Remedial Alternatives Analysis Report
Brownfield Cleanup Program
Lighthouse Pointe Riverfront Site
Rochester and Irondequoit, New York
Site #C828140

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LEADER

CERTIFICATION

I, Dixon Rollins, am currently a registered professional engineer licensed by the State of New York, and that this Remedial Alternatives Analysis Report was prepared in accordance with all applicable statues and regulations and in substantial conformance with the Department-approved Remedial Investigation Work Plan and Division of Environmental Remediation Technical Guidance for Site Investigation and Remediation (DER-10) and that all activities were performed in fill accordance with the DER-approved work plan and any DER approved modifications.

59206	8/16/16	
NYS Professional Engineer #	Date	Signature

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1.0 Introduction

This Remedial Alternatives Analysis Report ("RAAR") was prepared for Lighthouse Pointe Property Associates LLC ("LPPA") with regard to the Lighthouse Pointe Riverfront Site, New York State Department of Environmental Conservation ("NYSDEC") Brownfield Cleanup Program ("BCP") Site #C828140. The Lighthouse Pointe property ("Project Site") is divided into two brownfield sites: the Riverfront Site and the Inland Site (Site #C828141), see Figure 1.

1.1 Background

The Riverfront Site is used for recreational boating including; dockage, temporary boat storage and vehicle parking. The area was once composed of former lowlands adjacent to the Genesee River, which had been reclaimed for access to the River, a railroad right-of-way and bridge right-of-way. Fill in the property materials, including building debris, asphalt, stone debris and inert waste material (glass and scrap metal) were used to fill in the low areas.

The railroad easement is no longer active and residential streets (Thomas Avenue and Beaconview Court) and homes occupy the bluff overlooking the Riverfront Site. A complete history of the Project Site is provided in CDM Smith's 2013 Phase II Environmental Site Assessment Report ("Phase II") and Conestoga Rovers and Associates' ("CRA") 2006 Remedial Investigation Report.

In 2005, LPPA retained CRA to conduct a Phase I Environmental Site Assessment for the entire Project Site. One Recognized Environmental Condition ("REC") was identified for the Project Site, the former landfilling activities. Between 2005 and 2009, CRA conducted a Remedial Investigation ("RI") and supplemental investigations to fulfill the requirements of the BCP for the Project Site. The goal of the project was to characterize the environmental conditions so a plan could be developed to remediate the Project Site. The Riverfront Site was chosen for development of restricted residential and possibly commercial development. To satisfy all of the stakeholders, additional investigations were warranted resulting in the completion of the Remedial Investigation Report prepared by Leader Professional Services, Inc. ("Leader") in December 2014 for the Project Site. In July 2015, the BCP boundaries for the two sites were realigned to include in the Riverfront Site only those parcels south of Pattonwood Drive to facilitate the development of the Project Site.

The Riverfront Site is of particular interest to investors because of the access to the Genesee River and the obstacles to building are not as great as at the Inland Site. The RAAR addresses only the Riverfront Site.

1.2 Remedial Investigation Objectives

The objective of the RI was to characterize the Project Site's physical attributes, define the nature and extent of contamination, and to provide information to develop remedial alternatives from which a site remedial plan could be developed.

1.3 General

The Riverfront Site is underdeveloped property used by Voyager Marine to provide boaters dockage and property to build sheds to store boat supplies and recreational equipment. Owners of commercial vehicles also use the property for parking. Much of the property is vacant, but there are gravel covered road surfaces and parking areas with random areas of wild vegetation and grass lawns.

1.4 Site Topography and Drainage

The Riverfront Site topography is gently sloping to the west from the natural bluff on which Thomas Avenue and a former railroad bed are located. Drainage from the Riverfront Site follows the topography toward the river.

1.5 Geology and Hydrogeology

The Riverfront Site is located within the Erie Ontario Plains, a physiographic province boarding Lake Ontario and Lake Erie and is characterized by glacial landforms. The most characteristic of these that are expressed at the Project Site area are the glacial till plains and beach forms, which have been modified by the Genesee River, drainage pathways and use of the land for community infrastructure, landfilling and residential purposes. The soil and glacial sediment types expected in the undisturbed overburden include clay and silt beds from lacustrine lakes; dense clay, silt, sand and cobble/boulder mixtures from glacial till deposition; and sorted silt, sand and gravel intervals from post glacial fluvial and alluvial (water depositional) processes.

The bedrock beneath the overburden consists of limestone, shale and sandstones of the Upper Ordovician, Silurian, and Devonian Periods. Beneath the Project Site, the Queenston Shale is the first to be encountered. The erosion of the bedrock surface from the Genesee River results in a depth to bedrock ranging from approximately 30 to 111.4 feet below the ground surface (CRA July 2008, "Geotechnical Investigation and Conceptual Foundation Design Report"). The bedrock surface plunges to its lowest elevation near the river.

In the Riverfront Site groundwater is shallow, ranging from approximately 3 feet below ground surface to 9.5 feet below the ground surface. Based on the elevation change of the water table, groundwater is estimated to be flowing from east to west toward the Genesee River. The presence of fill, waste, and clay layers in the overburden, lenses or cells of perched groundwater are to be expected.

1.6 Climate

The climate in the Rochester area is temperate and can experience a range of temperatures from a winter low average of 18 degrees in January and to an average high temperature of 81 degrees in July. The average rainfall for the year is 34.34 inches, while the annual average snowfall is 99 inches.

1.7 Population and Land Use

The population of the City of Rochester is 210,358 (2010 Census) and averages approximately 6,135 individuals per square mile. The population of the Town of Irondequoit is 51,692 (2010 Census) and averages approximately 3,445 individuals per square mile. In the Riverfront Site

there are no residences and the property is used by tenants for recreational boat dockage and storage, and vehicle parking.

The Riverfront Site is located both in the City of Rochester and the Town of Irondequoit. The Riverfront Site within the City of Rochester's boundaries is zoned as "Harbortown Village District" a designation which permits water-oriented and water enhanced uses and encourages the development of pedestrian friendly mixed uses, including multi-family residential and commercial developments. The Town of Irondequoit designates its portion as "River Harbor" which permits moderate to high density multi-family residential development and certain commercial, recreational and open space development which can be an asset to the community.

1.8 Wetlands and Floodplains

Regulated wetlands are absent from the Riverfront Site.

Floodplains are areas located adjacent to waterways that are inundated when the banks of the waterway are exceeded. The Federal Emergency Management Agency ("FEMA") administers the response to natural disasters, including floods. To minimize those disasters caused by flooding, FEMA prepares and updates Flood Insurance Rate Maps ("FIRM") so communities are aware where there is a flooding potential. The FIRMs show the approximate limits of the base flood and other instances where there is a risk of flooding. The FIRM for the Project Site is shown as Figure 2 and shows the limits of the base flood (100 year flood) designated by "AE" which, according to the map, has an elevation of 249 feet above the National Geodetic Vertical Datum. The Riverfront Site also has limits designated a Zone X which include flood hazard areas between the 100 year (a flood elevation that has a 1-percent chance of being exceeded each year) and 500-year flood (a flood elevation that has a 0.2 percent change of being exceeded each year).

1.9 Previous Investigations

The previous reports conducted for the Project Site include approximately 13 documents listed in Table 1.

1.10 Environmental Quality Standards

To determine which contaminants are of concern, the NYSDEC regulations were reviewed based on the future use of the Riverfront Site, the groundwater classification and surface water classification of the Genesee River. NYSDEC regulations, Title 6 of New York Codes, Rules and Regulations ("6 NYCRR") Part 375 and NYSDEC Policy CP-51/Soil Cleanup Guidance provided information regarding cleanup requirements for the future use of the Riverfront Site and also conditions where ecological resources should be evaluated. As appropriate, soil sample results were compared to unrestricted use and restricted use residential soil cleanup objectives ("SCOs"). The Riverfront Site is contemplated to have multi-family residential and commercial development. During the evaluation of fish and wildlife, impacts portions of 6 NYCRR Part 375 and CP-51 were reviewed.

Groundwater in the Riverfront Site is classified as a Class GA groundwater in the Technical and Operational Guidelines and Standards ("TOGS") 1.1.1 Ambient Water Quality Standard and Guidance Values and Groundwater Effluent Limitations found in 6 NYCRR Parts 700-706. The Genesee River is classified as a Class B surface water and has an impaired status.

1.11 Contaminants of Concern

The contaminants of concern ("COC") impacting the Riverfront Site have been grouped into those impacting the soil and groundwater and those impacting the soil vapor. The COCs are those compounds found at concentrations above the unrestricted use SCOs include the following:

There are no COCs impacting the surface soil; however, NYSDEC has informed LPPA that additional sampling would be needed if NYSDEC and NYSDOH was to approve of using the surface soil without additional remediation.

The COCs impacting the subsoil include metals (Barium, Copper, Chromium, Lead, Silver, Zinc and Mercury), PAHs, 4,4-DDT and 4,4-DDD, and one occurrence of both Trichloroethene ("TCE") and Dioxin/Furan.

The COCs impacting the groundwater include Barium, Iron, Magnesium, Manganese, and Sodium.

The COC exceeding restricted residential SCOs include the following:

There are no COCs impacting the surface soil.

The COCs impacting the subsoil include metals (Barium, Lead, and Mercury), PAHs, and one occurrence of Dioxin/Furan.

The COCs impacting the groundwater include Barium, Iron, Magnesium, Manganese, and Sodium.

The COCs impacting the soil vapor are composed of volatile organic compounds ("VOCs") including: Benzene, Trichloroethene ("TCE"), Vinyl Chloride, and Methane (at concentrations which could potentially increase to be a fire and explosive hazard).

2.0 Fate and Transport of Contaminants of Concern

Fate and Transport of the COCs in the soil is dependent on the types of contaminants (organic compounds, inorganic compounds, and metals, etc.) and the transport mechanisms involved. In general, the fate of the COCs is similar even though they are chemically very different. PAHs (many times associated with petroleum products), TCE, and pesticides are organic compounds or synthetic organic compounds. All of the organic or synthetic organic compounds tend to attach themselves to other organic compounds found in the soil. Their relatively large molecular size, high octanol-water partition coefficients, and their low water solubility make them slow to migrate through the soil, groundwater or surface water. But if present at a high concentration or in a large volume like that from a spill, the potential for migration increases because there is a high enough concentration to overcome the absorption properties of the soil, there is enough volume to saturate the soil, and there is enough contaminant mass to overcome capillary forces in the soil. TCE is also very dense, so when it is spilled the weight of the spill will often drive itself downward, further than spills of other chemicals of the same size. This characteristic sometimes reduces the spill's surface area but increases the depth of penetration. When these conditions

occur, there is potential for the less soluble COCs to form a distinct non-aqueous phase liquid ("NAPL") in the soil or groundwater. An oily sheen on the water surface is an example of a NAPL. PAHs and pesticides also have low vapor pressures making them less susceptible to volatilization which would evaporate away some of the contaminant mass. In the environment, PAHs and pesticides are slow to degrade and attenuate, unless there are very specific conditions that exist; for example: pH, temperature, moisture, and oxygen content. As a result, PAHs and pesticides are persistent and relatively immobile.

The fate and transport of metals (Lead) are similar to PAHs in that they are also persistent and take special conditions to make them mobile in the environment. Metals are typically not very soluble unless the pH is correct. In most cases, metals migrate in solution when the pH of the water or leachate is low (<7). Once the pH of the fluid increases, metals will precipitate out of solution and attach to a soil particle or form a solid particle, which are less prone to fluid migration. As a solute, the metals are likely to attach themselves to other metals or ions, for example, hydroxide ions and calcium carbonate ions. As a solid particle or attached to a soil particle, metals are still susceptible to wind and water erosion, but as the size of the particle increases, the force needed to suspend the particle into the air or fluid becomes greater. As a result, these particles do not move readily.

In some cases, metals will be a part of another compound with different chemical properties, for example, Tetraethyl Lead once used in gasoline. Although not very soluble in water, Tetraethyl Lead is more soluble than a particle of Lead, allowing for greater mobility.

The persistence of metals in the environment is a concern, because there are no natural degradation processes. The oxidation state of the metal may change making more or less mobile, or more easily used by microbial organisms, but the mass of the base metal does not change. If they become part of the food chain, metals tend to bio-accumulate in the various organisms.

