of casing) ____ ft.

Depth to water table: (below top of casing) 10.8 ft.

Water table elevation: ____ ft.

Length of water column (LWC) 6.8 ft.

Volume of water in well:

2" diameter wells = 0.163 x (LWC) = 1.10 gallons 3.32

4" diameter wells = 0.653 X (LWC) = ____ gallons

6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color CLEAR Odor YES Turbidity NO

Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 3.5 gallons.

Did well go dry? No

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color BROWN Odor YES Turbidity NO

Was an oil film or layer apparent? NO

E. CONDUCTIVITY ____

F. pH ____

G. TEMPERATURE ____

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK, GM FISHER GUIDE Well No. MW-1
Sampled By JAMES A. MOORE Date 4/5/89 Time 12:03 Pm
Weather CLOUDY Sampled with Bailer ✓ Pump ____

A. WATER TABLE:

Well depth:
(below top of casing) 13.6 ft.
Well elevation:
(top of casing) ____ ft.
Depth to water table:
(below top of casing) 6.42 ft.
Water table elevation: ____ ft.
Length of water column (LWC) 6.58 ft.
Volume of water in well:

[✓ 2"] diameter wells = 0.163 x (LWC) = 1.07 gallons 3.21
4" diameter wells = 0.653 X (LWC) = ____ gallons
6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color CLEAR Odor NONE Turbidity LOW
Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 3.5 gallons.
Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color TAN Odor NONE Turbidity MED
Was an oil film or layer apparent? NO

E. CONDUCTIVITY ____

F. pH ____

G. TEMPERATURE ____

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK, GM FISHER GUIDE Well No. MW-2
Sampled By JAMES A. MOORE Date 4/5/89 Time 11:30 AM
Weather CLOUDY Sampled with Bailer ✓ Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 12.0 ft.
Well elevation: (top of casing) ____ ft.
Depth to water table: (below top of casing) 5.28 ft.
Water table elevation: ____ ft.
Length of water column (LWC) 6.72 ft.
Volume of water in well:
[✓ 2"] diameter wells = 0.163 x (LWC) = 1.09 gallons 3.28
4" diameter wells = 0.653 X (LWC) = ____ gallons
6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color CLEAR Odor NONE Turbidity LOW
Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 3.5 gallons.
Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color TAN Odor NONE Turbidity MED
Was an oil film or layer apparent? NO

E. CONDUCTIVITY ____

F. pH ____

G. TEMPERATURE ____

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK, GM FISHER GUIDE Well No. MW-3

Sampled By JAMES A. MOORE Date 4/5/89 Time 10:57 AM

Weather SUNNY Sampled with Bailer ✓ Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 11.4 ft.

Well elevation: (top of casing) ____ ft.

Depth to water table: (below top of casing) 6.0 ft.

Water table elevation: ____ ft.

Length of water column (LWC) 5.4 ft.

Volume of water in well:

[✓ 2"] diameter wells = 0.163 x (LWC) = .88 gallons 2.64

4" diameter wells = 0.653 X (LWC) = ____ gallons

6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color CLEAR Odor SULFUR Turbidity LOW

Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 3.0 gallons.

Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color GRAY Odor SULFUR Turbidity MED

Was an oil film or layer apparent? NO

E. CONDUCTIVITY ____

F. pH ____

G. TEMPERATURE ____

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK, GM FISHER GUIDE Well No. MW-4
Sampled By JAMES A. MOORE Date 4/5/89 Time 8:43 Am
Weather CROWDY Sampled with Bailer ✓ Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 11.9 ft.
Well elevation: (top of casing) ____ ft.
Depth to water table: (below top of casing) 4.62 ft.
Water table elevation: ____ ft.
Length of water column (LWC) 7.28 ft.
Volume of water in well:

②" diameter wells = 0.163 x (LWC) = 1.18 gallons 3.55
4" diameter wells = 0.653 X (LWC) = ____ gallons
6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color CLEAR Odor SULVENT Turbidity LOW
Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 4.6 gallons.
Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color TAN/GRAY Odor SULVENT Turbidity MED
Was an oil film or layer apparent? NO

E. CONDUCTIVITY ____

F. pH ____

G. TEMPERATURE ____

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK, GM FISHER GUIDE Well No. MW-5

Sampled By JAMES A. MOORE Date 4/4/89 Time 1:35 Pm

Weather CLOUDY Sampled with Bailer ✓ Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 12.2 ft.

Well elevation: (top of casing) ____ ft.

Depth to water table: (below top of casing) 5.49 ft.

Water table elevation: ____ ft.

Length of water column (LWC) 6.71 ft.

Volume of water in well:

2" diameter wells = 0.163 x (LWC) = 1.09 gallons 3.28

4" diameter wells = 0.653 X (LWC) = ____ gallons

6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color RUST Odor NO Turbidity LOW

Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 4.0 gallons.

Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color RUST Odor NO Turbidity MED

Was an oil film or layer apparent? NO

E. CONDUCTIVITY ____

F. pH ____

G. TEMPERATURE ____

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK, GM FISHER GUIDE Well No. MW-6

Sampled By JAMES A. MOORE Date 4/4/89 Time 1:00 pm

Weather CLOUDY Sampled with Bailer ✓ Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 20.0 ft.

Well elevation: (top of casing) ____ ft.

Depth to water table: (below top of casing) 7.01 ft.

Water table elevation: ____ ft.

Length of water column (LWC) 12.99 ft.

Volume of water in well:

[✓ 2"] diameter wells = 0.163 x (LWC) = 2.1 gallons 6.35

4" diameter wells = 0.653 X (LWC) = ____ gallons

6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color GRAY Odor SULFUR Turbidity MED

Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 7.0 gallons.

Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color GRAY/BLACK Odor SULFUR Turbidity HIGH

Was an oil film or layer apparent? NO

E. CONDUCTIVITY ____

F. pH ____

G. TEMPERATURE ____

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK, GM FISHER GUIDE Well No. MW-7A

Sampled By JAMES A. MOORE Date 4/5/89 Time 9:15 AM

Weather CLOUDY Sampled with Bailer ✓ Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 11.0 ft.

Well elevation: (top of casing) ____ ft.

Depth to water table: (below top of casing) 4.16 ft.

Water table elevation: ____ ft.

Length of water column (LWC) 6.84 ft.

Volume of water in well:

[✓ 2"] diameter wells = 0.163 x (LWC) = 1.11 gallons 3.34

4" diameter wells = 0.653 X (LWC) = ____ gallons

6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color CLEAR Odor NONE Turbidity LOW

Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 3.5 gallons.

Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color TAN/GRAY Odor SOLVENT Turbidity MED

Was an oil film or layer apparent? NO

E. CONDUCTIVITY ____

F. pH ____

G. TEMPERATURE ____

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK, GM FISHER GUIDE Well No. MW-7B
Sampled By JAMES A. MOORE Date 4/ /89 Time 9:45 Am
Weather SUNNY Sampled with Bailer ✓ Pump ____

A. WATER TABLE:

Well depth:
(below top of casing) 11.8 ft.
Well elevation:
(top of casing) ____ ft.
Depth to water table:
(below top of casing) 6.07 ft.
Water table elevation: ____ ft.
Length of water column (LWC) 5.73 ft.
Volume of water in well:

[✓ 2"] diameter wells = 0.163 x (LWC) = .93 gallons 2.80
4" diameter wells = 0.653 X (LWC) = ____ gallons
6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color CLEAR Odor NONE Turbidity LOW
Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 3.0 gallons.
Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color TAN Odor NONE Turbidity MED
Was an oil film or layer apparent? NO

E. CONDUCTIVITY ____

F. pH ____

G. TEMPERATURE ____

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK, GM FISHER GUIDE Well No. MW-7C
Sampled By JAMES A MOORE Date 4/5/89 Time 10:20 AM
Weather SUNNY Sampled with Bailer ✓ Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 12.6 ft.
Well elevation: (top of casing) ____ ft.
Depth to water table: (below top of casing) 7.33 ft.
Water table elevation: ____ ft.
Length of water column (LWC) 5.27 ft.
Volume of water in well:

[✓ 2"] diameter wells = 0.163 x (LWC) = .85 gallons 2.57
4" diameter wells = 0.653 X (LWC) = ____ gallons
6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color CLEAR Odor SULFUR Turbidity LOW
Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 3.0 gallons.
Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color GRAY Odor SULFUR Turbidity MED.
Was an oil film or layer apparent? NO

E. CONDUCTIVITY ____

F. pH ____

G. TEMPERATURE ____

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK GM FISHER GUIDE Well No. MW-8
Sampled By JAMES A. MOORE Date 4/4/89 Time 12:20 PM
Weather CLOUDY Sampled with Bailer ✓ Pump ______

A. WATER TABLE:

Well depth: (below top of casing) 15.7 ft.
Well elevation: (top of casing) ______ ft.
Depth to water table: (below top of casing) 6.67 ft.
Water table elevation: ______ ft.
Length of water column (LWC) 9.03 ft.
Volume of water in well:
[✓ 2"] diameter wells = 0.163 x (LWC) = 1.47 gallons 4.4
4" diameter wells = 0.653 X (LWC) = ______ gallons
6" diameter wells = 1.469 X (LWC) = ______ gallons

B. PHYSICAL APPEARANCE AT START:

Color CLEAR Odor NO Turbidity LOW
Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 5.0 gallons.
Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color BROWN Odor NO Turbidity HIGH
Was an oil film or layer apparent? NO

E. CONDUCTIVITY ______

F. pH ______

G. TEMPERATURE ______

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK, GM FISHER GUIDE Well No. MW-9

Sampled By JAMES A. MOORE Date 4/4/89 Time 11:35 AM

Weather RAIN Sampled with Bailer ✓ Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 15.1 ft.

Well elevation: (top of casing) ____ ft.

Depth to water table: (below top of casing) 1.70 ft.

Water table elevation: ____ ft.

Length of water column (LWC) 13.4 ft.

Volume of water in well:

[✓ 2"] diameter wells = 0.163 x (LWC) = 2.1 gallons 6.5

4" diameter wells = 0.653 X (LWC) = ____ gallons

6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color CLEAR Odor SULFUR Turbidity LOW

Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 7.0 gallons.

Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color GRAY Odor SULFUR Turbidity HIGH

Was an oil film or layer apparent? NO

E. CONDUCTIVITY ____

F. pH ____

G. TEMPERATURE ____

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK, GM FISHER GUIDE Well No. MW-10

Sampled By JAMES A. MOORE Date 4/4/89 Time 11:00 AM

Weather RAIN Sampled with Bailer ✓ Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 15.0 ft.

Well elevation: (top of casing) ____ ft.

Depth to water table: (below top of casing) 6.07 ft.

Water table elevation: ____ ft.

Length of water column (LWC) 8.93 ft.

Volume of water in well:

2" diameter wells = 0.163 x (LWC) = 1.45 gallons 4.36

4" diameter wells = 0.653 X (LWC) = ____ gallons

6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color CLEAR Odor NO Turbidity LOW

Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 5.00 gallons.

Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color TAN Odor NO Turbidity MED

Was an oil film or layer apparent? NO

E. CONDUCTIVITY ____

F. pH ____

G. TEMPERATURE ____

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK, GM FISHER GUIDE Well No. MW-11
Sampled By JAMES A. MOORE Date 4/4/89 Time 10:25 AM
Weather RAIN Sampled with Bailer ✓ Pump ____

A. WATER TABLE:

Well depth: (below top of casing) ~~75.20~~ 13.20 ft.
Well elevation: (top of casing) ____ ft.
Depth to water table: (below top of casing) 0.94 ft.
Water table elevation: ____ ft.
Length of water column (LWC) 12.26 ft.
Volume of water in well:

[✓ 2"] diameter wells = 0.163 x (LWC) = 1.99 gallons 5.99
4" diameter wells = 0.653 X (LWC) = ____ gallons
6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color CLEAR Odor NO Turbidity LOW
Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 6.0 gallons.
Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color TAN Odor NO Turbidity MED
Was an oil film or layer apparent? NO

E. CONDUCTIVITY ____

F. pH ____

G. TEMPERATURE ____

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK, GM FISHER GUIDE Well No. MW-12
Sampled By JAMES A MOORE Date 4/4/89 Time 9:25 Am
Weather RAIN Sampled with Bailer ✓ Pump ____

A. WATER TABLE:

Well depth:
(below top of casing) 18.86 ft.
Well elevation:
(top of casing) ____ ft.
Depth to water table:
(below top of casing) 10.19 ft.
Water table elevation: ____ ft.
Length of water column (LWC) 8.67 ft.
Volume of water in well:

[✓ 2"] diameter wells = 0.163 x (LWC) = 1.4 gallons 4.2
4" diameter wells = 0.653 X (LWC) = ____ gallons
6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color RUST Odor NO Turbidity LOW
Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 4.5 gallons.
Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color BROWN/TAN Odor NO Turbidity MED
Was an oil film or layer apparent? NO

E. CONDUCTIVITY ____

F. pH ____

G. TEMPERATURE ____

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEY CREEK, GM, SYRACUSE Well No. MW-13.
Sampled By JAMES A. MOORE Date 4/4/89 Time 8:50 AM
Weather RAIN Sampled with Bailer ✓ Pump ______

A. WATER TABLE:

Well depth:
(below top of casing) ~~17.6~~ 12.6 ft.

Well elevation:
(top of casing) ______ ft.

Depth to water table:
(below top of casing) 5.03 ft.

Water table elevation: ______ ft.

Length of water column (LWC) ~~12.57~~ 7.57 ft.

Volume of water in well:

2" diameter wells = 0.163 x (LWC) = ~~2.04~~ 1.25 gallons ~~6.12~~ 3.7
4" diameter wells = 0.653 X (LWC) = ______ gallons
6" diameter wells = 1.469 X (LWC) = ______ gallons

B. PHYSICAL APPEARANCE AT START:

Color CLEAR Odor NO Turbidity LOW
Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 4.5 gallons.
Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color CLEAR Odor NO Turbidity LOW
Was an oil film or layer apparent? NO

E. CONDUCTIVITY ______

F. pH ______

G. TEMPERATURE ______

H. WELL SAMPLING NOTES:

GROUND WATER SAMPLING FIELD LOG

Sample Location LEy Creek GM Inland Fisher Guide Well No. OBG ~~MW~~ - 1
Sampled By Peter Loretto Date 7/24 ~~23~~/92 Time 1441
Weather Cloudy Light RAin Sampled with Bailer X Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 12.31 ft.
Well elevation: (top of casing) ____ ft.
Depth to water table: (below top of casing) 8.77 ft.
Water table elevation: ____ ft.
Length of water column (LWC) 3.54 ft.
Volume of water in well:

2" diameter wells = 0.163 x (LWC) = .577 gallons 1.73
4" diameter wells = 0.653 X (LWC) = ____ gallons
6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color Light Rust Odor Slight sulfur Turbidity mod.
Was an oil film or layer apparent? No

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 2 gallons.
Did well go dry? yes

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color Lt Brown Odor None Turbidity mod
Was an oil film or layer apparent? NO

E. CONDUCTIVITY 1220

F. pH 4.5

G. TEMPERATURE 62° F

H. WELL SAMPLING NOTES:

SAmpled well at 1445 on 7/24/92

GROUND WATER SAMPLING FIELD LOG

Sample Location LEy Creek GM Inland Fisher Guide Well No. OBG ~~MW~~ - 2
Sampled By Peter Loretto Date 7/24/92 Time 1435
Weather Cloudy, Light Rain Sampled with Bailer X Pump ____

A. WATER TABLE:

Well depth: (below top of casing) ____ ft.
Well elevation: (top of casing) ____ ft.
Depth to water table: (below top of casing) ____ ft.
Water table elevation: ____ ft.
Length of water column (LWC) ____ ft.
Volume of water in well:

2" diameter wells = 0.163 x (LWC) = ____ gallons
4" diameter wells = 0.653 X (LWC) = ____ gallons
6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color Dark grey Odor None Turbidity High
Was an oil film or layer apparent? No

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling ____ gallons.
Did well go dry? No

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color Lt grey Odor None Turbidity mod
Was an oil film or layer apparent? No

E. CONDUCTIVITY 2790

F. pH 6.3

G. TEMPERATURE 62°F

H. WELL SAMPLING NOTES:

Sampled well at 1435 on 7/24/92

GROUND WATER SAMPLING FIELD LOG

Sample Location LEy Creek GM Inland Fisher Guide Well No. OBG ~~MW~~-3

Sampled By Peter Loretto Date 7/~~23~~24/92 Time 1330

Weather Cloudy Light Rain Sampled with Bailer X Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 12.37 ft.

Well elevation: (top of casing) ____ ft.

Depth to water table: (below top of casing) 8.96 ft.

Water table elevation: ____ ft.

Length of water column (LWC) 3.41 ft.

Volume of water in well:

2" diameter wells = 0.163 x (LWC) = .555 gallons 1.66

4" diameter wells = 0.653 X (LWC) = ____ gallons

6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color Dark Grey-Brown Odor organic Turbidity High

Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 1.75 gallons.

Did well go dry? Yes

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color Lt Brown Odor None Turbidity med.

