

**Analysis of Brownfields Cleanup Alternatives for
the Former Machinery Row Property located at
700, 900, and 1010 Water Street
Racine, Wisconsin
RDA – USEPA Cleanup Grant Application**

This Analysis of Brownfields Cleanup Alternatives (ABCA) has been prepared for the Redevelopment Authority of the City of Racine (RDA) to outline options identified and evaluated to complete the cleanup planning process for the Former Machinery Row property located at 700, 900, and 1010 Water Street in Racine, Wisconsin (the "Site"). Alternative cleanup and environmental management activities considered for the site consisted of the following:

- Alternative 1: No Action
- Alternative 2: Limited Soil Excavation/Off-Site Disposal of Volatile Organic Compounds (VOC)-impacted Soil with Natural Attenuation of Groundwater and Installation of Direct Contact Site Cap in limited areas in support of proposed redevelopment (likely greenspace and/or parking areas will be targeted)
- Alternative 3: In-Situ Chemical Oxidation via Hydraulic Injections for Treatment of Soil Impacts with Natural Attenuation of Groundwater and Installation of Direct Contact Site Cap in limited areas in support of proposed redevelopment (likely greenspace and/or parking areas will be targeted)

SITE BACKGROUND

The Site consists of three separate addresses including 700, 900, and 1010 Water Street, all of which are owned by the RDA (Figure 1). The layout of the site and the parcel boundaries are depicted on Figure 2. The Site is often referred to as the Water Street Redevelopment, which also includes the Promenade site, which is owned by the City of Racine and located at 800 Water Street. This ABCA is only in reference to the RDA-owned properties, which comprise a total of approximately 14.85 acres.

The Site has a long history of industrial operations and multiple historical operators, including J.I. Case, Western Publishing, The Massey Harris Company, and The Chicago, Milwaukee, St. Paul & Pacific Railroad. The Site was acquired by an Iowa-based developer, FDP MR, LLC (FDP) in approximately December 2014, but the developer failed to redevelop the Site. In November 2016, the City of Racine purchased the Promenade property (800 Water Street) from FDP to eliminate blight by creating a public gathering space along the Root River. The RDA purchased the properties at 700, 900, and 1010 Water Street in December 2017 to eliminate blight by preparing the entire Water Street Redevelopment property for private redevelopment. The City-owned Promenade will enhance the livability and access to the Root River for the residential private redevelopment and the City residents as a whole.

Several investigations have been conducted at the Site. A Phase II Environmental Site Assessment (ESA) was conducted for the western portion of the Site by AECOM in September 2014, and a Phase II ESA was conducted for the eastern portion of the Site by Symbiont in October 2014. Site investigation activities were completed by Symbiont, and the results are presented in Symbiont's July 2015 SI report. Results from soil investigation activities and UST investigation and removal activities conducted at the Site were summarized in the July 2015 Symbiont SI report.

In general, the site is underlain by a layer of fill material consisting of fine to coarse silty sand with trace crushed concrete, some medium to coarse gravel, foundry sand, cinders, slag, and brick. Low level impacts of metals, polycyclic aromatic hydrocarbons (PAHs), and volatile organic compounds (VOCs) are anticipated to be addressed by capping and/or limited soil excavation/off-site disposal

prior to site redevelopment. Petroleum VOC impacts have been identified on the 700 Water Street parcel, including 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, naphthalene, toluene, and xylenes at concentrations exceeding their respective Wisconsin Administrative Code (WAC) NR 720 Residual Contaminant Levels (RCLs) for the groundwater migration pathway. Other VOCs detected in soil include tetrachloroethene (PCE), and trichloroethene (TCE), and these impacts are generally within the upper 1-4 feet below ground surface (bgs) but extend to depths up to 7-9 feet bgs. A schematic showing the distribution of VOCs, including the petroleum-related compounds is provided as Figure 3.