3.0 Exposure Pathways

Exposure pathways are the routes the COCs take from the contaminant source to receptors. The routes include: inhalation, ingestion, and direct contact. In the Riverfront Site, receptors are limited to visitors which are individuals renting dock space to access the river and the lake. No one resides in the Riverfront Site seven days a week, although some individuals may live on their boat for a weekend. Construction workers/utility workers may work at the Site for one or two days to make a repair. The Riverfront Site has limited utilities and these include: overhead electric and faucets with municipal potable water.

3.1 Inhalation

The inhalation route of exposure includes the inhalation of ambient air and indoor air. In general, the inhalation of COC contaminated ambient air is not a concern to any of receptors because of the lack of occupied buildings, the lack of VOCs in the surface soil, and the attenuation of the soil vapor as it migrates from the subsurface and dilutes into the ambient air. The construction workers in the Riverfront Site have a greater potential to be impacted by the contaminated ambient air during site remediation or during their work on underground utilities during building construction phases. During the remediation and construction phases, the excavation and the handling of contaminated soil will occur more frequently and last for longer periods of time,

increasing the probability for anyone downwind of the contaminant source to be effected. However, these will be relatively short term monitored events and these conditions can be anticipated and controlled by wetting the material, spraying foam blankets, and immediately removing the contaminated material to an offsite disposal location. Post remediation and construction inhalation concerns will linger for those utility workers entering excavations and trenches. Proper work procedures and personal protective equipment will significantly reduce health risks associated with the COCs.

Indoor air impacts from the soil vapor may affect all future buildings with basements or floor slabs in contact with the soil. As a result, the new construction will have to have engineered systems to vent sub-slab areas, to monitor utility pits for hazardous conditions and to seal utility conduits from vapor infiltration.

Utility workers entering sub-surface pits for water meters and pumping stations could also be at risk by soil vapor infiltrating these spaces. Since these are not occupied spaces, procedures should be put into place to monitor the air quality prior to entry, and engineered systems could be constructed to ventilate those spaces prior to entry.

3.2 Ingestion

The ingestion of COCs occurs when wind borne dust is inhaled, when soil is left on the hands or face and gets ingested during eating or hand-mouth contact, or contaminated water is ingested. The ingestion of soil scenarios are due to incidents where an individual was exposed to contaminated soil/dust and did not wash their hands and face before eating. Receptors most prone to this sort of impact would include remediation workers, building construction workers, and utility workers. The current visitors of the Riverfront Site would not typically be engaged in activities which would include contact with the soil. The ingestion of windborne dust can potentially impact all receptors of the Riverfront Site during remediation and construction. Visitors will, however, have limited access to the Riverfront Site once remediation and construction begins, limiting their exposure opportunities.

The incidental ingestion of water involves only groundwater. We have excluded the incidental ingestion of river water since the Riverfront Site has no measurable impact to the river water quality, and the river is also impacted by other sources upstream of the Riverfront Site. The incidental ingestion of groundwater is limited to only those construction workers and utility workers that may have to work in a wet excavation where splashing of the water may occur. Like ambient air impacts, the exposure risk to water can be anticipated and controlled by the use procedures to limit water infiltration and handling, but also using personal protective equipment and good hygiene.

3.3 Direct Contact

The direct contact with the COCs occurs when bare skin comes into contact with contaminated soil and water. The direct contact of soil and water scenarios are due to incidents where an individual did not wash after a potential exposure or did not wear the appropriate clothing for the work tasks. Receptors most prone to this sort of impact would include remediation construction workers, building construction workers and utility workers. Visitors would not be engaged in activities which would include contact with the soil or groundwater. A direct exposure to water only includes groundwater. We have excluded the direct contact with river water since the

Riverfront Site has no measurable impact to the river water quality and the river is also impacted by other sources upstream of the site. A direct contact with groundwater is limited to only those construction workers and utility workers who may have to work in a wet excavation where splashing of the water may result in their skin getting wet. During remediation and construction, visitors will have limited access to the Riverfront Site and limited exposure opportunities. Like ambient air impacts, the exposure risk to contaminated soil or groundwater can be anticipated and reduced with good work practices and proper personnel protective equipment.

4.0 Qualitative Exposure Assessment

The qualitative exposure assessment assumed both the surface soil and subsurface soil is contaminated although there is insufficient evidence to support a conclusion regarding the soil quality for the surface soil layer.

4.1 Potential Human Health Exposures

Section 2.0 above discussed the fate and transport mechanisms and the exposure pathways to the targeted receptors are discussed in Section 3.0. In this section, the exposed populations will be further discussed in the context of the existing conditions and the conditions that would exist after remediation. The onsite receptor populations fall into two groups: visitors to the property and utility workers. Offsite there are visitors and workers of the surrounding businesses, the residents of the adjacent homes and utility workers working on these adjacent properties that could potentially be impacted. However, these populations would have only a limited exposure to wind borne dust prior to the completion of the project, and this would only occur when the existing soil is disturbed or removed.

The findings of the potential human health exposure analysis are presented on Table 2 for the Riverfront Site's current condition and Table 3 for the post remediation and development conditions.

4.1.1 Onsite Human Health Exposure - Current Conditions

There are two populations that are potentially exposed to COCs onsite: visitors and utility workers. Given the current conditions of the Riverfront Site there is only two scenarios that could potentially expose these populations to COCs found in the soil: soil (excavation), when a direct contact exposure could result; and inhalation of dust when the soil is disturbed. Inhalation (exposure) of soil vapor is a very low risk because there are no residential homes or utility pits located on the Riverfront Site where soil vapor could infiltrate causing a hazard. In addition, sample results to date do not indicate soil vapor is a concern.

Ingestion, inhalation, and dermal contact (direct contact) of COCs in soil could potentially impact onsite utility workers if their tasks involved digging into the soil. Inhalation of COCs attached to dust particles could be a concern when there is high wind, exposed soil or vehicles travel on the exposed soil. Inhalation, COCs in a vapor phase could also be concern, but the transfer of COCs from the contaminated soil into the ambient air would have to be rapid and the soil and groundwater data does not support this a viable exposure risk.

Incidental ingestion of soil is a possible risk to utility workers that do not practice good hygiene by washing after work and before eating. Visitors and users of the Riverfront Site should not be impacted because they would have no reason to dig into the ground to expose potentially

contaminated subsurface soils. Visitors and users of the Riverfront Site could potentially have an inhalation exposure to contaminated dust if the ground surface is disturbed or the subsurface soil is left exposed by utility workers. Utility workers can also be exposed to contaminated dust but their employer's safe work practices should provide them with personal protective equipment to address dust issues during their work regardless of the classification of the work site as a hazardous waste remediation project or residential home site.

Ingestion of, and direct contact with, groundwater is also a potential route for exposure, but like ingestion and direct contact of soil, it is limited to the utility workers and then under limited circumstances when excavations must go below the water table. The ingestion and direct contact with groundwater incidents would only occur when there is a breakdown of safety procedures and when personal protective clothing fails (leaky boots or tear in rain suits or splash proof clothing). Proper hygiene would also minimize the impact of the direct contact exposure. Visitors and users of the Riverfront Site are not considered at risk because digging below the water table is not considered an activity undertaken by these groups.

4.1.2 Offsite Human Health Exposure –Current Conditions

The potential for exposure to contaminants for those individuals offsite are limited because the activities creating the exposure issue would involve excavation of the soil. In these rare circumstances, only those individuals living, visiting or working immediately adjacent to the Riverfront Site on Thomas Avenue, Beaconview Court or Pattonwood Drive could potentially be impacted. Those individuals using the Genesee River or living and working west of the Genesee River would not be impacted because of the distance between the source area and the location of those individuals would likely mitigate the threat of exposure.

Those offsite individuals present in areas immediately adjacent to the Riverfront Site could potentially be exposed to airborne dust (inhalation). This exposure risk is very low because of the distance between the individual and the source of contamination, and there are only limited instances when the exposure could occur. The conditions that would need to be overcome to create airborne dust and dust migration exposure risk include: exposure of the soil (the existing surface not being covered with stone, asphalt, or another material); dry soil; threshold wind velocities to create an airborne dust; and the correct wind direction to blow the dust across open land without the interference from topography and features on the intervening land.

Other direct contact exposures with contaminated soil or groundwater are not important because the individuals cannot be at the source of contamination and still be offsite.

Impacts to indoor air quality from the migration of soil vapor is a potential exposure concern, but not considered to be completed pathway from the Riverfront Site for the following reasons:

- The offsite properties are located at higher ground surface elevation and less susceptible to impacts from soil vapor migration (a longer migration pathway to the receptor property); and
- CRA 2006 data suggests there are no onsite impacts to those areas near the property line by Thomas Avenue and Beaconview Court.

4.1.3 Post Remediation Exposures

This section discusses the exposures possible to the various populations post remediation. Table 3 summarizes the discussion. The proposed remediation/construction will address contamination to meet the requirements of a restricted residential use. It is contemplated that will consist of covering the Riverfront Site with 2-feet of clean fill, or components of the development of the site (e.g., buildings, pavement). Although the surface soil that has been sampled meets the soil cleanup objectives for unrestricted and restricted residential property use, the amount of data is deemed to be insufficient to allow the surface soil to be left exposed. LPPA has decided to cover the ground surface instead of collecting additional sample data. These actions will be protective of onsite and offsite receptors.

The post remediation/development of the Riverfront Site will also address exposures associated with soil vapor, since the developers will need to address these issues in their building plans and get their plans approved by municipal government, NYSDEC and NYSDOH.

As a part of the Riverfront Site remediation, a Site Management Plan ("SMP") will be prepared which will provide procedures and direction for the owners that addresses: the maintenance of the property (procedures for handling soil, groundwater, etc.); when municipal agencies, NYSDEC and NYSDOH need to be notified (when there is a planned excavation, underground utility repair, when there is a planned change of use, etc.); and when annual inspections should begin. The SMP is a valuable facet of the remediation, because its implementation will help reduce deterioration of the soil cover, provide procedures for the safe handling of potentially contaminated materials, and reduce potential exposures to contaminated materials.

4.2 Potential Ecological Exposures

The Riverfront Site was built upon the lowlands and floodplain of the Genesee River at the beginning of the last century when the railroad and shipping interests took over the area. Development of the area remained limited, but the lowlands periodically received fill materials. Since the late 1960's the property has been used for access to the river by recreational boaters and occasionally for equipment or vehicle storage.

The natural environment of the floodplain and possibly wetlands were either removed or changed to coexist with the uses along the river. Presently, with the exception of a floodplain which is little more than a spill over point in the river, the Riverfront Site offers little ecological benefit to the river or lake. The designated floodplain area within the Riverfront Site is only a few acres (See Figure 2) and provides few mechanisms (vegetation, tributaries or wetlands) to capture of sediment and retain it from re-entering the river. NYSDEC does not recognize the Riverfront Site as ecologically significant. The nearest area of ecological significance, a freshwater wetland, is located approximately 1,500 feet upstream from the Riverfront Site, see Figure 3.

The lower main stem of the Genesee River (PWL ID 0401-0001) is designated as an impaired water body being impacted by contaminants such as Phosphorous, PCBs, silt and sediment. This portion of the Genesee River is designated as a Class B Fresh Surface Water, where the best uses are primary and secondary contact recreation and fishing. NYSDEC has also deemed these waters as suitable for fish, shellfish, and wildlife propagation and survival. According to CRA's 2006 Remedial Investigation Report, river water sampling did not show a significant impact

from the Riverfront Site. Bis (2-ethylhexyl) phthalate and Thallium were detected in the river water at a concentration below the laboratory's reporting limit, but still exceeding the Class B water quality standard. Iron and Aluminum also exceeded the Class B standard. Although the land is subject to rare flooding events, the ground surface is a mixture of vegetated and gravel covered surfaces limiting the erosion of the ground surface and limiting the potential for exposing the contaminated materials. None of the groundwater samples found Bis (2-ethylhexyl) phthalate or Thallium, and Bis (2-ethylhexyl) phthalate did not appear in the Riverfront Site soils. This suggests those contaminants may be from other sources upriver.

