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Remedial Work Plan

General Motors LLC
Former General Motors
Assembly Plant Site
Sleepy Hollow, NY

June 2012

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Certification Statement

I Mark O. Gravelding, P.E., certify that I am currently a New York State registered professional engineer and that this *Remedial Work Plan* was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

June 26, 2012
Mark O. Gravelding, P.E. Date
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1. Introduction

This Remedial Work Plan (RWP) has been prepared by ARCADIS on behalf of General Motors LLC (GM LLC), in accordance with Brownfield Cleanup Agreements (BCAs) with the New York State Department of Environmental Conservation (NYSDEC) for the investigation and remediation of the Former General Motors Assembly Plant Site located at 199 Beekman Avenue, Village of Sleepy Hollow, New York (Site).

The Site is situated on the eastern shore of the Hudson River (Figure 1) and occupies an area of approximately 96.2 acres within the Village of Sleepy Hollow. The Site (Figure 2) is comprised of three, non-contiguous parcels: 1) the former main assembly plant area referred to as the West Parcel (approximately 66.2 acres); 2) the eastern parking lot referred to as the East Parcel (approximately 28.3 acres); and 3) the former salaried employee parking lot referred to as the South Parcel (approximately 1.7 acres).

The contemplated use of the Site is mixed commercial and restricted residential development, with public open space, including public access to the waterfront and municipal public works operations. The Site is located in the Village of Sleepy Hollow's RF – Riverfront Development Zoning district, which allows for a mixed use development of residential and commercial properties consistent with the RF zoning, as determined by the Village of Sleepy Hollow, lead Agency for State Environmental Quality Review (SEQR) of the proposed redevelopment of the Site (Findings Resolution adopted by the Village on July 24, 2007 and 2011 Amended Findings Resolution adopted January 25, 2011).

General Motors Corporation (GMC) and their development partner Roseland/Sleepy Hollow, LLC (Roseland) initiated formal NYSDEC review of Site environmental conditions in a Voluntary Cleanup Agreement (VCA) signed in November 2002. The VCA applied to the entire Site and included investigation of the Hudson River adjacent to the West Parcel. In June 2004, the project transitioned from the Voluntary Cleanup Program to the Brownfield Cleanup Program (BCP). As part of that transition, two separate BCAs were signed in May 2005, one for the East Parcel and the other for the West Parcel. The BCA for the West Parcel also includes the South Parcel and the Hudson River as an identified offsite area of interest to the West Parcel. On April 1, 2009, Roseland terminated its participation in the BCAs and the Site redevelopment. On June 1, 2009, GMC filed for bankruptcy. On July 10, 2009, in accordance with an order from the Bankruptcy court, GMC changed its name to Motors Liquidation Company (MLC) and sold its interest in the Sleepy Hollow site to a newly formed

company, General Motors LLC (GM LLC). GM LLC signed two BCAs in 2010 that superseded the two previous BCAs signed by GMC and Roseland.

On June 7, 2011 the Village of Sleepy Hollow adopted a resolution granting a Special Permit and Approving the Riverfront Development Concept Plan for the Lighthouse Landing Riverfront Development. In accordance with the Special Permit, the East Parcel will be donated to the Village of Sleepy Hollow for municipal uses and a portion may be donated to Historic Hudson Valley for their use as an expansion of Philipsburg Manor. The West and South Parcels will become a mixed commercial-residential development, with public open space, including public access to the waterfront. These West and South Parcel open spaces will also be donated to the Village of Sleepy Hollow.

In conformance with the BCP, the Site is being remediated for "restricted uses", as defined by New York State in 6NYCRR Part 375-1.8. "Restricted use" is a use with imposed restrictions, such as environmental easements, which as part of the remedy selected for the site, requires a site management plan and relies on institutional controls or engineering controls to manage exposure to contamination remaining at a site.

Restricted uses contemplated for the Site, and as defined in 6NYCRR Part 375-1.8, include:

1. "Restricted-residential use", which is the land use category which shall only be considered when there is common ownership or a single owner/managing entity of the site. Restricted-residential use shall, at a minimum, include restrictions which:

    a) Prohibit any vegetable gardens on a site, although community vegetable gardens may be considered with Department approval;

    b) Prohibit single family housing;

    c) Includes active recreational uses, which are public uses with a reasonable potential for soil contact; and

2. "Commercial use", which is the land use category which shall only be considered for the primary purpose of buying, selling or trading of merchandise or services. Commercial use includes passive recreational uses, which are public uses with limited potential for soil contact.

This RWP has been prepared in conformance with the BCAs for the Site and consistent with the following documents, where applicable:

- Draft Brownfield Cleanup Program Guide (NYSDEC, May 2004)
- DER-10, Technical Guidance for Site Investigation and Remediation (NYSDEC, May 2010)
- Title 6 of the New York State Compilation of Codes, Rules and Regulations Part 375 (6NYCRR Part 375)

1.1 Purpose

The overall objective of the remedial program for this site is to return the Site to productive use as a mixed commercial and restricted residential development, with public open space, including public access to the waterfront and municipal public works operations.

This RWP will:

- Indentify the remedial action objectives applicable to the intended use of the Site;
- Describe the basis for concluding that the results of the remediation will be protective of public health and the environment for the intended use of the Site; and
- Provide a description of the selected remedy.

1.2 Work Plan Organization

This RWP has been organized into the following sections:

Section	Description
1 – Introduction	Presents the purpose and objectives of this RWP and summarizes the site history and background information.
2 – Summary of Environmental Conditions	Presents a summary of remedial investigations conducted, interim corrective measures completed, and the nature and extent of contamination.
3 – Remedial Action Objectives	Presents the Remedial Action Objectives (RAOs) for the site that are protective of human health and the environment, and identifies media to be addressed through implementation of the remedial components.
4 – Summary of Alternatives Analysis	Provides a summary of the remedial alternatives analysis for the upland Site and offsite Hudson River sediments and identifies the selected alternative for each.
5 – Upland l Remedial Action Activities	Presents a summary description of the selected upland Site remedy.
6 – Sediment Remedial Action Activities	Presents a summary description of the selected Hudson River sediment remedy.
7 – Remediation Schedule	Presents the anticipated general schedule for the remedial designs and remedial actions.
8 – References	Identifies references, including reports, guidance documents, and other literature used in preparation of this RWP.

1.3 Site Background

1.3.1 Site Location and Description

The Site is located in the Village of Sleepy Hollow, Town of Mount Pleasant, Westchester County, New York and is identified as follows:

- East Parcel, Village Tax Section 15, Block 15, Lot 1 and Section 15, Block 7, Lot 11

- West Parcel, Village Tax Section 15, Block 1, Lot 1
- South Parcel, Village Section 16, Block 2, Lot 27

These parcels are identified on Figure 2.

The West Parcel (approximately 66.2 acres) is bordered by Metro North rail line to the east, Kingsland Point Park of Westchester County to the northwest, the Hudson River to the southwest, and Beekman Ave and Ichabod's Landing, a waterfront townhome development to the south.

The East Parcel (approximately 28.3 acres) is bordered by DeVries Park to the north, Philipsburg Manor, a restored early 18th century farm to the northeast, the Metro North rail line to the west, Barnhart Park and residential properties to the south-southeast, and Beekman Ave to the south.

The South Parcel (approximately 1.7 acres) is a corner lot, situated on a hillside and surrounded on three sides by village streets including Beekman Avenue to the north. The east side of the South Parcel abuts a residential property and lands owned by the Village of Sleepy Hollow for Department of Public Works operations.

The Village and Westchester County hold easements for sanitary sewers that cross the Site. A Village sewer connects to a Westchester County sanitary trunk line running through the East Parcel. The trunk line continues under the railroad corridor into the West Parcel and exits into Beekman Avenue.

1.3.2 Site History and Current Use

Prior to any commercial or industrial development, the Site was part of the Beekman Farm. In 1801, the Beekman family constructed a dock on what is now known as Kingsland Point (north of the Site). In 1830, a brickyard was established on the southern portion of the Site at the foot of Beekman Avenue, on the south side of the Pocantico Bay (which has since been filled). The brickyard closed in 1861.

Between 1885 and 1913, industrial operations on the West Parcel included:

- Rand Drill Company, manufacturing percussion rock drills (south side of parcel).
- Mobile Company of America, manufacturing steam-powered vehicles (north side of parcel).

- Maxwell Briscoe Company, manufacturing gasoline powered automobiles, with operations including assembly buildings, machine shops, woodworking facilities and painting/varnishing operations, and a small foundry (north and south sides of parcel).

The Chevrolet Motor Company (which later became a division of GMC) originally acquired the former Maxwell Briscoe Property and automobile manufacturing facility in 1914. Since that time, GMC had only assembled automobiles at the Site with the exception of a period during World War II when airplane wings and light military vehicles were assembled at the Site.

Much of the East and West Parcel land mass was formerly an embayment of the Hudson River. Historical fill material was initially placed in a north-south strip across the bay during the 1840s to support the construction of a railway between New York City and Albany, effectively separating the East Parcel area from the river. Historical fill material was also placed on the West Parcel during the early 1900s for industrial developments that preceded the arrival of GMC. As GMC operations grew, additional historical fill material was placed on the West Parcel during several expansion projects between 1924 and 1960. The final extension of the waterfront to its current configuration was filled with sediments dredged locally from the Hudson River. Historic fill material documented at the Site includes cribbing, former piers, sunken barges, ash and other debris.

The Village of Sleepy Hollow (formerly North Tarrytown) filled a portion of the East Parcel with municipal refuse during the 1920s. The Village continued to add soil fill on top of the municipal refuse and throughout the rest of the parcel during subsequent decades to reclaim this area for use as school athletic fields. GMC acquired the East Parcel from the Village in 1960 through a lease arrangement with the Town of Mount Pleasant Industrial Development Agency, and added some additional fill consisting of dredged sands and finished the surface with asphalt or slab-on-grade concrete foundations to reach the current grade throughout most of the parcel. Until the GMC assembly facility closed, the East Parcel served as the employee parking lot and rail loading area for new vehicles.

