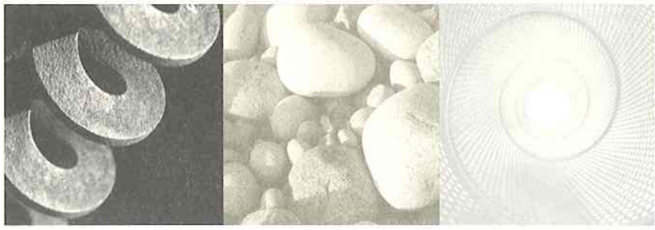

GEI Consultants

Geotechnical
Environmental
Water Resources
Ecological

Final Drainage Network Rehabilitation Interim Remedial Measure Completion Report

Operable Unit No. 3
Bay Shore/Brightwaters Former MGP Site

Town of Islip, New York
Suffolk County, Long Island, New York
AOC Index No. D1-0001-98-11

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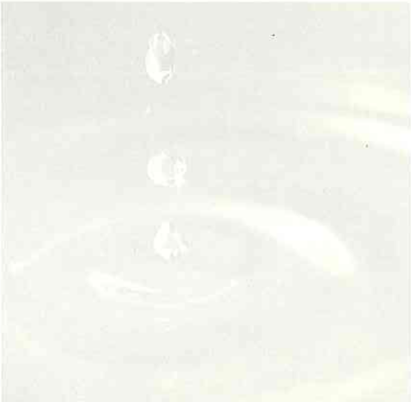

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Abbreviations and Acronyms

Alpha	Alpha Labs
AOC	Administrative Order on Consent
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CAMP	Community Air Monitoring Plan
CB	Catch Basin
CIPP	Cured-in-Place-Pipe
DER	Department of Environmental Remediation
ELAP	Environmental Laboratory Approval Program
EPA	United States Environmental Protection Agency
F&N	Fenley and Nicol Environmental
GEI	GEI Consultants, Inc.
HASP	Health and Safety Plan
IRM	Interim Remedial Measure
LILCO	Long Island Lighting Company
MGP	Manufactured Gas Plant
MH	Manhole
MSDS	Material Safety Data Sheet
NASSCO	National Association of Sewer Service Companies
NYCRR	New York Code of Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OU-1	Operable Unit Number 1
OU-3	Operable Unit Number 3
PAHs	Polycyclic Aromatic Hydrocarbons
Pengat	Pengat Technical Inspections, Inc.
PID	Photoionization detector
PVC	polyvinyl chloride
PPM	Progressive Pipe Management
RI	Remedial Investigation
SCG	Standards, Criteria, or Guidance
SVOC	Semivolatile Organic Compound
TOI	Town of Islip
VOC	Volatile Organic Compound

1. Introduction

This Interim Remedial Measure (IRM) Completion Report presents a summary of the drainage network rehabilitation that was completed by National Grid within Operable Unit No. 3 (OU-3) of the Bay Shore/Brightwaters former Manufactured Gas Plant (MGP) site. The IRM was completed in accordance with the New York State Department of Environmental Conservation (NYSDEC) approved *Draft Drainage Network Rehabilitation IRM Work Plan* dated April 17, 2008. The IRM was developed in accordance with the factors set forth in Title 6 of the New York Code of Rules and Regulations Part 375 (6 NYCRR Part 375), NYSDEC *Draft DER-10* [Department of Environmental Remediation] *Technical Guidance for Site Investigation and Remediation*, and the Modification of the Administrative Order on Consent (Index Number D1-0001-98-11) between National Grid and the NYSDEC for the Bay Shore/Brightwaters former MGP site.

The IRM consisted of the rehabilitation of a portion of the drainage network located on Cooper Lane and Lanier Lane within the Town of Islip (TOI), New York (**Figure 1**). The IRM was performed to mitigate both nuisance odors and the potential for impacted groundwater to enter the catch basin network in the vicinity of OU-3.

The IRM was conducted by National Grid, under the guidance of NYSDEC. Fenley and Nicol Environmental (F&N) and Progressive Pipe Management (PPM) provided contracting services. Pengat Technical Inspections, Inc. (Pengat) was subcontracted by PPM to perform pipe inspections and cured in place pipe (CIPP) rehabilitation. GEI Consultants, Inc. (GEI) provided the IRM design, construction quality assurance oversight, and the community air monitoring program (CAMP).

1.1 Site Description

The Bay Shore MGP began operations in 1889 on the OU-1 parcel. The MGP later expanded to include the Brightwaters Yard, the OU-3 source area. The plant was operated by Mutual Gas and Light Company, The Suffolk Gas and Electric Light Company, and later the Long Island Lighting Company (LILCO) in 1918. LILCO operated the plant from 1918 to approximately 1973 when most of the facilities were demolished. In 1998, KeySpan acquired the former MGP property through a merger of LILCO and Brooklyn Union Gas Company. In 2007 National Grid acquired KeySpan.

OU-3 is depicted in **Figure 1** and includes a mixture of residential and light commercial properties. The OU-3 dissolved-phase groundwater plume appears to migrate south to southeast from the Brightwaters Yard in the direction of local groundwater flow.

The Remedial Investigation (RI) and subsequent groundwater sampling events have bounded the width of the plume ranging from approximately 200 feet near the source area to 100 feet near the discharge point. The total length of the plume as defined in the RI is estimated to be approximately 1,400 feet extending from OU-3 to the discharge point at O-Co-Nee Pond.

In 2007, National Grid conducted an investigation of the storm sewer drainage network within the OU-3 area. The investigation consisted of an evaluation of the existing catch basin network, a zNose® odor screening, two rounds of catch basin and ambient air sampling, and catch basin sediment sampling. The investigation did not identify any locations where the catch basins appear to be influencing ambient air within the community. However, elevated benzene, toluene, ethylbenzene, and xylene (BTEX) concentrations were observed within two catch basins, which may be attributed to possible groundwater infiltration from the deterioration of the aging catch basin structures. Findings of these investigations are further summarized in **Section 2**.

1.2 Summary of Proposed IRM

National Grid proposed rehabilitating the storm sewer drainage network to mitigate the potential for groundwater infiltration into the system. The proposed rehabilitation included the replacement of existing drainage structures and using CIPP lining techniques to rehabilitate existing piping and cleanout structures. A summary of the proposed IRM is shown in **Figure 2**.

1.2.1 Drainage Structure Replacement

National Grid proposed to replace two catch basins (CB-40 and CB-41) and one manhole (MH-1) located within the OU-3 offsite groundwater plume. CB-40, CB-41 and MH-1 were aging structures constructed of brick and mortar and were being infiltrated by impacted groundwater. The replacement of these structures with impervious pre-cast concrete structures mitigates the potential for impacted groundwater infiltration.

1.2.2 Drainage Piping and Structure Rehabilitation

National Grid proposed to rehabilitate the existing drainage piping located between MH-1 and CB-50 using trenchless lining technology. The CIPP process involves placing a flexible, resin saturated liner within an existing pipe between to access structures. The liner is then inflated with steam and the pressure and heat bonds and cures the liner to the existing pipe creating a continuous, structurally sound, new pipe within the existing pipe. National Grid chose this method of rehabilitation because of its limited impact to the community.

2. Investigation Summary

National Grid conducted an investigation that consisted of an evaluation of the existing catch basin network, a zNose® odor screening, two rounds of catch basin and ambient air sampling (March 2007 and August 2007), and catch basin sediment sampling. The results of the investigation were presented in a summary report titled *Storm Sewer and Catch Basin Investigation Summary Report*, dated November 15, 2007. The conclusions and recommendations from this report are summarized below.

2.1 Catch Basin Sediment Sampling

The NYSDEC requested that sediments within the sampled catch basins be collected and analyzed as part of this investigation to determine if the OU-3 groundwater plume is impacting the sediments within the catch basins. Samples were collected and analyzed for volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). The results of the analytical sampling are presented in **Table 1**.

Polycyclic aromatic hydrocarbons (PAHs) were detected in the catch basin sediments at each location. PAH exceedances of the NYSDEC Standards, Criteria, or Guidance (SCG) values were observed at the upgradient catch basin location CB-77, as well as at catch basin locations CB-6, CB-26, CB-37, CB-38, CB-40, CB-41 and CB-50. There were no exceedances at CB-11. There was no recoverable sediment located within the sidegradient catch basin location CB-64, therefore it was not sampled. PAHs contamination is often associated with MGP residuals. However, several studies by EPA and others have indicated that urban road runoff is a significant source of PAHs in urban environments.

2.2 Catch Basin and Ambient Air Sampling

One catch basin air sample and one ambient air sample were collected at each catch basin identified above. Catch basin samples were collected from approximately 1 foot above the bottom of each catch basin. Ambient air samples were collected from the presumed breathing zone of a young child (approximately 3 feet aboveground) adjacent and downwind to each of the catch basins. Ambient air samples were collected using individually cleaned laboratory certified 6-liter SUMMA canisters fitted with 1-hour regulators. Catch basin samples were collected using a 6-liter SUMMAs and 1-hour regulators attached to inert Teflon tubing of laboratory or food grade quality. The Teflon tubing was lowered into the catch basin to approximately 1 foot above the bottom of the catch basin or any standing water surface.

The results of the catch basin and ambient air sampling were compared to the 95th percentile within Table C1 of the New York State Department of Health (NYSDOH) 2003: Study of Volatile Organic Chemicals in Air of Fuel Oil Heated Homes. Background values for naphthalene are from the NYSDOH 1997 Control Home Database presented in Table C3 of the NYSDOH 2006 Guidance. This comparison is presented in **Table 2** and **Figure 3**. For each sample location, the analytical results from the catch basin sample and the adjacent air sample are presented side by side for comparison.

National Grid did not identify any locations where the catch basins appear to be influencing ambient air within the community. However, elevated BTEX concentrations were observed within catch basins CB-40 and CB-41 during both sampling events. The elevated BTEX concentrations may be attributed to possible groundwater infiltration from the deterioration of the aging catch basin structures. Catch basin air quality located downgradient from CB-40 and CB-41 does not seem to be affected. Catch basins CB-35, CB-36, CB-37, CB-38, CB-39 and CB-50 were identified by local residents as possible sources of odor. These catch basins are downgradient and interconnected with catch basins CB-40 and CB-41. Three of these catch basins were sampled (CB-37, CB-38, and CB-50) and there were no exceedances of the NYSDOH 95th percentile background concentrations.

3. IRM Summary

The IRM at the Site consisted of the rehabilitation of the stormwater drainage network in the area of the OU-3 groundwater plume. The following sections describe the work performed as part of the IRM as well as the field observations. Restoration information is summarized in **Figure 2**.

3.1 Drainage Structure Replacement

From April 21, 2008 to May 6, 2008, drainage structures CB-40, CB-41, and MH-1 and associated piping were replaced as part of the IRM by F&N. Generally, these structures were replaced in-kind and in accordance with the TOI specifications except the replaced structures bottom slab and sidewalls are monolithic to prevent groundwater infiltration. Initially, the seams between the top slab and sidewalls of the catch basins were not sealed. However, in August of 2009, these seams were sealed with hydraulic cement because groundwater infiltration was occurring due to an unusually high water table. Details of the replaced structures and piping are shown in **Figure 2**.

The drainage structures and connecting pipe were excavated and replaced in two phases, requiring a traffic lane closure within Lanier Lane during working hours. Phase 1 included the replacement of CB-40, MH-1, and connecting pipe. Phase 2 consisted of replacement of CB-41 and connecting pipe. Excavations deeper than 4 feet were supported by shoring and/or trench boxes. Material excavated below the water table, which was approximately 2.5 feet below ground surface during the work, was removed by a vacuum excavation truck. The road pavement was sawcut to minimize the disturbed area and repaired with a hot asphalt patch at the conclusion of the excavations. The piping was replaced with 12” polyvinyl chloride (PVC) pipe and sealed to the drainage structures with hydraulic cement. The excavation was then backfilled and compacted in approximate 12 inch lifts to grade.

GEI conducted a CAMP in accordance with the NYSDEC-approved *Bay Shore/Brightwaters Former Manufactured Gas Plant (MGP) and Associated Off-Site Areas Health and Safety Plan* (HASP) during excavation. On May 5, there was an exceedance of the respirable dust action levels at approximately 9:30 am which was attributed to trenching activities. This incident was isolated and mitigated. No exceedances of action levels for VOCs were detected.

Excavated soil and groundwater were transported to the Brightwaters Yard staging area at the end of each working day. Waste streams are detailed in **Section 3.3**.

3.2 Drainage Piping and Structure Rehabilitation

From June 9, 2008 to November 12, 2008, drainage piping and structures within Lanier Lane and Cooper Lane were rehabilitated by PPM. Drainage piping from MH-1 in Lanier Lane to CB-50 in Cooper Lane was rehabilitated by using CIPP lining technology. Total length of rehabilitated pipe is approximately 800 linear feet. Drainage structures MH-2, MH-3, and MH-4 were sealed with a combination of polymer and micro-silica grouts.

Video inspection of the piping network revealed leaking joints that would impair the curing process of the liner. The leaks in piping network were grouted in June and July before the CIPP process was started. During this time drainage structures MH-2, MH-3, and MH-4 were also sealed with grout.

Video inspection of the network after the grouting process revealed that a bell joint required a spot repair which was performed by F&N in September 2008.

The lining process began in October. The pipe connecting MH-4 to MH-3 was lined and cured in place using a commonly used CIPP resin that contains styrene. A photoionization detector (PID) screening the steam exhaust from the bladder detected elevated concentrations of VOCs. Because of the elevated VOC concentrations detected in the exhaust, operations were put on hold after the curing until a substitute resin could be obtained. A copy of the resin material safety data sheet (MSDS) is included in **Appendix A**. A *Guideline for the Use and Handling of Styrenated Resins in Cured-in-Place-Pipe* by the National Association of Sewer Service Companies (NASSCO) is included in **Appendix B**.

The CIPP rehabilitation was completed in November 2008 by using a resin that was based on a vinyl ester which mitigates VOC emissions from the steam exhaust. The piping network between MH-1 and MH-3, and MH-4 and CB-50 were lined and cured with NOVOC® Performance Resins brand vinyl ester based resin. Screenings of the steam exhaust during the curing process with a PID did not detect VOCs. A copy of the resin material safety data sheet (MSDS) is included in **Appendix A**.

After each liner had cured, the pipe was flushed out with water. The water was collected at CB-50 via vacuum excavation truck and transported to the Brightwaters Yard staging area. The downstream pipe leaving CB-50 was plugged to ensure that the rinse water did not wash into O-co-nee Pond. Waste streams are detailed in **Section 3.3**.

3.3 Material Management and Waste Stream Tracking

Soil, groundwater, and pipe clean-out water were generated during the IRM. Material excavated below the water table was removed by vacuum excavation trucks.

Once the truck was full, the excavated soil and groundwater was transported to the Brightwaters Yard where the groundwater was decanted from the soil and placed into a fractionalization tank. The soil was placed in a lined roll-off container for transport and disposal. Material excavated above the water table consisted of mostly asphalt and road base fill and was reused when possible. Water used to clean and flush the drainage piping network was collected in a vacuum excavation truck and placed into a fractionalization tank.

Approximately 140 cubic yards of soil was removed during the IRM and transported to the thermal desorption unit at ESMI of Keasbey, New Jersey for treatment and disposal.

Fluids generated during the IRM were transported to Bridgeport United Recycling of Bridgeport, Connecticut for treatment and disposal.

3.4 Confirmation Sampling

One catch basin air sample and one ambient air confirmation sample was collected at four locations, CB-38, CB-40, CB-41 and CB-50 in August 2009 after completion of the IRM. Samples were collected using the same methods described in *Storm Sewer and Catch Basin Investigation Summary Report* and summarized in Section 2.2.

All samples were submitted to Alpha Labs (Alpha), a New York State Environmental Laboratory Approval Program (ELAP) certified laboratory, for analysis of VOCs plus naphthalene via Modified Environmental Protection Agency (EPA) Method TO-15.

Only one catch basin location had a detection of a compound above the NYSDOH outdoor air 95th percentile background concentration. At CB-38, styrene (0.72 J ug/m3) was detected above the NYSDOH 95th percentile background concentration. This could be a result of the styrene based resin used in the CIPP rehabilitation in the section of pipe connecting MH-3 to MH-4. No ambient air samples contained compounds that exceeded this limit. Catch basin and ambient air sample results are included in **Table 2** and **Figure 2**.

4. Recommendation

The IRM replaced drainage structures with impervious pre-cast concrete structures where they intercepted the OU-3 groundwater plume boundary and used CIPP lining techniques to rehabilitate existing piping and cleanout structures outside of the plume. The drainage network rehabilitation has effectively mitigated the potential for impacted groundwater to enter the drainage network in the vicinity of the OU-3 groundwater plume. Confirmatory catch basin and ambient air samples did not contain any concentrations of the MGP-plume related analytes that exceeded the NYSDOH 95th percentile background concentrations. Elevated styrene concentration was detected in one catch basin sample, which is likely the result of the styrene resin used in some of the CIPP processes. It is recommended that no further action is necessary to mitigate groundwater infiltration within the drainage network near the OU-3 groundwater plume.