Groundwater discharging into the river is another route for contaminants to enter the river; however, as Table 4 indicates, Iron is the only contaminant in the groundwater, if discharged without further reduction of its concentration that would be in excess of the Class B surface water standards. The volume of groundwater entering the river was estimated using data from the CRA's 2008 Geotechnical and Conceptual Foundation Design Report and CRA's 2006 Remedial Investigation Report. CRA (2006) reports the hydraulic conductivity of the groundwater zone ranges from 0.0002834 to 0.2834 feet per day based on visual assessment of the grain sizes of the saturated zone and comparing these grain sizes to hydraulic conductivity ranges for a given grain size. At the river, the thickness of the groundwater seepage face is unknown, but was assumed to be 110 feet based on boring logs from CRA 2006 and 2008. Based on these assumed values for the thickness and hydraulic conductivity of the water table, the transmissivity of the water table ranges from 0.031174 to 31.17 cubic feet per day. Applying the transmissivity value, over the 1,500 foot north to south distance of the Riverfront Site (distance along the river) and the using the calculated groundwater velocity, the estimated amount of groundwater discharging into the river is estimated to range from 0.1 to 140.3 cubic feet per day.

The Genesee River has a discharge (volume) ranging from 1,663 to 4,213 cubic feet per second (mean discharge) from 1904 to 2013. These measurements were taken at the Ford Street Bridge in the City Rochester, approximately 8.1 river miles upstream of the Riverfront Site. Significant sources of discharge volume (runoff and storm water effluent) from the City of Rochester, Monroe County's Combined Storm Water Overflow Sewer Project, and the Eastman Business Park all discharge into the Genesee River before reaching the Riverfront Site. As a result, these discharge volumes are low estimates of the total river flow by the time it passes the Riverfront Site. Therefore, the impact from groundwater entering the river is extremely low.

Appendix A provides information and calculations for the groundwater discharge into the river.

The surface soils found on the Riverfront Site, although meeting the SCOs for restricted residential use, have one contaminants, Mercury present at concentrations, which exceeds the SCOs for ecological resources. Table 5 compares the surface soil quality data to those values. Mercury was found at concentrations ranging from 0.058 to 0.46 milligrams per kilogram ("mg/Kg") compared to a SCO of 0.18 mg/Kg.

Since the Riverfront Site is not a habitat for any known endangered species or identified as valuable natural resource, the significance of these exceedances is low. Remediation and development of the property will eliminate the contamination from being a potential source of ecological exposure.

To show the limited impact from the Riverfront Site, Appendix 3C "Fish and Wildlife Resources Impact Analysis Decision Key" was completed and is presented as Appendix B. Based on this assessment, the fish and wildlife found in the environment around the Riverfront Site and in the river have a limited potential to be impacted by the soil and groundwater. Once the Riverfront Site is covered, impacts from the soil will decrease, because the threat of erosion of the ground surface will have been mitigated.

5.0 Remedial Alternatives Evaluation

Contamination within the Riverfront Site was identified in the soil and groundwater. Subsurface soil contamination was found across the entire Riverfront Site, as was groundwater contamination. To organize the discussion of alternatives, Areas of Concern ("AOCs") were designated to include: Soil contamination as AOC 1 and Groundwater contamination as AOC 2.

The objective of the remediation will be to complete a cleanup consistent with the Track 4 approach. We have also evaluated the cleanup of the Riverfront Site to an unrestricted use.

5.1 Remedial Action Objectives

The remedial action objectives ("RAOs") for the project are to provide a safe area for people to live and recreate, at the same time to protect the water quality of the Genesee River. It is also a goal to make the Riverfront Site a place where reasonable working conditions exist for the construction workers building the development and for future workers making utility and maintenance repairs. To achieve these goals, RAOs have been developed for each source of contamination and exposure threat. Each of the RAOs is based on NYSDEC and/or New York State Department of Health ("NYSDOH") standards, criteria and guidance values (SCGs) which are applicable for the future use of the property and the threats to human health and the environment.

The eventual use of the Riverfront Site will be for multi-family residential style buildings and some commercial use, including seasonal rental dock space. To remediate the Riverfront Site so it can be used for multi-family residential living (in addition to commercial use), two SCGs can be used: Unrestricted Use SCO ("UU-SCO") and the SCGs associated with Track 4 cleanups identified in the NYSDEC Policy CP-51/Soil Cleanup Guidance.

To meet the SCGs for UU-SCO, the overburden will need to be remediated to acceptable levels from the ground surface to the top of the bedrock (including the saturated zone). Conceptually, to meet this objective the Riverfront Site will need to be excavated to at least a depth equal to the bottom of any fill material present. Based on the Site Characterization study at its deepest point the fill is approximately 10 feet thick. If contaminants have migrated into the natural soils excavation of the 15-acre Riverfront Site could extend to a depth ranging from 30 to 111 feet below the ground surface. For addressing the UU-SCO in the Remedial Alternatives Evaluation, the remediation will consider some form of cleanup scenario of 73,700 cubic yards of soil and fill. This amount was based on assuming an average depth of fill of 3 feet over 15 acres of Riverfront Site.

For the Riverfront Site the Track 4 cleanup will entail covering the property with 2-feet of clean fill, or components of the development of the site (e.g., buildings, pavement). The fill will meet

the restricted residential soil quality criteria found in CP-51 and Part 375-6.8. Using this approach, the soil sample locations exceeding SCOs for Ecological Resources will be covered and no longer a threat.

In addition to a 2-foot cover of clean soil a SMP will be prepared and implemented.

Groundwater quality requirements identified in NYSDEC's TOGS found in Part 700–706 also need to be addressed in the alternatives analysis.

5.1.1 Soil

The RAOs for the soil include:

- RAOs for Public Health Protection
    - Prevent ingestion/direct contact with contaminated soils.
    - Prevent inhalation of or exposure from contaminants volatilizing from contaminants in soil.
- RAOs for Environmental Protection
    - Prevent migration of contaminants that would result in groundwater or surface water contamination.

The RAOs for soil vapor include:

- RAOs for Public Health Protection
    - Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at a site.

5.1.2 Groundwater

The RAOs for groundwater include:

- RAOs for Public Health Protection
    - Prevent the ingestion of groundwater with contaminant levels exceeding drinking water standards.
    - Prevent contact with, or inhalation of volatiles from contaminated groundwater water.

5.2 Alternative Evaluation

The following discussion of remedial alternatives addresses each of the sources of contamination soil and groundwater. Tables 6 and 7 provided comparisons of surface and subsurface soil contaminant concentrations to SCOs. Soil vapor was not identified as a source of contamination because it is a result of contaminated soil and groundwater. Current sample data suggests soil vapor is not an immediate threat, but if the Riverfront Site is developed the development plan

and building plans will need to address potential soil vapor issues. Non-point source contamination concerns like soil vapor are often best addressed by approaching the problem during the building and utility design stage.

5.2.1 Soil AOC 1

No Action

If the soil in the Riverfront Site remains un-remediated and remediation does not occur the potential for human health and environmental exposure will remain. The sources of exposure are represented solely by the contaminant concentrations found in the surface soil, which are very low compared to ingestion or direct contact exposures soil values. Since the subsurface soil has higher contaminant concentrations, there is a potential exposure concern, but only if soil is exposure by excavation work. The buried soil could continue to contribute to soil vapor and groundwater contamination. Soil vapor sample concentrations are relatively insignificant. Groundwater contamination was found to be the result of the presence of several naturally occurring elements such as Iron, Magnesium, Manganese, and Sodium.

Under the No Action Alternative, there is no cost for remediation, because it assumes the remediation and development are not completed.

Implementation of Site Management Plan

This alternative includes the development and implementation of a SMP (including institutional controls) that would be put into place to control the use of the property through deed and easement restrictions, procedures for the maintenance of the property, and requirements for notifying the various agencies. Procedures that would be included in the SMP would cover the excavation of soil, handling of soil and groundwater when encountered during soil excavations or repair work, monitoring the property for compliance with the SMP, and notification requirements in the event the soil will be disturbed or where there is a change of use on the property.

The use of the SMP is an attractive alternative because the Riverfront Site is not a significant threat to human or ecological health and it puts into effect various institutional controls to control future exposures. Any future development plans will also need to be reviewed by the municipal government, NYSDEC and NYSDOH to determine if the remediation that had been conducted is adequate for the planned use, if the SMP is adequate for those planned changes, and if a building specific remedial action plan is required.

Soil Removal

The removal of the soil addresses COCs that represent an unacceptable exposure to human health and the environment. The soil would be removed to treat or dispose of offsite contaminated soil or fill/debris from past landfill practices since these fill/debris materials are suspected of being contaminated with COCs or other yet defined contaminants. The excavation formed from the removal action would be backfilled with soil meeting the SCGs for UU-SCOs. Figure 4 shows the approximate area where the excavation would take place.

To prepare for this undertaking an investigation will be needed to further define the extent of excavation, possible COC treatment options, and groundwater control options. For the purposes

of this report we have assumed approximately 73,600 cubic yards of material would be removed and a similar amount of fill would be needed. Although it is likely some form of groundwater control and treatment would be needed, that will be discussed in Section 5.2.2 Groundwater Contamination AOC 2.

Soil Cover

A soil cover addresses the elevated concentrations of the COCs that represent an unacceptable exposure to human health and the environment. The surface soil will be covered a 2-foot cover of clean soil, or components of the development of the site (e.g., buildings, pavement) (in keeping with the Track 4 cleanup objective) and addresses any concerns with the soil exceeding ecological SCOs. Figure 4 shows the approximate area where the soil cover would be placed.

In preparation for the soil cover, the area will be grubbed of trees and vegetation that are within the Brownfield site boundary. The surface will be graded to provide a slight slope to reduce the potential for erosion. During the grading process the finding of organic municipal waste is a possibility and it would potentially have to be removed until the elevation of the new pre-filled surface ("subgrade") is achieve. This will provide the organic waste with a 2-foot cover of clean fill. Inert construction debris, ash, cinders and soil may remain in place or be used for onsite fill where it will be covered with 2-feet of clean fill, or components of the development of the site (e.g., buildings pavement). If stained, odiferous, or releasing volatile organic vapors as measured by an OVA the soil or fill will be removed and stockpiled for characterization and to determine where it can be treated or landfilled.

The costing for this alternative assumes no soil or waste is removed from the property and a 2-foot soil covered is placed over the 15-acre project.

5.2.2 Groundwater Contamination AOC 2

The discussion of remedial actions assumes that all alternatives with the exception of the No Action and Site Management Plan alternatives will include the establishment of a cover of 2-feet of clean fill, which meets the restricted residential SCO criteria in addition to any other remedial actions presented in the discussion, or components of the development of the site (e.g., buildings, pavement).

No Action

If the groundwater in the Riverfront Site goes un-remediated and the site area remains with the same level of development, there will remain the potential for exposure to groundwater to users of the site and a potential environmental exposure for the groundwater discharging into the river. The groundwater exposure threat to humans is very low, because the groundwater is not used as a source of potable or non-potable of water. Groundwater can contribute to the creation of soil vapor, but VOCs are not found in groundwater samples suggesting the source of contamination is from a soil source. Contaminated groundwater can impact the environment of the river, but the estimated discharge volume of groundwater into the river is insignificant compared to the discharge volume of the river. Additionally, groundwater contamination in the Riverfront Site appear to be the result of naturally occurring metals.

Implementation of Site Management Plan

This alternative includes the development and implementation of a SMP (including institutional controls) that would be put into place to control the use of the property through deed and easement restrictions, the inclusion of procedures for the maintenance of the property and requirements when the site owners must notify the various agencies. Procedures that would be included in the SMP would cover the excavation of soil, handling of soil and groundwater when encountered during soil excavations or repair work, monitoring the property for compliance with the SMP, and notification requirements in the event the soil will be disturbed or where there is a change of use on the property.

The use of the SMP is an attractive alternative because the groundwater is not a significant threat to human or ecological health and it puts into effect various institutional controls to control future exposures. Any future development plans will also need to be reviewed by the municipal government, NYSDEC and NYSDOH to determine if the remediation that had been conducted is adequate for the planned use, if the SMP is adequate for those planned changes, and if a building specific remedial action plan is required.