Was an oil film or layer apparent? No

E. CONDUCTIVITY 3060

F. pH 6.11

G. TEMPERATURE 62.°F

H. WELL SAMPLING NOTES:

Sampled well at 1330 on 7/24/92

Blind Duplicate Taken

GROUND WATER SAMPLING FIELD LOG

Sample Location Ley Creek GM Inland Fisher Guide Well No. OBG ~~MW~~ - 5
Sampled By Peter Loretto Date 7/~~23~~ 24/92 Time 1515
Weather Cloudy Light Rain Sampled with Bailer X Pump

A. WATER TABLE:

Well depth:
(below top of casing) 12.12 ft.

Well elevation:
(top of casing) ft.

Depth to water table:
(below top of casing) 6.56 ft.

Water table elevation: ft.

Length of water column (LWC) 5.66 ft.

Volume of water in well:

2" diameter wells = 0.163 x (LWC) = .9 gallons 2.71
4" diameter wells = 0.653 X (LWC) = gallons
6" diameter wells = 1.469 X (LWC) = gallons

B. PHYSICAL APPEARANCE AT START:

Color Black Odor organic Turbidity High
Was an oil film or layer apparent? No

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 3 gallons.
Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color Light Black/grey Odor organic Turbidity High
Was an oil film or layer apparent? No

E. CONDUCTIVITY 1230

F. pH 4.7

G. TEMPERATURE 62° F

H. WELL SAMPLING NOTES:

Well Sampled at 1515 on 7/24/92

GROUND WATER SAMPLING FIELD LOG

Sample Location GM Fisher Guide Ley Creek Well No. MW-6

Sampled By Peter Loretto Date 9/18/92 Time 10:15

Weather Sunny 70° Sampled with Bailer X Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 20.06 ft.

Well elevation: (top of casing) ____ ft.

Depth to water table: (below top of casing) 10.45 ft.

Water table elevation: ____ ft.

Length of water column (LWC) 9.61 ft.

Volume of water in well:

2" diameter wells = 0.163 x (LWC) = 1.39 gallons 4.5

4" diameter wells = 0.653 X (LWC) = ____ gallons

6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color Black Odor organic Turbidity High

Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 4.5 gallons.

Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color Dark gray Odor Slight organic Turbidity High

Was an oil film or layer apparent? NO

E. CONDUCTIVITY 765

F. pH 6.8

G. TEMPERATURE 62° F

H. WELL SAMPLING NOTES:

Sampled well At 10:15 on 9/17/92

Took MS, MSD

Sampled well with waterra Tubing

GROUND WATER SAMPLING FIELD LOG

Sample Location Ley Creek GM Inland Fisher Guide Well No. OBG ~~MW~~ - 7B
Sampled By Peter Loretto Date 7/~~23~~ 24/92 Time 1310
Weather Cloudy Light Rain Sampled with Bailer X Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 11.84 ft.
Well elevation: (top of casing) ____ ft.
Depth to water table: (below top of casing) 7.42 ft.
Water table elevation: ____ ft.
Length of water column (LWC) 4.42 ft.
Volume of water in well:

2" diameter wells = 0.163 x (LWC) = .72 gallons 2.16
4" diameter wells = 0.653 X (LWC) = ____ gallons
6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color Dark Brown Odor Organic Turbidity High
Was an oil film or layer apparent? ~~?5~~ none.

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 2.5 gallons.
Did well go dry? No

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color Lt grey Odor None Turbidity mod.
Was an oil film or layer apparent? No

E. CONDUCTIVITY 2240

F. pH 10.3

G. TEMPERATURE 62° F

H. WELL SAMPLING NOTES:

Sampled well at 1310 on 7/24/92

GROUND WATER SAMPLING FIELD LOG

Sample Location LEy Creek GM Inland Fisher Guide Well No. CBG ~~MW~~-7C

Sampled By Peter Loretto Date 7/24 ~~23~~/92 Time 1320

Weather Cloudy Light RAin Sampled with Bailer X Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 12.52 ft.

Well elevation: (top of casing) ____ ft.

Depth to water table: (below top of casing) 8.70 ft.

Water table elevation: ____ ft.

Length of water column (LWC) 3.82 ft.

Volume of water in well:

2" diameter wells = 0.163 x (LWC) = .632 gallons 1.86

4" diameter wells = 0.653 X (LWC) = ____ gallons

6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color Black Odor Organic Turbidity High

Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 2 gallons.

Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color LT Brown Odor None Turbidity mod.

Was an oil film or layer apparent? NO

E. CONDUCTIVITY 2220

F. pH 11.5

G. TEMPERATURE 63.0°F

H. WELL SAMPLING NOTES:

Sampled well at 1320 on 7/24/92

GROUND WATER SAMPLING FIELD LOG

Sample Location LEy Creek GM Inland Fisher Guide Well No. mw-8

Sampled By Peter Loretto Date 7/~~23~~24/92 Time

Weather Cloudy. Light RAin Sampled with Bailer X Pump

A. WATER TABLE:

Well depth: (below top of casing) 16.97 ft.

Well elevation: (top of casing) ft.

Depth to water table: (below top of casing) 9.36 ft.

Water table elevation: ft.

Length of water column (LWC) 7.61 ft.

Volume of water in well:

2" diameter wells = 0.163 x (LWC) = 1.2 gallons 3.72

4" diameter wells = 0.653 X (LWC) = gallons

6" diameter wells = 1.469 X (LWC) = gallons

B. PHYSICAL APPEARANCE AT START:

Color Lt Brown Odor None Turbidity mod.

Was an oil film or layer apparent? No

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 4 gallons.

Did well go dry? No

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color Clear Odor None Turbidity Low

Was an oil film or layer apparent? No

E. CONDUCTIVITY 1255

F. pH 7.5

G. TEMPERATURE 58.7°F

H. WELL SAMPLING NOTES:

Well Had Plant Roots in it.

SAmpled well at 10:20 Am on 7/24/92

Sample Location Ley Creek GM Inland Fisher Guide **Well No.** MW-9

Sampled By Peter Loretto **Date** 7/23/92 **Time** 11:05

Weather Cloudy Light Rain **Sampled with Bailer** X **Pump** ____

A. WATER TABLE:

Well depth: (below top of casing) 16.81 ft.

Well elevation: (top of casing) ____ ft.

Depth to water table: (below top of casing) 2.31 ft.

Water table elevation: ____ ft.

Length of water column (LWC) 14.5 ft.

Volume of water in well:

2" diameter wells = 0.163 x (LWC) = 2.36 gallons 7.09

4" diameter wells = 0.653 X (LWC) = ____ gallons

6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color DArk Grey Odor organic Turbidity High

Was an oil film or layer apparent? No

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 7.5 gallons.

Did well go dry? No

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color Light Brown Odor Slight organic Turbidity med

Was an oil film or layer apparent? No

E. CONDUCTIVITY 1820

F. pH 7.3

G. TEMPERATURE 54. °F

H. WELL SAMPLING NOTES:

SAmpled well at 11:05 on 7/24/92

GROUND WATER SAMPLING FIELD LOG

Sample Location LEy Creek GM Inland Fisher Guide Well No. mw-10
Sampled By Peter Loretto Date 7/~~22~~ 24/92 Time 11:20
Weather Cloudy Light RAin Sampled with Bailer X Pump

A. WATER TABLE:

Well depth: (below top of casing) 16.95 ft.
Well elevation: (top of casing) ft.
Depth to water table: (below top of casing) 6.91 ft.
Water table elevation: ft.
Length of water column (LWC) 10.04 ft.
Volume of water in well:

2" diameter wells = 0.163 x (LWC) = 1.63 gallons 5.
4" diameter wells = 0.653 X (LWC) = gallons
6" diameter wells = 1.469 X (LWC) = gallons

B. PHYSICAL APPEARANCE AT START:

Color Lt. Brown Odor None Turbidity High
Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 5 gallons.
Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color milky Brown Odor None Turbidity mod.
Was an oil film or layer apparent? NO

E. CONDUCTIVITY 3040

F. pH 7.17

G. TEMPERATURE 59 °F

H. WELL SAMPLING NOTES:

Sampled well at 11:20 on 7/24/92

GROUND WATER SAMPLING FIELD LOG

Sample Location LEy Creek GM Inland Fisher Guide Well No. MW-12
Sampled By Peter Loretto Date 7/~~23~~24/92 Time 1545
Weather Cloudy Light Rain Sampled with Bailer X Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 18.75 ft.
Well elevation: (top of casing) ____ ft.
Depth to water table: (below top of casing) 10.73 ft.
Water table elevation: ____ ft.
Length of water column (LWC) 8.02 ft.
Volume of water in well:

2" diameter wells = 0.163 x (LWC) = 1.3 gallons 3.9
4" diameter wells = 0.653 X (LWC) = ____ gallons
6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color Dark grey Odor Lt organic Turbidity High
Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 4 gallons.
Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color Lt grey Odor None Turbidity mod
Was an oil film or layer apparent? NO

E. CONDUCTIVITY 3500

F. pH 4.7

G. TEMPERATURE 63°F

H. WELL SAMPLING NOTES:

Sampled well at 1545 on 7/24/92

Sample Location LEy Creek GM Inland Fisher Guide **Well No.** MW-13
Sampled By Peter Loretto **Date** 7/~~22~~24/92 **Time** 1610
Weather Cloudy Light Rain **Sampled with Bailer** X **Pump** ____

A. WATER TABLE:

Well depth:
(below top of casing) 12.98 ft.

Well elevation:
(top of casing) ____ ft.

Depth to water table:
(below top of casing) 6.84 ft.

Water table elevation: ____ ft.

Length of water column (LWC) 6.14 ft.

Volume of water in well:

2" diameter wells = 0.163 x (LWC) = 1.0 gallons 3
4" diameter wells = 0.653 X (LWC) = ____ gallons
6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color Lt grey Odor none Turbidity mod
Was an oil film or layer apparent? NO

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 3 gallons.
Did well go dry? NO

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color Lt grey Odor none Turbidity mod
Was an oil film or layer apparent? NO

E. CONDUCTIVITY 2470

F. pH 5.35

G. TEMPERATURE 60.5

H. WELL SAMPLING NOTES:

Sampled well at on 7/24/92

GROUND WATER SAMPLING FIELD LOG

Sample Location GM Ley Creek Well No. mw 3D

Sampled By Pete Loretto Date 7/29/92 Time 11:00

Weather Cloudy Sampled with Bailer X Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 34.73 ft.

Well elevation: (top of casing) ____ f

Depth to water table: (below top of casing) 3.63 ft.

Water table elevation: ____ f

Length of water column (LWC) 31.10 ft.

Volume of water in well:

2" diameter wells = 0.163 x (LWC) = 5.07 gallons 15.2

4" diameter wells = 0.653 X (LWC) = ____ gallons

6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color Clear Odor None Turbidity Low

Was an oil film or layer apparent? No

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 15 gallons.

Did well go dry? No

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color Brown Odor none Turbidity med

Was an oil film or layer apparent? ____

E. CONDUCTIVITY ____

F. pH 7.0 6.9 7.0

G. TEMPERATURE 13.5 12.7 12.5

H. WELL SAMPLING NOTES:

Sampled well at 11:10

GROUND WATER SAMPLING FIELD LOG

Sample Location GM Ley creek Well No. mw 3D

Sampled By Pete Loretto Date 7/29/92 Time 11:00

Weather Cloudy Sampled with Bailer X Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 34.73 ft.

Well elevation: (top of casing) ____ f

Depth to water table: (below top of casing) 3.63 ft.

Water table elevation: ____ f

Length of water column (LWC) 31.10 ft.

Volume of water in well:

2" diameter wells = 0.163 x (LWC) = 5.07 gallons 15.2

4" diameter wells = 0.653 X (LWC) = ____ gallons

6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color Clear Odor None Turbidity Low

Was an oil film or layer apparent? No

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 15 gallons.

Did well go dry? No

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color Brown Odor None Turbidity med

Was an oil film or layer apparent? ____

E. CONDUCTIVITY ____

F. pH 7.0 6.9 7.0

G. TEMPERATURE 13.5 12.7 12.5

H. WELL SAMPLING NOTES:

Sampled well At 1110

GROUND WATER SAMPLING FIELD LOG

Sample Location GM Lex Creek Well No. MW-9D

Sampled By Pete Loretto Date 7/29/92 Time 1030

Weather Cloudy Sampled with Bailer ____ Pump ____

A. WATER TABLE:

Well depth: (below top of casing) 37.61 ft.

Well elevation: (top of casing) ____ f

Depth to water table: (below top of casing) 0 ft.

Water table elevation: ____ f

Length of water column (LWC) 37.61 ft.

Volume of water in well:

2" diameter wells = 0.163 x (LWC) = 6.1 gallons 18

4" diameter wells = 0.653 X (LWC) = ____ gallons

6" diameter wells = 1.469 X (LWC) = ____ gallons

B. PHYSICAL APPEARANCE AT START:

Color Clear Odor None Turbidity Low

Was an oil film or layer apparent? No

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling 20 gallons.

Did well go dry? No

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color Clear Odor None Turbidity Low

Was an oil film or layer apparent? No

E. CONDUCTIVITY ____

F. pH 7.1 7.0 7.0

G. TEMPERATURE 12.5 12.2 12.2

H. WELL SAMPLING NOTES:

Well was Artesian so I Put a water Spiket on well Casing and Attached hose To Purge well Volume

Sampled well at 1045

APPENDIX D

DATA VALIDATION REPORT

3247.078

DATA VALIDATION

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY LEY CREEK DREDGED MATERIAL AREA

GENERAL MOTORS CORPORATION
INLAND FISHER GUIDE
SYRACUSE, NEW YORK

SEPTEMBER 1993

O'BRIEN & GERE ENGINEERS, INC.
5000 BRITTONFIELD PARKWAY
SYRACUSE, NEW YORK 13221

SUMMARY

The analytical data generated for the General Motors Corporation, Inland Fisher Guide Division, Ley Creek Dredged Material Area in Syracuse, New York, were validated based on QA/QC criteria established by the NYSDEC Analytical Services Protocol (ASP) and QA/QC criteria presented in the Quality Assurance Project Plan (QAPP) for this project. Seven rounds of samples were collected during the remedial investigation. The first round of samples consisted of seventeen fish samples collected on July 16, 1992. The second round of samples consisted of twenty-six subsurface soil samples collected on July 20, 21, and 24, 1992. The third round of samples collected were six surface soil samples collected on July 22, 1992. Nineteen subsurface soil samples collected on July 23, 1992 made up the fourth round of sampling. The fifth round of samples consisted of thirty-four ground water samples collected on July 24, July 29, and September 17, 1992. The sixth round of sampling consisted of ten sediment samples collected on July 29, 1992. The seventh round of sampling consisted of five water samples and one sediment sample collected on August 13, 1992. The eighth round of sampling consisted of nine subsurface soil samples and one equipment blank collected on December 4, 1992.

Upon completion of the data validation, it was determined that the data for these eight rounds are useable for qualitative and quantitative purposes consistent with QAPP and ASP criteria. A summary of data useability with reference to the specific samples that required qualification is presented in Section 5 of this document.

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Inland Fisher Guide Division
General Motors Corporation
Ley Creek Dredged Material Area
Syracuse, New York

SECTION 1 - INTRODUCTION

1.01 Introduction

This report addresses the data quality of samples collected from the General Motors Corporation, Inland Fisher Guide Division-Ley Creek Dredged Material Area (Site) in Syracuse, New York. Samples were collected by O'Brien & Gere Engineers, Inc. of Syracuse, New York, and laboratory analyses were performed by H2M Labs, Inc. located in Melville, New York. Analytical results were presented in laboratory reports received August, October, and December 1992. Environmental samples, including blind duplicates, consisted of:

- Seventeen fish samples collected on July 16, 1992.
- Thirty-two groundwater samples collected on July 24, July 29, and September 17, 1992.
- Five surface soil samples collected on July 22, 1992.
- Forty-three subsurface soil samples collected on July 20, July 21, July 23, and July 24, 1992.
- Nine sediment samples collected on July 29, 1992.
- Four outfall water samples and one outfall sediment sample collected on August 13, 1992.
- Field blanks collected on July 20, July 22, July 24, July 29, and September 17, 1992.

- Nine subsurface soil samples and one equipment blank collected December 4, 1992.

1.02 General Considerations

Validation is a process of determining the suitability of a measurement system for providing useful analytical data. Although the term is frequently used in discussing methodologies, it applies to all aspects of the system and especially to samples, their measurement, and the actual data output. Accordingly, this report outlines excursions from applicable quality control outlined in the following documents:

Quality Assurance Project Plan (QAPP) for the Remedial Investigation/Feasibility Study (RI/FS) of Ley Creek Dredged Material Area, Syracuse, New York, O'Brien & Gere Engineers, Inc., February 1992.

New York State Department of Environmental Conservation Analytical Services Protocol (NYSDEC ASP), NYSDEC September 1989, 12/91 Revisions.

USEPA National Functional Guidelines for Organic Data Review, USEPA December 1990, Revised June 1991.

CLP Organics Data Review and Preliminary Review, SOP NO. HW-6 Revision #8, USEPA Region II, January 1992.

The following four sections of this document address distinct aspects of the validation process. Section 2 provides the analytical methodology employed in sample analysis. Section 3 lists the data quality assurance/quality control (QA/QC) protocols used to validate the sample data. Specific QA/QC excursions and qualifications performed on the sample data are discussed in Section 4. Finally, data completeness and usability with respect to the intended purposes of the data are discussed in Section 5.

