ANALYSIS OF BROWNFIELD CLEANUP ALTERNATIVES

River Point District; Manitowoc, Wisconsin

200 North 10th St (Site 1)

BRRTS ID: 02-36-00408 (Closed)
07-36-583000 (LGU Exemption/General Property)
02-36-585491 (Open ERP)
ACRES ID: 239715

1110 Buffalo Street (Site 3)

WDNR BRRTS ID: 03-36-001962 (Closed)
07-36-583000 (LGU)
02-36-585491 (Open ERP)
ACRES ID: 239716

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Professional Engineer

Richard J. Binder, PG
Project QA/QC Manager

Stantec

May 4, 2021
Project Number 193706269

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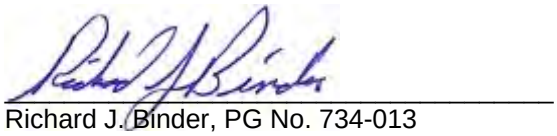
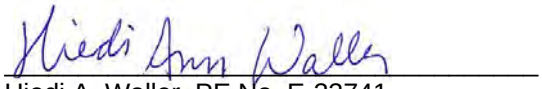
ANALYSIS OF BROWNFIELD CLEANUP ALTERNATIVES
1110 BUFFALO STREET AND 200 NORTH 10th STREET
MANITOWOC, WISCONSIN

"I, Richard J. Binder, hereby certify that I am a hydrogeologist as that term is defined in s. NR 712.03 (1), Wis. Adm. Code, am registered in accordance with the requirements of ch. GHSS 2, Wis. Adm. Code, or licensed in accordance with the requirements of ch. GHSS 3, Wis. Adm. Code, and that, to the best of my knowledge, all of the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wisconsin Administrative Code (WAC)."



Richard J. Binder, PG No. 734-013 — May 4, 2021 Date

"I, Hiedi A. Waller, hereby certify that I am a registered professional engineer in the State of Wisconsin, registered in accordance with the requirements of ch. A-E8, WAC; that this document has been prepared in accordance with the Rules of Professional Conduct in cg. A-E8, WAC; and that to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR700 to 726, WAC."



Hiedi A. Waller, PE No. E-33741 — April 30, 2021 Date

GENERAL INFORMATION
PHASE II ENVIRONMENTAL SITE ASSESSMENT

FACILITY:	River Point District Manitowoc, Wisconsin
PARCEL ID:	173020,173030,173060, 173170, 173022, 173040, 173070, 173023, 173150, 173110 (Site 3) 173000, 173003, 173100, 173160 and 173170 (Site 1)
SIZE:	5.1 Acres (Site 3) 6.1 Acres (Site 1)
USEPA ACRES ID:	239716 (Site 3) 239715 (Site 1)
WDNR BRRTS NO.:	03-36-001962 (Closed), 02-36-00408 (Closed), 07-36-583000 (LGU), 02-36-585491 (Open ERP)
SITE LOCATION:	N 1/2 of the NE 1/4 of Section 30, Township 19 North, Range 24 East, Manitowoc County, Wisconsin
PROPERTY OWNER:	Community Development Authority of the City of Manitowoc City of Manitowoc 900 Quay Street Manitowoc, WI 54220-4543
Contact:	Mr. Adam Tegen Community Development Director City of Manitowoc, Wisconsin 900 Quay Street Manitowoc, WI 54220-4543 Phone: (920)686-6931 Email: ategen@manitowoc.org
CONSULTANT:	Stantec Consulting Services Inc. 12075 Corporate Parkway, Suite 200 Mequon, Wisconsin 53089
Contact:	Harris Byers, Ph.D. Sr. Brownfields Project Manager Phone: 414-581-6476 Email: harris.byers@stantec.com
WDNR Oversight:	Wisconsin Department of Natural Resources 2984 Shawano Avenue, Green Bay, Wisconsin 54313
Contact:	Mr. Tauren Beggs Hydrogeologist Phone: (920) 662-5178 Email: Tauren.Beggs@wisconsin.gov

1.0 EXECUTIVE SUMMARY

Stantec Consulting Services Inc. (Stantec) has completed this Analysis of Brownfields Cleanup Alternatives (ABCA) for the former bulk petroleum storage parcels located at 1110 Buffalo Street (Site 3) and 200 North 10th Street (Site 1) in Manitowoc, Wisconsin utilizing the framework provided in ch. NR 722 Wisconsin Administrative Code (WAC) (NR 722) for a Remedial Action Options Report (RAOR). This ABCA was completed using funds from a brownfields revolving loan fund (RLF) grant provided to the City of Manitowoc (City) by the U.S. Environmental Protection Agency (USEPA) pursuant to the petroleum cleanup eligibility determination (Stantec, 2020b) approved by the Wisconsin Department of Natural Resources (WDNR) on June 3, 2020. The USEPA Assessment, Cleanup and Redevelopment Exchange System (ACRES) numbers are 239716 (Site 3) and 239715 (Site 1).

As noted in the Stantec (2020a, 2020c, 2020d, 2020e, 2020f, and 2021) investigations completed to date, residual soil and groundwater impacts associated with prior commercial/industrial use and placement of historic fill are present and will complicate redevelopment, as summarized below.

> Soil. As summarized in work completed to date, petroleum volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs)/polycyclic aromatic hydrocarbons (PAH), and heavy metals were detected in soil at concentrations greater than applicable ch. NR 720 WAC (NR 720) Residual Contaminant Levels (RCLs) and/or Background Threshold Values (BTVs) at Site 3 and Site 1. Assessment work has further identified and delineated multiple fill units, including a sitewide metals-rich heterogeneous granular black anthropogenic fill unit of varying quality.
>
> Groundwater. The potentiometric surface of shallow groundwater grades downward in a radial manner towards the Manitowoc River, which serves as a constant head boundary for groundwater. Select petroleum VOCs, PAHs, and/or dissolved heavy metals were detected in groundwater at Site 3 and Site 1 at concentrations greater than applicable ch. NR 140 WAC (NR 140) Preventive Action Limits (PALs) and/or Enforcement Standards (ESs).
>
> Vapor. Site 3 and Site 1 are currently vacant. Therefore, the vapor intrusion pathway cannot be quantitatively evaluated at this point. However, concentrations of petroleum VOCs in groundwater are greater than the ES and/or PAL at several groundwater monitoring locations. Depending on final reuse plans and building alignments, residual petroleum impacts could pose a threat to indoor air quality due to vapor intrusion.

Based on impacts identified to date, remedial action activities are warranted to facilitate redevelopment at the Site. Based on the evaluation described herein, the selected remedial approach to be funded under the RLF loan includes:

- Limited excavation and offsite disposal of soil with residual petroleum impacts;
- Constructing a soil engineered barrier to minimize sitewide direct contact with impacted soil/fill and reduce potential for leaching of residual impacts to groundwater; and
- Establishing institutional controls/continuing obligations and maintenance plans to provide for long-term control of residual soil and groundwater impacts.

Additional remedial activities not being funded under the RLF loan and not evaluated in detail in this ABCA could include:

- Post-construction groundwater monitoring;
- Installing clay plugs at the property boundary in new utility trenches;
- Installing BCTs in newly constructed buildings;
- Post-construction sub-slab vapor sampling; and/or
- Establishing institutional controls/continuing obligations and maintenance plans to provide for long-term operation of BCTs.