Soil Removal

Removal of the soil and fill/debris is the remedy evaluated for AOC 1 to meet UU-SCO. This also impacts groundwater quality because all of the COCs present in the soil and fill/debris presumably are COCs impacting the groundwater. Removing the source of the groundwater contamination would help achieve the AOC 2 RAO's. Development of Riverfront Site or providing a vegetated ground surface would also address any concerns about sediment migration into the Genesee River.

Soil Cover

A soil cover alternative is presented because it is a part of the Track 4 cleanup approach. The soil cover can be designed to reduce the amount of runoff infiltrating through the soil and this could potentially reduce further groundwater contamination and a SMP is prepared for any future work.

The improvements that might be observed by lowering the amount of runoff infiltration assumes that the naturally occurring metals are attributed to the site and not an up gradient offsite source; for example, natural soils and bedrock. Quantifying an improvement to groundwater quality may be difficult. The Genesee River is also the primary recipient of groundwater from the Riverfront Site and improving the groundwater quality discharging into the river should be a worthwhile effort; however, the estimated volume of groundwater discharging into the river is insignificant compared to the flow volume of the river. The soil cover will probably have more of an impact on river water quality by reducing the amount of contaminants and sediment entering the river, than it will have on improving the groundwater quality that enters the river.

Because the groundwater problem has the potential for being a natural condition, and a cover system is likely to have little impact on groundwater quality the soil cover as a remedial alternative for groundwater will not be discussed in Section 6.0 "Detailed Analysis of Alternatives."

Groundwater Migration Control
An alternative to include installing a groundwater control system offers the benefit of reducing the amount of COCs entering the Riverfront Site and the river. Since the contaminates of concern impacting the groundwater are naturally occurring elements, a groundwater control system would have to be placed up gradient of the Riverfront Site and near the shoreline to ensure all potential sources of contamination are addressed.

A groundwater control system to address this need would involve the removal of groundwater in such a volume as to intercept the flow of groundwater prior to it entering the Riverfront Site and before being discharged into the river. At the same time, the system cannot be located near the river or the groundwater removal may induce a flow of river water into the saturated zone (water table). This would increase the amount of water needing removal, and potentially treatment, to bring about the desired outcome. Other problems must also be reviewed including the effect of lowering of the groundwater on the stability of the fill and natural overburden materials. Because the groundwater problem has the potential for being a natural condition, groundwater control will not be discussed in Section 6.0 "Detailed Analysis of Alternatives."

In-situ Groundwater Treatment
In-situ groundwater treatment would involve the injection or placement of proprietary chemicals into the groundwater to sequester the COCs so they no longer migrate in the groundwater. Sequestering agents are available for many of the COCs but not all at this time. The application of these agents would need to be done periodically until the groundwater quality improves. In addition to this continuing expense, there is a concern with this technology that the groundwater zone will become clogged with the metal precipitates and/or biomass either rendering the treatment ineffective or causing changes to the groundwater flow characteristics. Because of these anticipated problems, in-situ groundwater treatment will not be discussed in Section 6.0, "Detailed Analysis of Alternatives."

6.0 Detailed Analysis of Remedial Alternatives

6.1 Soil
The discussion of remedial actions assumes two alternatives, Soil Removal and Soil Cover, will actually conduct some form of remediation. The No Action and Site Management Plan alternatives are largely administrative functions and do not meet any SCO criteria.

6.1.1 No Action
Description
If the soil in the Riverfront Site goes un-remediated and no activities are conducted which might remove contaminated soil or increase the amount of exposed contaminated soil, there will be no change to the environmental quality of the property.

Assessment
With no remediation or deterioration of the site conditions, there will be no change to the level of exposure to contaminants impacting users of the site or the environment.

The anticipated cost for the No Action Alternative is zero, but if groundwater monitoring was required for the existing Riverfront monitoring wells then the expected costs would be

approximately $7,400.00 per event. This cost assumes the sampling of four monitoring wells and reporting the results quarterly. The analysis would include a complete Target Compound List of organic and inorganic compounds and reporting the results on the NYSDEC's EQuIS database. Table 8 provides itemized costs for monitoring well sampling.

6.1.2 Implementation of Site Management Plan

Description

This alternative includes the development and implementation of a SMP (including institutional controls) that would be put into place to control the use of the property through deed and easement restrictions, the inclusion of procedures for the maintenance of the property, and the placement of requirements when the site owners must notify the various agencies. Procedures that would be included in the SMP would cover the excavation of soil, handling of soil and groundwater when encountered during soil excavations or repair work, monitoring the property for compliance with the SMP, and notification requirements in the event the soil will be disturbed or when there is a planned change of use for the property.

The use of the SMP is an attractive alternative because the Riverfront Site is not a significant threat to human or ecological health and it puts into effect various institutional controls to control future exposures and risks. Any future development plans will also need to be reviewed by the municipal government, NYSDEC and NYSDOH to determine if the remediation that had been conducted is adequate for the planned use, if the SMP is adequate for those planned changes, and if a building specific remedial action plan is required.

Assessment

The use of an SMP and its institutional controls is an effective means to control site conditions from deteriorating and to control changes to the property. A deteriorating ground surface could expose soil contamination or increase surface soil erosion. This in turn, might negatively impact visitors, workers on the property, or the river environment. In the long term implementing a SMP will prevent an increase of human and environmental exposures to contaminants and help control future risks associated with development or changes to the property.

The preparation of the SMP would have an expected fee of approximately $6,000.00. An annual engineer's inspection would have an additional fee of approximately $1,000.00. Table 9 provides the itemized costs for completing the SMP and annual inspections.

6.1.3 Soil Removal

Description

The removal of the soil and fill/debris across the Riverfront Site so UU-SCOs can be met removes all of the unacceptable exposure threats to human health and the environment.

In preparation for the soil removal additional studies will be required to further define the extent of the removal, possible treatment options, and to further evaluate groundwater controls, since the excavation may need to extend into the saturated zone. Treatment options may be varied due to the nature of the COCs, but for this evaluation it will be assumed that all fill and debris will be landfilled. In addition to these activities, the area would be grubbed of trees and vegetation within the Brownfield site boundary. Prior to beginning the removal process waste classifications would be made and arrangements would be made for disposal. For this evaluation, all of the

material that is not stained, not odiferous, not releasing volatile organic vapors ("VOVs") as measured by an organic vapor analyzer or have a waste like consistency (wet or dry sludge) will be assumed to be non-hazardous and acceptable for disposal in a sanitary landfill. All other wastes would be stockpiled for characterization for appropriate offsite disposal. Uncontaminated materials would be stockpiled and covered for future use.

The resulting excavation would be filled with a similar amount uncontaminated materials previously removed from the Riverfront Site and other fill materials meeting the requirements of UU-SCOs. The new ground surface would meet the requirements of the future development.

Assessment

This alternative would address the short and long term risks associated with the soil. This alternative would also provide a benefit river water quality by reducing runoff and sediment entering the river. The alternative would benefit groundwater quality, because it removes the source of groundwater contamination associated with the Riverfront Site, but would not address any contamination coming from natural sources or offsite. Further, it would cause excessive truck traffic, and increase risks of spreading contaminants off-site due to accidents or dust from the trucking.

To completely remove contaminated soil from the Riverfront Site would be expected to cost approximately $9,522,000.00. Table 10 provides the itemized cost for the cover soil alternative.

6.1.4 Soil Cover

Description

A soil cover addresses the elevated concentrations of the COCs that represent an unacceptable exposure to human health and the environment. The surface soil will be covered a 2-foot cover of clean soil, or components of the development of the site (e.g., buildings, pavement) (in keeping with the Track 4 cleanup objective) and addresses any concerns with the soil exceeding ecological SCOs.

In preparation for the soil cover, the area will be grubbed of trees and vegetation that is within the Brownfield site boundary. The surface will be graded to provide a slight slope to reduce the potential for erosion. During the grading process the finding of organic municipal waste is a possibility and it would potentially have to be removed until the elevation of the new subgrade is achieve. This will provide the organic waste with a 2-foot cover of clean fill. Inert construction debris, ash, cinders and soil may remain in place or be used for onsite fill where it will be covered with 2-feet of clean fill. If stained, odiferous, or releasing volatile organic vapors as measured by an OVA the soil or fill will be removed and stockpiled for characterization to determine the where it can be treated or landfilled.

Assessment

This alternative addresses the short and long term risks associated with the soil and if designed to be a permeable barrier will keep soil vapor at manageable levels. This alternative may also provide a benefit river water quality by reducing runoff and sediment entering the river. The alternative will have little to no benefit to groundwater quality and does not reduce the amount of contaminants on the site.

To completely cover the Riverfront Site with 2-feet of clean fill has an expected cost of approximately $1,630,000.00. Table 11 provides the itemize cost for the cover soil alternative.

6.2 Groundwater Contamination

6.2.1 No Action

Description

The no action alternative does nothing to improve groundwater quality beneath the Riverfront Site therefore no change to groundwater quality is expected.

Assessment

The human exposure to groundwater contamination is very low, because the groundwater is not used as a source of potable or non-potable water. Groundwater can contribute to soil vapor intrusion issues, but VOCs are not present in the groundwater at concentrations which might be problematic. This suggests the soil is a contributing source of VOCs. Contaminated groundwater can impact the environment of the river, but the estimated discharge volume of groundwater into the river is insignificant compared to the discharge volume of the river.

The anticipated cost for the No Action Alternative is zero, but if groundwater monitoring was required for the existing Riverfront Site monitoring wells, then the expected cost would be approximately $7,400.00 per event. Table 8 provides an itemized cost for the sampling.

6.2.2 Implementation of Site Management Plan

Description

This alternative includes the development and implementation of a SMP (including institutional controls) that would be put into place to control the use of the property through deed and easement restrictions, the inclusion of procedures for the maintenance of the property, and requirement when the site owners must notify the various agencies. Procedures that would be included in the SMP would cover the excavation of soil, handling of soil and groundwater when encountered during soil excavations or repair work, monitoring the property for compliance with the SMP, and notification requirements in the event the soil will be disturbed or when there is a planned change of use for the property.

The use of the SMP is an attractive alternative because the Riverfront Site is not a significant threat to human, ecological health, or groundwater and it puts into effect various institutional controls to control future exposure to contaminants. Any future development plans will also need to be reviewed by the municipal government, NYSDEC and NYSDOH to determine if the remediation that had been conducted is adequate for the planned use, if the SMP is adequate for those planned changes, and if a building specific remedial action plan is required.

Assessment

The use of the SMP will not improve groundwater quality, however, it will not cause the groundwater quality to deteriorate because of uncontrolled activities on the ground surface.

The preparation of the SMP would have an expected fee of approximately $6,000.00. An annual engineer's inspection would have an additional fee of approximately $1,000.00. Table 9 provides an itemize cost of the SMP preparation and follow up inspections.

6.2.3 Soil Removal

Description

This alternative was discussed in detail in Section 6.1.3 for AOC 1. The alternative addresses groundwater contamination by removing the soil and fill/debris which are probably contributing the many of the COCs with the exception of those metals that are believed to be from the natural soil and bedrock. Any offsite contributions of either organic compounds or metals would not be addressed by this alternative.

It is envisioned that some evaluation of groundwater control would be needed during the soil removal especially in those situations where the saturated zone is penetrated. For the purposes of this evaluation and costing no groundwater control measures have been assumed. Additional studies would be required during the design phase to determine the extent of groundwater control and treatment that would be needed.

After completing the remediation, it is not envisioned that an SMP would be needed since the Riverfront Site would meet the highest level of cleanup. In the event groundwater contamination lingers and SMP may be required for continued groundwater monitoring and institutional controls (deed restrictions and an easement) would be needed to complete groundwater monitoring and to remove the potential of a new owner using the groundwater.

Assessment

The removal of on-site COC sources would improve groundwater quality by eliminating those contaminants from migrating into the groundwater; however, it would not impact the off-site sources of contamination or sources of COCs which may be from the native soils and bedrock. Also by removing the sources of the on-site COCs does not provide an immediate benefit, groundwater contamination would remain until natural attenuation processes or another remedial alternative is implemented.

The preparation of the SMP an annual engineer's inspection fees are shown on Table 9. The cost of the soil removal is shown on Table 10.