SECTION 2 - ANALYTICAL METHODS

2.01 Drilling/Subsurface Soil Investigation

Forty-three subsurface soil and associated quality control (QC) samples collected on July 20, 21, 23, and 24, 1992 were analyzed for NYSDEC ASP Superfund-Contract Laboratory Program (CLP) PCBs utilizing method 91-3 from NYSDEC ASP (December 1991). Validated analytical results for samples collected for this set of samples are presented in Table 7 of the main report. The letters found immediately to the right of the individual sample results serve to qualify the sample data. Only one of the following qualifiers was used for an individual sample result.

U	Indicates that the compound was analyzed for, but was not detected. The sample quantitation limit is presented and adjusted for dilution and percent moisture. This qualifier is also used to signify that the detection limit of an analyte was raised due to blank contamination.
J	Indicates that the result should be considered approximate. This qualifier is used when the data validation process identifies a deficiency in the data generation process that effects a detected result.
JN	Indicates that the analyte is presumptively present at an approximated quantity. This flag is used for a pesticide/Aroclor target analyte when there is greater than 50% difference for detected concentrations between the two chromatograph columns.

UJ Indicates that the non-detected sample result for the analyte in this sample should be considered approximate. This qualifier is used when the data validation process identifies a deficiency in the data generation process that effects a non-detected sample result.

2.02 Ground Water Sampling

Fifteen unfiltered and fifteen filtered ground water and associated QC samples collected on July 24, and 29, 1992 were analyzed for NYSDEC ASP Superfund-CLP PCBs utilizing method 91-3 from NYSDEC ASP (December 1991). Validated analytical results for this set of samples are presented in Table 4 of the main report. Qualifiers used for this set of sample results are as described in Section 2.01.

2.03 Surface Soil Sampling

Five surface soil and associated QC samples collected on July 22, 1992 were analyzed for NYSDEC ASP Superfund-CLP PCBs utilizing method 91-3 from NYSDEC ASP (December 1991). Validated analytical results for this set of samples are presented in Table 8 of the main report. Qualifiers for this set of sample results are as described in Section 2.01.

2.04 Fish Sampling

Seventeen fish and associated QA/QC samples collected on July 16, 1992 were analyzed for NYSDEC ASP Superfund-CLP PCBs and percent lipids. Validated analytical results are tabulated in Table 14 of the main report. Qualifiers for this set of data are as specified in Section 2.01. The following methods were used for the analyses:

Parameter	Method
Superfund-CLP PCBs	NYSDEC ASP 91-3 (December 1991)
% Lipids	IR Spectroscopy

2.05 Sediment Sampling

Nine sediment and associated QC samples collected on July 29, 1992 were analyzed for NYSDEC ASP Superfund-CLP PCBs and total organic carbon (TOC). Validated analytical results obtained from utilizing the methods listed below can be found in Table 12 of the main report. Qualifiers for this set of data are as described in Section 2.01.

Parameter	Analytical Method
Superfund-CLP PCBs	NYSDEC ASP 91-3 (December 1991)
TOC	USEPA 415.1 (water)/Lloyd Kahn (sediment)

2.06 Outfall Sampling

Four water, one sediment, and associated QC samples collected on August 13, 1992 were analyzed for NYSDEC ASP Superfund-CLP PCBs utilizing method 91-3 from NYSDEC ASP (December 1991). Validated analytical results are presented in Table 15 of the main report. Qualifiers for this set of sample results are as described in Section 2.01.

2.07 Eighth Round Subsurface Soil Boring Sampling

Nine subsurface soil and associated QC samples collected on December 4, 1992 were analyzed for NYSDEC ASP Superfund-CLP PCBs utilizing method 91-3 from NYSDEC ASP (December 1991). Throughout this report, these samples are referred to as the eighth round of sampling. Validated analytical results are presented in Table 7 of the main report. Qualifiers used for this set of sample results are as described in Section 2.01.

SECTION 3 - DATA VALIDATION PROTOCOLS

The QA/QC criteria that were employed in the validation of Superfund-CLP PCBs, TOC and % lipids analyses are those outlined in the QAPP and in exhibit E of the NYSDEC ASP (December 1991). Qualification of sample data was based on data validation guidelines presented in *CLP Organics Data Review and Preliminary Review SOP HW-6 Revision 8,* (USEPA Region II, January 1992). The following subsections list the method specific QA/QC parameters which were evaluated in the validation of sample data from the Ley Creek Dredged Material Area.

3.01 Superfund-CLP PCB (Groundwater, Soil, and Sediment)

1. Holding Times
2. Instrument Performance
    a. Standards Retention Time Windows
    b. DCBP Retention Time Shift
    c. Baseline Stability
    d. Chromatographic Resolution
3. Calibration
    a. Initial Calibration
    b. Analytical Sequence Verification
    c. Continuing Calibration Verification
4. Blank Analysis
5. Surrogate Recovery
6. Matrix Spike/Matrix Spike Duplicate Analysis

7. Field Duplicate Analysis
8. Reference Standard Analysis
9. Percent Solids Analysis
10. Compound Identification and Quantification
11. Document Completeness
12. Overall Data Assessment

3.02 Superfund-CLP PCB (Fish)

1. Sample Preservation
2. Holding Times
3. Instrument Performance
    a. DCBP Retention Time Check
    b. Qualitative Standard Evaluation
4. Calibration
    a. Initial Calibration Curve Verification
    b. Analytical Sequence Verification
    c. Continuing Calibration Verification
5. Blank Analysis
    a. Method Blank
    b. Solvent Blank
6. Surrogate Recovery
7. Reference Standard Recovery
8. Matrix Spike/Matrix Spike Duplicate Analysis
9. PCB Identification

10. Compound Quantification

11. Document Completeness

3.03 Sediment TOC Analysis

1. Holding Times
2. Calibration
    - a. Initial Calibration Verification
    - b. Continuing Calibration Verification
3. CRDL Standard Analysis
4. Blank Analysis
6. Matrix Spike Analysis
7. Laboratory Duplicate Analysis
8. Field Duplicate Analysis
9. Laboratory Control Sample Analysis
10. Percent Solids Determination and Content
11. Document Completeness
12. Overall Data Assessment

3.04 % Lipids Analysis (Fish)

1. Holding Times
2. Calibration
    - a. Initial Calibration Verification
    - b. Continuing Calibration Verification
3. Blank Analysis

4. Matrix Spike Analysis
5. Laboratory Duplicate Analysis
6. Laboratory Control Sample Analysis
7. Documentation Completeness
8. Overall Data Assessment

SECTION 4 - DATA QUALITY EVALUATION

This section summarizes the QA/QC parameters which met validation criteria and describes qualifications performed on the sample data when QA/QC parameters did not meet criteria. Samples that required qualification are identified in the following sections and on Tables 4, 7, 8, 12, 14, and 15 of the main report by the client identification number or the description documented on the sample chain of custody records.

4.01 Superfund-CLP PCB Analyses

Forty-three subsurface soil, thirty-two groundwater, five surface soil, seventeen fish, nine sediment, and five outfall (four water and one sediment) samples were validated for Superfund-CLP PCBs (NYSDEC ASP 91-3).

The following QA/QC parameters were found to meet validation criteria: instrument performance, initial calibration, analytical sequence verification, and reference standard analyses.

Holding Times

The extraction holding time requirement of 5 days specified in the QAPP was exceeded for LCSS-4. The sample preparation log documented that the sample was originally extracted within holding time requirements, but required re-extraction and analysis. The re-analysis was required to investigate the possibility of sample contamination during extraction with Aroclors 1016 and 1260. Sample results were approximated (UJ, J) in this sample since re-extraction was completed 53 days over the holding time requirement.

Continuing Calibration Verification

Continuing calibration check standards at low or mid-level concentrations were analyzed approximately every ten samples and at the end of the analysis sequence. Continuing calibration RPD criteria of less than 25% were exceeded for surrogate compounds and Aroclor 1260 on several occasions. These excursions are listed in Table 1. Since samples were qualified based on their individual surrogate recoveries and Aroclor 1260 was not detected in the affected samples, qualification of data was not required.

Blank Analysis

Method blank and instrument blank analyses were performed at the required frequency and met acceptance criteria. Equipment Blank UF sampled on 7/24/92 contained 0.8 ug/l of Aroclor 1248. An action level of five times the blank concentration (4.0 ug/l) was applied to the unfiltered samples collected on 7/24/92. The affected samples listed in Table 2 were qualified as not detected (U) at the indicated elevated quantitation limit.

The sample container for the Field Blank collected on 7/22/92 broke during shipment leaving only 50 milliliters of sample for extraction. The sample quantitation limits were multiplied by a factor of twenty to compensate for the reduced sample volume. The modified results are listed in Table 7.

Surrogate Recovery

Surrogate recovery criteria for both TCX and DCB were exceeded in samples MW-7BUF, LCSS-4 (RE), and OBG-6M (2'-4'). Sample result qualifications are listed in Table 3. The high surrogate spike recoveries could not be attributed to matrix interference. The TCX recovery for sample MW-1F on the RTX-35 column was incorrectly reported as 113 %, the correct value is 98 %.

MS/MSD Analysis

MS/MSD analyses were performed at the required frequency utilizing groundwater samples MW-6F, MW-6UF, MW-8F, and MW-8UF, surface soil sample LCSS-1, subsurface soil sample B-29 (4'-8'), sediment sample SED-3, outfall samples FG Outfall 14:30 and FG Outfall (sediment), fish sample Carp #3 downstream (whole fish), and biological study subsurface soil sample OBG-3DM (6'-8'). Percent recovery criteria were exceeded for Aroclor 1016 in MS sample MW-8F and in MSD samples MW-8F and OBG-3DM (6'-8'). Percent recovery criteria were also exceeded for Aroclor 1260 in MS sample MW-8F and in MSD samples MW-8F, MW-6F, and OBG-3DM (6'-8'). Qualification of data due to excursions from MS/MSD criteria was not necessary since recoveries exceeded 10 % and the affected compounds were not detected in the unspiked samples. RPD criteria were exceeded for Aroclor 1260 in Carp #3 downstream (whole fish) and for both Aroclor 1016 and Aroclor 1260 in MW-8UF. Qualification of sample data was not necessary since the affected compounds were not detected in the unspiked sample. MS/MSD criteria excursion data are tabulated in Table 4.

MSB Analysis

Matrix spike blanks were analyzed at the required frequency, but recovery criteria were exceeded for Aroclor 1260 in MSB 7/31, MSB 8/14, and MSB 9/18, and also for Aroclor 1016 in MSB 7/31. Qualification of sample data was not required since recoveries exceeded 10% and the affected compounds were not detected in the samples. MSB excursions are summarized in Table 4.

Field Duplicate Analysis

Field duplicate analysis was performed at the frequency specified in the QAPP. RPD criteria were exceeded for Aroclor 1248 for samples B-34 (0'-4') and LCSS-4. Duplicate criteria were also exceeded for Aroclor 1248 in sample OBG-3DM (10'-12'), however, an RPD value could not be calculated since the original sample result was reported as not detected. Since the identities of these field duplicates were verified by the sampling team, the validity of these data are questionable due to the poor precision of the results and therefore, both results were qualified as estimated values (UJ,J). Qualification of field duplicate sample data are listed in Table 5.

Percent Solids Analysis

Percent solids determinations were performed on soil and sediment samples as required. The results were reported on Form I as percent moisture, and the PCB results were correctly reported on a dry weight basis where required. Supporting documentation was included for the sediment samples only, therefore verification of the percent solids procedure was based on the sediment sample results only. Since errors were not found qualification of sample results was not required.

Compound Identification and Quantification

Table 6 lists samples qualified for exceeding confirmation column percent difference criteria. Sample results with percent differences between 20% and 50% were qualified as approximated (J) and results that exceeded 50% difference were qualified as presumptively present at an approximated concentration (JN). Sample results for samples Field Blank 7/22/92, B-6 (0'-2'), OBG-3DM (4'-6'), and Field

Blank 7/23/92 that were modified for calculation and transcription errors are listed in Table 7.

Surface soil sample LCSS-4 was re-extracted and reanalyzed to verify the unlikely detection of equivalent amounts of Aroclor 1016 and Aroclor 1260. The original sample results were indicative of a sample that may have been accidently spiked during extraction. Reextraction and reanalysis of the sample resulted in the determination of 0.11 mg/kg of Aroclor 1248 and 0.061 mg/kg of Aroclor 1260. Detected and non-detected results were qualified as estimated (UJ,J) for this sample because the re-extraction was completed in excess of the holding time specified in the QAPP.

Document Completeness

The appropriate NYSDEC ASP Superfund reporting forms were utilized for each sample delivery group. Deviations from the reporting format included the omission of the pH value for several samples. The pH value for most of these samples could be found in the sample preparation log. The exceptions were the outfall water and sediment samples that required resubmission of Form Is by the laboratory.

Several of the ground water and equipment blank Form Is had sample volumes reported that did not correspond to the volume listed in the sample preparation log. After review of the data, it was discovered that a general value of 1,000 ml was used for the sample volume in all water sample calculations. This did not present a problem with the reported results since the volume differences were small enough to be insignificant in result calculations. The exception was for Field Blank 7/22/91 where the sample volume was only 50 milliliters and the quantitation limits should have been raised by a factor of twenty. Corrections are listed on Table 7.

Chromatograms were missing for samples: B-30 (4'-8')-RTX-35 column, OBG-30M (O'-2')-RTX-35 column, OBG-30M (10'-12') Blind Duplicate - RTX-35 column, and OBG-6M (6'-8')-RTX-35 column. Integration reports were present and used with the primary column results to validate the data.

Several typographical errors were found on the report forms and are listed below:

- SDG-OBG001 - Soil method blank extraction was incorrectly listed as SepF on Form X, Preparation log for the field blank was missing, but was included in another sample delivery group (SDG).
- SDG-OBG003 - Dates collected and sample IDs listed in the sample preparation and analysis summary are incorrect.
- SDG-OBX001 - Units for the field blank results are incorrectly reported as ug/kg.
- MW-3DUF - Laboratory ID# is incorrect on Form I, correct ID# is 9224737.
- FG Outfall - Percent moisture was missing on Form I, but was calculated to be 23.7% from sample results.
- OBG-3DM (0'-2') - Dilution factor on Form I and the preparation and analysis form is listed as 1.0, correct value is 1:10.
- OBG-6M (8'-10') - Dilution factor on Form I and the preparation and analysis form is listed as 1.0, correct value is 1:10.

Overall Data Assessment

The laboratory performed Superfund-CLP PCBs analysis and QA/QC procedures according to the requirements outlined in NYSDEC ASP Method 91-3 and the QAPP. Several samples listed in Table 6 were qualified as estimated (J) or presumptively present at an approximated quantity (JN) based on differences between chromatograph column results of 25% and 50%, respectively. Reanalysis of these samples was not required, but would have been useful in achieving a more accurate representation of the sample concentration. Field duplicate samples LCSS-4, OBG-3DM (10'-12') and B-34 (0'-4') were estimated due to the exceedence RPD criteria. Unfiltered ground water samples listed in Table 2 were qualified as not detected due to contamination detected in the field blank. Overall, several sample results were modified or qualified as listed in Tables 2, 3, 5, 6, and 7 but sample data were not rejected and the sample results were determined to be useable.

4.02 Sediment TOC Analysis

Ten sediment samples were validated for USEPA Method 415.1/Lloyd Kahn TOC analysis. Sample analyses were found to meet QA/QC validation criteria listed in the QAPP. These data did not require qualification and were found to be useable.

4.03 % Lipids Analysis (Fish)

Seventeen fish samples were validated for % lipids by IR spectroscopy. Sample analyses were found to meet QA/QC validation criteria listed in the QAPP, except the MS percent recovery for White Sucker #6 - downstream. The MS percent recovery for this sample was 59%, which exceeded the 75% to 125% recovery limits.

This information is summarized in Table 4. Due to this exceedence, the sample result in the unspiked sample was qualified as estimated (J). Other sample results did not require qualification and the data were determined to be useable.

4.04 Eighth Round Superfund - CLP PCB Analyses

Additional soil boring samples were collected after the bulk of sampling was complete for this field investigation program. These samples are referered to as the "Eighth Round" soil boring samples. Since these samples were validated separately from the other Superfund-CLP PCB analyses, a separate data quality excursion discussion follows. However, these analyses have been included in the final completeness and useability calculations.

Nine soil boring samples and one equipment blank were validated for Superfund CLP PCBs (NYSDEC ASP (91-3)). The following QA/QC parameters were found to meet validation criteria: instrument performance, initial calibration, continuing calibration verification, analytical sequence, and blank analysis.

Holding Times

The extraction holding time requirement of 5 days specified in the QAPP was exceeded for the Equipment Blank (12/4/92) sample by 3 days. Sample results were approximated (UJ) for this sample. The modified results are listed in Table 8.