2.0 BACKGROUND INFORMATION

Stantec has completed this ABCA for the former bulk petroleum storage parcels located at 1110 Buffalo Street and 200 North 10th Street in Manitowoc, Wisconsin utilizing the framework provided in NR 722 for a RAOR. This ABCA was completed using funds from a brownfields RLF grant funding provided to the City by the USEPA pursuant to the petroleum cleanup eligibility determination (Stantec, 2020b) approved by the WDNR on June 3, 2020. The USEPA ACRES numbers are 239716 (Site 3) and 239715 (Site 1).

2.1 HISTORIC PROPERTY USE/OCCUPANCY

Past Ownership and Site Uses – River Point District Area

As described in the Stantec (2019) Phase I ESA, the River Point District consists of a 20.1-acre peninsula bound to the north, south, and west by the Manitowoc River and bound to the east by North 10th Street and North 11th Street (Figure 1). The River Point District appears undeveloped in 1835; however, the proximity of the peninsula to the Lake Michigan/Great Lakes shipping route facilitated initial large scale industrial transloading development of the River Point District by 1868. Transloading operations on the peninsula in the late 19th Century included largescale coal, lumber/mills, grain, and large warehouses. Although ownership records are not available, a panoramic map drawn in 1883 indicates the River Point District was fully developed and occupied by several large industrial-like buildings and smaller commercial-like buildings.

Assessor records suggest the River Point District was later transferred to the Soo Line Railroad Company and ultimately transferred to Wisconsin Central, Ltd. (WCL) sometime during the latter half of the 20th Century. Railroad use of the River Point District ceased in the 1980s and the River Point District was formally decommissioned by the railroad in the 2000s. The River Point District consists of 23 individual contiguous parcel identification numbers currently zoned Industrial I-2 (Figure 2). As summarized in the Stantec (2019) Phase I ESA, the current parcel identification numbers (PIN) appear to correspond to leases between the previous owner and a variety of historic commercial/industrial tenants/occupants (Figure 3).

Past Tenants and Property Uses –1110 Buffalo Street (Site 3)

Site 3 consists 5.1 acres of land within the larger 20.1-acre River Point District (Figures 1-9). The property consists of 10 individual contiguous parcels of land (Figure 3) with the following PINs:

173020	173030	173060	173170
173022	173040	173070	
173023	173150	173110	

As noted previously, it is critical to realize that the individual PINs corresponded to leases between the previous owner and a variety of bulk petroleum storage companies. Records suggest large portions of Site 3 were leased to a variety of bulk fuel storage companies operating under a variety of names during the early/mid-20th Century, including: Stephani-Strupp Oil Co, William H. Froehlich, Shell Oil, Lake Park Oil, Spindler Co., and the Standard Oil Company (Figure 4). Consolidation of bulk petroleum storage operations began at Site 3 in 1969 by the "Wingfield Oil Company" with continued consolidation through 1975. The Wingfield Oil Company was renamed "Holmes Oil Corporation" on August 4, 1976. The Holmes Oil Corporation appears to have vacated Site 3 concurrent with reported removal of the final petroleum storage tanks by 1997.

Historic Sanborn® fire insurance maps indicate use for bulk petroleum storage began between 1912 and 1919 when the Standard Oil Company installed four steel tanks, a 20,000-gallon iron oil tank, and a partially inground 20,000-gallon iron oil tank along a railroad spur. Standard Oil Co. expanded operations at Site 3 through 1927 at which point the operation consisted of seven oil tanks and three oil houses. The Stephani-Strupp Oil Co. began operations at Site 3 by 1927 and the facility consisted of two oil tanks near North 11th Street, an oil house, and a pump house. Bulk petroleum storage in the central portion of the property expanded significantly in the 1940s-1960s, with continued expansion of the Standard Oil Co facility (twelve oil tanks, two pump houses, one oil house), construction of the Shell Oil Co. Inc. facility (five tanks, one oil house, one pump house), and construction of the Sinclair Refining Co. facility (nine oil tanks, two oil houses, one pump house). As noted above, bulk petroleum storage was consolidated by the Wingfield Oil Company (later renamed Holmes Oil Company) who continued to operate through the late 1990s. The Holmes Oil Corporation appears to have vacated Site 3 concurrent with removal of the final storage tanks by 1997.

Records indicate most of the petroleum stored/handled at Site 3 was fuel oil. However, state records indicate a significant quantity of leaded and unleaded gasoline, diesel fuel, kerosene, and used/waste motor oil may have been stored in bulk at the Site. It would be impractical to document specific fueling/storage operations dating across roughly 80 years of bulk petroleum storage at Site 3. The locations of known historic features associated with bulk fuel storage by tenants are illustrated on Figure 4 and Figure 5 and include 34 above-ground storage tanks (ASTs), 12 underground storage tanks (USTs), seven pump houses, four oil houses, and associated pipe runs.

Site Investigation activities were completed by WCL between 1996 and 1998. Through the competitive bidding process operated by Wisconsin Department of Commerce (WDCOMM), Northern Environmental Technologies Inc. (later acquired by Stantec) oversaw the excavation of 510 tons of petroleum-impacted soil from three locations at the property (see extents illustrated on Figure 4) and completed post-remediation soil and groundwater sampling. Of note, approximately one-inch of free product accumulated in monitoring well MW-2 following soil removal. The free product was removed from the well with a bailer and reportedly did not reform during two subsequent groundwater monitoring events. WDCOMM issued a closure letter on October 17, 2005 and listed the property on the WDNR Geographic Information System Registry of Closed Remediation Sites (GIS Registry) of closed remediation sites as an institutional control to manage residual petroleum impacts to soil and groundwater. At the time of closure, residual petroleum constituents remained in soil at the property following soil excavation at concentrations greater than applicable NR 720 RCLs.

Past Tenants and Property Uses – 200 North 10th Street (Site 1)

Site 1 consists of 6.1 acres of land within the larger 20.1-acre Riverpoint District (Figures 1-6). The property consists of five individual contiguous parcels of land (Figure 3) with the following PINs: 173000, 173003, 173100, 173160, and 173170.

Records indicate Zeman and Karinik operated a large lumber yard at Site 1 by 1883, which was expanded by Carl Zander by 1887. Key features of the lumber yard, planning mill, and sash/door/blind factory operated by Carl Zander in the late 19th Century are illustrated on Figure 4. As adapted from historic Sanborn® Fire Insurance Maps drawn in the late 19th Century, the western portion of the property was once part of the Manitowoc River (Figure 4). Placement of fill in the late 19th Century on the property and nearby areas pushed the bank of the Manitowoc River west/south to its current location prior to acquisition of the River Point District (and presumably the property) by the Western Railroad Company on July 22, 1895.