7.0 Remedial Alternative Summary and Recommendation

Five alternatives were discussed in Section 5 and 6 with various options and these are shown below:

1. No Action

2. Soil
    a. Implementing an SMP
    b. Complete Soil Cover
    c. Complete Soil Removal

3. Groundwater
    a. Implementing an SMP
    b. Complete Soil Removal

The soil cover addresses the immediate threats from soil contamination; exposure to humans and the environment. It does not address vapor migration, but this concern is suspected of being minimal and not a significant threat if the Riverfront Site is not developed. When the Riverfront Site is developed, further safeguards can be constructed with the buildings and infrastructure. The soil cover indirectly can affect groundwater too, by not allowing recharge through contaminated soil and fill/debris. Observing a positive impact to groundwater may not be realized or take many years to materialize. Surface water will be improved by eliminating surface soil from entering the river either as a dissolved contaminant or sediment.

The complete removal of soil from the Riverfront Site meets all of the requirements for unrestricted use and all of the RAO's for soil. It is suspected the completion of this alternative would also significantly improve the chances for improving groundwater quality, but it does not address naturally occurring compounds also found in the soil and bedrock and offsite sources of contamination. It should also be noted it many years afterward that GA groundwater quality standards will be met, because of residual contamination present in the groundwater zone and the rate of natural attenuation. It is possible that groundwater quality may never meet the GA groundwater standards.

As a result of our analysis when comparing the two remedial alternatives, after completion of the remediation both remedial alternatives may have the same outcome. Based on the information provided in each of the discussion of the alternatives, the requirements for a Track 4 cleanup and considerations for restricted residential, and ecological and groundwater protection of the Riverfront Site the following alternatives are recommended.

AOC 1 – Soil

Recommendations for AOC 1 include conducting placement of a two foot soil cover meeting restricted residential soil quality requirement, or components of the development of the site (e.g. buildings, pavement) and the preparation and implementation of a SMP.

The 2-foot soil cover (or buildings or pavement) restricts access to the existing soil. The benefit of implementing a SMP will be to limit the exposures and the release of contaminants because

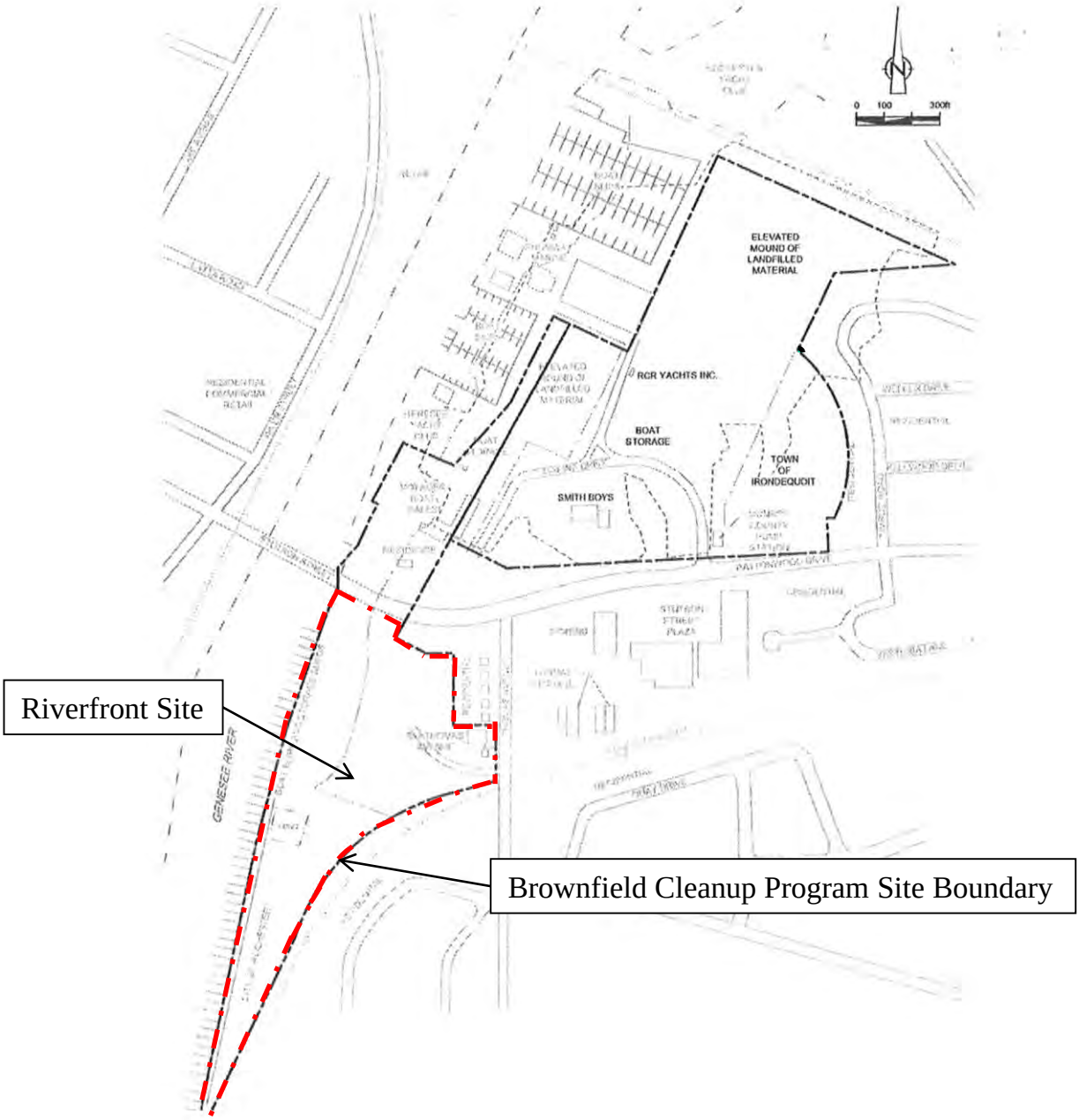
proper excavation and soil and groundwater handling techniques are used. Long term benefits of the SMP will include requiring the municipal governments, NYSDEC and NYSDOH to be notified of soil disturbance activities and potential changes to the property, to limit the use of the property to certain activities and instituting annual inspections.

AOC 2 – Groundwater Contamination

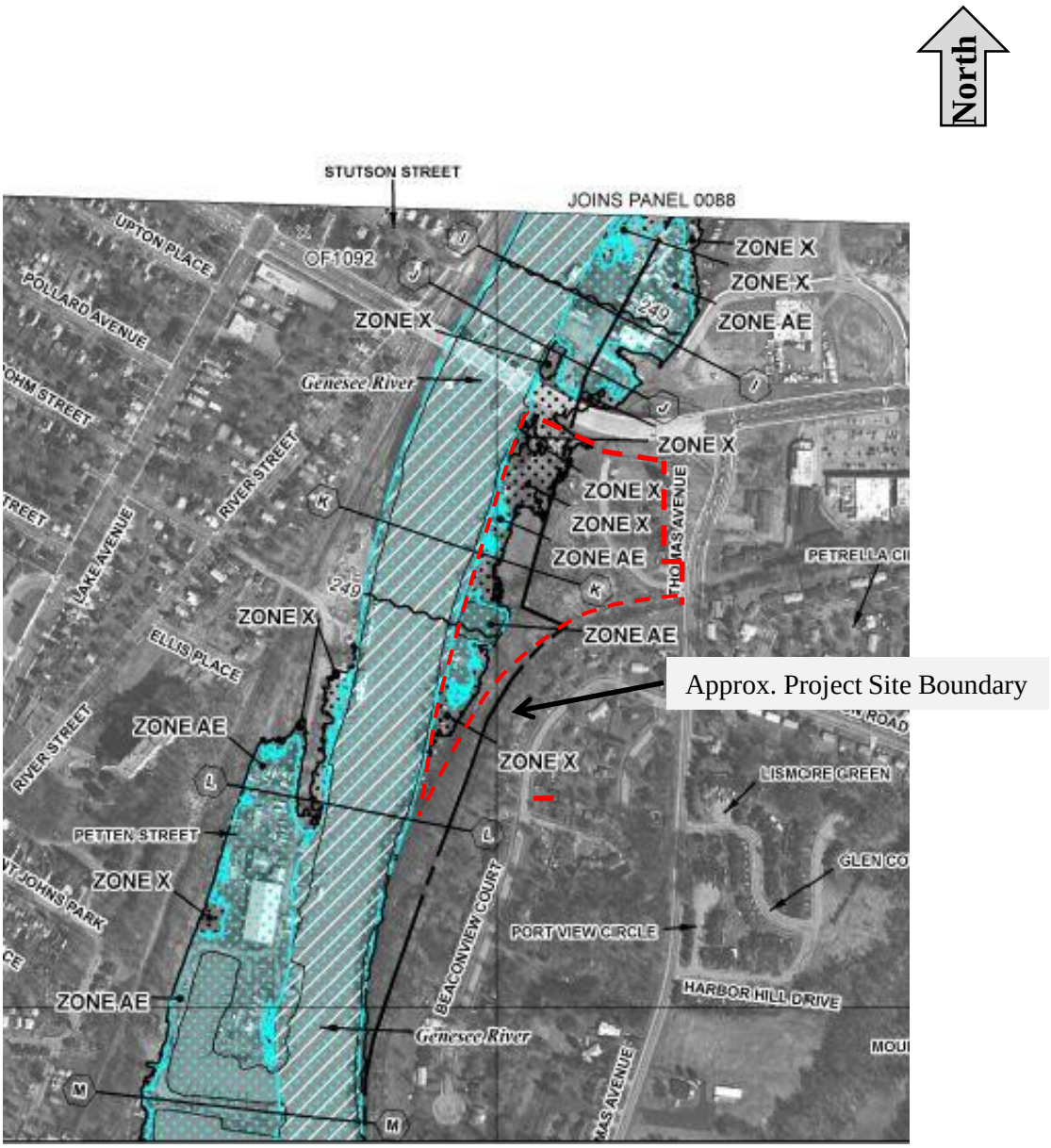
Recommendations for AOC 2 include preparing and implementing a SMP to address the future handling of soil and groundwater during maintenance activities where digging below the water table will be required, to address changes in property use and to incorporate institutional controls for the property.

If groundwater control is needed to stabilize an excavation, then groundwater control options should be utilized. How groundwater control is achieved should be evaluated when the goal for this activity is defined and treatment options can be explored. A full-time groundwater control system is not recommended because:

- Groundwater is not being used currently;
- Addressing groundwater concerns with control and treatment will have limited effect on lowering exposure to future users, visitors and workers on the property.
- There appears to be no correlation between groundwater quality and soil vapor impacts.
- The volume of groundwater entering the river is insignificant compared to the volume (flow) of water in the river. Consequently, impacts to the river are believed to be negligible.
- Groundwater control and treatment of the groundwater will not improve groundwater quality unless the source material is removed or treated and up gradient sources of contamination are also addressed. Since the groundwater quality is impacted by naturally occurring elements, there is no guarantee that there is a defined source of contamination.