The South Parcel, located across Beekman Avenue from the West Parcel, was developed as a parking lot on former residential land and is currently paved. A water storage tank and pump house, which supported the operating facility, was also located on the South Parcel.

After the facility closure in 1996, all buildings and most above-grade structures were demolished and removed. Most of the concrete floor slabs and foundations from the former Body and Chassis Plants on the West Parcel were not demolished. Minor structures on the East and South Parcels were also demolished and removed at that time.

1.3.3 Topography

The overall land topography of the West Parcel is relatively flat due to the predominance of the existing building floor slabs at an average elevation of 13.0 feet (ft). These building slabs and foundations cover approximately half of the West Parcel, and pavement covers the balance of the parcel. The paved areas adjacent to building remnants range in slope from 0.5% to 4%. Stormwater is conveyed to the Hudson River via a storm drain system with two active outfalls.

A stockpile of concrete millings from the floors and wall of the demolished assembly plants is situated along the West Parcel waterfront.

Approximately 2,300 linear feet (LF) of the existing Hudson River shoreline is lined with rip-rap shoreline protection from the water's edge to top of slope. The top of slope is at an approximate elevation of 7.5 ft for much of the property's waterfront.

The overall land topography of the East Parcel is relatively flat with the exception of steep slope areas located along the East Parcel's south and east perimeter. The highest ground surface elevations range between 60.0 and 70.0 feet amsl and are found along the parcel's easterly perimeter. The flat portion of the site is paved. Stormwater is conveyed to the Pocantico River, north of the parcel, via a storm drain system with one outfall, as well as a separate drainage ditch. This storm drain also receives some Village of Sleepy Hollow storm water from upland areas.

The South Parcel's overall land topography is relatively uniform, sloping at an approximate 10% grade running from a peak elevation of approximately 50.0 ft in the northeast corner of the parcel to a low point elevation of approximately 7.0 ft in the southwest corner. There is one generally flat portion of land located in the east corner of the parcel with a hilltop ridge, varying in height from between 15 feet to 25 feet in height, separating this area from the remainder of the parcel.

1.3.4 Geology

Approximately 90 percent of the Site acreage (most of the East and West Parcels) is developed on historic fill material of varying composition and thickness. The historic fill material is generally made up of fine to coarse sands with lesser amounts of gravel, silt, and clay. Varying amounts of debris are present within the historic fill material including cinders, brick fragments, cribbing, former piers and bulkheads, sunken barges, and other solid material. The historic fill material is underlain in areas by soft organic clay and peat deposits associated with the Hudson and Pocantico Rivers; in other areas silt and clay underlies the historic fill material. Beneath these deposits, a layer of compact granular till (a mixture of material of varying sizes including silty sand with gravel and occasional cobbles) overlies the bedrock with a thickness ranging from one foot to over 10 feet. The underlying bedrock is weathered to relatively competent gneiss. The depth to bedrock is extremely variable across the Site, ranging from approximately 10 feet to more than 100 feet below ground surface.

1.3.5 Site Groundwater

Regionally, groundwater flow is to the west towards the Hudson River, although there are local variations to this pattern associated with influences from surface water bodies such as streams, wetlands, and ponds. Specifically, groundwater flow across the East Parcel is generally to the west, while flow across the West Parcel is generally to the south-southwest. Groundwater contours appear to be influenced by the former Pocantico Creek and Bay, which once ran west across the East Parcel and southwest under the Chassis Plant on the West Parcel. Groundwater in the vicinity of the Site is not used as a potable water supply. A reservoir fed municipal water supply system services the Sleepy Hollow area, including the site. Reservoirs for this system (and other community water supplies) are located more than 3 miles upgradient of the site. The Catskill Aqueduct serves as the main source of water for the Village of Sleepy Hollow. Water is stored in the Village's reservoir in the Rockefeller State Park Preserve. It is unlikely that groundwater beneath the Site will be used as a potable water supply in the future since the area is serviced by the local municipal water supply system and the natural water bearing units beneath the Site are expected to have relatively low yields.

1.4 Anticipated Future Land Use

The anticipated future use of the Site is mixed commercial and restricted-residential development, with public open space, including public access to the waterfront and municipal public works operations.

The proposed Site Development Plan and other details contemplated for the proposed development are presented in the Draft Environmental Impact Statement (DEIS) for Lighthouse Landing at Sleepy Hollow adopted by the Village of Sleepy Hollow (Village) in January 11, 2005 (Divney Tung Schwalbe 2005), the Final Environmental Impact Statement released in December 2006 (Divney Tung Schwalbe 2006), the Findings Resolution adopted by the Village on July 24, 2007 (Village of Sleepy Hollow 2007) and amended on January 25, 2011 (Village of Sleepy Hollow 2011a) and the Special Permit and Concept Plan Approval adopted by the Village on June 7, 2011 (Village of Sleepy Hollow 2011b). The proposed site development plan is provided on Figure 3.

Key proposed post-development features along the waterfront portion of the Site include a fishing pier near the southwest corner of the site, a floating dock (dock and dine), an existing lighthouse, and a second floating dock for launching small craft. The existing lighthouse (Tarrytown Lighthouse) is listed on the National Register of Historic Places and is currently accessible to the public through Kingsland Point Park.

Specific development and use will also be subject to restrictions and environmental easements specified under the BCP, as referenced in Section 1 and summarized in Section 4 of this RWP.

2. Summary of Environmental Conditions

2.1 Site Soil

A Remedial Investigation (RI) was conducted under NYSDEC oversight, building upon data supplied by GMC and Roseland from prior due diligence investigations and an Interim Corrective Measures project completed by GMC during facility decommissioning. The RI determined that contamination at the Site is associated with historical fill and past operations at the former GMC facility (ARCADIS 2012a).

Historic fill material used to develop the Site from the mid-1800s through the last phase of filling and grading in 1960 typically may not meet all 6 NYCRR Part 375 Soil Cleanup Objectives (SCOs) for restricted residential use, primarily due to the presence of metals and PAHs. The historic fill on the East Parcel is comprised of municipal refuse on the east end, imported soil fill throughout the former bay prior to GMC ownership (pre-1960), and sediment dredged from the Hudson River to grade the area for parking lot construction by GMC in 1960. Domestic refuse, typically consisting of glass, coal ash, shells, ceramic material, metal debris, and decomposed organic material was found in refuse samples from the former Village landfill area. Fill materials containing lead and PAHs at levels above restricted residential SCOs are generally associated with the former Village landfill area. Additional metals found in the East Parcel fill at levels above restricted residential SCOs include arsenic, chromium, copper, manganese and mercury.

Within the West Parcel, the historic fill material consists of a variety of dredged materials, soils, ash, rubble, and other debris, as well as filled barges, bulkheads and foundations. Metals and PAHs are the principal COCs. Lead is the most widespread metal detected in soil samples from historic fill on the West Parcel. Other metals found at levels above restricted residential SCOs include arsenic, barium, cadmium, chromium, copper, mercury and zinc. PAHs are generally associated with ash or cinder fill in various areas and residual petroleum from historic spills in localized areas.

Historic operations on the West Parcel have also contributed to the presence of residual petroleum and petroleum derived volatile and semi-volatile organic compounds (VOCs and SVOCs), as well as localized areas where chlorinated VOCs, primarily trichloroethene (TCE) were found. Groundwater is present within the historic fill material and also contains variable concentrations of metals, VOCs and PAHs, as discussed further in Section 2.2.

Concrete millings, stockpiled on site, have been used as grade fill during the demolition of the former assembly plant complex to fill in depressions resulting from demolition of buildings and removal of supporting structures (during the 1998-1999 period). The millings were derived from the demolition of onsite concrete structures and contain metals and PAHs at levels greater than restricted residential SCOs and low levels of PCBs. Overall, the concrete millings onsite generally contain PCBs less than or equal to the SCO of 1 part per million (ppm) in surface soil for restricted residential use, and all samples are consistently below Commissioner Policy-51 (CP-51) Soil Cleanup Guidance of 10 ppm for subsurface soil on BCP sites designated for restricted residential use (i.e., beneath clean cover soil, permanent structures, pavement or other cover systems). Stockpiled millings were used as backfill above the groundwater table at select IRM excavation areas in 2007. This use was approved by NYSDEC in the form of a Beneficial Use Determination (BUD), No. 894-3-60.

2.2 Groundwater

Metals were detected in the groundwater samples at concentrations above the New York State (NYS) Class GA groundwater standards specified in 6NYCRR Part 703. Class GA groundwater is protected for drinking water use. However, as summarized in Section 1.3, it is unlikely that groundwater beneath the Site will be used as a potable water supply, now or in the future.

Groundwater samples collected from both the East and West Parcels contained detectable concentrations of one or more Target Analyte List metals. Between 14 and 20 different metals have typically been detected in the unfiltered samples. In the filtered samples, however, the metals detected at concentrations above the NYS Class GA groundwater standards have typically been limited to sodium, iron, magnesium, and manganese. These analytical results suggest that the metals detected in the unfiltered samples are derived principally from suspended particulate material contained in underlying historic fill material (ARCADIS 2012a).

Site investigations have found no evidence of organic TCL or Priority Pollutant constituents in groundwater above NYS Class GA standards in the East Parcel. Within the West Parcel, groundwater exhibited evidence of residual petroleum contamination (VOCs and/or occasional sheen and odor) in the vicinity of an abandoned 10,000-gallon No. 6 fuel oil UST that was partially removed during GMC's Interim Corrective Measures project in 1998. The remainder of the UST and two others were removed as part of the 2007 IRM project. The results of groundwater sampling downgradient of former sources showed that petroleum constituents have naturally attenuated within the Site.