As noted previously, it is critical to realize that the individual PINs corresponded to leases between the previous owner and a variety of former industrial/bulk petroleum storage/commercial tenants. Historic site features associated with previous tenants/owners are illustrated on Figure 4. The Stantec (2019) Phase I ESA notes the northern portion of Site 1 was developed for bulk petroleum storage/distribution by the “Clarke Oil Company” (presumably a tenant) between 1912 and 1919. Bulk petroleum storage operations expanded between 1919 and 1927, at which point the operation consisted of eight oil tanks and a pump house (Figure 5 in Attachment F). Bulk petroleum storage ceased between 1927 and 1946. The owner, Soo Line Minneapolis St. Paul and Sault St. Marie Railroad Company, leased the parcel to “JF Kerscher Co.” on May 22, 1950, who constructed a large warehouse at the Site and utilized the Site for a variety of storage/commercial uses (the remaining slab is visible on Figure 5). Unfortunately, the date of property transfer between the Soo Line Minneapolis St. Paul and Sault St. Marie Railroad Company and WCL remains unknown; however, property records suggest transfer took place between 1979 and 1986. The southern portion of Site 1 was developed for railroad use by 1895 and remained in railroad use through most of the 20th Century. The southern portion of the site appeared to have been regraded after removal of railroad features (ex. rail lines) and used for transloading stone by a tenant from the late 1990s through the first decade of the 21st Century.

A Phase II ESA completed by SEC Donohue in 1992 identified heavy metal and petroleum impacts at Site 1 using the total recoverable petroleum hydrocarbons method (USEPA Method 9073). Based on evaluation criteria used at the time, WDNR closed this spill case (Bureau for Remediation and Redevelopment Tracking System [BRRTS] Case Number 02-36-00408) on April 6, 1993.

Current Ownership of the River Point District and Site Use

A Phase I ESA was completed by Stantec (2019) per the All Appropriate Inquiries rule detailed in 40 CFR §312.21 utilizing ASTM E1527-13 on behalf of the current owner (Community Development Authority of the City of Manitowoc [CDA]) on March 21, 2019. The current owner acquired the property on April 12, 2019 for the purpose of blight elimination and subsequently received a Local Governmental Unit (LGU) Environmental

Liability Exemption from WDNR per ch. 292.11(9) of the WAC on March 18, 2019 under WDNR BRRTS Case Number 07-36-583000. Site 1 and Site 3 remain vacant.

Since taking ownership, the CDA has maintained compliance with the required continuing obligations and no records have been identified indicating the CDA is considered potentially liable or known to be affiliated with any other person that is potentially liable for contamination at the Site.

2.2 ENVIRONENTAL SITE INVESTIGATIONS

Stantec (2019) Phase I ESA. As summarized in the Stantec (2019) Phase I ESA, Stantec identified the following recognized environmental conditions (RECs) associated with the River Point District:

- REC 1: Prior Railroad Use
- REC 2: Prior Industrial Use
- REC 3: Residual Impacts to Soil and Groundwater
- REC 4: Apparent Anthropogenic Fill
- REC 5: Storage/Dumping by Adjacent Property Owners
- REC 6: Residual Impacts to Soil and Groundwater from Nearby Properties

In addition to railroad use during the 20th Century, prior leases correspond to a multitude of prior industrial occupants/uses include bulk coal transloading/storage, petroleum storage, ship building, grain storage/elevator, metal/scrap/junk yard, and transloading of stone (Figure 4). Historic features of specific environmental interest summarized by Stantec are illustrated on Figure 4.

Phase II ESAs and Construction Documentation Reports. Stantec completed multiple Phase II ESAs at Site 1 and Site 3 using funds from a hazardous substance and a petroleum brownfield assessment grant awarded to the City by the USEPA in 2018 under Cooperative Agreement Number BF 00E02377-0 and using funds from two Site Assessment Grants awarded to the City and CDA by the Wisconsin Economic Development Corporation in 2020. Soil and groundwater sample locations are illustrated on Figure 5. Results from the Stantec (2020a, 2020b, 2020c, 2020d, 2020e, 2020f, and 2021) investigations are summarized below.

Soil. Petroleum VOCs, SVOCs, PAHs, and heavy metals were detected in soil at Site 3 and Site 1 at concentrations greater than applicable NR 720 RCLs and/or BTVs. VOC and PAH impacts to soil appear attributable to historic releases in the former bulk petroleum storage areas at Site 3 and Site 1. Work has identified and delineated a sitewide historic fill unit consisting of black granular fill materials. The granular fill across River Point is rich in heavy metals and PAHs and is present in thicknesses of up to eight feet (Figure 6). Calculated volume estimates of this material for River Point, Site 3, and Site 1 are summarized below:

Project Area	Quantity of Granular Fill (cubic yards)
Site 3	25,700
Site 1	35,500
River Point	107,700

As illustrated on Figure 8, the River Point District is targeted for non-industrial redevelopment. Due to the large quantity of historic fill materials present at Site 3 and Site 1, historic fill will be managed in place and sitewide engineered barriers/caps will be constructed to prevent direct contact with residual soil impacts. The engineered barriers will be maintained with a continuing obligation/institutional control. Given the age and relative concentration of soil impacts, “hot spot” source control for soil is not required. However, select petroleum-rich soils may require offsite disposal if encountered during redevelopment as these materials cannot be reused onsite.

Groundwater. The potentiometric surface of shallow groundwater grades downward in a radial manner towards the Manitowoc River, which serves as a constant head boundary for groundwater (Figure 7). Select petroleum VOCs, PAHs, and/or dissolved heavy metals were detected in groundwater at concentrations greater than applicable NR 140 PALs and/or ESs. Petroleum VOC and PAH impacts to groundwater appear attributable to historic releases in the former bulk petroleum storage areas at Site 3 and Site 1. Of particular focus, residual petroleum impacts to groundwater at Site 1 are located in areas targeted for redevelopment as new rights of way and redevelopment as a multi-family apartment complex (Figure 9). Heavy metal impacts to groundwater appear to originate from natural sources. Additionally, per- and polyfluorinated alkyl substances were detected

at concentrations greater than proposed NR 140 PAL/ES groundwater quality standards. The source of per- and polyfluorinated alkyl substance impacts to groundwater appears to originate from offsite. Given the age and relative concentration of groundwater impacts, "hot spot" source control for groundwater is not required. Instead, residual groundwater impacts will be managed with a continuing obligation / institutional control.

Vapor Intrusion. Site 3 and Site 1 are currently vacant. Therefore, the vapor intrusion pathway cannot be quantitatively evaluated at this point. Although vapor intrusion is not a focus of this ABCA, groundwater with residual petroleum impacts may extend beneath the proposed apartment building on Site 1, as illustrated on Figure 9. As such, a building control technology (BCT) will be constructed beneath the apartment building and maintained with a continuing obligation / institutional control. Post-construction sub-slab vapor sampling will be conducted at the apartment building to determine if the BCT needs to be made active by adding a fan and the BCT system maintained through a continuing obligation. BCTs may also be warranted if buildings are constructed on Site 3 or elsewhere on Site 1.

3.0 REMEDIAL ACTION OPTIONS EVALUATION

3.1 PROPOSED SITE REDEVELOPMENT

As previously stated, Site 1 and Site 3 are part of the larger 20.1-acre River Point District Redevelopment Project. Conceptual redevelopment plans relative to the larger River Point District are illustrated on Figure 8. Specific redevelopment plans for Site 1 are illustrated on Figure 9.