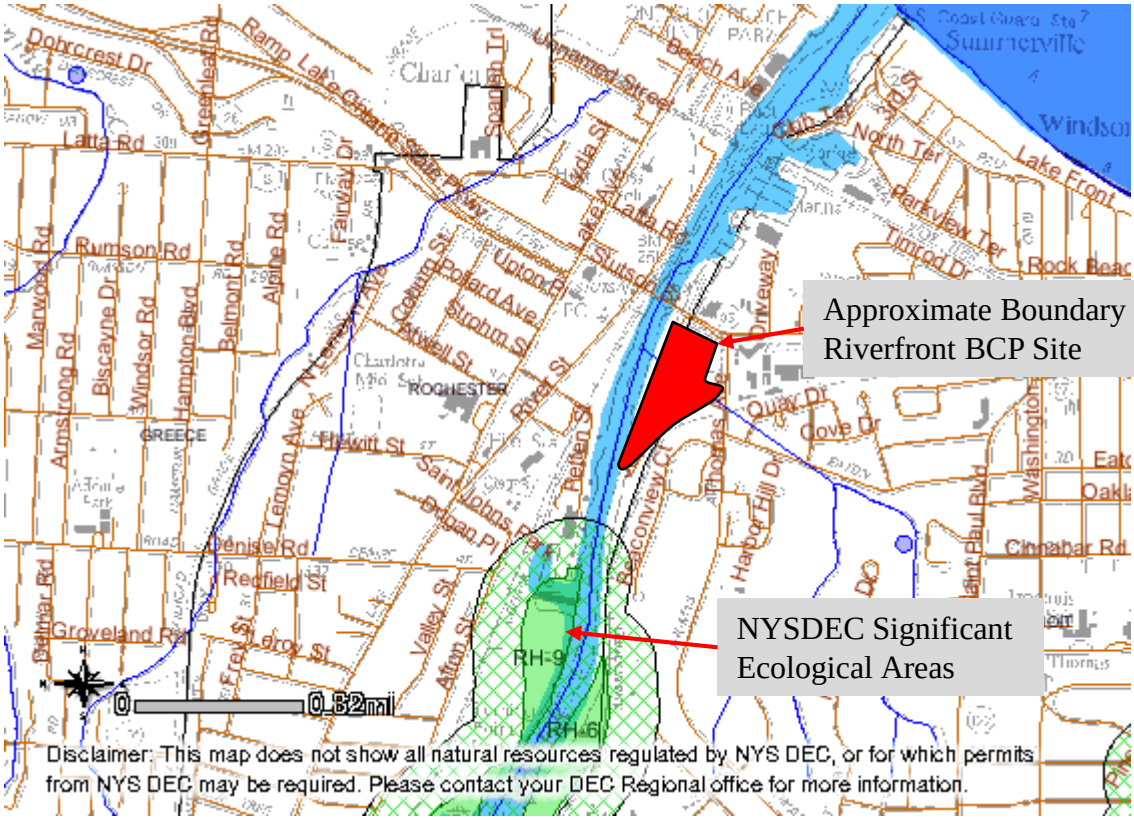


Title: Location of Riverfront Site Lighthouse Pointe Property Rochester and Irondequoit, New York	LEADER Leader Professional Services, Inc 271 Marsh Road-Suite 2 Pittsford, New York 14534 (585) 248-2413 Fax (585) 248-2834	Project 776.001 Date 04/24/2016 Scale NTS	Drawn PVS Checked MPR File Name Site Location	Figure 1
Prepared For: Lighthouse Pointe Property Associates LLC 1400 Crossroads Building Rochester, New York				



Title: Floodplains Map Riverfront Site Rochester and Irondequoit, New York	LEADER Leader Professional Services, Inc 271 Marsh Road-Suite 2 Pittsford, New York 14534 (585) 248-2413 Fax (585) 248-2834	Project 776.001 Date April 30, 2016 Scale NTS	Drawn PVS Checked MPR File Name Site Location	Figure 2
Prepared For: Lighthouse Pointe Property Associates 1400 Crossroads Building Rochester New York				

North



Title: Significant Ecological Areas Riverfront Site Rochester and Irondequoit, New York	LEADER Leader Professional Services, Inc 271 Marsh Road-Suite 2 Pittsford, New York 14534 (585) 248-2413 Fax (585) 248-2834	Project 776.001 Date April 30, 2016 Scale NTS	Drawn PVS Checked MPR File Name Site Location	Figure 3
Prepared For: Lighthouse Pointe Property Associates 1400 Crossroads Building Rochester New York				

Title	Approximate Area of Site Cover Lighthouse Pointe Riverfront Site Rochester and Irondequoit, New York
Prepared For	Lighthouse Pointe Property Associates, LLC 1400 Crossroads Building Rochester, New York

LEADER
Leader Professional Services, Inc.
271 Marsh Road-Suite 200
Pittsford, New York 14534

Project	776.001
Date	02/06/2016
Scale	None
Drawn	PVS
Checked	MPR
File Name	
Figure	4

TABLE 1

List of Previously Completed Reports for the Lighthouse Pointe Sites Lighthouse Pointe Property Associates, LLC Irondequoit and Rochester, New York

December 1988, Soil and Groundwater Investigation, Malcom Pirnie, Inc. for the Voyager Boat Sales Property.
1992, Investigation of Old Rochester City Landfill, Engineering Science, Inc. for NYSDEC.
1992, Phase I Environmental Site Assessment, Edward O. Watts for the Voyager Boats Sales Property.
June 1995, Sampling of a Portion of the Old Rochester City Landfill, F-E-S Associates for Mr. Skip Shumway.
1999, Phase I Environmental Site Assessment on Shumway Marina Property, C&O Technologies, Inc.
1999, Environmental Sampling and Geotechnical Study, Passero Associates, P.C. for the construction of Marina Drive for the Town of Irondequoit.
2001, Phase I Environmental Site Assessment on the Shumway Marina property , LaBella Associates, P.L.
2005, Phase I Environmental Site Assessment on Lighthouse Pointe Property, Conestoga Rovers and Associates for Lighthouse Pointe Property Associates.
2006, Remedial Investigation on Lighthouse Pointe Property, Conestoga Rovers and Associates for Lighthouse Pointe Property Associates.
July 2008, Geotechnical Investigation and Conceptual Foundation Design Report, Waterfront Property Development, Rochester, New York, CRA Infrastructure and Engineering, Inc. for Lighthouse Pointe Property Associates LLC.
2009, Additional Characterization Investigation Results for Lighthouse Pointe Property, Conestoga Rovers and Associates for Lighthouse Pointe Property Associates.
June 10, 2013, Phase II Environmental Site Assessment Report, Lighthouse Pointe Site Targeted Brownfields Assessment, City of Rochester and Town of Irondequoit, New York, CDM Smith for USEPA.
July 2014, Groundwater Sampling Report for Lighthouse Pointe Riverfront Area Property, for Lighthouse Pointe Property Associates, Leader Professional Services, Inc.

Table 2
Summary of Current Exposure Assessment

Environmental Media & Exposure Route	Exposure Assessment On-site Individuals	Exposure Assessment Off-site Individuals
Inhalation	Visitors – Windblown dust or vehicle traffic created dust is a concern, but visitors have limited exposure due to the amount of time they are on the site. On-site Workers - Windblown dust, vehicle traffic or digging in soil can increase the inhalation exposure, but the duration of exposure would be limited to either those times the individual is outdoors, the time the individual is conducting the digging activity, and limited by the use of personal protective equipment. Utility Workers - Windblown dust, vehicle traffic or digging in soil can increase the exposure, but the duration of exposure would be limited to the time the individual is conducting the digging activity and by the use of personal protective equipment.	Residents – Limited concern. Windblown dust. vehicle or traffic can create an inhalation exposure to the off-site residents but the risk is limited because of their location, the distance from the source of contamination, and wind direction. Visitors – Limited concern. Windblown dust or traffic can create an inhalation exposure to the off-site visitor but the risk is limited because of their location, the duration of the exposure, the distance from the source of contamination, and wind direction. Off-site Workers – Limited concern. – Limited concern. Windblown dust or traffic can create an inhalation exposure to the off-site worker but the risk is limited because of their location, the distance from the source of contamination, and wind direction. Utility Workers - Limited concern. – Limited concern. Windblown dust or traffic can create an inhalation exposure to the off-site worker but the risk is limited because of their location, the distance from the source of contamination, and wind direction.
Direct Contact and Accidental Ingestion of Soil	Visitors – Not a potential exposure route because they would not be digging in the soil. On-site Workers – Exposure would be the result of digging in the soil and not practicing good hygiene or using personal protective equipment. Utility Workers - Exposure would be the result of digging in the soil and not practicing good hygiene or using personal protective equipment.	No Concerns. The populations would not be on-site to have an exposure.
Environmental Media & Exposure Route	**Human Health Assessment On-site Individuals**	**Human Health Assessment Off-site Individuals**
Ingestion of Groundwater	Visitors – Not expected to be digging below the water table. Site does not use groundwater as a source of drinking water.	No Concerns. The populations would not be on-site to have an exposure.

Table 2
Summary of Current Exposure Assessment

	On-site Workers – Exposure would be the result of digging below the water table to make a repair and failing to take safety precautions and use appropriate personal protective equipment. Utility Workers – Exposure would be the result of digging below the water table to make a repair and failing to take safety precautions and use appropriate personal protective equipment.	
Soil Vapor	Visitors – Not expected to be impacted because there are no buildings on site. On-site Workers – There are no buildings on the site. Unless the workers are digging into the soil there is no concern from soil gas. Utility Workers – Exposure not expected to be a concern unless the workers are digging into the soil and spending prolonged periods of time in excavations. Failing to follow safety precautions and using appropriate personal protective equipment will increase a potential exposure.	No Concerns. The populations would not be on-site to have an exposure.

Table 3
Summary of Post Remedial Exposure Assessment

Environmental Media & Exposure Route	Exposure Assessment On-site Individuals	Exposure Assessment Off-site Individuals
Inhalation	No concern. The on-site contamination is either covered or removed.	No concern. Off-site contamination is covered.
Direct Contact and Accidental Ingestion of Soil	Visitors – No concern, visitors would not be engaged with digging activities. Utility Workers - Exposure would be the result of digging below the surface and not practicing good hygiene or using personal protective equipment.	No concern. The populations would not be on-site to have an exposure.
Ingestion of Groundwater	Visitors – Not expected to be digging below the water table. Site does not use groundwater as a source of drinking water. Utility Workers – Possible exposure would be the result of digging below the water table and failing to follow safety precautions and to use appropriate personal protective equipment. .	No concern. The populations would not be on-site to have an exposure.
Soil Vapor	Visitors – Not expected to be impacted because there are no buildings on the site. Utility Workers – Possible exposure would be the result of digging below surface soil and below the water table, and failing to follow safety precautions and to use appropriate personal protective equipment.	No Concerns. The populations would not be on-site to have an exposure.

TABLE 4
Summary of Groundwater Sample Results compared to Surface Water Quality Standards
Riverfront Site
Lighthousepointe Property Associates, LLC
Rochester and Irondeqouit, New York

LOCATION			GW052014 LVS MW6		GW052014 LVS MW7		GW052014 LVS MW8		GW052014 PVS DUP9		GW052014 PVS MW9	
SAMPLING DATE			5/20/2014		5/20/2014		5/20/2014		5/20/2014		5/20/2014	
LAB SAMPLE ID			L1411002-02		L1411002-03		L1411002-04		L1411002-06		L1411002-05	
SAMPLE TYPE												
SAMPLE DEPTH (ft.)												
	Units	Class B Std		Qual		Qual		Qual		Qual		Qual
General Chemistry												
Cyanide, Total	ug/l	5.2	5		2	J	6		5		3	J
Pesticides				U		U		U		U		U
PCB				U		U		U		U		U
Semivolatile Organics												
Acenaphthene	ug/l	5.3	0.19	U	0.19	U	0.2	U	0.2	U	0.2	U
Naphthalene	ug/l	13	0.19	U	0.19	U	0.2	U	0.2	U	0.2	U
Fluorene	ug/l	0.54	0.19	U	0.19	U	0.2	U	0.2	U	0.2	U
Total Metals												
Aluminum, Total	ug/l	100	46.9		144		148		18.3		22	
Arsenic, Total	ug/l	150	1.07		1.53		4.49		1.07		1.01	
Barium, Total	ug/l	NS	42.26		235.8		755		137.9		133.7	
Cadmium, Total	ug/l	as func of hardness	0.2	U	0.2	U	0.2	U	0.14	J	0.11	J
Calcium, Total	ug/l	NS	72600		143,000		106,000		102,000		102,000	
Chromium, Total	ug/l	func Hardness	0.78	J	0.71	J	1.93		0.84	J	0.8	J
Cobalt, Total	ug/l	5	0.31	J	0.42	J	1.14		1.69		1.65	
Copper, Total	ug/l	func hardness	4.94		1.12		2.8		3.57		3.54	
Iron, Total	ug/l	300	1,780		1,050		22,000		4,290		3,850	
Lead, Total	ug/l	func Hardness	0.66	J	0.22	J	2.25		0.53	J	0.51	J
Magnesium, Total	ug/l	NS	9,510		39,300		23,700		17,300		16,500	
Manganese, Total	ug/l	NS	96.48		58.22		182.6		241.3		224.4	
Nickel, Total	ug/l	func Hardness	1.3		1.61		5.06		4.37		4.21	
Potassium, Total	ug/l	NS	1,850		2,310		8,530		4,880		4,790	
Sodium, Total	ug/l	NS	6,990		78,400		10,600		23,300		22,300	
Zinc, Total	ug/l	Func of hard	56.01		5.92	J	90.03		127.3		125.7	
Volatile Organics												
Acetone	ug/l	NS	2	J	1.4	J	2	J	2.4	J	2.3	J