Significant VOC and metal contamination in groundwater, relative to Class GA standards, was limited to a small area beneath the oldest part of the former Body Plant near Kingsland Point Park, referred to as Potential Area of Concern #47 (PAOC 47). Chromium and TCE were the constituents that exceeded Class GA standards in groundwater samples, which was a condition not seen elsewhere on the Site. TCE was detected at a maximum concentration of 75 parts-per-billion (ppb) and chromium was detected at a maximum concentration of 42,100 ppb. An IRM was completed in 2007-2008 to remove the source of chromium and to chemically destroy TCE in the saturated zone through in-situ chemical oxidation (ISCO). As described further in Section 2.3.2, periodic post-IRM monitoring confirmed that the IRM objectives for groundwater were met.

2.3 Soil Gas and Vapor

2.3.1 Methane

A soil gas survey performed at the East Parcel indicated high levels of methane (70-100% combustible gas) under the asphalt covering the former Village landfill. Methane is primarily attributed to decomposition of historic municipal waste, with a possible contribution from decomposition of natural organic matter underlying the historic fill material. Approximately half of the area of the highest methane concentrations is located above the former Village landfill area.

In contrast to the presence of methane in soil gas throughout the paved areas of the East Parcel, methane was not prevalent on the West Parcel. Methane was limited to the northern corner of the West Parcel in an area where evidence of marsh vegetation (roots, organic mud) was noted in test borings. Methane ranged from 0.1% to 18% under asphalt surfaces in this area. Beyond this northern corner, only trace levels of methane (below 1%) were measured under asphalt or concrete surfaces within the West Parcel.

2.3.2 Volatile Organic Compounds (VOCs) in Soil Vapor

VOCs were detected in soil vapor samples throughout the areas sampled on the West Parcel. Petroleum-derived vapors were detected within and near petroleum attenuation areas. Chlorinated VOCs were detected primarily within and near PAOC 47, where TCE was found in groundwater. The extent of chlorinated VOCs was broader than the former footprint of groundwater contamination. The soil and groundwater sources of TCE were subsequently remediated as part of the IRMs performed in 2007-2008.

2.4 Site Conditions Following Completion of Interim Remedial Measures

2.4.1 Soil Removal

Soil removal IRM activities were conducted in four areas: PAOC 7, PAOC 29, PAOC 47 and the former 10,000-gallon UST area (Figure 4) during 2007. The activities were conducted in accordance with the IRM Work Plan (ARCADIS 2007) and are summarized in greater detail in the IRM Construction Completion Report (ARCADIS 2008).

The table below provides a general summary of the areas addressed, the amount of soil removed, the main constituent of concern and the cleanup level achieved.

Excavation Area	PAOC 29	PAOC 47	PAOC 7	Former UST Area
Approximate Soil Volume (cubic yards)	1,100	3,700	3,700	6,400
Constituent and associated Cleanup Level (in parts per million [ppm])	Lead: 5,000 ppm above the groundwater table 10,000 ppm below the groundwater table	Total Chromium: 50 ppm Trichloroethene: 0.47 ppm	Lead: 5,000 ppm above the groundwater table 10,000 ppm below the groundwater table	VOCs and SVOCs: 6 NYCRR Part 375 Restricted Residential Soil Cleanup Objectives

All excavated materials were disposed offsite at a permitted waste management facility. The excavation areas were surveyed and backfilled with imported soils and (in select areas) concrete millings. A final Interim Remedial Measure Construction Completion Report (ARCADIS 2008) was completed in September 2008 and approved by NYSDEC.

2.4.2 On-Site Groundwater Treatment

Treatment of contaminated groundwater using in-situ chemical Oxidation (ISCO) was performed in the spring of 2008 at PAOC 47, following the soil removal IRM.

The goal of the ISCO groundwater treatment program was to:

- Eliminate, to the extent practicable, the potential for off-site migration of residual contamination.

- Eliminate, to the extent practicable, the potential for exposure to residual contamination in groundwater.

- Eliminate, to the extent practicable, the potential for intrusion of volatile organic compound soil vapors into indoor air spaces in future buildings.

ISCO was successful in remediating TCE in groundwater to levels meeting the Class GA drinking water standard with the exception of a few very localized areas within the treatment zone. The observed trend in the post-injection groundwater monitoring data indicates some attenuated levels of TCE in groundwater at concentrations marginally above the Class GA standard onsite, with groundwater typically meeting the Class GA standard along the downgradient property line. Based on post-injection groundwater monitoring data obtained between June 2008 and May 2011, the TCE-affected area is remediated to the extent practicable and poses no exposure potential. NYSDEC issued a no further action letter for the PAOC 47 area on October 7, 2011.

Grossly contaminated soil and fill materials containing lead, chromium, TCE and PAHs have been removed from the site, such that no further degradation of groundwater is anticipated, either on-site or offsite. Per the IRM Decision Document, public health will be protected in the future from exposure to soil and fill that does not meet restricted residential SCOs through the use of engineering and institutional controls, and from exposure to groundwater that does not meet Class GA standards, by prohibiting future use of Site groundwater.

2.5 Hudson River Sediments

Several historical sediment investigations have been conducted for the lower Hudson River sediments in the vicinity of the Site. These investigations include a study conducted for GMC in 1997 specific to the Site, and regional studies conducted in 2000/2001 by others (Versar) for NYSDEC. Under the BCA for the West Parcel, two additional site-specific sediment investigations were conducted for GMC in 2004 (initial) and 2006 (supplemental) under NYSDEC-approved work plans. The methods and findings of the investigations performed for GMC under the BCA, as well as data from the previous site-specific and regional investigations, were included and evaluated in the Sediment Remedial Investigation Report (ARCADIS 2012b).This section summarizes the scope and activities of these sediment investigations.

The sample locations from the various sediment investigations were divided into two primary groups: background (upstream or reference locations) and near-Site. Background and near-Site sediment sample locations associated with the sediment investigations conducted for GMC between 1997 and 2006 are depicted on Figures 5 and 6.

The RI evaluated the distribution of metals, PAHs and PCBs in sediments upstream, downstream and in the immediate vicinity of the Site shoreline (including three outfall locations). Based on the bulk sediment chemistry data obtained throughout the study area in the 2004 investigation, GMC worked with NYSDEC to apply sediment screening techniques to reduce the list of contaminants of potential concern (COPCs) to five metals (chromium, copper, lead, mercury, and zinc).

The final supplemental investigation work plan was completed in 2006 with significant input from NYSDEC, and outlined a comprehensive approach to complete a benthic impact assessment, covering a broad area of interest in the Hudson River designed to evaluate multiple lines of evidence of possible benthic impacts attributable to COPCs in near Site sediments. The 2006 investigation consisted of sampling and analysis of sediments, extraction and analysis of pore-water within the sediments, life cycle toxicity tests with a benthic macroinvertebrate species exposed to the collected sediments, calculation of toxicity benchmarks based on contaminant attenuation properties of the sediments (AVS and TOC), and evaluation of the abundance and diversity of existing benthic communities throughout the background and near-Site study areas. Additionally, deep core sampling was conducted to evaluate vertical extent of COPCs and select cores were evaluated using geochronology techniques to assess sediment deposition history.

The sediment RI report evaluated all of the available data, from 1997 through 2006, including sediment data from an independent regional study by Versar for NYSDEC (Versar 2002). This comprehensive evaluation consisted of a risk-based approach to identify sampling stations that exhibit differences in COPC concentrations relative to background, characterize the observed concentrations relative to sediment screening criteria, evaluate bioavailability and potential toxicity of COPCs to benthic biota, and assess community-level indicators of benthic impact relative to background. Results of the 2006 investigation are presented in the Sediment Remedial Investigation Report (ARCADIS 2012b).

These investigations delineated the extent of COPC contamination relative to NYSDEC sediment screening criteria but the evaluation did not clearly demonstrate biological impact attributable to COPCs near the Site based on the multiple lines of evidence

gathered. However, sediments containing the highest levels of COPCs are concentrated at the mouth of OF-1, where a future fishing pier is contemplated in the proposed waterfront development plans described in Section 1.4. The scope of work for the 2006 investigation included delineation of the vertical and areal extent of COPCs in the vicinity of OF-1 to evaluate possible removal of grossly contaminated sediments.

A knee-of-the curve analysis of various sediment capping and removal alternatives for the vicinity of OF-1 was performed, similar to the method used to evaluate soils with high concentrations of lead for removal during the upland IRM completed in 2007. Based on the knee-of-the curve analysis, a removal alternative to remediate these sediments was developed and evaluated in a Sediment Alternative Analysis Report (Sediment AAR), as described further in Sections 3 and 4.

3. Remedial Action Objectives

Remedial Action Objectives (RAOs) are medium-specific goals that, if met, will be protective of public health and the environment relative to the environmental concerns identified at the Site. Separate RAOs were developed for the upland portion of the Site and the offsite Hudson River sediments due to differences in potential environmental exposure pathways and primary receptors.

3.1 Remedial Action Objectives for the Upland Site

The Remedial Action Objectives (RAOs) for the upland Site, in consideration of the constituents of interest, contemplated future use, and exposure pathways and receptors were presented in the NYSDEC's IRM Decision Document (NYSDEC 2007), and are as follows:

- Remove, to the extent practicable, the grossly contaminated soil present at the Site
- Eliminate, to the extent practicable, the potential for off-site migration of residual contamination
- Eliminate, to the extent practical, the potential for exposure to soils and historic fill materials that exceed TAGM 4046[1] or applicable BCP Soil Cleanup Objectives Values
- Eliminate, to the extent practicable, the potential for exposure to residual contamination in groundwater
- Eliminate, to the extent practicable, the potential for intrusion of VOCs and methane into indoor air spaces in future buildings.

