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Remedial Design Report (Groundwater)

Former Kenosha Engine Plant
5555 - 30th Avenue, Kenosha, Wisconsin

City of Kenosha

WDNR FID 230004500, BRRTS #02-30-000327

Project number: 60576836

July 23, 2018

Quality information

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In conformance with NR 712.09 submittal certification requirements:

"I, Lanette Altenbach, 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, Wis. Adm. Code."

Reviewed By: Lanette Altenbach, P.G., CPG
Senior Hydrogeologist

"I, Kevin Brehm, hereby certify that I am a registered professional engineer in the State of Wisconsin, registered in accordance with the requirements of ch. A-E4, Wis. Adm. Code; that this document has been prepared in accordance with the Rules of Professional Conduct in ch.A-E8, 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, Wis. Adm. Code."

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List of Acronyms

%	Percent
AECOM	AECOM Technical Services, Inc.
bgs	below ground surface
cm/sec	centimeters/second
COC	contaminants of concern
c-DCE	cis-1,2-dichloroethene
DHC	*Dehalococcoides spp.*
ERD	Enhanced Reductive Dechlorination
g/kg	grams of (ISCO treatment chemistry) per kilogram (of soil)
ISCO	In-Situ Chemical Oxidation
KEP	Kenosha Engine Plant
mL/min	milliliters per minute
OSHA	Occupational Safety and Health Administration
PCE	Tetrachloroethene (or also tetrachloroethylene)
RADR	Remedial Action Documentation Report
RAOR	Remedial Action Options Report
TCE	Trichloroethene (or also trichloroethylene), a common chlorinated volatile organic compound used in the degreasing of metal parts and equipment.
µg/L	micrograms per kilogram
USEPA	United Stated Environmental Protection Agency
VOCs	volatile organic compounds
WAC	Wisconsin Administrative Code
VC	vinyl chloride
WDNR	Wisconsin Department of Natural Resources
WPDES	Wisconsin Pollutant Discharge Elimination System

Executive Summary

AECOM Technical Services, Inc. (AECOM) has prepared this groundwater remedial design report for the City of Kenosha to address impacts to groundwater from automotive manufacturing operations at the former Kenosha Engine Plant (KEP). The KEP is located at 5555 - 30th Avenue in the city of Kenosha, Kenosha County, Wisconsin on approximately 100 acres of land The property is currently vacant. Three groundwater treatment systems are housed in small treatment buildings that include Sump 6 (northeast corner), Central (Sumps 18 and 23) and Southern (Sumps 7 and 17R). The site is relatively level and soil remediation (select areas of vadose zone excavation) has been completed.

Historic environmental impacts resulting from manufacturing operations were reported to the Wisconsin Department of Natural Resource (WDNR) at the time they occurred and/or were discovered by the site operator. To some extent, these impacts were investigated, and remedial efforts were conducted at the time of the reported releases. Investigations were conducted in the 1990's prior to demolition of buildings where manufacturing operations were discontinued. In 2010, manufacturing operations were permanently discontinued as part of the bankruptcy of the Chrysler Corporation. The bankruptcy court ordered the establishment of a bankruptcy trust to administer decommissioning of the plant, sales of equipment, and razing of the buildings. Site investigation and soil remediation were conducted after the site was abandoned (to the City) as the end of the bankruptcy process.

Fill material of varying thickness covers the entire site; below, the site geology consists of glacio-lacustrine sand and silt that comprises the upper or shallow aquifer unit of the water table. Beneath the sand aquifer is the clay till that acts as an aquitard to the deeper bedrock aquifers due to its low hydraulic conductivity and permeability, moderate thickness, density, and regional extent.

The water table at KEP typically occurs at a depth of 8 to 11 feet below ground surface (bgs). Horizontal groundwater flow is generally toward the northeast, east, and southeast across the site, both at the water table and just above the clay-till boundary. The groundwater flow direction is fairly consistent throughout the year with a general eastward flow modified by the effect of the existing groundwater recovery systems. There is little seasonal variation. Groundwater impacts are present in the shallow sand and in deeper silt portions of the unconsolidated aquifer. The existing groundwater recovery systems are not treating the sources of the groundwater contamination but are primarily controlling groundwater flow and limiting migration of contamination. More active groundwater treatment at the source areas is necessary to reduce contaminant mass to generate stable or receding groundwater plume conditions such that site closure can be achieved.

Treatability and pilot test studies were conducted to evaluate various in-situ treatment options. Both in-situ chemical oxidation (ISCO) and/or enhanced reductive dechlorination (ERD) were able to treat the groundwater impacts. The proposed plan for groundwater remediation is for in-situ treatment at each of the following four areas:

- Treatment Area 1 is the largest groundwater plume and is located over the central portion of the site.
- Treatment Area 2 is located along the northern property boundary around MW-31.
- Treatment Area 3 is a small area located south of the main gate at the end of 26th Avenue.
- Treatment Area 4 is the Jockey parking lot.

The existing perimeter monitoring well/piezometers will be used to monitor remediation and new monitoring wells and piezometers will be installed to monitor the each of the groundwater treatment areas. The specific remedial approach for each treatment area will be provided as part of a technical bid process to select the lowest, most responsive and qualified bidder to conduct a performance-based groundwater remediation.

1.0 Introduction

AECOM Technical Services, Inc. (AECOM) has prepared this groundwater remedial design report for the City of Kenosha to address impacts to groundwater from automotive manufacturing operations at the former Kenosha Engine Plant (KEP). The remedial design report for soil was submitted separately. This report was prepared to meet Wisconsin Administrative Code (WAC) NR 724 requirements.

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1.2 Site Location and Description

The KEP is located in the southeast ¼ of Section 36, Township 2 North, Range 22 East (Figure 1). The KEP includes approximately 100 acres of land and is located at 5555 - 30th Avenue in the city of Kenosha, Kenosha County, Wisconsin. The property is currently vacant; however, three groundwater treatment systems are housed in small treatment buildings that include Sump 6 (northeast corner), Central (Sumps 18 and 23) and Southern (Sumps 7 and 17R) as depicted on Figure 2. The site is relatively level and soil remediation (select areas of vadose zone excavation) has been completed. The remaining surface paving is being removed, the site will be graded to ensure proper drainage on site and a temporary vegetated cap will be placed on the site until redevelopment occurs. This site grading and surface work is anticipated to be mostly completed in the summer of 2019.

The overall site layout, including the existing perimeter monitoring well network, groundwater recovery systems, and surrounding properties, is shown in Figure 2. Figure 3 depicts existing utilities and access roads. Existing and proposed site grades are depicted in Figure 4.

2.0 Background

Historic operations at the site included complete automobile manufacturing and assembly, while more recent operations were focused on the manufacture of automotive engines. The KEP buildings were demolished in 2013 and the building floors were retained to act as a temporary cap over impacted soil and groundwater. Soil remediation activities were commenced in 2016 and the final soil excavation was completed in September 2018. Currently, the remaining paving was removed in late 2018 and early 2019 while final grading and temporary cap placement started in the spring of 2019 and is expected to be completed mid-summer. The temporary cap will remain in place until redevelopment occurs.

2.1 Site Investigation

Historic environmental impacts resulting from manufacturing operations were reported to the Wisconsin Department of Natural Resource (WDNR) at the time they occurred and/or were discovered by the site operator. To some extent, these impacts were investigated, and remedial efforts were conducted at the time of the reported releases. Investigations were conducted in the 1990's prior to demolition of buildings where manufacturing operations were discontinued. Underground storage tanks were upgraded or removed and limited remediation was conducted. The remediation typically consisted of soil removal and disposal followed by the installation of groundwater recovery systems when groundwater releases were observed.

In 2009 the former owner declared bankruptcy and in 2010 manufacturing operations were permanently discontinued. The bankruptcy court ordered the establishment of a bankruptcy trust to administer decommissioning of the plant, sales of equipment, and razing of the buildings. The building floors and paved areas between buildings were retained to act as a cap over impacted soil and groundwater during subsequent remediation. During liquidation activities, Phase I and Phase II Environmental Site Assessments were conducted by the City of Kenosha in 2011 and 2012, prior to the site's abandonment under the bankruptcy court order in January 2013. Site investigation activities incorporated the results of the Phase II ESAs and were initiated after the property was transferred to the City. The investigation was completed in 2014 in general conformance with WAC NR 716, (AECOM, March 2015).

2.1.1 Geology

Fill material of varying thickness covers the entire site; below, the site geology consists of glacio-lacustrine sand and silt that comprises the upper or shallow aquifer unit of the water table. Beneath the sand aquifer is the clay till that acts as an aquitard to the deeper bedrock aquifers due to its low hydraulic conductivity and permeability, moderate thickness, density, and regional extent. This clay till may contain groundwater at some locations but is not capable of containing or transmitting significant quantities groundwater. The lithology encountered at the sites includes the following:

- Fill – generally consisting of clay, sand, silt, crushed gravel, and in some areas, foundry sand. The majority of the concrete, brick, wood, and demolition debris fill to a depth of four feet below street grade was removed during the soil excavation work conducted in 2016 – 2018. The fill ranges in thickness from approximately 1.5 to 18.5 feet deep, with an average thickness of 7 to 9 feet.
- Silty Clay/Clayey Silt – a discontinuous thin layer of silty clay and clayey silt underlies the fill unit. This layer is generally described as very dark brown to black, dry to moist, slightly-cohesive, low-plasticity, and soft.

- Sand/Silty Sand – this generally consists of a brown, dry to wet, loose to dense sands and silts and comprises the "shallow sand" or "water table" portion of the unconsolidated aquifer. This unit ranges in thickness from 10 to 18 feet bgs.
- Silt/Clayey Silt – a discontinuous layer of lacustrine silt and/or clay separates the silty sand aquifer from the glacial clay till below. This lacustrine layer is one-two feet thick, occurring at approximately 18 to 19 feet bgs and is discontinuous, found most continuously in the western side of the KEP. The unit is generally described as grayish brown, wet, cohesive, medium plasticity, and firm to stiff. This unit comprises the "deeper silt" or "piezometer" portion of the unconsolidated aquifer.
- Clay till – a glacial till layer, which consists of dark gray, wet, cohesive, plastic, and hard clay with stones. This unit is typically encountered at depths of 22 feet (on the west side) to 35 feet (on the east side) bgs and constitutes the lower vertical boundary of groundwater impact.

2.1.2 Hydrogeology

The water table at KEP typically occurs at a depth of 8 to 11 feet below ground surface (bgs). Horizontal groundwater flow is generally toward the northeast, east, and southeast across the site, both at the water table and just above the clay-till boundary. The groundwater flow direction is fairly consistent throughout the year with a general eastward flow modified by the effect of the existing groundwater recovery systems. There is little seasonal variation. The most recent groundwater elevations are depicted in Figures 5 and 6, the potentiometric surface for the water table monitoring wells and piezometers, respectively.

Site-wide vertical gradients are generally low (less than 0.001 to 0.11) and generally downward, although some upward gradients occurred (likely due to recharge events and other natural influences). At the time of the site investigation there were five groundwater recovery systems that influenced local areas of flow on-site and maintained hydraulic containment of impacted groundwater on-site.

In 2016 during the ISCO pilot test, located on the west central portion of the KEP, horizontal hydraulic gradients at the KEP ranged from 0.002 to 0.01 in the shallow sand portion of the aquifer and 0.002 to 0.008 in the deeper silt portion of the aquifer. The hydraulic conductivity is approximately 10^{-2} centimeters/second (cm/sec) in the upper sand portion of the unconsolidated aquifer (water table) and 10^{-3} cm/sec to 10^{-4} cm/sec in the deeper silt portion of the unconsolidated aquifer. The average linear velocity of groundwater across the KEP is approximately 175 feet per year in the shallow sand portion of the aquifer (at the water table) and approximately 30 feet per year in the deeper silt portion of the aquifer (near the clay till interface).

In 2017 during the ERD pilot test conducted near the center of the KEP the horizontal hydraulic gradients ranged from 0.002 to 0.004 in the shallow sand portion of the aquifer and 0.002 to 0.007 in the deeper silt portion of the aquifer. The hydraulic conductivity is approximately 10^{-2} centimeters/second (cm/sec) in the upper sand portion of the unconsolidated aquifer (water table) and 10^{-3} cm/sec to 10^{-4} cm/sec in the deeper silt portion of the unconsolidated aquifer. The average linear velocity of groundwater across the KEP ranged from 160 to 790 feet per year in the shallow sand portion of the aquifer (at the water table) and 2.4 to 9.6 feet per year near in the deeper silt portion of the aquifer (near the clay till interface).

Vertical gradients during operation of the groundwater recovery system in this area were consistently downward (0.005 to 0.01). After suspension of the groundwater recovery system, vertical gradients have been variable between 0.01 downward and 0.02 upward, likely due to recharge events and other natural influences.

2.2 Summary of Prior Remedial Actions

Historically, remedial activities conducted at the KEP by Chrysler responded to reported releases to the environment and subsurface conditions encountered during reconstruction of the facility. These remedial activities typically included soil excavation and installation/operation of groundwater recovery systems as documented in prior reports. In many cases the remedial activities were not complete remediation but were implemented as source-control measures. The residual impacts remaining after implementation of these historic remedial efforts were considered as impacted areas during the evaluation of the 2014 site investigation data.

In addition to the historic excavation activities conducted by Chrysler, remedial excavation of targeted areas was conducted in multiple phases between 2012 and 2018 by the City of Kenosha. Three of the original five groundwater recovery systems continue to operate at the KEP to reduce the potential for off-site groundwater migration. Additional details regarding prior remedial actions conducted at the KEP are summarized in the *Remedial Action Options Report* (RAOR; AECOM, April 2015) and *Remedial Action Documentation Report: Phase I Groups, A, B, C, E, G, H and J* (RADR; AECOM, July 2018). Areas where vadose-zone soils were removed as part of soil remediation are depicted in Figure 7.

2.3 Conceptual Site Model

The KEP site has more than 100-year history of manufacturing. Industrial operations originated with a bicycle manufacturer that advanced to truck manufacturing (for the World War I efforts) then automotive manufacturing, as technology and consumer needs changed. The KEP has been reconfigured many times in its history and some of that history is buried in former building footprints.

2.3.1 Contaminants of Concern

Automotive manufacturing uses many petroleum-based fluids, and prior to 1980 chlorinated solvents were also used to remove the oily petroleum residues from the manufactured product. Since 1980, water-based solvents were used for degreasing. Uses of the liquids resulted in releases to the environment over the years. As identified by the site investigation the following are the contaminants of concern (COC):

- Petroleum Volatile Organic Compounds (VOCs): Benzene, naphthalene and, to a lesser extent, xylenes.
- Chlorinated VOCs: Tetrachloroethene (PCE, in several isolated and limited areas), trichloroethene (TCE, the primary COC), and their dechlorinated breakdown compounds, cis-1,2-dichloroethene (DCE) and vinyl chloride (VC).