Surrogate Recovery

Surrogate recovery calculations could not be verified since the theoretical concentration was not indicated on the extraction logs and surrogate spike standard logs were not submitted. The surrogate recovery criteria for decachlorobiphenyl (DCB) were exceeded on both columns for MSB 12-9 and MSBD 12-9 samples. The surrogate recovery criterion was also exceeded for tetrachlorometaxylene (TCX) in sample MSBD 12-9 on the RTX-35 column. The surrogate recovery criteria were exceeded or not quantified due to matrix interference on the RTX-5 column for the following samples: B37 4-8', B38 4-8', B42 0-4', B37 4-8'MS, and B37 4-8'MSD. Qualification of sample data was not necessary since DCB recovery for both columns was within limits.

MS/MSD Analysis

MS/MSD analysis were performed at the required frequency utilizing soil boring sample B37 4-8'. Due to the high concentration of Aroclor 1248 in the sample, the spike parameters (AR1016 and AR1260) were diluted out. Although an RPD was not reported for the difference in concentrations of Aroclor 1248 in the MS and MSD samples, the RPD was calculated to be 6.0%, therefore, meeting criteria. The soil matrix spike blank and matrix spike blank duplicate recoveries were within the QC limits for Aroclors 1016 and 1260; therefore, qualification of sample data was not necessary. A matrix spike was not performed for the Equipment Blank water sample, however a matrix spike blank was performed and met the criteria for recovery of Aroclors 1016 and 1260. Qualification of sample data was therefore not necessary.

MSB Analysis

A typographic error on the Water PCB Matrix Spike Blank Recovery form was noted which indicates that 50 ug/L of spike was added. Based on the percent recovery reported, it should be 5.0 ug/L.

Field Duplicate Analysis

Field duplicate analysis was performed at the required frequency specified in the QAPP. The RPD for sample B41 4-8' and the Blind Duplicate was 32% which meets QC criteria. The Blind Duplicate was identified as B41 4-8' per the sampler.

Compound Identification and Quantification

The chromatographic pattern identified as Aroclor 1248 in the soil boring samples was not identical to that of the Aroclor 1248 standards. In such cases, the identification and quantification of the Aroclor is somewhat subjective and relies on the experience of the analyst. For the samples noted on Table 9, the peak identified on both columns as Ar 1248 iso-1 was omitted from the mean concentration calculation on form X. The peak was flagged with an asterisk and referred to as interference. The justification of this is not noted. It is unlikely that non-PCB interference would elute at the same relative retention time as the AR 1248 iso-1 peak on two dissimilar columns. The exclusion of the Ar 1248 iso-1 peak from the mean concentration of Aroclor 1248 results in a low bias of the total concentration of PCB represented by the altered Aroclor pattern. The Aroclor concentrations in the soil samples were recalculated including the AR 1248 iso-1 peak in the mean concentration for form X. The sample results that were modified to reflect this change are listed in Table 9.

Percent Solids Analysis

The percent solids determinations were performed on the soil samples as required. The results were reported on form I's as percent moisture, and the PCB results were correctly reported on a dry weight basis where required.

Document Completeness

The pH for the Equipment Blank sample was not noted on the Form I as required. The sample preparation log for the Equipment Blank sample was not included in the data package.

The Form I's for the MS/MSD as well as the MSB/MSBD were not included in the Sample Data Summary Package. The PCB Surrogate Recovery forms were not included in the Sample Data Summary Package.

The concentration of surrogate spike added to the samples was not indicated on the sample prep logs. No standard or spike logs were included.

The detection limits for sample B42 4-8' should be 390 U for Aroclors 1016, 1232, 1242, 1254 and 1260 when adjusted for sample dilution and percent moisture.

The detection limit for sample B43 4-8' should be 1700 U for Aroclor 1221. The adjusted results are listed on Table 7.

The Form X for B37 4-8' MS was not completely filled out. The volume injected is noted as 4ul on the instrument log and 2ul injected on the chromatogram report. These emissions and excursions were minor in nature and do not adversely effect data quality or the ability to completely validate the data.

Overall Data Assessment

The laboratory performed Superfund-CLP PCBs analysis according to the requirements outlined in NYSDEC ASP Method 91-3 and the QAPP. The non-detected sample results for the Equipment Blank were qualified as approximate for exceeding the extraction holding time. The concentrations of Aroclor 1248 in the soil boring sample results were modified to incorporate AR 1248 peak iso-1 in the mean result. Overall, the sample results were modified or qualified as listed in Tables 8 and 9, but sample data were not rejected, and the sample results were determined to be usable.

SECTION 5 - SUMMARY AND DATA USEABILITY

The analytical data generated for the General Motors Corporation, Inland Fisher Guide Division, Ley Creek Dredged Material Area in Syracuse, New York, were validated based on QA/QC criteria established by New York State Department of Environmental Conservation Superfund-Contract Laboratory Program (CLP) (NYSDEC Analytical Services Protocol, December 1991) and QA/QC criteria presented in the QAPP for this investigation. Validation procedures were based on CLP data validation guidelines developed by USEPA Region II. Minor deficiencies in the data generation process resulted in the approximation of about 4.5% of the sample data. Approximation of a data point indicates uncertainty in the reported concentration of the chemical, but not its assigned identity. The conservative assumptions used in the development of conclusions made based on these analytical results allow for the quantitative use of approximated analytical data while still adhering to the project data quality objectives. This approach to the use of analytical data is consistent with the guidance presented in the *U.S. EPA Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)*, 540/1-891002, December 1989. The data for this investigation have been determined to be 100% useable for the following data quality objectives (DQOs) established for this investigation.

1. Assess the nature and extent of contamination, and characterize these properties;
2. Assess migration pathways of the contamination; and
3. Assess routes of exposure and potential receptors.

To determine the useability of the data with regard to meeting the DQOs, the following data quality parameters were evaluated; representativeness, comparability, completeness, precision, and accuracy. The representativeness of the samples refers to the degree to which samples taken from the site accurately represent the matrix of the site. Representativeness was achieved by the laboratory and the sampling team by documenting that established USEPA procedures were used and that the samples met preservation criteria.

Comparability refers to the use of consistent procedures, reporting units, standardized methods of field analysis and standardized data format with document control. Comparability criteria were met by the laboratory and the sampling teams by adhering to the standard procedures established in NYSDEC ASP and the QAPP for this investigation.

Completeness is defined as the percentage of measurements judged to be valid. The data for this investigation have been determined to be 100% complete, which meets the requirement of greater than 80-85% completeness established for this investigation.

Precision describes the reproductability of results and was evaluated through the use of blind duplicate samples. Duplicate samples were analyzed at the frequency required in the QAPP. Several duplicate results were approximated (J) for exceeding relative percent difference (RPD) criteria, but the results were determined to be useful in meeting the DQOs.

Accuracy was determined through the analysis of spiked samples and standards with known concentrations. The measure of accuracy is determined as the closeness of an individual measurement or average from a number of measurements to the true value. The laboratory analyses for this investigation did meet the accuracy criteria presented in NYSDEC ASP and the QAPP. A summary of specific QA/QC excursions that resulted in qualification of sample data is presented in Section 4 and are tabulated in Tables 1-7. In addition, summary tables of the validated sample results with the appropriate qualifiers are included in Tables 4, 7, 8, 12, 14 and 15.

This section summarizes the analytical data in terms of its completeness and useability for site characterization. Data completeness is defined as the percentage of sample results that have been determined to be useable as a result of the data validation process. Data completeness with respect to useability was calculated separately for each phase of the site investigation.

5.01 Drilling/Subsurface Soil Investigation

Forty-two subsurface soil samples were collected between July 20 and 24, 1992 and analyzed for NYSDEC ASP Superfund CLP PCBs. PCB sample results have been determined to be useable. Sample results for Aroclor 1248 were approximated (J) due to excursions from confirmation column percent difference criteria for samples; B-6M (8'-10'), B-25 (4'-8'), B-26 (0'-4'), B-26 (4'-8'), B-26 (8'-10'), B-28 (8'-12'), and B30 (0'-4'). Aroclor 1260 results were approximated (J) in OBG-3DM (10'-12') blind duplicate for exceeding confirmation column percent difference criteria. The following sample results for Aroclor 1248 were qualified as presumptively present at an approximated quantity (JN) for exceeding confirmation column percent difference criteria; B-27 (4'-8') and B-35 (0'-4'). Aroclor 1248 results were approximated (J) for exceeding duplicate RPD criteria for B-34 (0'-4') and B-34 (0'-

4') Blind Duplicate. Validated sample results are summarized in Table 7 of the main report.

5.02 Ground Water Sampling

Superfund - CLP PCB sample results have been determined to be useable for fifteen unfiltered and fifteen filtered ground water samples collected on July 24 and 29, 1992. Detection limits were raised for Aroclor 1248 in the following samples due to detection of Aroclor 1248 in the unfiltered equipment blank collected July 24, 1992; MW-1UF, MW-2UF, MW-3UF, MW-3UF Blind Duplicate, MW-4UF, MW-5UF, MW-7BUF, MW-7CUF, MW-10UF, and MW-12UF. Validated sample results are summarized in Table 4 of the main report.

5.03 Surface Soil Sampling

Superfund-CLP PCB sample results have been determined to be useable for five surface soil samples collected on July 22, 1992. Non-detected sample results were approximated (UJ) for Aroclor 1016, Aroclor 1221, Aroclor 1232, Aroclor 1242, and Aroclor 1254 for exceeding holding time criteria in LCSS-4. Aroclor 1248 results for LCSS-1, LCSS-2, LCSS-5, and Aroclor 1260 results for LCSS-4 were approximated (J) for exceeding confirmation column percent difference criteria. The Aroclor 1248 result for LCSS-4 was qualified as presumptively present at an approximated quantity (JN) for exceeding confirmation column percent difference criteria. Aroclor 1248 results were approximated (J) for LCSS-3 and LCSS-3 Blind Duplicate for exceeding duplicate RPD criteria. Validated sample results are tabulated in Table 8 of the main report.

5.04 Fish Sampling

Seventeen fish samples were collected on July 16, 1992 and analyzed for Superfund-CLP PCB and % lipids by IR spectroscopy. Both PCB and % lipids sample results have been determined to be useable. Percent lipids results for White Sucker #6 downstream were approximated (J) for exceeding matrix spike recovery criteria. Aroclor 1248 results were approximated (J) in Pumpkin Seed #3 upstream, and White Sucker #6 downstream, and qualified as presumptively present at an approximated quantity (JN) in Golden Shiner upstream for exceeding confirmation column percent difference criteria. Aroclor 1260 results were approximated (J) in Carp #1 downstream and qualified as presumptively present at an approximated quantity (JN) in White Sucker #3 outfall and Dace downstream for exceeding confirmation column percent difference criteria. Validated sample results are summarized in Table 14 of the main report.

5.05 Sediment Sampling

Nine sediment samples collected on July 29, 1992 were analyzed for Superfund-CLP PCBs and USEPA 415.1/Lloyd Kahn Total Organic Carbon (TOC). Both PCB and TOC results have been determined to be useable. Aroclor 1248 results were approximated (J) in SED-6 and SED-6 Blind Duplicate for exceeding confirmation column percent difference criteria. Validated sample results are summarized in Table 12 of the main report.

5.06 Outfall Sampling

Four water samples and one sediment sample collected on August 13, 1992 were analyzed for Superfund-CLP PCBs. Sample results have been determined to be useable. Aroclor 1248 results were qualified as presumptively present at an approximate quantity (JN) in Outfall Water 8/13/92 14:00 and approximated (J) in Outfall Water 8/13/92 Blind Duplicate for exceeding confirmation column percent difference criteria. Validated sample results are summarized in Table 15 of the main report.

5.07 Eighth Round Subsurface Soil Boring Investigation

Nine subsurface soil samples, one equipment blank and associated QC samples were collected December 4, 1992 and analyzed for NYSDEC ASP Superfund CLP PCBs. PCB results have been determined to be useable. Non-detected sample results for the Equipment Blank sample were approximated (UJ) for excursions of extraction holding time criteria. Validated sample results are summarized in Table 7 of the main report.

TABLE 1

Quality Control Excursions From Superfund-CLP PCBs Continuing Calibration Verification Criteria

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Date Analyzed	Column	Time Analyzed	Standard ID	Compound	Retention Time	RPD	Action
8/4/92	RTX-5	21:22	Aroclor-1254	DCB	24.341	39	N/A
8/4/92	RTX-35	21:22	Aroclor-1254	DCB	27.616	30	N/A
8/6/92	RTX-35	19:56	Aroclor-1660	DCB	27.584	56	N/A
8/6/92	RTX-35	19:56	Aroclor-1660	Aroclor-1260	19.712	68	N/A
8/8/92	RTX-5	08:22	Aroclor-1254	DCB	24.341	35	N/A
8/11/92	RTX-5	18:10	Aroclor-1221	DCB	24.320	30	N/A
8/11/92	RTX-35	18:10	Aroclor-1221	TCX	7.712	37	N/A
8/11/92	RTX-35	18:10	Aroclor-1221	DCB	27.595	36	N/A
8/12/92	RTX-35	10:25	Aroclor-1660	Aroclor-1260	19.744	31	N/A
8/25/92	RTX-35	11:37	Aroclor-1660	TCX	7.712	38	N/A
9/2/92	RTX-5	09:31	Aroclor-1254	TCX	6.325	45	N/A
9/2/92	RTX-35	09:31	Aroclor-1254	TCX	7.787	28	N/A
9/2/92	RTX-35	09:31	Aroclor-1254	DCB	27.659	33	N/A
9/3/92	RTX-35	02:37	Aroclor-1248	DCB	27.701	30	N/A

N/A	Samples were not affected, no qualification of data required.
DCB	Decachlorobiphenyl (surrogate compound).
TCX	Tetrachloro-m-xylene (surrogate Compound).

TABLE 2

Quality Control Excursions From Superfund-CLP PCBs
Equipment Blank Criteria

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Date Sampled	Blank ID	Compound	Concentration	Samples Affected	Action
7/24/92	Equipment Blank UF	Aroclor-1248	0.8 ug/l	MW-1UF	1.2 U
				MW-2UF	0.6 U
				MW-3UF	0.9 U
				MW-3UF Blind Duplicate	0.9 U
				MW-4UF	3.0 U
				MW-5UF	0.6 U
				MW-7BUF	1.9 U
				MW-7CUF	1.4 U
				MW-10UF	0.5 U
				MW-12UF	1.1 U

U Not detected at the indicated elevated quantitation limit.

TABLE 3

Quality Control Excursions From Superfund-CLP PCBs
Surrogate Recovery Criteria

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Sample ID	Quantitation Column	Surrogate Recovery		Action	Explanation
		TCX	DCB		
MW-7BUF	RTX-5	162 %	166 %	N/A	Aroclors were not detected above the CRQL.
LCSS-4 (RE)	RTX-5	168 %	158 %	N/A	Sample was previously qualified for % Difference between chromatographic columns.
OBG-6M (2'-4')	RTX-5	172 %	163 %	280 J	Detected results qualified for Aroclor 1248.

TCX	Tetrachloro-m-xylene
DCB	Decachlorobiphenyl
N/A	Sample qualification not required.
J	Detected results are estimated.

TABLE 4

Quality Control Excursions From Matrix Spike/Matrix Spike Duplicate Criteria

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Sample ID	Parameter	% Recovery		RPD	Action	Explanation
		MS	MSD			
Downstream Carp #3 (Filet)	Aroclor-1260	120	42	96	N/A	Unspiked sample did not contain Aroclor 1260.
Matrix Spike Blank 7/31 (Water)	Aroclor-1016	190			N/A	Samples extracted with MSB did not contain Aroclor 1016 or Aroclor 1260.
	Aroclor-1260	204				
Matrix Spike Blank 8/14 (Water)	Aroclor-1260	176			N/A	Samples extracted with MSB did not contain Aroclor 1260.
Matrix Spike Blank 9/18 (Water)	Aroclor-1260	170			N/A	Samples extracted with MSB did not contain Aroclor 1260.
MW-6F	Aroclor-1260	160	170	6	N/A	Aroclor 1260 was not detected in unspiked sample.
MW-8F	Aroclor-1016	194	176	10	N/A	Unspiked sample did not contain Aroclor 1016 or Aroclor 1260.
	Aroclor-1260	208	188	10		
MW-8UF	Aroclor-1016	78	140	57	N/A	Unspiked sample did not contain Aroclor 1016 or Aroclor 1260.
	Aroclor-1260	80	154	63		
OBG-3DM (6'-8')	Aroclor-1016	123	186	41	N/A	Unspiked sample did not contain Aroclor 1016 or Aroclor 1260.
	Aroclor-1260	119	186	44		
White Sucker #6 Downstream	% Lipids	59			0.1%	Unspiked sample result was qualified as approximated (J).

N/A Qualification of data not required.

TABLE 5

Quality Control Excursions From Superfund-CLP PCBs
Field Duplicate Criteria

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Sample ID	Date Sampled	Aroclor	Result	Duplicate Result	RPD	Action
LCSS-3	7/22/92	1248	2.7	5.2	63	2.7 J, 5.2 J
OBG-3DM (10'-12')	7/23/92	1248	0.042 U	0.15	N/A	0.042 UJ, 0.15 J
B-34 (0'-4')	7/24/92	1248	0.15	0.4	91	0.15 J, 0.4 J

U	Not detected at the indicated quantitation limit.
UJ	Not detected quantitation limits are estimated.
J	Detected results are estimated.
N/A	RPD is not applicable when one or both values are not detected at the CRQL.

