REPORT

Remedial Design
Ley Creek PCB Dredgings Site
Syracuse, New York

Remediation and Liability Management Company, Inc.

February 1999



O'BRIEN & GERE
ENGINEERS, INC.

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1. Introduction

The Ley Creek PCB Dredgings Site (the site) is a Class 2 site in the New York State Registry of Inactive Hazardous Waste Disposal Sites. The site is located in the Town of Salina, Onondaga County, New York, and is bounded by Factory Avenue on the south and Ley Creek to the north. The eastern limit of the site is Townline Road and the western limit is located approximately 4,300 ft downstream. A site location map is presented as Figure 1-1, and a site plan is presented as Figure 1-2. The site is approximately 19 acres in size. Additionally, there is a 0.4 acre area on the north side of Ley Creek to be addressed during site remediation.

This report, along with the February 1999 Hydraulic Analysis and Floodplain Assessment Report, the February 1999 Contract Drawings and the February 1999 Contract Documents (technical specifications and special provisions), represent the Remedial Design for the site. This Remedial Design Report was initially submitted to the New York State Department of Environmental Conservation (NYSDEC) on June 19, 1998. NYSDEC submitted its comments in a letter dated July 20, 1998, and USEPA submitted its comments by letter dated July 30, 1998. This revised Remedial Design Report incorporates NYSDEC's and USEPA's comments.

The following sections present the history and conditions of the site, investigations that have been conducted at the site, components of the Remedial Design, health and safety requirements, construction quality assurance, post construction maintenance and monitoring, contingency plan, and the anticipated construction schedule and sequence.

1.1. Site history

Prior to the early 1970's, the combination of poor channel conditions and large areas of low permeability in the Ley Creek watershed caused extensive flooding, some of the worst of which was near the General Motors Corporation (GM) former Inland Fisher Guide (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. Dredged material generated during these activities was placed along the south bank of the creek or used for land restoration projects (EDI, 1985[b]).

A hydrogeologic investigation performed by EDI Engineering and Science (EDI) on behalf of GM pursuant to a SPDES Consent Order indicated the presence of polychlorinated biphenyls (PCBs) in the dredged material at the site. Material previously used in hydraulic equipment for die casting operations at the GM facility (EDI, 1985[a]) is believed to be one of the sources of the detected PCBs.

Subsequent to the completion of the EDI study, NYSDEC requested that GM perform a more detailed study of the area between Factory Avenue and Ley Creek. Pursuant to an Order on Consent dated August 12, 1985 between NYSDEC and GM, GM completed an investigation of dredged material/soil and ground water in the area between Factory Avenue and Ley Creek. Ground water flow was determined to be generally north towards Ley Creek. PCBs were detected in dredged material/soil and ground water samples (O'Brien & Gere Engineers, 1987[a]).

As a result of the 1987 investigation, NYSDEC decided that a more comprehensive evaluation of the Ley Creek dredged material/soil 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. O'Brien & Gere Engineers, on behalf of GM, completed a field investigation of the site in 1989 which included the sampling and analysis of ground water, dredged material/soil, sediment, and surface water (O'Brien & Gere Engineers, 1989). The Field Investigation Report was submitted to NYSDEC in July 1989.

In its comments on the Field Investigation Report, NYSDEC requested: (i) additional investigatory work 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 and NYSDEC signed an Administrative Order on Consent for performance of a Remedial Investigation/Feasibility Study (RI/FS) at the site, effective

May 23, 1991. Based on NYSDEC's Field Investigation Report comments and on several meetings between GM 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). RI sampling activities commenced in July 1992, and the RI was completed in accordance with the RI/FS Work Plan (O'Brien & Gere Engineers, 1992). The September 1993 revised RI Report (O'Brien & Gere Engineers, 1993[a]) incorporated revisions approved by NYSDEC on August 25, 1993 (Schick, 1993) to the February 1993 initial RI Report.

A FS Report was submitted to NYSDEC on November 24, 1993. NYSDEC provided comments on the FS Report in letters dated January 14, 1994 (Schick, 1994[a]) and April 21, 1994 (Schick, 1994[b]). Responses were prepared and provided in an Addendum to the FS report and submitted to NYSDEC as the revised FS Report on May 20, 1994 (Kochem, 1994[a], and O'Brien & Gere Engineers, 1994). Based on further NYSDEC comments (Little, 1994) and Onondaga County concerns as a property owner (Pirro, 1994), a revised FS Report was submitted to NYSDEC on October 9, 1996. NYSDEC approved the FS Report in a letter dated January 23, 1997 (Davies, 1997). A topographic and property boundary survey was performed in the summer of 1995 for the FS.

In March 1997, following a period of public comment, NYSDEC issued its Record of Decision (ROD) for the site (NYSDEC, 1997). The United States Environmental Protection Agency (USEPA) concurred in the selection of NYSDEC's remedial alternative in the ROD by its letter dated February 9, 1998 to NYSDEC Commissioner John Cahill (Fox, 1998). Since that time, the site was designated as a subsite of the Onondaga Lake National Priorities List (NPL) site by NYSDEC and USEPA. The property owners at the time of issuance of the ROD are noted on Figure 1-2. It is anticipated that the current owners of property within the site will be conveying their respective fee interests to a GM subsidiary, the Remediation and Liability Management Company, Inc. ("REALM"). REALM, in turn, will be entering into an Order on Consent with NYSDEC to implement the ROD-selected remedial alternative at the site.

1.2. Existing site conditions

The September 1993 revised RI Report (O'Brien & Gere Engineers, 1993[a]) contains a detailed summary of investigatory activities performed and data generated at the site. A concise summary of site conditions is presented in this section.

1.2.1. Site topography and drainage

A site topography survey was conducted by C.T. Male Associates (C.T. Male) in March 1995. Cross sections of the creek and its banks within the site were surveyed every 500 ft as part of this effort. Additional surveying activities were conducted by C.T. Male in November 1997 and May 1998. The topography on the site varies from steeply sloped piles of dredgings near the creek to gently sloping piles of dredgings near Factory Avenue. Elevations on the site vary from 368 ft to 381 ft. The invert elevation of Ley Creek within the area of the site varies from 369 ft at the eastern end of the site and 367.5 ft at the western end of the site.

There are five drainage ditches on the site that span from Factory Avenue to Ley Creek. The drainage ditch referred to as Outfall 004 discharges storm water from the former IFG facility and local surface runoff to Ley Creek including sources located upgradient from the former IFG facility along Court Street. The drainage ditch referred to as Outfall 003 discharges storm water from the former IFG facility and treated water from the Industrial Waste Treatment Plant at the former IFG facility. Outfall 003 and Outfall 004 are engineered channels which consist of geofabricated mats, corrugated metal, and rip rap.

One of the drainage ditches conveys a State Pollution Discharge Elimination System (SPDES)-regulated wastewater discharge from the Syracuse China facility as well as local surface runoff to Ley Creek. This drainage ditch consists of native materials. The remaining two drainage ditches located toward the western end of the site discharge local surface runoff to Ley Creek; they consist of native materials. Local surface runoff includes runoff from Factory Avenue, property south of Factory Avenue, and the site.

1.2.2. Site geology

The site geology is characterized by the dredged material at the surface, and native soils consisting of 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 4 ft to 12 ft in thickness. The depths of fluvial and lacustrine sediments range from 5 ft to 25 ft.

The glacial till unit underlying the fluvial and lacustrine deposits consists of dense reddish brown clayey silt with sand and imbedded gravel fragments. On-site, the till layer ranges in depth from approximately 11 ft to approximately 30 ft below grade. Shale bedrock was encountered at between approximately 30 ft to 35 ft below grade.

1.2.3. Site hydrogeology

The direction of ground water flow is to the north toward Ley Creek. Ground water elevations indicate an upward flow potential exists between the upper fluvial and lacustrine deposits and the underlying till. The average ground water flow velocity in the shallow zone was calculated to be 0.08 ft/day (29 ft/yr) assuming an average study area-wide hydraulic conductivity for materials in the shallow aquifer of 9.5 gpd/ft^2, an average hydraulic gradient of 0.022 ft/ft, and an estimated porosity of 0.35.

2. Site investigations

2.1. Remedial investigation/feasibility study

An RI/FS was conducted for the Ley Creek PCB Dredgings Site by O'Brien & Gere Engineers, Inc. on behalf of GM in accordance with an Administrative Order on Consent (#A7-0239-90-07; Order) between GM and NYSDEC. The RI/FS was conducted in accordance with the RI/FS Work Plan (O'Brien & Gere Engineers, 1992) approved by NYSDEC on June 3, 1992 (Schick, 1992). The results of the RI were documented in the September 1993 revised RI Report (O'Brien & Gere Engineers, 1993[a]) which incorporated revisions approved by NYSDEC on August 25, 1993 (Schick, 1993) to the February 1993 initial RI Report. Results of the RI demonstrated PCB (Aroclor 1242, 1248) concentrations in dredged material/soil that ranged from less than the detection limit (generally 1 mg/kg) to 470 mg/kg.

The FS Report was submitted to NYSDEC on November 24, 1993. NYSDEC provided comments on the FS Report in letters dated January 14, 1994 (Schick, 1994[a]) and April 21, 1994 (Schick, 1994[b]). The revised FS Report was submitted to NYSDEC in October 1996 and approved on January 23, 1997.

The alternative recommended for implementation in the FS consisted of: excavation and off-site disposal of dredged material/soil containing PCBs at concentrations greater than or equal to 50 mg/kg, regrading of material in the floodway for the purposes of erosion control, 12-inch vegetated soil cover over the remaining material, construction of an access road along the south bank of Ley Creek to facilitate potential future dredging operations, installation of fence gates and access paths to provide access to Onondaga County sewer manholes, grading and piping of drainage swales crossing the site, routine ground water monitoring, deed restriction, fencing, routine inspection and maintenance, and five-year reviews. This remedial alternative is substantially what NYSDEC selected as the remedial action for the site in its ROD.

2.2. Remedial design investigations

2.2.1. Site survey

Site topographic and boundary surveys have been conducted by C. T. Male. The results of these surveys have been used during the Remedial Design and incorporated into the Contract Drawings.

2.2.2. Wetland delineation

O'Brien & Gere Engineers conducted a wetland delineation to identify the presence of federal wetlands at the site. Evaluating the presence of federal wetlands allows potential wetland impacts to be more fully considered in the Remedial Design. Field activities for the delineation were performed on October 21, 22, 27 and 28, 1997 by O'Brien & Gere Engineers, Inc. A detailed discussion of the site wetland history, delineation methodology, and results is presented in the Wetland Delineation Report (O'Brien & Gere Engineers, Inc., January 1998). Eight wetlands, totaling approximately 1.4 acres of the wetland delineation area, were identified (see the Contract Drawings G-2 through G-6 for wetland locations).

A Wetland Assessment Report (O'Brien & Gere 1998b) was prepared to evaluate:

- the types and acreage of wetlands that could be lost following remediation,
- the functions and values of the identified wetlands that may be affected by site remediation, and
- the potential impact of lost wetlands and functions to the site and its watershed, collectively referred to as the Ley Creek system.

It was concluded in the report that wetland losses at the site would not have a significant impact on Ley Creek or on the water quality of Onondaga Lake. USEPA, however, requested in its July 30, 1998 comments to NYSDEC that a wetland mitigation proposal be submitted. REALM submitted a proposal to NYSDEC for review dated February 5, 1999 (Hartnett 1999) to address mitigation requirements.

3. Remedial design

3.1. Remedial objectives

The following were the remediation goals identified by NYSDEC in its March 1997 ROD (the "remedial objectives").

- Reduce, control, or eliminate the PCB contamination present within the dredged material/soil on the site.
- Eliminate the threat to surface waters and sediments by eliminating any future contaminated surface runoff from the contaminated dredged material/soil on site.
- Eliminate a source of PCBs for uptake by fish and other organisms in Ley Creek.
- Eliminate the potential for direct human or animal contact with the contaminated dredged material/soil on site.
- Prevent, to the extent possible, migration of contaminants into the groundwater.

The description of the selected remedy in the ROD is presented in Exhibit A, and generally consists of the following:

- Excavation and removal of dredged material/soil that contain PCBs at concentrations at or exceeding 50 mg/kg to a permitted hazardous waste landfill.
- Consolidation and covering of the remaining PCB contaminated dredged material/soil where concentrations are less than 50 mg/kg but exceed the remedial levels of 1 mg/kg at the surface and 10 mg/kg for subsurface areas. The dredged material/soil will be removed, at a minimum, from the first twenty five feet of the floodway area to restore this area to appropriate elevation. After restoration to floodway elevations, remaining materials above the remedial level remaining in the floodway

will be covered with a geotextile or clay and then twelve inches of soil or the gravel access road. In areas to be addressed outside of the floodway the dredged material will be graded and covered with a vegetated soil cover which will consist of 12 inches of soil, with a permeability equal to or less than the material to be covered.

- A hydraulic analysis and floodplain assessment, in accordance with Executive Order 11988, will be completed to insure that the material to be left in the floodplain and floodway will not result in any significant change in flood elevations and to ensure that there will be no adverse impact to the remedy from a 100 or 500 year flood. Erosion control measures will be implemented, as necessary, to minimize the potential for cover materials to wash into Ley Creek during 100 yr and 500 yr floods.

- To provide Onondaga County crews access to maintain Ley Creek as a part of the existing drainage district, a gravel access road will be provided adjacent to the southern bank of the creek to allow for future maintenance and/or dredging. The five existing drainage swales which begin at the northern edge of Factory Avenue and end at the southern edge of Ley Creek will be hard piped. Access pads and pathways will be provided to allow access for maintenance of the County sewer line, which is also located in the area to be covered, without coming into contact with potentially contaminated soil. Gates will be installed in the fence to provide direct access to the maintenance locations and avoid travel over the covered area.

- Since the remedy will result in dredged material/soil with elevated levels of PCBs remaining, but covered at the site, a long term monitoring program will be instituted. In addition, reviews will be conducted to allow the effectiveness of the selected remedy to be evaluated and to determine whether the remedy continues to be protective of human health and the environment.

3.2. Clearing and grubbing

Clearing and grubbing of the site will be conducted prior to excavation of dredged material/soil with PCB concentrations equal to or exceeding 50 mg/kg. Trees, brush, and other vegetation will be cut at ground surface and processed using a wood chipper or other appropriate equipment such that the material can be used as onsite fill or transported offsite.

Utility poles designated by Niagara Mohawk Power Corporation (NMPC) will be taken down. The Remedial Action (RA) Contractor will address management of the utility poles in the Materials Handling Plan to be prepared prior to implementation of the remedial action.

During clearing and grubbing of the site, caution will be used to avoid damaging existing onsite monitoring wells and the fence.

3.3. Excavation of hot spots

Two of the remedial objectives established by the ROD are to reduce, control, or eliminate the PCB contamination present within the dredged material/soil on the site, and to eliminate a source of PCBs for uptake by fish and other organisms in Ley Creek. Excavation of areas of detectable PCBs at or above 50 mg/kg threshold will help achieve these remedial objectives.

3.3.1. Former drainage swale evaluation - test pitting sampling investigation

Further evaluation of the level of PCBs in the former drainage swale area will be conducted to address the first component of the ROD (as presented in Exhibit A). The purpose of this investigation will be to evaluate if there are additional areas which contain detectable PCBs at or above 50 mg/kg. Newly identified areas, if any are found, will be excavated as part of the Remedial Construction.

As discussed in the former drainage swale evaluation submittal submitted to NYSDEC on June 18, 1998 (O'Brien & Gere 1998c), the following soil borings were located on the site in the vicinity of the former drainage swale and were sampled for PCBs: MW-OBG7C, B-41, B-40, B-39, B-38, B-37, B-28, B-27, B-26, B-25, B-24, B-127B, B-127A. Figure 3-1 depicts the above listed soil borings and the approximate location of the former drainage swale. In addition to the soil boring characterization data, six test pits are proposed to evaluate the potential presence of PCBs at concentrations at or greater than 50 mg/kg. The first test pit will be located approximately 15 feet from the northern edge of Factory Avenue; the second will be located between B-24 and the site fence along the northern edge of Factory Avenue; the third will be located between B-25 and B-28; the fourth will be in the vicinity of B-41; and the fifth and sixth test pits will be located between MW-OBG7C and the southern edge of Ley Creek.

The test pits will be referred to as Test Pit #1, #2, #3, #4, #5, and #6. Locations of the test pits are shown on the attached Figure 3-1.

Each test pit will have a linear length of at least 40 feet and will be excavated to a depth of approximately 4 ft below the depth of the swale, or to the ground water table, whichever is shallower. The swale depth shall be based on visual identification, or, in the absence of visual indications, on the following estimated depths. The estimated depths are based on historical topographic information, as discussed in the June 18, 1998 former drainage swale evaluation submittal (O'Brien & Gere 1998c).

Table 3-1. *Estimated drainage swale depth*

Test Pit	Estimated Swale Invert Elevation (feet above sea level)	Estimated Depth (feet)
#1	370.6	8.4
#2	370.2	8.8
#3	370.0	9
#4	369.5	8.5
#5	369.1	5.4
#6	368.9	1.1

Test pits will be excavated approximately perpendicular to the estimated location of the former drainage swale.

If the test pit provides for visual identification of where the swale is located, three immuno assay grab samples will be collected. One sample will be collected in the middle of the channel, a second will be collected one foot above the top of the channel, and a third will be collected one foot below the channel. If the location of the drainage swale is not visually identified in the test pit, an alternate sampling procedure will be utilized. In this case, immuno assay grab samples will be collected in the estimated middle of the swale and extend laterally outward every 10 feet (*i.e.*, if the test pit is 40 feet long there will be 5 lateral sampling locations). At each of the lateral sampling locations, grab samples will be collected at three depths, dividing the depth of the test pit into three sections. The objective of the alternate sampling procedure is to evaluate the limits of the drainage swale. If the limits of the drainage swale are identified before all the samples have been collected, further sampling will not be performed. One grab sample from each test pit will be split and analyzed for PCBs (EPA Method 8082) at a certified laboratory.

Dredged material/soil excavated from the test pits will be staged on 40 mil plastic during sampling activities. Dredged material/soil contaminated with PCBs greater than or equal to 50 mg/kg will be transported off-site for disposal along with dredged material/soil from other previously identified PCB "hot spots" at the site. If a test pit dredged material/soil analysis indicates the presence of PCBs greater than or equal to 50 mg/kg, dredged material/soil confirmation sampling will be conducted similar to the Post-Excavation Confirmatory Sampling Program presented as Special Provision 23 (SP-23) in the Contract Documents. Dredged material/soil contaminated with PCBs less than 50 mg/kg will be regraded on-site and covered with a vegetative soil cover in accordance with the Contract Documents and Contract Drawings.

It may be necessary to dewater prior to or during excavation. Water generated as part of the dewatering efforts will be managed in accordance with the RA Contractor's Construction Water Management Plan. Sheeting/shoring of excavations may also be required to maintain excavation stability. Sheeting/shoring will be conducted according to the Contract Documents.

3.3.2. Excavation and staging

Excavation and staging of dredged material/soil that contain PCBs at concentrations at or exceeding 50 mg/kg will be conducted. Excavation of dredged material/soil will be conducted using standard equipment (*e.g.*, backhoes). Based on dredged material/soil analytical results from soil boring samples conducted during the RI, there are fifteen boring locations that contain PCBs at concentrations exceeding 50 mg/kg. The boring designations and their corresponding vertical extent of PCBs greater than 50 mg/kg are as follows: B-122.5A [0-4ft], B-122.5B [0-5ft], B118A [0-1ft], B118B [0-5ft], B127A [0-7ft], B127B [0-3ft], B1 [4-8ft], B6 [0-8ft], B37 [4-8ft], OBG3 [2-4ft], OBG4 [4-6ft], OBG5 [0-2ft], OBG6 [2-10ft], OBG7A [2-4ft], and OBG7B [6-8ft].

Each soil boring location mentioned above will be excavated with a 10 ft by 10 ft horizontal area using the boring location as the center of the area. Dredged material/soil will be excavated to the depth that corresponds to the vertical extent mentioned above. Thus, the minimum volume of dredged material/soil to be excavated as part of the proposed excavation is approximately 310 cy. The volume of dredged material/soil contaminated with PCBs equal to or greater than 50 mg/kg is approximately 220 cy and will be transported off-site. Based upon sampling data collected to date, the volume of dredged material/soil contaminated with PCBs less than 50 mg/kg is approximately 90 cy.

This dredged material/soil projected to be less than 50 mg/kg will be field tested to confirm the level of PCB concentrations. If the analytical results indicate that PCB concentrations are greater than 50 mg/kg, the dredged material/soil will be staged with dredged material/soil contaminated with PCBs greater than 50 mg/kg and transported offsite for disposal. If confirmed to be less than 50 mg/kg, the dredged material/soil will be used to backfill the excavation.

It may be necessary to dewater prior to or during excavation. Water generated as part of the dewatering efforts may contain soil particles contaminated with PCBs. Construction water will be managed in accordance with the RA Contractor's Construction Water Management Plan.

Excavations greater than 4 ft in depth that are within 15 ft of Factory Avenue will require sheeting/shoring. Sheeting/shoring of excavations may also be required to maintain excavation stability in other areas of the site. Sheeting/shoring will be conducted according to the Contract Documents.

Dredged material/soil contaminated with PCBs greater than or equal to 50 mg/kg will be transported to the Railcar Loading Area located on the former IFG facility site (see Contract Drawing G-7 for location). The dredged material/soil must pass the paint filter test prior to leaving the site. Thus, the dredged material/soil may require staging and dewatering at the site. The RA Contractor will provide procedures to stage, dewater, transport, test, and weigh the dredged material/soil in the Material Handling Plan.

Transport from the excavation areas to the Railcar Loading Area will be across Factory Avenue through the gates near Outfall 003 (see Contract Drawing G-7 for locations). Dredged material/soil will be loaded directly from transport vehicles into railcars for transport to the Laidlaw facility (TSDF) in Utah. Dredged material/soil will not be staged at the former IFG facility prior to loading onto the railcars.

3.3.3. Disposal of dredged material/soil contaminated with PCBs ≥ 50 mg/kg

Dredged material/soil contaminated with PCBs at concentrations greater than or equal to 50 mg/kg will be weighed and loaded into railcars. The railcars will be transported via train to the Laidlaw TSDF in Utah. The Laidlaw facility is a TSCA-permitted facility that has an agreement with GM to manage wastes contaminated with PCBs. The RA Contractor will be responsible for obtaining and completing required manifests for transport and disposal. Manifests will require the Owner's signature or a signature of the Owner's representative. Pre-disposal characterization for dredged

material/soil was performed in July-August 1998. Pre-disposal characterization data are presented in Exhibit B.

Transported dredged material/soil will be covered to minimize potential hazards to humans due to transportation of PCB contaminated dredged material/soil to the TSCA-permitted facility.

3.3.4. Confirmatory sampling/analysis

For the dredged material/soil contaminated with PCBs less than 50 mg/kg that are excavated and staged as part of the excavation, a minimum of one sample will be collected and analyzed using a field screening kit per excavation. An additional field screening sample will be collected and analyzed for every 20 cy of excavated dredged material/soil contaminated with PCBs less than 50 mg/kg per excavation.

A combination of field screening and laboratory analysis will be utilized to confirm PCB concentrations in excavated areas following the initial excavation. Samples of the excavation walls and floor will be obtained and analyzed using PCB field screening kits to evaluate whether the remaining dredged material/soil contains PCBs concentrations at or greater than 50 mg/kg. The minimum number of confirmatory samples will consist of one sample of each wall and one sample of the excavation floor (for a total of five samples per excavation). If a sample result shows PCB concentrations at or greater than 50 mg/kg, then the excavation will proceed in the appropriate direction, as indicated by the sample results. For example, if one of the wall samples contains PCBs in excess of 50 mg/kg, excavation of that wall surface will continue.

Numbers of confirmatory samples will increase as the excavation size increases. The number of confirmatory samples per length of wall excavation is as follows: up to 20 ft excavation length, one sample; 21 ft to 40 ft wall length, two samples; and 41 ft to 60 ft wall length, three samples. The number of confirmatory samples per depth of wall excavation is as follows: up to 10 ft excavation depth, one sample; 11 ft to 20 ft, two samples; 21 ft to 30 ft, three samples; and so on. In other words, one sample will be taken from a wall that has an excavation length up to 20 ft and an excavation depth up to 10 ft. If either the excavation length or excavation depth increases, additional samples will be taken as presented above.

The number of confirmatory samples for the floor excavation would increase as the amount of floor area increases. The number and approximate locations of the floor samples will be determined by superimposing the grid formed by connecting the locations of the wall samples from opposite walls

on the floor of the excavation or as directed by the Engineer. The floor samples would be collected from the grid intersection points or at locations designated by the Engineer.

A limited number of confirmatory samples would be submitted to an analytical laboratory to support the PCB field screening results. One sample will be submitted to an analytical laboratory for every twenty samples analyzed using the PCB field screening kits with a minimum of one laboratory analytical sample per excavation. Laboratory samples will be analyzed utilizing EPA Method 8082 which specifies that one matrix spike sample and one matrix spike duplicate sample per twenty samples collected be analyzed.

The PCB field screening kits will be ENSYS Inc. PCB RISc ® Soil Test, EPA SW-846 Method 4020. Each PCB RISc ® Soil Test Case contains enough material to perform 12 test samples, each at two detection levels. The PCB RISc ® Soil Test is divided into four phases: extraction and preparation of the sample, sample and standard preparation, immunoassay, and interpretation. Standards, samples, and color-change reagents will be added to test tubes, coated with a chemical specific to PCBs. The concentration of the PCBs in an unknown sample will be evaluated by comparing the color intensity of the sample to that of the standard. The PCB RISc Soil Test System User's Guide is included as Exhibit C.