In addition, low levels of metals, PAHs, and VOCs have been detected in one or more groundwater samples collected from existing monitoring wells on the site. The most recent groundwater sampling events were conducted in June and September 2018. Based on these sampling results, vinyl chloride was detected in one monitoring well in exceedance of its WAC NR 140 groundwater Enforcement Standard (ES). Other low-level exceedances of the WAC NR 140 groundwater Preventive Action Limit (PAL) for barium, lead, PCE, benzo(a)pyrene, benzo(b)fluoranthene, and chrysene were observed. The exceedances of WAC NR 140 groundwater quality standards in September 2018 are presented on Figure 4.

SITE REDEVELOPMENT PLAN

The Site is anticipated to be redeveloped for primarily residential development with some mixed-use commercial. Development plans are being prepared, but no specific development has been identified at this time. The area of the Site with low level petroleum-impacted soils will primarily be covered by concrete building slabs or removed from the site during site redevelopment. However, some of these impacted soils present a vapor intrusion risk to the anticipated development if these soils remain in place. It is anticipated that the future redevelopment plans will include a combination of limited hot-spot removal or remediation and site capping plan for the areas with identified impacts. Natural attenuation is the anticipated remedy for the low-level groundwater impacts. It's anticipated that some of the site-capping will be conducted in conjunction with the proposed redevelopment.

All solid wastes generated at the Site, including contaminated soil and other solid wastes generated during response actions associated with this USEPA Cleanup Grant Application, will be disposed of properly at either a Wisconsin Chapter 289, Stats., licensed landfill or in a manner consistent with the applicable provisions of WAC NR 718. Final approval of the proposed disposal option, on or off-site, will be in writing and authorized as a component of the Remedial Action Plan (RAP) to be reviewed and approved by WDNR.

ANALYSIS OF ALTERNATIVES

Three alternatives for remedial action at the Site were considered with the goal of maximizing the potential for redevelopment, which is currently impaired by the contamination present. The alternatives discussed below were evaluated based on effectiveness, implementability, and cost.

Alternative 1: No Action

The "No Action" alternative was considered but disregarded. While implementable and no cost, it does not meet regulatory requirements for soil and groundwater remediation and would potentially create a risk for direct contact with contaminated soil. It would also significantly hinder the proposed redevelopment of the Site.

Alternative 2: Limited Soil Excavation/Off-Site Disposal of VOC-impacted Soil with Natural Attenuation of Groundwater and Installation of Direct Contact Site Cap in limited areas in support of proposed redevelopment

This alternative consists of limited excavation of petroleum-impacted soil with off-site disposal and the construction of a direct contact site cap in areas with low-level residual impacts. Residual groundwater impacts will be addressed through monitored natural attenuation (MNA).

The excavation activities will focus on the areas of the site that have been determined to be impacted with petroleum VOCs above WAC NR 720 groundwater pathway RCL and in the vicinity of a former coal shed, which was constructed on the site as early as 1887. Petroleum VOCs, including 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, naphthalene, toluene, and/or xylenes, were detected above their respective NR 720 soil-to-groundwater pathway RCLs at soil borings AM-SB-14 (1-4') and AM-SB-15 (2-4'). These concentrations of PVOCs, particularly the benzene, could create a vapor intrusion issue for future structures, if left in place. The source of these impacts to shallow soils is unknown. Two estimated excavation areas with dimensions of 40'x40', to a depth of 5 feet bgs, are proposed, resulting in approximately 600 cy to be removed and disposed off-site. The final excavation area dimensions and volume of soil to be excavated will be confirmed with pre-remediation soil sampling. The excavations will be backfilled to grade with imported clean soil.

Following excavation of petroleum VOCs as provided above, the low-level soil impacts remaining on the site will be addressed through the construction of a direct contact site cap. A temporary site cap was constructed at the site as part of the site demolition activities, with crushed concrete from former building slabs placed across the site to minimize the risk of direct contact with contaminated soil, in conjunction with perimeter site fencing to limit access to the site; however the temporary cap is not consistent with a residential site use and is not sufficient to protect future residents of the site. The final site capping plan for the Site will likely consist of building slabs, clean soil cover in green space areas, and paved parking and drive areas as part of the site redevelopment. The building slab portion of the final cap is anticipated to be constructed as part of site redevelopment, while the final site cap in the paved parking and drive areas is anticipated to be constructed as part of this remedial action alternative, if funding is awarded to the Site through a USEPA Cleanup Grant. A concrete or asphalt pavement cover or a one to two-foot soil cover in greenspace areas would be constructed over an estimated 20% of the site, for the purpose of this alternatives evaluation. The site cap is considered an institutional control that will be listed on the WDNR's Bureau for Remediation and Redevelopment Tracking System (BRRTS) database with a long-term requirement for inspection and maintenance.