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FINAL DRAINAGE NETWORK REHABILITATION
INTERIM REMEDIAL MEASURE COMPLETION REPORT
NATIONAL GRID
OU-3 BAY SHORE/BRIGHTWATERS FORMER MGP SITE
TOWN OF ISLIP, NEW YORK
AUGUST 11, 2010

Tables

Table 1
Summary of Catch Basin Sediment Analytical Results
Drainage Network Rehabilitation - IRM Completion Report
Bay Shore/Brightwaters Former MGP Site
Operable Unit No. 3 (OU-3)

	NYSDEC SCG	CB-11 3/9/2007	CB-26 3/9/2007	CB-37 9/12/2007	CB-38 9/12/2007	CB-40 3/9/2007	CB-41* 3/9/2007	CB-50 9/12/2007	CB-6 9/12/2007	Duplicate of CB-77 9/12/2007	CB-77 9/12/2007
BTEX (mg/kg)											
Benzene	0.06	0.0055	0.0031 U	0.0042 U	0.0019 U	0.0023 U	0.0014 U	0.0028 U	0.0032 U	0.0024 U	0.0031 U
Toluene	1.5	0.0099	**0.025**	0.0042 U	0.0019 U	0.0023 U	**0.00079 J**	**0.0021 J**	0.0032 U	**0.0067**	**0.0031 J**
Ethylbenzene	5.5	0.0021	**0.002 J**	0.0042 U	0.0019 U	0.0023 UJ	0.0014 U	0.0028 U	0.0032 U	0.0024 U	0.0031 U
Xylene, m,p-	NE	0.12	**0.0034 J**	0.0083 U	0.0039 U	0.0047 U	**0.00073 J**	0.0056 U	0.0063 U	0.0048 U	0.0063 U
Xylene, o-	NE	0.1 J	0.0031 U	0.0042 U	0.0019 U	**0.0017 J**	0.0014 U	0.0028 U	0.0032 U	0.0024 U	0.0031 U
Xylene, total	1.2	0.22	**0.0034**	0.0083 U	0.0039 U	**0.0017**	**0.00073**	0.0056 U	0.0063 U	0.0048 U	0.0063 U
Total BTEX	NE	0.2375	**0.0304**	ND	ND	**0.0017**	**0.00152**	**0.0021**	ND	**0.0067**	**0.0031**
Other VOCs (mg/kg)											
Acetone	0.2	0.015 J	**0.11 J**	**0.019 B**	0.0048 U	**0.055 J**	**0.0056 J**	**0.015 B**	**0.0078 JB**	**0.038 B**	**0.012 B**
Butanone,2-	0.3	0.0043	**0.019**	0.0042 U	0.0019 U	**0.01 J**	0.0014 UJ	**0.0017 J**	0.0032 U	**0.0073**	**0.002 J**
Carbon disulfide	2.7	0.002 U	**0.002 J**	0.0042 U	0.0019 U	**0.0021 J**	0.0014 U	0.0028 U	0.0032 U	0.0024 U	0.0031 U
Isopropyl benzene	NE	0.002 U	0.0031 U	0.0042 U	0.0019 U	**0.015 J**	**0.0015 J**	0.0028 U	0.0032 U	0.0024 U	0.0031 U
Isopropyltoluene,4-	NE	0.002 U	0.0031 U	0.0042 U	0.0019 U	**0.004 J**	0.0014 U	0.0028 U	0.0032 U	0.0024 U	0.0031 U
Methyl tert-butyl ether	NE	0.002 U	0.0031 U	0.0042 U	0.0019 U	**0.0066**	0.0014 U	0.0028 U	0.0032 U	0.0024 U	0.0031 U
Methylene chloride	0.1	0.0049 U	0.0078 U	**0.0035 JB**	**0.0022 JB**	0.0058 U	0.0035 U	**0.004 JB**	**0.0031 JB**	**0.0039 JB**	**0.0066 JB**
Propylbenzene, n-	NE	0.002 U	0.0031 U	0.0042 U	0.0019 U	**0.0065 J**	**0.00078 J**	0.0028 U	0.0032 U	0.0024 U	0.0031 U
Trimethylbenzene,1,2,4-	NE	0.0072 J	**0.0028 J**	0.0042 U	0.0019 U	**0.018 J**	**0.00087 J**	0.0028 U	0.0032 U	0.0024 U	0.0031 U
Trimethylbenzene,1,3,5-	NE	0.03 J	0.0031 U	0.0042 U	0.0019 U	**0.0012 J**	0.0014 U	0.0028 U	0.0032 U	0.0024 U	0.0031 U
Vinyl acetate	NE	0.002 U	0.0031 U	0.0042 U	0.0019 U	R	0.0014 U	0.0028 U	0.0032 U	0.0024 U	0.0031 U
Non-carcin PAHs (mg/kg)											
Acenaphthene	50	0.2 U	0.25 U	0.33 U	0.23 U	0.21 U	0.2 U	**0.16 J**	0.27 U	**0.64**	**0.36**
Anthracene	50	0.2 U	**0.21 J**	**0.29 J**	**0.2 J**	0.21 U	0.2 U	**0.35**	0.27 U	**0.95**	**0.7**
Benzo[g,h,i]perylene	50	0.2 U	**0.39**	**1.6**	**1.3**	0.21 U	**0.12 J**	**1.5**	**0.94**	**2.7**	**1.8**
Fluoranthene	50	0.36	**3.2**	**5.9**	**4.2**	**0.64 J**	**0.67 J**	**6.2**	**2.3**	**12**	**7.8**
Fluorene	50	0.2 U	**0.15 J**	**0.2 J**	0.23 U	0.21 U	0.2 U	**0.22**	0.27 U	**0.74**	**0.44**
Methylnaphthalene,2-	36.4	0.26	0.25 U	0.33 U	0.23 U	0.21 U	0.2 U	0.17 U	0.27 U	0.27 U	0.25 U
Naphthalene	13	1.2	0.25 U	0.33 U	0.23 U	**0.13 J**	**0.3**	0.17 U	0.27 U	0.27 U	0.25 U
Phenanthrene	50	0.18 J	**1.6**	**3**	**1.7**	**0.29 J**	**0.35 J**	**3.1**	**0.82**	**8.4**	**5.1**
Pyrene	50	0.33	**2.6**	**3.8**	**2.9**	**0.44 J**	**0.52 J**	**3.9**	**1.6**	**8.3**	**5.4**
Total Noncarcinogenic PAHs	NE	2.33	**8.15**	**14.79**	**10.3**	**1.5**	**1.96**	**15.43**	**5.66**	**33.73**	**21.6**
Carcinogenic PAHs (mg/kg)											
Benz[a]anthracene	0.224	0.2 U	**1.1**	**1.7**	**1.3**	**0.17 J**	**0.22 J**	**2.4**	**0.82**	**4**	**2.7**
Benzo[a]pyrene	0.061	0.2 U	**1.2**	**2**	**1.6**	**0.22 J**	**0.27 J**	**2**	**0.99**	**4**	**2.5**
Benzo[b]fluoranthene	1.1	0.17 J	**2.1**	**2.7**	**2.4**	**0.4 J**	**0.36 J**	**2.8**	**1.5**	**5**	**3.5**
Benzo[k]fluoranthene	1.1	0.1 J	**0.93**	**1.6**	**1**	**0.17 J**	**0.26 J**	**1.9**	**0.91**	**2.6**	**1.3**
Chrysene	0.4	0.14 J	**1.6**	**2.7**	**2.1**	**0.33 J**	**0.36 J**	**3**	**1.4**	**5**	**2.9**
Dibenz[a,h]anthracene	0.014	0.2 U	**0.14 J**	**0.46**	**0.39**	0.21 U	0.2 U	**0.6**	**0.3**	**0.92**	**0.59**
Indeno[1,2,3-cd]pyrene	3.2	0.2 U	**0.39**	**1.4**	**1.2**	0.21 U	0.2 U	**1.4**	**0.87**	**2.6**	**1.7**
Total Carcinogenic PAHs	NE	0.41	**7.46**	**12.56**	**9.99**	**1.29**	**1.47**	**14.1**	**6.79**	**24.12**	**15.19**
Total PAHs (mg/kg)											
Total PAHs	NE	2.74	**15.61**	**27.35**	**20.29**	**2.79**	**3.43**	**29.53**	**12.45**	**57.85**	**36.79**
Other SVOCs (mg/kg)											
Bis(2-ethylhexyl)phthalate	50	0.55	**5.6**	**2.8 B**	**0.36 B**	**0.56 J**	**0.41**	**0.16 JB**	**0.87 B**	**0.77 B**	**1.1 B**
Butyl benzyl phthalate	50	0.2 U	0.25 U	0.33 U	**0.5 B**	0.21 U	0.2 U	0.17 U	**0.16 JB**	0.27 U	0.25 U
Carbazole	NE	0.2 U	**0.22 J**	NA	NA	0.21 U	0.2 U	NA	NA	NA	NA
Dibenzofuran	6.2	0.2 U	0.25 U	0.33 U	0.23 U	0.21 U	0.2 U	0.17 U	0.27 U	**0.39**	**0.19 J**
Di-n-octyl phthalate	50	0.2 U	0.25 U	0.33 U	**0.18 J**	0.21 U	0.2 U	0.17 U	0.27 U	**0.67**	0.25 U
Methylphenol, 4-	0.9	0.2 U	**0.5**	**0.17 J**	0.23 U	0.21 U	0.2 U	0.17 U	0.27 U	0.27 U	0.25 U

Notes:

mg/kg - milligrams/kilogram or parts per million (ppm)
BTEX - benzene, toluene, ethlybenzene, and xylene
VOCs - volatile organic compounds

NYSDEC SCG - New York State Department of Environmental Conservation Standards, Criteria, and Guidelines

ND - not detected; total concentration is listed as ND because no compounds were detected in the group
NE- not established
SB - site background, typical background metal concentrations in soil for the eastern United States were used

J - estimated value
U - indicates not detected to the reporting limit for organic analysis and the method detection limit for inorganic analysis
B - Analyte detected in the associated method blank

Bolding indicates a detected result value
Shading and bolding indicates that the detected result value exceeds established NYSDEC SCGs

Only detected analytes and BTEX are shown
*Sample CB-41 was rejected by validator due to poor surrogate recovery and not included; duplicate sample is reported.

Table 2
Summary of Catch Basin and Ambient Air Analytical Results
Drainage Network Rehabilitation - IRM Completion Report
Bay Shore/Brightwaters Former MGP Site
Operable Unit No. 3 (OU-3)

Location		Union Blvd. & Lanier La.				Montauk Highway & Community Rd				Cooper La. & Lanier La.							Lanier La.					
Constituent	NYDOH Outdoor 95th Percentile[1]	CB-11 3/9/2007	CB-11 8/31/2007	CB-11A 3/9/2007	CB-11A 8/31/2007	CB-26 3/9/2007	CB-26 8/31/2007	CB-26A 3/9/2007	CB-26A 8/31/2007	CB-37 8/30/2007	CB-37A 8/30/2007	CB-38 8/30/2007	Duplicate of CB-38 8/30/2007	CB-38 8/31/2009	CB-38A 8/30/2007	CB-38 AA 8/31/2009	CB-40 3/9/2007	CB-40 8/30/2007	CB-40 8/31/2009	CB-40A 3/9/2007	CB-40A 8/30/2007	CB-40 AA 8/31/2009
BTEX (ug/m3)																						
Benzene	5.8	**130**	**1.3**	**2.0**	**0.86**	**2.1**	**1.3**	**1.2**	**1.4**	**0.38 J**	**0.29 J**	**0.83**	**0.45 J**	**0.70**	**0.83**	**0.64**	**36**	**31**	**0.80**	**1.2**	**0.41 J**	**0.70**
Toluene	21	**490**	**2.7**	**3.6**	**3.0**	**5.8**	**2.7**	**2.5**	**2.2**	**1.3**	**0.56 J**	**2.8**	**2.3**	**3.4**	**5.4**	**2.2**	**42**	**250**	**2.3**	**2.0**	**1.2**	**2.2**
Ethylbenzene	1.9	**79**	**0.48 J**	**0.69 J**	**0.52 J**	**0.78 J**	**0.39 J**	**0.48 J**	**0.3 J**	**0.87**	0.87 U	**1.7 J**	**0.35 J**	**0.39 J**	**0.65 J**	**0.30 J**	**120**	**430**	**0.39 J**	**1.1**	**0.69 J**	**0.30 J**
Xylene, m,p-	3.1	**110**	**1.4 J**	**1.4 J**	**1.2 J**	**2.2**	**0.74 J**	**1.4 J**	**0.61 J**	**1.1 J**	1.7 U	**2.1**	**0.78 J**	**1.2 J**	**1.7**	**1.0 J**	**71**	**520**	**0.95 J**	**1.3 J**	**0.91 J**	**0.69 J**
Xylene, o-	2.5	**52**	**0.82 J**	**0.61 J**	**0.39 J**	**0.78 J**	**0.26 J**	**0.43 J**	0.87 UJ	**1.2 J**	0.87 UJ	**1.7 J**	**0.3 J**	**0.43 J**	**0.56 J**	**0.35 J**	**70**	**310 J**	**0.43 J**	**0.78 J**	**0.56 J**	**0.26 J**
Other VOCs (ug/m3)																						
Acetaldehyde	NE	0.36 UJ	9.0 U	0.36 UJ	**36**	0.36 UJ	**50**	0.36 UJ	**38**	**75**	**53**	**28**	**22**	**9.9**	**35**	**12**	0.36 UJ	**52**	**10**	0.36 UJ	**63**	**11**
Acetone	58	**38**	**13**	**9.8 J**	**14**	**9.4 J**	**12**	**12 J**	**24**	**15**	**19**	**11**	**9.9**	15 U	**20**	11 U	**6.6 J**	**10**	9.4 U	**9.3 J**	**20**	7.4 U
Acrolein (propenal)	NE	**0.41 J**	**0.53**	**0.27 J**	**0.71**	**0.23 J**	**0.5**	**0.39 J**	**1.2**	**0.8**	**0.78**	**0.66**	0.46 U	**0.64 J**	**0.71**	**0.44 J**	0.46 U	**0.44 J**	1.2 U	0.46 U	**1.0**	1.2 U
Benzothiophene	NE	5.5 UJ	14 U	5.5 UJ	14 U	5.5 UJ	14 U	5.5 UJ	14 U	14 U	14 U	14 U	14 U	1.1 UJ	14 U	1.1 UJ	5.5 UJ	**1.2 J**	1.1 UJ	5.5 UJ	14 U	1.1 UJ
Bromomethane	0.9	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U
Butadiene, 1,3-	NE	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	**0.13 J**	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U
Butane	NE	**3.0**	**1.1**	**1.8**	**1.2**	**3.4**	**1.6**	**2.3**	**1.4**	**0.55**	**0.64**	**0.97**	**0.64**	**0.76**	**1.1**	**0.71**	**2.4**	**0.71**	**0.64**	**1.7**	**0.59**	**0.57**
Butanone,2-	17	**4.7**	**1.3**	**1.0 J**	**3.2**	**1.1 J**	**5.1**	**1.3 J**	**6.6**	**6.9**	**6.8**	**2.6**	**2.1**	**2.1**	**2.6**	**1.2**	**0.53 J**	**5.6**	**1.1**	**1.3 J**	**5.7**	**0.88**
Carbon disulfide	NE	**1.1**	1.6 U	0.62 U	1.6 U	**0.31 J**	1.6 U	0.62 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	**0.28 J**	1.6 U	0.62 U	0.62 U	1.6 U	0.62 U	**0.19 J**	1.6 U	0.62 U
Carbon tetrachloride	1	**0.50 J**	**0.57 J**	**0.44 J**	**0.57 J**	**0.50 J**	**0.57 J**	**0.44 J**	**0.5 J**	**0.57 J**	**0.57 J**	**0.57 J**	**0.44 J**	**0.57 J**	**0.57 J**	**0.50 J**	**0.38 J**	**0.5 J**	**0.50 J**	**0.50 J**	**0.63 J**	**0.50 J**
Chloroethane	0.4	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U
Chloroform	0.5	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	**0.24 J**	0.98 U	0.98 U	0.98 U	0.98 U
Chloromethane	4.6	**1.8**	**1.0**	**1.2**	**1.1**	**1.5**	**1.2**	**1.3**	**1.0**	**1.4**	**0.95**	**1.8**	**1.7**	**0.97**	**0.83**	**0.72**	**0.97**	**0.91**	**0.83**	**1.3**	**1.3**	**0.80**
Chlorotoluene,2-	NE	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Cryofluorane	1.3	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	**0.56 J**	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U
Cyclohexane	3	**0.79**	0.69 U	**0.34 J**	**0.28 J**	**0.52 J**	**0.21 J**	0.69 U	0.69 U	0.69 U	0.69 U	0.69 U	**0.24 J**	**0.28 J**	**0.69**	**0.17 J**	**0.55 J**	**0.86**	0.69 U	0.69 U	0.69 U	0.69 U
Decane, n-	3.6	**11**	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	**3.0**	**0.81 J**	**2.3**	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
Dichlorobenzene,1,4-	0.8	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
Dichlorodifluoromethane	11	**3.1**	**2.6**	**2.8**	**2.7**	**2.9**	**2.8**	**2.6**	**2.5**	**2.7**	**2.3**	**2.7**	**2.5**	**1.9**	**2.6**	**1.8**	**2.9**	**2.9**	**1.9**	**2.9**	**2.2**	**1.9**
Dioxane,1,4-	NE	**0.83 J**	0.72 U	1.8 U	0.72 U	1.8 U	0.72 U	1.8 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	1.8 U	0.72 U	0.72 U	1.8 U	0.72 U	0.72 U
Dodecane, n-	7.6	**3.0**	1.4 U	**0.77 J**	1.4 U	1.4 U	**0.49 J**	1.4 U	1.4 U	**0.77 J**	1.4 U	1.4 U	1.4 U	**2.1**	**0.77 J**	**4.2**	1.4 U	1.4 U	**0.35 J**	1.4 U	1.4 U	1.4 U
Ethanol	220	9.4 U	**6.3**	9.4 U	**22**	9.4 U	**27**	9.4 U	**30**	**38**	**36**	**14**	**12**	**6.3**	**19**	**6.4**	9.4 U	**30**	**5.9**	9.4 U	**29**	**5.1**
Ethylthiophene, 2-	NE	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	**0.64 J**	0.92 U	0.92 U	0.92 U	0.92 U
Ethyltoluene, p-	NE	**3.5**	0.98 UJ	0.98 U	0.98 UJ	0.98 U	0.98 UJ	0.98 U	0.98 UJ	0.98 UJ	0.98 UJ	0.98 UJ	0.98 UJ	0.98 U	**0.25 J**	0.98 U	**7.7**	**24 J**	0.98 U	0.98 U	0.98 UJ	0.98 U
Heptane, n-	5.1	**0.82**	**0.41 J**	**0.53 J**	**0.41 J**	**0.98**	**0.61 J**	**0.37 J**	**0.61 J**	0.82 U	0.82 U	**0.45 J**	**0.33 J**	**0.94**	**0.82**	**1.0**	0.82 U	**0.41 J**	**0.61 J**	0.82 U	**0.37 J**	**0.53 J**
Hexane, n-	3.6	**1.1**	**1.7**	**0.88**	**1.9**	**1.8**	**1.9**	**1.2**	**2.1**	**1.5**	**1.3**	**0.77**	**0.56 J**	**0.99**	**1.6**	**0.67 J**	**1.1**	**1.8**	**0.42 J**	**0.49 J**	**1.4**	**0.49 J**
Hexanone,2-	NE	2.0 U	0.82 U	2.0 U	**0.29 J**	**4.0**	**0.53 J**	2.0 U	**0.53 J**	**0.74 J**	**0.7 J**	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	2.0 U	**0.65 J**	0.82 U	2.0 U	**0.82**	0.82 U
Indan	NE	**7.3**	**0.48 J**	0.97 U	0.97 U	0.97 U	0.97 U	0.97 U	0.97 U	**0.63 J**	0.97 U	**0.58 J**	0.97 U	0.97 U	0.97 U	0.97 U	**25**	**270**	**0.34 J**	0.97 U	**0.34 J**	0.97 U
Indene	NE	**8.8**	0.95 U	0.95 U	0.95 U	0.95 U	0.95 U	0.95 U	0.95 U	**0.52 J**	0.95 U	**0.47 J**	0.95 U	0.95 U	0.95 U	0.95 U	**5.9**	**160**	0.95 U	0.95 U	**0.28 J**	0.95 U
Methyl tert-butyl ether	5.9	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	**0.47 J**	**1.8**	0.72 U	0.72 U	0.72 U	0.72 U
Methyl-2-pentanone,4-	2.9	**0.78 J**	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	**0.9**	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U
Methylene chloride	2.9	**1.8 J**	**7.5**	1.7 U	**3.1**	**2.1 J**	**2.9**	**1.8 J**	**4.0**	**2.9**	**2.2**	1.7 U	**2.3**	**0.76 J**	**4.5**	**0.49 J**	1.7 U	**2.8**	**0.69 J**	1.7 U	**2.6**	**0.59 J**
Methylnaphthalene,1-	NE	14 U	5.8 U	14 U	5.8 U	14 U	5.8 U	14 U	5.8 U	5.8 U	5.8 U	5.8 U	5.8 U	1.2 U	5.8 U	1.2 U	14 U	**2.4 J**	1.2 U	14 U	5.8 U	1.2 U
Methylnaphthalene,2-	NE	14 U	29 U	14 U	29 U	14 U	29 U	14 U	29 U	29 U	29 U	29 U	29 U	1.2 U	29 U	1.2 U	14 U	**0.58 J**	1.2 U	14 U	29 U	1.2 U
Methylthiophene, 2-	NE	**0.56 J**	0.8 U	0.80 U	0.8 U	0.80 U	0.8 U	0.80 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.80 U	0.8 U	0.80 U	0.80 U	**0.36 J**	0.80 U	0.80 U	0.8 U	0.80 U
Methylthiophene, 3-	NE	**0.76 J**	0.8 U	0.80 U	0.8 U	0.80 U	0.8 U	0.80 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.80 U	0.8 U	0.80 U	0.80 U	**0.84**	0.80 U	0.80 U	0.8 U	0.80 U
Naphthalene	10	**4.2 J**	1.0 UJ	2.6 U	1.0 UJ	2.6 U	1.0 UJ	2.6 U	**0.31 J**	1.0 UJ	1.0 UJ	1.0 UJ	1.0 UJ	1.0 U	1.0 UJ	1.0 U	**1.4 J**	**20 J**	1.0 U	2.6 U	1.0 UJ	1.0 U
Nonane	1.2	**3.4**	**0.26 J**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**0.31 J**	1.0 U	1.0 U	**0.58 J**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Octane, n-	2.1	**0.70 J**	0.93 U	0.93 U	0.93 U	**0.28 J**	0.93 U	0.93 U	0.93 U	0.93 U	0.93 U	0.93 U	0.93 U	**0.47 J**	**0.33 J**	0.93 UJ	0.93 U	0.93 U	0.93 UJ	0.93 U	**0.23 J**	0.93 UJ
Pentane	NE	**19**	**1.1**	**0.94**	**1.1**	**20**	**1.2**	**1.1**	**1.2**	**0.56 J**	**0.59**	**0.94**	**0.71**	**1.6**	**1.9**	**1.2**	**18**	**0.68**	**0.65**	**0.62**	**0.53 J**	**0.59**
Propanol,2-	NE	**1.4 J**	**3.4**	**5.4 J**	**1.8**	1.2 U	**1.1**	1.2 U	**1.7**	**1.7**	**1.3**	**0.86**	**0.74**	1.6 U	**4.2**	1.3 U	1.2 U	**1.1**	1.2 U	1.2 U	**1.1**	1.2 U
Styrene	0.6	**2.8**	0.85 U	0.85 U	0.85 U	**2.3**	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U	**0.72 J**	0.85 U	0.85 U	**2.7**	**7.6**	0.85 U	0.85 U	0.85 U	0.85 U
t-Butyl alcohol	NE	**4.7**	**0.64**	0.61 U	**0.36 J**	0.61 U	**0.39 J**	0.61 U	**0.7**	0.61 U	0.61 U	**0.18 J**	0.61 U	0.61 U	**0.39 J**	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U	**0.36 J**	0.61 U
Tetrachloroethene	1.6	1.4 U	**0.41 J**	1.4 U	**0.41 J**	1.4 U	**0.41 J**	1.4 U	**0.41 J**	1.4 U	1.4 U	1.4 U	1.4 U	1.4 UJ	1.4 U	1.4 UJ	1.4 U	1.4 U	1.4 UJ	1.4 U	1.4 U	**0.41 J**
Tetramethylbenzene, 1,2,4,5-	NE	1.1 U	14 U	1.1 U	14 U	1.1 U	14 U	1.1 U	14 U	14 U	14 U	14 U	14 U	1.1 UJ	14 U	1.1 UJ	1.1 U	**6.0 J**	1.1 UJ	1.1 U	14 U	1.1 UJ
Trichloro-1,2,2-trifluoroethane, 1,1,2-	3.6	**0.61 J**	**0.54 J**	**0.61 J**	**0.54 J**	**0.77 J**	**0.54 J**	**0.46 J**	**0.69 J**	**0.61 J**	**0.61 J**	**0.69 J**	**0.46 J**	**0.54 J**	**0.54 J**	**0.46 J**	**0.54 J**	**0.61 J**	**0.46 J**	**0.54 J**	**0.69 J**	**0.46 J**
Trichloroethene	0.5	1.1 U	**0.43 J**	1.1 U	1.1 U	1.1 U	**0.32 J**	1.1 U	1.1 U	**0.43 J**	1.1 U	1.1 U	**0.27 J**	1.1 U	1.1 U	1.1 U	1.1 U	**0.32 J**	1.1 U	1.1 U	1.1 U	1.1 U
Trichlorofluoromethane	6.1	**1.5**	**1.4**	**1.6**	**1.4**	**1.6**	**1.4**	**1.4**	**1.5**	**1.5**	**1.2**	**1.2**	**1.2**	**1.1 J**	**1.6**	**1.1 J**	**1.5**	**1.4**	**1.2**	**1.5**	**1.2**	**1.1**
Trimethylbenzene,1,2,3-	0.6	**1.9**	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	**0.29 J**	0.98 U	0.98 U	**0.49 J**	**0.25 J**	**3.8**	**48**	**0.29 J**	0.98 U	0.98 U	0.98 U
Trimethylbenzene,1,2,4-	2.5	**5.8**	**0.29 J**	**0.49 J**	**0.25 J**	**0.64 J**	0.98 UJ	**0.49 J**	0.98 UJ	0.98 UJ	0.98 UJ	**0.39 J**	0.98 UJ	0.98 U	**0.69 J**	0.98 U	**8.9**	**40 J**	0.98 U	**0.29 J**	0.98 UJ	0.98 U
Trimethylbenzene,1,3,5-	1	**2.8**	0.98 UJ	0.98 U	0.98 UJ	0.98 U	0.98 UJ	0.98 U	0.98 UJ	0.98 UJ	0.98 UJ	0.98 UJ	0.98 UJ	0.98 U	**0.29 J**	0.98 U	**5.6**	**22 J**	0.98 U	0.98 U	0.98 UJ	0.98 U
Trimethylpentane, 2,2,4-	2	**0.61 J**	**0.93**	0.93 U	**0.93**	**0.84 J**	**0.56 J**	0.93 U	**0.65 J**	**0.23 J**	0.93 U	**0.98**	**0.7 J**	**0.79 J**	**0.93**	**0.79 J**	**0.65 J**	**0.42 J**	0.93 U	0.93 U	**0.56 J**	0.93 U
Undecane, n-	2.3	**4.0 J**	1.3 U	6.4 U	1.3 U	6.4 U	1.3 U	6.4 U	1.3 U	**0.51 J**	1.3 U	**0.38 J**	1.3 U	1.3 U	**1.1 J**	**0.32 J**	6.4 U	1.3 U	1.3 U	6.4 U	1.3 U	1.3 U