The IRM Decision Document provided a remedy that addressed all of these RAOs, but portions of the remedy (those intended for future construction) still have to be completed. As summarized in Section 4, the Alternatives Analysis Report (AAR) for

[1] Subsequent to the IRM Decision Document, TAGM 4046 has been replaced with 6 NYCRR Part 375 Soil Cleanup Objectives for specified use. In addition, Commissioner Policy, CP-51/ Soil Cleanup Guidance (October 21, 2010) provides supplemental SCOs and related guidance for the BCP and other remedial programs.

the upland Site evaluated the RAOs based on only those portions of the IRM Decision Document remedy that have not yet been completed.

3.1.1 Site-Specific Remedial Goals for the Upland Site

To address the constituents of concern and meet the upland RAOs established for the Site, specific remediation goals have been established in conformance with the Draft BCP Guide and 6 NYCRR Part 375. Two remedial alternatives were developed and assessed in the AAR for the upland Site based on NYSDEC defined cleanup tracks as follows:

- Track 1, 6 NYCRR Part 375-3.8(e)(1) soil cleanups requires the Site media to meet 6 NYCRR Part 375 SCOs for unrestricted use. This alternative will require 65 acres of soil to be removed from the site to an average depth of 25 feet.

- Track 4, 6 NYCRR Part 375-3.8(e)(4) soil cleanups utilize site-specific information to identify risk-based soil cleanup objectives to achieve a restricted use remedy. For Track 4 remedies, restrictions can be placed on the use of the property in the form of institutional and engineering controls if they can be realistically implemented and maintained in a reliable and enforceable manner. As set forth in 6 NYCRR 375-6.7(d), remaining contaminated soil must be covered by material meeting the requirements of the generic soil cleanup table for the applicable future Site uses (i.e., restricted residential and commercial).

3.2 Remedial Action Objectives for Sediments

The RAOs for the Hudson River sediments are NYSDEC's generic RAOs for sediments, which are independent of future use of the Site. These RAOs are as follows:

- <u>RAOs for Public Health Protection</u>
    - Prevent direct contact with contaminated sediments
    - Prevent surface water contamination which may result in fish advisories.
- <u>RAOs for Environmental Protection</u>
    - Prevent releases of contaminant(s) from sediments that will result in surface water concentrations in excess of (ambient water quality criteria).

- Prevent impacts to biota from ingestion/direct contact with sediments causing toxicity or impacts from bioaccumulation through the marine or aquatic food chain.

- Restore sediments to pre-release/background conditions to the extent feasible.

To determine the extent of remediation that may be needed to meet these generic RAOs, it is acknowledged that existing conditions already meet most of these objectives, based on the multiple lines of evidence presented in the Sediment RI Report. The one exception is restoration to pre-release/background conditions to the extent feasible. The proposed restoration is targeted at removing a concentrated COPC mass near the former industrial outfall in order to mitigate the potential for future impact of sediments with high metal concentrations during waterfront development. As summarized in Section 4, the Sediment AAR evaluated this outfall area removal alternative in comparison to a default alternative of restoring a much larger area of sediments (containing relatively lower concentrations of metals) to a condition meeting the most stringent sediment criteria (lower than many background area concentrations). The latter is analogous to the Track 1 alternative evaluated for the upland Site.

3.2.1 Site-Specific Remedial Goals for Sediments

The remediation goals for the site include attaining, to the extent practicable:

- Surface water quality standards set forth in Ambient Water Quality Standards and Guidance Values (NYSDEC 1998).

- Sediment quality guidelines in Technical Guidance for Screening Contaminated Sediments (NYSDEC 1999).

4. Summary of Alternatives Analysis

This section summarizes the remedial alternatives developed and evaluated for the upland and sediment areas and identifies the preferred remedies for these areas. Remedial alternatives were developed in accordance with DER-10 guidance applicable to BCP Sites (NYSDEC 2010).

4.1 Summary of Potential Remedial Alternatives for the Upland Site

The remedial alternatives identified in the Alternatives Analysis Report (AAR) for the upland portion of the Site (ARCADIS 2012c) were selected in consideration of appropriate Standards, Criteria and Guidance (SCGs) and RAOs identified for the Site. The following are the remedial alternatives selected for detailed analysis:

- Alternative A: Removal of Impacted Soil Containing Chemical Constituents at Concentrations Greater than 6 NYCRR Part 375 SCOs for unrestricted use (Track 1).

- Alternative B: Institutional Controls/Engineering Controls (Track 4).

4.1.1 Upland Alternative A - Removal of Impacted Soil Containing Chemical Constituents at Concentrations Greater than 6 NYCRR Part 375 SCOs

This alternative consists of the excavation and off-site disposal of all soil and historic fill material that contains chemical constituents at concentrations greater than 6 NYCRR Part 375 SCOs for unrestricted use (hereinafter referred to as “impacted materials”). Implementation of this alternative would remove the impacted materials previously placed onsite during historic fill operations to achieve the Track 1 remediation goals presented in Section 4 and Part 4.4 (d)(2) of DER-10.

The major components of this alternative include excavating approximately 2,673,000 in-place cubic yards (cy) of impacted materials to a maximum depth of 25 feet bgs (assumes a maximum depth of 20 feet below the top of the groundwater table), and providing appropriate excavation support and groundwater management for such excavation. Excavated materials would require handling and preparation for off-site transportation and disposal. In addition, due to the shallow depth to groundwater, a dewatering system would need to be installed to facilitate excavation activities. Water generated during the dewatering activities would be treated on-site via temporary water treatment system and then discharged to the Hudson River under a permitted discharge.

Existing asphalt and concrete covers, as well as existing utilities, would be located and removed prior to initiating excavation activities. Excavated areas would be backfilled with material meeting the BCP criteria presented in DER-10 and further in 6 NYCRR Part 375 to the pre-excavation elevations and grades, and all disturbed areas would be restored with topsoil and grass seeding, as appropriate.

4.1.2 Upland Alternative B – Institutional Controls/Engineering Controls

This alternative consists of implementing site-wide engineering and institutional controls (EC/IC), as described in the IRM Decision Document, to mitigate direct contact with soils and historic fill materials that exceed 6 NYCRR Part 375 SCOs for restricted residential use (referred to as "impacted soil"). This alternative builds on the remedial actions already taken to remove grossly contaminated soil and provide contaminant reduction through in-situ treatment of impacted groundwater.

The ECs for the site include a demarcation barrier and final barrier cap system (collectively referred to as the barrier system) throughout the Site, mitigation measures, as necessary, to address potential intrusion of methane and/or volatile organic vapors into future indoor air space within certain portions of the Site, and installation of additional monitoring wells, where necessary, to document the remedial action objectives are being achieved on-site and off-site.

This alternative will require the implementation of ICs to limit disturbance of the barrier cap, including, but not limited to, a soil management plan and site-specific health and safety plan for any future ground intrusive activities that have the potential to breech the barrier system (e.g., utility work), requirements for the handling and/or re-use of excavated on-site subsurface fill materials, and deed restrictions on property transferred following completion of remedial activities. Additionally, as part of the ICs, Environmental Easements would be implemented to place restrictions on the property.

The preparation of a Site Management Plan (SMP) that is signed and stamped by a professional engineer licensed in the State of New York would be required following construction of the remedy. Monitoring activities (sampling and analysis) would be conducted to document that natural remediation processes are continuing to reduce or stabilize site-related dissolved-phase constituent concentrations in groundwater and that offsite migration is not occurring during the post-development period.

4.2 Summary of Comparative Analysis of Upland Remedial Alternatives

A comparative analysis of the relative ability of the two upland alternatives to meet the evaluation criteria was provided in the AAR for the upland Site. A summary of the results is provided in Table 4.1:

Table 4-1: Comparative Analysis Summary – Upland Remedial Alternatives

Evaluation Criteria	Upland Alternative A	Upland Alternative B
Overall Protection of Human Health and the Environment	■	■
Compliance with SCGs	■	■
Long-Term Effectiveness and Permanence	■	◘
Reduction of Toxicity Mobility or Volume of Contamination through Treatment	■	□
Short-Term Impacts and Effectiveness	□	◘
Implementability	□	■
Cost Effectiveness	□	■
Land Use	■	◘
Community Acceptance	□	■

Legend:
Symbol represents the relative ability of the alternative to meet the evaluation criteria in comparison to the other alternatives

□	Poor
◘	Fair
■	Good

4.3 Preferred Upland Remedy

Based on the comparative analysis summarized in Table 4-1, both upland alternatives will meet the RAOs by satisfying key decision criteria for protection of human health and the environment. However, Upland Alternative A will not provide significant benefits over Upland Alternative B to justify the significant increase in construction time and cost. Alternative A is not readily implementable, nor is this alternative feasible from a timing or a cost standpoint (estimated at over $700 million and approximately 15 years to complete), and could also be a significant contributor to the region's greenhouse gas emissions.

Upland Alternative B is the more implementable and cost-effective option, and will likely be more accepted by the community because the alternative returns the site to a productive use consistent with current zoning and land use planning. The barrier system will mitigate human exposure to impacted soils, and implementation of a soil management plan will protect future site workers involved with subsurface excavation from exposure to the COCs in the soil and groundwater. In addition, groundwater monitoring will be conducted to document that site-related, impacted groundwater is not migrating off site and to monitor the ongoing natural attenuation processes. Based on future site development plans, mitigation measures may include performance standards, building design standards, low-permeability liners, etc. to reduce the intrusion of methane into any buildings that may be constructed over areas exhibiting percent levels of subsurface methane. For these reasons, Upland Alternative B (Implementation of Institutional and Engineering Controls) is the recommended site-wide remedy.