U= Not detected
J = Concentration below the reporting limit and value is an estimated concentration

TABLE 5
Comparison of Surface Soil Concentrations to Soil Cleanup Objectives for Ecological Resources
Riverfront Site
Lighthouse Point Property Associates, LLC
Irondequoit and Rochester, New York

Compound	Sample Location	SW-1 (sediment)	MW-9-05	MW-7-05	SV-2	SV-4
	SCO for Ecological Resources					
Benzo(a)anthracene	No Standard	0.44	0.9	0.28	0.096	0.33
Benzo(a)pyrene	2.6	0.41	0.076	0.26	0.092	0.38
Benzo(b)fluoranthene	No Standard	0.53	0.1	0.32	0.099	0.48
Benzo(k) fluoranthene	No Standard	0.49	0.9	0.19	0.083	0.26
Chyrsene	No Standard	ND	0.098	0.31	0.09	0.39
Dibenz (a,h) anthracene	No Standard	ND	ND	ND	ND	0.059
Indeno (1,2,3-cd)pyrene	No Standard	ND	0.09	0.16	0.052	0.23
4,4-DDE	0.003	ND	ND	ND	ND	ND
4,4-DDT	0.003	ND	ND	ND	ND	ND
Gamma Chlordane	No Standard	ND	ND	ND	ND	ND
PCB	1	ND	ND	ND	0.062	ND
Aluminum	10,000	3,770	5,400	6,750	6,220	5,390
Arsenic	13	3.5	3.9	4.5	4.4	5.4
Cadmium	4	0.24	0.22	0.16	0.15	0.52
Zinc	109	70.2	43.4	49.8	45.2	75.3
Copper	50	17.9	11.7	13.6	13.6	13.3
Total Chromium	1 and 41	7.3	7.8	9.7	10	8
Total Lead	63	42.3	24.9	16	10.4	26.3
Mercury	0.18	0.1	0.28	0.46	ND	0.058
Dioxin/Furan	1*	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed

* Units concentrations presented in milligrams per kilogram
ND = Not detected above laboratory detection limits.

NA = Not Analyzed

TABLE 6
Comparison of Surface Soil Concentrations to Soil Cleanup Objectives
Lighthouse Pointe Riverfront Site
Lighthouse Pointe Property Associates LLC
Rochester and Irondequoit, New York

Compound		Sample Location	SV-2	SV-4	MW-7	MW-9
	SCO for Unrestricted Use	SCO for Restricted -Residential Use				
1,2 Dichlorobenzene	1.1	100	0.00038J	ND	ND	ND
1,2,4-Trichlorobenzene	NL	NL	ND	ND	ND	ND
1,3 Dichlorobenzene	2.4	49	0.00041J	ND	ND	ND
1,4-Dichlorobenzene	1.8	13	0.00068J	ND	ND	ND
2-Butanone	0.12	100	0.012J	ND	ND	ND
Acetone	0.05	100	0.035	ND	0.0035J	0.03
Benzene	0.06	4.8	0.0041J	ND	ND	ND
Carbon Disulfide	100	NL	0.0087J	ND	ND	ND
Cyclohexane	NL	NL	0.0013J	ND	0.00036J	ND
Ethylbenzene	1	41	0.0014J	ND	ND	ND
Isopropylbenzene	100	NL	0.00057J	ND	ND	ND
m,p Xylene	0.26	100	0.1J	ND	0.00051J	ND
o-Xylene	0.26	100	0.0051J	ND	0.00029J	ND
Tetrachloroethene	1.3	19	0.0024J	ND	ND	0.00058J
Toluene	0.7	100	0.003J	0.00021J	0.00071J	ND
Trichloroethene	0.47	21	**0.87J**	ND	ND	ND
Trichlorofluoromethane	NL	NL	0.7J	0.00037J	0.00031J	ND
2-Methylnaphthalene	0.41	NL	0.37J	ND	ND	ND
4-Methylphenol	NL	NL	ND	0.068J	ND	ND
Acenphthene	20	100	ND	ND	ND	1.3J
Acenaphthylene	100	100	ND	ND	ND	0.32J
Anthracene	100	100	0.32J	0.011J	0.37J	3.4J
Benzaldehyde	NL	NL	ND	ND	ND	ND
Benzo(ghi)perylene	100	100	ND	0.0078J	0.85J	2.7J
Benzyl butyl phthalate	100	NL	ND	0.014J	ND	ND
Carbazole	NL	NL	ND	ND	ND	1.1J
Dibenzofuran	NL	NL	ND	ND	ND	0.68J
Diethyl Phthalate	100	NL	ND	0.007J	ND	ND
Fluoranthene	100	100	1.3J	0.054J	3.1J	21
Fluorene	30	100	0.34J	ND	ND	1.6J
Naphthalene	12	100	0.35J	0.036J	ND	0.36J
Phenanthrene	100	100	1.6J	0.053J	1.1J	13
Phenol	0.33	100	ND	0.0092J	ND	ND
Pyrene	100	100	0.97J	0.045J	2.6J	15
Benzo(a)anthracene	1	1	0.81J	0.023J	**1.7**	**10**
Benzo(a)pyrene	**1**	1	0.61J	0.02J	**1.8**	**9.2**
Benzo(b)fluoranthene	**1**	1	0.8J	0.027J	**2.2**	**13**
Benzo(k) fluoranthene	0.8	3.9	ND	0.014J	1	3.8
Chyrsene	1	3.9	ND	ND	ND	ND
Dibenz (a,h) anthracene	0.33	0.33	ND	ND	**0.34**	**1.1**
Di-n-butylphthalate			ND	ND	ND	ND
Indeno (1,2,3-cd)pyrene	0.5	0.5	0.34J	0.014J	**1.5**	**4.2**
4,4-DDE	0.0033	8.9	ND	ND	ND	ND
4,4-DDT	0.0033	7.9	**0.077**	ND	**0.021J**	**0.028J**
4,4-DDD	0.0033	13	**0.1**	ND	ND	**0.033J**
Gamma Chlordane	0.54	NL	ND	ND	ND	0.035
PCB	0.1	1	ND	ND	ND	ND
Aluminum	NL	NL	4,060	10,700	4,900	5,300
Arsenic	13	16	4.5	3.8	3.9	11
Barium	350	400	**433J**	70J	54.2J	**566J**
Beryllium	7.2	72	0.43J	0.83	0.34J	0.85J
Cadmium	2.5	4.3	1.2	0.16J	0.4J	0.85J
Copper	50	270	40.2	3.1	29.3	**54.4**
Chromium (Tri and Hexavalent)	1 - 30	110 - 180	14.6	17	10.4	**31.2**
Lead	63	400	**3,430**	4.8	**93.3**	**321**
Manganese	1600	2000	94	636	327	134
Nickel	30	310	16.7	33.3	11.4	12.9
Selenium	3.9	180	0.76J	ND	0.4J	0.68J
Silver	2	180	**8.1**	ND	0.16J	**3.6**
Zinc	109	10,000	**192**	51.4	86.1	**188**
Mercury	0.18	0.81	**0.34**	ND	ND	**0.3**
Dioxin/Furan	No Standard	No Standard	ND	ND	12.53 ng/kg	Not Analyzed

Concentrations shown in mg/Kg unless shown.

Chromium value shown is a total Cr concentration and not individual Tri- or Hex-valent Cr.

Bold font = value exceeds unrestricted SCO.

Highlight cell = value exceeds restricted residential SCO.

TABLE 7
Comparison of Subsurface Soil Concentrations to Soil Cleanup Objectives
Lighthouse Pointe Riverfront Site
Lighthouse Pointe Property Associates LLC
Rochester and Irondequoit, New York

Compound		Sample Location	SB-01 (3-5 ft.)	SB-01 (7-9 ft.)	SB-02 (2-4 ft.)	SB-02 (4-6 ft.)	SV-3 (Waste)
	SCO for Unrestricted Use	SCO for Restricted -Residential Use					
1,2 Dichlorobenzene	1.1	100	0.00038J	ND	ND	ND	0.0061J
1,2,4-Trichlorobenzene	NL	NL	ND	ND	ND	ND	0.0061J
1,3 Dichlorobenzene	2.4	49	0.00041J	ND	ND	ND	0.0061J
1,4-Dichlorobenzene	1.8	13	0.00068J	ND	ND	ND	0.0061J
2-Butanone	0.12	100	0.012J	ND	ND	ND	ND
Acetone	0.05	100	0.035	ND	0.0035J	0.03	ND
Benzene	0.06	4.8	0.0041J	ND	ND	ND	ND
Carbon Disulfide	100	NL	0.0087J	ND	ND	ND	ND
Cyclohexane	NL	NL	0.0013J	ND	0.00036J	ND	ND
Ethylbenzene	1	41	0.0014J	ND	ND	ND	ND
Isopropylbenzene	100	NL	0.00057J	ND	ND	ND	ND
m,p Xylene	0.26	100	0.1J	ND	0.00051J	ND	ND
o-Xylene	0.26	100	0.0051J	ND	0.00029J	ND	ND
Tetrachloroethene	1.3	19	0.0024J	ND	ND	0.00058J	ND
Toluene	0.7	100	0.003J	0.00021J	0.00071J	ND	ND
Trichloroethene	0.47	21	**0.87J**	ND	ND	ND	ND
Trichlorofluoromethane	NL	NL	0.7J	0.00037J	0.00031J	ND	ND
2-Methylnaphthalene	0.41	NL	0.37J	ND	ND	ND	0.091J
4-Methylphenol	NL	NL	ND	0.068J	ND	ND	0.043J
Acenphthene	20	100	ND	ND	ND	1.3J	0.17J
Acenaphthylene	100	100	ND	ND	ND	0.32J	0.18J

Concentrations shown in mg/Kg unless shown.

Chromium value shown is a total Cr concentration and not individual Tri- or Hex-valent Cr.

Bold values exceed Unrestricted SCOs

Highlights values exceed Restrictied, restricted residential values.

TABLE 7
Comparison of Subsurface Soil Concentrations to Soil Cleanup Objectives
Lighthouse Pointe Riverfront Site
Lighthouse Pointe Property Associates LLC
Rochester and Irondequoit, New York

Compound		Sample Location	SB-01 (3-5 ft.)	SB-01 (7-9 ft.)	SB-02 (2-4 ft.)	SB-02 (4-6 ft.)	SV-3 (Waste)
Anthracene	100	100	0.32J	0.011J	0.37J	3.4J	0.66J
Benzaldehyde	NL	NL	ND	ND	ND	ND	0.1J
Benzo(ghi)perylene	100	100	ND	0.0078J	0.85J	2.7J	0.92J
Benzyl butyl phthalate	100	NL	ND	0.014J	ND	ND	0.064J
Carbazole	NL	NL	ND	ND	ND	1.1J	0.22J
Dibenzofuran	NL	NL	ND	ND	ND	0.68J	0.13J
Diethyl Phthalate	100	NL	ND	0.007J	ND	ND	0.057J
Fluoranthene	100	100	1.3J	0.054J	3.1J	21	3.3
Fluorene	30	100	0.34J	ND	ND	1.6J	0.2J
Naphthalene	12	100	0.35J	0.036J	ND	0.36J	0.14J
Phenanthrene	100	100	1.6J	0.053J	1.1J	13	2
Phenol	0.33	100	ND	0.0092J	ND	ND	ND
Pyrene	100	100	0.97J	0.045J	2.6J	15	3.3
Benzo(a)anthracene	1	1	0.81J	0.023J	**1.7**	**10**	**2.1**
Benzo(a)pyrene	1	1	0.61J	0.02J	**1.8**	**9.2**	**1.8**
Benzo(b)fluoranthene	1	1	0.8J	0.027J	**2.2**	**13**	**2.4**
Benzo(k) fluoranthene	0.8	3.9	ND	0.014J	1	3.8	0.96J
Chyrsene	1	3.9	ND	ND	ND	ND	**2.1**
Dibenz (a,h) anthracene	0.33	0.33	ND	ND	**0.34**	**1.1**	0.32
Di-n-butylphthalate			ND	ND	ND	ND	0.12J
Indeno (1,2,3-cd)pyrene	0.5	0.5	0.34J	0.014J	**1.5**	**4.2**	**0.9J**
4,4-DDE	0.0033	8.9	ND	ND	ND	ND	ND
4,4-DDT	0.0033	7.9	**0.077**	ND	**0.021J**	**0.028J**	ND
4,4-DDD	0.0033	13	**0.1**	ND	ND	**0.033J**	ND

Concentrations shown in mg/Kg unless shown

Chromium value shown is a total Cr concentration and not individual Tri- or Hex-valent Cr.