3.4. Material consolidation

3.4.1. Northern area dredged material/soil

Dredged material/soil in the vicinity of boring B-19, located on the north bank of Ley Creek (see Contract Drawing G-1) will be excavated from an area of approximately 6,200 square feet (0.14 acres) to a depth of 4 ft. The total volume of dredged material/soil to be excavated is approximately 920 cy. Excavation will be completed with standard equipment (*e.g.*, backhoes, loaders) and excavated dredged material/soil will be transported to the site. Procedures to be used by the RA Contractor to transport the dredged material/soil will be presented in the RA Contractor's Materials Handling Plan. Based on RI analytical results, the excavated material is expected to exhibit less than 50 mg/kg PCBs and it will be consolidated on site exclusive of the area within 25 ft north and south of the sanitary sewer line. Clean fill will be brought to the northern area from off-site and used as backfill.

3.4.2. On-site dredged material/soil

On-site dredged material/soil will be consolidated on site exclusive of the area within 25 ft north and south of the sanitary sewer line after being removed from the following areas:

- That portion of the site bounded by Factory Avenue to the south, the site fence to the north and west, and Townline Road to the east. Dredged material/soil will be removed to a minimum depth of 1 ft from this area. For drainage purposes, some areas within the drainage ditch on the north side of Factory Avenue may require further excavation to establish final grades.
- As part of the drainage swale conversion to pipe culverts, dredged material/soil will be removed to a depth appropriate to construct the pipe culverts.
- Other portions of the site requiring dredge material/soil removal to establish final grades.

3.5. Site grading

3.5.1. Grading plans

Grading will be conducted using standard equipment (*i.e.,* dozers, graders) to establish the final grades presented in Contract Drawings G-2 through G-6.

3.5.2. Ley Creek hydraulic modeling

Hydraulic modeling was conducted utilizing the Hydrologic Engineering Center's River Analysis System (HEC-RAS) model. HEC-RAS is a modeling system developed by the United States Army Corp of Engineers and packaged as Windows®-based software by Haested Methods to perform steady flow hydrologic calculations. Modeling for this project was conducted using HEC-RAS for Windows® (Version 2.1). The hydraulic modeling was conducted as required by the ROD for the site. The ROD required that a hydraulic analysis and floodplain assessment be conducted to demonstrate compliance with Executive Order 11988 by verifying that the remedy would not result in a significant change in flood elevations and that there would be no adverse impacts to the remedy from the 100-yr and 500-yr floods. Accordingly, the HEC-RAS model was used as part of the Remedial

Design to evaluate water surface elevation changes during the 100-yr and 500-yr floods due to the remedy, and to provide flow velocity information for the selection of erosion-resistant materials of construction.

Water Surface Elevation Changes

According to NYS regulations (6 NYCRR Part 500), construction and fill in the floodway is prohibited unless a Professional Engineer demonstrates through hydrologic and hydraulic analysis that it would not result in any increase in flood levels within the community during a 100-yr flood. To evaluate water surface elevation changes, modeling was conducted by simulating the 100-yr and 500-yr flood scenarios for baseline conditions, current conditions, and design conditions.

The Baseline Conditions Model consisted of data from the 1979 HEC-2 modeling effort conducted by the United States Army Corp of Engineers for floodplain analysis and generation of the Ley Creek Flood Insurance Study (Federal Emergency Management Agency, 1982). The 1979 HEC-2 data, including 100-yr and 500-yr peak flow rates, geographic information, and bridge dimensions, were inputted to the HEC-RAS software.

The Current Conditions Model, representing post-dredging conditions, was also modeled. In 1995, a topographic survey was conducted at the site. Cross-sections of Ley Creek and the adjacent land were surveyed every 500 ft. from Townline Road to just east of the Town of Salina Garage. These surveyed cross sections were used to replace and augment the 1979 HEC-2 input data in the vicinity of the site. Thus, input data for current conditions include a combination of 1979 HEC-2 cross-sections and current cross-sections, and 1979 HEC-2 bridge geometry, coefficients, and flood flows.

Using the final grading plan developed as part of the Remedial Design for the site, cross sections of the site topography were substituted for baseline cross sections at the site to develop the Design Conditions Model. Baseline cross sections upstream and downstream of the site, the 100-yr and 500-yr flood peak flow rates, and bridge dimensions remained the same and were used in conjunction with the design cross sections to develop the Design Conditions Model.

In comparison, the water surface elevations for the design conditions (100-yr and 500-yr flood flows) are lower than the baseline conditions (100-yr and 500-yr flood flows). This reflects the fact that the Remedial Design will result in a net removal of material from areas adjacent to Ley Creek, providing greater hydraulic capacity under flood conditions compared to the

baseline conditions. Thus, the remedy as designed will not result in an increase in flood levels within the community during a 100-yr flood or 500-yr flood, as compared to baseline conditions.

The complete Hydraulic Analysis and Floodplain Assessment including hydraulic modeling procedures and results are presented in the Hydraulic Analysis and Floodplain Assessment Report (O'Brien & Gere 1999).

3.6. Access road

A gravel access road will be constructed at the site to provide Onondaga County a means to perform potential future dredging activities at Ley Creek. The access road will be located along the southern side of Ley Creek with curb tie-ins to Factory Avenue (see Drawings G-2 through G-6 for access road location). The access road will be 12 ft wide and sloped to facilitate proper drainage.

NYSDEC and Onondaga County have approached REALM to consider incorporation of a bike path along Ley Creek as part of a conceptual county-wide bike trail system. It is not appropriate at this time to evaluate the practical and legal feasibility of incorporating a bike path into the remedial design for the site, because the Ley Creek media are the subject of a continuing investigation as part of the Former IFG Facility/Ley Creek Deferred Media RI/FS.

3.7. Cover system

Constructing a cover system at the site will address the following remedial objectives established in the ROD: eliminate the threat to surface waters and sediments by eliminating future contaminated surface runoff from the contaminated dredged material/soil on site; prevent, to the extent possible, migration of contaminants into ground water; and eliminate the potential for direct human or animal contact with the contaminated dredged material/soil on site.

The materials of construction for the cover will consist of a vegetated soil cover over the entire site except for the area in which the gravel access road will be constructed. The 12 in vegetative soil cover will consist of 6 in of top soil placed over a 6 in barrier soil layer. Further, as a visual indicator of erosion in the soil cover, a non-woven geotextile will be placed between the

6 inch barrier soil layer and the 6 inch top soil layer between the southern edge of Ley Creek to a few feet south of the start of the slope increase south of the access road. Also, a synthetic geomat (erosion control and revegetation matrix) will be placed on top of the topsoil layer from the southern edge of Ley Creek to the northern edge of the access road, as an added protection against erosion. The primary purpose of the soil cover is to minimize contact between flood water and dredged material/soil contaminated with PCBs greater than 1 mg/kg and less than 50 mg/kg. The topsoil will be seeded and fertilized to establish a vegetative cover.

Twelve inches of crusher run stone underlain by stabilization fabric will be placed in the area designated for the access road instead of the 12 in vegetative soil cover.

3.7.1. Erosion control

The ROD requires that the Remedial Design take into consideration the flow velocities that the 100-yr and 500-yr floods would exhibit. The design, therefore, incorporates appropriate materials of construction and/or stabilization/flood protection techniques so that the integrity of the cover is not compromised during flood events. The flow velocities were calculated as part of the hydraulic modeling efforts for the Design Conditions Model (O'Brien & Gere 1999) for the 100-yr and 500-yr floods. As expected, velocities for the 500-yr flood scenario at each cross section were higher than for the 100-yr flood scenario. As a conservative measure, velocities for the 500-yr flood scenario were used as maximum flow velocities to evaluate cover materials. The maximum channel flow velocity in the vicinity of the site during a 500-yr flood is approximately 5 ft/s. Flow velocities outside the channel, particularly on the southern edge of Ley Creek extending across the site to the northern edge of Factory Avenue ranged from approximately less than 1 ft/s to 4.5 ft/s. Flow velocity distributions for the 500-yr flood within and outside the Ley Creek channel are plotted in the Hydraulic Analysis and Floodplain Assessment document (O'Brien & Gere 1999).

For comparison purposes, the following general erosion velocity capacity limits are provided (*Bank and Channel Protective Lining Design Procedures, Second Edition,* NYS Department of Transportation - Geotechnical Engineering Bureau, June 1995):

- Bare soil can withstand flow velocities of 1 ft/s or less without erosion
- Soil with excellent vegetation can withstand flow velocities of 5 ft/s or less without erosion

- Typical synthetic geomat materials with established vegetation can withstand flow velocities of 14 ft/s or less without erosion

The recommended remedial alternative in the NYSDEC-approved Feasibility Study Report contemplates the cover design to include a geomembrane to serve the express function of erosion protection. NYSDEC's ROD reflects this and includes the geomembrane throughout the floodway. Upon further evaluation of erosion protection of the cover in the Remedial Design, it is apparent that a cover cross section consisting of 12 inches of well-maintained vegetative cover would provide adequate erosion protection for even the 500-year flood. However, as a measure of additional erosion protection, the cover design will include a synthetic geomat (erosion control and revegetation matrix) from the southern edge of Ley Creek to the northern edge of the access road. This area has a slope of 33% and is the only area on the site which would require added erosion control based on slope and flood velocities. The synthetic geomat is a lightweight, porous material which strengthens the interface between soil and vegetation. It will be anchored by keying the edges into the soil cover as shown in the Contract Drawings.

As an added protection measure requested by NYSDEC (Mizerak 1998a), a visual indicator of erosion in the soil cover will be placed from the southern edge of Ley Creek to a few feet south of the start of the slope increase south of the access road, where the slope is upward to 33% at the creek bank. A non-woven geotextile will be placed between the 6 in barrier soil layer and the 6 in top soil layer. The non-woven geotextile is a lightweight (4 oz/sy), porous fabric which will serve as an indicator that erosion has occurred and maintenance to the soil cover is required. The non-woven geotextile will be anchored by keying the edges into the soil cover as shown in the Contract Drawings. During construction activities, the northernmost edge of the non-woven geotextile (visual indicator fabric) will be surveyed. The survey data will then be provided to Onondaga County and NYSDEC for use in future dredging operations.

The RA Contractor will provide an Erosion Control Plan which will include procedures to prevent dredged material/soil from washing into Ley Creek or the existing drainage ditches during Remedial Construction activities.

3.7.2. Slope stability

The proposed final grades of the cover system include one vertical on five horizontal (20%) for the slope leading from the central portion of the site to the access road, and one vertical on 25 horizontal (4%) for slope leading from the central portion of the site to Factory Avenue. During construction

of final grades, compaction of dredged material/soil will be conducted according to the Contract Documents. Based on the gradual slopes of compacted dredged material/soil within the cover systems, slope stability is not a concern. Should slopes significantly increase (greater than 33%) as a result of modifications during construction, slope stability analyses will be performed to assess the ability of the slopes to remain stable.

3.7.3. Settlement

It is estimated that the thickness of consolidated dredged material/soil at the site will be a maximum of 3 ft. During construction of final grades, compaction of dredged material/soil will be conducted according to the Contract Documents. Based on the relatively small additional load of compacted dredged materials/soil, settlement is not a concern.

3.8. Surface water control

Surface water control would address the remedial objective concerning eliminating the threat to surface waters and sediments by directing surface water away from dredged material/soil that is contaminated with PCBs. Also, the remediation goal of preventing, to the extent possible, migration of contaminants into the groundwater is addressed through surface water control.

Surface water control at the site will be accomplished by the following:

- Installation of five new catch basins and five new drainage pipes to convey storm water to Ley Creek
- Installation of thirteen new culverts within the drainage ditch between Factory Avenue and the site fence to convey storm water runoff beneath the access road at the eastern and western entrance/exit locations and the sanitary sewer truck access paths
- Grading of the drainage ditch between Factory Avenue and the site fence to promote storm water runoff drainage to the catch basins
- Grading of the site to promote drainage in a northerly direction to Ley Creek or a southerly direction to the drainage ditch between Factory Avenue and the site fence

There are five drainage ditches on the site that span from Factory Avenue to Ley Creek. The drainage ditch referred to as Outfall 004 discharges storm water from the former IFG facility and local surface runoff to Ley Creek including sources located upgradient from the former IFG facility along

Court Street. The drainage ditch referred to as Outfall 003 discharges storm water from the former IFG facility and treated water from the Industrial Waste Treatment Plant (IWTP) at the former IFG facility. The IWTP consists of equalization, chemical addition, flocculation, filtration, and carbon adsorption processes to treat water collected in oil/water collection sumps and thinner spill area interceptor trenches at the facility to remove oil, solids, PCBs, and VOCs . Outfall 003 and Outfall 004 are engineered channels which consist of geofabricated mats, corrugated metal, and rip rap.

One of the drainage ditches conveys a SPDES-regulated wastewater discharge from the Syracuse China facility as well as local surface runoff to Ley Creek. This drainage ditch consists of native materials. The remaining two drainage ditches located toward the western end of the site discharge local surface runoff to Ley Creek; they consist of native materials. Local surface runoff includes runoff from Factory Avenue, property south of Factory Avenue, and the site. As part of the Remedial Design, the five existing open drainage ditches will be converted to drainage pipes. In addition, catch basins will be installed between the Factory Avenue culverts and the newly installed drainage pipes. Locations and invert elevations of the catch basins and the hard pipes are shown on Contract Drawing G-2 through G-6. Details of the catch basin, hard pipe bedding, and drainage pipe end sections are shown on Contract Drawing G-9.

As shown in the Contract Drawings G-2 through G-6, the drainage ditch between Factory Avenue and the site will be graded such that storm water runoff drains to one of the five catch basins. There will be thirteen corrugated metal culverts installed within the drainage ditch. Locations and invert elevations of the culverts are shown on Contract Drawings G-2 through G-6. Two of the thirteen culverts will be installed beneath the access road at the eastern and western entrance/exit locations. The remaining eleven culverts will be installed beneath the sanitary sewer truck access paths.

To assist in the design of the drainage pipes, catch basins, culverts, drainage ditch sloping and site slopes, storm water runoff modeling was conducted. The EPA computer modeling package known as TR55® (USEPA, 1989) was utilized to calculate the flow of storm water runoff from the designated portions of the site that would drain into the culverts. Details of the modeling are presented in Appendix A. Flows generated from the TR55® modeling were combined with estimates of flows from the Factory Avenue culverts to calculate design flows for the new drainage pipes. Calculations for sizing the drainage pipes and culverts are presented in Appendix B.

3.9. Sanitary sewer manhole modification

There are eleven sanitary sewer manholes on the site (see Contract Drawings G-2 through G-6 for locations). The onsite sanitary sewer manholes will be extended to the final grade and crowned for drainage purposes. Contract Drawing G-9 shows a detail of the manhole modification. Dredged material/soil will not be consolidated on top of the manholes.

Access to each sanitary sewer manhole from Factory Avenue will be provided to allow for County maintenance. The existing 6 ft chain link will be modified to provide a 20 ft width for truck access. The sanitary sewer manhole truck access paths will be constructed of asphalt (see detail on Contract Drawing G-9). The length of each sanitary sewer access area will vary depending on distance from the manhole to Factory Avenue (see Drawings G-2 through G-6 for details).

3.10. Monitoring well modifications

There are sixteen existing monitoring wells [OBG-1, OBG-2, OBG-3, OBG-3D, OBG-4, OBG-5, OBG-6, OBG-7A, OBG-7B, OBG-7C, MW-8, MW-9, MW-9D, MW-10, MW-12, and MW-13] located onsite (see Drawings G-2 through G-6 for locations). Monitoring wells OBG-3, OBG-4, OBG-5, OBG-6, OBG-7A, and OBG-7B will be removed, because of their location in areas designated for hot spot excavation, during the excavation of dredged material/soil at or above 50 mg/kg PCBs. The RA Contractor will provide procedures for removing the wells in its Materials Handling Plan.

The remaining ten monitoring wells which do not need to be removed to accommodate construction efforts will be modified to an elevation that is flush with the final grade of the vegetative cover as installed in the course of the Remedial Construction. It may be necessary to shorten or extend the well depending on final grades (see Appendix C - Preliminary Basis of Design for the monitoring well modification table). A detail of the monitoring well modification is presented on Contract Drawing G-9.

3.11. Site access

Access will be provided by the new access road entering and leaving the site from Factory Avenue. The proposed location of the site access road is shown on Contract Drawings G-2 through G-6. During the excavation/staging/transport/disposal activities, the existing access gate just west of Outfall 003 will be modified to allow transport of dredged material/soil from the site to the Railcar Loading Area at the former IFG facility site. The modified access gate will allow transport vehicles to cross Factory Avenue perpendicularly.

3.12. Site security

As part of the site remediation, a new 6 ft chain link fence will be installed around the eastern and western limits of the soil cover system and off set from Factory Avenue on the southern side (see Contract Drawing G-2 for location and G-8 for details). The bottom of the fence will be 6 inches above the ground surface to allow passage of small wildlife.

As part of the Remedial Construction, two double swing security gates will be installed at both entrance/exit points along Factory Avenue (see Contract Drawings G-2 and G-6 for locations). A detail of the 15 ft wide security gates is shown on Contract Drawing G-8.

Site access during Remedial Construction will be monitored by the RA Contractor. Only authorized personnel will be permitted onsite. Authorized personnel will sign in and out at the site trailer using the sign in sheet provided by the RA Contractor. Appropriate signs will be posted at selected intervals on the security fence to warn potential trespassers.

3.13. Basis of design summary

A Basis of Design Summary is included as Appendix C to this Report.

3.14. Permits and related requirements

Substantive requirements under environmental laws which may be applicable to the implementation of the Remedial Design are set forth below. No permit will be sought for on-site activities under recited State regulatory programs under the authority of 6 NYCRR Section 375-1.7(a).

Federal

Clean Water Act

- Section 404 and 33 CFR Part 330 (Federal Wetlands). By letter dated May 11, 1998 to Arthur Marks of the Army Corps of Engineers (Buffalo District), O'Brien & Gere Engineers requested that the Corps advise whether it will take jurisdiction in view of the NPL subsite designation of the site. In the event the Corps decides to take jurisdiction, the May 11 correspondence included the necessary elements of a Pre-Construction Notification under Nationwide Permit (NWP) #38, as outlined in the December, 1996 Federal Register. As documented in a letter dated August 28, 1998 (McDannell 1998), the Corps concluded that the remedial design was authorized by NWP #38, provided that clean, non-erodible material is used to construct the access road, work pads, and to fill the excavated area adjacent to the creek channel.

Toxic Substances Control Act

- 40 CFR Part 761, Subpart C (Marking of PCBs and PCB Items)
- 40 CFR Part 761, Subpart D (Storage and Disposal) (§ 761.60 - disposal requirements, § 761.79 - decontamination and § 761.75 - chemical waste landfill)
- 40 CFR Part 761, Subpart K (PCB Waste Disposal Records and Reports)

Clean Air Act

- 40 CFR Part 50 - National Ambient Air Quality Standards

Occupational Safety and Health Standards

- 29 CFR Sections 1910 and 1926

Federal Hazardous Materials Transportation Regulations

- 49 CFR Sections 172-174 and 177-179

State

Environmental Conservation Law

- Article 15, Title 5 - Stream Disturbance and Excavation/Fill Below Mean High Water Level
- Article 17, Title 8 - SPDES
- Article 24 - Wetlands
- Article 27, Title 7 - Solid Waste - 6 NYCRR Part 364 - Waste Transporter
- Article 27, Title 9 - Hazardous Waste - 6 NYCRR Part 372 - Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities
- Article 36 - Participation in Flood Insurance Programs - 6 NYCRR Part 500 - Floodplain Management Regulations Development Permits

New York State Thruway

- Work Permit for activities on NYS Thurway Property

Local

Town of Salina Excavation/Fill Permit

- Work conducted in the Town of Salina which involves excavation/fill activities must be permitted. Although there exists an exemption from permitting under local government zoning, land-use or other regulatory program (see 6 NYCRR § 375-1.7(c)), Remediation and Liability Management Company, Inc. (REALM) applied for a permit as a courtesy to the Town. The submittal to the Town included a completed short environmental assessment form (EAF), which reflected the fact that the excavation/fill work will be undertaken in accordance with an Order on Consent with the NYSDEC. At a town meeting on July 13, 1998, the Town passed a resolution authorizing the permit.

County of Onondaga

- Department of Transportation (DOT) Permit for construction or modification of buildings, driveways, and miscellaneous means of access, related to any proposed or existing County road or drainage system.

4. Health and safety requirements

4.1. General

Prior to the commencement of on-site remedial activities, the RA Contractor will be required to prepare and implement a site-specific HASP for persons working at and in the vicinity of the site in accordance with the Federal Regulations found under 29 CFR 1910.120 Hazardous Waste Operations and Emergency Response, 29 CFR 1926 Safety and Health Regulations for Construction, and the citations adopted by reference.

The HASP will be developed by a certified health and safety professional. The site-specific HASP will, at a minimum, address the following elements:

- RA Contractor's organizational chart
- Results of health and safety risk analysis performed by the RA Contractor
- Employee training and experience
- Summary of medical surveillance program
- List of standard operating procedures incorporated into the HASP
- A method to monitor entry and exit from the work site
- Personnel and equipment decontamination procedures
- A spill containment program
- Emergency response plan and emergency reporting procedures
- Fire protection plan
- Confined space entry procedures

4.2. Organizational chart

Key Personnel and Organizational Chart. The lines of authority, responsibility and communication shall be presented in the HASP. The RA Contractor must provide an organization chart and resumes of the RA Contractor's key personnel involved in all phases of the Ley Creek PCB Dredgings Site construction activities. This chart must include Senior-Level Management, Project Manager, Health and Safety Officer, Field Supervisor, and Foreman Personnel. Resumes are required for the Project Manager, Field Supervisor, Health and Safety Officer, and Health and Safety Staff.

Site Health and Safety Officer (HSO). The RA Contractor must identify and assign a Site Health and Safety Officer (HSO) for the project. That individual must be responsible to the RA Contractor and have the authority and knowledge necessary to implement the site HASP and verify compliance with applicable safety and health requirements.

- The HSO shall have the following responsibilities and authority to perform the following functions:
  - Be present during site operations.
  - Have the authority to enforce the HASP and stop operations if personnel safety and health may be jeopardized.
  - Evaluate health monitoring data and make necessary field decisions regarding safety and health.
  - Initiate evacuation of the site if necessary.
- The HSO shall meet the following minimum qualifications:
  - HSO shall possess a sound working knowledge of State and Federal occupational safety and health regulations and shall have formal educational training in occupational safety and health. Documentation shall be provided that the HSO has completed the 40 hr. OSHA Training Course, the annual 8 hour refresher courses as appropriate, the 8 hour OSHA Supervisor's Training Course and met the field experience requirements.
  - Have documented experience that the HSO has worked on two projects similar in nature to this one.

4.3. Health and safety risk analysis

The RA Contractor shall perform and provide in the HASP the results of a health and safety risk analysis for each location and operation to be performed.

The risk analysis shall be based upon the best information available regarding the contaminants and conditions present at the site as well as the practices and tools to be applied in the operation and shall include but not be limited to the following:

- Overview of the following information:
  - Location, site topography, accessibility and size of the site.
  - Description of the site operation and tasks to be performed. The specific tasks for the activities include, but are not limited to:
    - Excavation and relocation of dredged material/soil within the limits of the proposed vegetative cover limits within the property boundary
    - Excavation and transportation of dredged material/soil to be disposed of off-site.
    - Extension of ground water monitoring wells located within the limits of the vegetative cover
    - Extension of sanitary manholes located within the limits of the vegetative cover
    - Construction of access roadways to the sanitary manholes
    - Covering of dredged material/soil with an erosion control and vegetation matrix between Ley Creek edge and the access road
    - Installation of drainage culverts within the vegetative cover area
    - Installation of chain link fences around the vegetative cover area to limit access
    - Construction of a site access road

- Site restoration
- Other proposed construction activities

- Approximate duration of the operation of each task.
- Chemical and physical properties of the known or suspected hazardous substances and health hazards.
- Known or potential safety hazards associated with each task.
- Known or suspected pathways of hazardous substance dispersion pertinent to the operation and tasks performed.

- An evaluation of the known or suspected contaminants and conditions that may pose inhalation, skin absorption/contact or ingestion hazards.
- An evaluation of known or potential safety and health hazards associated with each task on the site.
- An evaluation of engineering and work practice controls to be applied to minimize potential harm to employees on - site and persons living in the vicinity of the site from hazardous substances and activities during completion of the task.
  - Engineering and Work Practice Controls. The RA Contractor must consider the need to apply engineering and/or work practice controls as a means of protecting personnel in the performance of site specific tasks.
    - When practicable, engineering controls shall be implemented to reduce and maintain employee exposures to or below acceptable levels for those tasks with known or suspected hazards.
    - Work practice controls shall be applied when engineering controls are deemed impractical and shall be incorporated as site specific standard operating procedures (SOP) for personal precautions and routine operations.
- An evaluation of the status of emergency response teams.

4.4. Employee training and experience

Employees performing on-site activities and the supervisors and management responsible for the site are to be trained to the level required by their job function as specified by OSHA 29 CFR 1910.120(e) prior to the start of work at the site. Each employee, manager and supervisor will also receive eight hours of refresher training annually. Written certification of the successful completion of the necessary training is required by the regulations.

Employees who have been designated as responsible for responding to on-site emergencies are also required to receive additional training meeting the requirements of 29 CFR 1910.120(q) in how to respond to such emergencies prior to the start of site work.

4.5. Medical surveillance program

The RA Contractor will establish and implement a Medical Surveillance Program (MSP) for employees engaged in on-site operations, consistent with 29 CFR 1910.120(f). The MSP will include physical examinations performed by or under the supervision of a licensed physician. The written opinion of the attending physician on the employee's ability to perform the required work will be obtained by the RA Contractor and provided to the employee.