4.4 Summary of Potential Sediment Remedial Alternatives

The remedial alternatives identified in the Sediment Alternatives Analysis Report (Sediment AAR) for the Hudson River (ARCADIS 2012d) were selected in consideration of appropriate Standards, Criteria and Guidance (SCGs) and RAOs identified for the Site. The following are the remedial alternatives selected for detailed analysis:

- Sediment Alternative A – Sediment Removal in Sediment Screening Criteria Exceedance Area

- Sediment Alternative B – Sediment Removal in Near-Shore Area at Outfall OF-1

4.4.1 Sediment Alternative A – Sediment Removal in Sediment Screening Criteria Exceedance Area

This alternative involves removal and offsite disposal of sediment from within the 77.55-acre portion of the Hudson River identified by the NYSDEC as the area containing chemical constituents at concentrations greater than the Sediment Screening Criteria Low Effects Levels (NYSDEC 1999). The average removal depth for Alternative A would be approximately 7 ft, and approximately 840,000 cy of sediment would be removed under this alternative over a 14+ year remediation duration.

Dredged sediment would be segregated to remove debris and material not suitable for disposal and staged on site to facilitate dewatering, stabilization, and sampling for waste characterization and evaluation of treatment and disposal requirements. Materials would be prepared as appropriate based on their waste classification and transported to an appropriate waste management facility. The dredged area would be backfilled with in-kind material, and to the same elevation as it was prior to dredging activities. The habitat zones disturbed during remedial activities would be restored to current conditions. Water generated during the dredging and dewatering activities would be treated onsite using a portable water treatment system. Treated water would be discharged to the Hudson River.

In addition to sediment dredging, approximately 30 ft of the 48-inch storm sewer from OF-1 upstream to the first manhole would be cleaned out in this alternative.

4.4.2 Sediment Alternative B – Sediment Removal in Near-Shore Area at Outfall OF-1

Removal of sediment would occur over a 0.8 acre portion of the Hudson River, 150 feet upstream and downstream of Outfall OF-1 bounded by the shoreline and the existing harbor channel, as shown on Figure 7. Approximately 4,400 cy of sediment would be removed under this alternative.

Dredged sediment would be segregated to remove debris and material not suitable for disposal and staged on-site to facilitate dewatering, stabilization, and sampling for waste characterization and evaluation of treatment and disposal requirements. Materials would be prepared as appropriate based on their waste classification and transported to an appropriate waste management facility. The dredged area would be backfilled with in-kind material, and to the same elevation as it was prior to dredging activities. The habitat zones disturbed during remedial activities would be restored to current conditions. Water generated during the dredging and dewatering activities would be treated onsite using a portable water treatment system. Treated water would be discharged to the Hudson River.

In addition to sediment dredging, approximately 30 ft of the 48-inch storm sewer from OF-1 upstream to the first manhole would be cleaned out to remove any accumulated sediment.

4.5 Summary of Comparative Analysis of Sediment Remedial Alternatives

A comparative analysis of the relative ability of the two sediment alternatives to meet the evaluation criteria was provided in the Sediment AAR (ARCADIS 2012b). A summary of the analysis is provided in Table 4.2.

Table 4-2: Comparative Analysis Summary – Sediment Remedial Alternatives

Evaluation Criteria	Sediment Alternative A	Sediment Alternative B
Overall Protection of Human Health and the Environment	■	■
Compliance with SCGs	■	■
Long-Term Effectiveness and Permanence	◘	◘
Reduction of Toxicity Mobility or Volume of Contamination	■	◘
Short-Term Impacts and Effectiveness	□	■
Implementability	□	■
Cost Effectiveness	□	■
Land Use	□	■
Community Acceptance	◘	■

Legend:
Symbol represents the relative ability of the alternative to meet the evaluation criteria in comparison to the other alternatives

□	Poor
◘	Fair
■	Good

4.6 Preferred Sediment Remedy

Based on the comparative analysis summarized in Table 4-2, both sediment alternatives will meet the RAOs by satisfying key decision criteria for protection of human health and the environment. However, Alternative A (at an estimated cost of $460 million and 14 years to complete) will not provide significant benefits over Alternative B to justify the significant increase in construction time and cost. Sediment Alternative B is the more implementable and cost-effective alternative. The shorter duration to implement Alternative B (one construction season) will likely improve the community acceptance of the project and result in fewer short-term impacts such as

traffic and nuisance dust. The smaller volume of sediment to be removed under Alternative B will limit the short-term potential impacts to the water column, air, and biota in the Hudson River area and alteration and destruction of benthic habitat in the areas subject to those activities. For these reasons, Alternative B is the recommended remedy.

5. Upland Remedial Action Activities

5.1 Remedial Action Description

The upland Site remedy consists of implementing site-wide EC/IC to mitigate direct contact with soils and historic fill materials that exceed 6 NYCRR Part 375 SCOs for restricted residential use (referred to as "impacted soil"). This remedy builds on the remedial actions already taken to remove grossly contaminated soil and provide contaminant reduction through in-situ treatment of impacted groundwater.

5.1.1 Engineering Controls

The ECs for the site are as follows:

- A demarcation barrier consisting of a geotextile fabric or a structural surface (e.g., concrete or asphalt) over soil or historic fill material that does not meet 6 NYCRR Part 375 SCOs for unrestricted use.

- A final barrier cap system throughout the entire Site consisting of either or a combination of:

    - A 2-foot-thick surface soil cover for landscaped or naturally vegetated areas. If necessary, based upon additional testing, portions of the soil cover may be designed to minimize infiltration through unsaturated soil exhibiting the potential to leach lead to groundwater.

    - Pavement (or similar hard surfaces) over non-vegetated areas.

    - Permanent buildings or similar structures.

    - Soils imported to the site will meet the 6NYCRR Part 375 SCOs for restricted residential use.

- Mitigation measures, as necessary, to address potential for intrusion of methane into future indoor air space within the East Parcel and in the northern corner of the West Parcel.

- Mitigation measures, as necessary, to address potential intrusion of volatile organic vapors into future indoor air space within the East and West Parcels

- Installation of additional monitoring wells, where necessary, and post-IRM groundwater monitoring to document that remedial action objectives are being achieved on site and off site.

The demarcation barrier in combination with a 2 feet thick surface cover, pavement, or permanent structures is collectively referred to hereafter as the barrier system. The barrier system will mitigate both the potential exposure to humans and wildlife to the underlying impacted materials and the potential migration via overland transport of these materials. A geotextile fabric will be placed beneath the barrier system to identify the limits of the barrier system during any future intrusive activities (through visual controls). This remedy will require the implementation of institutional controls to limit disturbance of the barrier cap. ICs will include, but are not limited to, a soil management plan and site-specific health and safety plan for any future ground intrusive activities that have the potential to breech the barrier system (e.g., utility work), and deed restrictions on property transferred following completion of remedial activities.

In general, the ECs outlined above and the ICs outlined in further detail below are designed to:

- Eliminate, to the extent practicable, the potential for off-site migration of residual contamination

- Eliminate, to the extent practicable, the potential for exposure to soils and historic fill materials that exceed SCOs for the intended use.

- Eliminate, to the extent practicable, the potential for exposure to residual contamination in groundwater

- Eliminate, to the extent practicable, the potential for intrusion of volatile organic compound (VOC) soil vapors and methane into indoor air spaces in future buildings

Based on future site development plans, mitigation measures may include performance standards, building design standards, low-permeability liners, etc. to reduce the intrusion of methane into any buildings that may be constructed over areas exhibiting percent levels of subsurface methane.

The preparation of an SMP completed by a professional engineer, or such other qualified environmental professional as the Department may find acceptable, will be

required and will be referenced in the environmental easement (described in Section 5.1.3). The SMP details the institutional and engineering controls required for the Site and any physical components of the remedy that are required to be operated, maintained, and monitored to assure continued effectiveness of the approved remedy.

Monitoring activities (sampling and analysis) will be conducted to document that natural remediation processes are continuing to reduce or stabilize site-related dissolved-phase constituent concentrations in groundwater and that offsite migration is not occurring during the post-development period.

Field and laboratory data will be collected, at a minimum, from the following locations:

- Upgradient monitoring wells
- Monitoring wells located within the impacted areas
- Monitoring wells located downgradient of the impacted area and at the property line.

Monitoring wells will include those associated with prior IRMs and areas where VOCs are still present at levels exceeding Class GA standards. The required frequency of monitoring will be determined by NYSDEC. Monitoring activities may consist of the collection of groundwater field data (i.e., pH, turbidity, temperature, etc.) and the collection of groundwater samples for laboratory analysis to verify that COC concentrations in groundwater prior to development are maintained or are decreasing over time.

5.1.2 Institutional Controls

ICs will be implemented to limit disturbance of the barrier cap and prevent exposure to Site soil and groundwater. ICs will include, but are not limited to, a soil management plan and site-specific health and safety plan for any future ground intrusive activities that have the potential to breech the barrier system (e.g., utility work), and deed restrictions on property transferred following completion of remedial activities.

A general summary of the ICs for the site are as follows:

- A soil management plan and associated site-specific Health and Safety Plan (HASP) for potential future ground intrusive activities that may breach the demarcation barrier or extend beneath future permanent buildings/structures. The

soil management plan will also address the handling and re-use of excavated soil or historic fill material during Site development (e.g., on-site reuse of soil from excavation of building foundations and utility trenches), and beneficial reuse of the concrete millings as a subsurface fill material on site.