TABLE 6

Quality Control Excursions From Superfund-CLP PCBS
Confirmation Column % Difference Criteria

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Sample ID	Aroclor	% Difference	Action
B-25 (4'-8')	1248	32	5.4 J
B-26 (0'-4')	1248	48	4.2 J
B-26 (4'-8')	1248	27	0.15 J
B-26 (8'-10')	1248	37	0.043 J
B-27 (4'-8')	1248	69	1.2 JN
B-28 (8'-12')	1248	49	47 J
B-30 (0'-4')	1248	34	24 J
B-35 (0'-4')	1248	54	0.16 JN
SED-6	1248	29	0.23 J
SED-6 Blind Duplicate	1248	29	0.34 J
LCSS-1	1248	49	16 J
LCSS-2	1248	29	4.7 J
LCSS-4	1248	60	0.11 JN
	1260	38	0.061 J
LCSS-5	1248	33	0.048 J

TABLE 6 (continued)

Quality Control Excursions From Superfund-CLP PCBs Confirmation Column % Difference Criteria

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Sample ID	Aroclor	% Difference	Action
Upstream Golden Shiner (Whole Fish)	1248	57	0.86 JN
Upstream Pumpkinseed #3 (Edible Portion)	1248	46	0.11 J
Outfall White Sucker #3 (Whole Fish)	1260	56	0.23 JN
Downstream Dace (Whole Fish)	1260	82	0.33 JN
Downstream White Sucker #6 (Whole Fish)	1248	27	0.46 J
Downstream Carp #1 (Whole Fish)	1260	50	0.7 J
Outfall Water 8/13/92 14:30	1248	67	1.2 JN
Outfall Water 8/13/92 14:30 Blind Duplicate	1248	35	1.8 J
B-6M (8'-10')	1248	38	0.053 J
	1260	50	0.12 J
OBG-3DM (10'-12') Blind Duplicate	1248	27	0.15 J

J Detected results are estimated.
JN Detected results are presumptively present at an approximated quantity.

TABLE 7

Modifications Performed for PCB Sample Results

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Sample ID	Aroclor	Reported Results	Validated Results	Explanation
Field Blank 7/22/92	1016	0.5 U	10 U	Sample container broke during shipment, only 50 milliliters of sample were extracted. Quantitation limits were raised by a factor of twenty to compensate for the reduced sample volume.
	1221	1.0 U	20 U	
	1232	0.5 U	10 U	
	1242	0.5 U	10 U	
	1248	0.5 U	10 U	
	1254	0.5 U	10 U	
	1260	0.5 U	10 U	
B-6 (0'-2')	1248	15	18	All five peaks from the primary column (RTX-5) should have been used for quantification. Matrix interference was not observed, therefore exclusion of peaks for quantification is not required.
OBG-3DM (4'-6')	1248	0.1	0.099	Transcription error from Form X to Form I.
Field Blank 7/23/92	1016	1.0 U	0.5 U	Sample volume and dilution factors indicate that the quantitation limits should be reported at the CRQL for water samples.
	1221	2.0 U	1.0 U	
	1232	1.0 U	0.5 U	
	1242	1.0 U	0.5 U	
	1248	1.0 U	0.5 U	
	1254	1.0 U	0.5 U	
	1260	1.0 U	0.5 U	
B43 4-8'	1221	1660 U	1700 U	Results must be reported to 2 significant figures
B42 4-8'	1016	400 U	390 U	Results corrected for dilution and percent moisture
	1232	400 U	390 U	
	1242	400 U	390 U	
	1254	400 U	390 U	
	1260	400 U	390 U	

Modifications Performed For PCB Sample Results

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Sample ID	Aroclor	Reported Result	Validated Result	Explanation
B-29 (0'-4')	1016	3.95 U	4 U	Results were modified to meet significant figure reporting criteria.
	1221	7.9 U	8 U	
	1232	3.95 U	4 U	
	1242	3.95 U	4 U	
	1254	3.95 U	4 U	
	1260	3.95 U	4 U	
B-31 (0'-4')	1248	55	48	Peak area used for quantification exceeded linear calibration range. Results were recalculated using only the peaks with area counts within the calibration range.
B-31 (8'-10')	1248	0.04 U	0.08	Transcription error between Form X and Form I.
Equipment Blank UF 7/24/92	1248	1.0	0.8	Calculation error on Form X, results were incorrectly reported on Form I.
Field Blank 7/29/92	1016	1.0 U	0.5 U	Sample volume and dilution factors indicate that the quantitation limits should be reported at the CRQL for water samples.
	1221	2.0 U	1.0 U	
	1232	1.0 U	0.5 U	
	1242	1.0 U	0.5 U	
	1248	1.0 U	0.5 U	
	1254	1.0 U	0.5 U	
	1260	1.0 U	0.5 U	

U Not detected at the indicated quantitation limit.

TABLE 8

Quality Control Excursions From Holding Time Criteria

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Area

Sample ID	Aroclor	Reported Results	Validated Results	Explanation
Equipment Blank 12/4/92	1016	0.5 U	0.5 UJ	Sample exceeded holding time for extraction (<5 days).
	1221	1.0 U	1.0 UJ	
	1232	0.5 U	0.5 UJ	
	1242	0.5 U	0.5 UJ	
	1248	0.5 U	0.5 UJ	
	1254	0.5 U	0.5 UJ	
	1260	0.5 U	0.5 UJ	

Table 9

Modifications Performed For PCB Sample Results

Remedial Investigation/Feasibility Study
Ley Creek Dredged Material Aroclor Area

Sample ID	Parameter	Form X Reported Mean Conc.	Form X Modified Mean Conc.	Form 1 Modified Final Conc.
B-37 (4-8')	Aroclor-1248 col 1	129100	142180 *	140000
	Aroclor-1248 col 2	130150	144360 *	
B-37 (8-12')	Aroclor-1248 col 1	7961	10975 *	11000
	Aroclor-1248 col 2	7576	11497 *	
BLD DUP	Aroclor-1248 col 1	808	1146 *	1100
	Aroclor-1248 col 2	789	1123 *	
B-38 (4-8')	Aroclor-1248 col 1	1423	2691 *	2300
	Aroclor-1248 col 2	1272	2276 *	
B-41 (4-8')	Aroclor-1248 col 1	1216	1681 *	1600
	Aroclor- 1248 col 2	1059	1551 *	
B-42 (0-4')	Aroclor-1248 col 1	4788	6994 *	6800
	Aroclor-1248 col 2	4619	6827 *	
B-42 (4-8')	Aroclor-1248 col 1	3841	5209 *	5100
	Aroclor-1248 col 2	3655	5110 *	
B-42 (8-10')	Aroclor-1248 col 1	615	889 *	870
	Aroclor-1248 col 2	595	874 *	
B-43 (4-8')	Aroclor-1248 col 1	2680	3794 *	3800
	Aroclor-1248 col 2	2723	3804 *	
			units: ug/kg dry weight	

*Result includes Aroclor-1248 peak iso 1 to determine mean Aroclor-1248 concentration.

APPENDIX E

GRAIN SIZE ANALYSES RESULTS

parratt wolff inc
FISHER RD., EAST SYRACUSE, N.Y. 13057
TELEPHONE AREA CODE 315/437-1429

October 19, 1992

Project No. L-92013

Project Title Laboratory Testing Ley Creek: Dredge Material
File #3247.078

Sieve Analysis ASTM D422

	Sieve Size - Percent Passing Sieve														
Sample #	1"	3/4"	1/2"	3/8"	1/4"	#4	#10	#30	#40	#60	#100	#200		Lab ID#	
2	---	---	100	98.7	91.3	82.0	58.0	46.2	43.5	34.6	31.3	30.5		1920	
4	100	98.6	93.4	92.1	89.5	87.1	78.7	68.0	64.6	52.8	45.9	43.4		1921	
6	100	97.5	91.2	88.9	86.7	84.6	79.4	72.0	68.7	53.3	45.0	40.9		1922	
7	100	97.0	92.0	90.6	88.1	86.9	82.0	70.9	65.5	41.4	25.3	17.3		1923	

Remarks:

Prewashed ASTM D1140
Yes X No
Performed By BT. SMO AN

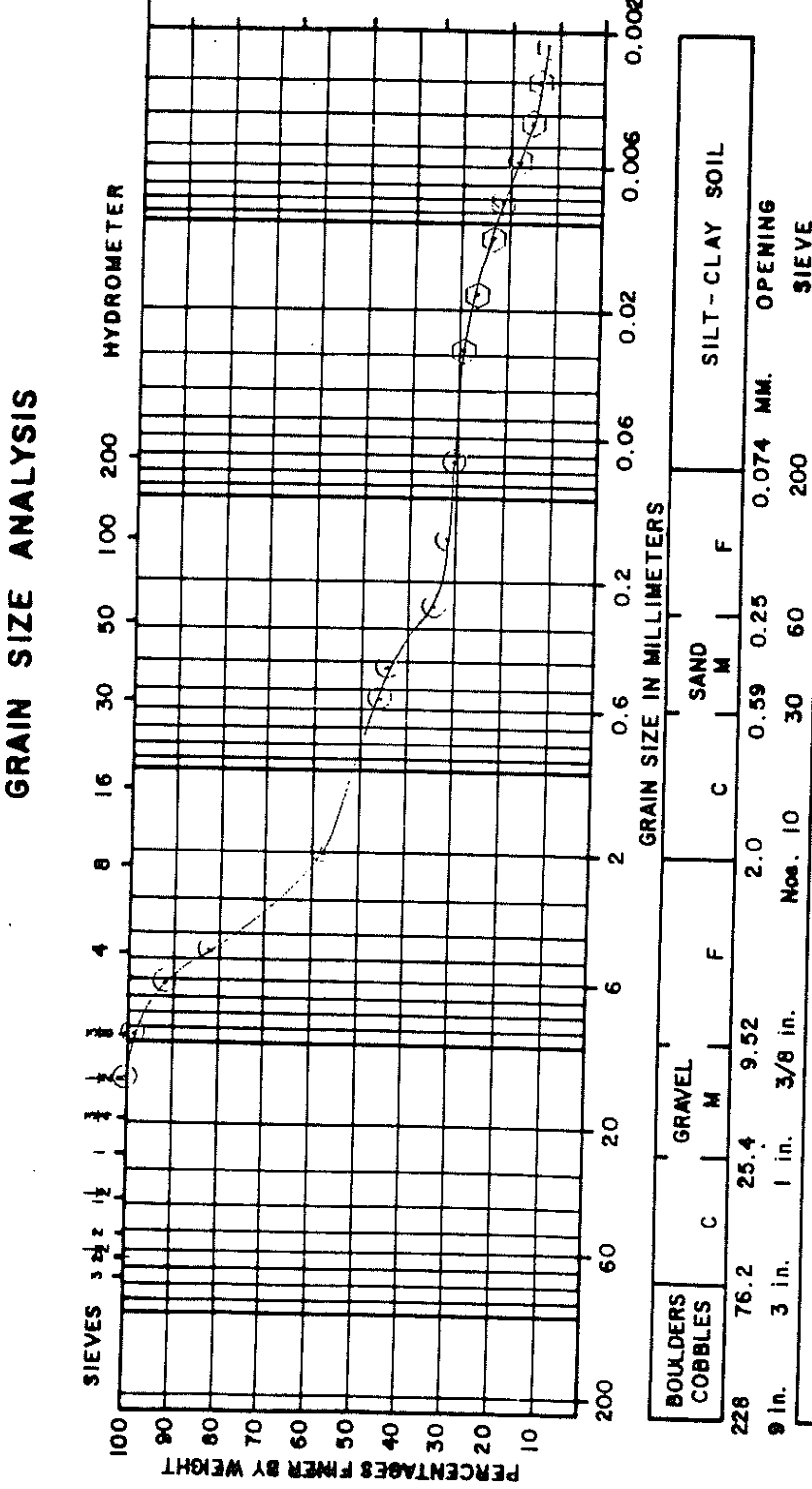
parratt wolff inc

FISHER RD. EAST SYRACUSE, N.Y. 13057
TELEPHONE AREA CODE 315/437-1429

JOB NO. L-92013
REPORT NO. 1

October 19, 1992

GRAIN SIZE ANALYSIS



Sample # 2
Lab I.D. # 1920

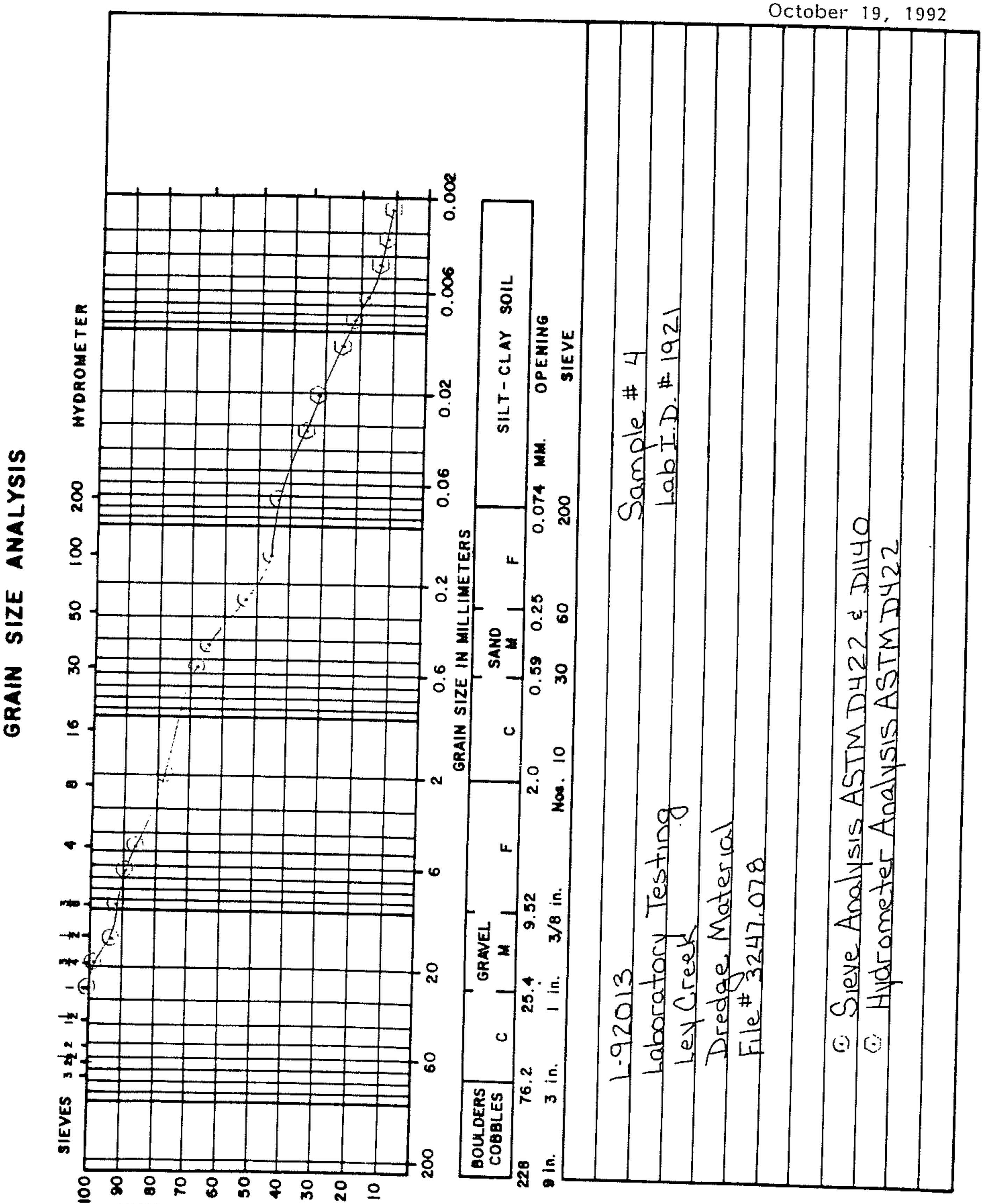
L-92013
Laboratory Testing
Ley Creek
Dredge Material
File # 3247.078

○ Sieve Analysis ASTM D422 & D1140
⬡ Hydrometer Analysis ASTM D422

parratt wolff inc
FISHER RD. EAST SYRACUSE, N.Y. 13057
TELEPHONE AREA CODE 315/437-1429