Table 2
Summary of Catch Basin and Ambient Air Analytical Results
Drainage Network Rehabilitation - IRM Completion Report
Bay Shore/Brightwaters Former MGP Site
Operable Unit No. 3 (OU-3)

Location		Lanier La.									Cooper La.				Union Blvd. & Community Rd.		Ackerson St.		Union Blvd.		Orinoco Drive	
Constituent	NYDOH Outdoor 95th Percentile[1]	CB-41 3/9/2007	Duplicate of CB-41 3/9/2007	CB-41 8/30/2007	CB-41 8/31/2009	Duplicate of CB-41 8/31/2009	CB-41A 3/9/2007	CB-41A 8/30/2007	CB-41 AA 8/31/2009	Duplicate of: CB-41 AA 8/31/2009	CB-50 8/30/2007	CB-50 8/31/2009	CB-50A 8/30/2007	CB-50 AA 8/31/2009	CB-6 8/30/2007	CB-6A 8/30/2007	CB-77 8/30/2007	CB-77A 8/30/2007	CB-64 8/30/2007	CB-64A 8/30/2007	FB-1 3/9/2007	FB 8/30/2007
BTEX (ug/m3)																						
Benzene	5.8	**1.4**	**1.4**	**34**	**0.77**	**0.61 J**	**1.4**	**0.32 J**	**0.93**	**0.96**	0.64 U	**0.35 J**	0.64 U	**0.45 J**	0.64 U	0.64 U	0.64 U	0.64 U	0.64 U	0.64 U	**0.96**	**0.48 J**
Toluene	21	**2.2**	**2.4**	**270**	**2.3**	**2.2**	**3.1**	**1.1**	**2.9**	**2.6**	**0.72 J**	**1.1**	**0.6 J**	**1.2**	**1.3**	**1.1**	**1.2**	**1.2**	**1.4**	**1.6**	**1.4**	**2.0**
Ethylbenzene	1.9	**1.0**	**1.2**	**560**	**0.30 J**	**0.35 J**	**1.7**	**0.82 J**	**0.39 J**	**0.35 J**	**0.3 J**	0.87 U	0.87 U	0.87 U	**0.22 J**	0.87 U	0.87 U	**0.3 J**	0.87 U	0.87 U	**0.30 J**	**0.22 J**
Xylene, m,p-	3.1	**1.2 J**	**1.3 J**	**560**	**0.87 J**	**0.82 J**	**3.8**	**0.82 J**	**0.95 J**	**0.91 J**	**0.3 J**	**0.56 J**	1.7 U	**0.43 J**	**0.48 J**	**0.43 J**	**0.48 J**	**0.65 J**	**0.39 J**	**0.39 J**	**0.82 J**	**0.52 J**
Xylene, o-	2.5	**0.69 J**	**0.74 J**	**380 J**	**0.30 J**	**0.35 J**	**2.0**	**0.52 J**	**0.39 J**	**0.35 J**	**0.3 J**	0.87 U	0.87 U	0.87 U	0.87 U	0.87 U	0.87 U	**0.3 J**	0.87 U	0.87 U	**0.22 J**	0.87 UJ
Other VOCs (ug/m3)																						
Acetaldehyde	NE	0.36 UJ	0.36 UJ	**69**	**12**	**7.6**	0.36 UJ	**14**	**8.6**	**6.3**	**56**	**8.3**	**15**	**9.1**	**54**	**42**	**45**	**490**	**53**	**16**	0.36 UJ	**9.8**
Acetone	58	**5.8 J**	**7.7 J**	**12**	10 U	8.1 U	**37**	**25**	9.1 U	6.5 U	**18**	8.1 U	**14**	7.3 U	**16**	**18**	**13**	**47**	**14**	**14**	**11 J**	**10**
Acrolein (propenal)	NE	0.46 U	0.46 U	**0.94**	1.2 U	1.2 U	**1.3**	**0.85**	1.2 U	1.2 U	**0.73**	1.2 U	0.46 U	1.2 U	0.46 U	**0.69**	**0.8**	**13**	**0.71**	**0.55**	**0.37 J**	**0.25 J**
Benzothiophene	NE	5.5 UJ	5.5 UJ	**0.93 J**	1.1 UJ	1.1 UJ	5.5 UJ	14 U	1.1 UJ	1.1 UJ	14 U	1.1 UJ	14 U	1.1 UJ	14 U	14 U	14 U	14 U	14 U	14 U	5.5 UJ	14 U
Bromomethane	0.9	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	0.78 U	**0.39 J**	0.78 U	0.78 U	0.78 U
Butadiene, 1,3-	NE	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	0.44 U	**0.27 J**	0.44 U	0.44 U	0.44 U	0.44 U
Butane	NE	**2.1**	**2.4**	**0.64**	**0.59**	**0.64**	**2.1**	**0.43 J**	**0.71**	**0.59**	**0.67**	**0.43 J**	**0.36 J**	**0.43 J**	**1.3**	**1.2**	**0.97**	**1.0**	**0.86**	**0.62**	**1.6**	**0.74**
Butanone,2-	17	1.5 U	**0.65 J**	**5.0**	**1.1**	**0.80**	**8.6**	**1.4**	**0.97**	**0.85**	**7.6**	**0.44 J**	**1.1**	**0.44 J**	**8.4**	**5.2**	**6.6**	**24**	**6.6**	**1.2**	**1.9**	**0.97**
Carbon disulfide	NE	0.62 U	0.62 U	1.6 U	**0.19 J**	0.62 U	**1.9**	1.6 U	0.62 U	0.62 U	1.6 U	0.62 U	1.6 U	0.62 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	**1.0**	1.6 U
Carbon tetrachloride	1	**0.31 J**	**0.38 J**	**0.44 J**	**0.44 J**	**0.44 J**	**0.57 J**	**0.63 J**	**0.44 J**	**0.50 J**	**0.63 J**	**0.38 J**	**0.57 J**	**0.50 J**	**0.69 J**	**0.69 J**	**0.5 J**	**0.69 J**	**0.57 J**	**0.57 J**	**0.44 J**	**0.82 J**
Chloroethane	0.4	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	**0.34 J**	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	**0.45 J**	0.53 U	0.53 U	0.53 U	0.53 U
Chloroform	0.5	0.98 U	0.98 U	**0.29 J**	0.98 U	0.98 U	**0.63 J**	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U
Chloromethane	4.6	**1.1**	**1.3**	**1.1**	**0.83**	**0.80**	**2.4**	**0.76**	**0.85**	**0.83**	**2.0**	**0.74**	**1.3**	**0.74**	**2.5**	**1.3**	**1.8**	**1.5**	**1.6**	**0.95**	**1.4**	**1.0**
Chlorotoluene,2-	NE	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**3.4**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Cryofluorane	1.3	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U
Cyclohexane	3	0.69 U	0.69 U	**1.2**	**0.17 J**	0.69 U	0.69 U	0.69 U	**0.31 J**	**1.6 J**	0.69 U	0.69 U	0.69 U	0.69 U	**0.24 J**	0.69 U	0.69 U	0.69 U	**0.17 J**	0.69 U	0.69 U	0.69 U
Decane, n-	3.6	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	**2.0**	1.2 U	1.2 U	**0.29 J**	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	**0.99 J**	1.2 U
Dichlorobenzene,1,4-	0.8	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	**0.36 J**	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
Dichlorodifluoromethane	11	**2.7**	**3.2**	**2.8**	**2.0**	**1.9**	**2.8**	**2.5**	**1.9**	**1.9**	**2.4**	**1.9**	**2.3**	**1.9**	**2.3**	**2.6**	**2.6**	**2.2**	**2.3**	**2.1**	**2.6**	**2.6**
Dioxane,1,4-	NE	1.8 U	1.8 U	0.72 U	0.72 U	0.72 U	1.8 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	1.8 U	0.72 U
Dodecane, n-	7.6	1.4 U	1.4 U	1.4 U	**0.56 J**	1.4 U	**7.2**	1.4 U	**0.56 J**	**0.56 J**	**0.49 J**	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	**2.2**	1.4 U
Ethanol	220	9.4 U	9.4 U	**22**	**4.7**	**4.2**	**14 J**	**5.0**	**8.9 J**	**5.4 J**	**27**	**2.4**	**5.1**	**3.6**	**35**	**20**	**27**	**1200**	**27**	**6.1**	9.4 U	**6.0**
Ethylthiophene, 2-	NE	0.92 U	0.92 U	**0.73 J**	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U	0.92 U
Ethyltoluene, p-	NE	0.98 U	0.98 U	**26 J**	0.98 U	0.98 U	**2.9**	0.98 UJ	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 UJ
Heptane, n-	5.1	**0.20 J**	0.82 U	0.82 U	0.82 U	**0.57 J**	**1.0**	**0.29 J**	**0.66 J**	**0.61 J**	**0.33 J**	**0.70 J**	0.82 U	**0.70 J**	0.82 U	**0.29 J**	**0.29 J**	**0.7 J**	**0.29 J**	**0.25 J**	**0.33 J**	**0.41 J**
Hexane, n-	3.6	**1.1**	**1.1**	**1.1**	**0.53 J**	**0.49 J**	**1.0**	**1.9**	**0.53 J**	**0.56 J**	**1.3**	**0.25 J**	**1.2**	**0.28 J**	**1.7**	**1.6**	**1.3**	**1.4**	**1.4**	**1.2**	**0.42 J**	**0.92**
Hexanone,2-	NE	2.0 U	2.0 U	0.82 U	0.82 U	0.82 U	**3.7**	**0.37 J**	0.82 U	0.82 U	**0.82**	0.82 U	0.82 U	0.82 U	**0.74 J**	**0.53 J**	**0.65 J**	**1.5**	**0.53 J**	0.82 U	**0.61 J**	0.82 U
Indan	NE	**0.29 J**	**0.34 J**	**280**	0.97 U	0.97 U	**2.6**	**0.29 J**	0.97 U	0.97 U	0.97 U	0.97 U	0.97 U	0.97 U	0.97 U	0.97 U	0.97 U	0.97 U	0.97 U	0.97 U	0.97 U	0.97 U
Indene	NE	0.95 U	0.95 U	**150**	0.95 U	0.95 U	**0.24 J**	0.95 U	0.95 U	0.95 U	**0.33 J**	0.95 U	0.95 U	0.95 U	0.95 U	0.95 U	0.95 U	0.95 U	0.95 U	0.95 U	0.95 U	0.95 U
Methyl tert-butyl ether	5.9	0.72 U	0.72 U	**2.2**	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U
Methyl-2-pentanone,4-	2.9	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	**2.0**	0.82 U	**0.37 J**	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	**0.29 J**	0.82 U	0.82 U	0.82 U
Methylene chloride	2.9	1.7 U	1.7 U	**2.3**	**0.90 J**	**0.83 J**	**4.0 J**	**3.1**	**0.80 J**	**0.62 J**	**2.2**	**0.59 J**	**2.4**	**0.56 J**	**3.2**	**2.2**	**3.0**	**1.7 J**	**2.3**	**1.9**	1.7 U	**2.3**
Methylnaphthalene,1-	NE	14 U	14 U	**1.4 J**	**0.29 J**	1.2 U	**1.0 J**	5.8 U	1.2 U	1.2 U	5.8 UJ	1.2 U	5.8 UJ	1.2 U	5.8 UJ	5.8 UJ	5.8 UJ	5.8 UJ	5.8 UJ	5.8 UJ	14 U	5.8 U
Methylnaphthalene,2-	NE	14 U	14 U	**0.46 J**	1.2 U	1.2 U	**1.3 J**	29 U	1.2 U	1.2 U	29 U	1.2 U	29 U	1.2 U	29 U	29 U	29 U	29 U	29 U	29 U	**0.41 J**	29 U
Methylthiophene, 2-	NE	0.80 U	0.80 U	**0.36 J**	0.80 U	0.80 U	0.80 U	0.8 U	0.80 U	0.80 U	0.8 U	0.80 U	0.8 U	0.80 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.80 U	0.8 U
Methylthiophene, 3-	NE	0.80 U	0.80 U	**0.68 J**	0.80 U	0.80 U	0.80 U	0.8 U	0.80 U	0.80 U	0.8 U	0.80 U	0.8 U	0.80 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.80 U	0.8 U
Naphthalene	10	2.6 U	2.6 U	**19 J**	**0.31 J**	1.0 U	**4.0 J**	**0.26 J**	**0.26 J**	**0.31 J**	1.0 UJ	1.0 U	1.0 UJ	1.0 U	1.0 UJ	1.0 UJ	1.0 UJ	1.0 UJ	1.0 UJ	1.0 UJ	2.6 U	1.0 UJ
Nonane	1.2	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**3.7**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**0.31 J**	1.0 U	1.0 U	1.0 U	**0.47 J**	1.0 U
Octane, n-	2.1	0.93 U	0.93 U	0.93 U	0.93 UJ	0.93 UJ	**1.9**	0.93 U	0.93 UJ	0.93 UJ	0.93 U	0.93 UJ	0.93 U	0.93 UJ	**0.28 J**	0.93 U	0.93 U	0.93 U	0.93 U	0.93 U	0.93 U	0.93 U
Pentane	NE	**8.0 J**	**14 J**	**0.71**	**0.74**	**0.62**	**1.0**	**0.44 J**	**0.74**	**0.71**	**0.44 J**	**0.41 J**	**0.35 J**	**0.38 J**	**1.1**	**1.3**	**0.62**	**0.71**	**0.62**	**0.77**	**0.59**	**0.91**
Propanol,2-	NE	1.2 U	1.2 U	**1.2**	1.2 U	1.2 U	**4.1**	**0.91**	1.2 U	1.2 U	**0.91**	1.2 U	**0.76**	1.2 U	**1.2**	**0.98**	**1.2**	**23**	**1.0**	**0.76**	1.2 U	**1.7**
Styrene	0.6	**0.43 J**	**0.68 J**	**7.5**	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U
t-Butyl alcohol	NE	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U	**1.0**	**2.0**	0.61 U	0.61 U	**0.82**	0.61 U	0.61 U	0.61 U	**1.2**	**0.3 J**	**0.82**	0.61 U	**1.1**	0.61 U	**0.45 J**	**0.21 J**
Tetrachloroethene	1.6	1.4 U	1.4 U	1.4 U	1.4 UJ	1.4 UJ	1.4 U	1.4 U	1.4 UJ	**0.41 J**	1.4 U	1.4 UJ	1.4 U	1.4 UJ	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U
Tetramethylbenzene, 1,2,4,5-	NE	1.1 U	1.1 U	**5.9 J**	1.1 UJ	1.1 UJ	**0.33 J**	14 U	1.1 UJ	1.1 UJ	14 U	1.1 UJ	14 U	1.1 UJ	14 U	14 U	14 U	14 U	14 U	14 U	1.1 U	14 U
Trichloro-1,2,2-trifluoroethane, 1,1,2-	3.6	**0.46 J**	**0.46 J**	**0.69 J**	**0.46 J**	1.5 U	**0.61 J**	**0.54 J**	**0.46 J**	**0.46 J**	**0.69 J**	**0.46 J**	**0.61 J**	**0.46 J**	**0.61 J**	**0.69 J**	**0.54 J**	**0.54 J**	**0.54 J**	**0.54 J**	**0.54 J**	**0.61 J**
Trichloroethene	0.5	1.1 U	1.1 U	**0.32 J**	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	**0.59 J**	1.1 U	**0.38 J**	1.1 U	**0.43 J**	1.1 U	1.1 U	1.1 U
Trichlorofluoromethane	6.1	**1.5**	**1.5**	**1.5**	**1.1 J**	**1.1**	**1.6**	**1.1**	**1.1**	**1.1 J**	**1.6**	**1.0 J**	**1.4**	**1.1**	**1.5**	**1.4**	1.2 U	**1.2**	**1.5**	**1.2**	**1.4**	**1.4**
Trimethylbenzene,1,2,3-	0.6	0.98 U	0.98 U	**52**	**0.29 J**	**0.29 J**	**3.0**	0.98 U	**0.29 J**	**0.29 J**	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U
Trimethylbenzene,1,2,4-	2.5	0.98 U	**0.25 J**	**41 J**	0.98 U	0.98 U	**5.3**	0.98 UJ	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	**0.54 J**	0.98 UJ
Trimethylbenzene,1,3,5-	1	0.98 U	0.98 U	**25 J**	0.98 U	0.98 U	**1.7**	0.98 UJ	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 U	0.98 UJ
Trimethylpentane, 2,2,4-	2	**0.28 J**	**0.47 J**	**0.33 J**	0.93 U	0.93 U	**0.28 J**	**0.47 J**	**0.84 J**	**0.84 J**	0.93 U	0.93 U	**0.28 J**	0.93 U	**0.42 J**	**0.42 J**	**0.42 J**	**0.42 J**	**0.28 J**	**0.23 J**	0.93 U	**0.47 J**
Undecane, n-	2.3	6.4 U	**0.45 J**	1.3 U	1.3 U	1.3 U	**1.9 J**	1.3 U	1.3 U	**0.45 J**	**0.32 J**	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	**1.6 J**	**0.32 J**