The RA Contractor will retain an accurate record of the required medical surveillance information for the appropriate period as specified in 29 CFR 1910.120.

4.6. Standard operating procedures

The RA Contractor shall be responsible for developing and implementing necessary standard operating procedures (SOP) for site operations.

4.7 Site control

Routine requirements: for ongoing operations, the RA Contractor and/or his designee will be required to meet with the Owner or Engineer, when present, prior to the start of the day's activities to prepare all the necessary paperwork

and outline the day's activities. The RA Contractor shall also meet at the completion of the day's activities to discuss the work performed.

Work zones requirements:

- The RA Contractor shall be responsible for conducting operations at the site in such a controlled fashion as to minimize the possibility of employee and community contact with contaminants present on the site and to prevent the removal of contaminants generated on the site by personnel or equipment leaving the site.

- The RA Contractor shall delineate work zones in which specific operations or tasks will occur and shall institute specific site entry, and decontamination procedures at RA Contractor designated control points in accordance with provisions set forth in 29 CFR 1910.120. At a minimum, three work zones will be established to perform this work - an exclusion/contamination zone, a contamination reduction zone, and a support/clean zone. A map or diagram showing the work zones and a description of the site control plan shall be included in the HASP.

Routine and emergency communications: the RA Contractor shall incorporate plans for routine and emergency communications appropriate for the site and project in the HASP.

Daily visitor log: the RA Contractor, in accordance with his security plan shall keep a daily visitor log, copies to be provided to the Engineer upon request. A time clock shall be used to record the arrival and departure times. This log shall include:

- Person visiting the site
- Affiliation
- Date
- Arrival time
- Departure time
- Purpose of visit

Personnel: the RA Contractor shall provide the Owner and Engineer a list of all RA Contractor and subcontractor personnel who are authorized to enter the site prior to the start of operations, updating the list as necessary. No unauthorized persons shall be permitted to enter the site.

The RA Contractor shall be responsible for conducting operations in accordance with federal, state and local regulations and requirements for storage of the RA Contractor's hazardous materials (*e.g.*, gasoline, lube oils, etc.) on-site, including locating staging areas, labeling/signage, etc.

The RA Contractor shall use a "buddy system" as required.

4.8. Personnel and equipment decontamination

The RA Contractor will develop and implement decontamination procedures as required by 29 CFR 1910.120(k) which will minimize employee contact with hazardous substances or equipment that has contacted hazardous substances. The RA Contractor will also develop and implement decontamination procedures for heavy equipment and tools.

Engineering controls, work practices, the use of PPE, or a combination of these will be implemented by the RA Contractor during site operations to protect employees from exposure to hazardous substances, and safety and health hazards as required by 29 CFR 1910.120(g).

A written personal protective equipment (PPE) program including, but not limited to, the following elements will be required to be incorporated into the RA Contractor's site-specific HASP:

- PPE selection based on site hazards
- Duration of site operations
- PPE use and limitations
- PPE maintenance and storage
- PPE decontamination and disposal
- PPE training and proper fit
- Procedures for donning and doffing PPE
- PPE inspection prior to, during, and after use
- Evaluation of the effectiveness of the PPE program

- Heat stress and cold injury prevention while using PPE.

4.9. Spill containment program

The RA Contractor will include a spill containment program in the site-specific HASP meeting the requirements of 29 CFR 1910.120(j), which will be implemented to contain and isolate a hazardous substance, in the event that a spill occurs in the course of the Remedial Construction.

4.10. Emergency response plan

The RA Contractor will develop and implement an emergency response plan as a section of the site-specific HASP, meeting the requirements of 29 CFR 1910.120(l). The emergency response plan will address, as a minimum, the following elements:

- Pre-planning of site operations to prevent emergencies
- Personnel roles, lines of authority, and communication
- Emergency recognition and prevention
- Evacuation routes and procedures
- Safe distances and places of refuge
- Site security control measures
- Decontamination procedures which are not covered elsewhere in the HASP
- Emergency medical treatment and first aid
- Emergency alerting and response procedures
- Measures to review on site response and follow-up
- Emergency and personal equipment kept at the site for emergencies.

4.11. Fire protection plan

The RA Contractor shall develop procedures for handling and responding to small and large fires. This Fire Protection Plan (FPP) shall be included in the HASP as a separate document. The FPP shall include procedures for requesting emergency assistance and notifying the Owner and Engineer of the incident. The RA Contractor shall insure that fire traffic lanes are available (not blocked) and all fire exits are properly marked.

4.12. Confined space entry

The RA Contractor will include confined space entry procedures in the site-specific HASP as required by 29 CFR 1910.120(b). Workers that are involved with confined space entry activities will be required to take an 8-hr confined space entry class.

5. Construction quality assurance

5.1. General

This Section has been prepared as a means of providing guidelines and procedures for Construction Quality Assurance and Construction Quality Control (CQA/CQC) during Remedial Construction. Within this Section, the CQA/CQC responsibilities of each of the entities associated with the project are outlined. This includes a delineation of the appropriate lines of communication between the RA Contractor, inspection personnel and design personnel associated with construction activities. Also provided is a description of the required level of experience and training for the RA Contractor, its crew, and CQA/CQC inspectors in sufficient detail to determine that personnel permitted to be involved with the project have the necessary qualifications to properly complete the work in accordance with the methods and procedures specified.

In addition to personnel requirements, this Section provides a description of the CQA/CQC protocols to be utilized for documenting construction activities and compliance with the technical specifications. Detailed information, including the frequency of inspection, field testing methods, sampling requirements for laboratory testing, testing procedures and equipment to be utilized, criteria for acceptance/failure, and a description of the corrective actions to be initiated upon test failure will also be presented in the technical specifications.

It is the responsibility of CQA/CQC personnel to coordinate with the parties involved with the construction activities of the project to maintain awareness of the requirements specified in the Contract Documents.

5.2. Project organization and responsibilities

An important facet of CQA/CQC during construction is management of the project. In this subsection, organizations involved in CQA/CQC for this project along with their responsibilities are discussed. The organizations involved in this project include:

- Remediation and Liability Management Company, Inc. (REALM)
- O'Brien & Gere Engineers, Inc. as design engineer and construction inspector
- RA Contractor (to be determined).

REALM Responsibilities

As the Respondent under the Order on Consent, REALM will perform the following:

- Retain qualified consultants and RA Contractors for design, construction, construction inspection and post closure monitoring of the site
- Maintain communications with NYSDEC
- Document to NYSDEC that the site construction has been completed as specified in accordance with the approved design, and approved design modifications, by submission of CQA/CQC documentation and As-built Drawings
- Accept, require modification to, or reject design plans and specifications, CQA/CQC plan, reports and recommendations of the design engineer, and the materials and workmanship of the RA Contractor.

Engineer's Responsibility

As the design engineer currently retained by General Motors Corporation and the construction inspector to be retained by REALM, O'Brien & Gere Engineers will perform the following:

- Prepare necessary Remedial Design modifications during construction if necessitated by unexpected site conditions or required changes in construction methodology

- Review submittals and shop drawings from the RA Contractor
- Schedule and perform CQA/CQC inspections of the construction work
- Approve firms retained and methods employed by the RA Contractor to perform CQA/CQC testing services
- Confirm that testing equipment, personnel, and procedures do not change over time, or if changes are made, determine that any changes do not adversely impact inspection processes
- Confirm that inspection reports are accurately recorded and maintained
- Confirm that work is conducted in accordance with RA Contractor's approved plans for project implementation (*e.g.*, Construction Quality Control Plan, Health and Safety Plan, Perimeter Air Monitoring and Dust Control Plan, Storm Water Pollution Prevention Plan, Construction Water Management Plan, and Materials Handling Plan)
- Provide REALM with reports on inspection results
- Accept, reject, or halt work based on the results of field inspection and CQA/CQC results and order corrective measures for defective work
- Conduct confirmatory sampling during the hot spot excavation
- Provide a line of communication between REALM and the RA Contractor
- Schedule and attend project meetings during construction
- Prepare the Certification Report and Operation, Maintenance and Monitoring Plan following construction completion.

RA Contractor's Responsibilities

The RA Contractor retained will perform the following:

- Complete the work of the project in accordance with the technical specifications and plans using appropriate construction procedures and techniques
- Immediately notify the Engineer of unforseen site conditions or discovered discrepancies in the design
- Retain and oversee qualified subcontractors to perform specialized components of construction
- Develop an implementation plan for construction quality control to comply with the design plans, specifications and this CQA/CQC plan
- Retain qualified firms to provide CQA/CQC testing services
- Submit required reports, results, shop drawings, As-built Drawings, etc. to the Engineer for distribution, review, and approval.

5.3. Qualifications

In order that the project is constructed in accordance with the approved design plans and specifications, it is important that organizations and personnel involved in implementing the design possess suitable qualifications to perform the work. This includes both construction inspection personnel and the RA Contractor.

The construction inspection CQA/CQC Manager will possess a minimum of five years of experience in construction projects similar to the Ley Creek PCB Dredgings Site Remedial Construction project. In addition, sufficient practical, technical, and managerial experience to successfully implement the Project will be required.

Other CQA/CQC inspection personnel will possess appropriate experience in construction practices. This experience may be a combination of formal training and practical technical and administrative experience. Knowledge of specific field practices relating to construction techniques used for soil excavation/grading construction will be required. In addition, knowledge of applicable codes and regulations for material installation, observation and testing procedures, equipment, documentation procedures, and site safety will be required.

The RA Contractor selected to construct this project will be prequalified based on evidence of having experience in constructing projects of similar size and scope.

5.4. Lines of communication

An important component to the successful completion of any project is effective communication. A pre-construction meeting will be held at the site with the selected RA Contractor, a REALM representative, the Engineer and the NYSDEC prior to the commencement of work to review site conditions, design considerations and implementation of the terms and conditions of the Contract Documents. Also, the responsibilities of both the Engineer and RA Contractor, and the lines of communication discussed herein will be reviewed during the pre-construction meeting.

During the performance of work, meetings will be held periodically to keep the involved parties apprised of the status of the project, to maintain awareness of the requirements specified herein and within the plans and specifications, and, as needed, to address construction-related problems. These meetings will be attended by a representative of the RA Contractor who has decision making responsibilities, and by the Engineer. NYSDEC will also be availed the opportunity to attend site meetings associated with construction issues. Minutes of these meetings will be kept and distributed.

5.5. Construction quality control and construction quality assurance

Construction quality control and construction quality assurance (CQC/CQA) will focus on two issues. First, CQC/CQA will focus on the execution of the work conducted by the RA Contractor during Remedial Construction. As a part of field inspections, the Engineer will review the RA Contractor's execution of the work relative to the approved plans (*e.g.*, Construction Quality Control Plan, Health and Safety Plan, Perimeter Air Monitoring and Dust Control Plan, Storm Water Pollution Prevention Plan, Construction Water Management Plan, and Materials Handling Plan) submitted by the RA Contractor prior to Remedial Construction.

Secondly, CQC/CQA will focus on the quality of the construction. This will be accomplished through testing parameters, procedures, and criteria to be utilized during the project. Procedures for field testing are outlined, and

laboratory test methods are specified in accordance with ASTM or other recognized standards. These standards typically detail calibration of laboratory equipment, laboratory QA/QC procedures and testing procedures. All test results will be submitted to the Engineer for review. The following are testing parameters, procedures, and criteria of construction products to be utilized during the Remedial Construction:

Embankment

The entire surface to be covered with embankment material shall be grubbed and stripped of all grass, vegetation, topsoil or other unsuitable materials before any embankment material is placed. Topsoil shall be stockpiled or placed as designated. Other grubbed and stripped materials shall be placed below the vegetative cover. Stripped or excavated surfaces on which embankments are to be placed shall be compacted to the required density of the embankment prior to any fill being placed.

Placement and compaction of embankment shall be done as follows:

- Materials shall be placed in lifts not greater than 8 inches of thickness unless greater thicknesses are allowed by the Engineer upon demonstration by the RA Contractor that the materials and compaction efforts are adequate to obtain the required density.
- Material shall be placed in a uniform lift and thoroughly compacted by compaction equipment suitable for the material encountered to obtain the required density prior to the placement of succeeding lift. Each lift shall be tested for proper compaction before successive lifts are applied.
- Stones shall not exceed 6 inches in greatest dimension and shall be well distributed throughout the soil mass. Stone shall be defined as rock material either in its natural or broken state.
- Stones not well mixed with soil material shall not be used in earth embankments unless the stone material is sufficiently deteriorated or friable so as to be compacted to achieve minimum voids and required density.
- If the required density is not obtained, compaction of the embankment shall continue until specified densities are obtained, before any

additional embankment is placed. Improperly compacted embankment shall be removed.

- Where required, the RA Contractor shall, at his expense, add sufficient water during the compaction effort to assure proper density. If, due to rain or other causes, the material exceeds the optimum moisture content for satisfactory compaction, it shall be allowed to dry, assisted by discing or harrowing, if necessary, before compaction or filling effort is resumed.

- The RA Contractor shall be required to seal the working surface at the close of each day's operation and when practical prior to rainfall. Sealing shall be accomplished by rolling the surface with a smooth wheel steel roller.

- Compaction or consolidation achieved by traveling trucks, machines and other equipment will not be accepted unless such procedures are approved by the Engineer and proper compaction density is achieved.

- Hand tamping shall be required around buried utility lines or other subsurface features that could be damaged by mechanical compaction equipment.

- Embankments shall be constructed to such elevations as to make allowance for any settlement that may occur. Prior to the construction of any structure, roadway or other ground feature and before final acceptance of the contract, the RA Contractor shall regrade the embankments to conform to the established lines and grades.

The density control of embankments will vary based on the type of material the embankment is placed over. If the embankments are placed primarily over organic materials, then a performance based criteria will be used to provide that the embankment material is compacted adequately. If embankments are placed primarily over soil, then analytical based criteria will be used to provide that the embankment material is compacted adequately.

The performance based criteria consists of a certain type of compaction equipment that is specified or proposed by the Contractor. The proposed compaction equipment will operate at a predetermined speed for a predetermined number of passes. The compaction effort will be monitored by the Engineer and will be modified if adequate compaction is not obtained. The analytical based criteria will consist of compacting the embankments to 90% of maximum dry density as determined by the density tests designated

in ASTM D 698, Method D. Compaction curves for the full range of soil materials to be used in the embankment shall be developed by an approved independent testing laboratory.

Field control samples shall be taken and tested by the testing laboratory as required to evaluate whether adequate compaction of the embankment material is being achieved.

A minimum of one in-place density test shall be made for every 10,000 square feet of compacted area per lift. In-place density of soils shall be determined by the methods described in ASTM D1556 or ASTM D2922 and expressed as a percentage of the maximum dry density.

Structural excavation, backfill and compaction

Excavations shall be made to the elevations or subgrades specified and shall be only of sufficient size to allow suitable room for the proper construction of structures and appurtenances, including allowances for sheeting, de-watering, and other similar work necessary for completion of the Contract. Normal subgrade for structures shall be one foot below the underside of footing lines or mud mats, if installed. In no case will undercutting excavation faces be permitted.

Subsurface reinforcement will be conducted as follows:

- Where an unstable subgrade is encountered and subject to the approval of the Engineer, select fill may be used for subgrade reinforcement if satisfactory results can be obtained thereby. Such material shall be applied in thin layers, each layer being entirely embedded in the subsoil by thorough tamping.

- All excess material shall be removed to compensate for the displacement by the select fill and the finished elevation shall not be above the specified subgrade.

- Where subgrade reinforcement is unsatisfactory, a concrete mud mat of sufficient thickness to withstand subsequent construction operations shall be installed below the specified elevation and the structural concrete deposited thereon.

Subsurface for all concrete structures shall be undisturbed original earth or, mud mat on undisturbed original earth, or where excavation below subgrade is ordered, it shall be thoroughly compacted Special Backfill or concrete

mudmat as specified or directed and shall be sufficiently stable to remain firm and intact during the preparation for the placing of concrete thereon.

The RA Contractor shall at all times provide and maintain proper and satisfactory means and devices for the removal of all water entering the excavations, and shall remove all such water as fast as it may collect, in such manner as shall not interfere with the prosecution of the work or the proper placing of pipes, structures, or other work. The management of water shall be in accordance with the RA Contractor's Construction Water Management Plan.

Backfilling will be conducted as follows:

- Backfilling shall be with suitable excavated materials which can be compacted as specified. In the event the excavated materials are not suitable, Special Backfill as specified or ordered by the Engineer shall be used for backfilling.

- Backfilling around structures shall not be commenced before the structure has developed sufficient strength to withstand the loads applied. No backfill material shall be allowed to fall directly on a structure, until at least 12 in of material has been hand-placed and compacted nor shall any material be pushed directly against a structure in backfilling.

- Backfill shall be deposited in horizontal layers in 8 in lifts or thickness no greater than can be compacted to obtain the specified minimum densities.

Compaction will be conducted as follows:

- Where structures, driveways, sidewalks or other features are to be constructed on the backfilled area the entire backfill shall be compacted to obtain 95% maximum modified effort density in accordance with ASTM D1557. Other areas shall be compacted to obtain 90% maximum standard effort density in accordance with ASTM D698 or as directed by the Engineer.

- The density shall be determined as set forth in the Contract Documents.

Trenching, backfill, compaction

Excavation of the trenching will be conducted as follows:

- The trench excavation shall be located as shown on the Contract Drawings or as specified. Under ordinary conditions, excavation shall be by open cut from the ground surface. Where the depth of trench and soil conditions permit, tunneling may be required beneath cross walks, curbs, gutters, pavements, trees, driveways, or other surface structures. No additional compensation will be allowed for such tunneling over the price bid for open cut excavation of equivalent depths below the ground surface unless such tunnel excavation is specifically provided for in the Contract Documents.

- Trenches shall be excavated to maintain the depths as shown on the Contract Drawings or as specified for the type of pipe to be installed.

- The alignment and depth shall be determined and maintained by the use of a string line installed on batter boards above the trench, a double string line installed along side of the trench or a laser beam system. Piping alignments installed utilizing a laser beam system shall be periodically verified utilizing an optical level instrument.

- The minimum width of trench excavation shall be 6-in on each side of the pipe hub for 21-in diameter pipe and smaller and 12-inch on each side of the pipe hub for 24-in diameter pipe and larger unless otherwise shown on the Contract Drawings, specified or directed.

- Trenches shall not be opened for more than 300 feet in advance of pipe installation nor left unfilled for more than 100 feet in the rear of the installed pipe when work is in progress without the consent of the Engineer. Open trenches shall be protected and barricaded as required.

- Bridging across open trenches shall be constructed and maintained where required.

Subgrade preparation for pipe shall be conducted as follows:

- Where pipe is to be laid on undisturbed bottom of excavated trench, mechanical excavation shall not extend lower than the finished subgrade elevation at any point.

- Where pipe is to be laid on special granular material the excavation below subgrade shall be to the depth specified or directed. The excavation below subgrade shall be refilled with special granular material as specified or directed, shall be deposited in layers not to exceed 6-inches and shall be thoroughly compacted prior to the preparation of pipe subgrade.

- The subgrade shall be prepared by shaping with hand tools to the contour of the pipe barrel to allow for uniform and continuous bearing and support on solid undisturbed ground or embedment for the entire length of the pipe.

- Pipe subgrade preparation shall be performed immediately prior to installing the pipe in the trench. Where bell holes are required they shall be made after the subgrade preparation is complete and shall be only of sufficient length to prevent any part of the bell from becoming in contact with the trench bottom and allowing space for joint assembly.

Storage of materials shall be conducted as follows:

- Traffic shall be maintained at all times in accordance with the applicable County DOT Permit. Where no County DOT Permit is required at least one-half of the street must be kept open for traffic.

- Where conditions do not permit storage of excavated materials having suitable character for utilization as backfill adjacent to the trench, the material excavated from a length as may be required, shall be removed by the RA Contractor, at his cost and expense, as soon as excavated and stored on-site in designated stockpiling areas. The material subsequently excavated shall be used to refill the trench where the pipe had been built, provided it be of suitable character. The RA Contractor shall, at his cost and expense, bring back adequate amounts of satisfactory excavated materials as may be required to properly refill the trenches.

- Any soil displaced during pipe installation shall be incorporated under the soil cover.

- If directed by the Engineer, the RA Contractor shall refill trenches with select fill or other suitable materials and excess excavated, not potentially contaminated, materials shall be either incorporated into the work (if feasible) or disposed of as spoil.

Removal of water and drainage shall be conducted as follows:

- The RA Contractor shall at all times provide and maintain proper and satisfactory means and devices for the removal of all water entering the trench, and shall remove all such water as fast as it may collect, in such manner as shall not interfere with the prosecution of the work. All water removed shall be handled in accordance with the RA Contractor's Construction Water Management Plan.

Pipe embedment shall be conducted as follows:

- All pipe shall be protected from lateral displacement and possible damage resulting from superimposed backfill loads, impact or unbalanced loading during backfilling operations by being adequately embedded in suitable pipe embedment material. To ensure adequate lateral and vertical stability of the installed pipe during pipe jointing and embedment operations, a sufficient amount of the pipe embedment material to hold the pipe in rigid alignment shall be uniformly deposited and thoroughly compacted on each side, and back of the bell, of each pipe as laid.

- Concrete cradle and encasement of the class specified shall be installed where and as shown on the Contract Drawings or ordered by the Engineer. Before any concrete is placed, the pipe shall be securely blocked and braced to prevent movement or flotation. The concrete cradle or encasement shall extend the full width of the trench as excavated unless otherwise authorized by the Engineer. Where concrete is to be placed in a sheeted trench it shall be poured directly against sheeting to be left in place or against a bond-breaker if the sheeting is to be removed.

- Embedment materials placed above the centerline of the pipe or above the concrete cradle to a depth of 12-inches above the top of the pipe barrel shall be deposited in such manner as to not damage the pipe. Compaction shall be as required for the type of embedment being installed.

Backfill above embedment shall be conducted as follows:

- The remaining portion of the pipe trench above the embedment shall be refilled with suitable materials compacted as specified.
    - Where trenches are within the ditch-to-ditch limits of any street or road or within a driveway or sidewalk, or shall be under a structure, the trench shall be refilled in horizontal layers not more than 8 in thickness, and compacted to obtain 95% maximum standard density.
    - Where trenches are within areas of general grading, the trench shall be refilled in horizontal layers not more than 8 in thickness, and compacted to obtain 95% maximum standard density.
    - Hand tamping shall be required around buried utility line or other subsurface features that could be damaged by mechanical compaction equipment.
- Backfilling of trenches beneath, across or adjacent to drainage ditches and water courses shall be done in such a manner that water will not accumulate in unfilled or partially filled trenches and the backfill shall be protected from surface erosion by adequate means.
    - Where trenches cross waterways, the backfill surface exposed on the bottom and slopes thereof shall be protected by means of stone or concrete rip-rap or pavement.
- All settlement of the backfill shall be refilled and compacted as it occurs.

Selected fill

Type A fill shall be crushed gravel and shall have the following characteristics:

- Thoroughly washed crushed, durable, sharp angled fragments of gravel free from coatings. Crushed particles shall be a minimum of 85% by weight of the particles with at least two fractured faces. The total area of each fractional face shall exceed 25% of the maximum cross-sectional area of the particle.

- Crushed gravel shall have the following gradation by weight:

% Passing	Sieve
100%	1 ½ in
0-25%	¾ in
0-5%	½ in

Type B fill shall be crushed stone and shall have the following characteristics:

- Thoroughly washed clean, sound, tough, hard crushed limestone or approved equal free from coatings. Gradation for crushed stone shall be the same as specified for Type A material.

Type C fill shall be crushed stone and shall have the following characteristics:

- Thoroughly washed, clean, sound, tough, hard, crushed limestone or approved equal free from coatings. It shall have a gradation by weight of 100% passing a 1-in square opening and 0 - 15% passing a ¼ in square opening.

Type D fill shall be washed sand and shall have the following characteristics:

- Washed coarse sand having the following gradation by weight:

% Passing	Sieve
100	⅜ in
95 - 100	No. 4
80 - 100	No. 8
50 - 85	No. 16
25 - 60	No. 30
10 - 30	No. 50
2 - 10	No. 100

Type E fill shall be run-of-bank gravel and shall have the following characteristics:

- Run-of-bank gravel or other acceptable granular material free from organic matter with a gradation by weight of 100% passing a 1 ½ in square opening, 30 to 65% passing a ¼-in square opening and not more than 10% passing a No. 200 mesh sieve as determined by washing through the sieve in accordance with ASTM D422.

Type F fill shall be run-of-crusher stone and shall have the following characteristics:

- Run-of-crusher hard durable limestone or approved equal having the following gradation by weight:

% Passing	Square Opening (in)
100	1 ½
95 - 100	1
65 - 80	½
40 - 60	¼
0 - 10	#200 Sieve

Type G fill shall be a mixture of Type E material and Portland cement mixed in a ratio of 15:1 and placed and compacted in a dry state.

Type H fill shall be a specially blended mixture of materials as specified in the Payment Items.

Installation of fill shall be conducted as follows:

- Special granular material as specified or directed for pipeline embedment shall be placed in accordance with the Contract Documents.

- Special backfill where specified or directed shall be placed in accordance with the backfilling provisions of the Contract Documents.

Disposal of fill shall be conducted as follows:

- Materials displaced through the use of selected fill shall be incorporated under the soil cover.

Any settlements in the finished work shall be made good by the RA Contractor.