MNA was determined to be the most cost effective and technically feasible alternative to address the low-level residual groundwater impacts at the site. There are currently exceedances of WAC NR 140 ESs and PALs at the site, and four additional quarters of MNA groundwater sampling are proposed to document a stable or decreasing plume, prior to receiving final case closure on the site.

Based on the estimated extent of soil contamination at the subject site, the estimated cost to implement the soil excavation/off-site disposal including four rounds of MNA groundwater sampling, construction of the site cap, and associated reporting is \$407,000. Under this remedial alternative, active remediation could be completed within 1 month and regulatory case closure could likely be secured within a 2-year timeframe, after completion of MNA groundwater monitoring.

Alternative 3: In-Situ Chemical Oxidation via Hydraulic Injections for Treatment of Soil Impacts with Natural Attenuation of Groundwater and Installation of Direct Contact Site Cap in limited areas in support of proposed redevelopment

This alternative consists of *in-situ* chemical oxidation involving the application of the chemical oxidant, sodium persulfate directly into the subsurface for the treatment of impacted soil. When the sodium persulfate is applied to the subsurface, it aerobically breaks down the contaminants into non-toxic products such as carbon dioxide and water. Various oxidant delivery methods can be considered for the treatment of shallow soil impacts, such as direct injection or *in-situ* soil mixing. A challenge with injection methods is the potential for the surfacing of oxidants due to the shallow treatment zone, extending only 5 feet bgs; however, soil mixing inherently affects the structural stability of the soils, which can potentially impact redevelopment in the impacted area.

The soil treatment area for *in-situ* chemical oxidation will focus on the area of the site that has been determined to be impacted with petroleum VOCs above WAC NR 720 groundwater pathway RCL and in the vicinity of a historic former coal shed. The direct injection delivery method is considered in order to maximize redevelopment potential. Pre-remediation sampling would be completed in order to determine the actual quantity of oxidant to be injected at the site and the number of injection points.

The low-level soil impacts remaining on other portions of the site will be addressed through the construction of a direct contact site cap. A temporary site cap will be constructed at the site as part of the site demolition activities, with crushed concrete from former building slabs placed across the site to minimize the risk of direct contact with contaminated soil, in conjunction with perimeter site fencing to limit access to the site.

The final site capping plan for the Site will likely consist of building slabs, paved parking and drive areas as part of the site redevelopment. The building slab portion of the final cap is anticipated to be constructed as part of site redevelopment, while the final site cap in the paved parking and drive areas is anticipated to be constructed as part of this remedial action alternative, if funding is awarded to the Site through a USEPA Cleanup Grant. A concrete or asphalt pavement cover or a one to two-foot soil cover in greenspace areas would be constructed over an estimated 20% of the site, for the purpose of this alternatives evaluation. The site cap is considered an institutional control that will be listed on the WDNR's Bureau for Remediation and Redevelopment Tracking System (BRRTS) database with a long-term requirement for inspection and maintenance.

Based on the estimated extent of soil contamination at the subject site, the estimated cost to implement *in-situ* chemical oxidation for soil remediation, including four rounds of MNA groundwater sampling, construction of the site cap, and associated reporting is \$455,000. Under this remedial alternative, active remediation could be completed within 1 month and regulatory case closure could likely be secured within a 2-year timeframe, after completion of MNA groundwater monitoring.