Bold values exceed Unrestricted SCOs

Highlights values exceed Restrictied, restricted residential values.

TABLE 7
Comparison of Subsurface Soil Concentrations to Soil Cleanup Objectives
Lighthouse Pointe Riverfront Site
Lighthouse Pointe Property Associates LLC
Rochester and Irondequoit, New York

Compound		Sample Location	SB-01 (3-5 ft.)	SB-01 (7-9 ft.)	SB-02 (2-4 ft.)	SB-02 (4-6 ft.)	SV-3 (Waste)
Gamma Chlordane	0.54	NL	ND	ND	ND	0.035	ND
PCB	0.1	1	ND	ND	ND	ND	ND
Aluminum	NL	NL	4,060	10,700	4,900	5,300	4.75-
Arsenic	13	16	4.5	3.8	3.9	11	10.2J
Barium	350	400	**433J**	70J	54.2J	**566J**	198
Beryllium	7.2	72	0.43J	0.83	0.34J	0.85J	ND
Cadmium	2.5	4.3	1.2	0.16J	0.4J	0.85J	0.94J
Copper	50	270	40.2	3.1	29.3	**54.4**	46
Chromium (Tri and Hexavalent)	1 - 30	110 - 180	14.6	17	10.4	**31.2**	17.7
Lead	63	400	**3,430**	4.8	**93.3**	**321**	**2,750**
Manganese	1600	2000	94	636	327	134	300
Nickel	30	310	16.7	33.3	11.4	12.9	17J
Selenium	3.9	180	0.76J	ND	0.4J	0.68J	ND
Silver	2	180	**8.1**	ND	0.16J	**3.6**	0.79J
Zinc	109	10,000	**192**	51.4	86.1	**188**	**601**
Mercury	0.18	0.81	**0.34**	ND	ND	**0.3**	**0.88**
Dioxin/Furan	No Standard	No Standard	ND	ND	12.53 ng/kg	Not Analyzed	Not Analyzed

Concentrations shown in mg/Kg unless shown.

Chromium value shown is a total Cr concentration and not individual Tri- or Hex-valent Cr.

Bold values exceed Unrestricted SCOs

Highlights values exceed Restrictied, restricted residential values.

TABLE 8
Cost for Annual Quarterly Groundwater Monitoring
Riverfront Site
Lighthouse Pointe Property Associates, LLC

Item	Quantity	Units	Unit Cost	Extended Cost	Present Value
Capital Indirect Costs					
Labor	4	Events	$ 1,870.00	$ 7,480.00	
Expenses	4	Events	$ 2,153.75	$ 8,615.00	
Analysis	4	Events	$ 3,350.00	$ 13,400.00	
				$29,495.00	
					$29,495.00
Total Capital Cost					$29,495.00

TABLE 9
Cost for Preparing and Implementing a Site Management Plan
Riverfront Site
Lighthouse Pointe Property Associates, LLC

Item	Quantity	Units	Unit Cost	Extended Cost	Present Value
Capital Indirect Costs					
Preparation of Plan	1	Lump sum	$6,000.00	$6,000.00	
Annual Inspection	1	Lump sum	$1,000.00	$1,000.00	
					$7,000.00
Total Capital Cost					$7,000.00

TABLE 10
Cost for Completing Removing Site Fill/Debris
Riverfront Site
Lighthouse Pointe Property Associates, LLC

Item	Quantity	Units	Unit Cost	Extended Cost	Present Value
Capital Direct Costs					
Complete Removal					
Site Preparation, erosion control, grading	653,400	square feet	$0.13	$84,942.00	
Excavate	108,900	tons	$3.40	$370,260.00	
Haul and disposal non-hazardous	108,900	tons	$62.16	$6,769,688.13	
Fill Purchase, Spread, and Compact	72,600	cubic yards	$29.34	$2,130,084.00	
Hydroseed	72,600	square yards	$0.52	$37,752.00	
Oversight and Air Monitoring	70	days	$1,100.00	$77,000.00	
Total Direct Cost					$9,469,726.13
Capital Indirect Costs					
Engineering and Design				$51,095.00	
Total Indirect Cost					$51,095.00
Total Capital Cost					$9,520,821.13

TABLE 11
Cost for Constructing a 2-Foot Thick Soil Cover
Riverfront Site
Lighthouse Pointe Property Associates, LLC

Item	Quantity	Units	Unit Cost	Extended Cost	Present Value
Capital Direct Costs					
Soil Cover					
Site Preparation, erosion control, grading	72,600	square yards	$1.20	$87,120.00	
Fill Purchase, Spread, and Compact	48,390	cubic yards	$29.34	$1,419,762.60	
Hydroseed	72,600	square yards	$0.52	$37,752.00	
Oversight and Air Monitoring	70	days	$1,100.00	$77,000.00	
Total Direct Cost					$1,621,634.60
Capital Indirect Costs					
Engineering and Design				$7,500.00	
Total Indirect Cost					$7,500.00
Total Capital Cost					$1,629,134.60

APPENDIX A

Calculations and Information to Estimate the Amount of Groundwater Entering the Genesee River

Parameters, Estimates, and Calculations Use for Estimating the Groundwater Discharge (Flux) to the River
Lighthouse Point Property Associates, LLC
Rochester and Irondequoit, New York

	MW5-05	MW5-05	MW5-05	MW5-05
Date	5/20/2014	5/20/2014	5/20/2014	5/20/2014
Top of Riser Elv.	253.85	253.85	253.85	253.85
Depth to Groundwater	6.13	6.13	6.13	6.13
Elevation of Groundwater	247.72	247.72	247.72	247.72
Saturated Thickness ft.	110	110	110	110
Shoreline ft.	1,500	1,500	1,500	1,500
Gradient	0.003	0.003	0.003	0.003
K ft/day ft/day	0.2834	0.2834	0.0002834	0.0002834
Effective porocity	0.28	0.4	0.28	0.4
Velocity ft/day	0.003036429	0.0021255	3.03643E-06	2.1255E-06
Discharge area sq. ft.	165000	165000	165000	165000
Cubic feet per day	140.3	140.3	0.1	0.1
Gallons per day for route	1049.3	1049.3	1.0	1.0

Hydraulic Conductivity (K) = from CRA 2006
Effective Porocity estimated from boring logs and using *Groundwater and Wells* , 1986, page 67.
Velocity = hydraulic conductivity x gradient/effective porocity, *Ground Water Hydraulics,* USGS Paper 798,1972.
Gallons per day for route = Discharge Area x velocity x porocity x 7.47 gallon/cubic foot, *Ground Water Hydraulics,* USGS Paper 798, 1972.

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Monroe County, New York Hydrologic Unit Code 04130003 Latitude 43°08'30.2", Longitude 77°36'58.7" NAD83 Drainage area 2,474 square miles	HTML table of all data Tab-separated data Reselect output format

Water Year	00060, Discharge, cubic feet per second
1906	1,886
1908	3,495
1910	2,179
1911	2,289
1912	2,549
1913	2,823
1915	1,956

1916	3,899
1917	2,178
1918	2,613
1921	2,199
1922	2,526
1923	2,123
1924	2,777
1925	2,378
1926	2,726
1927	3,072
1928	4,109
1929	3,388
1930	3,015
1931	2,014
1932	2,927
1933	2,461
1934	1,740
1935	2,383
1936	2,795
1937	2,854
1938	2,487
1939	2,474
1940	2,712
1941	2,264
1942	2,697
1943	4,074
1944	2,448
1945	3,447
1946	3,376
1947	3,859
1948	2,723
1949	2,041
1950	2,510
1951	3,666
1952	2,886

1953	2,328
1954	2,446
1955	2,082
1956	4,237
1957	2,716
1958	2,166
1959	2,744
1960	3,606
1961	2,444
1962	1,718
1963	2,092
1964	2,201
1965	1,666
1966	2,273
1967	2,181
1968	3,028
1969	2,916
1970	2,543
1971	3,309
1972	3,865
1973	3,735
1974	2,956
1975	3,326
1976	3,991
1977	3,290
1978	4,426
1979	3,162
1980	2,869
1981	2,820
1982	3,764
1983	2,722
1984	4,272
1985	2,464
1986	2,824
1987	2,678

1988	1,962
1989	2,587
1990	2,926
1991	3,086
1992	2,538
1993	3,505
1994	2,906
1995	1,763
1996	3,492
1997	3,162
1998	3,456
1999	1,663
2000	2,670
2001	2,002
2002	2,515
2003	3,143
2004	4,213
2005	3,181
2006	2,910
2007	3,952
2008	2,989
2009	2,935
2010	2,378
2011	4,081
2012	2,552
2013	2,641
** No Incomplete data have been used for statistical calculation	

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APPENDIX B

Appendix 3C “Fish and Wildlife Resources Impact Analysis Decision Key”

Appendix 3C Fish and Wildlife Resources Impact analysis Decision Key	If Yes Go to:	If No Go to:	Comments
1. Is the site or area of concern a discharge or spill event?	13	2	
2. Is the site or area of concern a point source of contamination to the groundwater which will be prevented from discharging to surface water? Soil contamination is not widespread, or if widespread, is confined under buildings and paved areas.	13	3	
3. Is the site and all adjacent property a developed area with buildings, paved surfaces and little or no vegetation?	4	9	The Riverfront Site is has gravel surfaces covering approximtely 40 to 50% of the ground surface. The remaining space is covered with tress, brush and some mowed lawn space. The water front is covered with sheds and docks which renters use for river access. The east side of the project site fronts onto a municipal street, residential property and a former railroad right of way.
4. Does the site contain habitat of an endangered, threatened or special concern species?	Section 3.10.1	5	
5. Has the contamination gone off-site?	6	14	
6. Is there any discharge or erosion of contamintion to surface water or the potential for discharge or erosion of contamination?	7	14	
7. Are the site contaminants PCBs, pesticides, or other persistent, bioaccumulable substances?	Section 3.10.1	8	
8. Does contamination exist at concentrations that could excced ecological impact SCGs or be toxic to aquatic life if discharge to surface water?	Section 3.10.1	14	
9. Does the site or any adjacent or downgradient property contain any of the following resources? i. Any endanged, threatened or special concern species, or rare plants or their habitat; ii. Any DEC designated significant habitats or rare NYS Ecological Communities; iii. Tidal or freshwater wetlands; iv. Stream, creek or river; v. Pond, lake, lagoon; vi. Drainage ditch or channel; vii. Other surface water feature; viii. Other marine or freshwater habitat; ix. Forest; x. Grassland or grassy field; xi. Parkland or woodland; xii. Shrubby area; xiii. Urban wildlife habitat; or xiv. Other terrestrial habitat.	11	10	The Riverfront Site is adjacent to the Genesee River.
10. Is the lack of resources due to the contamination?	Section 3.10.1	14	
11. Is the contamination a localized source which has not migrated and will not migrate from the source to impact any on-site or off-site resources?	14	12	There is no evidence to suggest the Riverfront Site is impacting the Genesee River.
12. Does the site have widespread surface soil contamination that is not confined under and around building or paved areas?	Section 3.10.1	12	The Riverfront Site's surface soil sample results are consistent with the use of the property for restricted residential use.
13. Does the contamination at the site or area of concern have the potential to migrate to, erode into or otherwise impact any on-site or off-site habitat of endangered, threatened or special concern species or other fish and wildlife resource? (See #9 for list of potential resoruces. Contact DEC for information regarding endangered species.)	Section 3.10.1	14	
14. No Fish and Wildlife Resources Impact Analysis needed.			