Rip rap

Stone used for dumped rip-rap shall be sound, tough, durable, angular in shape, resistant to weathering and shall meet the gradation requirement specified. Neither breadth nor thickness of a single stone should be less than one-third its length. Rounded stone, broken concrete, or boulders will not be accepted. Stone shall be free from decomposed stones, overburden, spoil, shale, organic material, or other defects impairing its durability and shall meet the gradation requirement specified.

Materials and construction of rip rap shall be as follows:

- The gradation of materials furnished for use as rip-rap shall be as follows and will be accepted or rejected based on a visual examination of the material by the Engineer. The size of stone shall be as specified below.

Rip-Rap (layer thickness)	Stone Size	Percent of Total by Weight
Heavy (36 in)	Heavier than 600 lbs	50 - 100
	Smaller than 6 in	0 - 10
Medium (24 in)	Heavier than 100 lbs	50 - 100
	Smaller than 4 in	0 - 10
Light (18 in)		
	Lighter than 100 lbs	90 - 100
	Larger than 6 in	50 - 100
Fine (12 in)	Smaller than ½ in	0 - 10
	Smaller than 8 in	90 - 100
	Larger than 3 in	50 - 100
	Smaller than No. 10 Sieve	0-10

Notes:

1) Stone sizes other than weights, refer to the average of the maximum and minimum dimensions of a stone particle as estimated by the Engineer.

2) Materials shall contain a sufficient amount of stones smaller than the average stone size to fill the spaces between the larger stones.
3) Materials shall contain less than 20 percent of stones with a ratio of maximum to minimum dimension greater than three.

Installation of rip rap shall be as follows:

- The ground surface on which rip-rap is to be placed shall be free of brush, trees, stumps, and other objectionable material and shall be dressed to a smooth surface. All soft or spongy material shall be removed to the depth shown on the plans or as directed by the Engineer and replaced with approved material. Filled areas shall be compacted in accordance with applicable provisions of the Contract Documents.

- The area to be protected by rip rap shall be accurately shaped prior to placing of any bedding material or rip rap. Where bedding material is called for, it shall be placed on the prepared area and compacted to the depth, lin and grades indicated on the plans.

  The riprap shall be placed to its full course thickness in one operation in such a manner as to produce a reasonably well-graded mass of rock without causing displacement of the underlying material. The finished surface shall be free from pockets of small stones and clusters of larger stones. Placing this material by methods likely to cause segregation of the various sizes of stone will not be permitted. Rearranging of individual stones by mechanical or hand methods will be required to the extent necessary to obtain a reasonably well-graded distribution of the specified stone sizes. The completed course shall be of the specified thickness and to the lin and grades as shown on the plans or as ordered by Engineer.

- Placement of stone upon finished bedding material or geotextile filter fabric, when used, shall be carefully controlled to avoid disruption and damage to the layer of bedding material or geotextile filter fabric. The stone shall be so placed and distributed that there will be no pockets of uniform size material.

- The desired distribution of the various sizes of stone throughout the mass shall be obtained by selective loading of the material at the quarry or other source; by controlled dumping of successive loads during final placing; or by other methods of placement which will produce the specified results. Rearranging of individual stones by

mechanical equipment or by hand will be required to the extent necessary to secure the specified results. When stone filling is dumped under water, methods shall be used that will minimize segregation.

Erosion control and revegetation matrix

The Erosion Control and Revegetation Matrix (ECRM) shall have the following characteristics:

- The ECRM shall consist of a dense web of green polyolefin fibers positioned between two biaxially oriented nets and mechanically bound together by parallel stitching with polyolefin thread. The matrix shall possess strength and elongation properties to limit stretching and shall be maintained in a water saturated condition. Every component of the matrix shall be stabilized against ultraviolet degradation and inert to chemicals normally encountered in a natural soil environment. The matrix shall be documented to resist a sustained channel flow velocity rate of at least 8 feet per second and/or a tractive force of 2 pounds per square foot during a 40 hour period in a non-vegetated condition. The erosion control and revegetation matrix shall also conform to the following physical properties after a 24 hour saturation period.

- The ECRM shall conform to the following requirements:

Property (Continued)	Standard	MARV[1]	Typical Value
Tensile Strength[3] (lb/ft)	ASTM D5035	170 x 125	250 x 180
Tensile Elongation[3] (%)	ASTM D5035	50 (max)	25
Ultraviolet Stability[6] (%)	ASTM D4355	80	90
Moisture Absorption (%)	ASTM D570	0.01 (max)	0.01

Mass Per Unit Area (oz sy)	ASTM D5261	10.0	10.5
Porosity[4] (%)	Calculated	95	95
Ground Cover Factor[5] (%)	Light Project Analysis	74	85

Notes:
1 All values are Minimum Average Roll Values (MARV) unless otherwise indicated.
2 Resiliency defined as percent of original thickness retained after 3 cycles of a 100 psi load for 60 seconds followed by 60 seconds without load...thickness measured 30 minutes after load removed by ASTM D1777.
3 Values for machine and cross machine directions, respectively, under dry or saturated conditions. Formerly test method ASTM D1682.
4 Porosity calculation based upon unit weight, thickness and specific gravity.
5 Ground Cover Factor represents "% shade" from Lumite Light Projection Test.
6 Tensile strength retained after 1000 hours in a Xenon ARC Weatherometer.

- During all periods of shipment and storage, the ECRM shall be protected from adverse weather, heavy winds or precipitation, direct sunlight, ultraviolet light, temperatures greater than 140°F, mud, dirt, dust, debris, and vandals. To the extent possible, the geotextile shall be maintained wrapped in a heavy duty protective covering. In the event of damage, the RA Contractor shall immediately make all repair and replacements at no additional cost to the Owner.

- All testing including laboratory and field services required during installation of the ECRM shall be provided by the RA Contractor.

Installation of the ECRM shall be as follows:

- The ECRM shall be installed in accordance with the manufacturers recommendations reviewed by the Engineer prior to installation. The standard manufacturer's installation criteria shall include the following details:
  - Longitudinal anchor trench
  - Initial channel anchor trench
  - Intermittent check slot
  - Terminal channel anchor trench
  - All anchor patterns.

- Prior to the installation of the ECRM all topsoil and seeding of the vegetative cover will be completed in accordance with the Contract Documents.

- Prior to installation of the ECRM, the surface on which the ECRM is to be installed will be free of irregularities, protrusions, and any abrupt changes in grade that could damage the ECRM. The supporting layer will be maintained in a smooth, uniform, and compacted condition during installation of the ECRM. The subgrade shall be inspected and accepted by the Engineer prior to placement of the ECRM.

- The ECRM shall be placed in manner and at the locations shown on the drawings. At the time of the installation, the geotextile shall be rejected if it has defects, rips, holes, flaws, deterioration, or damage incurred during manufacture, transportation, or storage.

- The ECRM used in the side slope diversion ditches shall be placed normal to the line of the trench and shall be laid smooth and free of tension, stress, folds, wrinkles, or creases. The ECRM shall be overlapped, anchored, pined and installed in accordance with the manufacturers recommendations.

- The ECRM shall be protected at all times during construction from damage by surface runoff and any ECRM so damaged shall be removed and replaced with undamaged ECRM. Any damage to the ECRM during its installation or during placement of adjacent to rip-rap shall be replaced by the RA Contractor at the RA Contractor's expense.

- The ECRM shall be placed tightly against the soil such that no void spaces occur behind the mat.

Non-woven Geotextile

The RA Contractor will be required to provide documentation regarding quality control of physical properties of the non-woven geotextile. The non-woven geotextile will consist of a non-woven, needle-punched geotextile. Samples of the production run of the geotextile material will be obtained and tested and the results certified in accordance with the following minimum average roll values:

Property	Standard	Criteria
Grab Tensile Strength	ASTM D4632	Minimum 100 lbs. (MD/CD)
Grab Tensile Elongation	ASTM D4632	Minimum 60%
Permittivity	ASTM D4491	Minimum of 1.9 sec^{-1}
Trapezoid Tear Strength	ASTM D4533	Minimum 35 lbs.
Puncture Strength	ASTM D4833	Minimum 55 lbs.
Mullen Burst Strength	ASTM D3786	Minimum 225 psi
UV Resistance	ASTM D4355 (after 150 hours)	70% strength retained

The RA Contractor will provide the Engineer with certified copies of the factory and laboratory test results prior to arrival of material on-site. In addition, the RA Contractor will provide the manufacturer's certification that the non-woven geotextile meets the chemical, physical, and manufacturing requirements.

The Engineer will review submittal information provided by the RA Contractor. Upon delivery of the rolls of geotextile, the Engineer will visually inspect the material.

During installation of the non-woven geotextile, the Engineer will determine that the geotextile is installed in accordance with the requirements of the Contract Documents and as shown on the Contract Drawings.

During the installation phase, the geotextile will be visually inspected for the following:

- Defects
- Rips
- Holes
- Flaws
- Deterioration
- Damage.

Any imperfections, such as those noted above, will be immediately repaired by the RA Contractor and reinspected.

Woven geotextile stabilization fabric

Geotextile stabilization fabric shall have the following characteristics:

- The geotextile stabilization fabric shall consist of a long-chain geosynthetic polymer composed of at least 85 percent by weight of propylenes and shall contain stabilizers and/or inhibitors added to the base plastic to make the fibers resistant to deterioration due to ultraviolet light and heat exposure. The fibers shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including salvages. The geotextile shall also be mildew and rot resistant, and inert to chemicals and hydrocarbons.
- The geotextile stabilization fabric shall be a woven geotextile.
- The geotextile stabilization fabric shall conform to the following minimum average roll values:

Property	Standard	Criteria
Puncture Strength	ASTM D 4833	Minimum 120 lbs.
Mullen Burst Strength	ASTM D 3786	Minimum 600 psi
Trapezoid Tear Strength	ASTM D 4533	Minimum 115 lbs.
Grab Tensile Strength	ASTM D 4632	Minimum 300 lbs.
Grab Tensile Elongation	ASTM D 4632	Minimum 15%
Wide Width Tensile Strength	ASTM D4595	Minimum 180 lbs MD and XD
Wide Width Tensile Elongation	ASTM D4595	Minimum 10% MD and XD
UV Resistance	ASTM D4355 (after 150 hours)	70% strength retained

- During all periods of shipment and storage, the geotextile shall be protected from adverse weather, heavy winds or precipitation, direct sunlight, ultraviolet light, temperatures greater than 140°F, mud, dirt, dust, debris, and vandals. To the extent possible, the geotextile shall be maintained wrapped in a heavy duty protective covering. In the event of damage, the RA Contractor shall immediately make all repairs and replacements at no additional cost to the Owner.

- All geotextile testing services as specified herein necessary for the RA Contractor to obtain an acceptable geotextile stabilization fabric shall be provided by the RA Contractor. All testing including laboratory and field services required during installation of the geotextile stabilization fabric shall be provided by the RA Contractor.

- Temporary securing pins shall be 3/16 in. in diameter, of steel, pointed at one end and fabricated with a head to retain a steel washer having an outside diameter of no less than 1.5 in or as recommended by the geotextile manufacturer. The pins shall be no longer than nine in.

Installation of the geotextile stabilization fabric shall be conducted as follows:

- Prior to installation of the geotextile stabilization fabric, the material on which the geotextile is to be installed will be free of organic matter, irregularities, protrusions, and any abrupt changes in grade that could damage the geotextile. The supporting layers shall be maintained in a smooth, uniform, and compacted condition during installation of the geotextile. The subgrade shall be inspected and accepted by the Engineer prior to placement of the geotextile.

- The geotextile stabilization fabric shall be placed in the manner and at the locations shown on the drawings. At the time of the installation, the geotextile shall be rejected if it has defects, rips, holes, flaws, deterioration, or damage incurred during manufacture, transportation, or storage.

- The geotextile shall be placed with the long dimension parallel to the line of the access road and shall be laid smooth and free of tension, stress, folds, wrinkles, or creases. The strips shall be placed to provide minimum overlaps of 3 feet. Overlap shall be increased if during fill placement excessive wandering of the unrolled geotextile is observed.

- Temporary pinning of the geotextile stabilization fabric into the underlying subgrade to help hold the geotextile in place shall be allowed. The temporary pins shall be removed as the overlying materials are placed to relieve high tensile stress which may occur during placement of material on the geotextile. The geotextile shall be placed so that the upper strip of geotextile will overlap the next lower strip by a minimum of 3 feet. Each securing pin shall be

pushed through the geotextile until the washer bears against the geotextile and secures the pin firmly to the supporting layer.

- The geotextile shall be protected at all times during construction from damage by surface runoff. Any damaged geotextile shall be removed and replaced with undamaged geotextile. Any damage to the geotextile during installation or during placement of soil layers or other activities shall be replaced by the RA Contractor at the RA Contractor's expense.

- The work shall be scheduled so that covering of the geotextile with a layer of the specified material is accomplished within 5 days after placement of the geotextile. Failure to comply shall require replacement of geotextile.

- The geotextile stabilization fabric shall be protected from damage due to the placement of materials by limiting the height of drop of the material to less than 1 foot.

- Cover material shall be placed on the geotextile in such a manner that a minimum of 6 in of material will be between the vehicle or equipment tires, or tracks, and the geotextile at all times.

- Compaction of the first lift above the geotextile shall be limited to routing of placement and spreading equipment only. No vibratory compaction will be allowed on the first lift.

Vegetative soil layer

The vegetative soil layer shall have the following characteristics:

- Vegetative soil layer shall be obtained from a source reviewed by the Engineer.

- The vegetative soil layer must be uniform in composition and texture, clean and free from stones, weeds, stumps, roots, toxic substances, and debris or similar substances. The vegetative soil layer material shall be characterized as a silty sand and shall have physical and chemical characteristics conducive to the establishment of vegetation. The vegetative soil layer shall have the following gradation by weight:

  6-in lift of vegetative soil layer above the relocated soil.

% Passing	Sieve
100	2-in
25 - 40	No. 200

These analyses will be performed in accordance with ASTM D422.

- The RA Contractor shall submit testing methods (prior to conducting tests), test results, and a certification from the approved soils testing laboratory that the vegetative soil layer meets the requirements of this section. The results of all soils testing specified herein shall be submitted to the Engineer for review.
- Prior to installation of the vegetative soil layer, from the borrow source shall be tested in accordance with the following:

Parameter	Standard	Criteria
Particle Size Analysis	ASTM D422	Material proposed for the 6-in lift of vegetative soil layer: % Passing — Sieve 100 — 2-in 25-40 — No. 200
Compaction Characteristics	ASTM D698	Develop compaction characteristics

- During installation of the vegetative soil layer, material from the borrow source shall be tested in accordance with the following standards and frequencies:

Parameter	Standard	Minimum Frequency	Criteria
Particle Size Analysis	ASTM D422	Once per 3000 cy	6-in lift of vegetative soil layer: % Passing — Sieve 100 — 2 -in 25-40 — No. 200

Parameter	Standard	Minimum Frequency	Criteria
In-Place Density	ASTM D1556 or ASTM D2922 or ASTM D2167	5 tests per acre per lift of soil placed	85-90% of the Standard Proctor Compaction as determined by ASTM 698.
In-Place Moisture Content	ASTM D3017	5 tests per acre per lift of soil placed	Monitor compaction
Liquid Limit, Plastic Limit, Plasticity Index	ASTM D4318	Once Per 5000 cy	Monitoring consistency of borrow source.

A minimum of one test for each parameter shall be performed.

- The results of all testing shall be submitted to the Engineer for review. Any materials not meeting the requirements of this section shall be removed from the project site at no cost to the Owner.

- If at any time during this Contract the Engineer requests further soils testing to insure that the characteristics of the vegetative soil layer material obtained from the borrow area(s) have not changed, the RA Contractor shall perform these tests at no additional cost to the Owner.

Installation of the vegetative soil layer shall be conducted as follows:

- Placement of the vegetative soil layer shall be in accordance with the provisions of this Section. Any vegetative soil layer material which cannot comply with the provisions of this Section will be considered as spoil and will be removed and disposed of at the RA Contractor's expense.

- The vegetative soil layer shall be constructed by placing suitable material in one 6 - in lift. Compaction of the lift shall be accomplished by a smooth wheel vibratory roller or other suitable equipment. Compaction of the vegetative soil layer shall be 85 to 90 percent of the Standard Proctor Compaction as determined by ASTM D698.

- Vegetative soil layer containing frozen soil, or ice shall not be placed.

- Compaction or consolidation achieved by traveling trucks, machines, and other equipment will not be accepted unless such procedures are reviewed by the Engineer and proper compaction criteria are achieved.

- Any damage to the completed surface of the vegetative soil layer, whether caused by erosion, the RA Contractor's work, or any other occurrences, shall be immediately repaired and maintained in good condition until completion of the work.

Bituminous concrete pavement

Installation of bituminous concrete pavement shall be conducted as follows:

- Install finished pavement to the grades and cross-sections as shown on the Contract Drawings.

- Subgrade

  - The subgrade shall be shaped to line and grade and compacted with self-propelled rollers.

  - Depressions which develop under rolling shall be filled with acceptable material and the area re-rolled.

  - Soft areas shall be removed and filled with acceptable materials and the area re-rolled.

  - Should the subgrade become rutted or displaced prior to the placing of the subbase it shall be reworked to bring to line and grade.

- Soil Stabilization Fabric

  - The soil stabilization fabric shall be placed on the subgrade prior to the depositing of the subbase.

    - The soil stabilization fabric shall be the full width of the subgrade and shall extend up the sides the depth of the subbase.

    - The fabric shall be lapped a minimum of 3 feet at all joints.

- Subbase
  - The subbase shall consist of 12 in of Type F material placed in 6 - in layers. Each layer shall be compacted by rolling with self-propelled rollers.

    (Note: The loose lift thickness shall be a minimum of 1.5 times the maximum particle size with a minimum of 6 in.)
  - Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller.
  - After completion of the subbase rolling there shall be no hauling over the subbase other than the delivery of material for the top course.
- Bituminous Material
  - The bituminous base course shall be 3 in compacted depth.
  - The bituminous wear course shall be 1 in compacted depth.
  - Prior to placing of any bituminous pavement a sealer shall be applied to the edges of existing pavement, curbing, gutters, manholes and other structures.

Field testing shall be conducted as follows:

- The surface tolerance shall not exceed ¼ in. in 10 feet.
- There shall be no depressions which will retain standing water.
- Variations exceeding ¼ in or depressions shall be satisfactorily corrected.

Cast-in-place concrete

Cast-in-place concrete shall have the following characteristics:

- Form Materials: Furnish form materials with sufficient stability to withstand pressure of placed concrete without bow or deflection.

- Forms for Exposed Concrete Surfaces: Suitable panel-type material to provide continuous, straight, smooth, exposed surfaces.

- Reinforcing Materials: As follows:
  - Reinforcing Bars: ASTM A 615, Grade 60 deformed.
  - Plain Welded Wire Fabric: ASTM A 185.

- Concrete Materials: As follows:
  - Portland Cement: ASTM C 150, Type 1.
  - Aggregates: ASTM C 33.
  - Water: Potable.

- Admixtures: Provide admixtures that contain not more than 0.1 percent chloride ions.
  - Air-Entraining Admixture: ASTM C 260.
  - Water-Reducing, Retarding, and Accelerating Chemical Admixtures: ASTM C 494.

- Related Materials: As follows:
  - Water stops: PVC

- Mix Proportions and Design: Proportion mixes complying with mix design procedures specified in ACI 301.
  - Design mixes to provide normal weight concrete with the following properties:
    - 4000-psi, 28-day compressive strength; water-cement ratio, 0.45 maximum.
  - Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
    - Not more than 4 in.
  - Adjust mix designs when material characteristics, job conditions, weather, test results, or other circumstances warrant. Do not use revised concrete mixes until laboratory test data and strength results have been submitted to and reviewed by the Engineer.

- Use air-entraining admixture in exterior exposed concrete, providing not less than 4.5 percent nor more than 7 percent entrained air for concrete exposed to freezing and thawing, and from 2 percent to 4 percent for other concrete.

- Use water-reducing, accelerating, and retarding admixtures that have been tested and accepted in mix designs in strict compliance with manufacturer's directions.

- Job-Site Mixing: Use drum-type batch machine mixer, mixing not less than 1-1/2 minutes for 1 cu. yd. or smaller capacity. Increase mixing time at least 15 seconds for each additional cu. yd.

- Ready-Mix Concrete: ASTM C 94.

Installation of the cast-in-place concrete shall be conducted as follows:

- Form work: Construct Form work so that concrete members and structures are of correct size, shape, alignment, elevation, and position. Select form materials to obtain required finishes.

  - Maintain Form work tolerances and surface irregularities within ACI 347 limits, Class A tolerances for concrete exposed to view and Class C tolerances for other concrete surfaces.

  - Provide openings in Form work to accommodate work of other trades. Accurately place and securely support items built into forms.

  - Clean and adjust forms prior to concrete placement. Apply form-release agents or wet forms as required. Retighten forms during concrete placement, if required, to eliminate mortar leaks.

- Reinforcement: Accurately position and support reinforcement, and secure against displacement. Locate and support reinforcement to maintain minimum cover with metal chairs, runners, bolsters, spacers, and hangers as required. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

  - Install welded wire fabric in lengths as long as practicable; lap at least one full mesh and lace splices with wire.

- Joints: Locate and install construction, isolation, and control joints as indicated or required. Locate construction joints so they do not impair strength and appearance of structure. Place isolation and control joints in slabs-on-ground to stabilize differential settlement and prevent random cracking.

- Installation of Embedded Items: Set and build anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting diagrams, templates, and instructions provided by others for locating and setting.

  - Locate and support water stops to prevent displacement.

- Concrete Placement: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," for placing concrete in a continuous operation within planned joints or sections. Do not begin concrete placement until other affected work is completed.

  - Consolidate placed concrete using mechanical vibrating equipment with hand rodding and tamping so that concrete is worked around reinforcement and other embedded items and into forms.

  - Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placing, and curing.

    - In cold weather comply with ACI 306.
    - In hot weather comply with ACI 305.

- Finish of Formed Surface: As follows:

  - Smooth-Formed Finish: Provide a smooth finish for concrete surfaces exposed to view and surfaces to be covered with a coating or covering material applied directly to concrete. Repair and patch defective areas, with fins and other projections completely removed and smoothed.

- Curing: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather, apply an evaporation-control compound according to manufacturer's instructions after screening and bull floating, but before power floating and troweling.

- Begin initial curing as soon as free water has disappeared from exposed surfaces.

- Continue curing unformed concrete surfaces by water ponding, continuous fog spraying, continuously wetted absorptive cover, or by moisture-retaining cover curing. Cure formed surfaces by moist curing until forms are removed. Keep concrete continuously moist for not less than 72 hours for high- early strength concrete and 7 days for all other concrete.

- Field Quality Control: Perform sampling and testing during concrete placement, as follows:

  - Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

    - Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.

    - Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.

    - Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.

    - Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.

    - Compressive-Strength Tests: ASTM C 39; one set for each 50 cu yd or fraction thereof, of each concrete mix placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

- When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.

- When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

- Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.

- Test results will be reported in writing to the Engineer, ready-mix producer, and RA Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

- Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

- Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Engineer. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

Topsoil and seeding

Prior to installation of the topsoil layer and seeding, the following will be submitted to the Engineer for review:

- Documentation giving location of properties from which the topsoil will be obtained, names and addresses of the owners, and depth to be stripped

- Documentation giving the seed vendor's certified statement for the grass seed mixture required, stating common name, scientific name, percentage by weight, and percentages of purity and germination

- Documentation giving data concerning hydroseeding equipment (if used), including all material application rates.

- Following review by the Engineer, the following QC program will be implemented:

Parameter	Standard	Minimum Frequency	Criteria
Topsoil Grain Size	ASTM D422-63	Once per 5000 cy	Monitoring consistency of borrow source
Topsoil pH	ASTM 2974	Once per 5000 cy	pH in the range of 5.5 and 7.6
Topsoil Organic Content	ASTM 2974	Once per 5000 cy	not less than 2% nor more than 20%

The cover system soils will be carefully placed in lifts and compacted using appropriate equipment to the required thickness specified in the Contract Drawings. Any damage to the cover system, whether caused by erosion, the RA Contractor's work, or any other occurrences, will be immediately repaired and maintained in good condition until completion of the work.

The vegetative cover seed mix will be fresh, clean, of current season's crop and shall be delivered in unopened containers bearing the guaranteed analysis of the mix. The selection of vegetative cover is based on two primary objectives. First, the selected vegetation should stabilize the landfill cap soil cover while not having a negative impact on the deeper layers of the cap and growing well at the site with minimal fertilization. Second, the selected vegetation should provide good wildlife habitat with an emphasis on migratory birds. The vegetation mix, as recommended by the United States Department of Fish and Wildlife, is presented in Exhibit D.

Fertilizer will be a complete, prepared, and packaged material and will contain a minimum of 10% nitrogen, 10% phosphoric acid, and 10% potash. Each bag will bear the manufacturer's guarantee statement of analysis.

The mulch will be stalks of oats, wheat, rye, or other approved crops free from noxious weeds, mold, or objectionable material.

Field quality assurance will consist of the following:

- The Engineer may require additional testing of the topsoil material if changes in material are noted
- Inspection of topsoil, grass seed, fertilizer, and mulch material to verify that the materials meet the specified requirements. If any of the materials fail to meet these requirements, the materials will be rejected
- Inspection to verify that the areal extent of completed cover is covered by a minimum of 6 in of topsoil meeting the requirements. The topsoil shall then be seeded, mulched, and fertilized as required
- Inspection to verify that the finished grades conform to those shown in the engineering plans, reports, and specifications. Any irregularities shall be corrected before placement of grass seed, fertilizer, and mulch.
- The vegetative cap will be inspected quarterly during post-construction maintenance and monitoring, to verify that there are no areas of thinning vegetation.