2.3.2 Extent of Groundwater Impacts

Groundwater impacts are present in the shallow sand and in deeper silt portions of the unconsolidated aquifer. The existing groundwater recovery systems are not treating the sources of the groundwater contamination but are primarily controlling groundwater flow and limiting migration of contamination. More active groundwater treatment at the source areas is necessary to reduce contaminant mass to generate stable or receding groundwater plume conditions such that site closure could be achieved.

Source areas of TCE in groundwater have been identified throughout the site (see Figures 8 and 9). TCE in these source areas is degrading, as evidenced by the higher concentrations of c-DCE and VC; however, the natural site conditions are not conducive to efficient or complete degradation.

2.3.3 Potential Receptors

Potential receptors include site workers, residents in the area surrounding the KEP, and the general public that may traverse the site. Potential exposure pathways evaluated include direct contact with contaminated soil (ground surface to four feet bgs), direct contact with contaminated soil or groundwater (may extend below four feet bgs) during future excavation activities associated with redevelopment, inhalation of contaminated soil/dust, contact or ingestion of contaminated groundwater, and vapor intrusion. Each of these pathways has been determined to be incomplete, has been mitigated, or is in the process of being mitigated:

- The risk of direct-contact with impacted soil has been mitigated by the targeted soil remediation (excavation), backfilling with soil and/or aggregate approved under the *Soil Management Plan* (AECOM, 2016) and will be further mitigated when the final grading and temporary cap are installed in the spring of 2019.
- Future redevelopment that requires excavation of impacted soil will be required to comply with the existing *Soil Management Plan* (AECOM, 2016) or will be required to develop and comply with a new soil management plan that includes protective controls regarding soil work, staging, transportation and disposal, run off, and dust.
- The KEP is served by the City of Kenosha municipal water supply and sanitary sewer. The City uses water from Lake Michigan for its potable water supply and groundwater is not permitted for potable or production use within City limits.
- Subsurface utilities, such as storm sewer and sanitary sewer lines, are also potential contaminant migration pathways. The storm sewers on the north half of the KEP drain to Pike Creek at 50th Street. Pike Creek flows to the east-southeast and eventually into Lake Michigan. Storm sewers in the southern half of the KEP drain to the main sewer in 60th Street. Specific potential pathways include migration to the 52nd Street right-of-way to the north near the northwest corner of the KEP and migration down the utility corridors of 54th Street to the east. The storm sewer backfill does not appear to be a preferential pathway based on groundwater monitoring conducted at the site. Sanitary sewers were disconnected at the property boundary when the building were razed in 2011-2012 and sanitary lines present in the subsurface within the property boundaries were removed (in part) during soil remediation completed in 2016 through 2018. Thus, the utility corridors are considered an incomplete pathway.
- The United States Environmental Protection Agency (USEPA) conducted a subsurface vapor migration study (USEPA, September 2011), which was provided to the WDNR. The vapor study collected samples in the areas of specific potential pathways, as well as other areas surrounding the KEP. USEPA concluded that vapor intrusion was not a risk to the surrounding properties. Vapor intrusion risk will be mitigated at the KEP because the City of Kenosha will require a vapor barrier as part of any new construction.

2.4 Remedial Action Selection

A range of alternatives for remediating impacted soil and groundwater at the KEP based on the chemicals present, the nature and extent of the contaminated media, site characteristics, and future redevelopment impacts were evaluated in general accordance with WAC NR 722. The remedial alternatives evaluation process is documented in the RAOR (AECOM, April 2015). The RAOR was approved by the WDNR on June 18, 2015.

Based on the evaluation presented in the RAOR, Alternative 4 (Soil and Groundwater Source Control) was identified to be the most technically and economically feasible alternative for implementation at the KEP. This remedy includes a combination of soil excavation, capping, and in-situ groundwater treatment using in-situ chemical oxidation (ISCO) and/or enhanced reductive dechlorination (ERD). The selected approach addresses the remediation goals and objectives for site-wide management of residual soil and groundwater impacts, focusing on protection of human health and the environment, while considering potential redeveloped site uses and available funding for remediation.

2.5 Treatability and Pilot Studies

Pre-design treatability studies on soil and groundwater samples were conducted in 2015 to evaluate ISCO and ERD as potential remedial options for groundwater.

ISCO treatability studies evaluated various oxidants and oxidant loading rates required to achieve COC reductions. Five oxidants were evaluated including: alkaline persulfate, sodium persulfate with iron activation, alkaline persulfate with calcium peroxide, sodium permanganate, and RegenOx™. Based on the treatability study results, sodium permanganate was the most-effective treatment chemistry of the five oxidants evaluated and a chemical loading rate of three grams treatment chemistry per kilogram of soil (g/kg) was selected for the field pilot test. The remaining four treatment chemistry options evaluated had inconclusive results for success in treating the chlorinated VOCs.

The ERD treatability study evaluated the ability of carbon substrates to stimulate native bacteria capable of biodegrading chlorinated VOCs. The in-situ microcosm study evaluated two carbon substrates: Emulsified Oil Substrate (EOS®), and ABC®+. EOS is a proprietary blend of plant-based fermentable carbon (soybean oil), nutrients, emulsifiers stabilizers. ABC+ contains a mixture of lactate, fatty acids, alcohols, phosphate buffer, and zero-valent iron. The substrates were applied to Bio-Trap® passive samplers and installed in monitoring wells/piezometers within known TCE source areas at the KEP for approximately two months. Based on the treatability study results, both substrates promoted anaerobic conditions; however, populations of specific dechlorinating bacteria known to degrade TCE (*Dehalococcoides spp.* ([DHC]) remained below functional levels. Therefore, bioaugmentation with a DHC culture was recommended for the pilot study.

Two pilot studies were conducted on separate areas of the KEP to evaluate the implementability and effectiveness of two different in-situ treatment techniques. The first pilot test evaluated ISCO treatment in an area of the KEP documented with some of the highest TCE concentrations observed in groundwater. The second pilot test evaluated ERD in an area with moderate TCE concentrations and TCE-degradation products in the groundwater. Competitive bids were solicited from three qualified groundwater remediation contractors and AECOM retained Redox Tech, LLC (Redox Tech) of Chicago, Illinois, to conduct both pilot tests.

Injection permit applications were prepared and submitted to the WDNR. After the permits were granted, the pilot test injections were scheduled. While the permit applications were pending, temporary wells were installed in each pilot test area. The temporary wells and select existing wells in each pilot test areas were sampled for baseline parameters prior to the pilot test injections.

The ISCO pilot test injection activities were initiated on December 5, 2016 and concluded on December 13, 2016. Six temporary monitoring wells were installed at varying distances from proposed injection locations to serve as pilot test monitoring points. Three existing monitoring well/piezometers locations were also used as monitoring points. The sodium permanganate oxidant solution was injected into the subsurface using direct-push technology with injection tooling that consisted of an outer casing with an expendable tip. Based on the treatability study results, the initial design mix included sodium permanganate (40% by weight) mixed with potable water to create a 3% by weight solution. Cold temperatures and the need for reduced injection pressures increased the pilot test injection duration. Monitoring of field parameters, depth to water and vapor monitoring in nearby manholes was conducted during the testing in conformance with permit-required monitoring. Post-treatment samples were collected four weeks after injection and again 14 weeks after injection.

A comparison of TCE concentrations in groundwater prior to and following the pilot injections documented that the selected oxidant chemistry was effective in reducing contaminant mass at most locations within the pilot study area. Significant COC molar mass reductions were documented one month following the pilot injection activities (January 2017). Although rebound occurred in some wells, based on groundwater results approximately three months following injection (March 2017), molar mass at those wells remained significantly below the baseline molar mass. The resulting overall average COC molar mass decrease between the baseline and March 2017 monitoring events was 31 percent (%). The most-significant decreases were in wells screened within the deeper silt portion of the aquifer (averaging 49% molar mass reduction) with lesser reductions in the shallow sand portion of the aquifer (averaging 18%). The report *In-Situ Chemical Oxidation Pilot Test Documentation Report* (AECOM, March 2018) contains a complete discussion of the findings. A copy of the report is attached to the Technical Plans and Specifications for Groundwater Remediation (AECOM, January 2019b). The ISCO pilot test results tables and figures are included in Appendix A.

The ERD pilot test injections were initially planned to be completed immediately following the ISCO injections in December 2016; however, unusually cold weather precluded the injections at that time and the pilot test was postponed until March 2017. Three temporary wells, two monitoring wells and two piezometers were used to monitor the ERD pilot test. The ERD injection points were placed at specific distances from the temporary wells. ABC+ and RTB-1 (bacterial culture) was injected into the subsurface using direct-push technology with injection tooling that consisted of an outer casing with an expendable tip. Based on the treatability study results, a total of 7,692 pounds of ABC^+ (5,292 pounds of ABC® and 2,400 pounds of zero-valent iron) was mixed with potable water to form 5,333 gallons of solution (approximately 12 percent by weight). Prior to mixing, sugar and yeast were added for the purpose of deoxygenating the water. The ABC^+ solution was augmented with 30 liters of RTB-1 culture. Monitoring of field parameters, depth to water and vapor monitoring in nearby manholes was conducted during the testing in conformance with permit-required monitoring.

Confirmation groundwater sampling events were conducted three months (June 2017), six months (September 2017), and one year (March 2018) after the pilot test injections. In general, VOC molar mass decreased in most wells, with an overall average COC molar mass decrease of 40% between the baseline and March 2018 monitoring events (approximately 12 months), which included TCE reductions of over 99% in all but one of the monitoring points within the injection area. Field parameters, dissolved iron concentrations, and dissolved gas concentrations generally indicated strongly-reducing conditions, conducive to ERD. However, DHC populations did not attain the 1E+04 cells/L population considered the threshold for generally-useful rates of reductive dechlorination. The ERD amendments reduced COC molar mass in the groundwater despite limited DHC population growth and sub-optimal TOC concentrations and/or pH levels in some wells. The report Reductive *Dechlorination Pilot Test Documentation Report* (AECOM, October 2018) contains a complete discussion of findings. A copy of this report is provided in the Technical Plans and Specifications for Groundwater Remediation (AECOM, January 2019b). The ERD pilot test results tables and figures are included in Appendix B.

2.6 Anticipated Post-Remedial Site Conditions

The site is currently zoned M-1 Light Manufacturing and M-2 Heavy Manufacturing. Redevelopment after remediation assumes the following:

- Post-remediation uses are anticipated to be commercial or light manufacturing;
- Residential uses for the site will not be considered;
- The City of Kenosha will require a vapor barrier system for new building construction;
- As redevelopment occurs, the buildings, pavement and landscape will provide the final cap, where necessary;
- Until a final cap is in place (through redevelopment) the site will be capped temporarily by vegetated soil;
- Impacted soil and groundwater encountered during site redevelopment activities will require special handling and disposal; and
- Institutional controls will be utilized to address residual soil and groundwater impacts that remain after completion of the remedial efforts.

3.0 Groundwater Remedial Design Considerations

3.1 Remedial Objective and Design Approach

The objective for the groundwater remedial action is reduction of groundwater contaminants in source areas of the KEP to establish a stable and shrinking plume, reduce the potential for offsite migration while removing the need for active groundwater recovery, and allow for redevelopment of the site considering potential redeveloped site uses.

The contaminants of concern at the KEP consist of chlorinated VOCs and petroleum VOCs with the highest concentration of a single analyte being TCE at 83,100 micrograms per liter (µg/L). The plume size encompasses approximately 1,500,000 square-foot area with an average 10-foot thickness in one larger area and three smaller areas. Although the groundwater WAC NR 140 Enforcement Standards (ES) were considered for use as the remedial endpoint, active remediation to these standards may not be technically or economically feasible for KEP given the context of the restricted post-development property use and available funding resources. It is anticipated that the post-remediation development plan will incorporate buildings and paved surfaces, which will provide additional protections against potential completion of the direct-contact and groundwater pathways. Thus, a target of 90% reduction in molar mass is selected as a remedial performance standard. The design considerations to achieve this reduction are described below.

Supplementing this Remedial Design Report are the bid documents for the planned performance-based groundwater remediation, in accordance with WAC NR 724. The performance-based specification allows each remedial contractor the freedom to propose their specific or preferred in-situ chemical treatment(s) because the in-situ groundwater treatment universe is continually improving. The selected remedial treatment will be based on approach, cost and timeframe to achieve the desired improvement of groundwater quality.

3.2 Groundwater Corrective Action Design

This design report describes the groundwater conditions at the KEP to support a performance-based groundwater remediation. As part of the public funding process, the groundwater remediation will be publicly-bid in a manner that remedial contractors will be asked to propose their own treatment mix and implement their described method that includes a guarantee for groundwater contamination reduction to achieve a 90% reduction in detected molar mass, rather than an absolute reduction of detected groundwater concentrations below NR 141 Enforcement Standards. Flexibility is planned and adjustments to the remedial design may be made, as necessary, based on work progress, timing, and conditions encountered in the field. Specific details included in the Technical Plans and Specifications for Groundwater Remediation (AECOM, January 2019b) describe how the performance-based remediation will be implemented and how performance will be assessed.

The results of the pilot tests indicate that in-situ remediation is an effective approach to achieve 90% COC molar mass reduction in the groundwater plumes. Due to the variability of VOC concentrations in groundwater and the findings of the ISCO and ERD pilot tests, the site will be spilt in to treatment areas for more-precise targeting of remedial actions (see Figure 10). The precise approach (ISCO, ERD, or some combination) will be proposed by potential remediation contractors to reach the targeted COC reduction. An example of a proposed approach is a combined remedial strategy of ERD and ISCO through a series of treatment grids and reactive zones. This approach may include a phased series of injections and monitoring periods between injection events.

The treatment proposed by bidders will be evaluated using a scoring system for technical approach, past performance and quality and cost. The selected bidder will be determined by the City in consultation with AECOM after the bidders are scored.

3.2.1 Planning and Permits

Following WDNR approval of the groundwater design report (and technical specifications), the planned groundwater remediation will be advertised for public comments to comply with the requirements of the Ready for Reuse Grant that will be used to fund this project. The advertisement for bids for groundwater remediation will be released mid-way through the public comment period. The advertisement for bids requires a minimum of two weeks of publication, and as such, the overlap between receipt of public comments and the receipt of the public bids will permit time to address any public comments that may be received that would necessitate modification(s) incorporation into the technical specifications.

The Technical Plans and Specifications for Groundwater Remediation prepared by AECOM as a companion document to this design report will require that the successful bidder to prepare injection or other permits necessary to implement their specified remediation. AECOM will provide technical support and will review the permit applications before they are submitted. The contractor will be required to include permitting time in the schedule required as part of their bid. AECOM will assist with the preparation of the injection permit applications and upon receipt of the permits, with conducting monitoring required by the permit(s).

A temporary exemption pursuant to WAC NR 140.28(5), approval to inject materials under WAC NR 812.05, and a Wisconsin Pollutant Discharge Elimination System (WPDES) permit are required to complete the groundwater remediation. AECOM will prepare and submit an Injection Request for submittal to the WDNR. As part of the Injection Request, an application for coverage under the WPDES general permit for Discharge of Contaminated Groundwater from Remedial Action Operations (WI-0046566-6) will also be prepared. The selected remedial contractor will be required to provide the documentation needed to support these permit requests.