Table 2
Summary of Catch Basin and Ambient Air Analytical Results
Drainage Network Rehabilitation - IRM Completion Report
Bay Shore/Brightwaters Former MGP Site
Operable Unit No. 3 (OU-3)

Notes:

ug/m3 - micrograms/meter cubed
BTEX - benzene, toluene, ethlybenzene, and xylene
VOCs - volatile organic compounds

[1] Source: New York State Department of Health (NYSDOH), October 2006. Summary of Indoor and Outdoor Levels of Volatile Organic Compounds from Fuel Oil Heated Homes reported in various locations within sampled homes in NYS, 1997-2003. Background values for naphthalene are from the NYSDOH 1997 Control Home Database presented in Table C3 of the NYSDOH 2006 Guidance.

Only detected analytes are shown

CS - confirmation sample

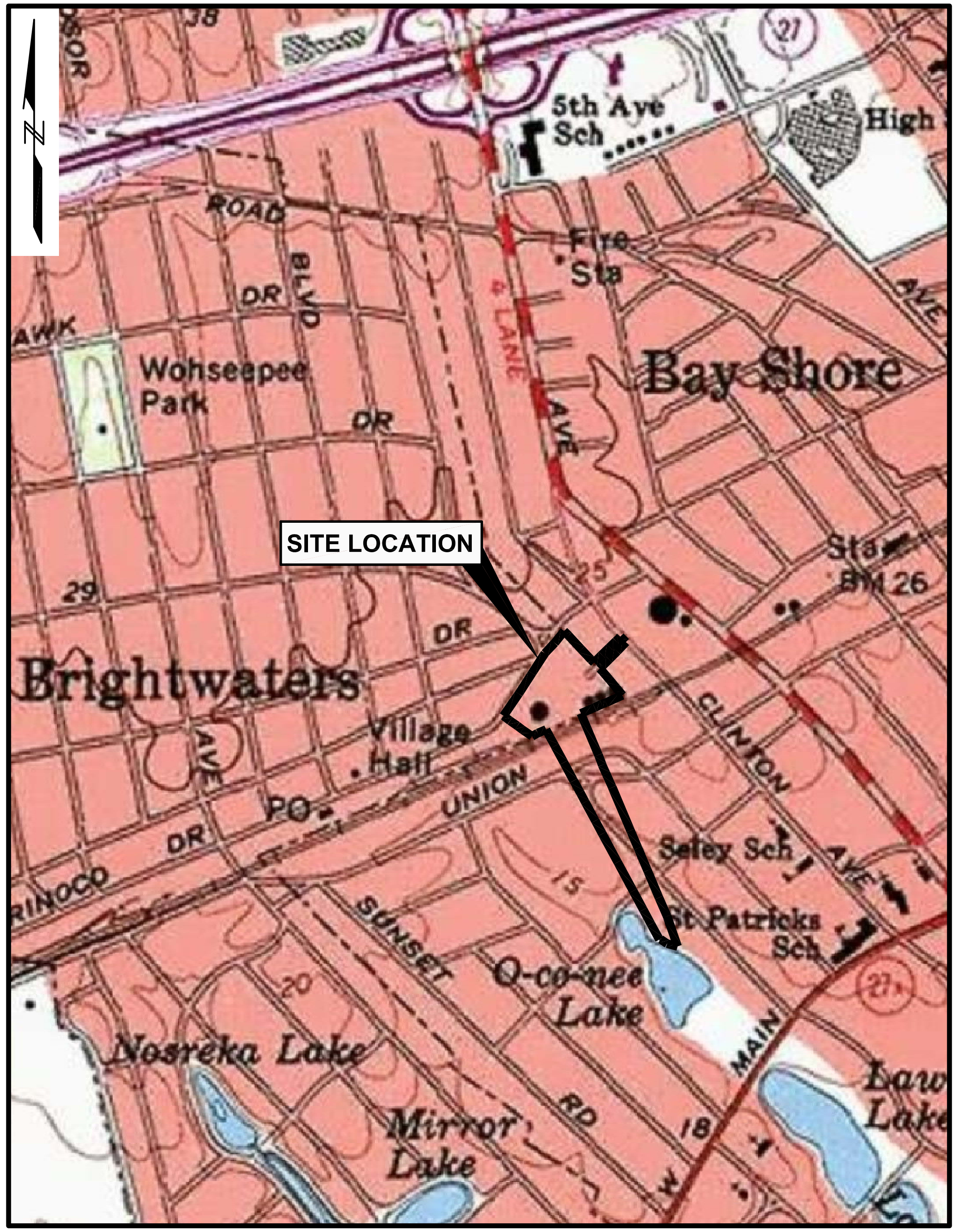
NE- not established
ND - not detected; total concentration is listed as ND because no compounds were detected in the group

Bolding indicates a detected result value
Shading and bolding indicates that the detected result value exceeds NYSDOH 95 Percentile

J - estimated value
U - indicates not detected to the reporting limit for organic analysis and the method detection limit for inorganic analysis

FINAL DRAINAGE NETWORK REHABILITATION
INTERIM REMEDIAL MEASURE COMPLETION REPORT
NATIONAL GRID
OU-3 BAY SHORE/BRIGHTWATERS FORMER MGP SITE
TOWN OF ISLIP, NEW YORK
AUGUST 11, 2010

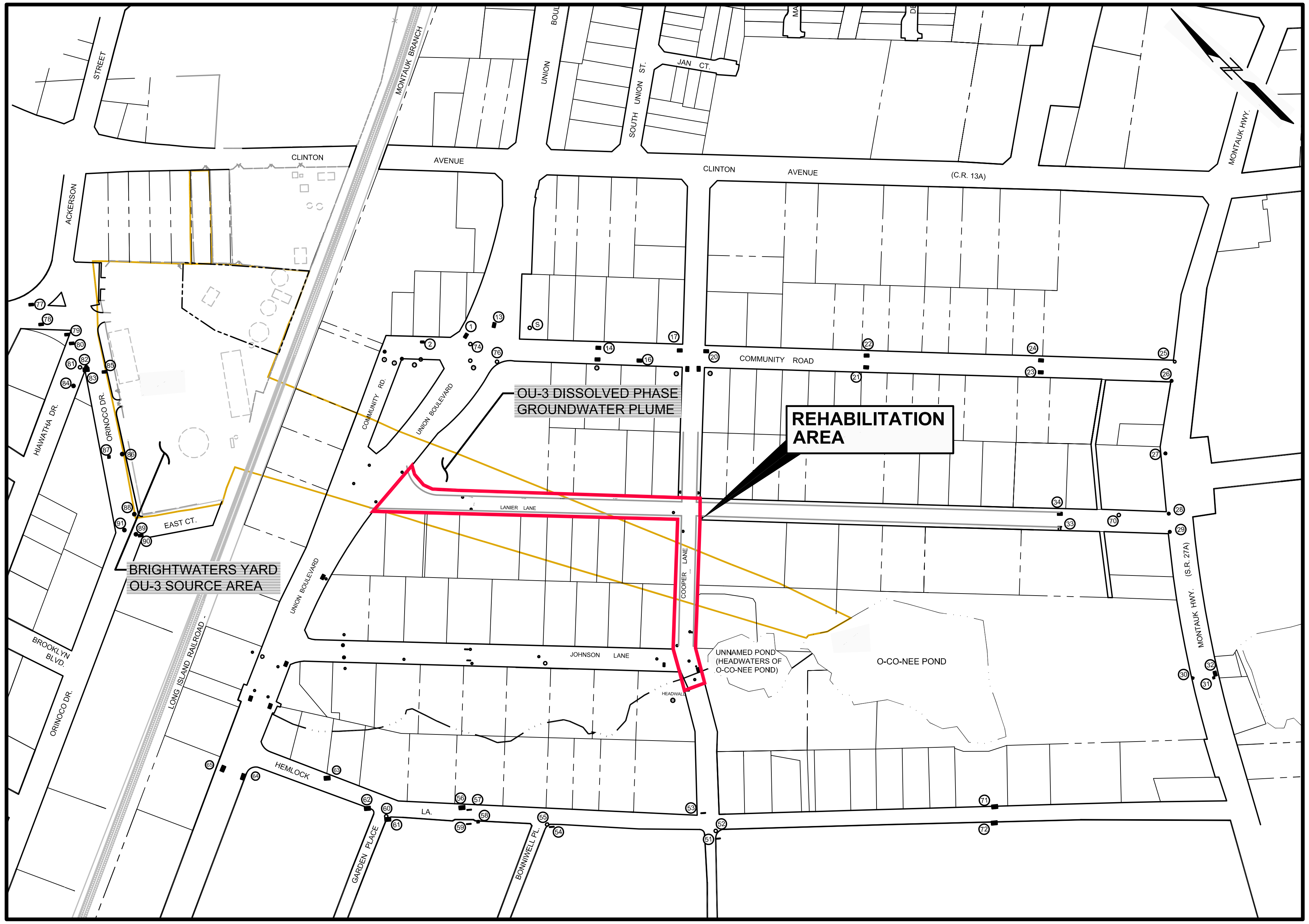
Figures



SOURCE:
U.S.G.S. TOPOGRAPHIC MAP, 1:24,000, BAY SHORE WEST, NY, REVISED 1979. MAP CREATED WITH TOPO! ® © 2001 NATIONAL GEOGRAPHIC (www.nationalgeographic.com/topo)

REGIONAL MAP

SCALE: 1" = 1000'



SOURCES:
1. MAP TITLED "BAY SHORE/BRIGHTWATERS, FORMER MGP SITE FINAL REMEDIAL INVESTIGATION, BAY SHORE, NEW YORK, OFF-SITE SAMPLE LOCATION MAP", SEPT. 2002 BY DVIRKA AND BARTILUCCI.
2. PROPERTY BOUNDARY LOCATIONS WERE DETERMINED BY OTHERS USING AERIAL PHOTOGRAPHS AND TAX MAPS. PROPERTY BOUNDARIES ARE APPROXIMATE.