Engineering Sampling

Sampling of dredged material/soil contaminated with PCBs less than 50 mg/kg that is excavated and staged as part of the excavation will be conducted by the Engineer using an ENSYS Inc. PCB RISc ® Soil Test field screening kit (EPA Method 4020). Sensitivity of the analytical results will be within 1 mg/kg PCB. An additional field sample will be collected and analyzed for every 20 cy of dredged material/soil within the initial excavation. Analytical results will be recorded and submitted to the Engineer for review. PCB field screening will follow the manufacturer's procedures regarding calibration, sample collection, testing, and reporting. The PCB RISc Soil Test System User's Guide is included as Exhibit C.

Confirmatory field screening and laboratory analysis of dredged material/soil will be conducted by the Engineer and utilized to confirm PCB

concentrations in excavated areas following the initial excavation. Samples of the excavation walls and floor will be obtained and analyzed using PCB field screening kits to evaluate whether the remaining dredged material/soil contains PCBs concentrations at or greater than 50 mg/kg. The minimum number of confirmatory samples will consist of one sample of each wall and one sample of the excavation floor (for a total of five samples per excavation). If a sample result shows PCB concentrations at or greater than 50 mg/kg, then the excavation will proceed in the appropriate direction, as indicated by the sample results. For example, if one of the wall samples contains PCBs in excess of 50 mg/kg, excavation of that wall surface will continue.

Numbers of confirmatory samples will increase as the excavation size increases. The number of confirmatory samples per length of wall excavation is as follows: up to 20 ft excavation length, one sample; 21 ft to 40 ft wall length, two samples; and 41 ft to 50 ft wall length, three samples. The number of confirmatory samples per depth of wall excavation is as follows: up to 10 ft excavation depth, one sample; 11 ft to 20 ft, two samples; 21 ft to 30 ft, three samples; and so on. In other words, one sample will be taken from a wall that has an excavation length up to 20 ft and an excavation depth up to 10 ft. If either the excavation length or excavation depth increases, additional samples will be taken as presented above.

The number of confirmatory samples for the floor excavation would increase as the amount of floor area increases. The number and approximate locations of the floor samples will be determined by superimposing the grid formed by connecting the locations of the wall samples from opposite walls on the floor of the excavation or as directed by the Engineer. The floor samples would be collected from the grid intersection points or at locations designated by the Engineer.

A limited number of confirmatory samples would be submitted to an analytical laboratory to support the PCB field screening results. One sample will be submitted to an analytical laboratory for every twenty samples analyzed using the PCB field screening kits with a minimum of one laboratory analytical sample per excavation. Laboratory samples will be analyzed by a certified laboratory utilizing EPA Method 8082 which specifies that one matrix spike sample and one matrix spike duplicate sample per twenty samples collected be analyzed.

5.6. Documentation

Upon completion of construction, a set of As-built Drawings will be prepared by the RA Contractor to document site conditions and submitted to the Engineer for review. The original plans will serve as the basis for the As-built Drawings and will be marked up accordingly.

As required by the Consent Order, the Engineer will prepare a Certification Report signed by a Professional Engineer licensed to practice in New York State documenting that the project was completed in accordance with the approved Remedial Design. This certification will be based on review of daily field logs, material test reports and the As-built Drawings.

6. Post construction maintenance and monitoring activities

6.1. Introduction

The Remedial Design for the site includes the following major components:

- A 12 in vegetative soil cover placed over the site
- A gravel access road
- Erosion control mats placed along the southern Ley Creek bank from the edge of creek to the gravel access road
- Geotextile visual indicator between the southern edge of Ley Creek and a few feet south of the start of the slope increase south of the access road
- Surface water runoff control pipes, culverts, and catch basins
- Ground water monitoring wells
- Sanitary sewer manhole access paths

Following construction activities at the site, post construction maintenance and monitoring activities will be conducted.

6.2. Vegetative cover

Inspections of the newly seeded cover will be conducted biweekly until vegetation is established on the site. Following establishment of vegetation, routine inspection of the site will be performed monthly during the first year following construction completion, except during winter conditions, and quarterly thereafter. The inspector will observe the

condition of the vegetative cover. Should areas of settlement, erosion, or slope instability be noted, regrading will be conducted to promote runoff.

Periodic mowing of the vegetated cover will be performed to maintain satisfactory runoff, and to retard the establishment of deep-rooting shrubs, brush, or trees on the cover. If visual observation indicates that deep-rooting vegetation has established on the cover, a program to control this vegetation will be implemented. The routine cover inspection should also note any problems with thinning of vegetation. Areas which appear to be thinning over time may require overseeding to keep the vegetative cover as dense and uniform as necessary.

6.3. Access road

During routine inspections, the inspector will walk along the access road and look for excessive rutting, potholes, or settlement. Should any of these conditions be observed, they will be corrected by filling with appropriate material. During the winter, portions of the road will be plowed as needed to access surface water control culverts and routine sampling of ground water monitoring wells.

6.4. Surface water drainage

Surface water drainage facilities will be inspected at the same frequency as the vegetative cover and access road. They will be inspected for accumulation of debris or soils which may inhibit flow into culverts, catch basins and pipes. Should excessive debris or soil accumulation be noted, it will be promptly removed to maintain flow capacity. Necessary repairs to the culverts, catch basins, and pipes will also be performed, if needed, to maintain their integrity.

6.5. Ground water monitoring wells

A long term monitoring program will be conducted at the site to monitor ground water conditions. The program will include ground water sampling and analysis of monitoring wells OBG-2, OBG-7C, MW-8, and MW-12.

Ground water monitoring will be conducted semiannually, beginning sixty (60) days after the date of completion of the Remedial Construction until such time that the ground water remedy for the Former IFG Facility/Ley Creek Deferred Media Site is established. At that time a ground water monitoring program will be developed as part of the ground water remedy. An equipment blank will be collected along with the ground water samples. The samples will be analyzed for PCBs using EPA Method 8082.

The ground water monitoring wells selected for the post-Remedial Construction sampling will be inspected for signs of damage. If damage is detected, or if routine sampling indicates a problem with one or more of the wells, it may be necessary to re-develop or replace the well or wells.

6.6. Sanitary sewer manhole access paths

The eleven sanitary sewer manholes and access paths will be inspected at the same frequency as the access path, vegetative cover, drainage facilities, and monitoring wells. Severe cracks in the access path asphalt or manhole concrete cover will be repaired. The manhole covers will checked for vandalism.

6.7. Record keeping

An inspection checklist will be developed and filled out during routine inspections. The results of ground water monitoring will be summarized in annual reports. Also, copies of all records, reports, or other information relative to maintenance and monitoring activities at the site will be provided to NYSDEC by REALM in the annual reports.

7. Contingency plan

The contingency plan presented in this Section is applicable to the closure period following completion of the Remedial Construction. The contingency plan will be implemented in the event that any component of the Remedial Design fails to operate in accordance with the intent of the Remedial Design.

7.1. Freezing conditions

The Remedial Design considered freeze/thaw conditions, but in the event of unusual freeze/thaw activity, the heaved area of the cover should be scarified, recompacted, topsoil reinstalled, and the area reseeded. Freeze/thaw activity could also cause excessive rutting or pot hole formation in the site access road. If this occurs, the damaged portion of the road would be filled with a suitable granular material.

7.2. Heavy rains

Repeated heavy rainfall could cause erosion of the final cover. If this occurs, the eroded area would be scarified and additional cover material added, if necessary, and recompacted. Topsoil would then be applied and reseeded. Areas of persistent erosion may require utilization of an erosion control fabric or ditching and rip rap.

7.3. Surface water control culverts

Should flow in the surface water runoff control culverts become inhibited by the accumulation of excessive debris or soils from the erosion of the adjacent embankment, appropriate measures would be taken to repair or clean the culverts to maintain flow capacities.

7.4. Health and safety

Health and safety measures to be implemented during the post construction period include restricting site access and appropriate personal protective equipment and decontamination during ground water monitoring. These measures are meant to minimize damage to site-related construction materials and protect the sampling crew during ground water monitoring activities.

In the event that routine maintenance and monitoring activities indicate problems with the remedial components, activities outlined in this contingency plan would be implemented. The type of health and safety requirements to be implemented in the event of failure of the remedial components would depend on the type of failure and field activities conducted in implementing this contingency plan. It is likely that health and safety requirements utilized in the event of implementation of this contingency plan will be similar to those implemented during remedial construction. However, it may be necessary to develop specific health and safety requirements and procedures to address the specific conditions encountered.

7.5. Emergency contacts

In the event of an emergency at the Site, REALM should be contacted as appropriate. The current addresses and phone numbers are as follows:

Mr. William E. Kochem, Jr.
Supervisor Plant Engineering
North American Operations/GMC
1 General Motors Drive
Syracuse, NY 13206
(315) 432-5314

Mr. James F. Hartnett
Remediation and Liability Management Company, Inc.
c/o GM Remediation Project Office
Rt. 37 East, Box 460
Massena, NY 13662-0460
(315) 764-2239 GM 8-344-2239

The NYSDEC and NYSDOH may also be contacted as necessary. The current addresses and phone numbers are as follows:

Mr. George Harris
Division of Environmental Remediation
NYSDEC
50 Wolf Road
Albany, New York 12233-7010
(518) 457-9280

Mr. Ronald Heerkens
NYSDOH
Syracuse Regional Office
217 South Salina Street
Syracuse, New York 13202
(315) 426-7613

8. Anticipated construction schedule and sequence

8.1. Construction schedule

An anticipated schedule for Remedial Construction at the site is shown in Figure 8-1. It indicates that the total estimated time for Remedial Construction will be on the order of 27 weeks. It is anticipated that the construction will be completed from May 1999 through November 1999. If vegetation is delayed until the following spring, erosion control and siltation minimization measures will be installed and maintained in the interim. It should also be noted that the Contract Documents will require the RA Contractor to submit a time frame for completion of this project with the bid. The selected RA Contractor may propose a schedule which differs in construction sequence or duration of various tasks from that shown in Figure 8-1.

The anticipated schedule was prepared based on experience with similar projects. It was assumed that one month will consist of 22 work days, each with a duration of eight hours.

8.2. Construction sequence

The anticipated construction sequence for the Ley Creek PCB Dredgings Site will generally be, with modifications made by the RA Contractor, as follows:

- Mobilization
- Clearing and grubbing of the site including utility pole removal
- Test pitting/drainage swale evaluation program
- Excavation/transport/disposal (along with confirmatory sampling) of areas of dredged material/soil at or greater than 50 mg/kg PCBs
- North area excavation/transport/consolidation
- Rough grading
- Catch basin, drainage culvert, drainage pipe installation
- Sanitary sewer manhole modification including access path installation

- Monitoring well modifications
- Final grading
- New fence installation and old fence modifications
- Vegetative soil cover and geotextile installation
- Access road installation
- Erosion control mat installation
- Final grading
- Seeding and fertilization

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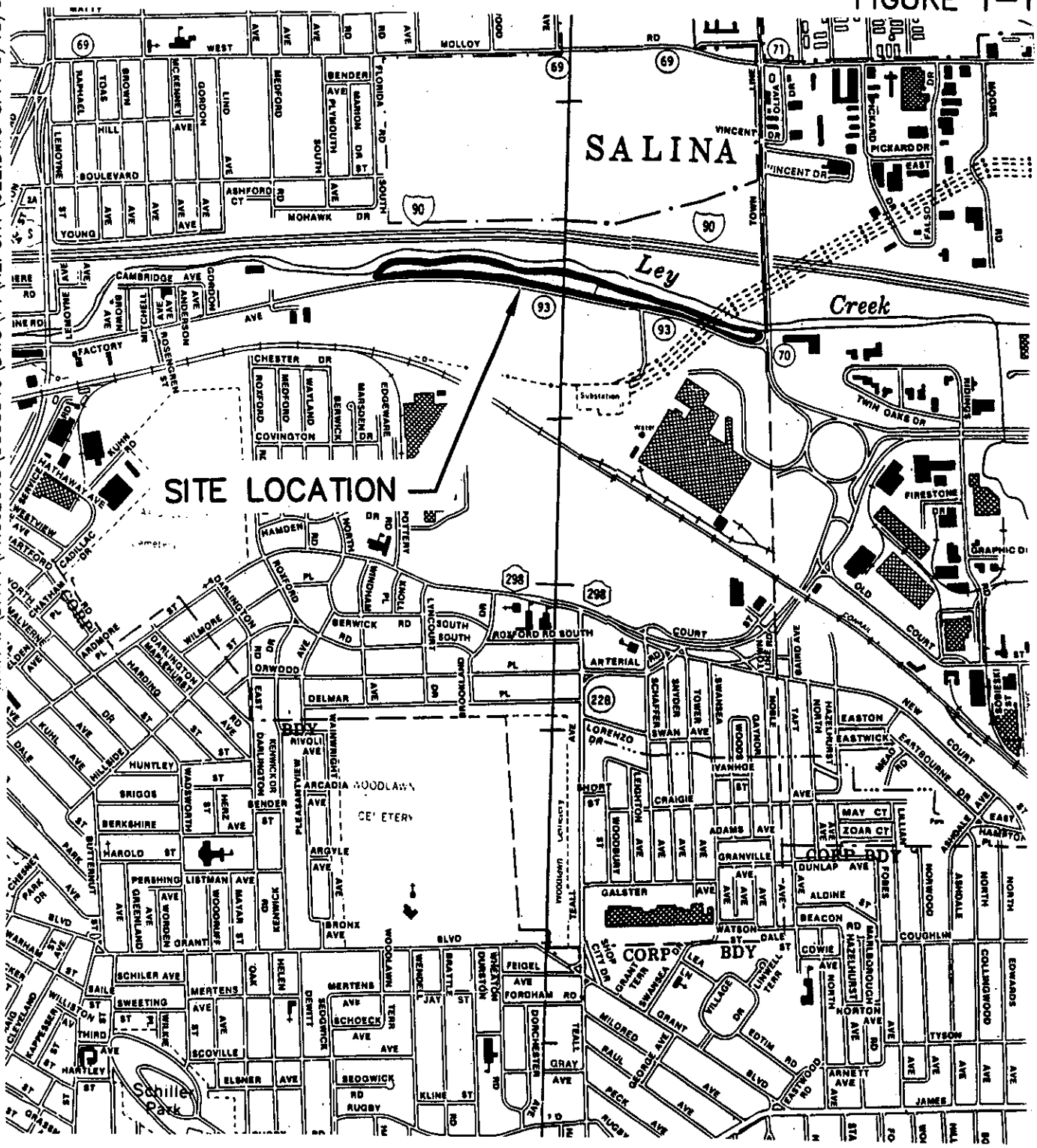
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FIGURE 1-1



MWH I:\DIV71\PROJECTS\5858040\DWG\71\REPORT\022.DWG SF:1 6/18/98



LEY CREEK PCB DREDGINGS SITE
SYRACUSE, NEW YORK
REMEDIATION AND LIABILITY
MANAGEMENT COMPANY, INC.

SITE LOCATION PLAN

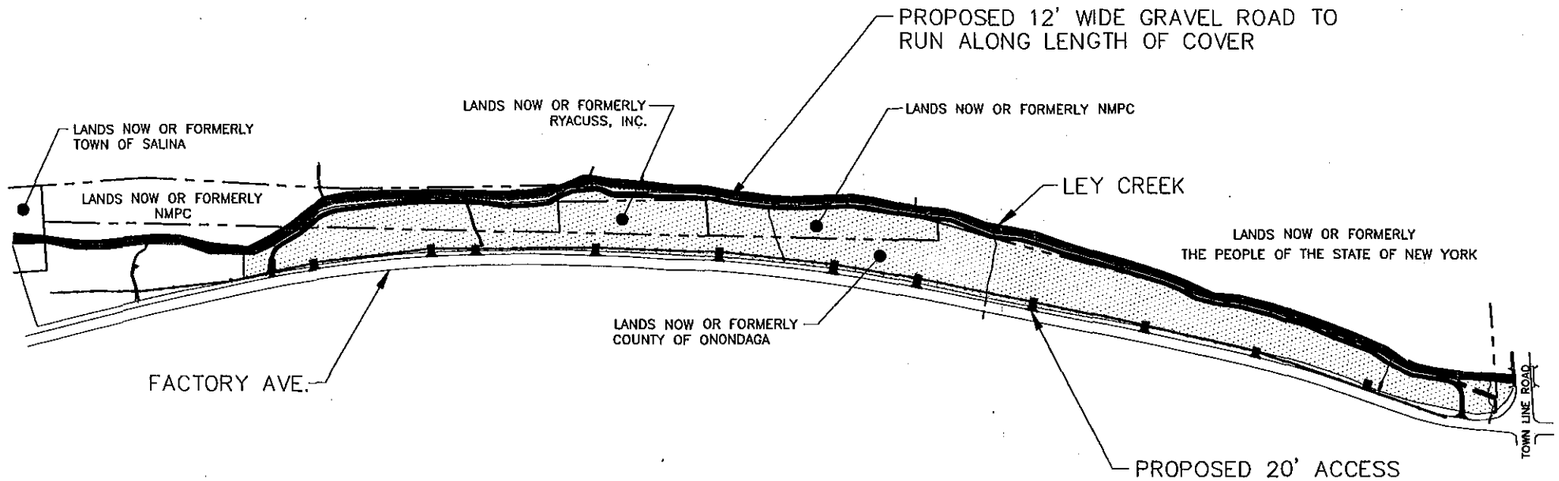
FILE NO. 5858.040-022

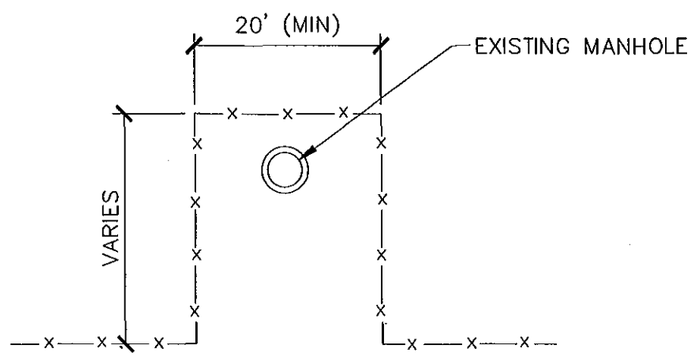
NOT TO SCALE

O'BRIEN & GERE ENGINEERS INC.

MWH I: \DIV71\PROJECTS\5858040\DWG\71\019.DWG SF:500

FIGURE 1-2





PROPOSED TYPICAL MANHOLE ACCESS

LEGEND

- GRAVEL ACCESS ROAD
- SANITARY SEWER
- PROPERTY BOUNDARY
- MANHOLE ACCESS LOCATION
- FENCE
- PROPOSED EXTENT OF SOIL COVER

NOTE:

1. LOCATION OF FENCE AND SANITARY SEWER ARE APPROXIMATE.

REV DATE: 2/19/99

LEY CREEK PCB DREDGING SITE SYRACUSE, NEW YORK

SITE PLAN

0 500 1000

SCALE IN FEET

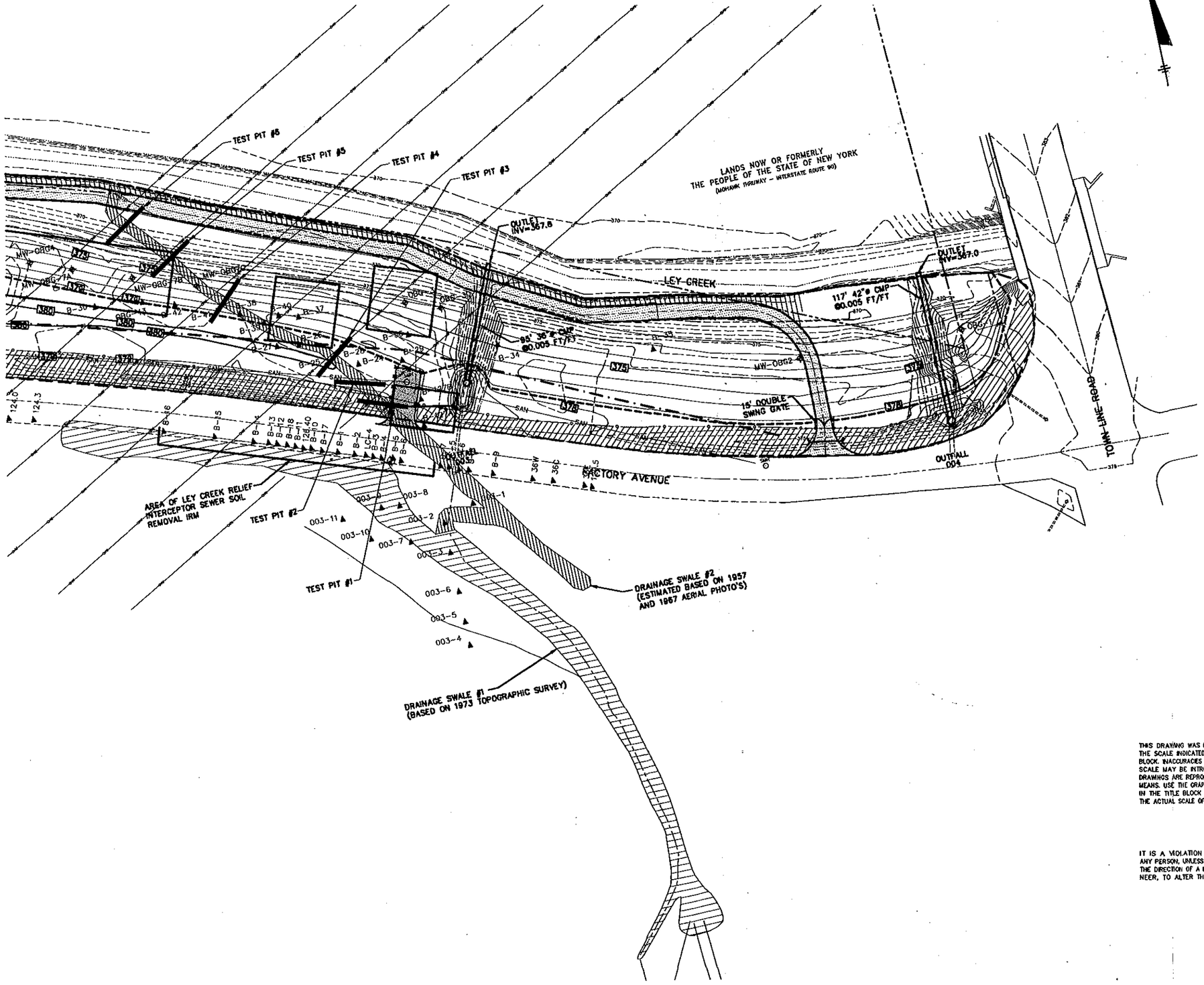
DATE: FEBRUARY 1999

FILE NO. 5858.040.019

O'BRIEN & GERE ENGINEERS INC.

PLOT DATE:

FIGURE 3-1



LEGEND

- OVERHEAD WIRES
- CHAINLINK FENCE (SEE NOTE 8)
- GATE IN FENCE
- PROPERTY BOUNDARY
- EDGE OF WOODS
- TOP OF BANK
- UTILITY POLE
- GUY WIRE
- SAN — SANITARY SEWER
- SMH — SANITARY MANHOLE
- CATCH BASIN
- 380 — EXISTING ELEVATION CONTOUR
- 380 — PROPOSED ELEVATION CONTOUR
- x 379.0 — PROPOSED SPOT ELEVATION
- HP — HIGH POINT
- PROPOSED SECURITY FENCE
- PROPOSED PAVEMENT
- PROPOSED STONE ACCESS ROAD
- LIMITS OF SOIL LOCATED ALONG FACTORY AVENUE TO BE RELOCATED
- PROPOSED CATCH BASIN
- MW-08G7C — MONITORING WELL
- LIMITS OF EROSION CONTROL MAT
- B-41 — SOIL BORING
- HOT SPOT EXCAVATION AREA (ACTUAL AREA MAY VARY)
- LIMITS OF COVER SYSTEM
- 25 FT. SANITARY OFFSET
- LIMITS OF NON-WOVEN GEOTEXTILE

NO.	DATE	REVISION	INIT.

1" = 40' (40 0 40 80)

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED IN THE TITLE BLOCK. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR IN THE TITLE BLOCK TO DETERMINE THE ACTUAL SCALE OF THIS DRAWING.

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED ENGINEER, TO ALTER THIS DOCUMENT.

O'BRIEN & GERE ENGINEERS INC.