RECOMMENDATION

Based on this remedial alternative analysis and in consideration of the remedial activities conducted to date, it is concluded that the most cost-effective and technically feasible alternative to complete the remedial action is Alternative 2: Limited Soil Excavation/Off-Site Disposal of VOC-impacted Soil with Natural Attenuation of Groundwater and Installation of Direct Contact Site Cap. Under this alternative, regulatory case closure could likely be secured within a 2-year timeframe, and redevelopment potential would be maximized for the Site.

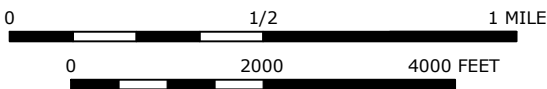
DECISION DOCUMENT

A decision document will be issued at the close of the 14-day public comment period with additional details on the selected alternative.


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CONTOUR INTERVAL 10 FEET



LEGEND:

 PROPERTY BOUNDARY (APPROXIMATE)

SOURCE:
2016 USGS 7.5 Minute Series Racine South, Wisconsin Topographic Quadrangle.
Site Location; N: 42.727594° W: 87.789624° WGS84



SITE LOCATION MAP
FORMER MACHINERY ROW PROPERTY
700, 900, AND 1010 WATER STREET
RACINE, WISCONSIN

FIGURE
1

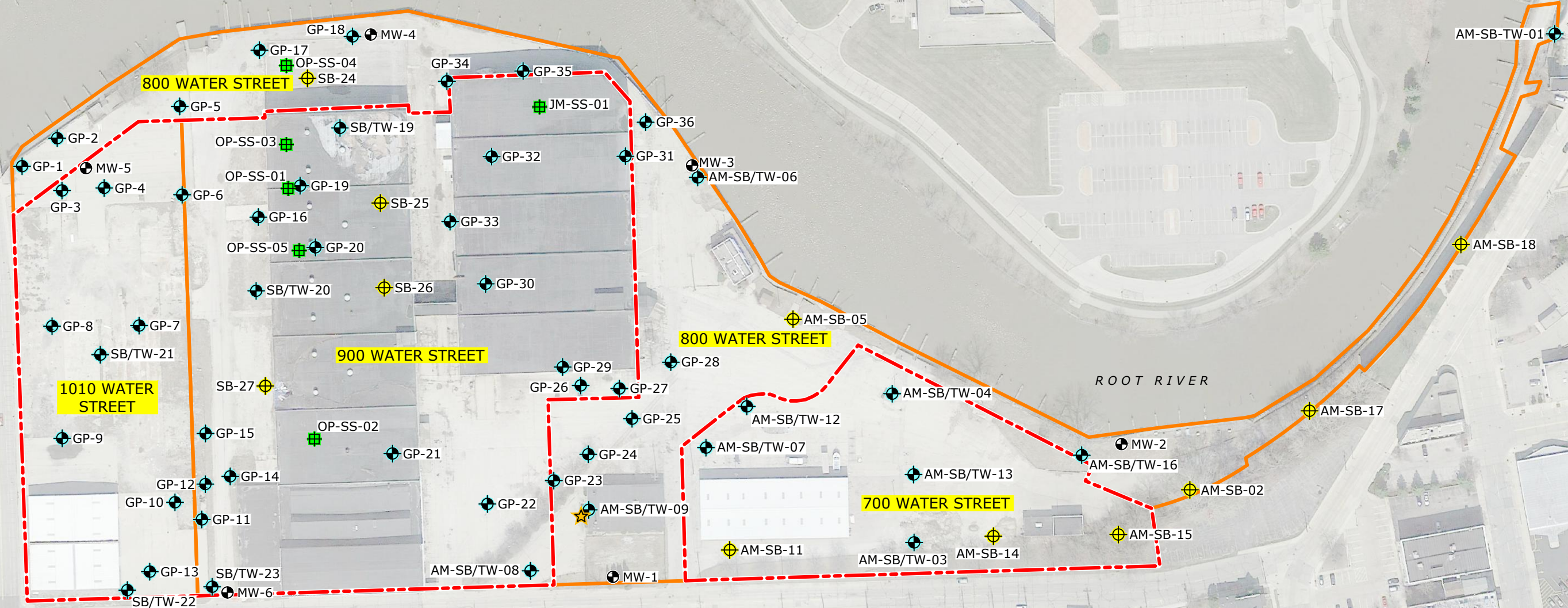
DRAFTED BY: HJW

DATE: 1/3/19

1690005038-002



ROOT RIVER



LEGEND	
	NR 141 MONITORING WELLS
	SOIL BORING (INSTALLED BY OTHERS)
	SOIL BORING / TEMPORARY WELL (INSTALLED BY OTHERS)
	SUB-SLAB VAPOR LOCATION (INSTALLED BY OTHERS)
	FORMER UST LOCATION
	PROPERTY BOUNDARY (APPROXIMATE)
	PARCEL BOUNDARY

NOTES:

1. SOIL, GROUNDWATER, AND SUB-SLAB VAPOR SAMPLES COLLECTED AT THE SITE PRIOR TO 2018 WERE COLLECTED BY AECOM AND SYMBIONT.
2. TEMPORARY WELLS INSTALLED BY OTHERS WERE ABANDONED BY OTHERS IN MAY AND JUNE 2018.
3. MONITORING WELLS INSTALLED BY RAMBOLL IN MAY AND JUNE 2018 WERE INSTALLED IN ACCORDANCE WITH WISCONSIN ADMINISTRATIVE CODE (WAC) NR 141.



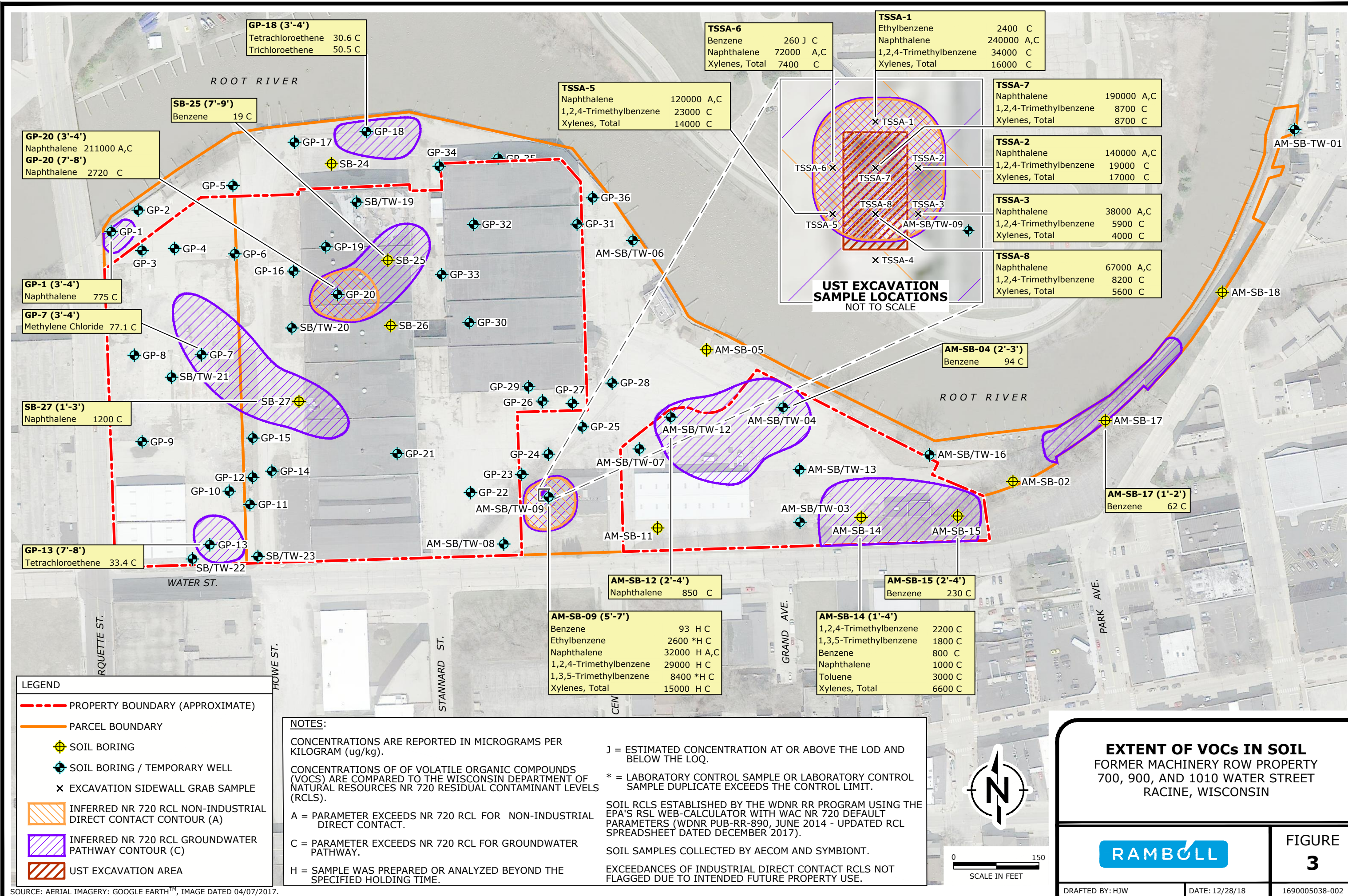
SITE LAYOUT
 FORMER MACHINERY ROW PROPERTY
 700, 900, AND 1010 WATER STREET
 RACINE, WISCONSIN