- Requirement that any historic fill material excavated during underground utility construction be replaced by clean backfill (meeting DER-10 specified criteria).
- Requirement for post-construction monitoring and/or sampling as necessary to evaluate the potential for soil vapor intrusion prior to building occupancy.
- Performance specifications for maintenance of the Site-wide barrier cap system.
- Requirement for periodic inspection and evaluation by a qualified individual to confirm that EC/ICs are in-place and reliable.
- Requirement that Site groundwater not be used for any purpose.
- Environmental easements (institutional controls) including a soil management plan and site-specific HASP for potential future ground intrusive activities that may breech the demarcation barrier or extend beneath future permanent buildings/structures.
- Mitigation measures to address the potential presence of methane in the East Parcel and in the northern corner of the West Parcel.
- Installing monitoring wells (if required) and implementing a periodic groundwater monitoring program to document that the RAOs are being achieved.
- Conducting periodic groundwater monitoring (sampling and analysis) to document that offsite migration is not occurring.

5.1.3 Environmental Easements

An Environmental Easement is an enforcement mechanism used for property where the remedial program leaves residual contamination that makes the property suitable for some, but not all uses, or includes engineering controls that must be maintained to be effective. The purpose of the Environmental Easement is to ensure that such use restrictions or engineering controls remain in place. An Environmental Easement:

- Can only be created by the property owner (the grantor) through a written instrument recorded in the appropriate county recording office. It can only be granted to the State (the grantee) and can only be extinguished or amended by a written instrument executed by the Commissioner of the Department of Environmental Conservation and duly recorded;

- Is binding upon all subsequent owners and occupants of the property. The deed or deeds for the property (as well as any other written instruments conveying any interest in the property) must contain a prominent notice that it is subject to an Environmental Easement;

- May be enforced in perpetuity against the grantor, subsequent owners of the property, lessees, and any person using the property by its grantor, by the State, or by the municipality in which the property is located.

The Environmental Easement will include the following requirements and restrictions on the upland Site property:

- Engineering and Institutional Controls will be maintained and inspected as specified in the Department-approved SMP.

- Single-family housing[2] is prohibited.

- Vegetable gardens and farming on the property are prohibited.

- Use of groundwater underlying the property is prohibited without treatment rendering it safe for the intended use.

- All future activities on the property that will disturb remaining impacted soil must be conducted in accordance with the soil management plan included in the SMP.

- The potential for vapor intrusion must be evaluated for any buildings developed on the site, and any potential impacts that are identified must be mitigated.

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[2] Prohibited single family housing does not include attached or detached housing units where there is common ownership or a single owner/managing entity of the entire site encompassed in the environmental easement, meeting the definition of restricted residential use in 6NYCRR Part 375.

- The property may be used for restricted residential and commercial use, provided that the long-term EC/ICs described in the SMP remain intact and meet their respective performance requirements.

As specific uses are identified for lands donated to the Village of Sleepy Hollow or other organizations, the easement may be amended by the grantor, subject to approval by the Commissioner, to specify and enforce restrictions consistent with any change in use that is not consistent with restricted residential or commercial use.

6. Sediment Remedial Action Activities

6.1 Remedial Action Description

Removal of sediment will occur over a 0.8 acre portion of the Hudson River near Outfall OF-1 as shown on Figure 7. The removal area will extend 150 feet upstream and downstream of the outfall and will be bounded by the shoreline and the existing Tarrytown Harbor channel (as identified by the US Army Corps of Engineers). Removal will extend to the cut elevations shown on Figure 7, which maximize mass removal based on sampling results and a knee-of-the-curve evaluation of the data. Approximately 4,400 cy of sediment will be removed under this plan.

Dredging will be conducted using mechanical dredging in the wet using, for example, a crane-mounted clamshell located on a barge or other similar methods. With mechanical dredging techniques, the dredged material will be loaded into scows, which will be transported to a floating work platform for offloading via long reach excavator. If possible, dredging could also be conducted from the shore using a long-reach excavator with an environmental bucket. If alternative hydraulic techniques are employed, sediments will be pumped directly to a temporary dewatering system on the Site. The final method, or combination of methods, will be decided upon during the remedial design and permitting process.

During sediment dredging, the final section of the 48-inch storm sewer that discharges at OF-1 will be cleaned out to remove any accumulated sediments. It is estimated that this cleanout will extend from the outfall to the first upstream manhole, a distance of approximately 30 feet.

To provide environmental controls, turbidity curtains will be used and water quality monitoring will be conducted. The turbidity curtain design will consider factors such as water depth and velocity, tidal fluctuation, and sediment properties. For the purposes of this plan, it is anticipated that the turbidity curtains will be installed around the entire sediment removal area. Daily water column turbidity monitoring downstream of the dredging areas will be conducted during construction activities to monitor the effectiveness of the turbidity curtain systems.

Dredged sediment will be staged on the West Parcel. The staging area will be constructed prior to dredging. Dredged material will be segregated to remove debris and material not suitable for disposal and staged to facilitate dewatering, stabilization, and sampling for waste characterization and evaluation of treatment and disposal requirements. The stabilized materials will be tested to determine if any materials may

be classified as hazardous waste as defined by Resource Conservation and Recovery Act (RCRA) regulations. Materials determined to be nonhazardous will be prepared and transported to a permitted solid waste management facility. Materials determined to be hazardous waste will be segregated onsite, if appropriate and feasible, then transported to a permitted hazardous waste management facility where they will be treated (if necessary) to comply with any applicable land disposal restrictions (LDRs). Alternatively, a Beneficial Use Determination (BUD) could be considered for the stabilized sediment. Analysis of the physical, chemical, and structural properties of the stabilized material will be required to determine whether or not to apply for a BUD to recycle this material onsite as structural fill under the final cover system (e.g., soil cap, building or road surfaces) to be constructed as part of the land-based remedy.

For the purpose of developing a cost estimate, it has been assumed that dredged sediment will be stabilized with 10% Portland cement and no sediments will be classified as RCRA hazardous waste.

The dredged area will be backfilled with in-kind material; likely sand to within 2 feet of the final grade and 2 feet of fine material to the final grade on top of the sand. Backfill material placement will be conducted using general construction equipment, similar to that of dredging activities. The final elevations of the restored dredged area will be the same as it was prior to dredging activities. The habitat zones disturbed during these remedial activities will be restored to current conditions.

Water generated during the dredging and dewatering activities will be treated onsite using a portable water treatment system. Treated water will then be discharged to the Hudson River.

6.1.1 Engineering Controls

No post remediation engineering controls or monitoring will be required following completion of the removal action.

6.1.2 Institutional Controls

No institutional controls will be required for the sediment remedial action. No use restrictions will be placed on the remediated sediment area.

6.1.3 Environmental Easements

No environmental easements will be required for the remediated sediment area.

7. Remediation Schedule

Upland IRMs initiated in 2007 and 2008 have been completed and require no further action prior to establishing the final engineering and institutional controls described in the IRM Decision Document (NYSDEC 2007).

The final engineering controls will be designed into the Site architectural and engineering plans for redevelopment. Responsibility for design, implementation, monitoring and certification of the land-based remediation will be assumed by the future controlling parties, under an executed BCA, following GM LLC's sale of the 96-acre Site and the subsequent donation of the East Parcel to the Village of Sleepy Hollow. Institutional controls will be established and environmental easements will be filed during the property transfer from GM LLC to a future controlling party, as well as any subsequent property transfer. The controlling parties will establish schedules for all land based remedial design and implementation.

Remedial design for removal of sediments from the Hudson River will follow final NYSDEC approval of the proposed remedial action as presented in the Sediment AAR (ARCADIS 2012d). Responsibility for design, implementation, monitoring and certification of the Hudson River sediment-based remediation will be assumed by GM LLC under their current BCA.

The planned sequencing and approximate duration of Hudson River sediment design and remediation activities is as follows:

- Remedial Design and Permit Applications: 3 months
- Design & Permit Reviews and Approvals: 1-2 months
- Contracting: 1-2 months
- Mobilization and Site Controls: 1 month
- Dredging & Sediment Management: 4-5 months within local construction season
- Demobilization: 1 month
- Completion Report: 2 months
- NYSDEC Review and Approval of Completion Report: 1-2 months

8. References

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Village of Sleepy Hollow 2011a. Amended Findings Resolution for Lighthouse Landing at Sleepy Hollow , adopted January 25, 2011.

Village of Sleepy Hollow 2011b. Special Permit and Concept Plan Approval adopted by the Village on June 7, 2011.

ARCADIS

Figures

REFERENCE: BASE MAP USGS 7.5 MIN. QUAD., WHITE PLAINS, NY, 1967, PHOTOREVISED 1979.

2000' 0 2000'

Approximate Scale: 1" = 2000'

FORMER GENERAL MOTORS ASSEMBLY PLANT SITE
SLEEPY HOLLOW, NEW YORK

REMEDIAL WORK PLAN

SITE LOCATION MAP

ARCADIS

FIGURE
1

02/07/2012 SYRACUSE, NY-ENV/CAD-DJHOWES
B0064462/0001/00058/CDR/64462N01.CDR

02/07/2012 SYRACUSE, NY-ENV/CAD-DJHOWES
B0064462/0001/00058/CDR/64462G01.CDR

SOURCE: EARTH ATTRIBUTES
DATE OF PHOTOGRAPH: APRIL 24, 2000

LEGEND:

SITE BOUNDARY

TOWN LINE

REFERENCE:
FIGURE FROM DEIS FOR LIGHTHOUSE LANDING AT SLEEPY HOLLOW, NOVEMBER 2004, PREPARED BY DIVNEY TUNG SCHWALBE.