IRM LOCATION

SCALE: 1" = 300'

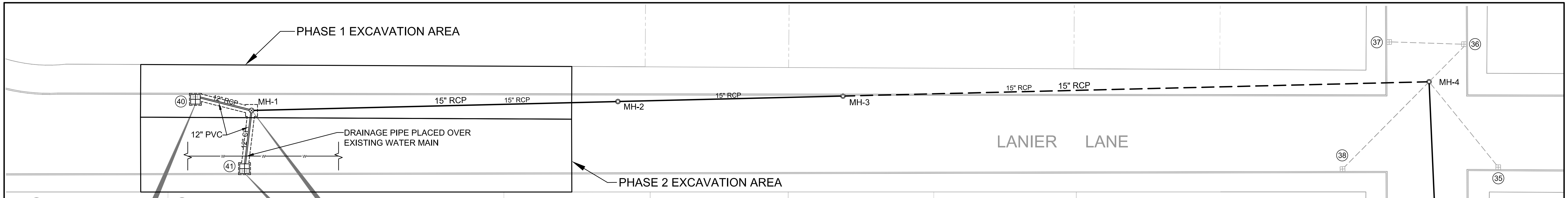
IRM COMPLETION REPORT
OPERABLE UNIT No. 3 DRAINAGE NETWORK REHABILITATION
BAYSHORE/BRIGHTWATERS FORMER MGP SITE
BAY SHORE, NEW YORK

nationalgrid

GEI Consultants

SITE LOCATION

Project 093180-3-1302 | August 2010 | Figure 1



CATCH BASIN 40 (1/2)

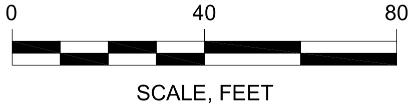
Size (ft)	4X4
Grade Elevation	15.5
Depth (ft bgs)	4'
Invert Elevation	13.7
Invert Direction	Southwest
Pipe Type	12" PVC

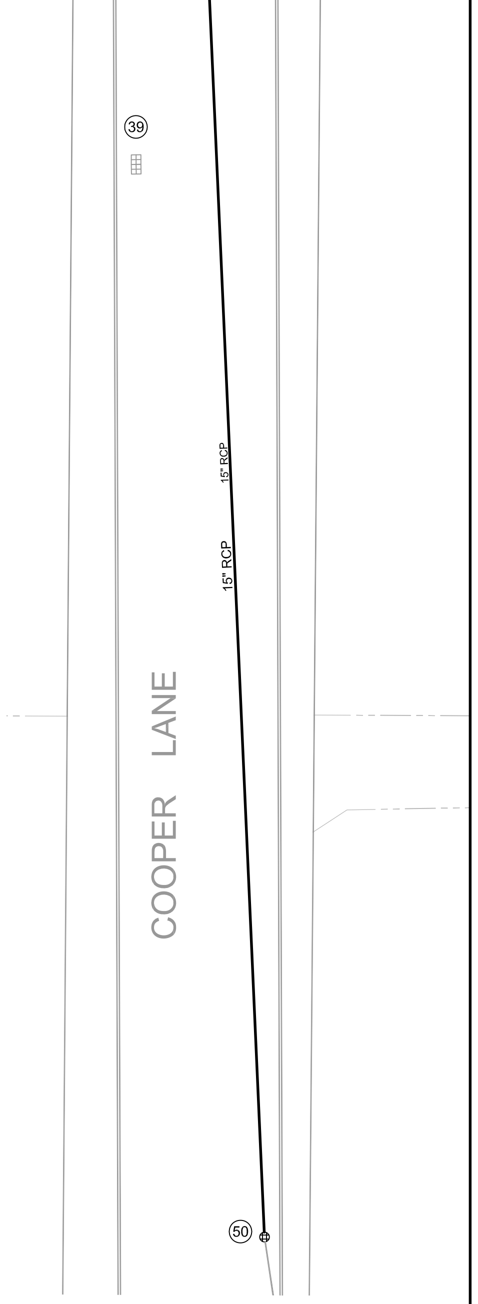
CATCH BASIN 41 (1/2)

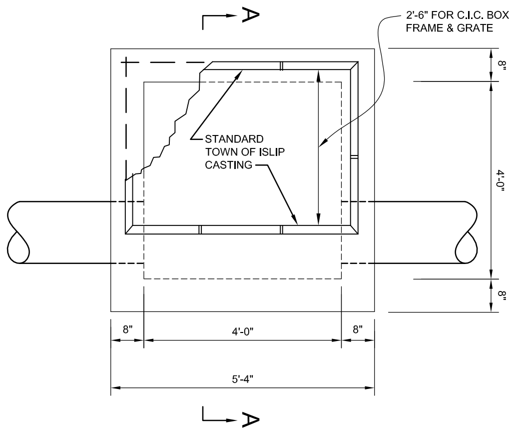
Size (ft)	4X4
Grade Elevation	15.7
Depth (ft bgs)	2
Invert Elevation	13.9
Invert Direction	East
Pipe Type	12" PVC

MANHOLE 1 (2/2)

Size (ft)	4X4
Depth (ft bgs)	4'
Invert Elevation	13.8
Invert Direction	West
Invert Elevation	13.6
Invert Direction	Northeast
Grade Elevation	*

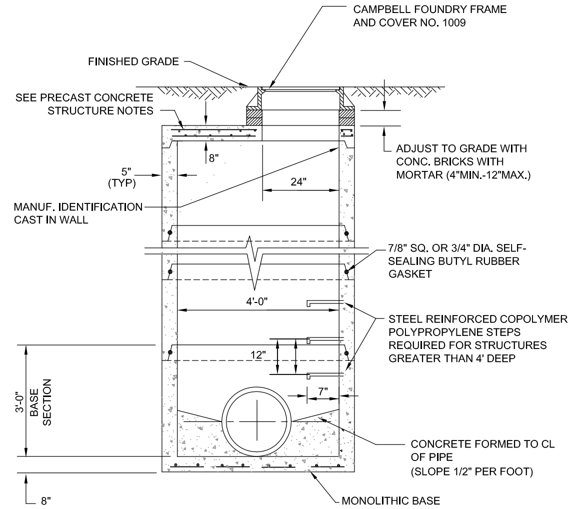






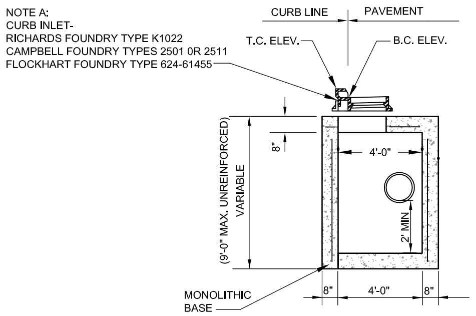
RESTORED CATCH BASIN DETAIL PLAN VIEW (1/2)

NOT TO SCALE



RESTORED MANHOLE DETAIL (2/2)

NOT TO SCALE



SECTION A-A

RESTORED CATCH BASIN

NOT TO SCALE

LEGEND

────	MAIN DRAINAGE PIPING (APPROXIMATE LOCATION)
– – – – –	SECONDARY DRAINAGE PIPING (APPROXIMATE LOCATION)
(43) ⊕ ○	DRAINAGE MANHOLE LOCATION
(15) ⊞	CATCH BASIN LOCATION
───w───	WATER MAIN
═══	CURB LOCATION (APPROXIMATE)
○ MH	REHABILITATED MANHOLE
⊗ MH	REPLACED MANHOLE LOCATION
⊞	REPLACED CATCH BASIN LOCATION
━━━━	MAIN DRAINAGE PIPING REHABILITATION-CIPP WITH VOC FREE BASED RESIN (APPROXIMATE LOCATION)
━ ━ ━	MAIN DRAINAGE PIPING REHABILITATION-CIPP WITH STANDARD RESIN (APPROXIMATE LOCATION)
═══	REPLACED DRAINAGE PIPING
-----------	EXCAVATION AREA

NOTES:

1. PROPERTY BOUNDARY LOCATIONS WERE DETERMINED BY OTHERS USING AERIAL PHOTOGRAPHS AND TAX MAPS. PROPERTY BOUNDARIES ARE APPROXIMATE.
2. EDGE OF ROAD SURFACE WAS DETERMINED BASED ON THE NELSON AND POPE SURVEY OF THE CATCH BASINS. EDGE OF THE ROAD IS APPROXIMATE AND FOR REFERENCE ONLY.
3. PRE-IRM DRAINAGE FEATURES DEPICTED BASED ON SURVEYS CONDUCTED BY NELSON & POPE ON JANUARY 23, 2007, JANUARY 31, 2007 AND SEPTEMBER 19, 2007. INSERT TABLES REFLECT PRE-IRM SURVEY MEASUREMENTS.
4. MAIN DRAINAGE PIPING WERE REHABILITATED USING CURED IN PLACE PIPING TECHNOLOGY. GROUT WERE INSERTED INTO ALL JOINTS ROBOTICALLY. ONCE GROUTING WAS COMPLETED, A CURED IN PLACE LINER WAS INSTALLED.
5. MANHOLES MH-2, MH-3 AND MH-4 WERE REHABILITATED BY GROUT INJECTION.
6. CATCH BASINS CB-40 AND CB-41 WERE REPLACED IN ACCORDANCE WITH TOWN OF ISLIP SPECIFICATIONS WITH THE EXCEPTION OF A MONOLITHIC BASE.
7. MANHOLE MH-1 WAS REPLACED IN ACCORDANCE WITH TOWN OF ISLIP SPECIFICATIONS.
8. THE SECONDARY DRAINAGE PIPING CONNECTING CB-40 AND CB-41 TO MH-1 WAS REPLACED WITH 12" DIAMETER PVC PIPE.
9. ALL ASPHALT BORDERING AN EXCAVATION AREA WAS SAWCUT 2' BEYOND THE EXCAVATED AREA.
10. RESTORATION DETAILS PROVIDED BY THE TOWN OF ISLIP, SUBDIVISION AND LAND DEVELOPMENT REGULATIONS, 2004.

IRM COMPLETION REPORT
OPERABLE UNIT No. 3 DRAINAGE NETWORK REHABILITATION
BAYSHORE/BRIGHTWATERS FORMER MGP SITE
BAY SHORE, NEW YORK

nationalgrid

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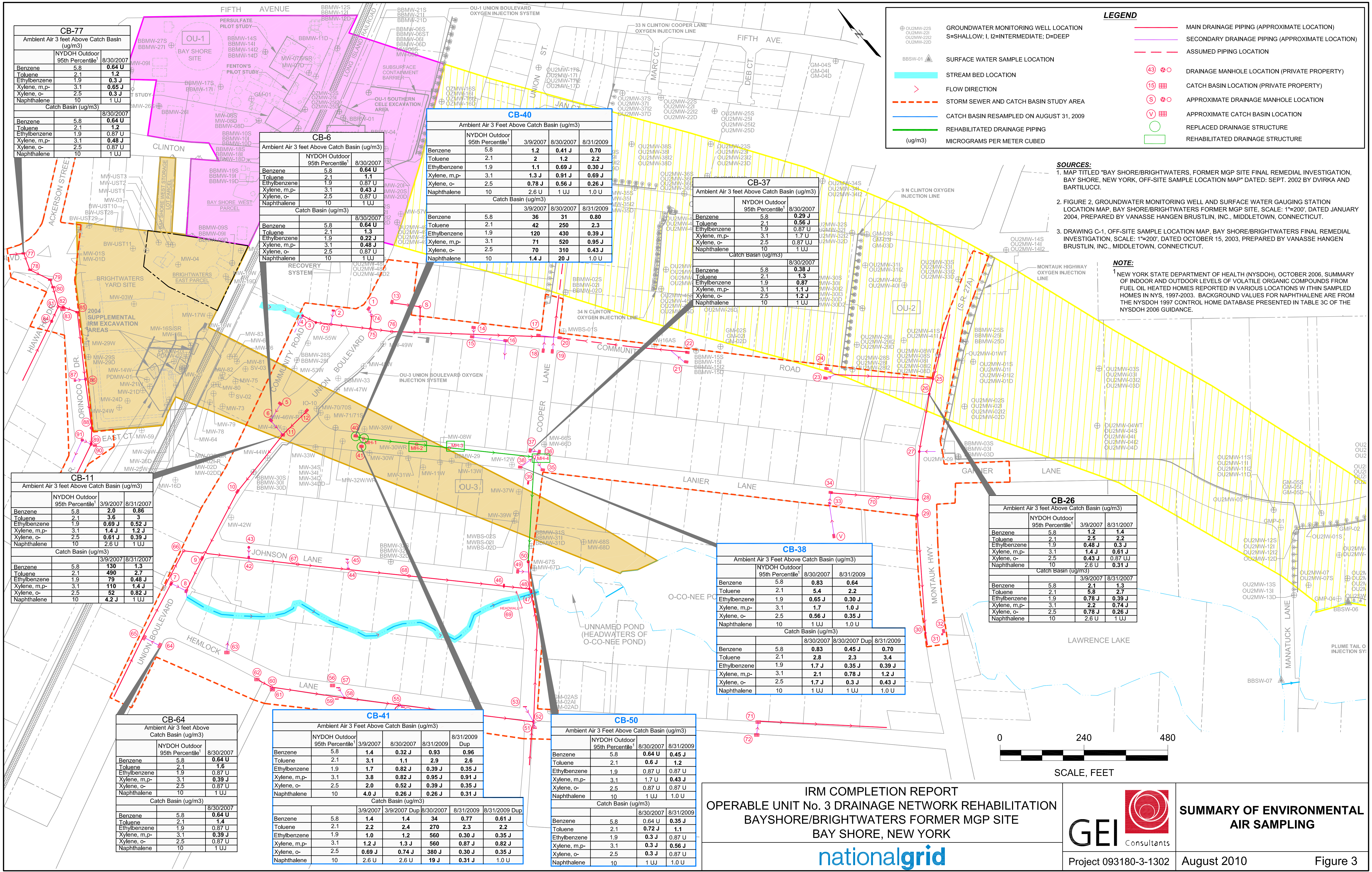
SUMMARY OF PROPOSED AND COMPLETED IRM

Project 093180-3-1302
August 2010
Figure 2

I:\Project\National Grid\Bay Shore\OU-3\SEWER IRM\IRM COMPLETION RPT\ OU-3 Sheet 2 IRM SUMMARY.dwg \Aug 10, 2010



CB-77

Ambient Air 3 feet Above Catch Basin (ug/m3)

	NYDOH Outdoor 95th Percentile[1]	8/30/2007
Benzene	5.8	**0.64 U**
Toluene	2.1	**1.2**
Ethylbenzene	1.9	**0.3 J**
Xylene, m,p-	3.1	**0.65 J**
Xylene, o-	2.5	**0.3 J**
Naphthalene	10	1 UJ

Catch Basin (ug/m3)

		8/30/2007
Benzene	5.8	**0.64 U**
Toluene	2.1	**1.2**
Ethylbenzene	1.9	0.87 U
Xylene, m,p-	3.1	**0.48 J**
Xylene, o-	2.5	0.87 U
Naphthalene	10	1 UJ

CB-6

Ambient Air 3 feet Above Catch Basin (ug/m3)

	NYDOH Outdoor 95th Percentile[1]	8/30/2007
Benzene	5.8	**0.64 U**
Toluene	2.1	**1.1**
Ethylbenzene	1.9	0.87 U
Xylene, m,p-	3.1	**0.43 J**
Xylene, o-	2.5	0.87 U
Naphthalene	10	1 UJ

Catch Basin (ug/m3)

		8/30/2007
Benzene	5.8	**0.64 U**
Toluene	2.1	**1.3**
Ethylbenzene	1.9	**0.22 J**
Xylene, m,p-	3.1	**0.48 J**
Xylene, o-	2.5	0.87 U
Naphthalene	10	1 UJ

CB-40

Ambient Air 3 Feet Above Catch Basin (ug/m3)

	NYDOH Outdoor 95th Percentile[1]	3/9/2007	8/30/2007	8/31/2009
Benzene	5.8	**1.2**	**0.41 J**	**0.70**
Toluene	2.1	**2**	**1.2**	**2.2**
Ethylbenzene	1.9	**1.1**	**0.69 J**	**0.30 J**
Xylene, m,p-	3.1	**1.3 J**	**0.91 J**	**0.69 J**
Xylene, o-	2.5	**0.78 J**	**0.56 J**	**0.26 J**
Naphthalene	10	2.6 U	1 UJ	1.0 U

Catch Basin (ug/m3)

		3/9/2007	8/30/2007	8/31/2009
Benzene	5.8	**36**	**31**	**0.80**
Toluene	2.1	**42**	**250**	**2.3**
Ethylbenzene	1.9	**120**	**430**	**0.39 J**
Xylene, m,p-	3.1	**71**	**520**	**0.95 J**
Xylene, o-	2.5	**70**	**310**	**0.43 J**
Naphthalene	10	**1.4 J**	**20 J**	1.0 U

CB-37

Ambient Air 3 feet Above Catch Basin (ug/m3)

	NYDOH Outdoor 95th Percentile[1]	8/30/2007
Benzene	5.8	**0.29 J**
Toluene	2.1	**0.56 J**
Ethylbenzene	1.9	0.87 U
Xylene, m,p-	3.1	1.7 U
Xylene, o-	2.5	0.87 UJ
Naphthalene	10	1 UJ

Catch Basin (ug/m3)

		8/30/2007
Benzene	5.8	**0.38 J**
Toluene	2.1	**1.3**
Ethylbenzene	1.9	**0.87**
Xylene, m,p-	3.1	**1.1 J**
Xylene, o-	2.5	**1.2 J**
Naphthalene	10	1 UJ

CB-11

Ambient Air 3 feet Above Catch Basin (ug/m3)

	NYDOH Outdoor 95th Percentile[1]	3/9/2007	8/31/2007
Benzene	5.8	**2.0**	**0.86**
Toluene	2.1	**3.6**	**3**
Ethylbenzene	1.9	**0.69 J**	**0.52 J**
Xylene, m,p-	3.1	**1.4 J**	**1.2 J**
Xylene, o-	2.5	**0.61 J**	**0.39 J**
Naphthalene	10	2.6 U	1 UJ

Catch Basin (ug/m3)

		3/9/2007	8/31/2007
Benzene	5.8	**130**	**1.3**
Toluene	2.1	**490**	**2.7**
Ethylbenzene	1.9	**79**	**0.48 J**
Xylene, m,p-	3.1	**110**	**1.4 J**
Xylene, o-	2.5	**52**	**0.82 J**
Naphthalene	10	**4.2 J**	1 UJ

CB-26

Ambient Air 3 feet Above Catch Basin (ug/m3)

	NYDOH Outdoor 95th Percentile[1]	3/9/2007	8/31/2007
Benzene	5.8	**1.2**	**1.4**
Toluene	2.1	**2.5**	**2.2**
Ethylbenzene	1.9	**0.48 J**	**0.3 J**
Xylene, m,p-	3.1	**1.4 J**	**0.61 J**
Xylene, o-	2.5	**0.43 J**	0.87 UJ
Naphthalene	10	2.6 U	**0.31 J**

Catch Basin (ug/m3)

		3/9/2007	8/31/2007
Benzene	5.8	**2.1**	**1.3**
Toluene	2.1	**5.8**	**2.7**
Ethylbenzene	1.9	**0.78 J**	**0.39 J**
Xylene, m,p-	3.1	**2.2**	**0.74 J**
Xylene, o-	2.5	**0.78 J**	**0.26 J**
Naphthalene	10	2.6 U	1 UJ

CB-38

Ambient Air 3 Feet Above Catch Basin (ug/m3)

	NYDOH Outdoor 95th Percentile[1]	8/30/2007	8/31/2009
Benzene	5.8	**0.83**	**0.64**
Toluene	2.1	**5.4**	**2.2**
Ethylbenzene	1.9	**0.65 J**	**0.30 J**
Xylene, m,p-	3.1	**1.7**	**1.0 J**
Xylene, o-	2.5	**0.56 J**	**0.35 J**
Naphthalene	10	1 UJ	1.0 U

Catch Basin (ug/m3)

		8/30/2007	8/30/2007 Dup	8/31/2009
Benzene	5.8	**0.83**	**0.45 J**	**0.70**
Toluene	2.1	**2.8**	**2.3**	**3.4**
Ethylbenzene	1.9	**1.7 J**	**0.35 J**	**0.39 J**
Xylene, m,p-	3.1	**2.1**	**0.78 J**	**1.2 J**
Xylene, o-	2.5	**1.7 J**	**0.3 J**	**0.43 J**
Naphthalene	10	1 UJ	1 UJ	1.0 U

CB-64

Ambient Air 3 feet Above Catch Basin (ug/m3)

	NYDOH Outdoor 95th Percentile[1]	8/30/2007
Benzene	5.8	**0.64 U**
Toluene	2.1	**1.6**
Ethylbenzene	1.9	0.87 U
Xylene, m,p-	3.1	**0.39 J**
Xylene, o-	2.5	0.87 U
Naphthalene	10	1 UJ