	FIGURE 2
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SOURCE: AERIAL IMAGERY: GOOGLE EARTH™, IMAGE DATED 04/07/2017.

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LEGEND

- PROPERTY BOUNDARY (APPROXIMATE)
- PARCEL BOUNDARY
- SOIL BORING
- SOIL BORING / TEMPORARY WELL
- x EXCAVATION SIDEWALL GRAB SAMPLE
- INFERRED NR 720 RCL NON-INDUSTRIAL DIRECT CONTACT CONTOUR (A)
- INFERRED NR 720 RCL GROUNDWATER PATHWAY CONTOUR (C)
- UST EXCAVATION AREA

NOTES:

CONCENTRATIONS ARE REPORTED IN MICROGRAMS PER KILOGRAM (ug/kg).

CONCENTRATIONS OF VOLATILE ORGANIC COMPOUNDS (VOCs) ARE COMPARED TO THE WISCONSIN DEPARTMENT OF NATURAL RESOURCES NR 720 RESIDUAL CONTAMINANT LEVELS (RCLS).

A = PARAMETER EXCEEDS NR 720 RCL FOR NON-INDUSTRIAL DIRECT CONTACT.

C = PARAMETER EXCEEDS NR 720 RCL FOR GROUNDWATER PATHWAY.

H = SAMPLE WAS PREPARED OR ANALYZED BEYOND THE SPECIFIED HOLDING TIME.

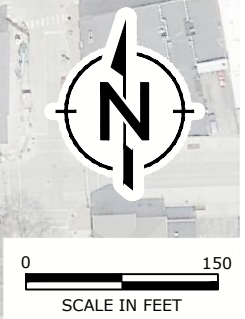
J = ESTIMATED CONCENTRATION AT OR ABOVE THE LOD AND BELOW THE LOQ.

* = LABORATORY CONTROL SAMPLE OR LABORATORY CONTROL SAMPLE DUPLICATE EXCEEDS THE CONTROL LIMIT.

SOIL RCLS ESTABLISHED BY THE WDNR RR PROGRAM USING THE EPA'S RSL WEB-CALCULATOR WITH WAC NR 720 DEFAULT PARAMETERS (WDNR PUB-RR-890, JUNE 2014 - UPDATED RCL SPREADSHEET DATED DECEMBER 2017).

SOIL SAMPLES COLLECTED BY AECOM AND SYMBIONT.

EXCEEDANCES OF INDUSTRIAL DIRECT CONTACT RCLS NOT FLAGGED DUE TO INTENDED FUTURE PROPERTY USE.