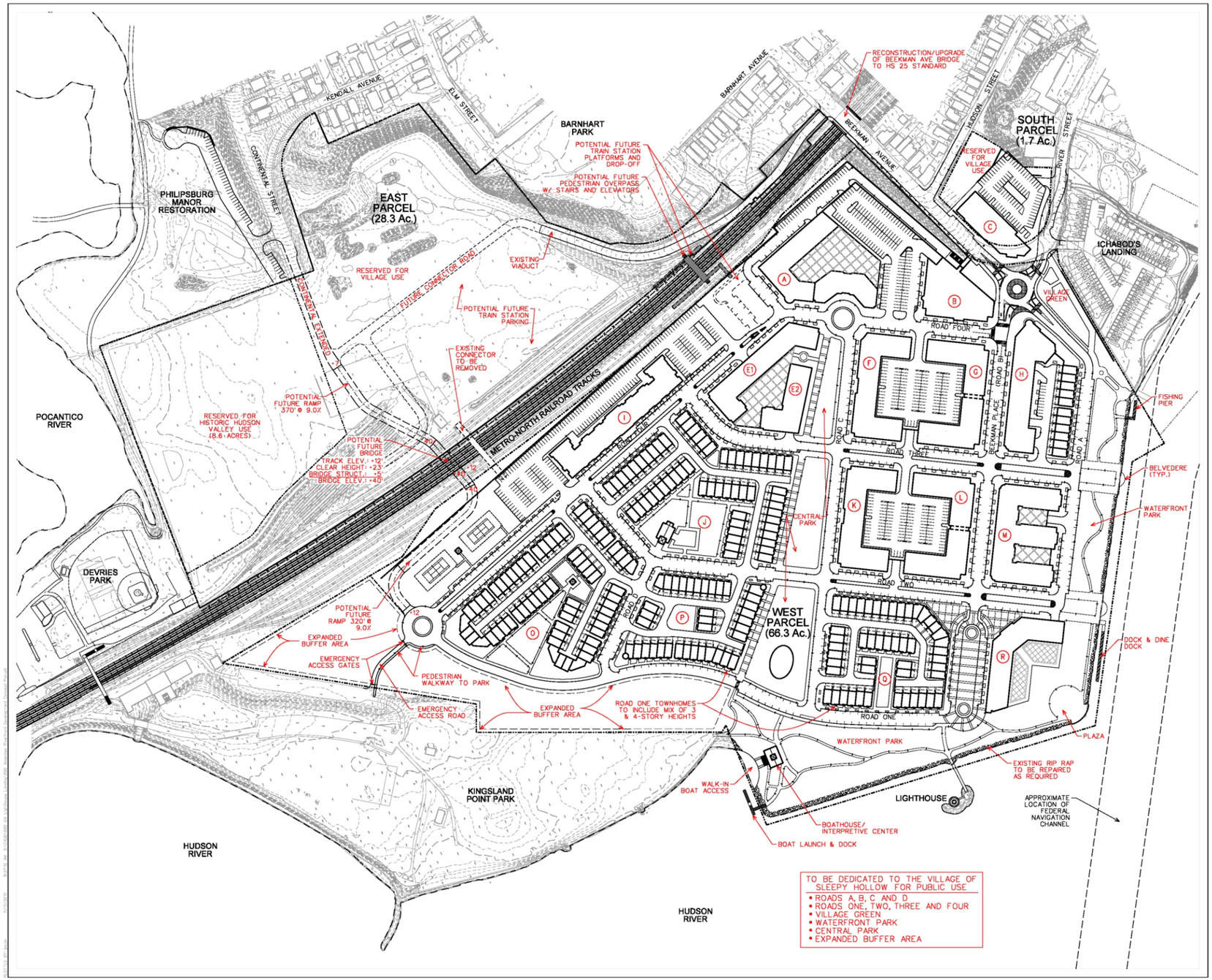
FORMER GENERAL MOTORS ASSEMBLY PLANT SITE
SLEEPY HOLLOW, NEW YORK

REMEDIAL WORK PLAN

AERIAL VIEW

ARCADIS

FIGURE
2



LIGHTHOUSE LANDING AT SLEEPY HOLLOW
Sleepy Hollow, New York

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REVISIONS
NO. DATE ISSUE

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AMENDED RIVERFRONT DEVELOPMENT CONCEPT PLAN

DRAWN BY: JEB | CHECKED BY: AVT
PROJECT NO.: 690 | DATE:
DRAWING NO.: ARDC-1

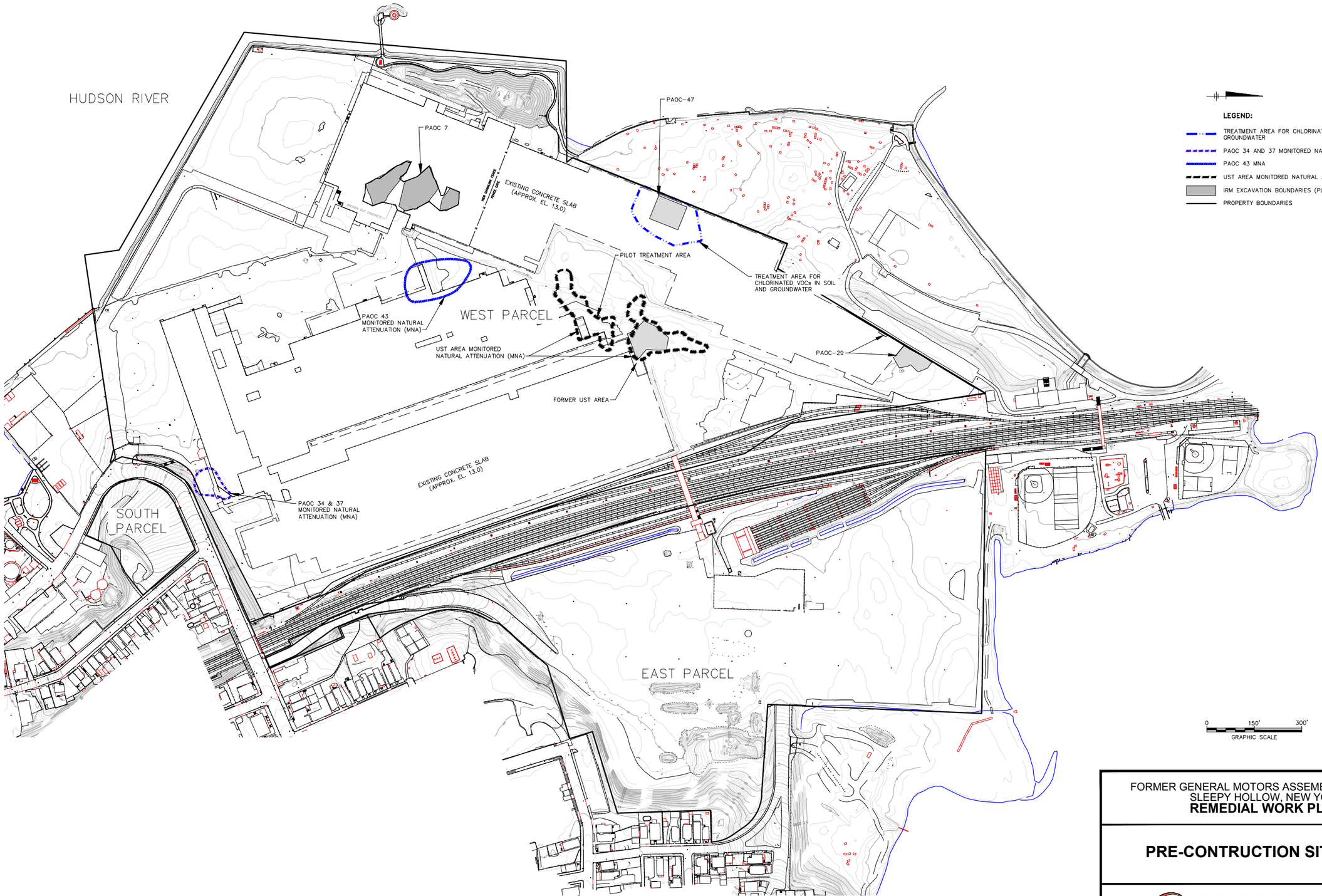
FORMER GENERAL MOTORS ASSEMBLY PLANT SITE
SLEEPY HOLLOW, NEW YORK
REMEDIAL WORK PLAN

AMENDED RIVERFRONT DEVELOPMENT CONCEPT PLAN

ARCADIS

FIGURE
3

12/19/2011 SYRACUSE, NY-ENV/CAD-DJHOWES
B006446200011/00058/CDR/64462G02.CDR



FORMER GENERAL MOTORS ASSEMBLY PLANT SITE
SLEEPY HOLLOW, NEW YORK
REMEDIAL WORK PLAN

PRE-CONTRUCTION SITE PLAN

ARCADIS

FIGURE
4

CITY:SYR DIV/GROUP:85 DB:AMS K. SINSABAUGH R. BASSETT LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACTIVE\064462\0001\000580\DWG\64462B04.DWG LAYOUT: 4 SAVED: 6/21/2012 2:42 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 6/21/2012 2:43 PM BY: DECLERCQ, BRIAN
XREFS:
64462X08
64462X09
IMAGES:
PROJECTNAME: ----

CITY: SYR DIV/GROUP: IM DB: K. SINSABAUGH J.RAPP LD: PIC: PM: TM: TR:
GM - Tarrytown (B0064462.0001.00058)
O:\GeneralMotors\Tarrytown\RemedialWP\mxd\SampleLocations_NearSite.mxd - 2/8/2012 @ 12:59:38 PM

LEGEND:

- OUTFALL LOCATION
- SEDIMENT SAMPLE LOCATION
- 28 RIVER MILE MARKER
- 2006 SHALLOW SEDIMENT SAMPLE LOCATION
- 2006 BENTHIC BIOTA SAMPLE LOCATION
- 2006 BIOTISSUE SAMPLE LOCATION
- 2006 SEDIMENT CORE LOCATION
- HARBOR CHANNEL
- NAVIGATION CHANNEL
- BACKGROUND/UPSTREAM BOUNDARY
- NEAR SITE BOUNDARY
- T15D 1997 EXPONENT SAMPLE LOCATION
- 1082 2000-2001 VERSAR SAMPLE LOCATION
- SED-41 2004 AMEC SAMPLE LOCATION