JOB NO. L-92013
REPORT NO. 2

October 19, 1992



Sample # 4
Lab I.D. # 1921

L-92013
Laboratory Testing
Ley Creek
Dredge Material
File # 3247.078

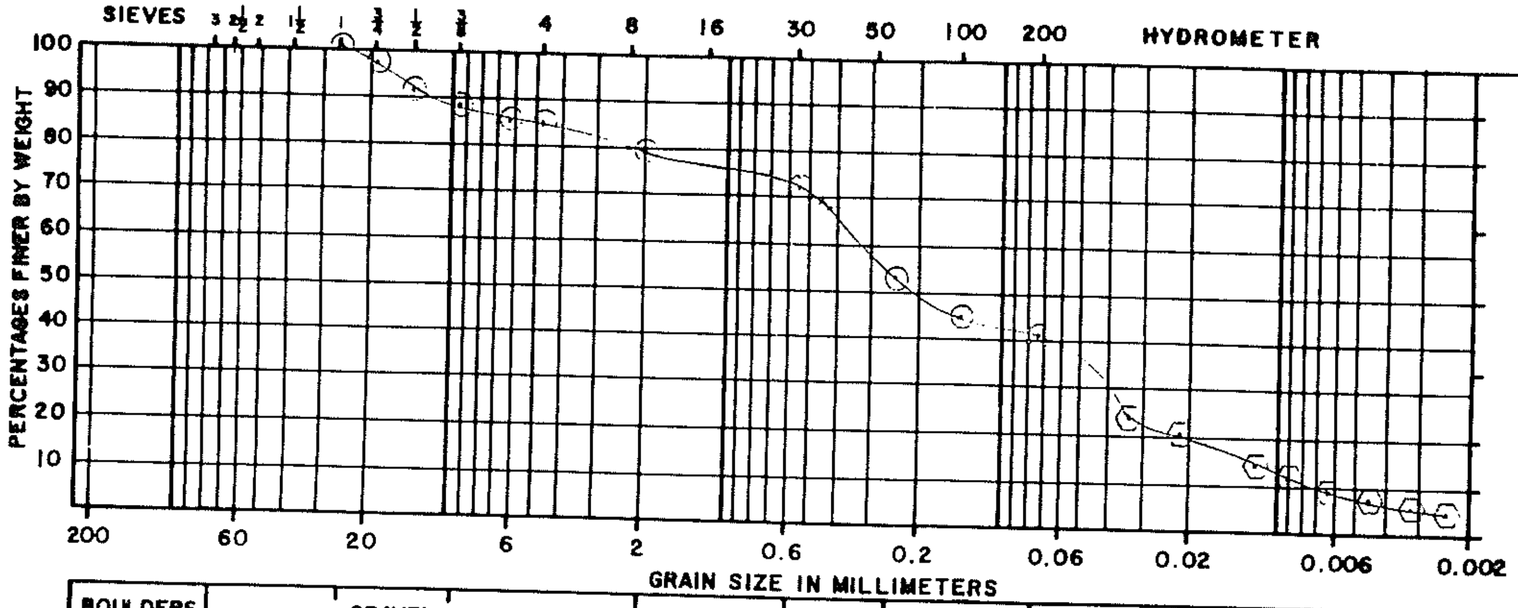
⊙ Sieve Analysis ASTM D422 & D1140
⊙ Hydrometer Analysis ASTM D422

parratt wolff inc
FISHER RD. EAST SYRACUSE, N.Y. 13057
TELEPHONE AREA CODE 315/437-1429

JOB NO. L-92013
REPORT NO. 3

October 19, 1992

GRAIN SIZE ANALYSIS



BOULDERS COBBLES	GRAVEL			SAND			SILT-CLAY SOIL
	C	M	F	C	M	F	

228 76.2 25.4 9.52 2.0 0.59 0.25 0.074 MM. OPENING
9 in. 3 in. 1 in. 3/8 in. Nos. 10 30 60 200 SIEVE

L-92013
Laboratory Testing
Ley Creek
Dredge Material
File # 3247.078

Sample # 6
Lab I.D. # 1922

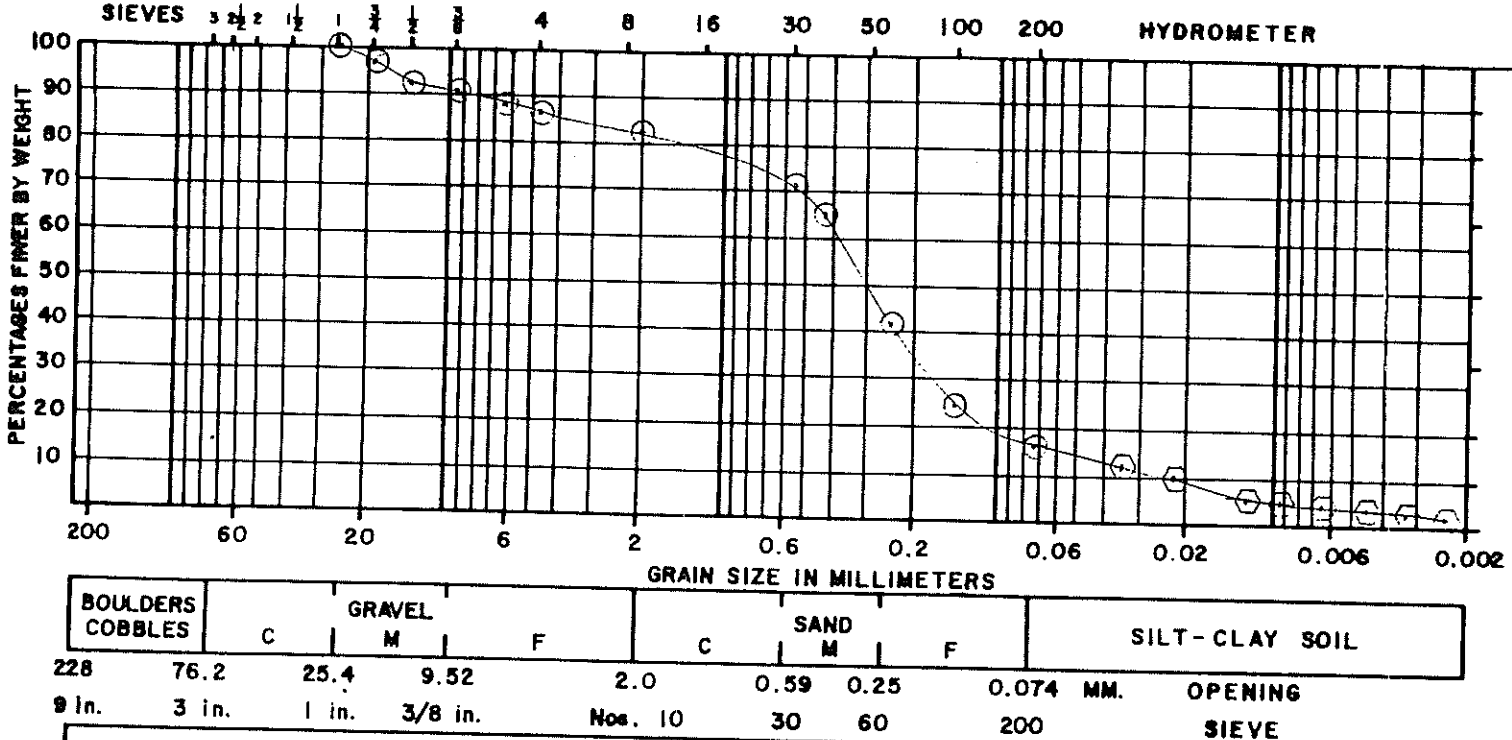
⊙ Sieve Analysis ASTM D422 & D1140
⬡ Hydrometer Analysis ASTM D422

parratt wolff inc
FISHER RD. EAST SYRACUSE, N.Y. 13057
TELEPHONE AREA CODE 315/437-1429

JOB NO. L-92013
REPORT NO. 4

October 19, 1992

GRAIN SIZE ANALYSIS



L-92013
Laboratory Testing
Ley Creek
Dredge Material
File # 3247.078

Sample # 7
Lab I.D. # 1923

⊙ Sieve Analysis ASTM D422 & D1140
⬡ Hydrometer Analysis ASTM D422

APPENDIX F

RISK ASSESSMENT DATA CALCULATIONS

RISK ASSESSMENT DATA CALCULATIONS

Sample Location	Aroclor 1248 Concentration (mg/kg)		Averaging Value * (mg/kg)
SURFACE SOIL			
LCSS-1	16	J	16
LCSS-2	4.7	J	4.7
LCSS-3	2.7	J	2.7
LCSS-3 DUP	5.2	J	5.2
LCSS-4	0.11	JN	0.11
LCSS-5	0.048	J	0.048
B-25 0' - 4'	48		48
B-26 0' - 4'	4.2	J	4.2
B-27 0' - 4'	5.5		5.5
B-28 0' - 4'	38		38
B-29 0' - 4'	33		33
B-30 0' - 4'	24	J	24
B-31 0' - 4'	48		48
B-34 0' - 4'	0.15	J	0.15
B-34 0' - 4' DUP	0.4	J	0.4
B-35 0' - 4'	0.16	JN	0.16
B-42 0' - 4'	6.8		6.8
B-6M 0' - 2'	18		18
OBG-3DM 0' - 2'	3.3		3.3
OBG-6M 0' - 2'	4.3		4.3
B1	1	U	0.5
B2	22		22
B3	15		15
B4	27		27
B5	11		11
B6	59		59
B7	4.4		4.4
B8	2.1		2.1
B9	15		15
B10	5.6		5.6
B11	4.9		4.9
B12	1	U	0.5
B13	1	U	0.5
B14	1	U	0.5
B15	1	U	0.5
B16	1	U	0.5
B17	1	U	0.5
B18	1	U	0.5
B19	27		27
B20	1	U	0.5
B21	3.5		3.5
B22	2		2
B23	1	U	0.5
OVERALL MEAN			10.84
OVERALL MAXIMUM			59
STD DEV; OVERALL			14.88
STD ERROR; OVERALL			2.27
Z-SCORE			2.02
UPPER 95% CONFIDENCE LEVEL			15.42

RISK ASSESSMENT DATA CALCULATIONS

Sample Location	Aroclor 1248 Concentration (mg/kg)		Averaging Value * (mg/kg)
SEDIMENTS			
SED-1	0.043	U	0.02
SED-2	0.04	U	0.02
SED-3	0.039	U	0.02
SED-4	0.045	U	0.02
SED-5	0.045	U	0.02
SED-6	0.23	J	0.23
SED-6 DUP	0.34	J	0.34
SED-7	0.19		0.19
SED-8	0.71		0.71
SED-9	0.81		0.81
SS-1	1	U	0.5
SS-2**	8.6		8.6
SS-3**	1.9		1.9
SS-4**	3.3		3.3
SS-5**	3.8		3.8
SS-6	1	U	0.5
OVERALL MEAN			1.31
OVERALL MAXIMUM			8.60

** SS-2,3 Aroclor 1016/1242/1248; SS-4,5 Aroclor 1242

RISK ASSESSMENT DATA CALCULATIONS

Sample Location	Aroclor 1248 Concentration (mg/kg)	Averaging Value * (mg/kg)
FISH		
Pumpkinseed #1 E.P. Upstream	2.4	2.4
Pumpkinseed #2 E.P. Upstream	1.7	1.7
Pumpkinseed #3 E.P. Upstream	0.11 J	0.06
Carp #1 Filet Downstream	0.11	0.11
Carp #2 Filet Downstream	0.2	0.2
Pumpkinseed #1 E.P. Downstream	0.32	0.32
1992 MEAN		0.80
1992 MAXIMUM		2.40

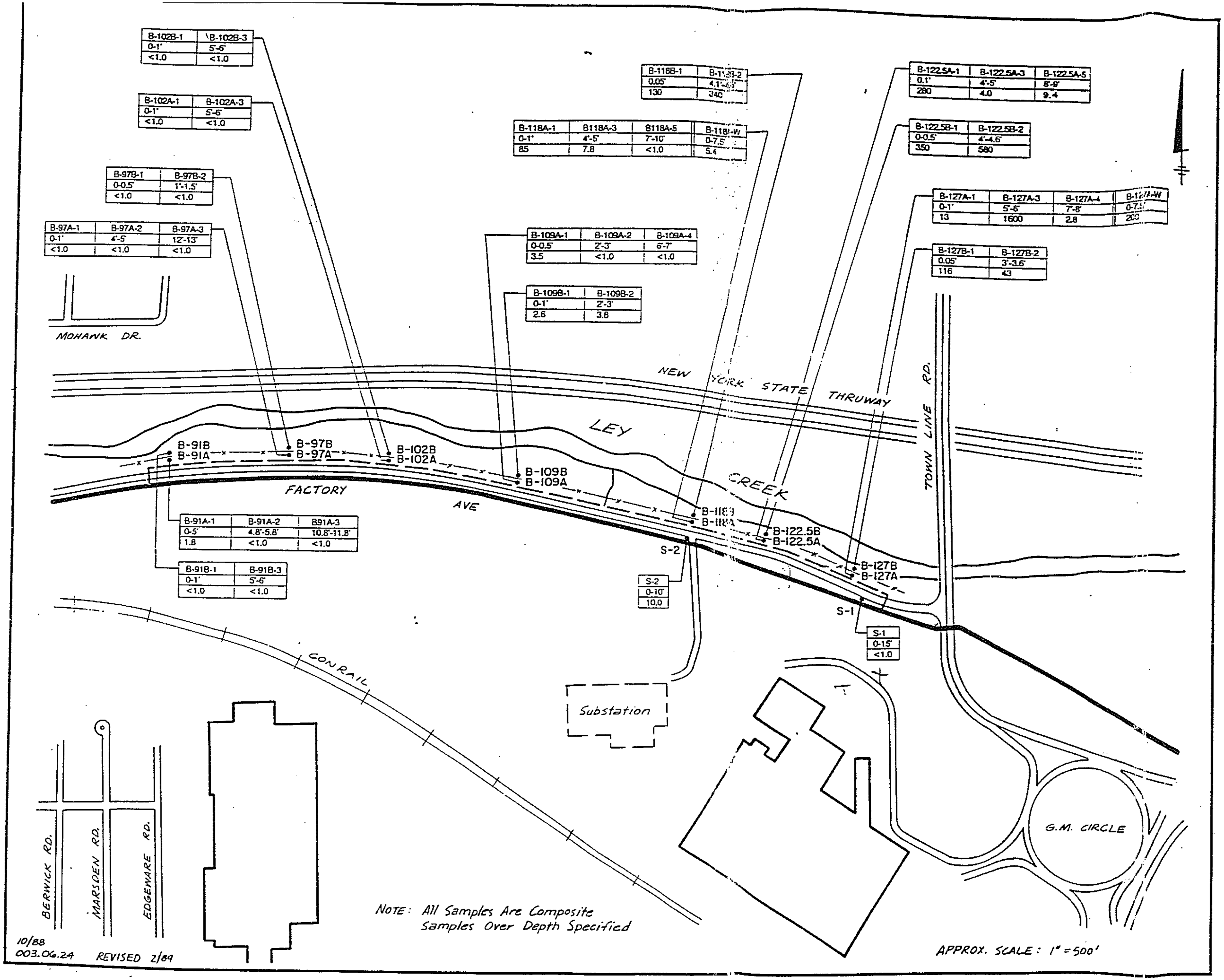
* Mean calculated using 1/2 detection limit for less than detectable concentrations.

Exhibits

EXHIBIT A

FACTORY AVENUE SOIL AND GROUND WATER SAMPLING PROGRAM LOCATION PLAN

FIGURE 1



B-102B-1	B-102B-3
0-1'	5'-6'
<1.0	<1.0

B-102A-1	B-102A-3
0-1'	5'-6'
<1.0	<1.0

B-97B-1	B-97B-2
0-0.5'	1'-1.5'
<1.0	<1.0

B-97A-1	B-97A-2	B-97A-3
0-1'	4'-5'	12'-13'
<1.0	<1.0	<1.0

B-118B-1	B-118B-2
0.05'	4.1'-4.5'
130	340

B-118A-1	B118A-3	B118A-5	B-118A-W
0-1'	4'-5'	7'-10'	0-7.5'
85	7.8	<1.0	5.4

B-109A-1	B-109A-2	B-109A-4
0-0.5'	2'-3'	6'-7'
3.5	<1.0	<1.0

B-109B-1	B-109B-2
0-1'	2'-3'
2.6	3.8

B-122.5A-1	B-122.5A-3	B-122.5A-5
0.1'	4'-5'	8'-9'
280	4.0	9.4

B-122.5B-1	B-122.5B-2
0-0.5'	4'-4.6'
350	580

B-127A-1	B-127A-3	B-127A-4	B-127A-W
0-1'	5'-6'	7'-8'	0-7.5'
13	1600	2.8	200

B-127B-1	B-127B-2
0.05'	3'-3.6'
116	43

B-91A-1	B-91A-2	B91A-3
0-5'	4.8'-5.8'	10.8'-11.8'
1.8	<1.0	<1.0

B-91B-1	B-91B-3
0-1'	5'-6'
<1.0	<1.0

S-2
0-10'
10.0

S-1
0-15'
<1.0

NOTE: All Samples Are Composite Samples Over Depth Specified

10/88
003.06.24 REVISED 2/89

LEGEND

—x—x— EXISTING CHAIN LINK FENCE
▬▬ NYSDEC APPROVED SEWER ROUTE
— — — PROPOSED ALTERNATE SEWER ROUTE
● B-91A BORING

B-91A-1	— SOIL SAMPLE NUMBER
0-5'	— SAMPLE DEPTH
1.8	— PCB CONCENTRATION (mg/kg)

B-127A-W	— GROUND-WATER SAMPLE NUMBER
0-7.5'	— WELL DEPTH
200	— PCB CONCENTRATION (ppb)

ONONDAGA COUNTY
DEPARTMENT OF DRAINAGE AND SANITATION

LEY CREEK SERVICE AREA IMPROVEMENTS
(C-36-1200-06)