3.2.2 Health and Safety Plan

Consistent with the requirements of the Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120), a site-specific health and safety plan must be developed and followed during the implementation of the proposed remedial action. The Health and Safety Plan was developed as part of the site investigation activities and will be updated for use by AECOM during the remediation work. All remediation contractors will be responsible for their own site-specific Health and Safety Plans. The contractor will have overall operational authority for health and safety during active site remediation work.

3.2.3 Site Security and Fencing

The existing perimeter chain link fence and gates will remain throughout implementation of the remedial actions. Temporary fencing may be necessary depending upon the treatment contractors plan and/or to meet the requirements of the contractor’s Health and Safety Plan as well as when other contractors may be working on different parts of the KEP site.

3.2.4 Traffic Control Plan

No closures of the public roadways are necessary for this work because the work will be conducted within the property boundaries on private property. Truck traffic will enter/exit the primary work area via the gated entrance at 26th Avenue and 52nd Street.

3.2.5 Utilities

Active utilities that are to remain in operation are identified in Figures 3 and 4 and must be protected by the contractor during performance of the remedial activities. These include:

- ATC-owned overhead power transmission lines (north to south) in a center easement on the KEP,
- We Energies-owned overhead power distribution lines that traverse the site from north to south located in on the eastern property boundary;
- Overhead power lines that run from a pole on the west central property line eastward to power the central groundwater remediation system;
- Site-wide storm sewers, new and existing, as depicted in Figure 4;
- Subsurface piping and electrical power associated with the pumps for the groundwater recovery systems; and
- Three active sanitary discharge lines associated with the groundwater recovery systems.

Abandoned utilities that served the KEP during its active operations that may be encountered include; potable water, fire-suppression water lines, internal sanitary sewers, internal underground electrical, and former subsurface process piping. These utilities were removed from the site as encountered during subsequent soil remedial activities, generally to a depth of four feet bgs. Underground electrical services (except as noted above), sanitary sewers (except as noted above) and potable water were cut and capped at the property boundary in conformance with City of Kenosha ordinances. Most of the abandoned utilities that were found during the remedial soil excavations were capped at the excavation edge. Thus, these utilities are no longer continuous nor connected and are not expected to interfere significantly with the groundwater treatment, as the bulk of the treatment activities will occur below the level that these utilities would normally be encountered (*i.e.*, groundwater treatment zone is 10 to 20 feet bgs and the abandoned utilities are generally 8 feet bgs or less).

3.2.6 Waste Management

Soil cuttings from monitoring well installations will be placed in 55-gallon drums, the soil will be characterized, and properly disposed. Decontamination fluids and monitoring well purge water will be treated in the on-site central remediation groundwater treatment system and discharged to the sanitary sewer under the existing permit.

The remedial contractor will be responsible for wastes generated by their remediation activities and must provide all documentation regarding generation, characterization, and disposal to the City of Kenosha.

3.3 Implementation

It is anticipated that the delivery of aquifer amendments for in-situ remediation will likely be conducted using direct-push technology, similar to the techniques used during the pilot testing. Soil boring spacing and locations will be determined and documented in each individual bid. Once the bids have been received, evaluated and a bidder selected, the name of the selected contractor and their proposed remedial approach will be submitted to the WDNR. The specific amendment(s) and implementation approach will also be incorporated into the injection permit request(s).

4.0 Post Groundwater Remediation Monitoring

4.1 Groundwater Monitoring During Remediation

The existing perimeter monitoring well/piezometers will continue to be monitored by AECOM on a semi-annual basis. The existing perimeter wells are included in Table 1. Perimeter wells at three locations were damaged during soil remediation and are planned for replacement as part of the groundwater remediation program. These planned replacements are also listed on Table 1.

WAC NR 141-compliant groundwater monitoring wells and/or piezometers will be installed after approval of this remedial design report and prior to implementation of the remedial activities to monitor baseline conditions as well as conditions during and after remediation. Groundwater samples will be collected by AECOM from the planned monitoring wells/piezometer locations before the remedial work is conducted to obtain baseline measurements prior to remediation. The schedule for post-remediation monitoring will be dependent upon the proposed remedial contractors plan. Performance confirmation sampling is anticipated to be conducted quarterly basis. A list of the wells, their locations and planned sample events will be updated after the remediation contractor has been selected and approved for remediation. This update will be submitted to the WDNR with the remedial contractor identification and proposed remedial plan.

Groundwater monitoring during remediation has been planned on a per-treatment area basis and proposed treatment area and monitoring locations are depicted on Figure 10.

- Treatment Area 1 is the largest area of groundwater treatment located over the central portion of the site. Thirteen water table monitoring wells and eight piezometers will be installed around the perimeter and through the middle of the treatment area.
- Treatment Area 2 is located along the northern property boundary around MW-31. Three water table monitoring wells and two piezometers will be installed around the southern and eastern boundaries of the treatment area. Additionally, perimeter wells MW-31, MW-113, MW-114 and PZ-118 will be sampled during remediation.
- Treatment Area 3 is a small area located south of the main gate at the end of 26th Avenue. Three water table monitoring wells and three piezometers will be installed north, east and south of the treatment area.
- Treatment Area 4 is the Jockey parking lot. Four existing water table monitoring wells and one new piezometer will be installed for monitoring during remediation.

The areas, the list of wells by area and proposed analytes (with analytical methods) are shown in Table 1. Some perimeter existing monitoring wells will be used for Treatment Areas 2 and 4

4.1.1 Sampling and Collection Methods

Groundwater samples will be collected from existing and newly-installed monitoring wells and piezometers as shown in Table 1. Before sampling, depth-to-groundwater measurements will be collected for calculating the groundwater flow direction. Depth to water will be measured using an audible water level indicator and measurements will be referenced to the top of the surveyed well casing at each monitoring point.

Prior to sample collection, monitoring wells will be purged at a low-flow rate using a peristaltic pump. The wells will be purged at a pumping rate of approximately 200 milliliters per minute (mL/min) or less if needed to reduce the turbidity of the groundwater and/or maintain groundwater levels. If the wells purge dry, a bailer will be used to collect the groundwater samples after the well has been purged dry and the water level has recovered to within 90% of its original level. Groundwater field measurements, including temperature, pH, conductivity, dissolved oxygen, and oxidation-reduction potential will be measured at approximate five-minute intervals using a portable water quality meter (*e.g.,* Aqua Troll or equivalent meter) with a flow through cell. After groundwater field parameters stabilize, groundwater samples will be collected at the low-flow sampling rate of 200 mL/min or less as required maintain the groundwater level without drawdown and low turbidity levels.

Groundwater samples will be collected in laboratory-supplied bottles containing preservatives, as appropriate. Duplicate samples (1 per 10 samples) and a trip blanks (1 per shipment container or one per day) will be submitted for analysis for quality control (QC) purposes. The samples will be placed on ice in an insulated rigid cooler and delivered with completed chain-of-custody forms to Pace Analytical (a Wisconsin certified laboratory). Groundwater samples will be analyzed using SW846 Method 8260 for VOCs.

4.2 Site Restoration

Areas disturbed performing remedial activities will be repaired and seeded following completion of the groundwater remediation activities to repair any damage to the vegetative soil cap in place from previous soil remediation activities. New seeding will be watered, as needed, to maintain soil moisture for a minimum of two weeks after seeding. The water will be applied at a rate that does not result in soil erosion or runoff.

If weather or other unforeseen delays prevent implementation or completion of the site restoration activities based on permanent seeding time periods, then the final site restoration activities (seeding and mulching) will be completed at the beginning of the next growing season.

5.0 Documentation and Implementation Schedule

5.1 Documentation

Remediation activities will be documented in a field logbook or on designated field sheets that will be maintained in the project file. Included in the daily documentation are:

- Procedures for routine activities associated with the groundwater remedial action activities;
- Personnel working on the KEP;
- Chronological log of site activities;
- Daily tailgate meeting and site safety briefing summaries;
- Site visitors log; and,
- Other pertinent sample collection data and/or field/weather observations.

Upon completion of the groundwater remediation activities, data evaluation, and receipt of the groundwater remediation performance confirmation analytical results, a Groundwater Remedial Action Documentation Report to WDNR in accordance with NR 724. The Groundwater Remedial Action Documentation Report will summarize the on-site cleanup activities and describe the work completed, dates of completion, field observations, results from confirmation samples, quantities of materials removed, certificates of waste disposal, and well abandonment documentation.

5.2 Implementation Schedule

The planned implementation schedule is:

Activity	Days for Completion
Submit Groundwater Remedial Design Report and Groundwater Technical Specifications	1
WDNR Review and Approval	60
Publish Request for Public Comment	14
Request for Bids	28
Bid Opening and Review	5
Award of Contract, Common Council Approval and Signed Contract from Awarded Contractor	30
Prepare and Submit Injection Permit to WDNR	30
WDNR Permit Review and Issuance	60
Groundwater Remediation	12 to 24 months

6.0 Implementation Plan

Following is a listing of the primary tasks that will be implemented as part of the groundwater remedial action. The following provides a general implementation plan of groundwater remedial activities:

- Publish public notice for comments on the Groundwater Remediation Design Report (AECOM, January 2019a) and Technical Plans and Specifications for Groundwater Remediation (AECOM, January 2019b)
- Publicly bid groundwater remediation at the KEP
- Receive and evaluate bids
- Select remediation contractor and negotiate contract
- Conduct site preparation, injections, and site restoration activities
- Progress reports will be prepared to document intermediary milestones, such as after the following work phases:
  - Monitoring well/piezometer installation and baseline, pre-remediation groundwater monitoring
  - Injection completion
  - Annual groundwater monitoring (during remediation and post-remedial confirmation)
  - Other phases (*e.g.*, supplemental injections)
- Prepare and submit the Groundwater RADR at the completion of the remedial action for demonstration that the remedial objectives have been achieved.

It is anticipated that each progress report will be submitted to the WDNR approximately 60 days following completion of the work included in the progress report.

7.0 Reference

AECOM, March 2015, *Site Investigation Report*

AECOM, April 2015, *Remedial Action Options Report*

AECOM, Month, Soil Remediation Design Report

AECOM*, March* 2016, *Soil and Material Management Plan*

AECOM, March 2018, *In-Situ Chemical Oxidation Pilot Test Documentation Report*

AECOM, July 2018, *Remedial Action Documentation Report: Phase I Groups, A, B, C, E, G, H and J* (RADR; AECOM, July 2018)

AECOM, October 2018, *Enhanced Reductive Dechlorination Pilot Test Documentation Report*

AECOM, January 2019a, *Groundwater Remediation Design Report*

AECOM, January 2019b, *Technical Plans and Specifications for Groundwater Remediation*

Weston Solutions, Inc., September 2011, *Preliminary Investigation Report, Revision 3 for Chrysler Kenosha Engine Plant Site, Kenosha, Wisconsin,* prepared for the United States Environmental Protection Agency, Region V.

Tables

Table 1
Proposed Groundwater Monitoring
Monitoring Wells, Piezometers and Proposed Analytes
Former Kenosha Engine Plant

Perimeter Monitoring Wells

Sample Frequency	Semi-annually
Field Measurement	Temperature, pH, conductivity, dissolved oxygen, and oxidation reduction potential
Chemical Analysis	Volatile Organic Compounds (Analyzed by method SW-846 8260)
Existing Monitoring Wells and Piezometers	
(in order counterclockwise around KEP starting at NW corner)	
MW-101	West
MW-102	West
MW-103	West
MW-105	South (in sidewalk)
MW-107	South (in sidewalk)
MW-108	Southeast
MW-44	Southeast
MW-109	East-southeast
MW-110	East
MW-116	East
PZ-116	East
MW-117	East
PZ-117	East
MW-111	East
MW-112	East
MW-113	North
PZ-118	North
MW-31	North
MW-114	North
MW-115	North
MW-206	Southwest -Water level only
New Wells to be Installed	
MW-69R	East Side of KEP between 55th Street to the north and 56th Street to the south
PZ-69R	
MW-70R	
MW-71R	

Table 1
Proposed Groundwater Monitoring
Monitoring Wells, Piezometers and Proposed Analytes
Former Kenosha Engine Plant

Groundwater Treatment Area 1		
Sample Frequency	Quarterly	
Field Measurement	Temperature, pH, conductivity, dissolved oxygen, and oxidation reduction potential	
Chemical Analysis	Volatile Organic Compounds (Analyzed by method SW-846 8260)	
New Monitoring Wells/Piezometers to be Installed		
MW-2101	MW-2106	MW-2111
PZ-2101	MW-2107	PZ-2111
MW-2102	PZ-2107	MW-2112
MW-2103	MW-2108	PZ-2112
PZ-2103	MW-2109	MW-2113
MW-2104	PZ-2109	PZ-2113
MW-2105	MW-2110	MW-2114
PZ-2105	PZ-2110	PZ-2114
Additional analysis if Chemical Oxidation		
Analyte	*Analytical Method*	
Total Organic Carbon	SM 5310C	
Permanganate	Field Kit	
Chloride	EPA 300.0	
Barium	EPA 6020	
Chromium	EPA 6020	
Lead	EPA 6020	
Nickel	EPA 6020	
Additional analysis if Enhanced Reductive Dechlorination		
Analyte	*Analytical Method*	
TOC	SM 5310C	
Alkalinity	EPA 310.2	
Chloride	EPA 300.0	
Total Iron	EPA 6010	
Dissolved Iron	EPA 6010	
Total Manganese	EPA 6010	
Dissolved Manganese	EPA 6010	
Sulfate	EPA 300.0	
Sulfide		
Methane, ethane, ethene	EPA 8015B	
Barium	EPA 6020	
Chromium	EPA 6020	
Lead	EPA 6020	
Nickel	EPA 6020	

If other treatment alternatives are proposed, the proposed monitoring will be modfied.

Groundwater Treatment Area 2		
Sample Frequency	Quarterly	
Field Measurement	Temperature, pH, conductivity, dissolved oxygen, and oxidation reduction potential	
Chemical Analysis	Volatile Organic Compounds (Analyzed by method SW-846 8260)	
Existing Monitoring Wells and Piezometers		
MW-114	MW-113	
MW-31	PZ-118	
New Monitoring Wells/Piezometers to be Installed		
MW-2201	MW-2202	MW-2203
	PZ-2202	PZ-2203
Additional analysis if Chemical Oxidation		
Analyte	*Analytical Method*	
Total Organic Carbon	SM 5310C	
Permanganate	Field Kit	
Chloride	EPA 300.0	
Barium	EPA 6020	
Chromium	EPA 6020	
Lead	EPA 6020	
Nickel	EPA 6020	
Additional analysis if Enhanced Reductive Dechlorination		
Analyte	*Analytical Method*	
TOC	SM 5310C	
Alkalinity	EPA 310.2	
Chloride	EPA 300.0	
Total Iron	EPA 6010	
Dissolved Iron	EPA 6010	
Total Manganese	EPA 6010	
Dissolved Manganese	EPA 6010	
Sulfate	EPA 300.0	
Sulfide		
Methane, ethane, ethene	EPA 8015B	
Barium	EPA 6020	
Chromium	EPA 6020	
Lead	EPA 6020	
Nickel	EPA 6020	

If other treatment alternatives are proposed, the proposed monitoring will be modfied.