LEY CREEK PCB DREDGINGS SITE
SYRACUSE, NEW YORK
SITE REMEDIATION PROJECT

GENERAL

TEST PITTING PLAN

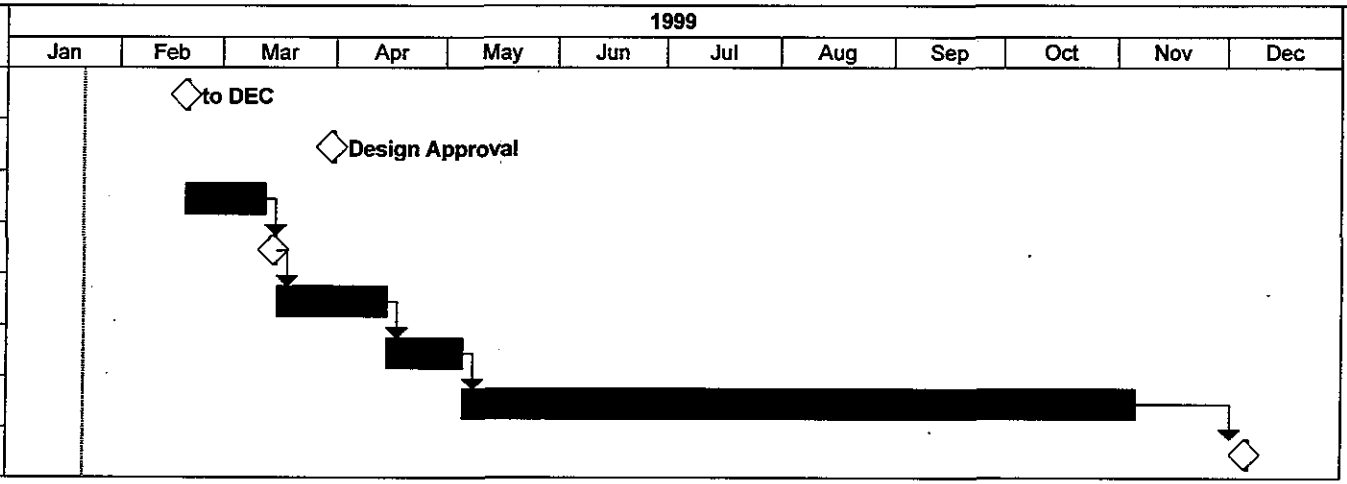
IN CHARGE OF _____ _____
DESIGNED BY _____ CHECKED BY _____
DRAWN BY _____ _____

FILE NO. 5858.040.020
DATE FEBRUARY 1999

PLOT DATE: MWH I:\DV71\PROJECTS\5858040\DWG\71\009.DWG SF:1 2/19/99 (DVIEW 348.59)

Figure 8-1
Ley Creek PCB Dredgings Site
Remediation Schedule

ID	Task Name
1	Submit Remedial Design Plans/Specs
2	DEC Approval of Design
3	Contractor Negotiations
4	Contract Awarded
5	Contractor Develops and Submits Plans
6	Mobilization
7	Field Work
8	Certification Report



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Appendix A

Storm water runoff calculations

Appendix A

Storm Water Runoff Calculations

A storm water modeling program TR55 was utilized to calculate design runoff flows for the Ley Creek PCB Dredgings Site. Assumptions are as follows:

- 25-year, 24-hour design storm
- Drainage type = II (dredged material/soil geologic characteristics)
- Coverage = fallow (during construction) was used in the design scenario as worst case (maximum runoff); dense grass (following design) was used as baseline scenario
- One half of Factory Avenue width drains to the northern ditch
- Runoff from the norther portion of the site using the peak elevation as a division point will drain to Ley Creek

The following table lists the designated subareas and their respective areas, slopes, maximum drainage lengths, and peak runoff flows. Attached are figures which depict the subareas.

Subarea	Area (sq mi)	Max. Slope (ft/ft)	Drainage Length (ft)	Peak Runoff Flow (cfs)
1	0.0025	0.05	100	8
1A	0.00089	0.005	25	4
2	0.0028	0.05	100	8
2A	0.0008	0.005	25	3
3	0.0029	0.05	110	9
3A	0.0011	0.005	30	5
4	0.00056	0.05	40	2
4A	0.00069	0.005	25	3
5A	0.00061	0.005	25	3

Attached is the raw data from the two TR55 scenarios (During Construction and Following Construction). The scenario used for design was During Construction which is reflected above and is the worst case.

TABULAR HYDROGRAPH METHOD Version 2.00

Project : GM Ley Creek PCB Dredging Site User: Date: 05-28-98
County : Onondaga State: NY Checked: _____ Date: _____
Subtitle: Remedial Design - 25 yr storm - DURING CONSTRUCTION

Total watershed area: 0.013 sq mi Rainfall type: II Frequency: 25 years

	Subareas				
	I	IA	II	IIA	III
Area(sq mi)	0.00	0.00	0.00	0.00	0.00
Rainfall(in)	4.5	4.5	4.5	4.5	4.5
Curve number	86	98	86	98	86
Runoff(in)	3.00	4.26	3.00	4.26	3.00
Tc (hrs)	0.05*	0.01*	0.05*	0.01*	0.06*
(Used)	0.10	0.10	0.10	0.10	0.10
TimeToOutlet	0.00	0.00	0.00	0.00	0.00
Ia/P	0.07	0.01	0.07	0.01	0.07
(Used)	0.10	0.10	0.10	0.10	0.10

Time (hr)	Total Flow	Subarea Contribution to Total Flow (cfs)				
		I	IA	II	IIA	III
11.0	0	0	0	0	0	0
11.3	0	0	0	0	0	0
11.6	0	0	0	0	0	0
11.9	16	3	1	3	1	3
12.0	28	5	2	5	2	6
12.1	45P	8P	4P	8P	3P	9P
12.2	27	5	2	5	2	5
12.3	11	2	1	2	1	2
12.4	6	1	1	1	1	1
12.5	4	1	0	1	0	1
12.6	3	1	0	1	0	1
12.7	3	1	0	1	0	1
12.8	3	1	0	1	0	1
13.0	2	0	0	1	0	1
13.2	0	0	0	0	0	0
13.4	0	0	0	0	0	0
13.6	0	0	0	0	0	0
13.8	0	0	0	0	0	0
14.0	0	0	0	0	0	0
14.3	0	0	0	0	0	0
14.6	0	0	0	0	0	0
15.0	0	0	0	0	0	0
15.5	0	0	0	0	0	0
16.0	0	0	0	0	0	0
16.5	0	0	0	0	0	0
17.0	0	0	0	0	0	0
17.5	0	0	0	0	0	0
18.0	0	0	0	0	0	0
19.0	0	0	0	0	0	0
20.0	0	0	0	0	0	0
22.0	0	0	0	0	0	0
26.0	0	0	0	0	0	0

P - Peak Flow * - value(s) provided from TR-55 system routines

TABULAR HYDROGRAPH METHOD Version 2.00

Project : GM Ley Creek PCB Dredging Site User: Date: 05-28-98
County : Onondaga State: NY Checked: Date: _____
Subtitle: Remedial Design - 25 yr storm - DURING CONSTRUCTION

Continuation of subarea information

	Subareas			
	IIIA	IV	IVA	VA
Area(sq mi)	0.00	0.00	0.00	0.00
Rainfall(in)	4.5	4.5	4.5	4.5
Curve number	98	86	98	98
Runoff(in)	4.26	3.00	4.26	4.26
Tc (hrs)	0.02*	0.03*	0.01*	0.01*
(Used)	0.10	0.10	0.10	0.10
TimeToOutlet	0.00	0.00	0.00	0.00
Ia/P	0.01	0.07	0.01	0.01
(Used)	0.10	0.10	0.10	0.10

Time	Subarea Contribution to Total Flow (cfs)			
(hr)	IIIA	IV	IVA	VA
11.0	0	0	0	0
11.3	0	0	0	0
11.6	0	0	0	0
11.9	2	1	1	1
12.0	3	1	2	2
12.1	5P	2P	3P	3P
12.2	3	1	2	2
12.3	1	0	1	1
12.4	1	0	0	0
12.5	1	0	0	0
12.6	0	0	0	0
12.7	0	0	0	0
12.8	0	0	0	0
13.0	0	0	0	0
13.2	0	0	0	0
13.4	0	0	0	0
13.6	0	0	0	0
13.8	0	0	0	0
14.0	0	0	0	0
14.3	0	0	0	0
14.6	0	0	0	0
15.0	0	0	0	0
15.5	0	0	0	0
16.0	0	0	0	0
16.5	0	0	0	0
17.0	0	0	0	0
17.5	0	0	0	0
18.0	0	0	0	0
19.0	0	0	0	0
20.0	0	0	0	0
22.0	0	0	0	0
26.0	0	0	0	0

P - Peak Flow * - value(s) provided from TR-55 system routines

TIME OF CONCENTRATION AND TRAVEL TIME Version 2.00

Project : GM Ley Creek PCB Dredging Site User: Date: 05-28-98
County : Onondaga State: NY Checked: ____ Date: _____
Subtitle: Remedial Design - 25 yr storm - DURING CONSTRUCTION

Subarea #1 - I

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	2.5	100	0.05	B					0.053

Time of Concentration = 0.05*

Subarea #2 - IA

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	2.5	25	.005	A					0.013

Time of Concentration = 0.01*

Subarea #3 - II

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	2.5	100	.05	B					0.053

Time of Concentration = 0.05*

Subarea #4 - IIA

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	2.5	25	.005	A					0.013

Time of Concentration = 0.01*

Subarea #5 - III

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	2.5	110	0.05	B					0.057

Time of Concentration = 0.06*

* - Generated for use by TABULAR method

TIME OF CONCENTRATION AND TRAVEL TIME Version 2.00

Project : GM Ley Creek PCB Dredging Site User: Date: 05-28-98
County : Onondaga State: NY Checked: ____ Date: _____
Subtitle: Remedial Design - 25 yr storm - DURING CONSTRUCTION

Subarea #6 - IIIA

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	2.5	30	.005	A					0.015

Time of Concentration = 0.02*

Subarea #7 - IV

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	2.5	40	.05	B					0.026

Time of Concentration = 0.03*

Subarea #8 - IVA

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	2.5	25	.005	A					0.013

Time of Concentration = 0.01*

Subarea #9 - VA

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	2.5	25	.005	A					0.013

Time of Concentration = 0.01*

--- Sheet Flow Surface Codes ---

A Smooth Surface	F Grass, Dense	--- Shallow Concentrated ---
B Fallow (No Res.)	G Grass, Burmuda	--- Surface Codes ---
C Cultivated < 20 % Res.	H Woods, Light	P Paved
D Cultivated > 20 % Res.	I Woods, Dense	U Unpaved
E Grass-Range, Short	J Range, Natural	

* - Generated for use by TABULAR method

TABULAR HYDROGRAPH METHOD Version 2.00

Project : GM Ley Creek PCB Dredging Site User: Date: 05-28-98
County : Onondaga State: NY Checked: ____ Date: _____
Subtitle: Remedial Design - 25 yr storm

Total watershed area: 0.013 sq mi Rainfall type: II Frequency: 25 years

	Subareas				
	I	IA	II	IIA	III
Area(sq mi)	0.00	0.00	0.00	0.00	0.00
Rainfall(in)	4.5	4.5	4.5	4.5	4.5
Curve number	61	98	61	98	61
Runoff(in)	1.08	4.26	1.08	4.26	1.08
Tc (hrs)	0.19*	0.01*	0.19*	0.01*	0.20*
(Used)	0.20	0.10	0.20	0.10	0.20
TimeToOutlet	0.00	0.00	0.00	0.00	0.00
Ia/P	0.28	0.01	0.28	0.01	0.28
(Used)	0.28	0.10	0.28	0.10	0.28

Time	Total	Subarea Contribution to Total Flow (cfs)				
(hr)	Flow	I	IA	II	IIA	III
11.0	0	0	0	0	0	0
11.3	0	0	0	0	0	0
11.6	0	0	0	0	0	0
11.9	6	0	1	0	1	0
12.0	14	1	2	1	2	1
12.1	25P	2P	4P	2P	3P	2P
12.2	17	2	2	2	2	2
12.3	9	1	1	1	1	2
12.4	6	1	1	1	1	1
12.5	4	1	0	1	0	1
12.6	0	0	0	0	0	0
12.7	0	0	0	0	0	0
12.8	0	0	0	0	0	0
13.0	0	0	0	0	0	0
13.2	0	0	0	0	0	0
13.4	0	0	0	0	0	0
13.6	0	0	0	0	0	0
13.8	0	0	0	0	0	0
14.0	0	0	0	0	0	0
14.3	0	0	0	0	0	0
14.6	0	0	0	0	0	0
15.0	0	0	0	0	0	0
15.5	0	0	0	0	0	0
16.0	0	0	0	0	0	0
16.5	0	0	0	0	0	0
17.0	0	0	0	0	0	0
17.5	0	0	0	0	0	0
18.0	0	0	0	0	0	0
19.0	0	0	0	0	0	0
20.0	0	0	0	0	0	0
22.0	0	0	0	0	0	0
26.0	0	0	0	0	0	0

P - Peak Flow * - value(s) provided from TR-55 system routines

TABULAR HYDROGRAPH METHOD Version 2.00

Project : GM Ley Creek PCB Dredging Site User: Date: 05-28-98
County : Onondaga State: NY Checked: ____ Date: _____
Subtitle: Remedial Design - 25 yr storm

Continuation of subarea information

	Subareas			
	IIIA	IV	IVA	VA
Area(sq mi)	0.00	0.00	0.00	0.00
Rainfall(in)	4.5	4.5	4.5	4.5
Curve number	98	61	98	98
Runoff(in)	4.26	1.08	4.26	4.26
Tc (hrs)	0.02*	0.09*	0.01*	0.01*
(Used)	0.10	0.10	0.10	0.10
TimeToOutlet	0.00	0.00	0.00	0.00
Ia/P	0.01	0.28	0.01	0.01
(Used)	0.10	0.28	0.10	0.10

Time (hr)	Subarea Contribution to Total Flow (cfs)			
	IIIA	IV	IVA	VA
11.0	0	0	0	0
11.3	0	0	0	0
11.6	0	0	0	0
11.9	2	0	1	1
12.0	3	0	2	2
12.1	5P	1P	3P	3P
12.2	3	0	2	2
12.3	1	0	1	1
12.4	1	0	0	0
12.5	1	0	0	0
12.6	0	0	0	0
12.7	0	0	0	0
12.8	0	0	0	0
13.0	0	0	0	0
13.2	0	0	0	0
13.4	0	0	0	0
13.6	0	0	0	0
13.8	0	0	0	0
14.0	0	0	0	0
14.3	0	0	0	0
14.6	0	0	0	0
15.0	0	0	0	0
15.5	0	0	0	0
16.0	0	0	0	0
16.5	0	0	0	0
17.0	0	0	0	0
17.5	0	0	0	0
18.0	0	0	0	0
19.0	0	0	0	0
20.0	0	0	0	0
22.0	0	0	0	0
26.0	0	0	0	0

P - Peak Flow * - value(s) provided from TR-55 system routines

TIME OF CONCENTRATION AND TRAVEL TIME Version 2.00

Project : GM Ley Creek PCB Dredging Site User: Date: 05-28-98
County : Onondaga State: NY Checked: ____ Date: _____
Subtitle: Remedial Design - 25 yr storm

Subarea #1 - I

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	2.5	100	0.05	F					0.187

Time of Concentration = 0.19*

Subarea #2 - IA

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	2.5	25	.005	A					0.013

Time of Concentration = 0.01*

Subarea #3 - II

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	2.5	100	.05	F					0.187

Time of Concentration = 0.19*

Subarea #4 - IIA

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	2.5	25	.005	A					0.013

Time of Concentration = 0.01*

Subarea #5 - III

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	2.5	110	0.05	F					0.201

Time of Concentration = 0.20*

* - Generated for use by TABULAR method

TIME OF CONCENTRATION AND TRAVEL TIME Version 2.00

Project : GM Ley Creek PCB Dredging Site User: Date: 05-28-98
County : Onondaga State: NY Checked: ____ Date: _____
Subtitle: Remedial Design - 25 yr storm

Subarea #6 - IIIA

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	2.5	30	.005	A					0.015

Time of Concentration = 0.02*

Subarea #7 - IV

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	2.5	40	.05	F					0.090

Time of Concentration = 0.09*

Subarea #8 - IVA

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	2.5	25	.005	A					0.013

Time of Concentration = 0.01*

Subarea #9 - VA

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	2.5	25	.005	A					0.013

Time of Concentration = 0.01*

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense
J Range, Natural

--- Shallow Concentrated --- Surface Codes ---

P Paved
U Unpaved

* - Generated for use by TABULAR method

Appendix B

Drainage culvert calculations

Appendix B

Drainage Culvert Calculations

Using the results from the TR55 storm water runoff model, the thirteen drainage culverts which will run along the drainage ditch between Factory Avenue and the site fence were sized. The culvert/pipe design program Flowmaster for Windows® was utilized with the following assumptions:

- Manning's n = 0.012 (asphalt coated corrugated metal)
- Drainage culvert A and B would not convey storm water runoff to one of the newly designed catch basins; the storm water runoff flow through drainage culverts A and B (conveyed west toward Town of Salina Garage property) would be less than the maximum design runoff flow
- The TR55 flow can be divided to the appropriate culvert using a linear relationship between flow and distance from extent of subarea to the associated catch basin

The following table list the designated culverts, the subarea in which each culvert will convey storm water runoff, the TR55 flow, the culvert size calculated by the Flowmaster for Windows® model using Manning's Method, and the design culvert size.

Drainage Culvert	Subarea	Flow (cfs)	Diameter Size (in)	Pipe Arch Design Diameter Size (in)
A (western access road)	None	NA	NA	15" x 21"
B (MH access path)	None	NA	NA	15" x 21"
C (MH access path)	1, 1A	6	16	15" x 21"
D (MH access path)	1, 1A	6	16	15" x 21"
E (MH access path)	1, 1A	6	16	15" x 21"
F (MH access path)	2, 2A	5.5	14	15" x 21"
G (MH access path)	2, 2A	5.5	14	15" x 21"
H (MH access path)	3, 3A	7	16	15" x 21"
I (MH access path)	3, 3A	7	16	15" x 21"
J (MH access path)	3, 3A	7	16	15" x 21"
K (MH access path)	4, 4A	2.5	12	15" x 21"
L (MH access path)	4, 4A	2.5	12	15" x 21"
M (eastern access road)	5A	3	12	15" x 21"

Note: NA = not applicable

As a factor of safety and for construction purposes, a uniform design drainage culvert size of 18 inch diameter

will be used.

The existing storm water culverts beneath Factory Avenue will contribute flow to the proposed catch basins and drainage pipes. As a worst case scenario, the flow through the Factory Avenue culverts was calculated assuming the culverts were discharging full. Thus, the culverts would be under head pressure at the inlet. At the outlet (catch basin), the flow would be free falling. The following expressions were used to calculate flow from the Factory Avenue culverts:

$$Q = A * v$$

$$v = \text{square root } (H / (((1 + Ke) / 2 * g) + ((n^2 * L)/(2.21 * rH^{1.33}))$$

Where: Q = flow (cfs)
A = area of elliptical culvert flowing full with dimensions 24 in x 36 in = 4.71 sf
v = velocity of flow
H = head at inlet = 0.01 ft (assumed)
Ke = minor loss coefficient (projecting concrete groove) = 0.15 (unitless)
g = gravitational acceleration = 32.2 ft/s^2
n = Manning's coefficient = 0.016 (unitless; concrete with rough joints)
L = length of culvert = 40 ft
rH = hydraulic radius = A / P = 0.59 ft
P = wetted perimeter for elliptical culvert flowing full with dimensions 24 in x 36 in = 8 ft

Velocity of flow through the Factory Avenue culverts is approximately 11.6 ft/s for each culvert. The flow through each Factory Avenue culvert is approximately 54.8 cfs. As an additional factory of safety, 60 cfs was used for design purposes.

The flows through the Factory Avenue culverts combined with the storm water runoff flows from the TR55 modeling were used to design the proposed drainage pipes that would extend from the proposed catch basins to Ley Creek. The following table lists the proposed drainage pipes along with pipe lengths, slope, combined flow, and design drainage pipe size. The drainage pipe sizes were calculated using Flowmaster for Windows® with the Manning's Method and the Kutter's Method. A Manning's n of 0.012 (asphalt coated corrugated metal) and a Kutter's coefficient of 0.010 (smooth pipe) was used, respectively.

Pipe	Length (ft)	Slope (ft/ft)	Flow (cfs)	Design Size (in)
1 (west)	160	0.005	72	36
2	185	0.005	73	36
3	195	0.005	74	36
4	95	0.005	65	36
5 (east)	115	0.005	63	42

Appendix C

Basis of design summary

Appendix C

Preliminary Basis of Design

Hot Spot Excavation

- Dredge materials/soils excavation/backfill volume calculations were based on Remedial Investigation dredge materials/soils analytical results. Dredge materials/soils which were found to contain PCBs at or greater than 50 mg/kg. Volumes below may be changed in the field as a result of confirmatory sampling.

- Excavation areas located within the consolidation area will not require backfill from off-site. During grading, material from the site will be used as backfill.

  Hot Spot Excavation and Disposal ~ 307.1 cy
  On-site fill ~ 307.1 cy
  Off site fill ~ 0 cy

Dredge Materials/Soils Consolidation/Relocation

- Volume of dredge materials/soils to be relocated from the north side of Ley Creek to the consolidation area on-site is 920cy (4 ft depth by 6,200 sf). Clean, off-site fill will be used as backfill for the north side excavation.

- Cuts and fills for the site:
  - Cut ~ 24,700 cy
  - Fill ~ 22,800 cy
- Net Cut ~ 1,900 cy

Cover System

- Slopes:
  - Max = 20% (1:5)
  - Min = 4% (1.25), per Part 360

- Components (top to bottom)
  - Erosion control mat (only in area between southern edge of Ley Creek and access road)
  - Vegetated top soil [6 inch]
  - Fill [6 inch]

  - Gravel [12 inch] (only for access road)

Surface Water Drainage

- Design storm = 25-year, 24-hour

- Design Flows:
  - Drainage subarea 1 = 8 cfs
  - Drainage subarea 1A = 4 cfs
  - Drainage subarea 2 = 8 cfs
  - Drainage subarea 2A = 3 cfs
  - Drainage subarea 3 = 9 cfs
  - Drainage subarea 3A = 5 cfs
  - Drainage subarea 4 = 2 cfs
  - Drainage subarea 4A = 3 cfs
  - Drainage subarea 5A = 3 cfs

  - Drainage through five culverts under Factory Avenue = 60 cfs/ea = 300 cfs

- Drainage culvert design:
  - Slope = 0.001 - 0.005
  - Manning's n = 0.012 (asphalt coated corregated metal)
  - Culvert size = 15" x 21" pipe arch for each of the 13 culverts

- Drainage pipe design:
  - Slope = 0.005
  - Manning's n = 0.012 (asphalt coated corregated metal)
  - Kutter's n = 0.010 (smooth pipe)
  - Pipe size = 36 inch diameter for each of the 4 pipes
  - Peak velocity = 8.5 ft/s - 10.5 ft/s

- Drainage Pipe Design
  - Slope = 0.005
  - Manning's n = 0.012
  - Pipe size = 42 in diameter for one pipe
  - Peak velocity = 9.10 ft/sec

Monitoring well modifications

- Monitoring well modification: wells will be modified such that they are flush with the final grade. Therefore, it may be necessary to shorten or extend the well depending on the final grades at the specific well location. The following table shows approximate linear lengths to modify the well. Changes may be made to the modification lengths in the field as final grades change.

Well	Existing Ground Elev.	Existing Well Elev.	Final Ground Elev.	Action
OBG-1	377.5	379.5	373.5	shorten well 6ft
OBG-2	376	378	373.5	shorten well 5.5ft
OBG-3D	377	380	373	shorten well 3ft
OBG-7C	378	380	376	shorten well 4ft

MW-8	380	382	379.5	shorten well 2.5ft
MW-9	375	377	379.5	extend well 2.5ft
MW-9D	375	378	379.5	extend well 1.5ft
MW-10	378.5	380.5	379	shorten well 1.5 ft
MW-12	382	384	379.5	shorten well 4.5ft
MW-13	379	381	380	shorten well 1ft

Site Access

- Site access
  - Gravel road access width = 12 ft
  - Maximum grade = 20%
  - Drainage slope = 0.025

- Site security
  - Fence: 6 ft chain link
  - Gates: Proposed vehicle swing security gates (15 ft wide span) at two entrance/exit access road locations
    Existing vehicle swing security gates (12 ft wide span)

Exhibit A

ROD excerpt - Summary of the Preferred Remedy

can be used as the basis for the final decision. A remedy is cost effective if the cost of the remedy is proportional to its' overall effectiveness. The costs for each alternative are presented in Table 3.

8. Community Acceptance. Concerns of the community regarding the RI/FS reports and the Proposed Remedial Action Plan have been evaluated. The "Responsiveness Summary" included as Appendix A presents the public comments received and the Department's response to the concerns raised. No significant public comments were received at the public meeting, however, extensive written comments were received from General Motors, Onondaga County, Syracuse China/Pfaltzgraff and the New York State Thruway Authority. In general these comments were supportive of the selected remedy, while raising several specific concerns with certain aspects of the project, such as flood protection and possible impacts to the property owners resulting from the remedy. These concerns should either be addressed by the ongoing negotiation between GM and the various property owners or, for the more technical issues, will be addressed during the design of the remedy.

SECTION 7: SUMMARY OF THE PREFERRED REMEDY

Based upon the results of the RI/FS, and the evaluation presented in Section 7, the NYSDEC has selected **Alternative 8: Excavation and Off Site Disposal of Dredged Material /Soil > 50 mg/kg PCBs, Regrading of Material in the Floodway with a Low Permeability Cover, 12-inch Vegetated Soil Cover Over the Remaining Material, Groundwater Monitoring, Deed Restrictions, Fencing and Maintenance Access Provisions** as the remedy for this site. This selection is based upon this alternative's ability to meet New York State Standards, Criteria and Guidance, be protective of human health and the environment, and offer the best balance of the five remaining evaluation criteria presented in Section 7.

This selection is based upon the evaluation of the eight alternatives developed for this site. Alternative 8 will be protective of human health and the environment, as discussed in Sections 3.3 and 3.4, by removing PCB contamination above hazardous waste levels from the site and consolidating the remaining materials out of the floodway. These remaining contaminated areas, approximately 17 acres, exceeding the remedial goals will be covered with a minimum of a twelve (12) inch vegetated soil cover, with the exception of the areas in the floodway where this cover will consist of a geomembrane or clay layer overlain with the twelve (12 inch vegetated soil cover or the gravel access road. This will prevent exposures to the PCBs below 50 mg/kg which will remain on the site. While Alternatives 3 and 5 would offer greater long term protection, their respective costs would be excessive in comparison to the increased effectiveness and the risk presented by the remaining contamination. Alternative 8 will be effective in the short term, since much of the contaminated material will remain undisturbed. Alternative 8 will also address the volume and toxicity of the most highly contaminated material and reduce the mobility of the remaining contaminants present at the site, however, not to as high a degree as the removal or treatment alternatives. Alternative 8 is significantly lower in cost than the removal and treatment

alternatives and since it equally satisfies the other criteria, including the threshold criteria, it is the preferred alternative.