Catch Basin (ug/m3)

		8/30/2007
Benzene	5.8	**0.64 U**
Toluene	2.1	**1.4**
Ethylbenzene	1.9	0.87 U
Xylene, m,p-	3.1	**0.39 J**
Xylene, o-	2.5	0.87 U
Naphthalene	10	1 UJ

CB-41

Ambient Air 3 Feet Above Catch Basin (ug/m3)

	NYDOH Outdoor 95th Percentile[1]	3/9/2007	8/30/2007	8/31/2009	8/31/2009 Dup
Benzene	5.8	**1.4**	**0.32 J**	**0.93**	**0.96**
Toluene	2.1	**3.1**	**1.1**	**2.9**	**2.6**
Ethylbenzene	1.9	**1.7**	**0.82 J**	**0.39 J**	**0.35 J**
Xylene, m,p-	3.1	**3.8**	**0.82 J**	**0.95 J**	**0.91 J**
Xylene, o-	2.5	**2.0**	**0.52 J**	**0.39 J**	**0.35 J**
Naphthalene	10	**4.0 J**	**0.26 J**	**0.26 J**	**0.31 J**

Catch Basin (ug/m3)

		3/9/2007	3/9/2007 Dup	8/30/2007	8/31/2009	8/31/2009 Dup
Benzene	5.8	**1.4**	**1.4**	**34**	**0.77**	**0.61 J**
Toluene	2.1	**2.2**	**2.4**	**270**	**2.3**	**2.2**
Ethylbenzene	1.9	**1.0**	**1.2**	**560**	**0.30 J**	**0.35 J**
Xylene, m,p-	3.1	**1.2 J**	**1.3 J**	**560**	**0.87 J**	**0.82 J**
Xylene, o-	2.5	**0.69 J**	**0.74 J**	**380 J**	**0.30 J**	**0.35 J**
Naphthalene	10	2.6 U	2.6 U	**19 J**	**0.31 J**	1.0 U

CB-50

Ambient Air 3 Feet Above Catch Basin (ug/m3)

	NYDOH Outdoor 95th Percentile[1]	8/30/2007	8/31/2009
Benzene	5.8	**0.64 U**	**0.45 J**
Toluene	2.1	**0.6 J**	**1.2**
Ethylbenzene	1.9	0.87 U	0.87 U
Xylene, m,p-	3.1	1.7 U	**0.43 J**
Xylene, o-	2.5	0.87 U	0.87 U
Naphthalene	10	1 UJ	1.0 U

Catch Basin (ug/m3)

		8/30/2007	8/31/2009
Benzene	5.8	0.64 U	**0.35 J**
Toluene	2.1	**0.72 J**	**1.1**
Ethylbenzene	1.9	**0.3 J**	0.87 U
Xylene, m,p-	3.1	**0.3 J**	**0.56 J**
Xylene, o-	2.5	**0.3 J**	0.87 U
Naphthalene	10	1 UJ	1.0 U

LEGEND

⊕ OU2MW-22S OU2MW-22I OU2MW-22I2 OU2MW-22D	GROUNDWATER MONITORING WELL LOCATION S=SHALLOW; I, I2=INTERMEDIATE; D=DEEP
BBSW-01 ▲	SURFACE WATER SAMPLE LOCATION
▬	STREAM BED LOCATION
>	FLOW DIRECTION
– – – –	STORM SEWER AND CATCH BASIN STUDY AREA
──	CATCH BASIN RESAMPLED ON AUGUST 31, 2009
━━	REHABILITATED DRAINAGE PIPING
(ug/m3)	MICROGRAMS PER METER CUBED
──	MAIN DRAINAGE PIPING (APPROXIMATE LOCATION)
──	SECONDARY DRAINAGE PIPING (APPROXIMATE LOCATION)
— — —	ASSUMED PIPING LOCATION
(43) ⊗ ○	DRAINAGE MANHOLE LOCATION (PRIVATE PROPERTY)
(15) ▦	CATCH BASIN LOCATION (PRIVATE PROPERTY)
(S) ⊗ ○	APPROXIMATE DRAINAGE MANHOLE LOCATION
(V) ▦	APPROXIMATE CATCH BASIN LOCATION
○	REPLACED DRAINAGE STRUCTURE
▭	REHABILITATED DRAINAGE STRUCTURE

SOURCES:

1. MAP TITLED "BAY SHORE/BRIGHTWATERS, FORMER MGP SITE FINAL REMEDIAL INVESTIGATION, BAY SHORE, NEW YORK, OFF-SITE SAMPLE LOCATION MAP" DATED: SEPT. 2002 BY DVIRKA AND BARTILUCCI.
2. FIGURE 2, GROUNDWATER MONITORING WELL AND SURFACE WATER GAUGING STATION LOCATION MAP, BAY SHORE/BRIGHTWATERS FORMER MGP SITE, SCALE: 1"=200', DATED JANUARY 2004, PREPARED BY VANASSE HANGEN BRUSTLIN, INC., MIDDLETOWN, CONNECTICUT.
3. DRAWING C-1, OFF-SITE SAMPLE LOCATION MAP, BAY SHORE/BRIGHTWATERS FINAL REMEDIAL INVESTIGATION, SCALE: 1"=200', DATED OCTOBER 15, 2003, PREPARED BY VANASSE HANGEN BRUSTLIN, INC., MIDDLETOWN, CONNECTICUT.

NOTE:

[1] NEW YORK STATE DEPARTMENT OF HEALTH (NYSDOH), OCTOBER 2006, SUMMARY OF INDOOR AND OUTDOOR LEVELS OF VOLATILE ORGANIC COMPOUNDS FROM FUEL OIL HEATED HOMES REPORTED IN VARIOUS LOCATIONS W ITHIN SAMPLED HOMES IN NYS, 1997-2003. BACKGROUND VALUES FOR NAPHTHALENE ARE FROM THE NYSDOH 1997 CONTROL HOME DATABASE PRESENTED IN TABLE 3C OF THE NYSDOH 2006 GUIDANCE.

0 240 480

SCALE, FEET

IRM COMPLETION REPORT
OPERABLE UNIT No. 3 DRAINAGE NETWORK REHABILITATION
BAYSHORE/BRIGHTWATERS FORMER MGP SITE
BAY SHORE, NEW YORK

nationalgrid

GEI Consultants

SUMMARY OF ENVIRONMENTAL AIR SAMPLING

Project 093180-3-1302
August 2010
Figure 3

I:\Project\National Grid\Bay Shore\OU-3\SEWER IRM\IRM COMPLETION RPT\ Bay Shore-OU3 STORM SEWER & CB AREA-Resampled 2009.dwg \Aug 10, 2010

FINAL DRAINAGE NETWORK REHABILITATION
INTERIM REMEDIAL MEASURE COMPLETION REPORT
NATIONAL GRID
OU-3 BAY SHORE/BRIGHTWATERS FORMER MGP SITE
TOWN OF ISLIP, NEW YORK
AUGUST 11, 2010

Appendix A

CIPP Resin MSDS

MATERIAL SAFETY DATA SHEET

INTERPLASTIC CORPORATION
1225 Willow Lake Boulevard
St. Paul, MN 55110-5145
(651) 481-6860

CHEMTREC 24-Hour Emergency Telephone (800) 424-9300

ATTN: PLANT MGR/SAFETY DIR

Date Printed: 10/03/07
Revision Date: 10/03/07
MSDS File ID: MSDSLETO
Customer No:
Warehouse No: 0001

This MSDS complies with 29 CFR 1910.1200 (Hazard Communication).

SECTION I - PRODUCT IDENTIFICATION

Product Name: COR72-AT-470HT CIPP ISO RESIN
General or Generic ID: Unsaturated Polyester Resin
Hazard Classification: Flammable Liquid
Shipping Name: Resin Solution, 3, UN1866, PG III

SECTION II - HAZARDOUS COMPONENTS

INGREDIENT	CAS NO.	PERCENT	OSHA-PEL	ACGIH-TL	NOTE
Unsaturated Polyester Base Resin	See Index	69.0	None-Estb.	None-Est	
Styrene	100-42-5	32.6	50 ppm TWA	50 ppm	(1)

(1) OSHA has formally endorsed a styrene industry proposal for a voluntary 50 ppm PEL for workplace exposure to styrene. This proposal was agreed upon by representatives of the UPR industry. The OSHA STEL is 100 ppm. The ACGIH recently changed the TLV for styrene from 50 ppm to 20 ppm, and the STEL from 100 ppm to 40 ppm.

SECTION III - PHYSICAL DATA

PROPERTY		MEASUREMENT
Initial Boiling Point	For Styrene	293.40 Deg F (145.22 Deg C) @ 760.00 mm Hg
Vapor Pressure	For Styrene	4.3 mm Hg 68 Deg F (20 Deg C)
Specific Gravity		1.01-1.30 @ 77 Deg F (25 Deg C)
Vapor Density	Air = 1	3.6
Evaporation Rate		Slower than Ether

SECTION IV - FIRE AND EXPLOSION DATA

Flash Point: 88 Deg F (31.1 Deg C) for Volatile Component

Flammable: (Lowest Value of Styrene) Lower - 1.1%
(Upper Value of Styrene) Upper - 6.1%

Extinguishing Media: Foam, carbon dioxide, dry chemical, or water fog.

Hazardous Decomposition Products: May form toxic materials such as carbon dioxide, carbon monoxide, and various hydrocarbons.

Special Firefighting Procedures: Wear self-contained breathing apparatus with a full facepiece operated in pressure demand or other positive pressure mode when fighting fires.

Vapors are heavier than air and may travel along the ground or may be moved by ventilation and ignited by ignition sources at locations distant from material handling point.

Never use welding or cutting torch on or near drum (even empty) because product vapor can ignite explosively.

SECTION V - HEALTH DATA

Permissible Exposure Level: Not established for product. See Section II.

POTENTIAL HEALTH EFFECTS

Eyes - Can cause severe irritation, redness, tearing, blurred vision.

Skin - Prolonged or repeated contact can cause moderate irritation, defatting, dermatitis.

Inhalation - Excessive inhalation of vapors can cause nasal irritation, dizziness, weakness, fatigue, nausea, headache, possible unconsciousness, and even asphyxiation.

Swallowing - Can cause gastrointestinal irritation, nausea, vomiting, diarrhea. Aspiration of material into the lungs can cause chemical pneumonitis.

SECTION V - HEALTH DATA (continued)

TARGET ORGAN EFFECTS

Overexposure to this material (or its components) has been suggested as a cause of the following effects in laboratory animals, and may aggravate pre-existing disorders of these organs in humans: mild, reversible kidney effects, effects on hearing, respiratory tract (nose, throat, and airways), testis, liver. Overexposure to this material (or its components) has been suggested as a cause of the following effects in humans, and may aggravate pre-existing disorders of these organs: central nervous system effects, mild effects on color vision, effects on hearing, and respiratory tract damage (nose, throat, and airways).

FIRST AID

If on Skin: Thoroughly wash exposed area with soap and water. Remove contaminated clothing. Launder contaminated clothing before re-use.

If in Eyes: Flush with large amount of water, lifting upper and lower lids occasionally. Get medical attention.

If Swallowed: Do not induce vomiting. Keep person warm, quiet, and get medical attention. Aspiration of material into the lungs due to vomiting can cause chemical pneumonitis which can be fatal.

If Inhaled: If affected, remove individual to fresh air. If breathing is difficult, administer oxygen. If breathing has stopped, give artificial respiration. Keep person warm, quiet, and get medical attention.

PRIMARY ROUTE(S) OF ENTRY

Inhalation, skin absorption, skin contact, eye contact.

SECTION VI - REACTIVITY DATA

Hazardous Polymerization: Possible

Stability: Stable

Incompatibility: Avoid contact with strong alkalies, strong mineral acids, and oxidizing agents.

Conditions to Avoid: Exposure to excessive heat or open flame, storage in open containers, prolonged storage (6 months), storage above 100 Deg F (38 Deg C), and contamination with oxidizing agents.

Hazardous Decomposition Products: Carbon monoxide, carbon dioxide, low molecular weight hydrocarbons, and organic acids.

SECTION VII - SPILL OR LEAK PROCEDURES

Eliminate all ignition sources (flares, flames (including pilot lights), and electrical sparks). Persons not wearing protective equipment should be excluded from area of spill until clean-up has been completed. Stop spill at source, dike area of spill to prevent spreading, shovel or pump to tank or drums. Remaining liquid may be absorbed in sand, clay, earth, or other absorbent material and shoveled into containers.

SECTION VIII - PROTECTIVE EQUIPMENT TO BE USED

Respiratory Protection: If PEL of the product or any component is exceeded, an NIOSH/MSHA approved respirator is advised in absence of proper engineering control (see your safety equipment supplier). Engineering or administrative controls should be implemented to reduce exposure.

Ventilation: Provide sufficient mechanical (general and/or local exhaust) ventilation to maintain exposure below TLV(s).

Protective Gloves: Wear chemical resistant gloves that afford proper protection to the hands, such barrier creams maybe used in some environments as long as proper skin protection is afforded.

Eye Protection: Chemical splash goggles in compliance with OSHA regulations are advised; however, OSHA regulations also permit other type safety glasses. (Consult your safety equipment supplier.)

Other Protective Equipment: Work clothing that covers arms and legs.

SECTION IX - SPECIAL PRECAUTIONS

Containers of this material may be hazardous when empty. Since empty containers retain product residues (vapors, liquid, and/or solids), all hazard precautions given in this MSDS must be observed.

The information accumulated herein is believed to be accurate, but is not warranted to be, whether originating with Interplastic or not. Recipients are advised to confirm in advance of need that the information is current, applicable, and suitable to their circumstances.

SECTION X - SUPPLEMENT

Styrene has been identified as a possible human carcinogen by the International Agency for Research on Cancer (IARC). The IARC determination is based on "limited evidence" in animals and other "relevant data." IARC concedes there is "inadequate evidence" on humans for its findings.

The Styrene Information and Research Center (SIRC) recently sponsored studies to evaluate potential health effects in laboratory rats and mice exposed by inhalation to styrene for six hours per day for five days per week of their lifetime. The rat study, completed in 1996, showed no increased incidence of tumors related to styrene exposure at levels up to 1000 parts per million (ppm). The results of the mouse study are in the process of being analyzed, and so far only the lungs have been evaluated. The number of lung tumors observed at exposure levels of 20 to 160 ppm was increased as compared to the number of tumors seen in unexposed mice. These lung tumor results from the mouse study have been added to the MSDS for styrene.

The lung effects in the new mouse study are in contrast to findings in other studies in both rodents and humans, including the recent SIRC-sponsored study in rats. No link between styrene exposure and an increased incidence of cancer has been found collectively in eight studies of workers in the reinforced plastics and composites industries prior to 1992, or in two subsequent studies of composites/reinforced plastics workers. All together, over 90,000 people have been studied. Exposure levels in these industries are above the levels routinely measured in styrene and polystyrene production.

Also in the recent animal studies, irritation and degenerative effects on the olfactory cells in the nose (responsible for the sense of smell) were observed in mice exposed repeatedly by inhalation to 20 ppm and above, and in rats exposed to 50 ppm and above. Atrophy (degeneration) of the olfactory nerve was observed at levels at or above 40 ppm in mice and at or above 500 ppm in rats. SIRC is conducting follow-up research to further understand these findings and their possible importance to humans. Liver damage has been reported in mice at exposure levels of 100 ppm or above; comparable liver damage has not been reported in rats or humans exposed to styrene. It appears that mice are more sensitive to styrene than are other species. Information about potential damage to olfactory cells, irritation in the respiratory tract, and potential liver damage has been added to the MSDS for styrene.

We recommend that the precautions in this MSDS be followed.

SECTION XI - SUPPLIER NOTIFICATION

This product contains toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 and of 40 CFR 372. Please refer to "Section II - Hazardous Components" for the specific product and concentration.

BASE RESIN CAS INDEX

The base resins indicated under Section II are identified by one or more of the following CAS numbers:

113060-15-4
135108-89-3
141224-31-9
149717-53-3
155122-62-6
25037-66-5
25101-03-5
25215-72-9
25464-21-5
25609-89-6
25749-46-6
25749-49-9
25987-82-0
26098-37-3
26123-45-5
26265-08-7
26301-26-8
26588-55-6
26795-76-6
27342-37-6
27837-75-8
27863-48-6
28472-89-1
28516-30-5
29403-69-8
28572-30-7
28679-80-3
29011-83-4
29350-58-1
29403-69-8
30110-00-0
30946-90-8
31260-98-7
31472-46-5
32505-78-5
32677-47-7
32762-75-7
36346-15-3
36425-15-7
36425-16-8
37339-47-2
37347-86-7
37999-57-8
42133-45-9
464920-01-2
52453-94-8
54228-09-0
56083-98-8
56083-99-9
57863-48-6
58182-50-6
61224-63-3
62569-28-2
64386-66-9
67386-67-0
67380-21-6
67599-39-7
67712-08-7
67845-68-5
67939-08-6
67939-40-6
68002-44-8
68140-84-1
68140-88-5
68171-28-8
68238-98-2
68299-40-1
68492-68-2
68511-26-2
68585-94-4
68647-07-4
72259-64-4
81192-92-9
9003-20-7
9065-68-3

NoVOC
PERFORMANCE RESINS, LLC

"Environmentally Resposible Resin Systems"

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT & COMPANY IDENTIFICATION

MATERIAL IDENTITY:
NOVOC 4982, Vinyl Ester Resin

INFORMATION TELEPHONE:
920-803-1700

COMPANY:
NOVOC Performance Resins, LLC
3687 Enterprise Drive
Sheboygan, WI 53083

EMERGENCY TELEPHONE:
CHEMTREC: 800-424-9300

2. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient(s)	CAS Number	% (by weight)
Vinyl Ester Resin	See Index	AP 25-85
Monomer(s)	See Index	AP 15-75
Photoinitiator	7473-98-5	AP 1-35
Limestone	1317-65-3	AP 1-70
Blue Pigment	147-14-8	AP 1-10
Titanium Dioxide	13463-67-7	AP 1-10
Carbon Black	1333-86-4	AP 1-10

3. HAZARDS IDENTIFICATION

EYE -- PRIMARY ROUTE

Although no appropriate human or animal health effects data are known to exist, this material is expected to cause eye irritation. Symptoms may include pain or burning sensation, redness, swelling, tearing/discharge or blurred vision.

SKIN ABSORPTION – PRIMARY ROUTE

Although no appropriate human or animal health effects data are known to exist, this material is expected to be a health hazard by skin absorption. Repeated/prolonged skin contact with this material may result in absorption through the skin causing redness, burning, drying, cracking of the skin, and skin burns.