Future public infrastructure investments at the River Point District will include streets, trails, utilities, lighting, and streetscape of over $10M. It is estimated that the installation of the public improvements will lead to a mix of private investments ranging from residential condos and apartments to commercial and mixed-use buildings with a value of up to $150M. With over 3,500 feet of river frontage, the project also nearly doubles public pedestrian access to the Manitowoc River through trails and key nodes intended to serve as overlooks, trailheads and river access points to enhance connection to the river and the natural environment. The overall site redevelopment also offers the unique distinction of being located immediately adjacent to the existing downtown core furthering the potential economic impact of the project. City support for the project includes acquisition of the property in 2019, infrastructure design and construction that are currently underway, brownfield assessment and cleanup, establishment of a new Tax Incremental Financing District and site preparation. The site of the trail network and redevelopment is located on what was once one of the key economic drivers within the community that has fallen into blight and remained largely vacant since the 1980's.

The redevelopment of the former industrial peninsula has been part of the vision for the City for well over 20 years. More recently, the site was shown for redevelopment from Industrial to Planned Mixed Use in the 2009 Comprehensive Plan. Also in 2009, the City adopted the Port of Manitowoc, Downtown & River Corridor Master Plan. Within that plan, the property was shown as a redevelopment site. A third plan related to the path extension was adopted in 2009, Manitowoc Riverwalk Master Plan and Design Guidelines. The importance of the peninsula portion of the riverwalk was covered extensively in the document as was the overall site. Most recently, in 2019, the City adopted a Downtown Master Plan with the peninsula redevelopment identified as one of four catalyst sites for redevelopment. The City Council approved moving forward with design and construction documents for the necessary infrastructure to redevelop the peninsula in 2019.

3.2 REMEDIAL ACTION OPTIONS EVALUATION

Based on impacts identified to date, remedial action activities are warranted to facilitate redevelopment at the Site. An evaluation of three remedial options to be funded under the RLF loan was conducted utilizing criteria presented in ch. NR 722.07(4) WAC and ch. NR 722.09(2m) WAC to address legacy environmental impacts to facilitate redevelopment for non-industrial purposes. Additional remedial activities not being funded under the RLF loan (and therefore not evaluated in detail in this ABCA) are summarized in Section 4.8. As summarized on Table 1, the remedial options evaluated under this ABCA for possible funding under an RLF loan included the following:

1. Natural Attenuation (no action)
2. Excavate all impacted soils and haul offsite for disposal; backfill with clean fill materials to final grade; and establish an institutional control to manage residual groundwater impacts.
3. Limited excavation and offsite disposal of soil with residual petroleum impacts; constructing a soil engineered barrier to minimize sitewide direct contact with impacted soil/fill and reduce potential for leaching of residual impacts to groundwater; and establishing institutional controls/continuing obligations and maintenance plans to provide for long-term control of residual soil and groundwater impacts.

As required in the purchase agreement, the Site 3 will need to be enrolled in the Voluntary Party Liability Exemption (VPLE) program and appropriate groundwater insurance purchased through the program. Site 1 will not be enrolled in the VPLE program. In general, each remedial option is considered technically feasible; however, the short-term and long-term effectiveness of each remedial option's capability to be protective of public health, safety, or welfare or the environment and the cost associated with each approach varies greatly.

Alternative 1. Although the cost to implement remedial Alternative 1 is the least of the three options, constituents associated with residual impacts are considered recalcitrant to natural attenuation. The overall magnitude, mobility, and toxicity of impacts would not decrease, and Site restoration will not occur within a reasonable

timeframe. Following redevelopment, impacts would be near sensitive receptors. Therefore, Remedial Alternative 1 is not considered a prudent approach.

Alternative 2. Excavation and offsite disposal of impacted soils proposed in Alternative 2 will be effective in long-term elimination of the mobility, toxicity, and magnitude of residual soil impacts. However, the cost for Alternative 2 is excessive (estimated $4.3MM). Further, Alternative 2 will require hauling a considerable volume of soil for disposal in a landfill and require an extraordinary volume of clean fill to be imported to the Site just to bring the Site back to current grade. Therefore, Alternative 2 is not considered a sustainable option.

Alternative 3. Under Remedial Alternative 3, petroleum-impacted soil encountered during future development will be excavated and disposed of at a licensed solid waste landfill. Following, clean fill will be placed to raise the grade of the Site, which will result in creating an engineered barrier suitable to prevent direct contact with residual soil impacts. Clean fill is being generated during ongoing infrastructure upgrades in the City, which if approved for placement on the property by the WDNR, could result in a considerable cost savings. Completion of the engineered barriers/caps is likely to include Site amenities (e.g., buildings, parking lots, concrete structures, landscaping, driving/parking surfaces), as illustrated on Figure 9.

Remedial Alternative 3 will cost-effectively provide for long-term reduction in the mobility, toxicity, and magnitude of impacts. Institutional controls will provide for long-term maintenance of the engineered barrier and will prevent groundwater consumption. Remedial Alternative 3 is considered the most reasonable and cost-effective approach to facilitate proposed redevelopment. Remedial Alternative 3 is the selected remedial alternative based on its short-term and long-term effectiveness, ability to be implemented within the proposed development, restoration time frame, economic feasibility, and sustainability.

4.0 SELECTED REMEDIAL ACTION OPTION

4.1 SELECTED REMEDIAL ACTION OPTION TO BE FUNDED UNDER AN RLF LOAN

The selected remedial action option to be funded under an RLF Loan includes up to seven elements described below:

Enroll Site 3 in the VPLE Program and Purchase Insurance. As a requirement of acquisition, the property must be enrolled in the VPLE program to facilitate non-industrial reuse of the property. Per program guidelines, groundwater insurance must be purchased through the program.

Develop and Implement a Soil Characterization Workplan for Site 3. A workplan to characterize soil prior to placement on the property will need to be completed and approved by the VPLE committee. Fill soils targeted for use in constructing the engineered barrier will need to be sampled and the quality of fill approved by the VPLE committee prior to placement at the property.

Develop a Remedial Action Plan / Material Management Plan for Site 3 and Site 1. A combined remedial action plan (RAP) and material management plan (MMP) will need to be completed and approved by the VPLE committee for Site 3. A RAP and a MMP will need to be completed and approved by the WDNR project manager for Site 1. Each plan will describe the soils targeted for use in the engineered barrier (e.g., quality, placement location, placement depth, etc.) and outline contingency plans for managing fluids (e.g., infiltrated groundwater, stormwater, etc.) and/or other materials encountered during construction.

Excavation and Offsite Disposal of Petroleum Impacted Soils Encountered During Future Construction. Soil generated during future excavation activities with obvious residual petroleum impacts cannot be moved around the Site for beneficial reuse. Instead, this soil will be transported offsite for disposal at the Waste Management solid waste landfill in Whitelaw, Wisconsin. The soil will be placed on the biopile to allow natural attenuation of residual petroleum impacts. Remediated soil will likely remain in the landfill for beneficial reuse.

Placement/Compaction/Grading of Fill to Construct the Engineered Barrier. Suitable fill will be placed/compacted/and graded at Site 1 and/or Site 3 to raise the grade and construct the engineered barrier.

Construction Documentation Report. A documentation report will be prepared following construction of the engineered barriers at Site 3 and Site 1.

Establish Institutional Controls. Following construction of the engineered barrier, Site 3 and Site 1 will be listed on the WDNR GIS Registry. Listing the Site on the GIS Registry will restrict groundwater consumption and restrict disturbance of the engineered barrier. The GIS Registry will provide for notification of residual impacts to soil and groundwater and will include an annual engineered barrier maintenance plan.