The area in which the remedy will be located is a Class 2 freshwater wetland. The original deposition of the PCB dredge material occurred before the September 1, 1975 Article 24 regulation regarding the filling in of wetlands. The consolidation of the contaminated PCB soils will occur in areas that are designated as wetland. However, the NYSDEC Division of Fish, Wildlife and Marine Resources was consulted and has determined that while Alternative 8 will result in the continued loss of several acres of regulated freshwater wetland along the shore of Ley Creek, the potential reduction in PCB contamination to Ley Creek and Onondaga Lake outweighs the loss of wetlands. This will be consistent with the intent of Article 24, Environmental Conservation Law (ECL) Section 663.5 and will comply with Executive Order 11990: Protection of Wetlands.

The preferred remedy also will comply with the Fish and Wildlife Coordination Act, 16 U.S. C. 661, which requires consultation with state and federal wildlife agencies when wetlands/water resources are impacted, the Endangered Species Act, 16 U.S. C. 1531, which requires consultation with the U. S. Fish and Wildlife Service regarding endangered or threatened species and/or their habitat and any substantive requirements of Section 404 of the Clean Water Act for discharge of dredged or fill material in a wetland.

The estimated present worth cost to implement the remedy will be $6,671,453. The cost to construct the remedy is estimated to be $5,249,798. The estimated average annual operation and maintenance cost for 30 years will be $90,671.

The elements of the selected remedy are as follows:

1. A remedial design program to verify the components of the conceptual design and provide the details necessary for the construction, operation and maintenance, and monitoring of the remedial program. Uncertainties identified during the RI/FS, specifically the identification and characterization of any PCB contamination which may be associated with known or suspected drainage swale(s) which historically conveyed surface runoff from the GM; Fisher Guide Site. This sampling will be conducted as a pre-design activity for this site. The investigation will involve subsurface sampling in the area of the swale encountered during the sewer installation as well as in areas of identified historic swales which may have drained the GM site, to determine the nature and extent of any subsurface PCB contamination, in the area which will be addressed by the remedy. Based upon this sampling, appropriate modifications to the proposed alternative, will be implemented prior to or in conjunction with, the construction of the remedy to avoid the necessity of future disturbance of the remediated site.

2. Excavation and removal of dredge material/soils that contain PCBs at concentrations exceeding 50 ppm to a permitted hazardous waste landfill. It is estimated that up to 5000 cubic yards could be excavated from the areas identified on Figure 2.

3. Consolidation and covering of the remaining PCB contaminated dredge materials where concentrations are less than 50 mg/kg but exceed the remedial level of 1 mg/kg at the surface and 10 mg/kg for subsurface areas. The dredged materials will be removed, at a minimum, from the first twenty five feet of the floodway area to restore this area to appropriate elevation, with the excavated material consolidated in the area shown on Figure 2. After restoration to floodway elevations, any remaining materials above the remedial level remaining in the floodway will be covered with a geomembrane or clay and then twelve inches of soil or the gravel access road (see Figure 3 and 4). The floodway is the area defined by the Federal Emergency Management Agency August 23,1982 Flood Boundary and Floodway Map for the Town of Salina (Community Panel Number 360591 0007). In areas to be addressed outside of the floodway the dredged material will be graded and covered with a vegetated soil cover which will consist of twelve (12) inches of soil, with a permeability equal to or less than the material to be covered. Figure 5 shows the approximate 17 acre area that will be covered.

4. Dredged material/soils in the vicinity of boring B-19, located on the north bank of Ley Creek (See Figure 2), will be excavated from an area of approximately 6200 square feet to a depth of 3 feet to achieve the remedial levels for the site. The excavated material is expected to be less than 50 ppm and will be consolidated with the rest of the material on the south bank.

5. A hydraulic analysis and floodplain assessment to assure compliance with Executive Order 11988 (Floodplain Management) will be completed during the remedial design for the consolidated capped materials to insure that the material to be left in the floodplain and floodway will not result in any significant change in flood elevations and to ensure that there will not be any adverse impact to the remedy from a 100 or 500 year flood. If necessary, based on this analysis, additional material will be consolidated out of the floodway/flood-plain. Rip rap or other stabilization/flood protection techniques will also be applied as determined necessary during the design, to assure the integrity of the cover during flood events.

6. To provide Onondaga County crews access to maintain Ley Creek as a part of the existing drainage district, a gravel access road will be provided adjacent to the southern bank of the Creek to allow for future maintenance and/or dredging. The four existing drainage swales from Factory Avenue will be graded back, covered with the vegetated cover and the flow channel lined with a half pipe or formed concrete spillway where they pass through the area of covered dredge spoils.

Gravel access pathways and asphalt working pads will be constructed to allow maintenance crews access to the sewer for routine maintenance activities, without coming into contact with potentially contaminated soil. Gates will be provided in the fence to provide direct access to the above maintenance locations to avoid having to travel over the covered area. During the remedial design consideration will be given to the removal of dredge material from the existing sewer right of way, if additional material will be needed to achieve final cover contours.

7. Access agreements and deed restrictions will have to be negotiated with Onondaga County and other impacted property owners to allow the implementation of the remedy. The deed restrictions will be used to preclude activities which could potentially expose contaminated materials and to insure the integrity of the cover is maintained.

   The area where PCBs will remain will be fenced and all gates locked, with keys provided to appropriate Onondaga County agencies. The fence identified for this remedy is intended to limit accesss to the site in order to assure the integrity of the cover system is maintained. However, alternative means of limiting access or activities which could result in damage to the cover (i.e.use of ATVs) may be proposed as part of the design. The agreement negotiated for access to implement the remedy will also have to address the potentially increased costs to Onondaga County which may be associated with sewer repair or installation and future widening of Factory Avenue in the areas where PCBs remain covered at the site.

8. Since the remedy will result in dredge materials/soils with elevated levels of PCBs remaining untreated, but covered at the site, a long term monitoring program will be instituted. In addition, yearly reviews will be conducted to allow the effectiveness of the selected remedy to be evaluated and to determine whether the remedy continues to be protective of human health and the environment. This long term monitoring program will be a component of the operations and maintenance for the site and will be developed in accordance with New York State Standards, Criteria and Guidance.

9. The remedial design would include provision for the completion of a Stage 1A Cultural Resources Survey, and any additional investigations required, to be consistent with the requirements of the National Historic Preservation Act (16 U.S.C. 470).

10. An operation and maintenance program would be implemented to maintain the site and the integrity of the cover.

11. Further evaluation of the groundwater beneath the dredged material, as well as, surface water and sediments in Ley Creek would be included in the scope of work for the RI/FS for the General Motors; Fisher Guide Site.

Exhibit B

Predisposal characterization data

O'Brien & Gere Laboratories, Inc.

Analytical Results Trace Metals

Client: General Motors Corporation
Project: Ley Creek PCB Dredging Site
Proj. Desc: Syracuse, NY

Job No.: 5858.010.517
Certification NY No.: 10155

Sample: J2746
Samp. Description: OBG3,B122.5B,B127B
Units: mg/L

Collected: 07/28/98
Received: 07/28/98

Matrix: Leachate
%Solids:
Number of analytes: 8

Parameter	Result	Method	Prepared	Analyzed	QC Batch	Dilut.	Note
TCLP Arsenic	<.5	1311/6010	07/28/98	07/31/98	072998W2	6	
TCLP Barium	.7	1311/6010	07/28/98	07/31/98	072998W2	6	
TCLP Cadmium	<.1	1311/6010	07/28/98	07/31/98	072998W2	6	
TCLP Chromium	<.5	1311/6010	07/28/98	07/31/98	072998W2	6	
TCLP Lead	<.5	1311/6010	07/28/98	07/31/98	072998W2	6	
TCLP Mercury	<.0005	1311/7470	07/30/98	07/30/98	072998W1	1	
TCLP Selenium	<.1	1311/6010	07/28/98	07/31/98	072998W2	6	
TCLP Silver	<.5	1311/6010	07/28/98	07/31/98	072998W2	6	

Notes:

Date leachate created: 07/28/98

L-Estimated value

Authorized: Thomas Alexander
Date: August 4, 1998

5000 Brittonfield Parkway / Suite 300, Box 4942 / Syracuse, NY 13221 / (315) 437-0200

O'Brien & Gere Laboratories, Inc.

Analytical Results Wet Chemistry

Client: General Motors Corporation
Project: Ley Creek PCB Dredging Site
Proj. Desc: Syracuse, NY

Job No.: 5858.010.517
Certification NY No.: 10155

Sample: J2746
Samp. Description: OBG3,B122.5B,B127B

Collected: 07/28/98
Received: 07/28/98 11:05

Matrix: Solid

Parameter	Result	Units	Method	Prepared	Analyzed	QC Batch
Flashpoint	>60.	deg. C	EPA 1010		08/04/98	080498S20
Total releasable H2S	<5.0	mg/Kg Orig. wt.	EPA 9030		08/04/98	080398S25
Total releasable HCN	<.25	mg/Kg Orig. wt.	EPA 9010A	08/03/98	08/03/98	080398S25
pH	7.0	STD units	EPA 9045C		08/04/98	080498S11

Notes:

pH analyzed outside 15 minute holding time

J-Estimated value

Authorized: Thomas Alexander
Date: August 5, 1998

5000 Brittonfield Parkway / Suite 300, Box 4942 / Syracuse, NY 13221 / (315) 437-0200

O'Brien & Gere Laboratories, Inc.

Analytical Results Method: TCLP 8240

Client: General Motors Corporation
Project: Ley Creek PCB Dredging Site
Proj. Desc: Syracuse, NY

Job No.: 5858.010.517
Certification NY No.: 10155

Sample: J2747
Samp. Description: B122.5B
Instrument: HP5970 GC/MS#2
Units: mg/L
Number of analytes: 13

Collected: 07/28/98
Received: 07/28/98
Prepared: 08/03/98

Matrix: Leachate
QC Batch: 080498W1
%Solids:
Purge volume: 5 ml

Parameter	Result	Surrog Limits	Dilution	Analyzed Not
Vinyl chloride	<.10		10	08/04/98
1,1-Dichloroethene	<.050		10	08/04/98
Chlorobenzene	<.050		10	08/04/98
1,2-Dichloroethane	<.050		10	08/04/98
Chloroform	<.050		10	08/04/98
Benzene	<.050		10	08/04/98
Trichloroethene	<.050		10	08/04/98
2-Butanone	<.10		10	08/04/98
Tetrachloroethene	<.050		10	08/04/98
Carbon tetrachloride	<.050		10	08/04/98
Dibromofluoromethane (surrogate)	102.%	80-127	10	08/04/98
Toluene-d8 (surrogate)	98.%	92-120	10	08/04/98
Bromofluorobenzene (surrogate)	101.%	77-117	10	08/04/98

Notes:

Outside control limits J-Estimated value

Authorized: Thomas Alexander
Date: August 4, 1998

5000 Brittonfield Parkway / Suite 300, Box 4942 / Syracuse, NY 13221 / (315) 437-0200

O'Brien & Gere Laboratories,Inc.

Analytical Results Method: TCLP 8270

Client: General Motors Corporation
Project: Ley Creek PCB Dredging Site
Proj. Desc: Syracuse, NY

Job No.: 5858.010.517
Certification NY No.: 10155

Sample: J2746
Samp. Description: OBG3,B122.5B,B127B
Instrument: HP5972A GCMS#5
Units: mg/L
Number of analytes: 18

Collected: 07/28/98
Received: 07/28/98
Prepared: 07/29/98

Matrix: Leachate
QC Batch: 072798W4
%Solids:
Sample Size: .1 L

Parameter	Result	Surrog Limits	Dilution	Analyzed
Pyridine	<.50		1	08/04/98
1,4-Dichlorobenzene	<.10		1	08/04/98
2-Methylphenol	<.10		1	08/04/98
(3+4)-Methylphenol	<.10		1	08/04/98
Hexachloroethane	<.10		1	08/04/98
Nitrobenzene	<.10		1	08/04/98
Hexachlorobutadiene	<.10		1	08/04/98
2,4,6-Trichlorophenol	<.10		1	08/04/98
2,4,5-Trichlorophenol	<.50		1	08/04/98
2,4-Dinitrotoluene	<.10		1	08/04/98
Hexachlorobenzene	<.10		1	08/04/98
Pentachlorophenol	<.50		1	08/04/98
2-Fluorophenol (surrogate)	100.%	50-111	1	08/04/98
Phenol-d5 (surrogate)	102.%	42-126	1	08/04/98
2,4,6-Tribromophenol (surrogate)	121.%	# 72-106	1	08/04/98
Nitrobenzene-d5 (surrogate)	104.%	55-123	1	08/04/98
2-Fluorobiphenyl (surrogate)	104.%	53-113	1	08/04/98
Terphenyl-d14 (surrogate)	129.%	21-150	1	08/04/98

Notes:

Date leachate created: 07/28/98

- Outside control limits J-Estimated value

Authorized: Thomas Alexander
Date: August 4,1998

5000 Brittonfield Parkway / Suite 300, Box 4942 / Syracuse, NY 13221 / (315) 437-0200

Exhibit C

ENSYS PCB RISc ® Soil Test System Rapid Immunoassay Screen User's Guide

ENSYS INC.
ENVIRONMENTAL PRODUCTS

* For information only
Consent was given
from kit when
Actually running
Samples.

PCB RISC® SOIL TEST SYSTEM

RAPID IMMUNOASSAY SCREEN

User's Guide

IMPORTANT NOTICE

This method correctly identifies 95% of samples that are PCB-free and those containing 1 ppm or greater of PCBs. A sample that develops less color than the standard is interpreted as positive. It contains PCBs. A sample that develops more color than the standard is interpreted as negative. It contains less than 1 ppm PCBs.

This test system should be used only under the supervision of a technically qualified individual who is capable of understanding any potential health and environmental risks of this product as identified in the product literature. The components must only be used for the analysis of soil samples for the presence of polychlorinated biphenyls. After use, the kits must be disposed of in accordance with applicable federal and local regulations.

TROUBLESHOOTER GUIDE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WASH STEP

Lack of vigorous washing may result in false positives or negatives depending on whether the wash error was committed on standard or sample tubes. Solution: Make sure to wash four times vigorously, washing the whole set of 12 tubes at once.

PIPET CALIBRATION

An out-of-calibration pipet may result in false positives or negatives depending on whether the amount is greater or less than the specified transfer volume. *Solution:* Check the calibration at least daily and after any extreme mechanical shock (such as dropping). An indication that the pipet is out of calibration is if the gold barrell is loose and will turn. (When set on 30 µl there should be about a 1/4 of an inch between the white plunger and the end of the clear pipet tip.)

AIR BUBBLES IN THE PIPET

The presence of air bubbles in the pipet tip when transferring extracts may result in false positives or negatives depending on whether the error was committed on standard or sample tubes. *Solution:* Quickly examine the pipet tip each time an aliquot is withdrawn and go back to the source and take another aliquot to displace the bubble if necessary.

MIXING

Lack of thorough mixing, when instructed, can cause inconsistent results. *Solution:* Observe the times in the instructions and mix with sufficient force to ensure that the liquid is homogenous.

TIMING

It is important to follow the timing steps in the instructions carefully. The incubation step in the antibody tubes can vary a bit without harm to the tests. The color development step timing is critical and should be no less than 2 minutes and no greater than 8 minutes.

WIPING THE TUBES

Wiping of the tubes should be done before they are read in the spectrophotometer because smudges and fingerprints on the tubes can give potentially false negative readings.

MIXING LOT #'S

Never mix lots! Each kit's components are matched for optimal performance and may give inaccurate results with the components from other kits with different lot #'s. Also, NEVER mix components from different types of kits (ex: Petro kit buffer can not be used with a PAH kit).

STORAGE AND OPERATING TEMPERATURES

Temperature requirements are very important and should be strictly adhered to. This test kit should be stored at less than 80°F/27°C and operated between 40°F/4°C and 90°F/32°C.

SHELF-LIFE

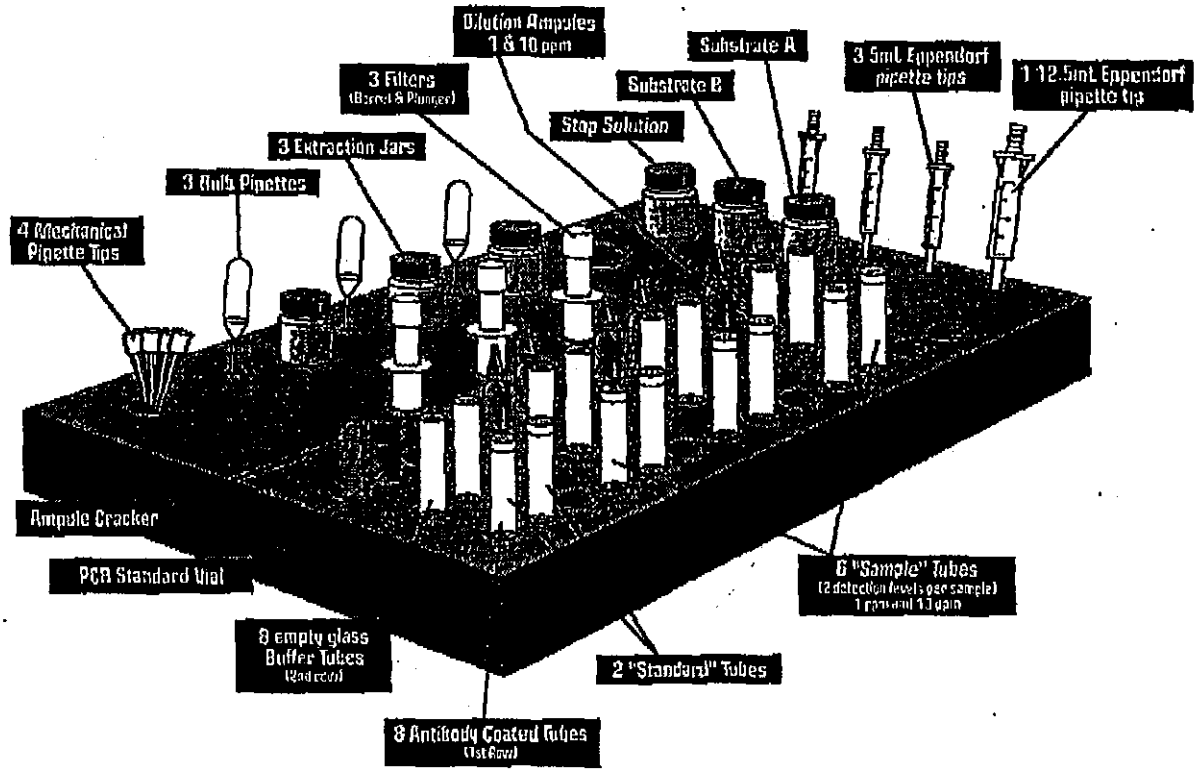
Each kit label contains the kit expiration date. To achieve accurate results, kits must be used prior to expiration.

WORKSTATION SET-UP

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WORKSTATION SET-UP

- Mechanical pipet tips
- Filter barrels & plungers
- Ampule cracker
- Glass PCB buffer tubes
- Substrate A
- Eppendorf pipet tips
- Bulb pipets
- PCB standard
- Antibody coated tubes
- Substrate B
- Extraction jars
- 1 & 10 ppm dilution ampules
- Stop Solution



Workstation shows components for 3 samples tested at 2 levels

TEST PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

- Do not attempt to run more than 12 tubes, two of which must be standards.
- Items that you will need that are not provided in the test kit include: a permanent marking pen, laboratory tissue (or paper towels), a liquid waste container, and disposable gloves.
- This User's Guide was written for analyzing soil samples for PCBs at 1 and 10 ppm. See table on page 10 for sensitivity to various aroclors.

TEST PREPARATION

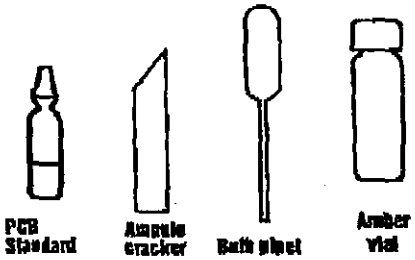
- Label all Eppendorf repeater tips. Tips can be reused for future analyses. Label the first 5mL tip "A", the second 5mL tip "B" and the third 5mL tip "Stop".
- Label the 12.5 mL tip "Buffer".



Eppendorf Tip

STANDARD PREPARATION

- Open PCB Standard ampule by slipping ampule cracker over top, and then breaking tip at scored neck. Transfer solution to empty vial with Bulb Pipets.
- Label vial with current date. Standard is usable for 2 weeks. Always cap tightly when finished using standard.
- A new PCB Standard should be opened for every 4 samples.



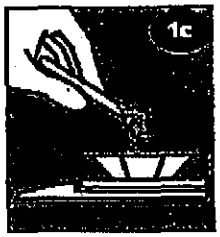
PCB Standard | Ampule cracker | Bulb pipet | Amber vial

PHASE 1

EXTRACTION & PREPARATION OF THE SAMPLE

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

WEIGH SAMPLE

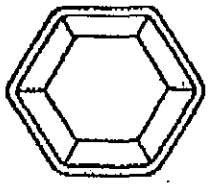


1a. Place unused weigh boat on pan balance.

1b. Press ON/MEMORY button on pan balance. Balance will beep and display 0.0.

1c. Weigh out 10 ± 0.1 grams of soil.

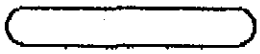
1d. If balance turns off prior to completing weighing, use empty weigh boat to retare, then continue.



Weigh Boat



Pan balance



Wooden spatula

EXTRACT PCBS



2a. Uncap extraction jar and place on a flat surface. Without contacting solvent puncture foil seal with ampule cracker or sharp object. Peel the remainder of the seal off extraction jar.

2b. Using wooden spatula, transfer 10 grams of soil from weigh boat into extraction jar.

2c. Recap extraction jar tightly and shake **vigorously** for one minute.

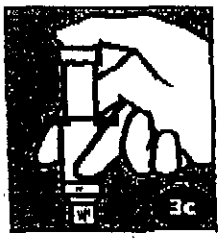
2d. Allow to settle for one minute.

Repeat steps **1a - 2c** for each sample to be tested.



Extraction jar

FILTER SAMPLE



3a. Disassemble filtration plunger from filtration barrel.

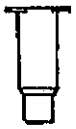
3b. Insert bulb pipet into top (liquid) layer in extraction jar and draw up sample. Transfer at least ½ bulb capacity into filtration barrel. **Do not use more than one full bulb.**

3c. Press plunger firmly into barrel until adequate filtered sample is available (place on table and press if necessary).

Repeat steps **3a - 3c** for each sample to be tested.



Filtration plunger



Filtration barrel



Bulb pipet

READ TO AVOID COSTLY MISTAKES

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

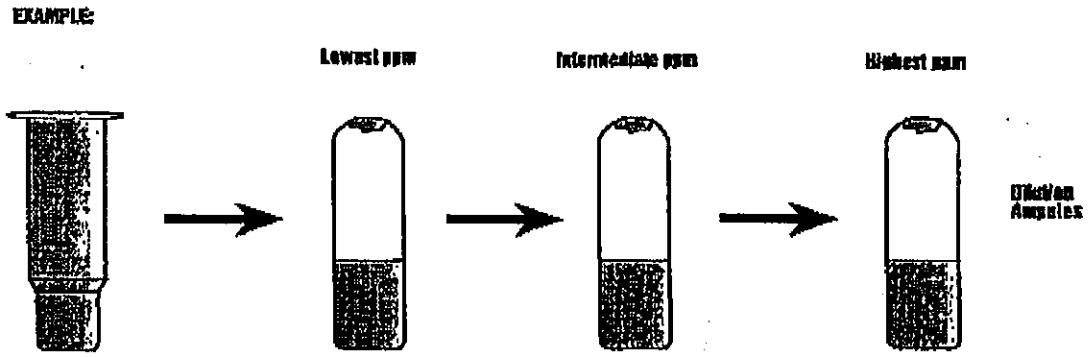
SAMPLE DILUTION PROGRAM

1. The sample dilution procedure on the next page is for standard detection levels. The following diagram represents the sample dilution procedure for all other detection levels.

2. Your kit may include extra dilution ampules to reach high detection levels.

3. **EVERY AMPULE PROVIDED MUST BE USED!**

If there are any questions concerning the dilution procedure please call Technical Services before running the samples to help avoid costly mistakes.
1-800-242-7472 or 919-941-5509.



NOTE: Your Kit may include additional ampules in order to achieve your test levels. Always transfer filtered sample to the dilution ampule labeled with the lowest PPM level and then transfer from this ampule to the next higher level dilution tube.

PHASE 2

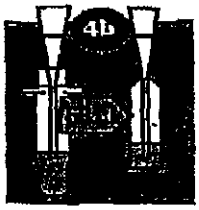
SAMPLE & STANDARD PREPARATION

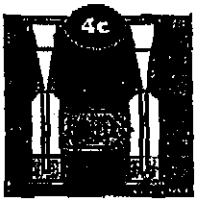
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

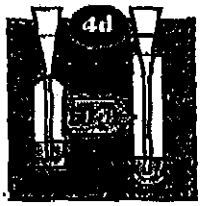
READ BEFORE PROCEEDING

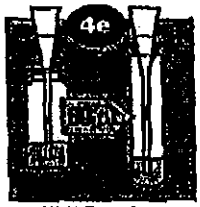
- Label the plastic antibody coated tubes with a permanent marking pen.
- When using the mechanical pipet always withdraw and dispense below the liquid level.
- "Shake tubes" means to thoroughly mix the contents with special care not to spill or splash.