SKIN IRRITATION -- PRIMARY ROUTE

Although no appropriate human or animal health effects data are known to exist, this material is expected to be a skin irritant. May cause delayed skin irritation and blistering. Symptoms may include localized redness or rash, swelling, blistering and flaking of the skin. Prolonged or repeated exposure may cause a more severe skin response. This material may cause an allergic skin reaction (sensitization) in susceptible individuals upon repeated exposure.

INGESTION

Although no appropriate human or animal health effects data are known to exist, this material is expected to be a slight ingestion hazard. Lethargy and ataxia may result. Irritation or corrosive effects on the stomach may also occur.

INHALATION -- PRIMARY ROUTE

Wear appropriate respiration equipment if vapor or mist is expected. Over exposure may cause irritation to the respiratory tract and to other mucous membranes. Symptoms of irritation may include coughing, mucous production and shortness of breath.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE

This material or its emissions may induce an allergic or sensitization reaction and thereby aggravate systemic disease.

4. FIRST AID MEASURES

EYES

Immediately flush eyes gently with large amounts of water for at least 20-30 minutes. Retract eyelids often. Get prompt medical attention.

SKIN

Remove contaminated clothing. Wash the exposed area with mild soap and water. Flush w/lukewarm water for 15 minutes. If sticky, use waterless cleaner first. Seek medical attention if ill effect or irritation develops.

INGESTION

If large quantity is swallowed, give lukewarm water (pint) if victim is completely conscious/alert. Do not induce vomiting as risk of damage to lungs exceeds poisoning risk. Obtain emergency medical attention.

INHALATION

If overcome by exposure, remove victim to fresh air immediately. Give oxygen or artificial respiration as needed. Obtain emergency medical attention. Prompt action is essential.

ADVISE TO PHYSICIANS

If exposed, treat skin and eye burns or irritation conventionally after decontamination.

5. FIRE FIGHTING MEASURES

FLASH POINT METHOD= (Estimated)

GT 102C/216F

FLAMMABLE LIMITS (% VOLUME IN AIR) **AUTOIGNITION TEMP. METHOD=N/AP**

LOWER: N/AP UPPER: N/AP

FIRE AND EXPLOSIVE HAZARDS

High temperatures, inhibitor depletion, accidental impurities, or exposure to radiation or oxidizers may cause spontaneous polymerizing reaction generating heat/pressure. Closed containers may rupture or explode during runaway polymerization

EXTINGUISHING MEDIA

Dry Chemical, CO2, Foam, Water spray/water fog for cooling.

FIRE FIGHTING INSTRUCTIONS

Do not enter fire area without proper protection. Wear self contained breathing apparatus (pressure-demand MSHA/NIOSH) approved or equivalent. See Section 10 – decomposition products possible. Fight fire from safe distance/protected location. Heat/impurities may increase temperature/build pressure/rupture closed containers, spreading fire, increasing risk of burns/injuries. Water may be ineffective in firefighting due to low solubility. Use water spray/fog for cooling. Pressure relief system may plug with solids, increasing risk of overpressure. Notify authorities if liquid enters sewer/public waters.

6. ACCIDENTAL RELEASE MEASURES

Spilled or released material may polymerize and release heat/gases. Extinguish all ignition sources and ventilate area. Wear protective equipment during clean up. Dike and recover large spill. Soak up small spill with inert solids (such as vermiculite, clay) and sweep/shovel into vented disposal container. Wash spill area with a strong detergent and water solution; rinse with water but minimize water use during clean up. For spills on water, contain, minimize dispersion and collect. Dispose/report per regulatory requirements.

7. HANDLING AND STORAGE

Unless inhibited, product can polymerize, raising temperature and pressure, possibly rupturing container. Check inhibitor content often, adding to bulk liquid if needed. Do not blanket or mix with oxygen-free gas as it renders inhibitor ineffective. Do not store at below 32F – inhibitor can separate as a solid. If frozen, warm and remix material gently (<90F). Prevent moisture contact. Store in tightly closed, properly vented containers away from: heat, sparks, open flame, strong oxidizers, radiation and other initiators. Prevent contamination by foreign materials. Use only non-sparking tools and limit storage time.

DECONTAMINATION PROCEDURES

Follow standard plant procedures or supervisor’s instructions for decontamination operations.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

EYE PROTECTION

Eye protection such as chemical splash goggles and/or face shield must be worn when possibility exists for eye contact due to splashing or spraying liquid, airborne particles or vapor. Contact lenses should not be worn.

SKIN PROTECTION

When skin contact is possible, protective clothing including gloves, apron, sleeves, boots head and face protection should be worn. This equipment must be cleaned thoroughly after each use.

RESPIRATORY PROTECTIONS

No occupational exposure standards have been developed for this material. Where exposure through inhalation may occur from use, NIOSH/MSHA approved respiratory protection equipment is recommended.

ENGINEERING CONTROLS

Local exhaust ventilation may be required in addition to general room ventilation.

OTHER HYGIENIC PRACTICES

Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.

OTHER WORK PRACTICES

Use good personal hygiene practices. Wash hands before eating, drinking, smoking or using toilet facilities. Promptly remove soiled clothing and wash thoroughly before reuse. Shower after work using plenty of soap and water.

9. PHYSICAL AND CHEMICAL PROPERTIES

Boiling Point	N/DA
Vapor Pressure	N/DA
Vapor Density (air=1)	N/DA
Specific Gravity (water=1 @39.2F)	AP 1.20 @ 25C/77F
Percent Volatiles	Negligible
Evaporation Rate (Bac=1)	N/DA
Viscosity Units, Temp. (Brookfield)	AP 650 cps @ 25C/77F
Odor	Mild to sweet acrylic odor
pH	N/DA
Color	Straw to light yellow
State	viscous liquid

10. STABILITY AND REACTIVITY

CONDITIONS AND MATERIALS TO AVOID

High temperatures, localized heat sources (i.e., drum or band heaters), oxidizing conditions, freezing conditions, direct sunlight, ultraviolet radiation, inert gas blanketing; strong oxidizers, strong reducers, free radical initiators, inert gases, oxygen scavengers**.**

HAZARDOUS DECOMPOSITION PRODUCTS

Acrid smoke-fumes, carbon monoxide, carbon dioxide and perhaps other toxic vapors may be released during a fire involving this product.

11. SUPPLEMENT

NPCA HMIS RATING

Health	2
Flammability	1
Reactivity	2
Personal Protection**	D

**Respiratory protection may be necessary depending on conditions of use.

12. CHRONIC HEALTH EFFECTS INFORMATION

SARA TITLE 3: SECTION 311/312 HAZARD CLASS (40CFR370)

This product does not contain a chemical which is listed in Section 313 at or above the de minimus concentrations.

CERCLA INFORMATION (40CFR302.4)

This material contains no hazardous or extremely hazardous substances as defined by CERCLA or SARA Title III, and release is therefore not reportable.

13. REGULATORY INFORMATION

TSCA status: All components of this product are listed, or excluded from listing, on the United States Environmental Protection Agency Toxic Substances Control Act (TSCA) inventory.

California Proposition 65 Information: This product contains, or may contain, trace quantities of a substance(s) known to the state of California to cause cancer and/or reproductive toxicity.

This material contains an inhibitor (HQ, MEHQ, etc.). The type and amount meet product specifications. Contact a company representative for exact concentrations and details on inhibitor level maintenance.
*Note – qualifiers and codes used in this MSDS

EQ=Equal; AP= Approximately; LT= Less Than; GT = Greater Than; TR =Trace; UK = Unknown; N/AP = Not Applicable; N/P = No Applicable Information Found; N/DA = No Data Available.

TRANSPORTATION INFORMATION

US DOT Hazard Class Non-Regulated

WORKPLACE CLASSIFICATION

This product is not considered hazardous under the OSHA Hazard Communication Standard (29 CFR 1910.1200)

WASTE CLASSIFICATION

When a decision is made to discard this material as supplied, it does not meet RCRA's characteristics definition of ignitability, corrosiveness, or reactivity and is not listed in 40CFR261.33. The toxicity characteristic (TC), has not been evaluated by the Toxicity Characteristic Leaching Procedure (RCLP).

14. OTHER INFORMATION

Some of the information presented and conclusions drawn herein are from sources other than direct test data on the product itself. The information in this MSDS was obtained from sources, which we believe are reliable. However, the information is provided without any warranty, express or implied, regarding its correctness. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage or expense arising out of or in any way connected with the handling, storage, use or disposal of the product. This MSDS was prepared and is to be used only for this product. If the product is used as a component in another product, this MSDS information may not be applicable. This MSDS has been prepared in accordance with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).

15. RESIN & MONOMER CAS INDEX

The resins and monomers listed under Section 2 are identified by one or more of the following CAS numbers:

26098-37-3
113060-15-4
149717-53-3
29350-58-1
28516-30-5
31472-46-5
25215-73-9
27342-37-6
28572-30-7
29403-69-8
37339-47-2
56083-98-8
67712-08-7
68299-40-1
62569-28-2
32677-47-7
37347-86-7
37999-57-8
52453-94-8
56083-99-9
57863-48-6
61224-63-3
13048-33-4
1746-23-2
58182-50-6
68585-94-4
25749-46-6
27837-75-8
28679-80-3
30110-00-0
42133-45-9
58182-50-6
135108-89-3
112945-52-5
155122-62-6
25101-03-5
26588-55-6
28516-30-5
29350-58-1
31472-46-5
54228-09-0
67380-21-6
67939-40-6
68647-07-4
68492-68-2
68140-84-1
68140-88-5
68171-28-8

25987-82-0	67845-68-5 68585-94-4	64386-66-9

FINAL DRAINAGE NETWORK REHABILITATION
INTERIM REMEDIAL MEASURE COMPLETION REPORT
NATIONAL GRID
OU-3 BAY SHORE/BRIGHTWATERS FORMER MGP SITE
TOWN OF ISLIP, NEW YORK
AUGUST 11, 2010

Appendix B

NASSCO (National Association of Sewer Service Companies).
Guideline for the Use and Handling of Styrenated Resins in Cured-in-Place-Pipe

GUIDELINE FOR THE USE AND HANDLING OF STYRENATED RESINS IN CURED-IN-PLACE-PIPE

Prepared by the NASSCO CIPP Committee:

Committee Member:	Title:	Company Affiliation:
Norman E. “Ed” Kampbell	Principal Author	National Liner
Lynn Osborn	Committee Chairman	Insituform Technologies, Inc.
Marc Anctil	President, NASSCO	Logiball, Inc.
Irvin Gemora	Exec.Director, NASSCO	NASSCO, Inc.
Steve Gearhart	Committee Member	CIPP Corporation
Geoff Yothers	Committee Member	Inliner Technologies, Inc.
Greg Laszczynski	Committee Member	Mississippi Textiles Corporation
Gerry Muenchmeyer	Committee Member	Muenchmeyer & Associates Inc.
Kaleel Rahaim	Committee Member	Interplastic Corporation, Inc.
Jim Harris	Committee Member	City of Murfreesboro, TN
Larry Kiest	Committee Member	LMK Enterprises, Inc.

Disclaimer

This document presents a state-of-the-art guideline for the use and handling of styrene based resins in the CIPP pipeline rehabilitation industry. Following these guidelines does not guarantee that environmental damage, property damage, personal injury, or other damage or injury will not occur at, on, or near a CIPP installation site. CIPP projects and the associated risks vary tremendously and must be evaluated on a case-by-case basis. Some project circumstances may pose environmental risks completely unassociated with styrene. In addition, downstream sewers and receiving waters are variable, not only from place to place but also from time to time, and the discharge of cure water and condensates must be thoroughly evaluated for each installation. This document is not intended as a substitute for professional advice pertaining to the use and handling of styrene based resins, and it is recommended that a professional be consulted for such purposes. NASSCO makes no warranty of any kind whatsoever, whether express or implied, with respect to the guidelines set forth in this document. NASSCO disclaims any and all liability, including but not limited to property damage, personal injury, or any other manner of damage or injury arising out of the use of this document or the use and handling of styrene based resins in the CIPP pipeline rehabilitation industry.

EXECUTIVE SUMMARY

Styrenated resin systems as they are currently used today in cured in place pipe (CIPP) rehabilitation systems produce a safe and environmentally sound solution to the challenges of the need for restoring the nation's failing infrastructure. While current thought by U.S. academics assessing the overall use of styrene is leaning toward the conclusion that one might "reasonably anticipate styrene to be carcinogenic", a similar study carried out by the ECETOC (European Centre for Econtoxicology and Toxicology of Chemicals) concluded that "the carcinogenic potential of styrene, if one exists at all, is rated so low that occupational or environmental exposure to styrene is unlikely to present any carcinogenic hazard to man." Further, the current U.S. study background information states that there is no clear connection for styrene as a carcinogen until you add in the exposure to butadiene and/or benzene; both of which don't exist in the resin systems used by CIPP installers. The risk associated with styrene's use in CIPP is minimal and well within the Clean Water Acts' original intent of keeping the environment as free as is practical of chemical pollutants. CIPP installation sites managed with good housekeeping will present little opportunity for human health risks and/or environmental risks.

Although styrene occurs naturally in many foods such as cinnamon, coffee, and strawberries, styrene derived from petroleum and natural gas by-products have raised many questions about whether its usage in polyester and vinyl ester resin systems commonly used in CIPP to rehabilitate piping systems has the potential to adversely affect human health and/or the environment. While the CIPP process is a potential source of styrene, studies done to date have concluded that these type resin systems do not appear to be a significant source of styrene or any of the other volatile organic compounds (VOCs) that are typically of concern in occupational or air quality studies.

In a study undertaken by the Toronto Works and Emergency Services in 2001, AirZOne, Inc. conducted an investigation of the airborne concentrations of styrene and 24 other VOCs in eight randomly selected residences during the rehabilitation of sewers with CIPP installation. The study also measured ambient air quality, emissions from manholes and occupational exposure from these compounds. Air sampling was executed in three phases, before, during, and after the CIPP's installation. Styrene levels were elevated significantly during the CIPP installation in just two homes where the homes' traps were engineered to be dry in order to simulate a worst case scenario; the levels, although elevated, proved not to be a health concern. Levels measured in these eight homes were 0.1 to 0.2ppm. Styrene emissions from manholes during the CIPP process ranged from 0.16ppm to 3.2ppm. Personal exposure of the installation personnel in the breathing zone ranged from 0.08 to 0.5ppm. Styrene in the breathing zone was well below the industry's voluntary occupational limit of 50ppm for the installation personnel.

Independent, peer reviewed scientific journals have published numerous studies on the fate of styrene and its natural occurrence in the environment. "Biodegradation of Styrene in Samples of Natural Environments" by Min Hong Fu and Martin Alexander of Cornell University, concluded that styrene will be rapidly destroyed by biodegradation in most environments having oxygen; although the rates may be slow at low concentrations in lake waters and in environments at low pH. "Desorption and Biodegradation of Sorbed Styrene in Soil and Aquifer Solids" by Min Hong Fu, Hilary Mayton, and Martin Alexander of Cornell University, concluded that being broken down by microbes is a major fate mechanism by which styrene is destroyed in soils. The "Ecotoxicity Hazard Assessment of Styrene" by J.R. Cushman concluded that styrene was shown to be moderately toxic to fathead minnows, daphnids, and amphipods. It was further shown to be highly toxic to green algae, and slightly toxic to earthworms. There was no indication of a concern for chronic toxicity based on these studies. Styrene's potential impact on aquatic and soil environments, it was concluded, is significantly mitigated by the rapid rate at which it evaporates and biodegrades in the environment. And finally, Martin Alexander, in his "The Environmental Fate of Styrene", concluded that transport of styrene in nature is "very limited" because of its volatility from soils and surface waters, its rapid destruction in air, and its biodegradation in soils and surface and ground waters.

Because the styrene odor can be detected at such low concentrations (0.4 to 0.75ppm, depending on one's ability to detect odors), styrene's odor can be considered a nuisance to those not used to working around it. Some people are offended by this odor and are fearful of it; even though the concentrations they smell present no harm to them. To minimize odor problems during the installation of CIPP, residents should be advised to ensure that their sewer traps are in a proper state of repair. In cases of damaged, dry, or non-existent traps, the areas or rooms where floor drains or access to traps are located should be ventilated, if possible, by leaving doors or windows open to the outside during the CIPP installation process.

The CIPP installation contractor should practice good housekeeping and protect the project site such that any accidental resin spillage can be cleaned up and properly disposed of by the contractor. Given the nature of these resin systems to resist movement once placed in the tube's fiber matrix only very small quantities should be anticipated; excepting in the case of over-the-hole saturation installations.

The impact of styrene concentrations in the process water when discharged directly into a sewer collection system is insignificant. An eight inch pipeline 650 linear feet in length will discharge approximately 1700 gallons of water to the receiving sewer. At a typical concentration of 20ppm, the resultant discharge would be less than 0.3 pounds of styrene. A 48-inch pipeline 650 linear feet in length will discharge approximately 61,300 gallons of water to the collection system; which, again, amounts to approximately 10.2 pounds of styrene at a concentration level of 20ppm. With the assimilative capabilities of the downstream flows, no harm is thus anticipated to the wastewater treatment works and/or the POTW's discharge requirements.

Based upon the above given discharge quantities of typical CIPP installations, a CIPP installation contractor discharging these same quantities of process water to a ditch or other waterway is expected to meet the requirements of the EPA's small quantity generator exemption. In fact, due to the nomadic nature of the installer's discharges, a case could be made that the discharges fall under the category of non-point source contributions. However, the installation contractor is still advised to consider the negative impacts of the temperature of the water at discharge if the receiving drainage conveyance contains aquatic organisms that can be harmed by the possible sudden drop in available oxygen due to the large temperature difference between the process water and the receiving water body's temperature.

Any time an environmental release of a hazardous substance exceeds its reportable quantity as defined in 40 CFR Part 302, the contractor shall report this release immediately to the National Response Center (NRC). The reportable quantity for styrene per 40 CFR § 302.4 is 1000 pounds (or 2500 pounds of resin). Quantities below this amount are to be handled by the contractor in an expeditious manner; but do not require reporting.