4.2 SCHEDULE

A proposed Schedule is provided below.

Task #	Task Description	Weeks to Complete
1	Enroll Site 3 in VPLE and Purchase Insurance	1-2 Weeks
2	Develop and Implement a Soil Characterization Workplan	1-2 Months, pending availability of a suitable quantity of fill
3	Develop a Remedial Action Plan / Material Management Plan	2-4 Weeks, pending the results of Task 3
4	Excavation and Offsite Disposal of Petroleum-Impacted Soil	2-4 Weeks, depending on construction schedule
5	Placement/Compaction/Grading of Fill to Construct Engineered Barrier	2-4 Months, pending availability of a suitable quantity of fill
6	Construction Documentation Report	1-2 Weeks
7	Establish Institutional Controls	2-4 Weeks

4.3 ESTIMATED COST

A preliminary estimate of the cost for implementation of Remedial Alternative 3 is presented on the table below.

Cost Estimate for Remedial Alternative 3

#	Item	Estimated or Assumed Value
1	Enroll Site 3 in VPLE and Purchase Insurance	$4,000 application fee $18,266 insurance
2	Develop and Implement a Soil Characterization Workplan	$5,000 workplan $15,000 sampling potential fill
3	Develop a Remedial Action Plan / Material Management Plan	$8,000
4	Excavation and Offsite Disposal of Petroleum-Impacted Soil	$142,500 (3,000 cubic yards)
5	Placement/Compaction/Grading of Fill to Construct Engineered Barrier	$154,050 if fill is free and already onsite $950,000 if fill is purchased
6	Construction Documentation Report	$3,000
7	Establish Institutional Controls	$10,000
	Total remedial cost	**$359,816 to $1,155,766**

4.4 RESTORATION TIME FRAME

As described in Section 4.2, implementation of Remedial Alternative 3 is anticipated to take 6-9 months to complete, as clean fill becomes available at the River Point District. If a developer is identified, establishing institutional controls may be delayed until after construction of the final engineered barrier (e.g., building slab, roads, etc.). Long-term maintenance will include annual inspections of the engineered barrier.

4.5 PERFORMANCE MEASURES

Confirmation samples will not be collected.

4.6 TREATMENT RESIDUALS

As described in Section 4.1, soil generated during future excavation activities with obvious residual petroleum impacts cannot be moved around the Site for beneficial reuse. Instead, this soil will be transported offsite for disposal at the Waste Management solid waste landfill in Whitelaw, Wisconsin. The soil will be placed on the biopile at the landfill to allow natural attenuation of residual petroleum impacts. Remediated soil will likely remain in the landfill for beneficial reuse. No additional treatment of residuals is anticipated as part of the RLF-funded work.

4.7 SUSTAINABLE REMEDIAL ACTION CONSIDERATIONS

The described remedial approach primarily relies on utilizing an engineered barrier, which will be constructed concurrent with raising the elevation of the property to the proposed grade. This approach minimizes transporting of soil for offsite disposal in a landfill. Petroleum soils that are removed from the Site will be added to a biopile at the solid waste landfill to facilitate natural attenuation of residual impacts. Low sulfur diesel can be used, and a no-idle policy will reduce the carbon footprint.

4.8 ADDITIONAL REMEDIAL ACTIONS

This ABCA evaluated a set of remedial actions to be funded under an RLF loan to address residual soil and groundwater impacts at Site 3 and Site 1. Additional remedial actions to be discussed in a future RAP not described in this ABCA could, if required by WDNR, include:

- Post-construction groundwater monitoring;
- Installing clay plugs in new utility trenches;
- Installing BCTs in newly constructed buildings;
- Post-construction sub-slab vapor sampling; and/or
- Establishing institutional controls/continuing obligations and maintenance plans to provide for long-term operation of BCTs

5.0 REFERENCES

Stantec, 2019, 10th Street Railroad Property, Manitowoc, Wisconsin, Phase I Environmental Site Assessment, March 21, 2019.

Stantec, 2020a, Phase II Environmental Site Assessment, Riverpoint District; Manitowoc, Wisconsin, March 23, 2020.

Stantec, 2020b, State Eligibility Determination for Federal Petroleum Assessment Grant, 1110 Buffalo Street, Manitowoc, Wisconsin, May 18, 2020.

Stantec, 2020c, Phase II Environmental Site Assessment, River Point District; Manitowoc, Wisconsin, 200 North 10th Street (Site 1), August 24, 2020.

Stantec, 2020d, Construction Documentation Report, 200 N 10th Street, Manitowoc, Wisconsin, November 4, 2020.

Stantec, 2020e, Construction Documentation Report for Demolition and Removal of Structural Impediments, River Point District – Site 3, December 11, 2020.

Stantec, 2020f, Phase II Environmental Site Assessment, River Point District; Manitowoc, Wisconsin, Site 3, December 18, 2020.

Stantec, 2021, Site Investigation for Phase I Construction Area, in press.

FIGURES

Figure No.
1
Title
Project Areas and Regional Topography

Client/Project
ABCA
River Point District
City of Manitowoc

0 390 780 Feet

Prepared by HLB on 4/15/2021

N

Legend

- Riverpoint District
- Site 1 - 200 North 10th Street
- Site 3 - 1110 Bufalo Street