EXTENT OF VOCs IN SOIL
FORMER MACHINERY ROW PROPERTY
700, 900, AND 1010 WATER STREET
RACINE, WISCONSIN

FIGURE 3

DRAFTED BY: HJW

DATE: 12/28/18

1690005038-002

GP-18 (3'-4') Tetrachloroethene 30.6 C Trichloroethene 50.5 C	GP-20 (3'-4') Naphthalene 211000 A,C GP-20 (7'-8') Naphthalene 2720 C	GP-1 (3'-4') Naphthalene 775 C	GP-7 (3'-4') Methylene Chloride 77.1 C	SB-27 (1'-3') Naphthalene 1200 C	GP-13 (7'-8') Tetrachloroethene 33.4 C
SB-25 (7'-9') Benzene 19 C	GP-1 (3'-4') Naphthalene 775 C	GP-7 (3'-4') Methylene Chloride 77.1 C	SB-27 (1'-3') Naphthalene 1200 C	GP-13 (7'-8') Tetrachloroethene 33.4 C	GP-13 (7'-8') Tetrachloroethene 33.4 C

TSSA-5 Naphthalene 120000 A,C 1,2,4-Trimethylbenzene 23000 C Xylenes, Total 14000 C	TSSA-6 Benzene 260 J C Naphthalene 72000 A,C Xylenes, Total 7400 C	TSSA-1 Ethylbenzene 2400 C Naphthalene 240000 A,C 1,2,4-Trimethylbenzene 34000 C Xylenes, Total 16000 C
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TSSA-2 Naphthalene 140000 A,C 1,2,4-Trimethylbenzene 19000 C Xylenes, Total 17000 C	TSSA-3 Naphthalene 38000 A,C 1,2,4-Trimethylbenzene 5900 C Xylenes, Total 4000 C	TSSA-8 Naphthalene 67000 A,C 1,2,4-Trimethylbenzene 8200 C Xylenes, Total 5600 C
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AM-SB-09 (5'-7') Benzene 93 H C Ethylbenzene 2600 *H C Naphthalene 32000 H A,C 1,2,4-Trimethylbenzene 29000 H C 1,3,5-Trimethylbenzene 8400 *H C Xylenes, Total 15000 H C	AM-SB-14 (1'-4') 1,2,4-Trimethylbenzene 2200 C 1,3,5-Trimethylbenzene 1800 C Benzene 800 C Naphthalene 1000 C Toluene 3000 C Xylenes, Total 6600 C
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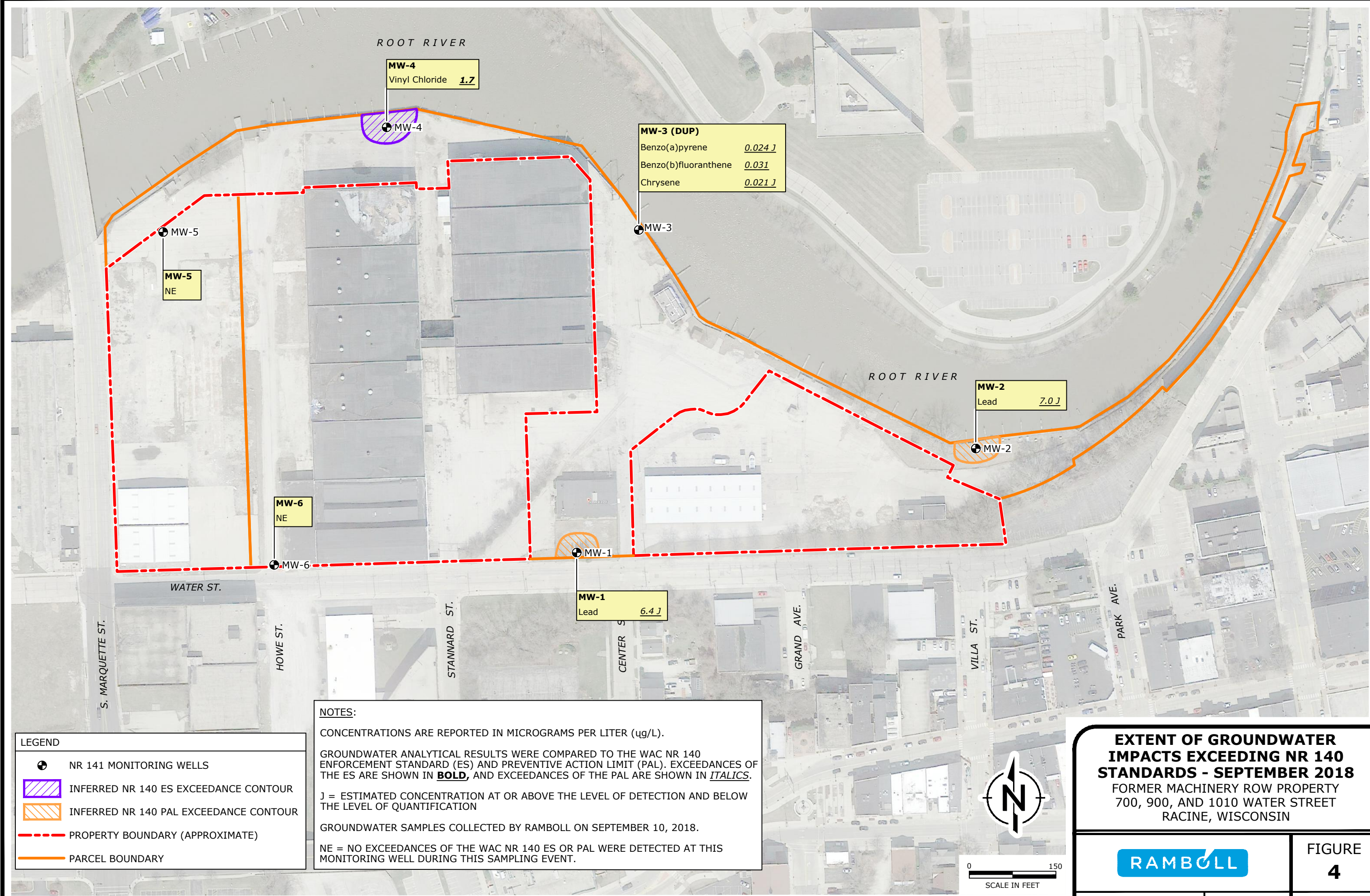
AM-SB-15 (2'-4') Benzene 230 C
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AM-SB-17 (1'-2') Benzene 62 C