Table 1
Proposed Groundwater Monitoring
Monitoring Wells, Piezometers and Proposed Analytes
Former Kenosha Engine Plant

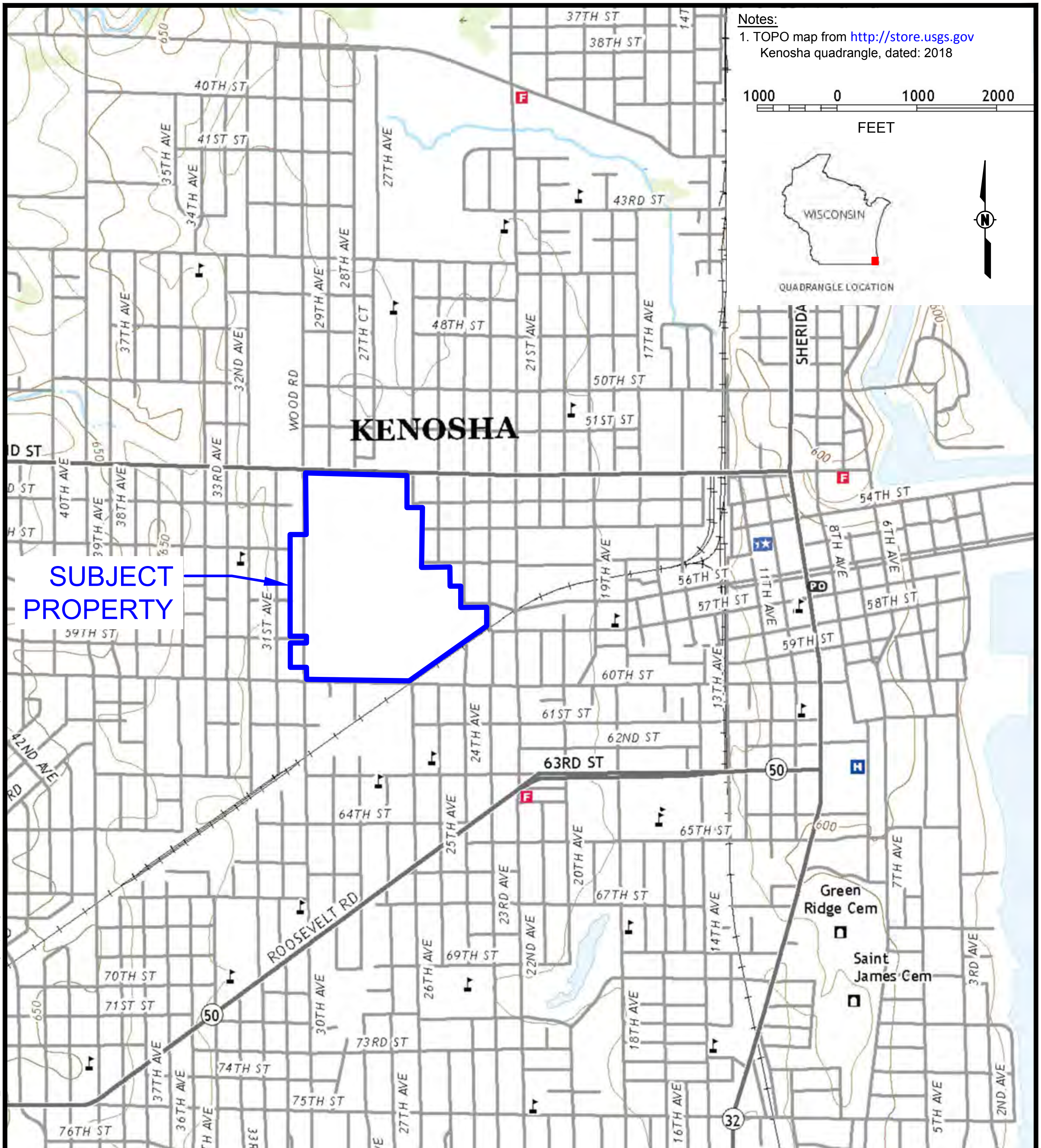
Groundwater Treatment Area 3		
Sample Frequency	Quarterly	
Field Measurement	Temperature, pH, conductivity, dissolved oxygen, and oxidation reduction potential	
Chemical Analysis	Volatile Organic Compounds (Analyzed by method SW-846 8260)	
New Monitoring Wells/Piezometers to be Installed		
MW-2301	MW-2302	MW-2303
PZ-2301	PZ-2302	PZ-2303
Additional analysis if Chemical Oxidation		
Analyte	*Analytical Method*	
Total Organic Carbon	SM 5310C	
Permanganate	Field Kit	
Chloride	EPA 300.0	
Barium	EPA 6020	
Chromium	EPA 6020	
Lead	EPA 6020	
Nickel	EPA 6020	
Additional analysis if Enhanced Reductive Dechlorination		
Analyte	*Analytical Method*	
TOC	SM 5310C	
Alkalinity	EPA 310.2	
Chloride	EPA 300.0	
Total Iron	EPA 6010	
Dissolved Iron	EPA 6010	
Total Manganese	EPA 6010	
Dissolved Manganese	EPA 6010	
Sulfate	EPA 300.0	
Sulfide		
Methane, ethane, ethene	EPA 8015B	
Barium	EPA 6020	
Chromium	EPA 6020	
Lead	EPA 6020	
Nickel	EPA 6020	

If other treatment alternatives are proposed, the proposed monitoring will be modfied.

Groundwater Treatment Area 4		
Sample Frequency	Quarterly	
Field Measurement	Temperature, pH, conductivity, dissolved oxygen, and oxidation reduction potential	
Chemical Analysis	Volatile Organic Compounds (Analyzed by method SW-846 8260)	
Existing Monitoring Wells and Piezometers		
MW-65	MW-108	MW-81
MW-77	MW-79	MW-82
MW-44	MW-80	
New Piezometer to be Installed		
PZ-82		
Additional analysis if Chemical Oxidation		
Analyte	*Analytical Method*	
Total Organic Carbon	SM 5310C	
Permanganate	Field Kit	
Chloride	EPA 300.0	
Barium	EPA 6020	
Chromium	EPA 6020	
Lead	EPA 6020	
Nickel	EPA 6020	
Additional analysis if Enhanced Reductive Dechlorination		
Analyte	*Analytical Method*	
TOC	SM 5310C	
Alkalinity	EPA 310.2	
Chloride	EPA 300.0	
Total Iron	EPA 6010	
Dissolved Iron	EPA 6010	
Total Manganese	EPA 6010	
Dissolved Manganese	EPA 6010	
Sulfate	EPA 300.0	
Sulfide		
Methane, ethane, ethene	EPA 8015B	
Barium	EPA 6020	
Chromium	EPA 6020	
Lead	EPA 6020	
Nickel	EPA 6020	

If other treatment alternatives are proposed, the proposed monitoring will be modfied.

Figures



AECOM

1555 RiverCenter Dr
Milwaukee, WI 53212
414.944.6080
www.aecom.com

SITE LOCATION (USGS TOPOGRAPHIC MAP)
KENOSHA ENGINE PLANT
CITY OF KENOSHA
KENOSHA, WISCONSIN

Drawn :	SAE	12/3/2018
Checked:	KC	12/3/2018
Approved:	LLA	12/3/2018
PROJECT NUMBER	60576836	
FIGURE NUMBER	1	

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LEGEND

- APPROXIMATE SITE BOUNDARY
- RAILROAD
- EXISTING FENCE
- REMEDIATION BUILDING
- SUMPS AND SANITARY OUTFALLS
- SUMP UTILITY LINES
- MONITORING WELLS AND PIEZOMETERS

NOTES

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH PRO, IMAGE DATED 7/6/2018; DOWNLOADED ON 12/3/2018.
2. BORDER DISCONTINUITIES ARE DUE TO ANGLE OF 2018 AERIAL.

0' 150' 300' 600'
SCALE

N

AECOM

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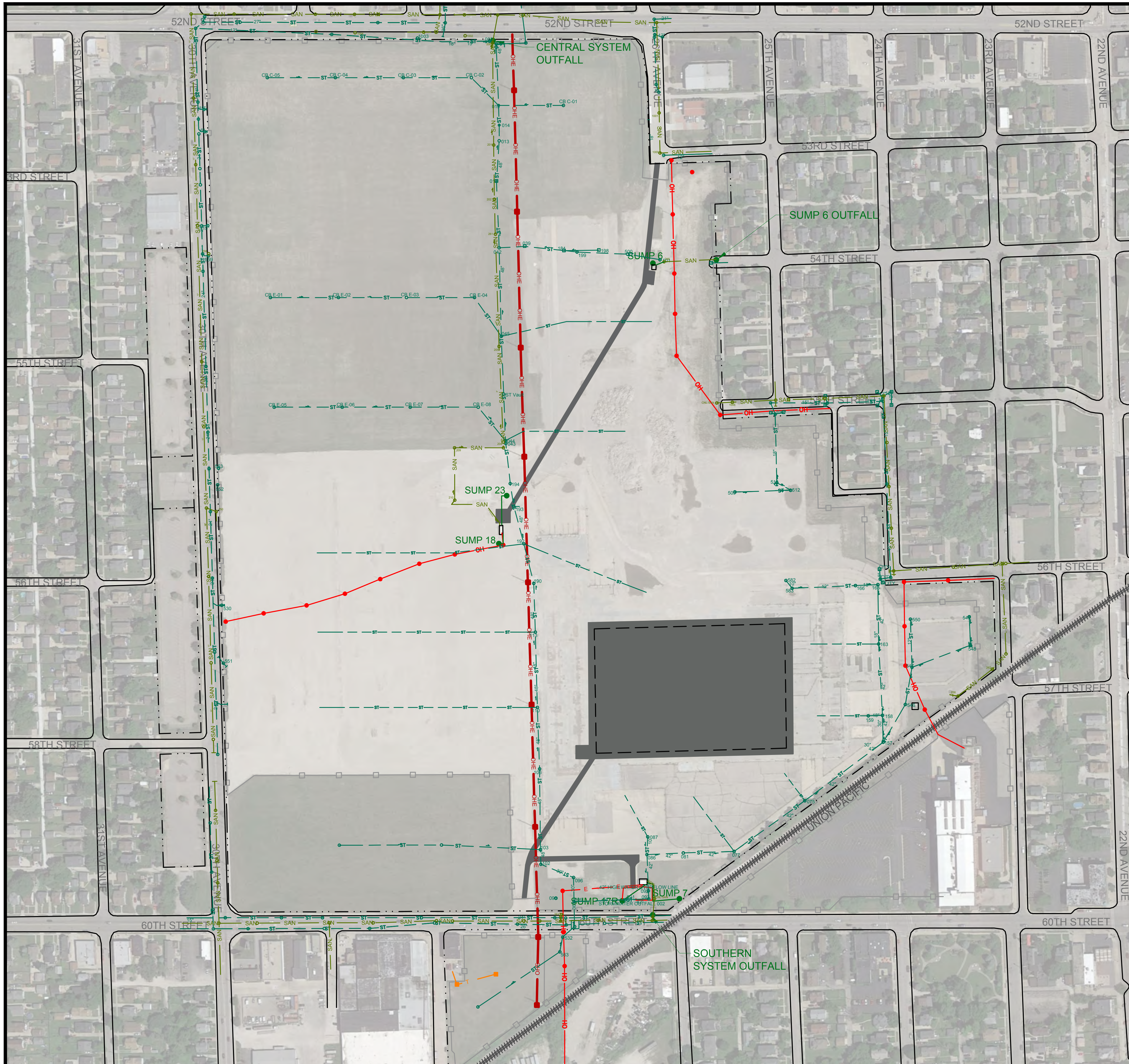
SITE LAYOUT
KENOSHA ENGINE PLANT
CITY OF KENOSHA
KENOSHA, WISCONSIN

Drawn :	SAE	12/4/2018
Checked:	KC	12/4/2018
Approved:	LLA	5/10/2017

PROJECT NUMBER 60576836

FIGURE NUMBER 2



LEGEND

- APPROXIMATE SITE BOUNDARY
- RAILROAD
- EXISTING FENCE
- REMEDIATION BUILDING
- SUMPS AND SANITARY OUTFALLS
- SUMP UTILITY LINES
- SANITARY SEWER
- STORM SEWER
- OVERHEAD ELECTRIC (DISTRIBUTION)
- OVERHEAD ELECTRIC (TRANSMISSION)
- UNDERGROUND ELECTRIC
- TELEPHONE
- ACCESS ROADS AND AGGREGATE STOCKPILE

NOTES

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH PRO, IMAGE DATED 7/6/2018; DOWNLOADED ON 12/3/2018.
2. BORDER DISCONTINUITIES ARE DUE TO ANGLE OF 2018 AERIAL.