Notes
1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet

Stantec

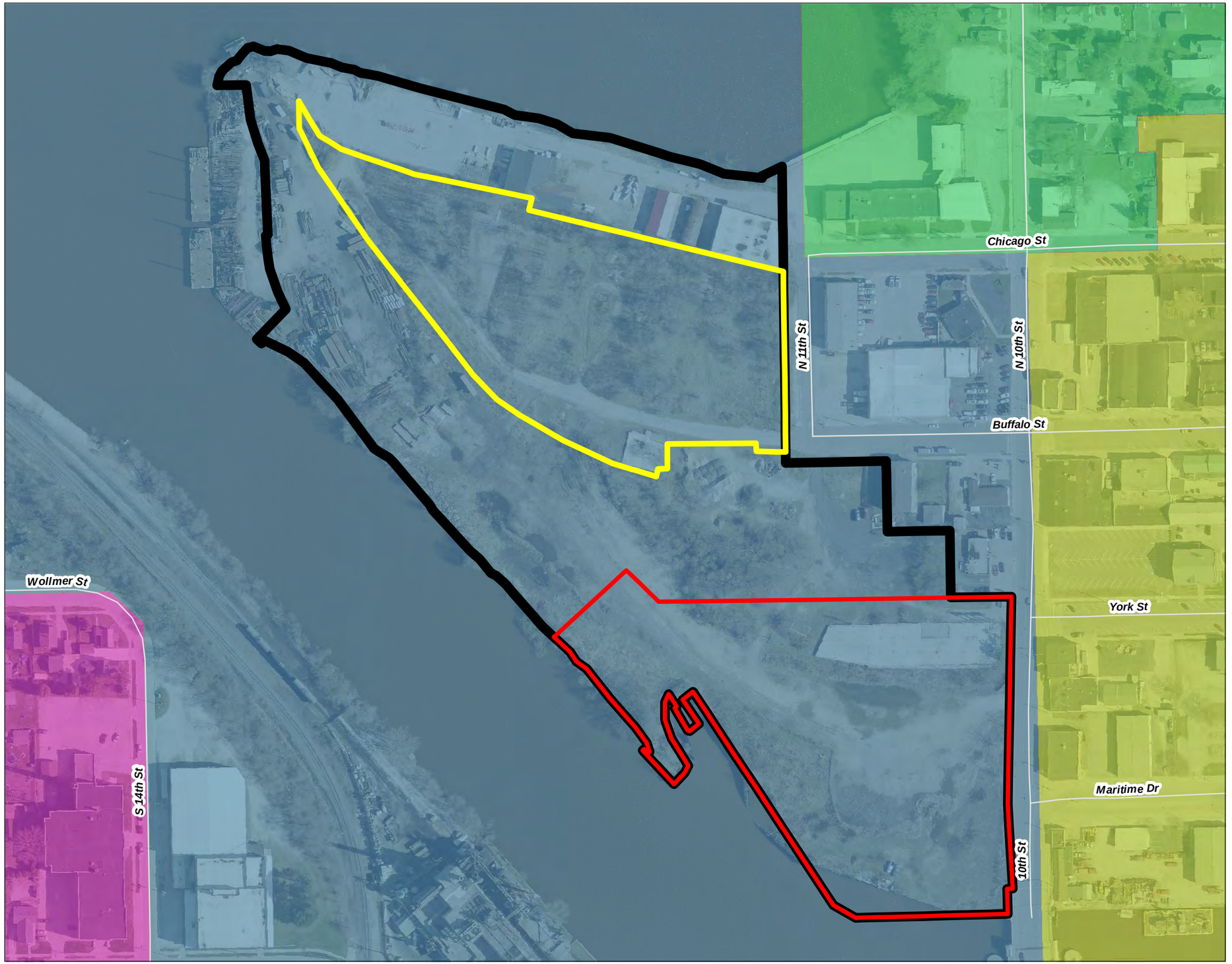


Figure No.
2

Title
Project Areas and Zoning

Client/Project
ABCA
River Point District
City of Manitowoc

0 125 250 Feet

Prepared by HLB on 3/25/2020

Legend

- Site 1 - 200 North 10th Street
- Site 3 - 1110 Bufalo Street
- Riverpoint District

N

Zoning

- B-3
- C-1
- I-2
- R-6

Notes

1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
2. Historic Site features illustrated on this figure were digitized from multiple historic maps/sources, including City Assessor files, WDNR files, and Sanborn (R) Fire Insurance Maps. These features are provided for illustration purposes only; Stantec makes no warranty as to the accuracy of these features.
3. Orthophotograph: Manitowoc County, 2017

Stantec

Figure No.
3

Title
Project Areas and PINs

Client/Project
ABCA
River Point District
City of Manitowoc

0 135 270 Feet

Prepared by HLB on 4/15/2021

N

Legend

- Site 1 - 200 North 10th Street
- Site 3 - 1110 Bufalo Street
- Parcel Identification Numbers

Notes

1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
2. Orthophotograph: Manitowoc County, 2017

Stantec

Figure No.

4

Title

Project Areas and Historic Site Features

Client/Project

ABCA
River Point District
City of Manitowoc

0 125 250 Feet

Prepared by HLB on 4/15/2021

N

Legend

- Site 1 - 200 North 10th Street
- Site 3 - 1110 Bufalo Street
- Riverpoint District

Prior Site Features (City Records)

- Oil House (5)
- Oil Tank (AST) (42)
- Pump House (5)
- UST (2)
- Railroad Spurs

Additional Site Features (WDNR Files)

- Former UST (10)
- Product Piping (2)
- Pump House (2)
- Soil Excavation (3)
- Bank of the Manitowoc River (19th Century)

Carl Zander Planing Mill and Factory (~1870s-1895)

Site Feature

- Drying House
- Engine Room
- Lumber
- Planing Mill
- Warehouse
- Shavings
- Shed
- Steam Boxes

Notes

1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
2. Historic Site features illustrated on this figure were digitized from multiple historic maps/sources, including City Assessor files, WDNR files, and Sanborn (R) Fire Insurance Maps. These features are provided for illustration purposes only; Stantec makes no warranty as to the accuracy of these features.
3. Orthophotograph: Manitowoc County, 2017