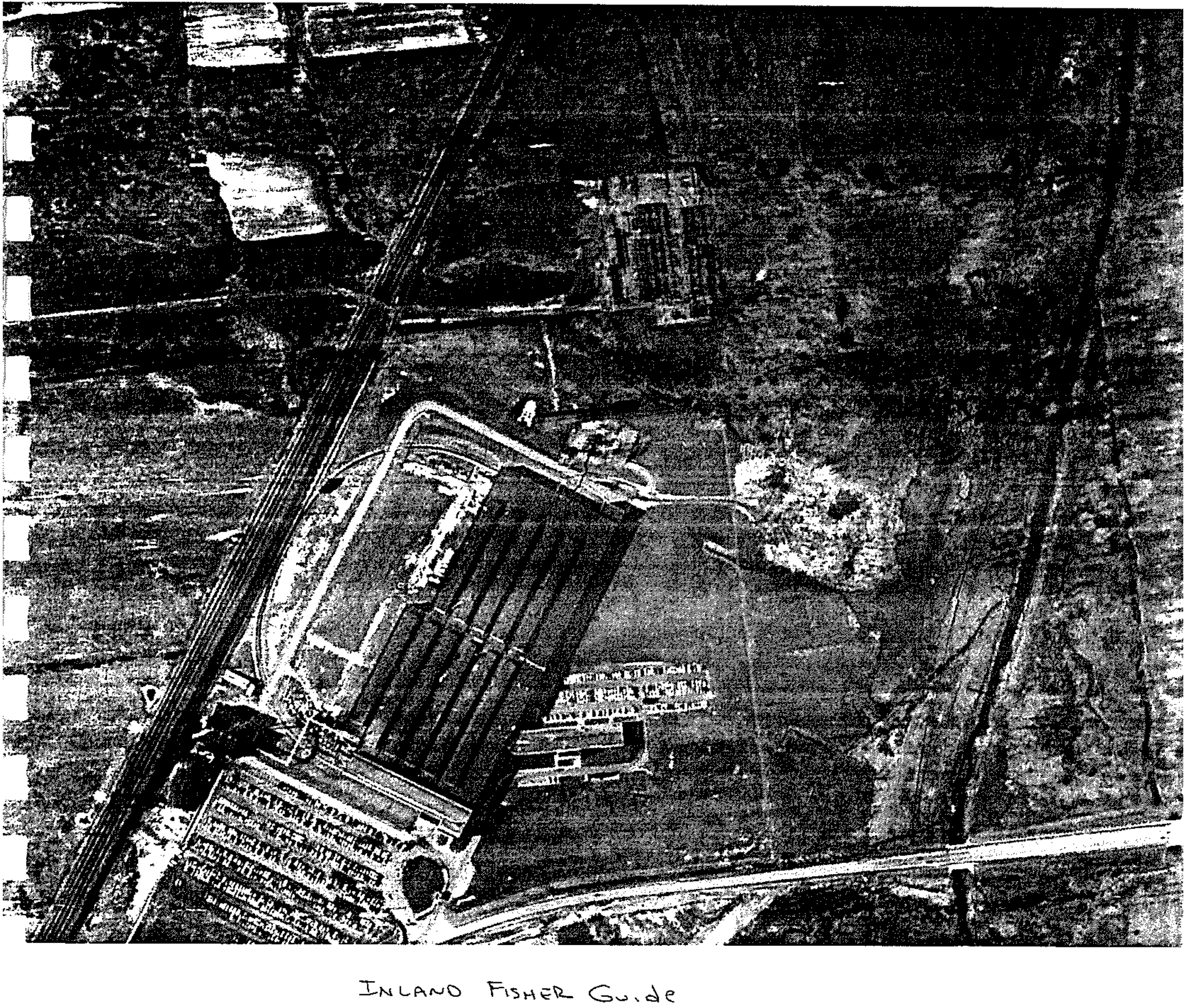
FACTORY AVENUE
SOIL AND GROUND-WATER
SAMPLING PROGRAM

LOCATION PLAN

BLASLAND & BOUCK
ENGINEERS, P.C.

EXHIBIT B

1957 AERIAL PHOTO



INLAND FISHER Guide
Syracuse, PLANT
1957

EXHIBIT C

ANALYTICAL RESULTS - PCB DETECTIONS SOUTH OF FACTORY AVENUE

DATE: / /

DRAFT

Upstate Laboratories, Inc.
Analysis Results
Report Number:
Client I.D.: MEMPHIS CONSTRUCTION, INC.

APPROVAL:
QC:
Lab I.D.: 10170
Sampled by: Client

ID:22091119 Mat:Soil LEY CREEK 122+00 SOIL 8/8/91 0800H G

PARAMETERS	RESULTS	KEY
EPA 8080		
Aroclor 1016		
Aroclor 1221		34
Aroclor 1232		34
Aroclor 1242		34
Aroclor 1248	87mg/kg	19
Aroclor 1254		34
Aroclor 1260		34
Total PCB		34
	87mg/kg	19

ll results are on an as rec.d basis unless otherwise stated.

ATE: / /

Upstate Laboratories, Inc.
nalysis Results
eport Number:
Client I.D.: MEMPHIS CONSTRUCTION, INC.

APPROVAL:
QC:
Lab I.D.: 10170
Sampled by: Client

:22191193 Mat:Water LEY CREEK 122.30 8/9/91 0810H G

PARAMETERS	RESULTS	KEY
PCB		
Aroclor 1221		
Aroclor 1016		
Aroclor 1232		34
Aroclor 1242		34
Aroclor 1248		34
Aroclor 1254		34
Aroclor 1260		34
Total PCB		34
	<0.1ug/1	34

l results are on an as rec.d basis unless otherwise stated.

DATE: 08/20/91

DRAFT

Upstate Laboratories, Inc.
Analysis Results
Report Number:
Client I.D.:-MEMPHIS CONSTRUCTION, INC.

APPROVAL:
QC: MF
Lab I.D.: 10170
Sampled by: Client

ID:22691045 Mat:Soil LEY CREEK 123+00 SOIL 8/14/91 0945H G

PARAMETERS	RESULTS	DATE ANAL.	KEY
Aroclor 1260		08/15/91	34
Total PCB	<2mg/kg	08/15/91	19

ID:22691046 Mat:Soil LEY CREEK 123+40 SOIL 8/14/91 0950H G

PARAMETERS	RESULTS	DATE ANAL.	KEY
Total Chromium		/ /	
PCB			
Aroclor 1221		08/20/91	34
Aroclor 1016		08/20/91	34
Aroclor 1232	190mg/kg	08/20/91	19
Aroclor 1242		08/20/91	34
Aroclor 1248		08/20/91	34
Aroclor 1254		08/20/91	34
Aroclor 1260		08/20/91	34
Total PCB	190mg/kg	08/20/91	19

:22691047 Mat:Air LEY CREEK GRASER 8/14/91 VOL=24.8L

PARAMETERS	RESULTS	DATE ANAL.	KEY
Chromium		/ /	
PCB			
Aroclor 1221		08/20/91	34
Aroclor 1016		08/20/91	34
Aroclor 1232		08/20/91	34
Aroclor 1242		08/20/91	34
Aroclor 1248		08/20/91	34
Aroclor 1254		08/20/91	34
Aroclor 1260		08/20/91	34
Total PCB	<4ug/m3	08/20/91	

2691048 Mat:Air LEY CREEK ROLEWICZ 8/14/91 VOL=24.4L

PARAMETERS	RESULTS	DATE ANAL.	KEY
Chromium		/ /	

esults are on an as rec.d basis unless otherwise stated.

state Laboratories, Inc.
Analysis Results
Report Number:
Lient I.D.: MEMPHIS CONSTRUCTION, INC.

APPROVAL:
QC:
Lab I.D.: 10170
Sampled by: Client

ID:23991008 Mat:Water LEY CREEK TRENCH WATER 123+45 AT 19' 8/27/91 0745H G

PARAMETERS	RESULTS	DATE ANAL.	KEY
Total Chromium		/ /	
EPA 608			
Aroclor 1016		08/28/91	34
Aroclor 1221		08/28/91	34
Aroclor 1232		08/28/91	34
Aroclor 1242	2.9ug/l	08/28/91	
Aroclor 1248		08/28/91	34
Aroclor 1254		08/28/91	34
Aroclor 1260		08/28/91	34
Total PCB	2.9ug/l	08/28/91	

ID:23991009 Mat:Soil LEY CREEK SOIL 124+00 AT 7' 8/27/91 0745H G

PARAMETERS	RESULTS	DATE ANAL.	KEY
Total Chromium		/ /	
EPA 8080			
Aroclor 1016		08/28/91	34
Aroclor 1221		08/28/91	34
Aroclor 1232		08/28/91	34
Aroclor 1242	1300mg/kg	08/28/91	19
Aroclor 1248		08/28/91	34
Aroclor 1254		08/28/91	34
Aroclor 1260		08/28/91	34
Total PCB	1300mg/kg	08/28/91	19

ll results are on an as rec.d basis unless otherwise stated.

DATE: / /

DRAFT

Upstate Laboratories, Inc.
nalysis Results
eport Number:
Client I.D.: MEMPHIS CONSTRUCTION, INC.

APPROVAL:
QC:
Lab I.D.: 10170
Sampled by: Client

ID:23491022 Mat:Soil LEY CREEK 1 MEMPHIS 129+50 AT 2' SOIL 8/22/91 0850H G

PARAMETERS	RESULTS	DATE ANAL.	KEY
Total Chromium	17mg/kg	08/28/91	
EPA 8080			
Aroclor 1016		08/26/91	34
Aroclor 1221		08/26/91	34
Aroclor 1232		08/26/91	34
Aroclor 1242	4mg/kg	08/26/91	19
Aroclor 1248		08/26/91	34
Aroclor 1254		08/26/91	34
Aroclor 1260		08/26/91	34
Total PCB	4mg/kg	08/26/91	19

ID:23491023 Mat:Soil LEY CREEK 2 MEMPHIS 129+50 AT 6' SOIL 8/22/91 0850H G

PARAMETERS	RESULTS	DATE ANAL.	KEY
Total Chromium	370mg/kg	08/28/91	
EPA 8080			
Aroclor 1016		08/26/91	34
Aroclor 1221		08/26/91	34
Aroclor 1232		08/26/91	34
Aroclor 1242	130mg/kg	08/26/91	19
Aroclor 1248		08/26/91	34
Aroclor 1254		08/26/91	34
Aroclor 1260		08/26/91	34
Total PCB	130mg/kg	08/26/91	19

All results are on an as rec.d basis unless otherwise stated.

EXHIBIT D

WILDLIFE SPECIES ASSOCIATED WITH SPECIFIC COVERTYPE

FLOODPLAIN FOREST

N HER AM ND ODP N
W AND AN ND MAL

Amphibians
Green Frog
Pickerel Frog
Red Salamander
Spotted Salamander

Spring Peeper
Striped Chorus Frog
Two-lined Salamander

Wood Frogs

Reptiles
Black Swamp Snake

Brown Snake
Green Water Snake
Northern Water Snake
Timber Rattlesnake

Wood Turtle

Wildflowers, Ferns, and Grasses
Blue Flag
Butterfly Orchid
Buttonbush
Cardinal Flower
Cinnamon Fern
Elderberry
False Hellebore
Golden Ragwort
Great Hedge Nettle
Great Laurel
Green Dragon
Hibiscus
Highbush Blueberry

Jack-in-the-Pulpit
Large Purple Fringed Orchid
Lizard's Tail
Marsh Marigold
Marsh Skullcap
Nodding Bur Marigold
Red Iris
Royal Fern
Showy Lady's Slipper
Skunk Cabbage
Soft Rush
Spicebush
Spotted Joe-pye Weed
Spotted Touch-me-not
Swamp Buttercup
Swamp Dewberry
Swamp Honeysuckle
Swamp Rose
Swamp Saxifrage
Sweet Pepperbush
Tall Meadow Rue
Tufted Loosestrife
Turk's Cap Lily
Water Hemlock
Winterberry
Wool Grass
Yellow Skunk Cabbage

Mushrooms
Blueberry Cup
Silky Parchment
Swamp Beacon
Wrinkled Thimble-cap

Insects and Spiders
American Horse Fly
Golden-silk Spider
Vinegar Fly

Butterflies and Moths
Appalachian Brown

Broken Dash
Creole Pearly Eye
Great Gray Cooper
Harvester
Lace-winged Roadside Skipper
Palamedes Swallowtail
Sedge Skipper
Swamp Metalmark
White Peacock

Trees
American Elder
American Elm
Atlantic White-cedar
Black Ash
Black Tupelo
Black Willow
Eastern Cottonwood
Green Ash
Mountain Alder
Northern White-cedar
Nutmeg Hickory
Pin Oak
Poison Sumac
Possumhaw
Red Alder
Red Maple
Silver Maple
Swamp Cottonwood
Swamp White Oak
Western Redcedar

Birds
Barred Owl
Barrow's Goldeneye
Black-crowned Night-Heron
Black Duck
Common Yellowthroat
Double-crested Cormorant
Little Blue Heron
Prothonotary Warbler
Red-bellied Woodpecker
Red-shouldered Hawk
Swamp Sparrow
Wild Turkey
Wood Duck
Yellow-crowned Night-Heron

Mammals
Arctic Shrew
Black Bear
Bobcat
Moose
Raccoon
Smoky Shrew
Star-nosed Mole
White-tailed Deer

SUCCESSIONAL NORTHERN HARDWOOD

WHITE ASH — AMERICAN ELM — RED MAPLE

MAMMALS

Masked Shrew
Smoky Shrew
Northern Water Shrew
Least Shrew
Shorttail Shrew
Starnose Mole
Eastern Mole
Hairytail Mole
Little Brown Myotis
Keen Myotis
Indiana Myotis
Silver-haired Bat
Eastern Pipistrelle
Big Brown Bat
Red Bat
Hoary Bat
Black Bear
Raccoon
Fisher
Shorttail Weasel
Longtail Weasel
Mink
River Otter
Striped Skunk
Coyote
Red Fox
Gray Fox
Bobcat
Woodchuck
Eastern Chipmunk
Gray Squirrel
Red Squirrel
Southern Flying Squirrel
Beaver
Deer Mouse
White-footed Mouse
Southern Bog Lemming
Boreal Red-backed Vole
Meadow Vole
Yellownose Vole
Pine Vole
Muskrat
Meadow Jumping Mouse
Woodland Jumping Mouse
Porcupine
Snowshoe Hare
Eastern Cottontail
New England Cottontail
White-tailed Deer

BIRDS

Great Blue Heron
Green Heron
Little Blue Heron
Great Egret
Snowy Egret
Louisiana Heron
Black-crowned Night Heron
Yellow-crowned Night Heron
Mallard
American Black Duck
Wood Duck
Common Merganser
Hooded Merganser
Turkey Vulture
Northern Goshawk
Cooper's Hawk
Red-tailed Hawk
Red-shouldered Hawk
Broad-winged Hawk
Bald Eagle
Osprey
Peregrine Falcon
American Kestrel
Ruffed Grouse
Common Bobwhite
American Woodcock
Mourning Dove
Yellow-billed Cuckoo
Black-billed Cuckoo
Barn Owl
Common Screech Owl
Great Horned Owl
Barred Owl
Long-eared Owl
Saw-whet Owl
Whip-poor-will
Common Nighthawk
Ruby-throated Hummingbird
Common Flicker
Pileated Woodpecker
Red-bellied Woodpecker
Red-headed Woodpecker
Yellow-bellied Sapsucker
Hairy Woodpecker
Downy Woodpecker
Eastern Kingbird
Great Crested Flycatcher
Eastern Phoebe
Acadian Flycatcher
Willow Flycatcher
Alder Flycatcher
Least Flycatcher
Eastern Pewee
Tree Swallow
Blue Jay
Northern Raven
American Crow
Black-capped Chickadee
Tufted Titmouse
White-breasted Nuthatch
Brown Creeper
House Wren
Winter Wren
Carolina Wren
Northern Mockingbird
Gray Catbird
Brown Thrasher
American Robin
Wood Thrush
Veery
Eastern Bluebird
Blue-gray Gnatcatcher
Cedar Waxwing
Loggerhead Shrike
Yellow-throated Vireo
Red-eyed Vireo
Warbling Vireo
Black and White Warbler
Prothonotary Warbler
Worm-eating Warbler
Golden-winged Warbler
Blue-winged Warbler
Tennessee Warbler
Nashville Warbler
Yellow Warbler
Cerulean Warbler
Chestnut-sided Warbler
Prairie Warbler
Ovenbird
Northern Waterthrush
Louisiana Waterthrush
Mourning Warbler
Kentucky Warbler
Common Yellowthroat
Yellow Breasted Chat
Hooded Warbler
Canada Warbler
American Redstart
Orchard Oriole
Northern Oriole
Rusty Blackbird
Common Grackle
Brown-headed Cowbird
Scarlet Tanager
Northern Cardinal
Rose-breasted Grosbeak
Indigo Bunting
American Goldfinch
Rufous-sided Towhee
Chipping Sparrow
Field Sparrow
White-throated Sparrow
Swamp Sparrow
Song Sparrow