DILUTE SAMPLES AND STANDARDS









4a. Set the Eppendorf Repeater on 4, assemble the "Buffer" tip and fill with Buffer.

4b. Dispense 1 mL of Buffer into each glass buffer tube.

4c. Open 1 and 10 ppm dilution ampules by slipping ampule cracker over top, and then breaking top at scored neck.

4d. Withdraw 60 µL of filtered sample using mechanical pipet and dispense below the liquid level in "1 ppm" dilution ampule. Gently shake ampule from side to side for 5 seconds to mix thoroughly.

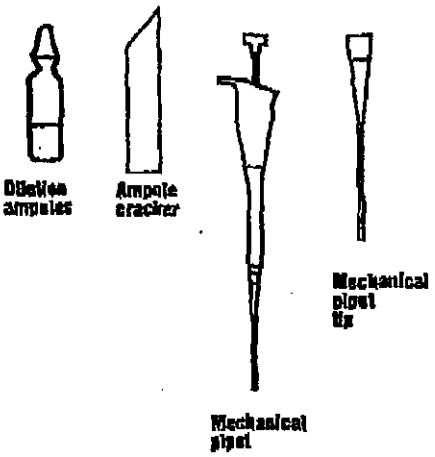
4e. Withdraw 60 µL from the "1 ppm" dilution ampule using mechanical pipet and dispense below the liquid level in "10 ppm" dilution ampule. Gently shake ampule from side to side for 5 seconds to mix thoroughly.

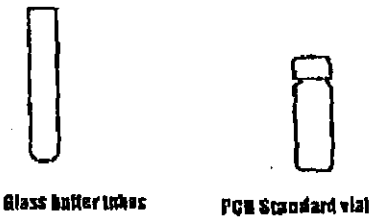
4f. Transfer 60 µL from each dilution ampule into glass buffer tubes. Always wipe tip after dispensing into buffer tube.

4g. Change pipet tip and repeat **4d - 4f** for each sample.

4h. Assemble new pipet tip on mechanical pipet and transfer 60 µL from Standard vial into two glass buffer tubes. Immediately replace cap on PCB Standard vial.

4i. Shake all glass buffer tubes for 5 seconds.





PHASE 3
THE IMMUNOASSAY
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

TRANSFER FROM DILUTION TUBE TO ANTIBODY COATED TUBE



5a. Set timer for 10 minutes.

5b. Working left to right in the workstation:

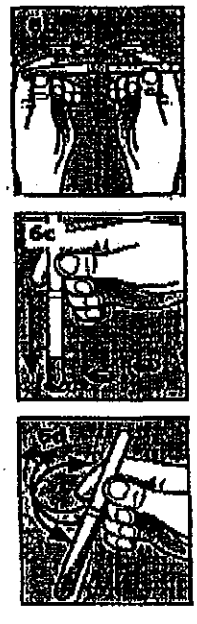
1. Fit all antibody coated tubes firmly on top of all corresponding glass buffer tubes.
2. Start timer and immediately invert all connected tube pairs so that the liquid is poured into the antibody coated tubes. Return the tube pairs to the appropriate workstation row making sure the larger (antibody coated) tube is on the bottom.

5c. Invert all tube pairs several more times making sure the pair is returned to the workstation with the larger (antibody coated) tube on the bottom.

5d. Disconnect and discard the smaller (dilution) tubes. It is not important to worry about drops of liquid adhering to lips of tubes..

5e. Place conjugate tubes behind antibody tubes in workstation. Remove grey caps and discard.

TRANSFER OF CONJUGATE TO ANTIBODY COATED TUBES



AFTER 10 MINUTES, IMMEDIATELY:

6a. Set timer for 5 minutes.

6b. Working left to right in the workstation:

Start timer and immediately:

Dissolve the conjugate pellets by horizontally connecting the antibody coated tubes and conjugate tubes and tilt the liquid up to pour it onto the conjugate.

6c. Return the connected tubes to the appropriate workstation row making sure the larger (antibody coated) tube is on the bottom. It is important that this step is completed within one minute for all tubes.

6d. In order to adequately mix solution, invert all connected tube pairs several more times making sure that the pair is returned to the workstation with the larger (antibody coated) tube on the bottom.

6e. Disconnect and discard the conjugate tubes. It is not important to worry about the loss of liquid adhering to lip of tubes.

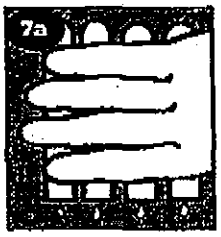
PHASE 4
INTERPRETATION

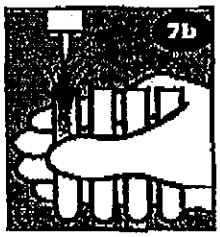
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING
WASH PROCEDURE

- An accurate test requires a virgorous wash accomplished by directing a strong stream into the antibody coated tubes.
- The wash solution is a harmless, dilute solution of detergent.

WASH



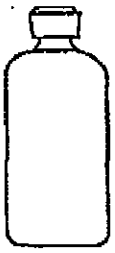


7a. After the 5 minute incubation (a total of 15 minutes), empty antibody coated tubes into liquid waste container.

7b. Wash antibody coated tubes by vigorously filling and emptying a total of 4 times.

7c. Tap antibody coated tubes upside down on paper towels to remove excess liquid. Residual foam in the tubes will not interfere with test results.

Note: When running up to 12 antibody coated tubes, tubes can be washed in two groups - one group immediately following the other group.



Wash bottle

PHASE 3
THE IMMUNOASSAY

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

COLOR DEVELOPMENT

8a. Set the Eppendorf Repeater on 2, assemble the "A" tip and fill with Substrate A (TMB, yellow label).

8b. Dispense once (200 µL) into each antibody coated tube.

8c. Set timer for exactly 2 1/2 minutes.

8d. Assemble "B" tip, fill with Substrate B, start timer, and dispense once (200 µL H_2O_2, green label) into each antibody coated tube.

8e. Shake all tubes for 5 seconds. Solution will turn blue in some or all antibody coated tubes.

8f. Assemble "Stop" tip, fill with Stop Solution (red label), and stop reaction at end of 2 1/2 minutes by dispensing once (200 µL) into each antibody coated tube.

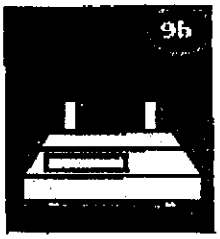


AROCLOR SENSITIVITY

Aroclor	Lowest Detection Level
1248	1.0 ppm
1254	0.5 ppm
1260	0.5 ppm
1242	2.0 ppm
1232	4.0 ppm
1016	4.0 ppm

PHASE 4
ANALYSIS OF RESULTS
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

SELECT STANDARD



9a. Wipe outside of all antibody coated tubes.

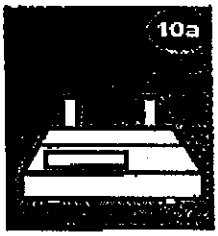
9b. Place both Standard tubes in photometer.

9c. Switch tubes until the photometer reading is negative or zero. Record reading.

If reading is greater than - 0.3 in magnitude, results are outside QC limits. Retest the sample(s).

9d. Remove and discard tube in right well. The tube in the left well is the conservative standard.

MEASURE SAMPLE



10a. Place 1 ppm tube in right well of photometer and record reading.

If photometer reading is negative or zero, PCBs are present.

If photometer reading is positive, concentration of PCBs is less than 1 ppm.

10b. Place 10 ppm tube in right well of photometer and record reading.

If photometer reading is negative or zero, PCBs are present.

If photometer reading is positive, concentration of PCBs is less than 10 ppm.

QUALITY CONTROL

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

System Description

Each PCB RISc Soil 12 Test Case contains enough material to perform 12 test samples, each at two detection levels.

The PCB RISc Soil Test is divided into four phases. The instructions and notes should be reviewed before proceeding with each phase.

Hotline Assistance

If you need assistance or are missing necessary Test System materials, call toll free: 1-800-242-RISC (7472).

Validation and Warranty Information

Product claims are based on validation studies carried out under controlled conditions. Data has been collected in accordance with valid statistical methods and the product has undergone quality control tests of each manufactured lot.

PCB-free soil and soil containing 1 ppm or greater of PCBs were tested with the EnSys PCB RISc analytical method. The method correctly identified 95% of these samples. A sample that has developed less color than the standard is interpreted as positive. It contains PCBs. A sample that has developed more color than the standard is interpreted as negative. It contains less than 1 ppm PCBs.

The company does not guarantee that the results with the PCB RISc Soil 24 Test Case will always agree with instrument-based analytical laboratory methods. All analytical methods, both field and laboratory, need to be subject to the appropriate quality control procedures.

EnSys, Inc. warrants that this product conforms to the descriptions contained herein. No other warranties, whether expressed or implied, including warranties of merchantability and of fitness for a particular purpose shall apply to this product.

EnSys, Inc. neither assumes nor authorizes any representative or other person to assume for it any obligation or liability other than such as is expressly set forth herein.

Under no circumstances shall EnSys, Inc. be liable for incidental or consequential damages resulting from the use or handling of this product.

How It Works

Standards, Samples, and color-change reagents are added to test tubes, coated with a chemical specific to PCBs. The concentration of PCBs in an unknown Sample is determined by comparing its color intensity with that of a Standard.

Note: PCB concentration is inversely proportional to color intensity; the lighter the color development of the sample, the higher the concentration of PCBs.

Quality Control

Standard precautions for maintaining quality control:

- Do not use reagents or test tubes from one Test System with reagents or test tubes from another Test System.
- Do not use the Test System after any portion has passed its expiration date.
- Do not attempt the test using more than 12 antibody coated tubes (two of which are Standards) at the same time.
- Do not exceed incubation periods prescribed by the specific steps.
- Always follow the procedure in this user's guide.
- Use EPA Method 8080 or Code of Federal Regulations Title 40, Part 136, Appendix A, Method 680 to confirm results.

Storage and Handling Precautions

- Wear protective gloves and eyewear.
- Store kit at room temperature and out of direct sunlight (less than 80°F).
- Keep aluminized pouch (containing unused antibody coated tubes) sealed when not in use.
- If Stop Solution or liquid from the extraction jar comes into contact with eyes, wash thoroughly with cold water and seek immediate medical attention.
- Standard Solution contains PCBs. Test samples may contain PCBs. Handle with care.

REPEATER-PIPET & MECHANICAL PIPET

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

HOW TO OPERATE THE REPEATER PIPET

To Set Or Adjust Volume

To determine the pipetting volume, the dial setting (1-5) is multiplied by the minimum pipetting volume of the tip.

To Assemble Pipet Tip

Slide filling lever down until it stops. Then raise the locking clamp and insert the tip until it clicks into position. Be sure the tip plunger is fully inserted into the barrel before lowering the locking clamp to affix the tip in place.

To Fill Tip

With tip mounted in position on pipet, immerse end of tip into solution. Slide filling lever upward slowly.

To Dispense Sample

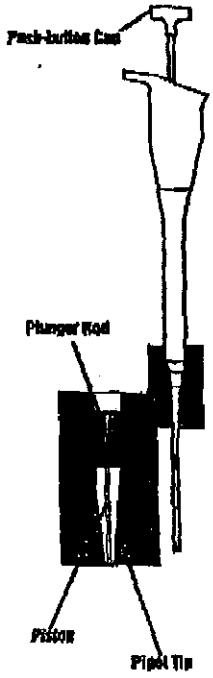
Check the volume selection dial to ensure pipetting volume. Place tip inside test tube so that tip touches the inner wall of tube. Completely depress the pipetting lever.

To Eject Tip

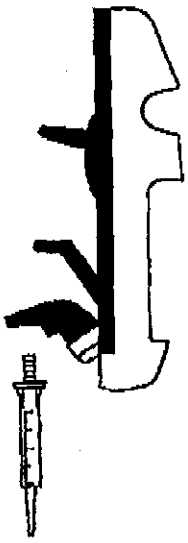
Empty tip of any remaining solution into appropriate container. Raise locking clamp upward, and remove the tip.

For additional information regarding operation and use of repeater, please refer to your Repeater pipet manual.

Mechanical Pipet



Repeater Pipet



HOW TO OPERATE THE MECHANICAL PIPET

To Set Or Adjust Volume

Remove push-button cap and use it to loosen volume lock screw. Turn lower part of push-button to adjust volume up or down. Meter should read "060". Tighten volume lock screw and replace push-button cap.

To Assemble Pipet Tip

Slide larger mounting end of pipet tip onto end of pipet. Holding tip in place, press push-button until plunger rod enters pipet tip. **Ensure no gap exists between piston and plunger rod.**

To Withdraw Sample

With tip mounted in position on pipet, press push-button to first stop and hold it.

Place tip at bottom of liquid sample and slowly release push-button to withdraw measured sample. Ensure that no bubbles exist in liquid portion of sample. If bubbles exist, dispense sample and re-withdraw sample.

To Dispense Sample

Place tip into dispensing vessel (immersing end of the tip if vessel contains liquid) and slowly press push-button to first stop. (Do not push to second stop or tip will eject).

Remove tip from vessel and release push-button.

To Eject Tip

Press push-button to second stop. Tip is ejected.

For additional information regarding operation and use of pipet, please refer to your pipet manual.

ON-SITE QUALITY CONTROL/QUALITY ASSURANCE RECOMMENDATIONS EnSys RISC® TEST SYSTEM

Please read the following before proceeding with field testing.

SAMPLING

The result of your screening test is only as valid as the sample that was analyzed. Samples should be homogenized thoroughly to ensure that the 10 grams you remove for field testing is representative of the sample as a whole. All other applicable sample handling procedures should be followed as well.

PRIOR TO TESTING SAMPLES

Carefully follow the instructions in the User's Guide included with every test kit. This is the key element in obtaining accurate results. In addition, store your unused test kits at room temperature and do not use them past their expiration date (see label on each test kit).

INTERNAL TEST QC

Two standards are analyzed with each sample to provide internal test system quality control. With both standards inserted in the photometer, a valid test is indicated when the magnitude of the displayed number (irrespective of the sign, + or -) is less than the value given in the User's Guide. Test runs resulting in a greater number should be repeated to ensure valid conclusions.

QA/QC

The validity of field test results can be substantially enhanced by employing a modest, but effective QA/QC plan. EnSys recommends that you structure your QA/QC plan with the elements detailed below. These have been developed based on the data quality principles established by the U.S. Environmental Protection Agency.

A. **Sample Documentation**
   1. Location, depth
   2. Time and date of collection and field analysis

B. **Field analysis documentation** - provide raw data, calibration, any calculations, and final results of field analysis for all samples screened (including QC samples)

C. **Method calibration** - this is an integral part of EnSys RISC® immunoassay tests; a duplicate calibration is performed for each set of samples tested (see the instructions in the User's Guide)

D. **Method blank** - analyze methanol from the extraction jar.

E. **Site-specific matrix background field analysis** - collect and field analyze uncontaminated sample from site matrix to document matrix effect

F. **Duplicate sample field analysis** - field analyze duplicate sample to document method repeatability; at least one of every 20 samples should be analyzed in duplicate

G. **Confirmation of field analysis** - provide confirmation of the quantitation of the analyte via an EPA-approved method different from the field method on at least 10% of the samples; choose at least two representative samples testing above the action level; provide chain of custody and documentation such as gas chromatograms, mass spectra, etc.

H. **Performance evaluation sample field analysis (optional, but strongly recommended)** - field analyze performance evaluation sample daily to document method/operator performance

I. **Matrix spike field analysis (optional)** - field analyze matrix spike to document matrix effect on analyte measurement

FURTHER QUESTIONS?

EnSys technical support personnel are always prepared to discuss your quality needs to help you meet your data quality objectives.

SDI

STRATEGIC DIAGNOSTICS INC.
U.S. Price Schedule: Remediation Products

Application Format Guide	D TECH	EnSys	EnviroGard	Ohmicron
Technology	latex particle	coated tube	coated tube	magnetic particle
Data Format	qualitative & semi-quantitative	semi-quantitative	semi-quantitative	quantitative & semi-quantitative
Sample Throughput	1 - 4 samples / run	1 - 10 samples / run	1 - 14 samples / run	1 - 50 samples / run
Analysis Time	20 minutes / run	30 minutes / run	30 minutes / run	60 minutes / run

[1] SW-846 Draft method status. Proposed method status expected with Update IV.

EPA SW-846 Method Designations		D TECH	EnSys	EnviroGard	Ohmicron
4010	PCP		Soil & Water		Soil
4015	2,4-D			Soil & Water	Soil & Water
4020	PCB	Soil	Soil & Oil	Soil	Soil
4030	TPH		Soil	Soil	Soil (SCHC)
4035	PAH		Soil (APAH)	Soil (APAH)	Soil (APAH) Soil (CPAH)
4040	Toxaphene			Soil	
4041	Chlordane			Soil	
4042	DDT			Soil	
4050	TNT	Soil & Water			Soil & Water
4051	RDX	Soil & Water			
4670	Triazines				Water [1]
8510	RDX		Soil [1]		
8515	TNT		Soil		

SPECIAL ORDER ITEMS:
Products denoted as "Special Order Items" may be subject to significant availability lead times, minimum order quantities, &/or special pricing considerations. Please call SDI Customer Services to discuss availability & pricing.

ORDERING: STRATEGIC DIAGNOSTICS INC. 111 Pencader Drive, Newark, DE 19702 U.S.A.
Phone: (800) 544-8881 or (302) 456-6789 Fax: (302) 456-6782

TERMS & CONDITIONS:

- All prices are F.O.B. Newark, DE. Prices are subject to change without notice.
- Payment terms are net 20 days from date of invoice on approved accounts.
- A 1.5% per month service charge will be applied to all past due notices.
- All returns require a preapproved Return Goods Authorization (RGA) number.
- Refunds or credits are not provided on unused or expired kits.

WARRANTY TERMS & CONDITIONS:

- SDI's products are manufactured under strict quality control guidelines and are warranted to be free from defects in materials and workmanship. New instruments and related non-expendable items are warranted for one year from date of shipment against defective materials or workmanship under normal use and service.
- Warranty obligation is limited to repair or replacement of the defective product or to refund of the purchase price, at the discretion of SDI. Other warranties, express or implied, are disclaimed. SDI's liability under any warranty claim shall not exceed the refund of the purchase price paid by the customer. Under no circumstances shall SDI be liable for special, indirect or consequential damages.

4/28/98

SDI Products for Remediation Applications

Immunoassay Test Kit Product Line Guide

Application Format Guide	D TECH™	EnSys	EnviroGard™	RaPID Assay
Technology	latex particle	coated tube	coated tube	magnetic particle
Data Format	qualitative & semi-quantitative	semi-quantitative	semi-quantitative	quantitative & semi-quantitative
Sample Throughput	1 - 4 samples / run	1 - 10 samples / run	1 - 14 samples / run	1 - 50 samples / run
Analysis Time	20 minutes / run	30 minutes / run	30 minutes / run	60 minutes / run

Application Matrix & Detection Limits

Analyte	Application	D TECH™	EnSys	EnviroGard™	RaPID Assay™
PCB	Soil Water Wipes Concrete/Cable Oil	0.5 ppm n/a 10 µg/wipe n/a n/a	0.5 ppm 50 ppb* 5 µg/wipe 0.5 ppm 3 ppm	< 1 ppm < 1 ppm <10 µg/wipe n/a n/a	< 0.5 ppm 0.2 ppb < 5 µg/wipe 0.5 ppm n/a
BTEX	Soil Water	2.5 ppm 0.6 ppm	n/a n/a	2 ppm 0.1 ppm	0.9 ppm 0.09 ppm
TPH	Soil Water	25 ppm (as Jet A) 6ppm (as Jet A)	10 ppm (as fuel) n/a	5 ppm (as HHO) 0.1 ppm (as HHO)	10 ppm (as fuel) 1 ppm (as fuel)
PAH	Soil Water	0.6 ppm 8 ppb	1 ppm 15 ppb*	< 1 ppm < 2 ppb	0.2 ppm 0.9 ppb
Carcinogenic PAH	Soil Water	n/a n/a	n/a n/a	n/a n/a	10 ppb 0.2 ppb
TNT	Soil Water	0.5 ppm 5 ppb	0.7 ppm 0.9 ppb*	n/a n/a	0.25 ppm 0.07 ppb
RDX	Soil Water	0.5 ppm 5 ppb	Non-Immunoassay 0.8 ppm 3.8 ppb*	n/a n/a	n/a n/a
PCP	Soil Water	n/a n/a	0.5 ppm 5 ppb	n/a n/a	0.1 ppm 0.06 ppb
Pesticides	Kits available for numerous pesticide analytes in soil & water matrices. Contact SDI for the MDL's for various analytes.				

* Protocol Not Validated.

STRATEGIC DIAGNOSTICS INC. - 111 PENCADER DRIVE, NEWARK, DE 19702 - Phone: (800) 544-8881 - Fax: (302) 456-6782

Exhibit D

Vegetation mix

DTE
MDM
MS

File 5858 04C

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
50 Wolf Road, Albany, New York 12233

John P. Cahill
Commissioner

telex

TO: Maureen Sallinger, O'Brien and Gere

FROM: Wayne Mizerak, DEC Albany

DATE: July 22, 1998

RE: Ley Creek Site

Number of Pages 4 **(including cover page)**

For verification or problems contact Tracey DeMarco at

Remedial Action Section A
Bureau of Western Remedial Action
Division of Hazardous Waste Remediation

phone: 518/457-4343
fax: 518/457-3972

Maureen,

Attached are some recommendations for seed mix, seed application, and maintenance of the resulting vegetative cover. If there are any questions, please call me at the above number.

Wayne Mizerak

From: Emmy Thomee
To: NYSDEC0.Remediat.wjmizera
Date: 7/22/98 8:38am
Subject: Landfill Cap Planting Recommendattions for Landfill Caps - from USFWS

Wayne - Got these which apply to Upstate NY. I will run a copy down to you. However, it does not include the precise recommendations on site prep. (soil, use of herbicides before seeding,seed bed prep.); seed application (timing, type of seeder drill and depth to plant, landroller, hydroseeder/mulcher type, bulldozer, running parallel to ground contours to prevent erosion); or management of the cap (time and frequency of mowing to what height for first three seasons to establish plantings and reduce weed invasion) which the New Jersey version does.

USFWS recommends they be called before work is started, at 607/753-9334. The contractor can get the above information from them then.

The details should be included in, or appended to the design document.

Thank you very much, Emmy

CC: REG71.Cortland.rjnolan

The U. S. Fish and Wildlife Service generally recommends the following seed mixture for planting on landfill caps and other relatively dry areas which are being developed in upstate New York. The Service is willing to assist in the development of more specific recommendations and we recommend that the New York Field Office be contacted prior to any work being initiated. Our phone number is (607) 753-9334.

The selection of vegetative cover is based on two primary objectives. First, to select vegetation that will stabilize the landfill cap soil cover, not negatively impact the deeper layers of the cap, will grow well in the site locality and will require minimum fertilization (legumes eliminate the need for nitrogen - the primary constituent in most fertilizers) and maintenance. Second, to have the selected vegetation provide good wildlife habitat with an emphasis on migratory birds.

The plants selected, minimum seeding rates (maintain proportion if rates are increased) and specific purpose for inclusion follow:

SPECIES	POUNDS PER ACRE
White Clover (*Trifolium repens*)	5
Lancer perennial pea (*Lathyrus latifolius*)	20
Perennial ryegrass (*Lolium perenne*)	10
Timothy grass (*Phleum pratense*)	5
Orchard grass (*Dactylis glomerata*)	5
Smooth bromegrass (*Bromus inermis*)	5

Planting should occur in early spring, no later than June 1st in most cases. The soil pH should be between 5 and 8.

White Clover (*Trifolium repens*) is a thick growing perennial legume which has a relatively shallow root system (for clover), exhibits good soil holding characteristics and is relatively tolerant of drought conditions. It adds diversity to the legume portion of the seed mixture recommended and provides forage and cover for grassland birds.

"Lancer perennial pea (*Lathyrus latifolius*) is a legume which is used for erosion control, often on steep areas. It has excellent drought tolerance, and provides a thick, viney mat which helps resist erosion and provides good bird habitat. There is also a high aesthetic value to this species since it blooms continuously for 6 - 8 weeks. The blooms are attractive to butterflies, honey bees, and hummingbirds and also should result in a good seed crop for birds. Seeding rate and proportion of the total is set to make this the primary cover type.

Perennial ryegrass (*Lolium perenne*) is a early season, fast growing grass which is used in this mixture as a nursery crop for the other species which are slower growing. For the first several years it should produce a good source of seeds for migratory birds. Seeding rate is set to fulfill this species roll as a nursery crop.

Postit® Fax Note 7671	Date	# of pages ▶
To Emmy Tomey	From Ray Nolan	
Co./Dept. Albany	Co.	
Phone #	Phone # 607 753-3095 x 224	
Fax #	Fax # (607) 753-8532	

37 P.002

Timothy grass (*Phleum pratense*) is a good soil holder which works well in legume mixtures. It produces large clumps near its base which provide nesting habitat for ground nesting birds.

Orchard grass (*Dactylis glomerata*) is a persistent long lived bunch grass which is adapted to well drained soils. It does well in legume mixtures and like the Timothy and Smooth bromegrass will provide habitat for ground nesting birds.

Smooth bromegrass (*Bromus inermis*) is a long lived sod forming perennial grass which works well in well drained fine textured soils. It has good seed heads and forms a dense near-ground cover which is good for erosion control and food and cover for ground nesting birds.

Seeding rates for the last three species are set to provide a diversity of cover and food source for nesting birds while meeting the need to protect the cap soil cover.