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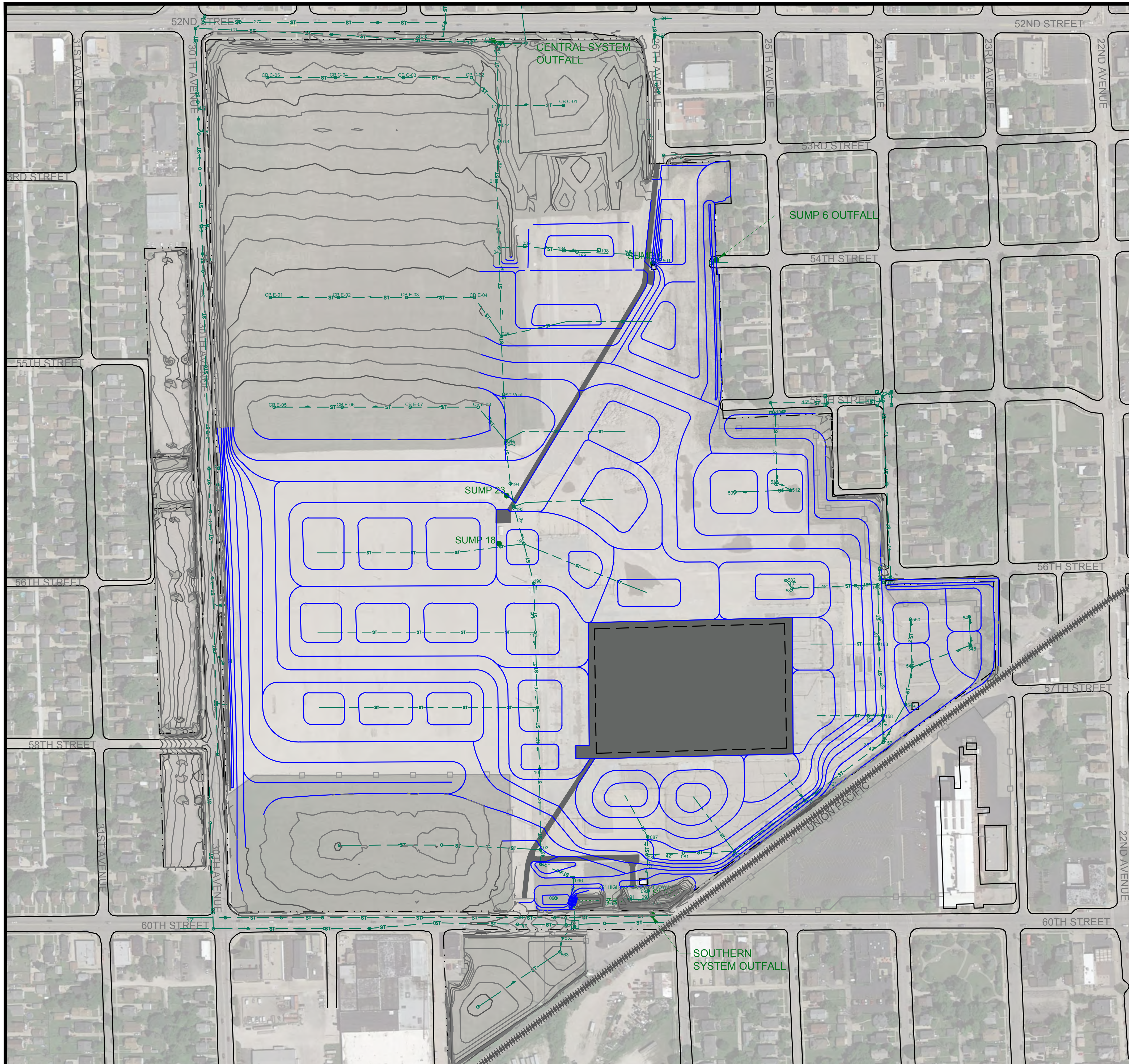
EXISTING UTILITY LOCATIONS AND ACCESS ROADS
KENOSHA ENGINE PLANT
CITY OF KENOSHA
KENOSHA, WISCONSIN

Drawn :	SAE	12/5/2018
Checked:	KC	12/5/2018
Approved:	LLA	12/5/2018
PROJECT NUMBER	60576836	
FIGURE NUMBER	3	



LEGEND

- APPROXIMATE SITE BOUNDARY
- RAILROAD
- EXISTING FENCE
- REMEDIATION BUILDING
- STORM SEWER
- ACCESS ROADS AND AGGREGATE STOCKPILE
- EXISTING (2018) TOPOGRAPHY
- PROPOSED TOPOGRAPHY

NOTES

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH PRO, IMAGE DATED 7/6/2018; DOWNLOADED ON 12/3/2018.
2. BORDER DISCONTINUITIES ARE DUE TO ANGLE OF 2018 AERIAL.

0' 150' 300' 600'
SCALE

N

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2018 EXISTING AND PROPOSED SITE GRADES
KENOSHA ENGINE PLANT
CITY OF KENOSHA
KENOSHA, WISCONSIN

Drawn :	SAE	12/5/2018
Checked:	KC	12/5/2018
Approved:	LLA	12/5/2018

PROJECT NUMBER 60576836

FIGURE NUMBER 4

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LEGEND

- APPROXIMATE SITE BOUNDARY
- RAILROAD
- EXISTING FENCE
- REMEDIATION BUILDING
- SUMPS AND SANITARY OUTFALLS
- SUMP UTILITY LINES
- MONITORING WELLS
- 617 WATER TABLE CONTOURS
- GROUNDWATER FLOW DIRECTION

NOTES

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH PRO, IMAGE DATED 7/6/2018; DOWNLOADED ON 12/3/2018.
2. BORDER DISCONTINUITIES ARE DUE TO ANGLE OF 2018 AERIAL.
3. * WELLS LOCATED SOUTHEAST OF THE RAILROAD TRACKS (SOUTHEAST OF KEP) ARE UNDER THE INFLUENCE OF THE SOUTHERN GROUNDWATER RECOVERY SYSTEM AND ARE NOT INCLUDED IN THE CONTOURS.
4. GROUNDWATER ELEVATIONS FROM OCTOBER 2018 SAMPLING EVENT.

0' 150' 300' 600'

SCALE

N

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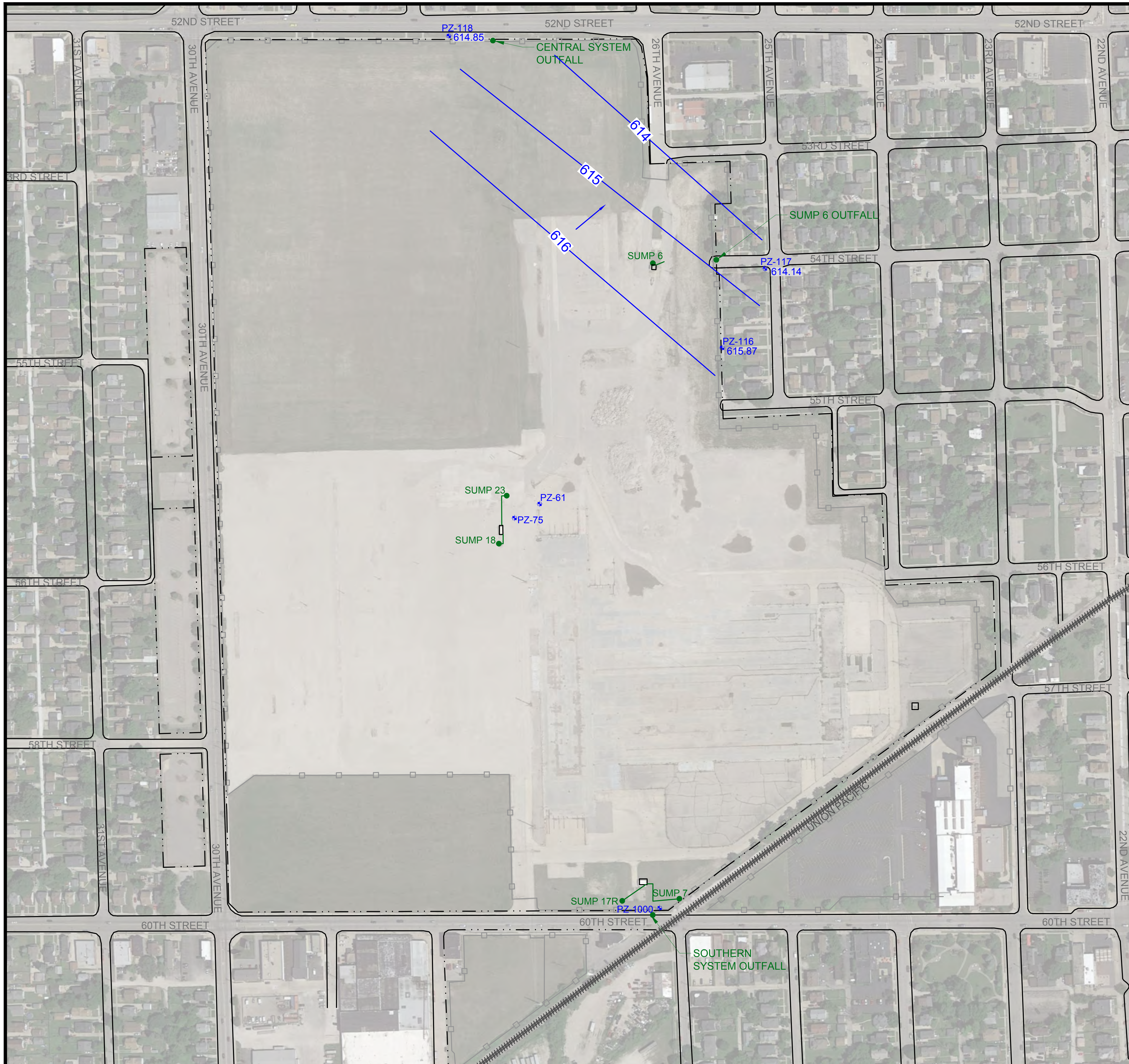
WATER TABLE POTENTIOMETRIC SURFACE MAP
KENOSHA ENGINE PLANT
CITY OF KENOSHA
KENOSHA, WISCONSIN

Drawn :	SAE	12/5/2018
Checked:	KC	12/5/2018
Approved:	LLA	12/5/2018

PROJECT NUMBER 60576836

FIGURE NUMBER 5



LEGEND

- APPROXIMATE SITE BOUNDARY
- RAILROAD
- EXISTING FENCE
- REMEDIATION BUILDING
- SUMPS AND SANITARY OUTFALLS
- SUMP UTILITY LINES
- MONITORING WELLS
- 617 POTENTIOMETRIC SURFACE CONTOURS
- GROUNDWATER FLOW DIRECTION

NOTES

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH PRO, IMAGE DATED 7/6/2018; DOWNLOADED ON 12/3/2018.
2. BORDER DISCONTINUITIES ARE DUE TO ANGLE OF 2018 AERIAL.
3. GROUNDWATER ELEVATIONS FROM OCTOBER 2018 SAMPLING EVENT.

0' 150' 300' 600'
SCALE

N

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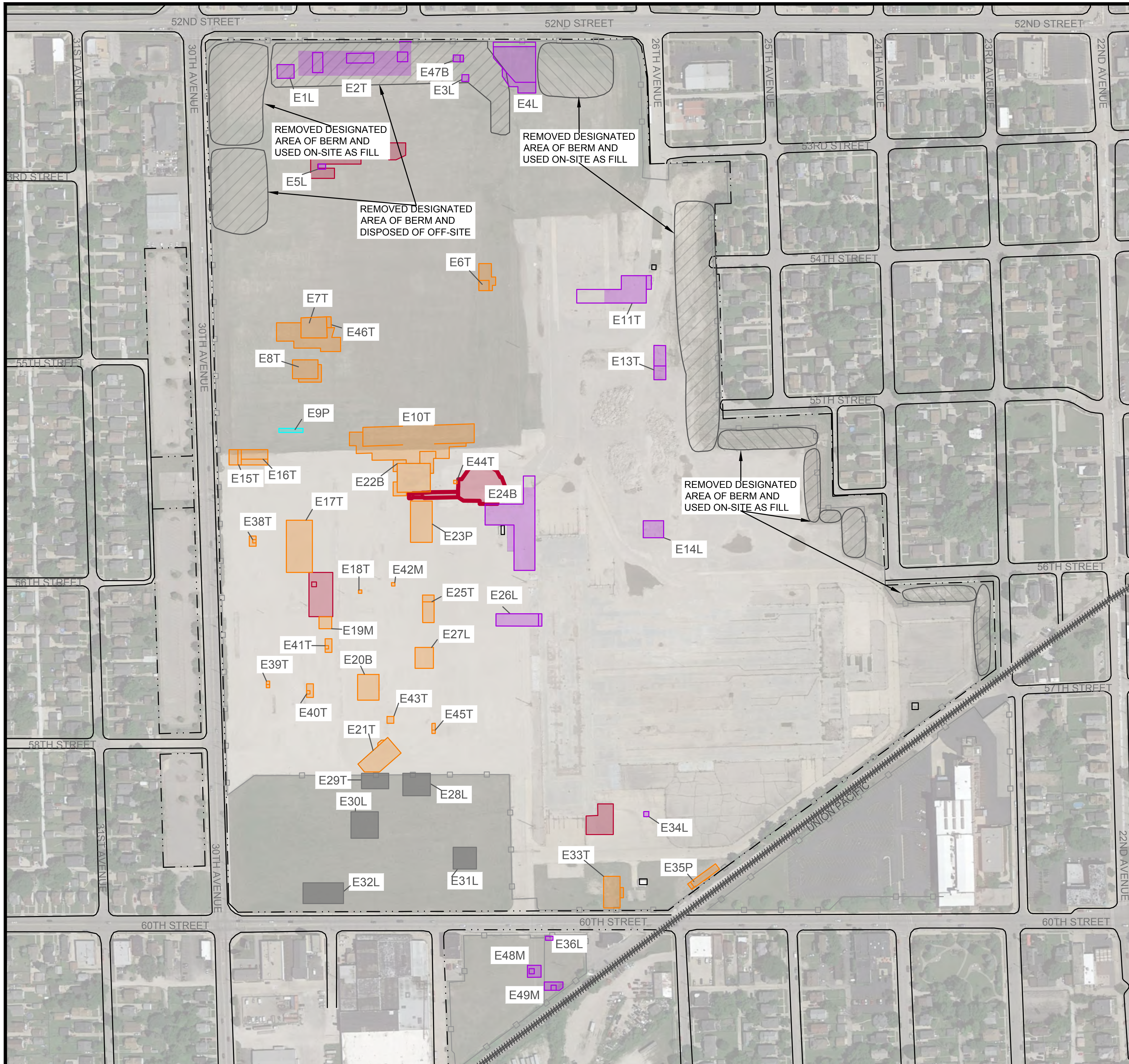
PIEZOMETER POTENTIOMETRIC SURFACE MAP
KENOSHA ENGINE PLANT
CITY OF KENOSHA
KENOSHA, WISCONSIN

Drawn :	SAE	12/5/2018
Checked:	KC	12/5/2018
Approved:	LLA	12/5/2018

PROJECT NUMBER 60576836

FIGURE NUMBER 6

File: \\USMWK1FS001\prod\Data\Projects\60576836\900_Work\CAD\KEP - GW Rem Design Rpt.dwg; USER: ENGELHARDT, SARAH; PLOTTED:December 10, 2018 - 5:25 PM



LEGEND

- APPROXIMATE SITE BOUNDARY
- RAILROAD
- EXISTING FENCE
- REMEDIATION BUILDING
- GROUP A EXCAVATIONS
- GROUP B EXCAVATIONS
- GROUP K EXCAVATIONS
- PRIOR EXCAVATIONS

NOTES

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH PRO, IMAGE DATED 7/6/2018; DOWNLOADED ON 12/3/2018.
2. BORDER DISCONTINUITIES ARE DUE TO ANGLE OF 2018 AERIAL.
3. UNFILLED AREAS ARE NOT EXCAVATED.
4. IRREGULAR SHAPES SHOW WHERE EXCAVATIONS WERE EXTENDED.