AM-SB-04 (2'-3') Benzene 94 C

AM-SB-12 (2'-4') Naphthalene 850 C
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LEGEND

- NR 141 MONITORING WELLS
- INFERRED NR 140 ES EXCEEDANCE CONTOUR
- INFERRED NR 140 PAL EXCEEDANCE CONTOUR
- PROPERTY BOUNDARY (APPROXIMATE)
- PARCEL BOUNDARY

NOTES:

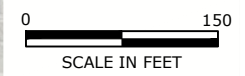
CONCENTRATIONS ARE REPORTED IN MICROGRAMS PER LITER (µg/L).

GROUNDWATER ANALYTICAL RESULTS WERE COMPARED TO THE WAC NR 140 ENFORCEMENT STANDARD (ES) AND PREVENTIVE ACTION LIMIT (PAL). EXCEEDANCES OF THE ES ARE SHOWN IN **BOLD**, AND EXCEEDANCES OF THE PAL ARE SHOWN IN *ITALICS*.

J = ESTIMATED CONCENTRATION AT OR ABOVE THE LEVEL OF DETECTION AND BELOW THE LEVEL OF QUANTIFICATION

GROUNDWATER SAMPLES COLLECTED BY RAMBOLL ON SEPTEMBER 10, 2018.

NE = NO EXCEEDANCES OF THE WAC NR 140 ES OR PAL WERE DETECTED AT THIS MONITORING WELL DURING THIS SAMPLING EVENT.



EXTENT OF GROUNDWATER IMPACTS EXCEEDING NR 140 STANDARDS - SEPTEMBER 2018

FORMER MACHINERY ROW PROPERTY
700, 900, AND 1010 WATER STREET
RACINE, WISCONSIN



FIGURE 4