T13E T13D T13C T13B T13A SED111 T12E T12D SED112 T12C T12B T12A SED113 T10G T10F T11G T11F T11E T11D T11C SED114 T09G SED115 SED-39 SED-38 SED-37 T10E T10B T10A T09F SED-36 OF-3 SED116 T10C T09E SED-35 T10D SED-34 SED120 T09B T09D SED-32 T09A SED-33 T09C SED-31 SED-29 T08C T08B T08G SED-27 T08E T08A T08F SED-28 T08D SED117 SED-30 SITE SED119 SED-26 SED118 OF-2 SED-25 SED-24 SED-22 SED121 SED122 SED-23 SED123 SED-21 SED-19 SED124 T07C T07B SED-10 SED127 SED126 SED-20 SED-18 SED-15 OF-1 SED125 T07D T07A T07E SED-9 T07F SED-17 SED-14 SED129 SED128 SED-16 SED-13 SED-8 T07H T07G SED130 SED-4 T06F T06A T06I T06H SED-12 SED-7 SED131 T06D SED-3 T06E T06B T06G SED-11 SED-6 T06C SED132 SED-2 SED-5 SED-1 SED134 SED133 SED136 T05I T05H T05G T05F T05E T05C SED135 T05D T05A T05B T04H T04G T04F T04E T04C T04D SED138 T03E T03D T03C T03B T03A SED139 T02A T02B T02E T02D T02C

SED140 SED143 SED126 SED146 A SED141 OF-1 SED147 B SED144 SED149 SED142 SED152 SED145 SED150 SED154 A' SED151 SED153 B' SED155

0 60 120 Feet
GRAPHIC SCALE

NOTES:

1. DIGITAL ORTHO QUARTER QUADS PROVIDED BY THE NEW YORK STATE GIS CLEARINGHOUSE.
2. HARBOR CHANNEL PROVIDED BY USACE. SURVEY COMPLETED APRIL 8 AND 12, 2004. FILE NO. 24.
3. NAVIGATION CHANNEL DIGITIZED FROM NOAA NAUTICAL CHART 12343 18th ED., JUNE 2002.

0 600 1,200 Feet
GRAPHIC SCALE

FORMER GENERAL MOTORS ASSEMBLY PLANT SITE
SLEEPY HOLLOW, NEW YORK
REMEDIAL WORK PLAN

NEAR-SITE SEDIMENT INVESTIGATION SAMPLE LOCATIONS

ARCADIS

FIGURE
5

CITY: SYR DIV/GROUP: IM DB: K. SINSABAGH J.Rapp LD: PIC: PM: TM: TR:
GM - Tarrytown (B0064462.0001.00058)
O:\GeneralMotors\Tarrytown\RemedialWP\mxd\SampleLocations_Background.mxd - 6/21/2012 @ 2:36:41 PM

LEGEND:

- SEDIMENT SAMPLE LOCATION
- 28 RIVER MILE MARKER
- 2006 GEOTECHNICAL CORE
- 2006 SHALLOW SEDIMENT SAMPLE LOCATION
- 2006 BENTHIC BIOTA SAMPLE LOCATION
- 2006 BIOTISSUE SAMPLE LOCATION
- 2006 SEDIMENT CORE LOCATION
- NAVIGATION CHANNEL
- BACKGROUND/UPSTREAM BOUNDARY
- NEAR SITE BOUNDARY
- T15D 1997 EXPONENT SAMPLE LOCATION
- 1082 2000-2001 VERSAR SAMPLE LOCATION
- SED-41 2004 AMEC SAMPLE LOCATION

35, 34, 33, 32, 31, 30, 29

604, 74, 608, SED100, 510, SED101, 504, 551, SED102, 506, 508, T17C, 606, SED-45, SED-44, T17D, 1080, SED103, SED-43, T17B, T17A, 1079, 452, T16B, T16C, SED-42, T16A, 407, 402, 408, SED104, 1078, 1081, SED-41, 1075, T15B, SED106, SED-40, 1077, T15D, 403, 1076, T15C, T15A, SED105, 252, 255, 1082, 302, 1085, 259, 353, SED107, 1084, SED108, 306, 209, T14B, 1083, 208, T14D, SED109, T14E, T14C, T14A, SED110, 202, 1086, 310, 207, 307, 1087

NOTES:

1. DIGITAL ORTHO QUARTER QUADS PROVIDED BY THE NEW YORK STATE GIS CLEARINGHOUSE.
2. NAVIGATION CHANNEL DIGITIZED FROM NOAA NAUTICAL CHART 12343 18th ED., JUNE 2002.

0 2,500 5,000 Feet

GRAPHIC SCALE

FORMER GENERAL MOTORS ASSEMBLY PLANT SITE
SLEEPY HOLLOW, NEW YORK

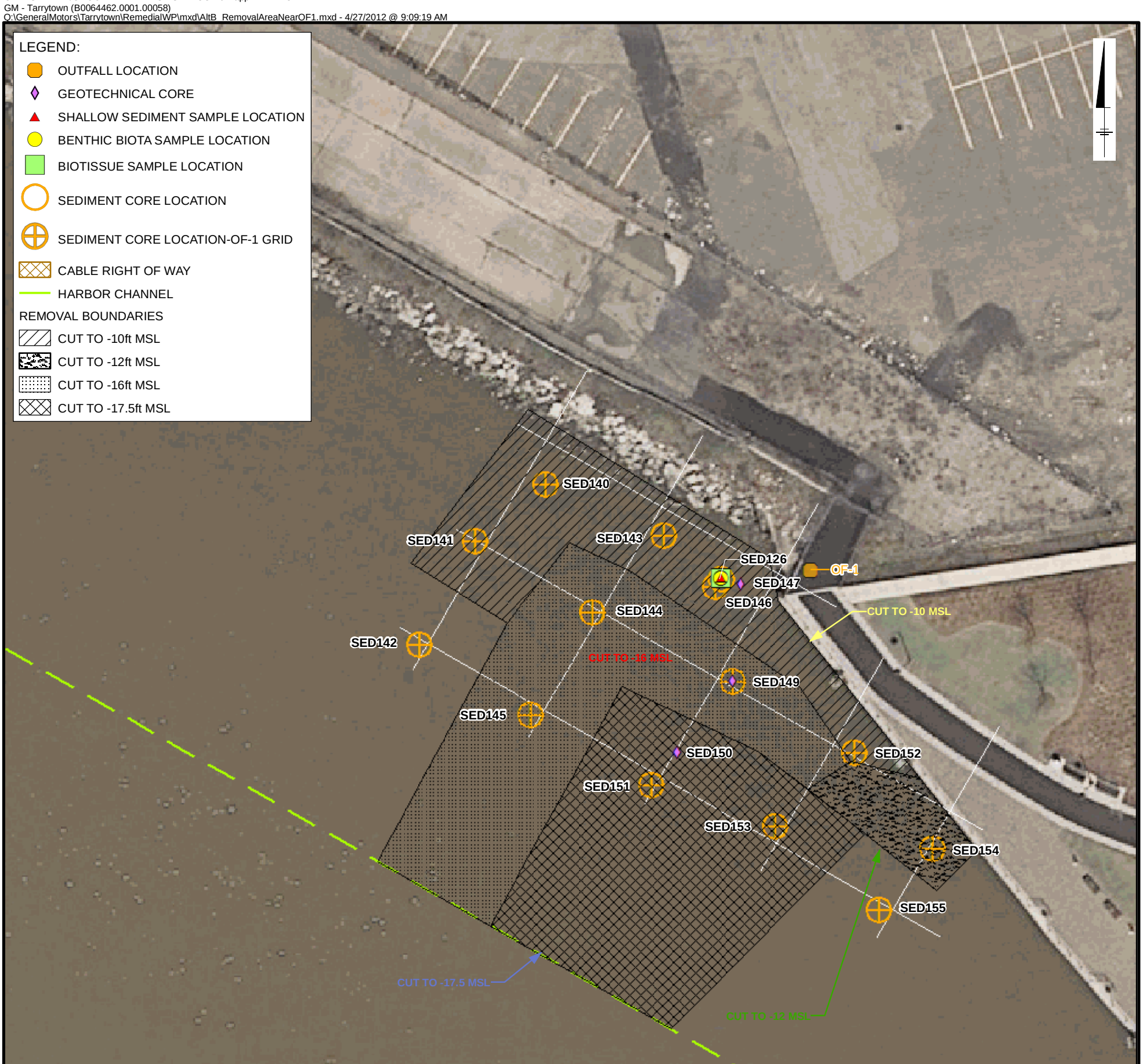
REMEDIAL WORK PLAN

BACKGROUND SEDIMENT INVESTIGATION SAMPLE LOCATIONS

ARCADIS

FIGURE
6

CITY: SYR DIV/GROUP: IM DB: K. SINSABAUGH J.Rapp LD: PIC: PM: TM: TR:
GM - Tarrytown (B0064462.0001.00058)
O:\GeneralMotors\Tarrytown\RemedialWP\mxd\AltB_RemovalAreaNearOF1.mxd - 4/27/2012 @ 9:09:19 AM



NOTES:

1. DIGITAL ORTHO QUARTER QUADS PROVIDED BY THE NEW YORK STATE GIS CLEARINGHOUSE.
2. HARBOR CHANNEL PROVIDED BY USACE. SURVEY COMPLETED APRIL 8 AND 12, 2004. FILE NO. 24.

0 30 60 Feet
GRAPHIC SCALE

FORMER GENERAL MOTORS ASSEMBLY PLANT SITE
SLEEPY HOLLOW, NEW YORK

REMEDIAL WORK PLAN

ALTERNATIVE B:
SEDIMENT REMOVAL IN SIGNIFICANTLY ELEVATED METALS AREA NEAR OUTFALL OF-1

ARCADIS

FIGURE
7