0' 150' 300' 600'
SCALE

N

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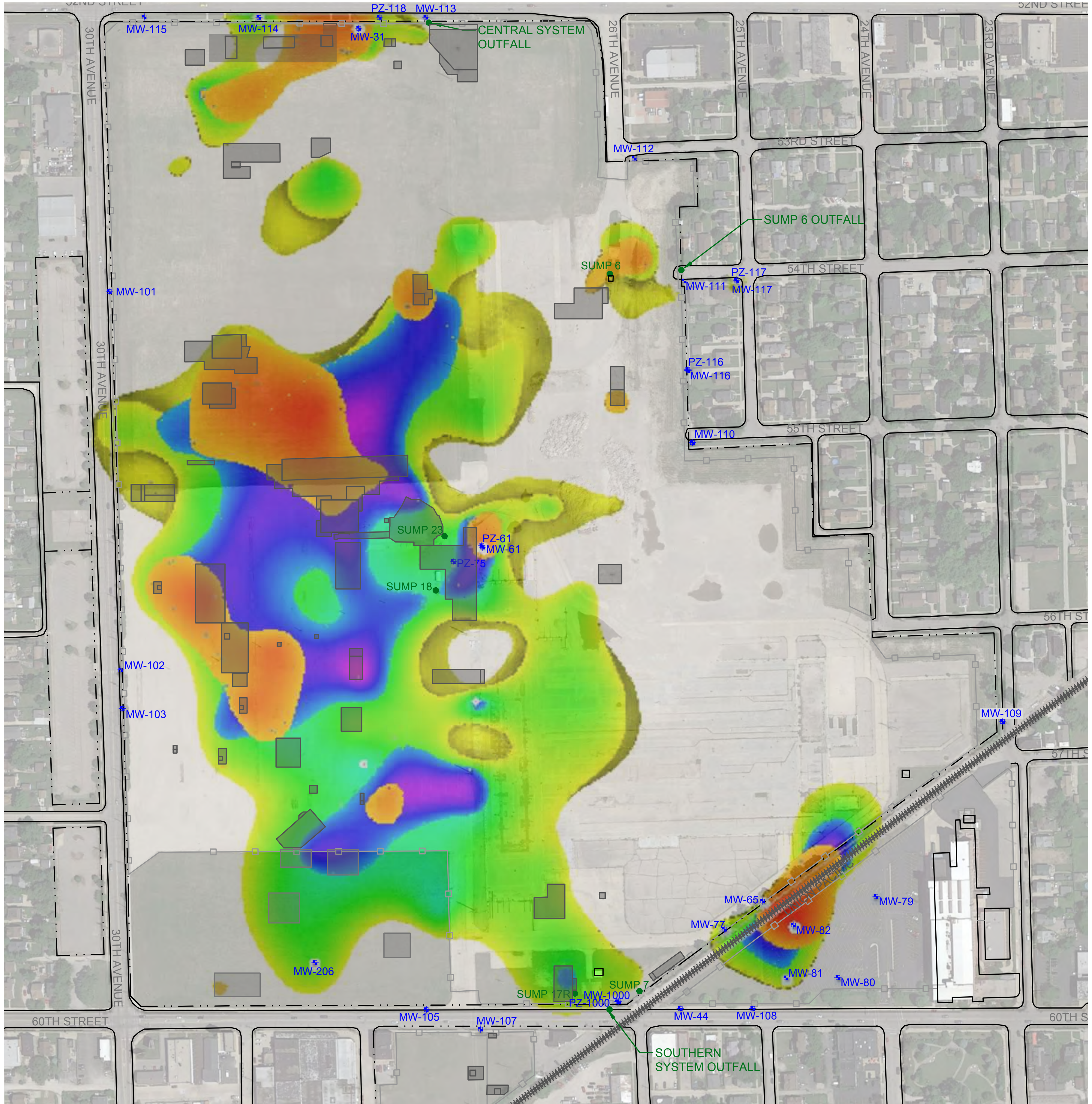
REMEDIAL SOIL EXCAVATION LOCATIONS
KENOSHA ENGINE PLANT
CITY OF KENOSHA
KENOSHA, WISCONSIN

Drawn :	SAE	12/4/2018
Checked:	KC	12/4/2018
Approved:	LLA	12/4/2018
PROJECT NUMBER	60576836	
FIGURE NUMBER	7	



LEGEND

- APPROXIMATE SITE BOUNDARY
- RAILROAD
- EXISTING FENCE
- REMEDIATION BUILDING
- SUMPS AND SANITARY OUTFALLS
- MONITORING WELLS AND PIEZOMETERS - EXISTING PERIMETER MONITORING LOCATIONS
- EXCAVATION AREAS - MOST EXTEND TO ~12' BELOW GROUND SURFACE

NOTES

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH PRO, IMAGE DATED 7/6/2018; DOWNLOADED ON 12/3/2018.
2. BORDER DISCONTINUITIES ARE DUE TO ANGLE OF 2018 AERIAL.
3. PLUME IMAGE FROM EARTH VOLUMETRIC STUDIO; VERSION 2018.12

Geology	Trichloroethene	cis-1,2-Dichloroethene	Vinyl Chloride
Fill	69,900 ug/l	15,700 ug/l	10,200 ug/l
Clay	30,000 ug/l	10,000 ug/l	3,000 ug/l
Sand	10,000 ug/l	3,000 ug/l	1,000 ug/l
Silt	3,000 ug/l	1,000 ug/l	300 ug/l
Till	1,000 ug/l	300 ug/l	100 ug/l
	300 ug/l	100 ug/l	30 ug/l
	100 ug/l	70 ug/l	10 ug/l
	30 ug/l		3 ug/l
	10 ug/l		1 ug/l
	5 ug/l		0.3 ug/l
			0.2 ug/l

0' 175' 350' 700'

SCALE

N

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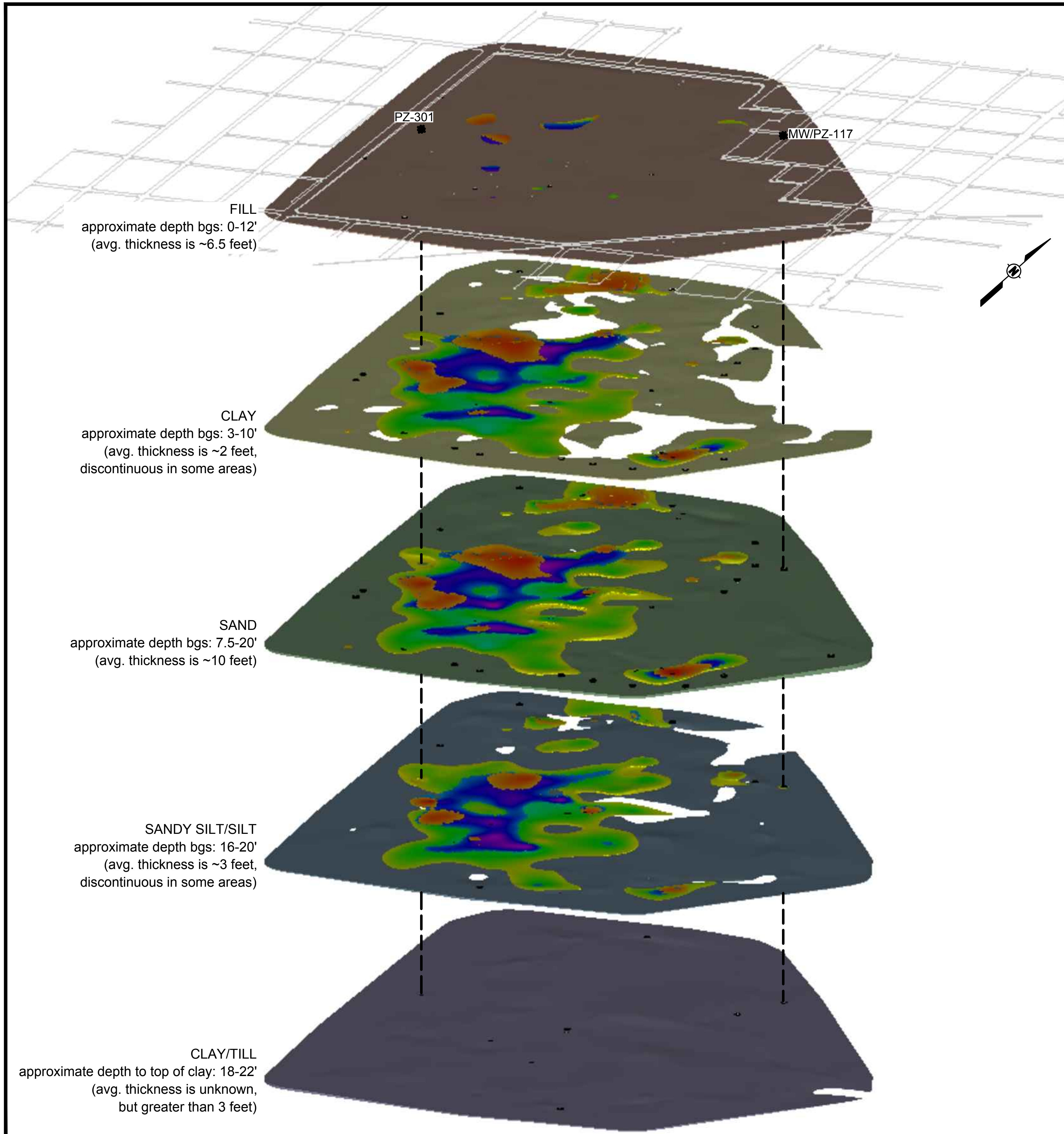
PLAN VIEW - GROUNDWATER QUALITY EXCEEDANCES
KENOSHA ENGINE PLANT
CITY OF KENOSHA
KENOSHA, WISCONSIN

Drawn :	SAE	12/26/2018
Checked:	KC	12/26/2018
Approved:	LLA	12/26/2018

PROJECT NUMBER 60576836

FIGURE NUMBER 8

File: \\USMWK1FS001\prod\Data\Projects\60576836\900_Work\CAD\KEP - GW Rem Design Rpt 2.dwg; USER: ENGELHARDT, SARAH; PLOTTED January 23, 2019 - 12:41 AM



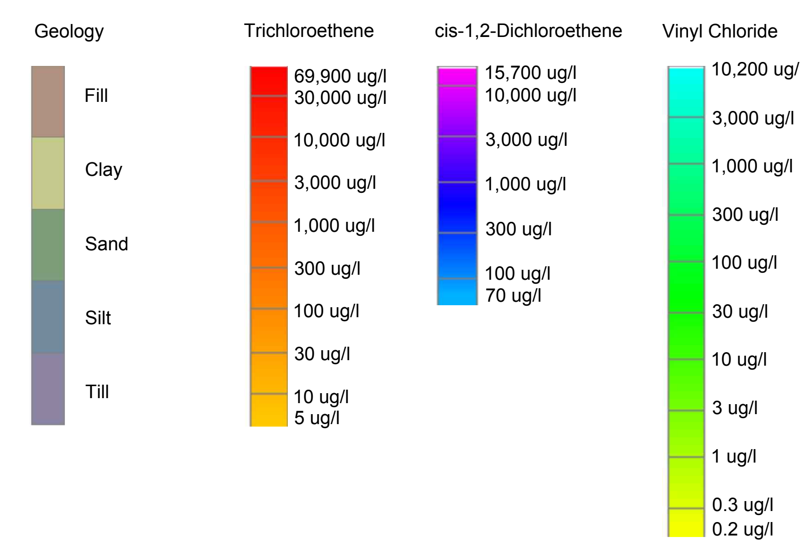
LEGEND

ROADS

RAILROAD

NOTES

1. IMAGE FROM EARTH VOLUMETRIC STUDIO; VERSION 2018.12
2. PLUMES ONLY DEPICT CONCENTRATIONS ABOVE THEIR WDNR ENFOURCEMENT STANDARD
   Trichloroethene > 5 ug/l
   cis-1,2-Dichloroethene > 70 ug/l
   Vinyl Chloride > 0.2 ug/l



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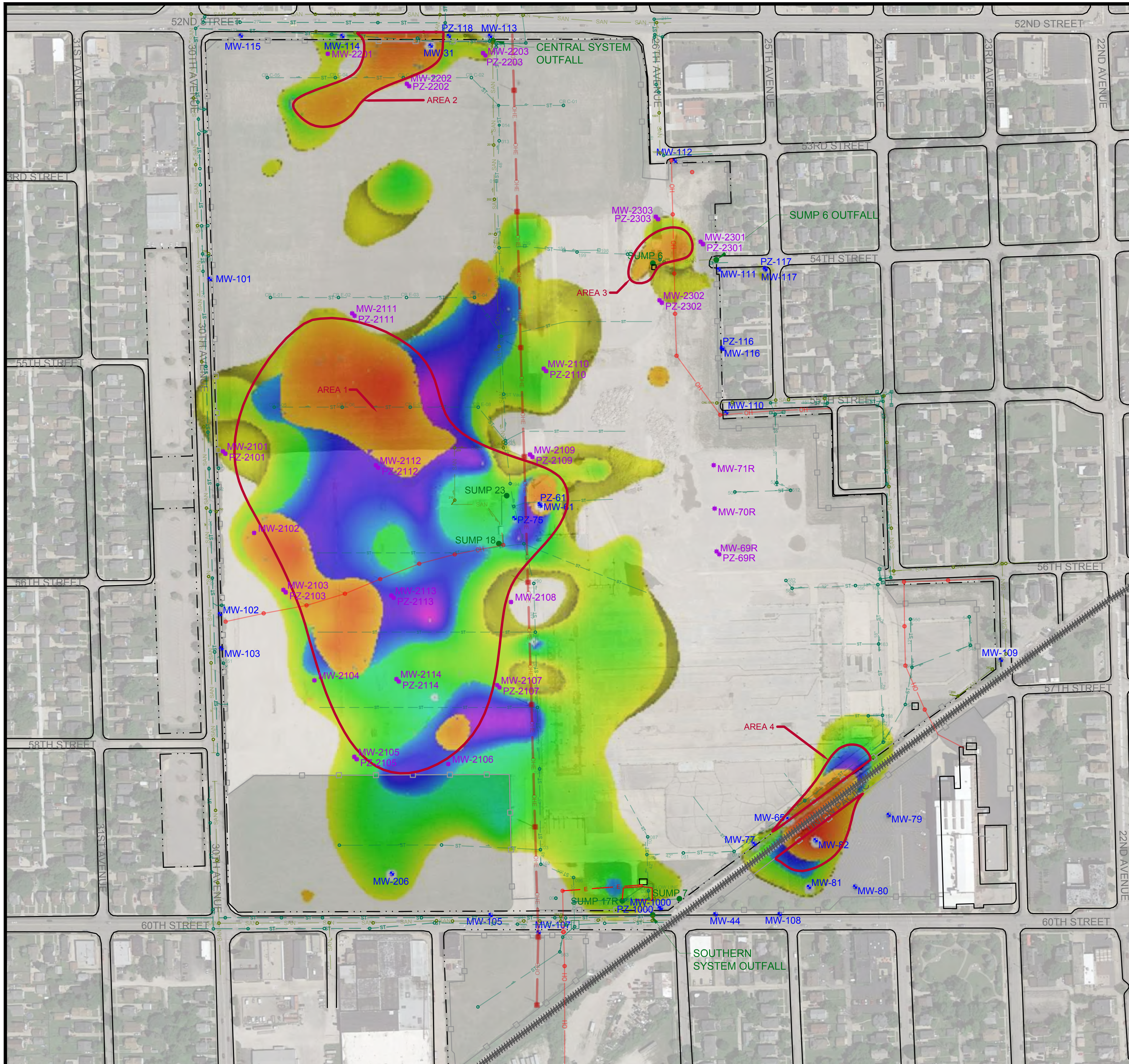
CROSS SECTIONAL VIEW - GROUNDWATER QUALITY EXCEEDANCES
KENOSHA ENGINE PLANT
CITY OF KENOSHA
KENOSHA, WISCONSIN

Drawn :	SAE	12/26/2018
Checked:	KC	12/26/2018
Approved:	LLA	12/26/2018

PROJECT NUMBER 60576836

FIGURE NUMBER 9

File: \\USMWK1FS001\prod\Data\Projects\60576836\900_Work\CAD\KEP - GW Rem Design Rpt.dwg; USER: ENGELHARDT, SARAH; PLOTTED:February 7, 2019 - 2:28 PM



LEGEND

- APPROXIMATE SITE BOUNDARY
- RAILROAD
- EXISTING FENCE
- REMEDIATION BUILDING
- SUMPS AND SANITARY OUTFALLS
- SUMP UTILITY LINES
- SANITARY SEWER
- STORM SEWER
- OVERHEAD ELECTRIC (DISTRIBUTION)
- OVERHEAD ELECTRIC (TRANSMISSION)
- UNDERGROUND ELECTRIC
- TELEPHONE
- MONITORING WELLS AND PIEZOMETERS - EXISTING PERIMETER MONITORING LOCATIONS
- MONITORING WELLS AND PIEZOMETERS - PROPOSED REMEDIAL MONITORING LOCATIONS
- PLANNED REMEDIAL TREATMENT AREAS

NOTES

1. AERIAL PHOTOGRAPH FROM GOOGLE EARTH PRO, IMAGE DATED 7/6/2018; DOWNLOADED ON 12/3/2018.
2. BORDER DISCONTINUITIES ARE DUE TO ANGLE OF 2018 AERIAL.