INTRODUCTION

Styrene is the ideal monomer used for cross-linking polyester and vinyl ester resins. Although alternative monomers have been extensively investigated, none of those monomers have matched the overall performance of styrene. Over the last 30 years the increasing awareness of the need to limit the effects of styrene exposure have lead the polyester resin processing industry to pursue strategies to reduce exposure in the manufacturing and processing plant environment. Most, if not close to all, of the studies undertaken to date have centered on these producers and users environments which are dramatically different than the work environment of the CIPP installation contractor. Given the desire to address the rehabilitation industry's need for standards in the proper safe use and handling of styrenated resins for CIPP, NASSCO created a styrene task force to review the technical information available from these studies and current CIPP installation practices to produce this CIPP specific guideline. In addition to this guideline, NASSCO has prepared an Inspector Training Course to properly equip the owner and the project engineer with the necessary knowledge to ensure that a proper installation is achieved which will minimize the potential for release of styrene to the environment.

Polyester and vinyl ester resin systems have been used for more than 35 years in CIPP. During this timeframe there have been no noted serious consequences to their usage in CIPP. However, as no definitive document for these resin systems as used in this specific application existed, the unknown has given rise to speculation as to their safety with respect to the work force involved, the general public when the odors enter the structures connected to the piping under rehabilitation, and to the greater downstream environment from where the work is taking place.

Styrene is a common chemical compound found where we live and work. Indoor sources of styrene emissions include off-gassing of building materials and consumer products and tobacco smoke. Styrene is emitted from glued carpet, floor waxes and polishes, paints, adhesives, putty, etc.; and infiltration of gasoline-related VOCs from attached garages is well documented.

Styrene, with its low vapor pressure, is expected to exist solely as a vapor in the ambient atmosphere (Hazardous Substances Data Bank 2008). In its vapor phase it is expected to react rapidly with hydroxyl radicals and with ozone. Half-lives based on these reactions have been estimated to range from 0.5 to 17.0 hours (Luderer et al. 2005). Atmospheric washout (the removal from the atmosphere of gases and sometimes particles by their solution in or attachment to raindrops as they fall) is not expected to be an important process because of these rapid reaction rates and styrene's relatively high Henry's law constant (the extent to which a gas dissolves into a liquid is proportional to its vapor pressure). Outdoor air monitoring by the EPA for 259 monitoring sites involving some 8,072 observations in 2007 showed that the mean concentrations for these sites ranged from 0.028 to 5.74 ppb. The primary sources of styrene in outdoor air include emissions from industrial processes involving styrene and its polymers and copolymers, vehicle emissions, and other combustion processes.

Volatilization and biodegradation are expected to be the major fate and transformation processes in water. Again, based on its Henry's law constant, styrene is expected to volatilize rapidly from environmental waters; the extent of volatilization depends on the water depth and turbulence with low volatilization occurring in stagnant, deep water. The estimated volatilization half-life of styrene in a river three feet deep with a current of three feet per second and wind velocity of 9.5 feet per second is roughly three hours. Half-lives have been estimated from one hour for a shallow body of water to 13 days in a lake. Some biological oxygen demand studies have shown styrene to be biodegradable. Cohen et al. 2002 found that styrene generally does not persist in water because of it biodegradability and volatility.

MATERIAL FACTS

Styrene Monomer

Property	Value
Auto-ignition Temperature (in air)	914°F
Boiling Point:	
14.7 psi	293°F
1.9 psi	180°F
0.6 psi	130°F
Color	Colorless
Corrosivity	Non-corrosive to metals except copper and alloys of copper
Density (in air):	
32°F	7.71 lbs/US Gallon
68°F	7.55 lbs/US Gallon
122°F	7.33 lbs/US Gallon
Solubility: Styrene in Water	
32°F	0.018 gms/100 gmsH$_2$0
104°F	0.040 gms/100 gmsH$_2$0
176°F	0.062 gms/100 gmsH$_2$0
Solubility: Water in Styrene	
32°F	0.020 gms/100 gms styrene
104°F	0.100 gms/100 gms styrene
176°F	0.180 gms/100 gms styrene
Vol. Shrinkage upon Polymerization, typ.	17%

RECEIVING AND STORING CIPP RESINS AND INITIATION CHEMICALS

Resins should be received and stored in controlled conditions. Today’s state of the art facilities for tube saturation (wet out) consist of temperature controlled storage tanks mounted outside in a spill prevention area with interconnecting piping to the static mixing (and resin system disbursement) unit inside the saturation shop. This minimizes the typical styrene concentration in the work area to less than 0.5ppm, well below the industry’s voluntary standard of 50ppm (for an 8-hour work period). The remainder of the facilities in use varies from working with resin stored in totes to resin stored in drums; and catalyzed by combining the initiators, typically Perkadox and Trigonox, with the resin directly in the drums or in a vat (batch mixing) using a mixing blade. These latter methodologies can, without proper ventilation create styrene concentrations around 2-3ppm in the work area. A well ventilated work area is recommended if mixing is to be done in this fashion.

Based on studies to date, worker exposure to concentrations between 20 and 50ppm have been shown to produce no negative health effects. At concentrations above 50ppm, reversible effects on the central nervous system have been observed. With increasing exposure levels, e.g. levels of 200ppm, a distinct irritation of mucous membranes can result. Such effects are reversible and similar in character to exposure to solvents without adequate ventilation or after excessive intake of alcohol. According to a study carried out by the ECETOC (European Centre for Econtoxicology and Toxicology of Chemicals), the carcinogenic potential of styrene, if one exists at all, is rated so low that occupational or environmental exposure to styrene is unlikely to present any carcinogenic hazard to man.

Drums and Totes

Drums and totes of resin should not be allowed to stand in the sun for more than a few hours. As soon as possible after being received, drums and totes should be moved to a cool, shaded area. In hot weather they can be cooled with a water spray. It is advisable that inventories utilizing these two storage methods be kept to a minimum during summer months and that the resin be stored no longer than is necessary. Having the resin manufacturer acknowledge your usage rates and tailoring any additional inhibitor needs to compensate for the storage environment is strongly recommended.

Inhibitors are customarily added to resin systems to prevent polymer formation and oxidative degradation during shipment and storage. Inhibitors prevent polymerization in two ways; (1) they can react with and deactivate the free radicals in a growing polymer chain and (2) they can act as an antioxidant and prevent polymerization by reacting with oxidation products in the styrene monomer. Sufficient oxygen must be present for this inhibition to be realized. In the absence of oxygen, polymerization will take place as if no inhibitor were present. The rate of the inhibitor's depletion is dependent on the set of environmental conditions seen in the storage environment. Heat, water, and air can greatly accelerate the depletion of the inhibitor; with heat being the most influential. The table below illustrates the effects of temperature and oxygen levels on the storage time of styrenated resin systems.

	12ppm Inhibitor		50ppm Inhibitor Saturated w/ Air
Temperature	Saturated w/ Air	Less than 3ppm O_2	
60°F	6 months	10 to 15 days	1 year
85°F	3 months	4 to 5 days	6 months
110°F	8 to 12 days	Less than 24 hours	Less than 30 days

The safe storage and use of resins in non-bulk packaging is described in the National Fire Protection Association's (NFPA) code 30, chapter 4. Although each state can enforce other fire codes, such as the UFC and BOCA, the NFPA codes serve as a good initial planning document. It is strongly recommended that contractors engaged in their own saturating their tubes consult this book if they intend to store resins in non-bulk packaging.

Bulk Storage Tanks

In designing bulk storage facilities, certain basic factors must be considered. Resins containing the styrene monomer can be stored for relatively long periods of time if simple, but carefully prescribed conditions are met. In addition to the usual precautions taken with flammable liquids against fire and explosion hazards, precautions must also be taken against conditions that would promote the formation of polymer and oxidation products. To accomplish this, the design and construction of a satisfactory bulk storage system for styrenated resin systems requires careful consideration to eliminate excessive temperatures and to prevent contamination of the resin from infrequently used lines and other equipment.

Vertical storage tanks are commonly used for large volume storage. Horizontal storage tanks are equally satisfactory for resin storage; but are used for smaller volumes such as are typical of CIPP saturation facilities. The inlet and outlet piping is normally located near the bottom. To facilitate mixing where external refrigeration or heating are employed, it is recommended that either the inlet or outlet line operate through a floating swing-pipe adjusted so that the resin is always either withdrawn or discharged a few inches below the surface. Warm resin is withdrawn from the top, circulated through the chiller, and discharged to the bottom of the tank; cooling the tank from the bottom up.

A self-supporting-type dome roof is recommended for vertical storage tanks. This type of construction simplifies the installation of tank linings and permits the rapid drainage of uninhibited condensed vapors back into the liquid resin, thus reducing the polymer and stalactite problem. Roof and sidewall openings above the normal liquid levels in the tank should be of large diameter and the number kept to as few as practical. Large diameter openings are easily lined and can also be used for dual service features.

Insulation and temperature control equipment are key elements of a well done bulk storage system. The resin should be kept around 65°F (between 60°F and 75°F is acceptable) to facilitate the saturation process and allow for proper maintenance of the calibration of the resin mixing system.

The working capacity of the storage tanks should be, within reason, based upon the installer’s resin usage. A general rule of thumb is that a bulk tank system should be of a size to allow for the turning of the resin inventory every 45 days. Given that a full truckload shipment is approximately 4,500 gallons, a typical system would have a minimum storage volume of 5,500 to 6,000 gallons to ensure that the system does not completely empty prior to receiving another resin shipment.

Requirements of diking, tank spacing, and other features of safety are detailed in guidelines set by the National Fire protection Association (see NFPA 30, Chapter 2). These, as well as local building codes and governmental regulations, should be consulted since some requirements vary with the size and configuration of the installation.

Organic Peroxides

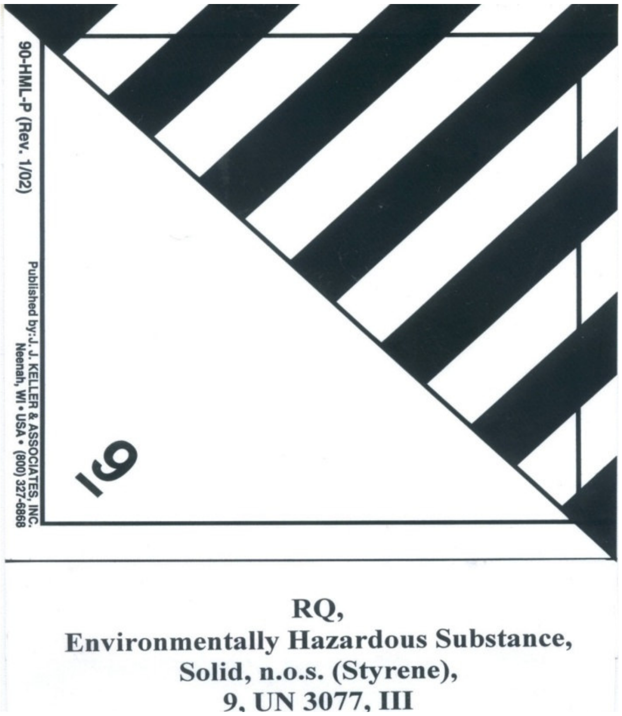
All peroxides are heat sensitive to some degree and require a controlled temperature for storage. Storage temperatures should be kept at, or below, 59°F for longer shelf life and stability. Prolonged storage at temperatures greater than 68°F is not recommended. Perkadox 16 will degrade if stored at elevated temperatures leading to gassing and potential container rupture which can result in a fire and/or explosion. Prolonged storage of Trigonox above 80°F is not recommended. All storage should be done in the peroxides’ original containers away from flammables and all sources of heat, sparks, or flames; out of direct sunlight; and away from cobalt naphthenate, other promoters, accelerators, oxidizing or reducing agents, and strong acids or bases.

HANDLING CIPP RESINS AND INITIATION CHEMICALS

Styrene based polyester resins are sensitive to contact with both heavy metals and red metals. Interaction with these metals is not predictable as in some cases they will inhibit the cure; and in others they will accelerate it. Common metals to avoid are; copper, brass, beryllium, chromium, lead and galvanized metal. The recommended metals or plastics to be used for storage and piping are carbon steel, stainless steel, aluminum, polyethylene, polypropylene, and Teflon. Resin transfer hoses must be chemically resistant and approved for use with styrene.

TRANSPORTATION OF RESIN-SATURATED TUBES

Per previous correspondence with the Federal Highway Transportation Agency, the resin-saturated tube is considered an acceptable "container" for shipment to the project site from the saturation shop. Currently, each tube is to be identified on its end with a class 9 placard and a description of its contents as shown in the figure to the right. If any one tube being transported in the truck exceeds 1000 pounds of styrene (approximately 2500 pounds of resin), then the truck itself must be placarded with the class 9 placard bearing the UN 3077 designation.



The transporting truck should be equipped with provisions to keep the saturated tubes out of direct sunlight and at or below 40°F. The floor should be insulated well enough to keep any heat from the roadway generating heat in the stored liners.

Depending upon the number of tubes being shipped and/or the residence time in the truck, styrene concentration levels in the air space of the storage box can reach approximately 90ppm. While this level can be irritating to the eyes, it will not produce any harm to the workers (NIOSH allowable concentration for work areas is 215ppm STEL, or short term exposure limit) and dissipates quite rapidly once the doors are opened.

CIPP INSTALLATION PRACTICES

All CIPP resin systems require that good housekeeping be practiced by the installation team on the project site. Provisions must be made by the contractor in advance for containing any accidental spillage of the resin on the work area. Further, if more than 2500 pounds of resin (1000 pounds of styrene) is spilled, the spill must be reported to the appropriate local pollution control authorities. Spills less than this "reportable quantity" are to be handled in a responsible manner by the contractor. Absorption with an inert material and placing in an appropriate waste disposal container is the industry standard for handling small spills on the ground. Some absorbing agents, such as untreated clays and micas, will cause an exothermic reaction which might ignite the styrene monomer. For this reason, absorbing agents should always be tested for their effect on the polymerization of the monomer before they are used on larger spills. Claymax®, a loose "vermiculite-like" material has been found to be an effective absorbent. Oil dry, kitty litter and sand will also work well. If the spill occurs on a hard surface, the area should be scrubbed with soap and water after the bulk of the spill has been cleaned up by the absorbent material. If the spill gets into a waterway, the spill must be contained using a floating dike similar to those used for oil spills. The resin can then be picked up by vacuuming the resin into a vacuum truck and subsequently placed in an appropriate waste disposal container.

Water inversions require that consideration be given to the temperature of the process water and any styrene content it may have after the CIPP installation has been completed. Depending on the volume of water used in the processing and the receiving environment (sanitary sewer, drainage ditch, waterway, etc), the water may require transportation and/or treatment prior to its final disposition. As stated in the introduction of this guideline, styrene readily dissipates through volatilization and degradation. In order to ensure that the cured liner remains tight fitting and dimensionally stable with the release of the cure water, the standard in the industry is to require that the cool down be continued until the temperature of the liner (and the surrounding ground) is no more than 100°F. During the cool down process a small hole is made in the downstream end to release hot water as cold water is introduced at the boiler truck to facilitate this effort. Process water once the liner temperature reads 100°F will probably have a temperature around 90°F or less which has been observed to have a styrene concentration in the range of 20 to 25ppm. The releasing of the process water directly to the sewer is not a problem due to the benefits of dilution in the downstream wastewater.

Process water released directly to a surface water course such as a drainage ditch or waterway must consider the allowable styrene concentration with respect to the receiving environment and the possible oxygen depleting capabilities of the process water's elevated temperature. Based upon the exhaustive literature review of the quick volatilization of the styrene and its potential to result in any long-term harm to plant and animal life, discharges of process water having the normal concentration levels of styrene and temperature at cool-down directly to a dry waterway should pose no harm. Further, while the common practice of many CIPP installers is to transport the process water to the nearest wastewater treatment facility, releases of process waters to ditches and/or waterways containing water and/or aquatic life containing no more than a concentration of 25ppm styrene and a temperature approximately equal to that of the receiving waterway should not create any environmental harm (see note below). For projects requiring large quantities of process water to be directly discharged to the environment, it is recommended that an engineering analysis be undertaken to determine the assimilative capacity of the receiving stream with respect to the temperatures and styrene concentrations anticipated.

Note: A typical 24-inch diameter culvert 100 linear feet in length will require around 2400 gallons of water to process. If released at 25ppm, the amount of styrene anticipated in its release is approximately 0.45 pounds.

Air inversion of the resin-saturated tube and curing the liner by the introduction of steam into the pressurized air flow greatly reduces the amount of styrene that will potentially be released into the environment. This is because the very quick cross-linking of the resin effectively binds up the styrene to a much higher degree using this method for curing. Most of the styrene released in this method of curing will be in the vapor form and requires little or no action on the contractor's part so long as the discharge point is maintained 6-inches above ground. The condensate generated in the pipeline being processed should be minimized by maximizing the flow of air for the site-specific conditions. The small volume of condensate produced during processing should be detained in a temporary impoundment if the quantity is expected to be discharged to a ditch or waterway containing water and/or aquatic life. Measurements made to date have shown that the condensate will probably have a concentration of around 30ppm. Depending upon the assimilative capacity of the receiving waterway, the condensate may be released once it has cooled to near ambient temperature (which will also result in a drop in the styrene concentration due to volatilization); or it can be retrieved into the steam generation system's water storage tank for later use in the production of steam during curing of the next CIPP.

It is imperative that the processing of the liner, whichever method of curing is used, is properly completed. Properly cured liners release little or no styrene to the environment. Thermocouples placed strategically in the liner-host pipe interface are a must. A written curing schedule developed for a CIPP system acknowledging the conditions present in the curing environment and the resin system proposed will lead to a proper cure and a long CIPP life; and no environmental impact.

SUMMARY

Proper curing and handling of CIPP systems should be done using the following guidelines:

Water Curing

Sanitary Sewers

1. Cure resin system per written curing schedule
2. Release process water to the sewer after per industry standards during/after cool-down.

Storm Sewers and Culverts

1. Cure resin systems per written curing schedule
2. Based upon receiving waterway's assimilate capabilities

        a. Discharge water once at ambient air temperature
        b. Discharge water once styrene concentration is confirmed to be at or below 25ppm; or
        c. Transport process water to nearest wastewater treatment facility

Steam Curing

Sanitary Sewers

1. Cure resin system per written curing schedule
2. Release condensate water directly to receiving sewer while processing

Storm Sewers and Culverts

1. Cure resin system per written curing schedule
2. Based upon receiving waterway's assimilative capabilities
    a. Detain condensate in a lined holding pond until it cools to ambient
    b. Discharge water once styrene concentration is confirmed to be less than 25ppm; or
    c. Retrieve condensate by pumping it into the steam generation truck's reservoir; or
    d. Transport condensate to nearest wastewater treatment facility.

Any residual styrene concentrations from a properly cured resin system that are taken into the runoff water from storm events will typically be short-lived, in the range of less than 1.0ppm and therefore pose no significant environmental threat.

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* indicates the paper was peer reviewed prior to publication.