WHITE ASH-AMERICAN ELM-RED MAPLE (CONT'D)

REPTILES

Common Snapping Turtle
Bog Turtle
Wood Turtle
Eastern Box Turtle
Eastern Painted Turtle
Five-lined Skink
Coal Skink
Northern Water Snake
Queen Snake
Northern Brown Snake
Northern Redbelly Snake
Eastern Garter Snake
Shorthead Garter Snake
Eastern Ribbon Snake
Eastern Hognose Snake
Northern Ringneck Snake
Eastern Worm Snake
Northern Black Racer
Eastern Smooth Green Snake
Black Rat Snake
Eastern Milk Snake
Northern Copperhead
Eastern Massasauga
Timber Rattlesnake

AMPHIBIANS

Marbled Salamander
Jefferson Salamander
Spotted Salamander
Eastern Tiger Salamander
Red-spotted Newt
Northern Dusky Salamander
Mountain Dusky Salamander
Redback Salamander
Slimy Salamander
Four-toed Salamander
Northern Spring Salamander
Northern Red Salamander
Northern Two-lined Salamander
American Toad
Fowler's Toad
Northern Spring Peeper
Gray Treefrog
Western Chorus Frog
Bullfrog
Green Frog
Mink Frog
Wood Frog
Southern Leopard Frog
Pickerel Frog

COTTONWOOD

MAMMALS

Masked Shrew
Shorttail Shrew
Hairytail Mole
Little Brown Myotis
Indiana Myotis
Silver-haired Bat
Big Brown Bat
Red Bat
Raccoon
Longtail Weasel
Striped Skunk
Red Fox
Gray Fox
Eastern Chipmunk
Beaver
White-footed Mouse
Meadow Vole
Eastern Cottontail
White-tailed Deer

BIRDS

Great Blue Heron
Green Heron
Little Blue Heron
Great Egret
Snowy Egret
Louisiana Heron
Black-crowned Night Heron
Yellow-crowned Night Heron
Mallard
American Black Duck
Wood Duck
Common Merganser
Hooded Merganser
Northern Goshawk
Cooper's Hawk
Red-tailed Hawk
Red-shouldered Hawk
Broad-winged Hawk
Bald Eagle
Osprey
Peregrine Falcon
American Kestrel
Ruffed Grouse
Common Bobwhite
American Woodcock
Mourning Dove
Yellow-billed Cuckoo
Black-billed Cuckoo
Barn Owl
Common Screech Owl
Great Horned Owl
Long-eared Owl
Saw-whet Owl
Whip-poor-will
Common Nighthawk
Common Flicker
Pileated Woodpecker
Red-bellied Woodpecker
Red-headed Woodpecker
Yellow-bellied Sapsucker
Hairy Woodpecker
Downy Woodpecker
Eastern Kingbird
Great Crested Flycatcher
Eastern Phoebe
Acadian Flycatcher
Willow Flycatcher
Alder Flycatcher
Least Flycatcher
Eastern Pewee
Tree Swallow
Blue Jay
American Crow
Black-capped Chickadee
White-breasted Nuthatch
Brown Creeper
House Wren
Carolina Wren
Northern Mockingbird
Gray Catbird
Brown Thrasher
American Robin
Wood Thrush
Veery
Eastern Bluebird
Cedar Waxwing
Loggerhead Shrike
White-eyed Vireo
Yellow-throated Vireo
Red-eyed Vireo
Warbling Vireo
Black and White Warbler
Prothonotary Warbler
Worm-eating Warbler
Golden-winged Warbler
Blue-winged Warbler
Nashville Warbler
Yellow Warbler
Cerulean Warbler
Chestnut-sided Warbler
Ovenbird
Mourning Warbler
Common Yellowthroat
Yellow Breasted Chat
Canada Warbler
American Redstart
Common Grackle
Brown-headed Cowbird
Scarlet Tanager
Northern Cardinal
Rose-breasted Grosbeak
Indigo Bunting
American Goldfinch
Rufous-sided Towhee
Chipping Sparrow
Field Sparrow
White-throated Sparrow
Swamp Sparrow
Song Sparrow

REPTILES

Common Snapping Turtle
Wood Turtle
Eastern Box Turtle
Five-lined Skink
Northern Water Snake
Northern Brown Snake
Northern Redbelly Snake
Eastern Garter Snake
Northern Black Racer
Black Rat Snake
Eastern Milk Snake
Northern Copperhead

AMPHIBIANS

American Toad
Wood Frog

RED MAPLE — AMERICAN ELM

MAMMALS

Opossum
Masked Shrew
Smoky Shrew
Least Shrew
Shorttail Shrew
Starnose Mole
Eastern Mole
Hairytail Mole
Little Brown Myotis
Keen Myotis
Indiana Myotis
Silver-haired Bat
Eastern Pipistrelle
Big Brown Bat
Red Bat
Hoary Bat
Black Bear
Raccoon
Fisher
Shorttail Weasel
Longtail Weasel
Mink
River Otter
Striped Skunk
Coyote
Red Fox
Gray Fox
Bobcat
Woodchuck
Eastern Chipmunk
Gray Squirrel
Fox Squirrel
Red Squirrel
Southern Flying Squirrel
Beaver
Deer Mouse
White-footed Mouse
Southern Bog Lemming
Boreal Red-backed Vole
Meadow Vole
Pine Vole
Meadow Jumping Mouse
Woodland Jumping Mouse
Porcupine
Snowshoe Hare
Eastern Cottontail
New England Cottontail
White-tailed Deer

BIRDS

Great Blue Heron
Green Heron
Little Blue Heron
Great Egret
Snowy Egret
Louisiana Heron
Black-crowned Night Heron
Yellow-crowned Night Heron
Mallard
American Black Duck
Wood Duck
Common Merganser
Hooded Merganser
Turkey Vulture
Northern Goshawk
Cooper's Hawk
Red-tailed Hawk
Red-shouldered Hawk
Broad-winged Hawk
Bald Eagle
Osprey
Peregrine Falcon
American Kestrel
Ruffed Grouse
Common Bobwhite
American Woodcock
Mourning Dove
Yellow-billed Cuckoo
Black-billed Cuckoo
Barn Owl
Common Screech Owl
Great Horned Owl
Barred Owl
Long-eared Owl
Saw-whet Owl
Whip-poor-will
Common Nighthawk
Ruby-throated Hummingbird
Common Flicker
Pileated Woodpecker
Red-bellied Woodpecker
Red-headed Woodpecker
Yellow-bellied Sapsucker
Hairy Woodpecker
Downy Woodpecker
Eastern Kingbird
Great Crested Flycatcher
Eastern Phoebe
Acadian Flycatcher
Willow Flycatcher
Alder Flycatcher
Least Flycatcher
Eastern Pewee
Tree Swallow
Blue Jay
Northern Raven
American Crow
Black-capped Chickadee
Tufted Titmouse
White-breasted Nuthatch
Brown Creeper
House Wren
Winter Wren
Carolina Wren
Northern Mockingbird
Gray Catbird
Brown Thrasher
American Robin
Wood Thrush
Veery
Eastern Bluebird
Blue-gray Gnatcatcher
Cedar Waxwing
Loggerhead Shrike
White-eyed Vireo
Yellow-throated Vireo
Red-eyed Vireo
Warbling Vireo
Black and White Warbler
Prothonotary Warbler
Worm-eating Warbler
Golden-winged Warbler
Blue-winged Warbler
Nashville Warbler
Yellow Warbler
Cerulean Warbler
Chestnut-sided Warbler
Prairie Warbler
Ovenbird
Northern Waterthrush
Louisiana Waterthrush
Mourning Warbler
Kentucky Warbler
Common Yellowthroat
Yellow Breasted Chat
Hooded Warbler
Canada Warbler
American Redstart
Orchard Oriole
Northern Oriole
Rusty Blackbird
Common Grackle
Brown-headed Cowbird
Scarlet Tanager
Northern Cardinal
Rose-breasted Grosbeak
Indigo Bunting
American Goldfinch
Rufous-sided Towhee
Chipping Sparrow
Field Sparrow
White-throated Sparrow
Swamp Sparrow
Song Sparrow

RED MAPLE — AMERICAN ELM (CONT'D)

REPTILES

Common Snapping Turtle
Bog Turtle
Wood Turtle
Eastern Box Turtle
Eastern Painted Turtle
Five-lined Skink
Coal Skink
Northern Water Snake
Queen Snake
Northern Brown Snake
Northern Redbelly Snake
Eastern Garter Snake
Shorthead Garter Snake
Eastern Ribbon Snake
Eastern Hognose Snake
Northern Ringneck Snake
Eastern Worm Snake
Northern Black Racer
Eastern Smooth Green Snak
Black Rat Snake
Eastern Milk Snake
Northern Copperhead
Eastern Massasauga
Timber Rattlesnake

AMPHIBIANS

Marbled Salamander
Jefferson Salamander
Spotted Salamander
Eastern Tiger Salamander
Red-spotted Newt
Northern Dusky Salamander
Mountain Dusky Salamander
Redback Salamander
Slimy Salamander
Four-toed Salamander
Northern Spring Salamander
Northern Red Salamander
Northern Two-lined Salamander
American Toad
Fowler's Toad
Northern Spring Peeper
Gray Treefrog
Western Chorus Frog
Bullfrog
Green Frog
Mink Frog
Wood Frog
Northern Leopard Frog
Southern Leopard Frog
Pickerel Frog

MIDREACH STREAM

RIVERS AND STREAMS: PLANTS AND ANIMALS

Fishes
Alligator Gar
American Eel
American Shad
Apache Trout
Atlantic Salmon
Black Crappie
Bluegill
Brook Silverside
Brook Stickleback
Brook Trout
Brown Trout
Chain Pickerel
Channel Catfish
Chestnut Lamprey
Common Carp
Common Shiner
Cutthroat Trout
Desert Pupfish
Fathead Minnow
Gizzard Shad
Golden Shiner
Grass Carp
Green Sunfish
Johnny Darter
Lake Trout
Longear Sunfish
Mosquitofish
Mottled Sculpin
Mozambique Tilapia
Muskellunge
Northern Pike
Paddlefish
Pirate Perch
Plains Killifish
Pugnose Minnow
Pumpkinseed
Quillback
Rainbow Trout
Rio Grande Cichlid
Rock Bass
Sauger
Shovelnose Sturgeon
Smallmouth Bass
Smallmouth Buffalo
Snail Darter
Sockeye Salmon
Speckled Chub
Spotted Bass
Spotted Sucker
Starhead Topminnow
Stippled Darter
Striped Bass
Swamp Darter
Tadpole Madtom
Taillight Shiner
Walleye
White Bass
White Perch
White Sucker
Yellow Bullhead
Yellow Perch

Amphibians
Black-spotted Newt
Black Toad
Bullfrog
California Newt
Dusky Salamander
Hellbender
Many-lined Salamander
Mud Salamander

Mudpuppy
Northern Cricket Frog
Pacific Giant Salamander
Pickerel Frog
Red Salamander
Rio Grande Leopard Frog
River Frog
Southern Cricket Frog

Tiger Salamander

Two-lined Salamander

Reptiles
Brown Water Snake
Cottonmouth

Eastern Mud Turtle
Flattened Musk Turtle
Florida Redbelly Turtle
Glossy Crayfish Snake
Map Turtle
Mud Turtle
Northern Water Snake
Painted Turtle

Queen Snake
Razorback Musk Turtle
Slider
Spiny Softshell
Spotted Turtle
Stinkpot

Wildflowers, Ferns, and Grasses
American Lotus
Arrowleaf Groundsel
Cardinal Flower
Checkermallow
Duckweed
Fire Flags
Heartleaved Bittercress
Monkey flower
Mountain Bluebell
Mountain Globemallow
Red Osier Dogwood
Seep Spring Monkeyflowers
True Forget-me-not
Turtlehead
Umbrella Plant
Water Buttercup
Water Hyacinth
Water Willow
Watercress
Wild Rice
Wood Nettle
Yellow Pond Lily

Insects and Spiders
Betten's Silverstreak Caddisfly
Black Fly
Brown Darner
California Acroneuria
Common Backswimmer
Common Water Strider
Comstock's Net-winged Midge
Crane Fly
Eastern Dobsonfly

Elisa Skimmer
Fishfly
Giant Water Scavenger Beetle
Green Darner
Kirby's Backswimmer
Large Whirligig Beetle
Marsh Fly
Purplish-blue Cricket Hunter
Red Freshwater Mite
Short-stalked Damselfly
Six-spotted Fishing Spider
Small Mayfly
Swamp Milkweed Leaf Beetle
Swift Long-winged Skimmer
Twelve-spot Skimmer
Waterlily Leaf Beetle
Willow Borer
Willow Leaf Beetle

Butterflies and Moths
Cerisy's Sphinx
Least Skipperling
Milbert's Tortoiseshell
Viceroy
Western Tiger Swallowtail
Zebra Swallowtail

Trees
Baldcypress
Black Willow
Dahoon
Possumhaw
Red Alder
Red Maple
Silver Maple
Swamp Cottonwood
Sycamore
Water Tupelo

Birds
American Black Duck
American Dipper
Bald Eagle
Bank Swallow
Belted Kingfisher
Black Crowned Night-Heron
Bonaparte's Gull
Canada Goose
Caspian Tern
Common Loon
Common Merganser
Common Tern
Common Yellowthroat
Double-crested Cormorant
Eastern Phoebe
Great Blue Heron
Green-backed Heron
Harlequin Duck
Herring Gull
Hooded Merganser
Lesser Scaup
Louisiana Waterthrush
Mute Swan
Northern Rough-winged Swallow
Osprey
Ring-billed Gull
Ring-necked Duck
Semipalmated Sandpiper
Spotted Sandpiper
White-Fronted Goose

Mammals
Beaver
Mountain Beaver
Pacific Shrew
Pacific Water Shrew
River Otter
Smoky Shrew
Star-nosed Mole
Water Shrew
Water Vole

REEDGRASS/PURPLE LOOSESTRIFE MARSH

Fishes
Pumpkinseed
Starhead Topminnow

Amphibians
Brimley's Chorus Frog
Northern Leopard Frog
Rio Grande Leopard Frog
Southern Cricket Frog
Spring Peeper

Reptiles
Brown Snake
Eastern Ribbon Snake
Green Water Snake
Kirtland's Snake
Northern Water Snake
Pine Woods Snake
Smooth Green Snake
Western Pond Turtle

Wildflowers, Ferns, and Grasses
Arrow Arum
Arrowhead
Blue Flag
Bur Reed
Clearweed
Common Cattail
Common Piperwort
Fringed Loosestrife
Giant Reed
Marsh Cinquefoil
Marsh Fern
Marsh Marigold
Marsh Skullcap
Marsh St. Johnswort
Pickerelweed
Purple Loosestrife
Royal Fern
Soft Rush
Spider Lily
Swamp Candles
Swamp Milkweed
Swamp Rosemallow
Swamp Lily
Sweetflag
Tall Meadow Rue
Three-leaved Sundew
Turk's Cap Lily
Venus Flytrap
Virginia Bluebells
Virginia Meadow Beauty
Water Hemlock
Water Parsnip
Water Pennywort
Water Plantain
White-topped Sedge
Wild Rice
Wool Grass
Yellow Flag

Insects and Spiders
American Horsefly
Bluebell
Elisa Skimmer
Swamp Milkweed Leaf Beetle
Vinegar Fly
Widow

Butterflies and Moths
Black Dash
Eyed Brown
Great Gray Copper
Least Skipperling
Lilac-banded Longtail
Mulberry Wing
Palamedes Swallowtail
Pink Edged Sulfur
Saw-grass Skipper
Sedge Skipper
Skipperling
Small Checkered Skipper
Two-spotted Skipper
Viceroy

Trees
Black Ash
Red Maple

Birds
American Avocet
American Bittern
American Black Duck
American Coot
American Swallow-tailed Kite
American White Pelican
American Wigeon
Anhinga
Bald Eagle
Black-crowned Night-Heron
Black Tern
Blue-winged Teal
California Gull
Canada Goose
Canvasback
Cinnamon Teal
Common Goldeneye
Common Merganser
Common Moorhen
Common Snipe
Common Yellowthroat
Forster's Tern
Franklin's Gull
Fulvous Whistling-Duck
Gadwall
Green-backed Heron
Great Blue Heron
Great Egret
Green-winged Teal
King Rail
Least Bittern
Least Sandpiper
Limpkin
Mallard
Marsh Wren
"Mexican" Duck
Northern Harrier
Northern Pintail
Northern Shoveler
Olivaceous Cormorant
Palm Warbler
Pied-billed Grebe
Purple Gallinule
Red-winged Blackbird
Redhead
Ross Goose
Ruddy Duck
Sandhill Crane
Sedge Wren
Semipalmated Sandpiper
Sharp-tailed Sparrow
Short-eared Owl
Snail Kite
Snow Goose
Snowy Egret
Sora
Swamp Sparrow
Tricolored Blackbird
Western Grebe
White-faced Ibis
White-fronted Goose
Wilson's Phalarope
Yellow-headed Blackbird
Yellow Rail

Mammals
Marsh Rice Rat
Masked Shrew
Meadow Jumping Mouse
Meadow Vole
Mink
Muskrat
Nutria
Round-tailed Muskrat