Trichloroethene	cis-1,2-Dichloroethene	Vinyl Chloride
69,900 ug/l	15,700 ug/l	10,200 ug/l
30,000 ug/l	10,000 ug/l	3,000 ug/l
10,000 ug/l	3,000 ug/l	1,000 ug/l
3,000 ug/l	1,000 ug/l	300 ug/l
1,000 ug/l	300 ug/l	100 ug/l
300 ug/l	100 ug/l	30 ug/l
100 ug/l	70 ug/l	10 ug/l
30 ug/l		3 ug/l
10 ug/l		1 ug/l
5 ug/l		0.3 ug/l
		0.2 ug/l

0' 150' 300' 600'
SCALE

N

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Milwaukee, WI 53212
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PROPOSED TREATMENT AREAS
KENOSHA ENGINE PLANT
CITY OF KENOSHA
KENOSHA, WISCONSIN

Drawn :	SAE	12/5/2018
Checked:	KC	12/5/2018
Approved:	LLA	12/5/2018

PROJECT NUMBER 60576836

FIGURE NUMBER 10

Appendix A ISCO Pilot Test Results

Tables and Figures

Table 1
Groundwater Measurements and Elevations
Former Kenosha Engine Plant ISCO Pilot Test

Well Name	MW-302		PZ-302		PZ-316		MW-317		PZ-317		MW-354		PZ-354	
Ground Elevation (ft)	625.89		625.91		626.00		625.87		625.86		626.04		626.06	
Top of Casing Elevation (ft)	625.41		625.56		628.72		628.00		628.44		628.04		628.06	
Top of Screen Elevation (ft)	622.22		608.18		604.21		621.15		604.70		621.56		605.97	
Screen Length (ft)	10		2.5		2.5		10		2.5		10		2.5	
Well Bottom (ft)	13.19		19.88		27.01		16.85		26.24		16.48		24.59	
Relative Location to ISCO Test Area	Injection Area		Injection Area		Side-Gradient		Down-Gradient		Down-Gradient		Up-Gradient		Up-Gradient	
Date	Depth to GW from TOC (ft)	Groundwater Elevation (ft)	Depth to GW from TOC (ft)	Groundwater Elevation (ft)	Depth to GW from TOC (ft)	Groundwater Elevation (ft)	Depth to GW from TOC (ft)	Groundwater Elevation (ft)	Depth to GW from TOC (ft)	Groundwater Elevation (ft)	Depth to GW from TOC (ft)	Groundwater Elevation (ft)	Depth to GW from TOC (ft)	Groundwater Elevation (ft)
5/07 - 5/20/2014	7.45	617.78	6.61	618.95	10.80	617.92	9.95	618.05	10.42	618.02	10.36	617.68	10.32	617.74
9/22/2014	8.09	617.14	8.14	617.42	11.22	617.50	10.66	617.34	10.98	617.46	10.30	617.74	10.30	617.76
12/1/2014	8.10	617.13	8.30	617.26	11.34	617.38	11.62	616.38	10.98	617.46	10.38	617.66	10.39	617.67
3/20/2015	8.32	616.91	8.47	617.09	11.48	617.24	10.81	617.19	11.22	617.22	10.59	617.45	10.55	617.51
9/21/2015	7.74	617.49	8.07	617.49	10.94	617.78	10.31	617.69	10.66	617.78	9.91	618.13	9.91	618.15
4/13/2016	7.20	618.03	7.71	617.85	10.44	618.28	9.74	618.26	10.18	618.26	9.65	618.39	9.62	618.44
9/23/2016	8.09	617.32	8.22	617.34	11.24	617.48	10.55	617.45	10.98	617.46	10.35	617.69	10.34	617.72
12/6/2016 (Pilot Test)	7.43	617.98	7.51	618.05	10.64	618.08	NM	NM	NM	NM	Abandoned November 10, 2016 as part of other site remedial activities			
1/11/2017	7.64	617.77	7.84	617.72	10.83	617.89	10.29	617.71	10.64	617.80				
3/17/2017	7.20	618.21	7.45	618.11	NM	NM	9.97	618.03	10.33	618.11				
4/4/2017	Monitoring wells abandoned during excavation of contaminated source soil													

Well Name	ICO-1-TW-SE5		ICO-1-TW-SE7.5		ICO-6-TW-NE5		ICO-6-TW-NE7.5		ICO-7-TW-NE10		ICO-7-TW-SE10	
Ground Elevation (ft)	625.89		625.91		626.04		626.06		626.04		626.06	
Top of Casing Elevation (ft)	--		--		--		--		--		--	
Top of Screen Elevation (ft)	--		--		--		--		--		--	
Screen Length (ft)	15		15		15		15		15		15	
Well Bottom (ft)	19		19		19		20		19		19	
Relative Location to ISCO Test Area	Injection Area		Injection Area		Injection Area		Injection Area		Injection Area		Injection Area	
Date	Depth to GW from TOC (ft)	Groundwater Elevation (ft)	Depth to GW from TOC (ft)	Groundwater Elevation (ft)	Depth to GW from TOC (ft)	Groundwater Elevation (ft)	Depth to GW from TOC (ft)	Groundwater Elevation (ft)	Depth to GW from TOC (ft)	Groundwater Elevation (ft)	Depth to GW from TOC (ft)	Groundwater Elevation (ft)
9/23/2016	8.20	617.69	8.15	617.76	8.31	617.73	8.25	617.81	8.17	617.87	8.23	617.83
12/6/2017 (Pilot Test)	7.63	618.26	7.62	618.29	7.63	618.41	7.57	618.49	7.54	618.50	7.63	618.43
1/1/2017	7.81	618.08	7.78	618.13	7.81	618.23	7.79	618.27	7.72	618.32	7.78	618.28
3/17/2017	7.41	618.48	7.32	618.59	7.46	618.58	7.45	618.61	7.28	618.76	7.37	618.69

Notes:
-- Temporary wells not surveyed; adjacent ground elevation used to estimate groundwater elevation.
ft = feet
NM = not measured

Table 2
Field Paramater Measurements
Former Kenosha Engine Plant ISCO Pilot Test

Well Name/Sample Location	Relative Location to ISCO Test Area	Sample Date	pH (standard units)	DO (mg/L)	ORP (mV)	Conductivity (µS/cm)	Temperature (°C)	Depth to Groundwater (ft below TOC)
ISCO Pilot Test Area Permanent Wells								
MW-302	Injection Area	9/23/2016	6.89	0.83	-68.6	2.244	19.53	8.09
		1/11/2017	7.69	0.71	-30.3	4.810	12.50	10.00
		3/17/2017	7.55	0.87	66.4	3.695	8.68	9.14
PZ-302	Injection Area	9/23/2016	7.05	0.31	-106.6	2.233	17.99	8.62
		1/12/2017	8.17	0.75	496.4	7.805	13.90	10.08
		3/17/2017	9.35	0.11	29.8	5.980	11.16	8.63
PZ-316	Side-Gradient	9/23/2016	7.29	0.32	-42.8	1.335	18.39	14.29
		1/11/2017	7.62	5.46	55.3	1.389	12.71	13.92
		3/17/2017	--	--	--	--	--	--
MW-317	Down-Gradient	9/26/2016	6.76	0.51	-94.7	1.630	18.23	10.69
		1/11/2017	6.94	0.29	52.8	1.853	12.28	10.38
		3/16/2017	7.08	0.22	82.5	1.423	9.81	10.03
PZ-317	Down-Gradient	9/23/2016	7.33	0.34	13.3	1.345	17.94	16.28
		1/11/2017	7.28	5.99	173.7	1.212	12.30	15.73
		3/16/2017	7.81	2.23	48.3	1.640	10.72	14.45
MW-354*	Up-Gradient	9/26/2016	6.89	0.33	-48.1	0.657	18.81	10.35
PZ-354*	Up-Gradient	9/26/2016	7.33	0.76	35.2	0.694	17.48	15.71
ISCO Pilot Test Area Temporary Wells								
IC01-TW-SE5 TOS	Injection Area	9/23/2016	6.91	0.43	-89.4	1.436	19.11	8.30
		1/11/2017	7.01	0.52	-52.8	1.512	11.02	7.85
		3/16/2017	7.25	0.40	-38.8	1.909	10.93	7.42
IC01-TW-SE5 BOS	Injection Area	9/23/2016	6.88	0.29	-103.5	2.309	18.35	8.30
		1/11/2017	7.04	0.25	-68.2	2.104	12.97	7.90
		3/16/2017	7.28	0.45	-47.0	2.299	11.24	7.46
IC01-TW-SE7.5 TOS	Injection Area	9/23/2016	6.86	0.36	-81.6	1.478	19.00	8.26
		1/11/2017	7.01	0.85	-73.7	2.013	12.86	7.81
		3/16/2017	6.99	0.12	-74.9	1.702	11.51	7.36
IC01-TW-SE7.5 BOS	Injection Area	9/23/2016	6.82	0.44	-72.6	2.386	18.08	8.26
		1/11/2017	7.09	0.65	-72.3	2.206	13.71	7.79
		3/16/2017	7.02	0.11	-96.9	1.962	11.79	7.41
IC06-TW-NE5 TOS	Injection Area	9/23/2016	6.84	0.33	-76.6	1.931	19.35	8.34
		1/11/2017	7.80	0.36	-75.7	2.856	14.16	7.93
		3/16/2017	8.40	0.71	-42.3	2.080	10.69	7.43
IC06-TW-NE5 BOS	Injection Area	9/23/2016	6.90	0.38	-85.3	1.951	18.35	8.34
		1/11/2017	8.69	0.10	-53.1	5.426	13.92	7.91
		3/16/2017	8.63	0.83	-49.1	2.154	10.79	7.44
IC06-TW-NE7.5 TOS	Injection Area	9/23/2016	6.92	0.45	-80.1	1.943	19.75	8.31
		1/12/2017	7.59	0.57	73.2	3.108	13.39	7.97
		3/16/2017	7.05	0.32	84.0	1.566	11.99	7.51
IC06-TW-NE7.5 BOS	Injection Area	9/23/2016	6.94	0.33	-83.3	1.987	18.95	8.31
		1/12/2017	8.57	0.39	236.9	4.068	11.96	7.96
		3/16/2017	8.29	0.09	-0.4	2.087	11.94	7.41
IC07-TW-NE10 TOS	Injection Area	9/26/2016	6.93	0.60	-21.2	2.133	19.83	9.29
		1/12/2017	7.65	0.15	149.9	5.640	10.20	8.53
		3/17/2017	7.61	0.24	524.6	4.798	9.24	7.78
IC07-TW-NE10 BOS	Injection Area	9/26/2016	6.95	0.32	-54.9	2.181	18.48	9.29
		1/12/2017	7.71	0.20	112.5	6.948	12.19	8.58
		3/17/2017	7.56	0.57	532.2	5.049	9.40	7.78
IC07-TW-SE10 TOS	Injection Area	9/26/2016	6.91	0.49	-64.9	2.057	19.70	8.33
		1/12/2017	7.10	0.20	104.2	1.580	9.80	7.90
		3/17/2017	7.49	0.50	45.0	2.095	9.18	7.40
IC07-TW-SE10 BOS	Injection Area	9/26/2016	6.95	0.50	-79.8	2.260	18.53	8.33
		1/12/2017	7.14	0.18	94.1	1.777	12.10	7.90
		3/17/2017	7.51	0.56	94.2	2.181	9.99	7.40

Notes:

mg/L = milligrams per liter
mV = millivolts
µS/cm = microSiemens per centimeter
ºC = degrees Celsius
ft = feet
TOC = top of casing
TOS = Top of Screen
BOS = Bottom of Screen
* Wells abandoned during other site remedial activities
-- = not measured

Table 3
Baseline and Post-Injection VOCs Results Summary
Former Kenosha Engine Plant ISCO Pilot Test