Stantec

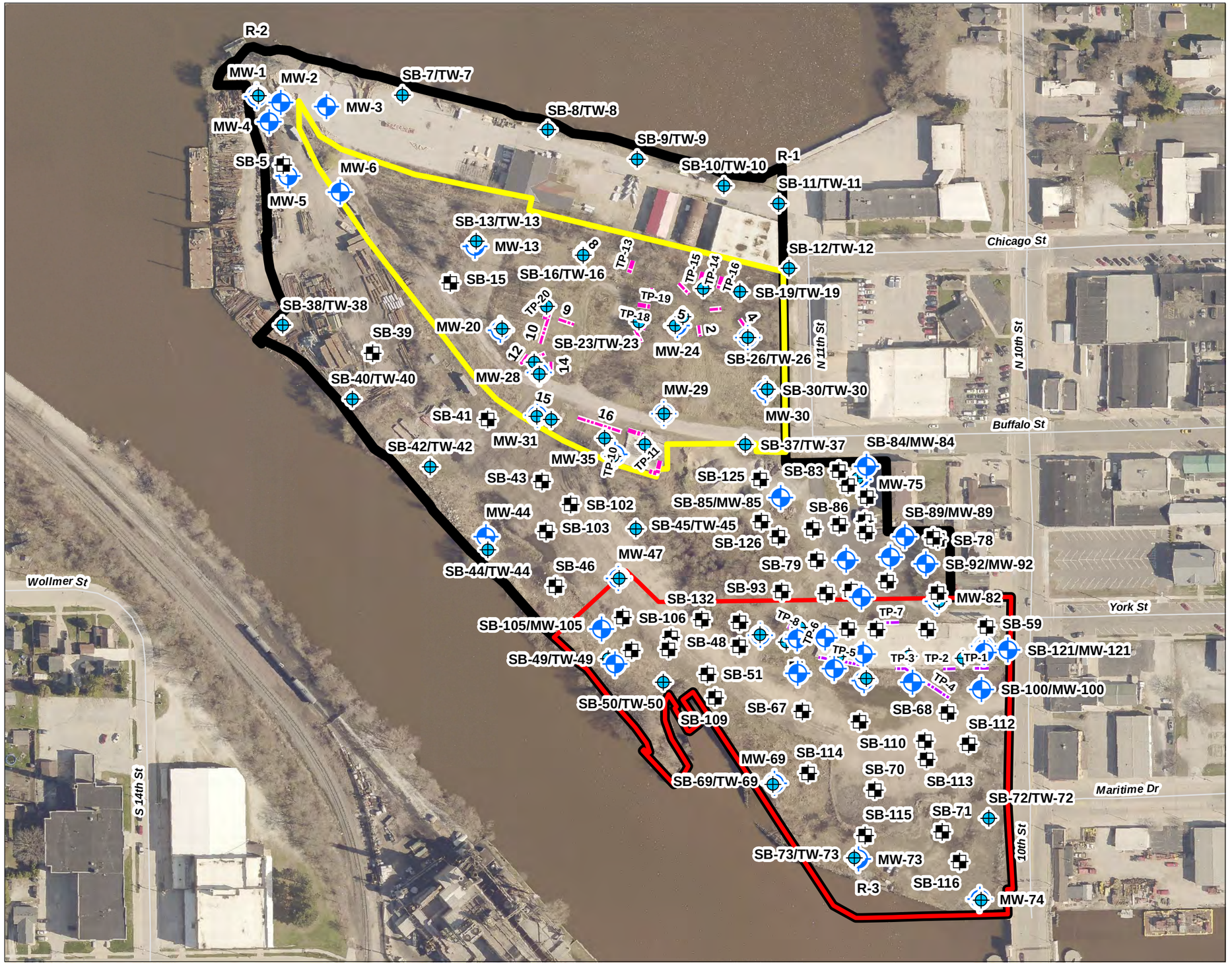


Figure No.
5

Title
Project Areas and Sample Locations

Client/Project
ABCA
River Point District
City of Manitowoc

0 125 250 Feet

Prepared by HLB on 4/15/2021

Legend

N

- Site 1 - 200 North 10th Street
- Site 3 - 1110 Bufalo Street
- Riverpoint District

Sample Locations

- Monitoring Well (43)
- Soil Boring (52)
- Soil Boring / Temp Well (52)
- Test Pits - Site 3
- Test Pits - Site 1

Notes

1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
2. Orthophotograph: Manitowoc County, 2017

Stantec

Figure No.
6
Title
Project Areas and Fill Thickness

Client/Project
ABCA
River Point District
City of Manitowoc

0 130 260 Feet

Prepared by HLB on 4/15/2021

Legend

- Site 1 - 200 North 10th Street
- Site 3 - 1110 Bufalo Street
- Riverpoint District

Fill Thickness (Feet)
High : 8
Low : 0

N

Chicago St
N 11th St
N 10th St
N 9th St
Buffalo St
Wollmer St
S 14th St
Clark St
S Water St
York St
Maritime Dr
10th St

Notes

1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
2. Orthophotograph: Manitowoc County, 2017

Stantec

Figure No.
7
Title

Groundwater Elevation at the River Point District (March 2021)

Client/Project
Riverpoint District Site 1
200 North 10th Street
City of Manitowoc

0 125 250 Feet

Prepared by HLB on 4/21/21

N

Legend

- Site 1 - 200 North 10th Street
- Site 3 - 1110 Bufalo Street
- Riverpoint District
- Groundwater Elevation (ft amls)

Monitoring Locations

- Monitoring Well (NR 141) (38)
- Staff Gage (3)
- Temporary Monitoring Well (16)

NOTE:
1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
2. Orthophotograph: Manitowoc County, 2017

Stantec

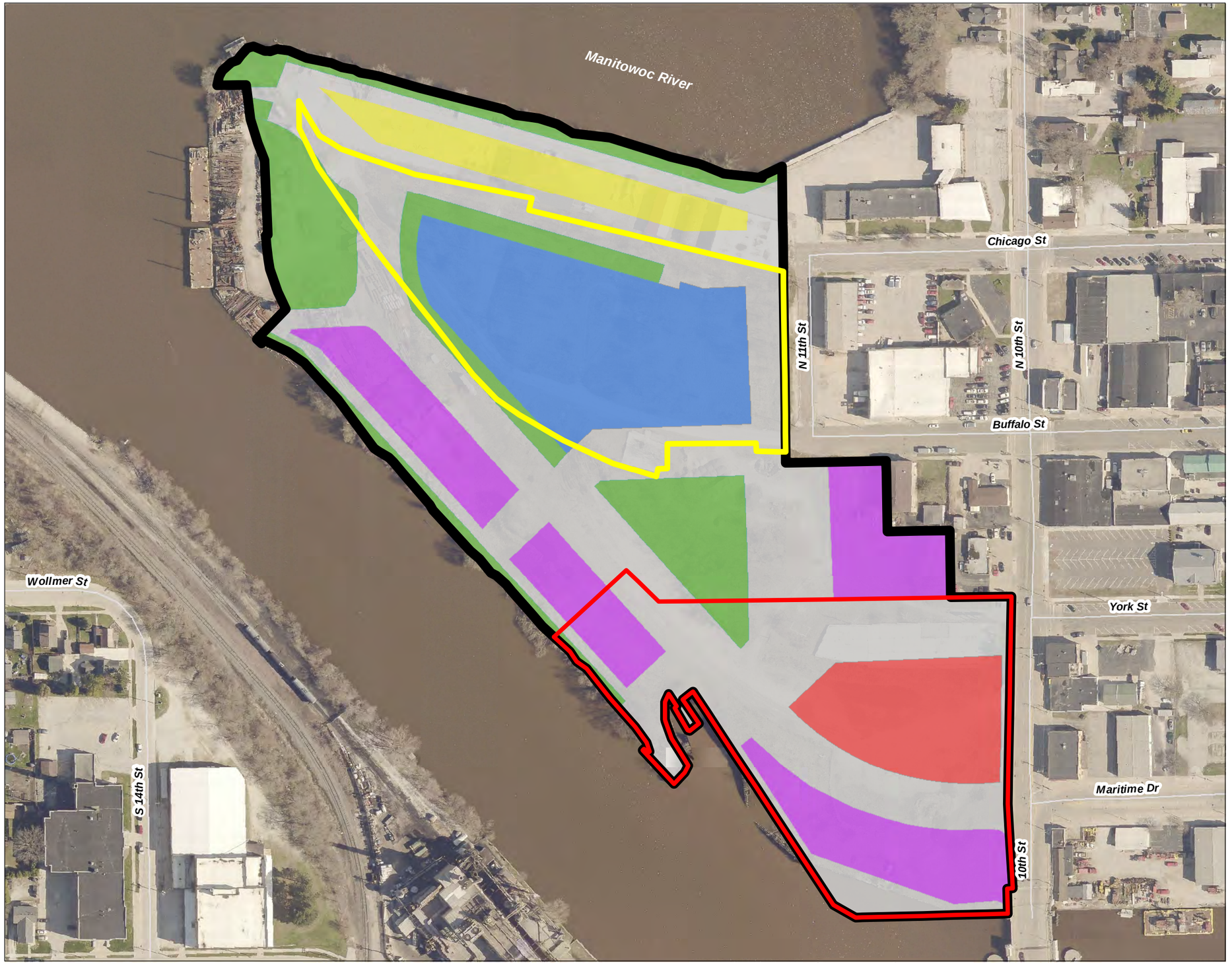


Figure No.
8

Title
Conceptual Reuse Plan

Client/Project
ABCA
River Point District
City of Manitowoc

0 125 250 Feet

Prepared by HLB on 7/11/18

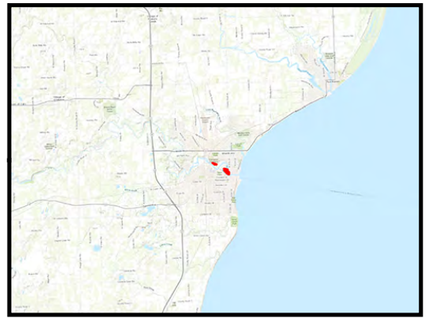
N

Legend

- Riverpoint District
- Site 1 - 200 North 10th Street
- Site 3 - 1110 Bufalo Street

Proposed Reuse

- Commercial
- Greenspace
- Mixed-Use / Multi-Level Res
- Multi-Level Residential
- Town Home Residential
- Roadway/Sidewalk/Parking



Notes

1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
2. Historic Site features illustrated on this figure were digitized from multiple historic maps/sources, including City Assessor files, WDNR files, and Sanborn (R) Fire Insurance Maps. These features are provided for illustration purposes only; Stantec makes no warranty as to the accuracy of these features.
3. Orthophotograph: Manitowoc County, 2017

Stantec

Figure No.
9

Title
Petroleum Impacts and Proposed Reuse at Site 1

Client/Project
ABCA
River Point District
City of Manitowoc

0 65 130 Feet

Prepared by HLB on 4/15/2021

N

Legend

- Site 1 - 200 North 10th Street
- Riverpoint District

Sample Locations

- Monitoring Well (26)
- Soil Boring (47)
- Soil Boring / Temp Well (20)
- Test Pits

VOC Impacts to Groundwater

- Benzene > ES
- Petroleum VOCs > PAL

Proposed Engineered Barrier/Cap

- Asphalt Cap (22,480 sf)
- Concrete Cap (6,605 sf)
- Landscaping Cap (19,800 sf)

Building Footprint and BCT Extent

- Building Footprint (BCT Extent; 23,327 sf)

Municipal Infrastructure

- Landscaping
- RIghts-of-way
- Rock Wall
- Sidewalk
- Undeveloped

Notes

1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
2. Orthophotograph: Manitowoc County, 2017

Stantec

TABLE

Table 1
Analysis of Brownfields Cleanup Alternatives to be Funded Under an RLF Loan
1110 Buffalo Street and 200 North 10th Street
Manitowoc, Wisconsin

Remedial Action Area Description:	The target remedial area consists of vacant land formerly used for bulk petroleum storage. Residual heavy metal and/or petroleum impacts are present in soil/fill across the Property at concentrations greater than health-based ch. NR 720 WAC non-industrial direct contact and/or ch. NR 720 soil to groundwater residual contaminant levels (RCLs). In addition, residual petroleum impacts to soil and groundwater remain at concentrations that exceed ch. NR 720 WAC soil standards and/or ch. NR 140 WAC groundwater enforcement standards (ES) and/or preventive action limits (PAL).											
Exposure Routes of Concern (*Check Boxes As Applicable*):	**Soil**				**Groundwater**		**Sub-Slab Vapor**		**Building Materials**			
	Direct Contact	*Yes*	Soil to Groundwater	*Yes*	Consumption	*Yes*	Vapor Intrusion	*Possibly; benzene > ES*	Lead Paint	*No*	Asbestos	*No*

Media	**Remedial Alternative**	**Remedial Action Options Evaluation**					
		Technical Feasibility - ch. NR 722.07(4)(a)				**Economic Feasibility**	**Sustainability**
		Long-Term Effectiveness	*Short Term Effectiveness*	*Implementability*	*Restoration Time Frame*	**ch. NR 722.07(4)(b)**	**ch. NR 722.09(2m)**
Soil and Groundwater	Alt 1 - Natural Attenuation	Natural attenuation of residual petroleum impacts to soil and groundwater is possible. However, heavy metal impacts in soil are considered recalcitrant to natural attenuation. Therefore natural attenuation would not reduce the overall heavy metal toxicity, mobility, and volume of impacts. Natural attenuation would not be protective of public health, safety, or welfare or the environment in the short-term or long-term time periods.		Implementation of Alt 1 is technically feasible; however, monitoring the effectiveness of the remedial action is impractical. Redevelopment potential would be impeded.	As heavy metal constituents associated with residual impacts are considered recalcitrant, the overall magnitude, mobility, and toxicity of impacts would not decrease and Site restoration will not occur within a reasonable timeframe.	Initial and capital costs to implement Alt 1 are minimal; however, future potential costs associated with monitoring natural attenuation could be significant as constituents are recalcitrant to natural attenuation.	The carbon footprint and energy use associated with Alt 1 is considered minimal. However, Alt 1 is not considered to be protective of health/safety/env. within a reasonable timeframe.
	Alt 2 - Excavate all impacted soil; backfill excavation to proposed final grade; establish an institutional control to prevent groundwater consumption	Excavation of impacted soil/fill will provide for immediate and permanent reduction in the toxicity, mobility, and volume of contaminants and would protect public health, safety, welfare and the environment in a short-term time frame. An institutional control is considered effective for prevention of groundwater consumption while residual impacts naturally degrade.		Alt 2 is technically feasible and technology is available for implementation. Waste disposal approval will be needed from the landfill.	The Property would be restored concurrent with redevelopment. Institutional controls will be needed to provide for long-term control of residual impacts.	Source removal capital includes excavation and offsite disposal of a considerable volume of fill and backfilling the excavation to current grade with imported fill (61,200 cubic yards @ $70 per yard =$4.3MM). Establishing the institutional control to control groundwater consumption will occur with final closure ($13,000).	Extraordinary energy and fuel use will be incurred with offsite disposal of building materials and backfilling the excavation; however low sulfur diesel can be used and a no-idle policy will reduce the carbon footprint. Alt. 2 will maximize energy use and soil disturbance. Alternative 2 allows for maximum reuse of the Property.
	Alt 3 - Limited excavation and offsite disposal of soil with residual petroleum impacts; constructing a soil engineered barrier to minimize sitewide direct contact with impacted soil/fill and reduce potential for leaching of residual impacts to groundwater; and establishing institutional controls/continuing obligations and maintenance plans to provide for long-term control of residual soil and groundwater impacts.	Excavation and removal of residual petroleum impacts is effective in both the short and long-term time frames. Construction of a soil engineered barrier through placement of clean fill to raise the current grade to proposed final grade would provide for short-term protection of public health, safety, welfare and the environment. However, long-term effectiveness will depend on maintenance of the engineered barrier. Residual groundwater impacts will be effectively managed by an institutional control.		Alt 3 is technically feasible and technology is available for implementation.	The Property would be restored concurrent with redevelopment. Institutional controls will be needed to provide for long-term control of residual impacts.	Petroleum impacted soils can be managed in a biopile at the solid waste landfill at a reduced fee (4,500 tons @ $25/ton = $112,500, though hauling will still be needed (3,000 cubic yards @ $10 per yard = $30,000) Capital costs would be minimized as the work will take place concurrent with placement of fill to raze the grade of the Site to final grade. Fill is currently available at no cost to the City, and pending approval from the VPLE committee, the fill could be used to construct a portion of the engineered barrier (47,400 cubic yards @ $3.25 per yard = $154,050). An incremental cost could be incurred, if fill needed to be purchased (47,400 cubic yards @ $20 per yard = $950K). Establishing the institutional control to control groundwater consumption will occur with final closure ($13k).	Petroleum-impacted soil can be placed on the biopile at the solid waste landfill and later reused by the landfill. Energy and fuel use would be minimized; however, local infrastructure (roads) could be impacted during importation of soil; however low sulfur diesel can be used and a no-idle policy will reduce the carbon footprint.

Note: Additional remedial actions to be discussed in a future RAP not described in the table above are summarized in Section 4.8 of the Stantec (2021) ABCA.