Well Name/Sample Location	Relative Location to ISCO Test Area	Field ID	Sample Date	Chloroform	DCA	c-DCE	t-DCE	Methylene Chloride	TCA	TCE	VC
			PAL:	0.6	85	7	20	0.5	40	0.5	0.02
			ES:	6	850	70	100	5	200	5	0.2
ISCO Pilot Test Area Permanent Wells											
MW-302	Injection Area	CS3-MW-302	9/23/2016	< 25	< 2.4	**850**	70.0	< 2.3	< 5	**342**	**173**
			1/11/2017	< 12.5	< 1.2	**166**	17.9	< 1.2	< 2.5	**216**	**3.8** J
			3/17/2017	< 25	< 2.4	**548**	64.4	< 2.3	< 5	**130**	**19.1**
PZ-302	Injection Area	CS3-PZ-302	9/23/2016	< 500	< 48.3	**9,470**	**376**	**132** J	< 100	**45,700**	**203**
			1/12/2017	**12.8** J	< 1.2	< 1.3	< 1.3	3.6 J	< 2.5	< 1.7	< 0.88
			3/17/2017	< 312	< 30.2	**8,500**	**199**	< 29.1	< 62.5	**5,110**	< 21.9
MW-317	Down-Gradient	CS3-MW-317	9/26/2016	< 25	< 2.4	**753**	64.6	3.3 J	< 5	< 3.3	**324**
			1/11/2017	< 10	< 0.97	**1,040**	80.1	< 0.93	< 2	< 1.3	**402**
			3/16/2017	< 10	< 0.97	**708**	44.7	< 0.93	< 2	< 1.3	**291**
		CS3-MW-317-DUP	1/11/2017	< 10	< 0.97	**1,070**	84.6	< 0.93	< 2	< 1.3	**418**
PZ-317	Down-Gradient	CS3-PZ-317	9/23/2016	< 2.5	< 0.24	1.1	< 0.26	< 0.23	< 0.5	0.53 J	< 0.18
			1/11/2017	< 2.5	< 0.24	0.40 J	< 0.26	< 0.23	< 0.5	< 0.33	< 0.18
			3/16/2017	< 2.5	< 0.24	0.31 J	< 0.26	< 0.23	< 0.5	< 0.33	< 0.18
MW-354*	Up-Gradient	CS3-MW-354	9/26/2016	< 10	< 0.97	**248**	12.5	1.1 J	< 2	**43.2**	**101**
		CS3-MW-354-FDUP	9/26/2016	< 12.5	< 1.2	**205**	10.1	< 1.2	< 2.5	**41.9**	**85.6**
PZ-354*	Up-Gradient	CS3-PZ-354	9/26/2016	< 2.5	< 0.24	0.65 J	< 0.26	< 0.23	< 0.5	0.45 J	< 0.18
ISCO Pilot Test Area Temporary Wells											
ICO1-TW-SE5	Injection Area	ICO1-TW-SE5-TOS	9/23/2016	< 12.5	< 1.2	**346**	26.0	2.1 J	< 2.5	< 1.7	**145**
			1/11/2017	< 10	< 0.97	**838**	**138**	< 0.93	< 2	< 1.3	**178**
			3/16/2017	< 10	< 0.97	**736**	**113**	< 0.93	< 2	< 1.3	**165**
		ICO1-TW-SE5-BOS	9/23/2016	< 25	< 2.4	**945**	**142**	3.7 J	< 5	< 3.3	**155**
			1/11/2017	< 10	< 0.97	**925**	**128**	< 0.93	< 2	< 1.3	**186**
			3/16/2017	< 10	< 0.97	**759**	**127**	< 0.93	< 2	< 1.3	**157**
ICO1-TW-SE7.5	Injection Area	ICO1-TW-SE7.5-TOS	9/23/2016	< 6.2	< 0.6	**393**	34.2	< 0.58	< 1.2	0.88 J	**171**
			1/11/2017	< 10	< 0.97	**733**	**104**	< 0.93	< 2	< 1.3	**191**
			3/16/2017	< 10	< 0.97	**653**	**101**	< 0.93	< 2	< 1.3	**176**
		ICO1-TW-SE7.5-BOS	9/23/2016	< 25	< 2.4	**693**	**122**	4.0 J	< 5	< 3.3	**129**
			1/11/2017	< 10	< 0.97	**813**	**116**	< 0.93	< 2	< 1.3	**206**
			3/16/2017	< 10	< 0.97	**762**	**120**	< 0.93	< 2	< 1.3	**180**
ICO6-TW-NE5	Injection Area	ICO6-TW-NE5-TOS	9/23/2016	< 12.5	< 1.2	**512**	43.2	1.3 J	< 2.5	**308**	**69.6**
			1/11/2017	< 6.2	2.0 J	**209**	20.9	0.77 J	< 1.2	**230**	**3.2**
			3/16/2017	< 12.5	< 1.2	**347**	27.5	< 1.2	< 2.5	**90.3**	**68.3**
		ICO6-TW-NE5-BOS	9/23/2016	< 25	< 2.4	**1,060**	92.6	2.7 J	< 5	**621**	**77.4**
			1/11/2017	< 10	1.4 J	**197**	16.4	1.2 J	< 2	**687**	**2.7** J
			3/16/2017	< 12.5	< 1.2	**360**	27.7	< 1.2	< 2.5	**84.6**	**69.2**

Table 3
Baseline and Post-Injection VOCs Results Summary
Former Kenosha Engine Plant ISCO Pilot Test

Well Name/Sample Location	Relative Location to ISCO Test Area	Field ID	Sample Date	Chloroform	DCA	c-DCE	t-DCE	Methylene Chloride	TCA	TCE	VC
ICO6-TW-NE7.5	Injection Area	ICO6-TW-NE7.5-TOS	9/23/2016	< 12.5	< 1.2	**984**	93.6	1.9 J	< 2.5	**376**	**99.6**
			1/12/2017	< 10	< 0.97	**132**	8.6	1.3 J	< 2	**450**	**2.0** J
			3/16/2017	< 2.5	0.51 J	**189**	17.5	< 0.23	< 0.5	**126**	**54.8**
		ICO6-TW-NE7.5-BOS	9/23/2016	< 50	< 4.8	**1,360**	**117**	**8.6** J	< 10	**639**	**75.0**
			1/12/2017	< 10	< 0.97	**134**	9.6	1.3 J	< 2	**624**	**1.8** J
ICO7-TW-NE10	Injection Area	ICO7-TW-NE10-TOS	9/26/2016	< 125	< 12.1	**3,600**	**236**	**15.8** J	< 25	**9,660**	**46.7** J
			1/12/2017	< 10	< 0.97	**191**	14.9	< 0.93	< 2	**491**	**1.8** J
			3/17/2017	< 2.5	< 0.24	37.2	< 0.26	< 0.23	0.60	**177**	< 0.18
		ICO7-TW-NE10-BOS	9/26/2016	< 500	< 48.3	**7,970**	**436**	< 46.5	< 100	**24,800**	< 35.1
			1/12/2017	< 10	< 0.97	**125**	9.6	1.1 J	< 2	**892**	**1.3** J
			3/17/2017	< 2.5	< 0.24	< 0.26	< 0.26	< 0.23	0.84	< 0.33	< 0.18
ICO7-TW-SE10	Injection Area	ICO7-TW-SE10-TOS	9/26/2016	< 125	< 12.1	**1,670**	**144**	< 11.6	< 25	**14,900**	**83.4**
			1/12/2017	< 250	< 24.2	**2,840**	**190**	< 23.3	< 50	**20,300**	**69.1** J
			3/17/2017	< 125	< 12.1	**1,560**	**145**	< 11.6	< 25	**9,470**	**56.1**
		ICO7-TW-SE10-TOS DUP	9/26/2016	< 250	< 24.2	**1,740**	**161**	**31.0** J	< 50	**15,800**	**81.2** J
			1/12/2017	< 250	< 24.2	**3,340**	**214**	< 23.3	< 50	**26,600**	**71.1** J
			3/17/2017	< 100	< 9.7	**1,470**	**141**	< 9.3	< 20	**8,960**	**51.7**
		ICO7-TW-SE10-BOS	9/26/2016	< 2500	< 242	**6,100**	**476** J	< 233	< 500	**66,600**	< 176
			1/12/2017	< 250	< 24.2	**3,160**	**209**	< 23.3	< 50	**22,700**	**64.1** J
			3/17/2017	< 250	< 24.2	**2,370**	**162**	< 23.3	< 50	**20,000**	**46.9** J

Notes:
All results in micrograms per liter (µg/L)
Only compounds detected at least once are reported
PAL - Preventive Action Limit, Wisconsin Administrative Code NR 140.10 Table 1, February 2017; concentrations above PAL are underlined
ES - Enforcement Standard, Wisconsin Administrative Code NR 140.10 Table 1, February 2017; **concentrations above ES are bold-underlined**
* Wells were abandoned during other site remedial activities
J = Estimated value
c-DCE = cis-1,2-dichloroethene
TCE = trichloroethene
VC = vinyl chloride
DCA = 1,1-dichloroethane
t-DCE = trans-1,2-dichloroethene
TCA = 1,1,1-trichloroethane

Table 4
Baseline and Post-Injection Metals Results Summary
Former Kenosha Engine Plant ISCO Pilot Test

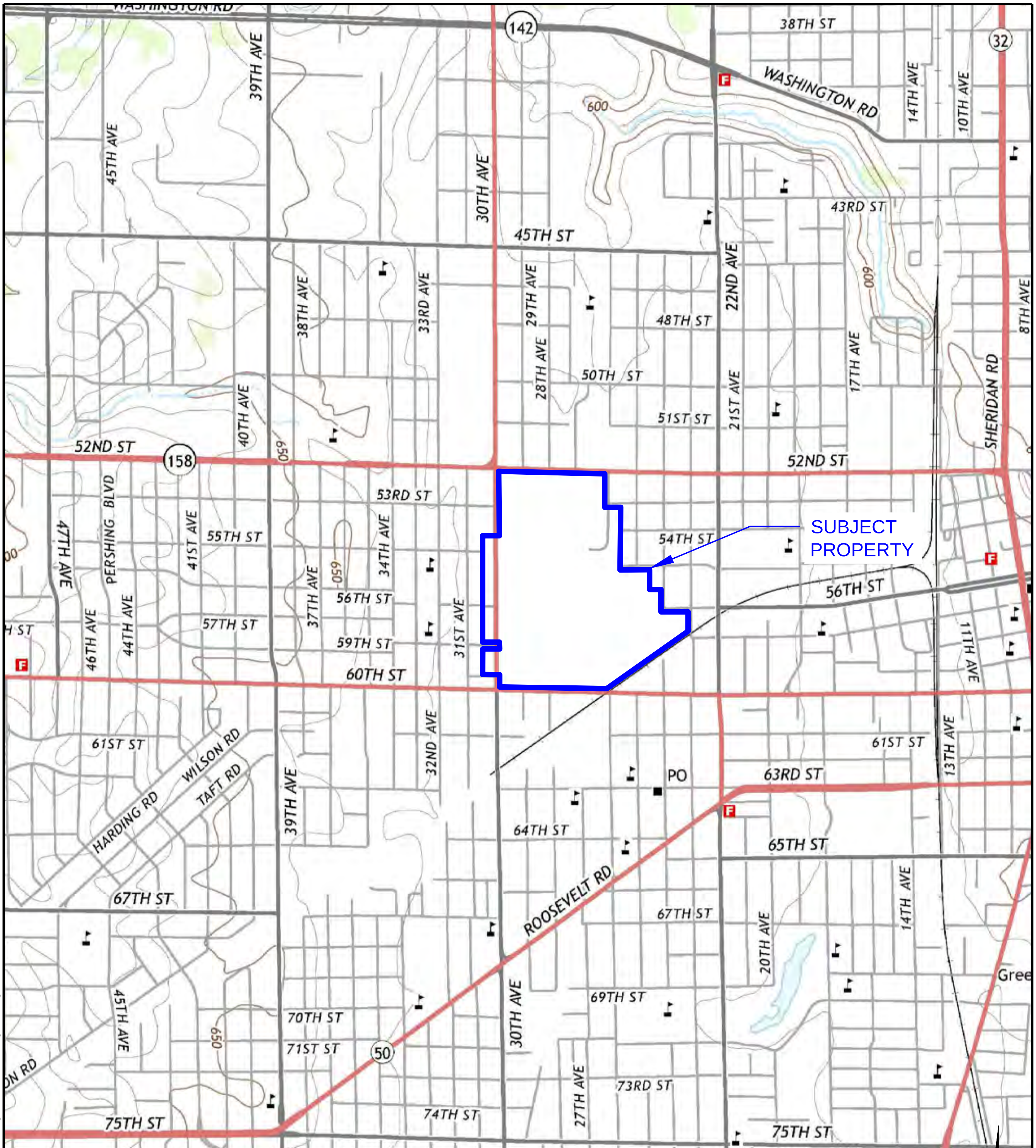
Location	Relative Location to ISCO Test Area	Field ID	Sample Date	Barium	Chromium	Iron (dissolved)	Lead	Manganese (dissolved)	Nickel
			PAL:	400	10	150	1.5	60	20
			ES:	2000	100	300	15	300	100
ISCO Pilot Test Area Permanent Wells									
MW-302	Injection Area	CS3-MW-302	9/23/2016	129	< 0.39	**3,200**	0.37 J	256	6.0
			1/11/2017	20.0	26.4	< 15.5	3.4 J	**1,320**	12.4
PZ-302	Injection Area	CS3-PZ-302	9/23/2016	107	0.76 J	**3,330**	0.17 J	113	3.0
			1/12/2017	10.2 J	**367**	< 34	< 2.0	**204,000**	< 5.6
MW-317	Down-Gradient	CS3-MW-317	9/26/2016	95.0	< 0.39	**4,030**	0.12 J	190	9.5
			1/11/2017	77.0	0.57 J	**3,160**	0.24 J	214	8.6
		CS-3-MW-317 DUP	1/11/2017	76.1	< 0.39	**2,980**	0.07 J	213	8.4
PZ-317	Down-Gradient	CS3-PZ-317	9/23/2016	162	< 0.39	83.6 J	< 0.04	59.8	1.0 J
			1/11/2017	155	< 0.39	< 15.5	< 0.04	13.8	0.91 J
MW-354*	Up-Gradient	CS3-MW-354	9/26/2016	67.1	< 0.39	**416**	< 0.04	274	2.7
		CS3-MW-354 DUP	9/26/2016	67.6	< 0.39	**407**	< 0.04	273	2.6
PZ-354*	Up-Gradient	CS3-PZ-354	9/26/2016	131	0.56 J	48.6 J	0.08 J	14.9	1.2
ISCO Pilot Test Area Temporary Wells									
ICO1-TW-SE5	Injection Area	ICO1-TW-SE5-TOS	9/23/2016	125	< 0.39	**2,280**	0.08 J	279	6.6
			1/11/2017	98.7	0.59 J	**4,550**	< 0.04	214	4.9
		ICO1-TW-SE5-BOS	9/23/2016	122	< 0.39	**4,720**	0.10 J	*246*	4.9
			1/11/2017	97.9	< 0.39	**4,800**	0.12 J	216	4.7
ICO1-TW-SE7.5	Injection Area	ICO1-TW-SE7.5-TOS	9/23/2016	121	< 0.39	**2,470**	0.07	298	13.3
			1/11/2017	99.2	0.44 J	**3,850**	0.09 J	**366**	7.2
		ICO1-TW-SE7.5-BOS	9/23/2016	119	< 0.39	**1,420**	0.09 J	**308**	6.6
			1/11/2017	89.7	< 0.39	**4,310**	0.04 J	**302**	6.6
ICO6-TW-NE5	Injection Area	ICO6-TW-NE5-TOS	9/23/2016	102	< 0.39	**3,190**	< 0.04	**354**	6.5
			1/11/2017	228	18.2	**1,380**	1.1	**3,920**	18.6
		ICO6-TW-NE5-BOS	9/23/2016	95.8	< 0.39	**2,770**	0.16 J	**305**	6.6
			1/11/2017	189	30.9	**317**	1.5 J	**3,220**	30.9
ICO6-TW-NE7.5	Injection Area	ICO6-TW-NE7.5-TOS	9/23/2016	94.2	0.84 J	**2,370**	1.0	**341**	8.2
			1/12/2017	16.5	24.1	120	< 0.04	**5,050**	25.8
		ICO6-TW-NE7.5-BOS	9/23/2016	94.0	< 0.39	**2,620**	0.05 J	286	6.7
			1/12/2017	15.0	24.2	< 15.5	0.37 J	**3,280**	34.2
ICO7-TW-NE10	Injection Area	ICO7-TW-NE10-TOS	9/26/2016	107	< 0.39	**868**	0.04 J	**306**	8.1
			1/12/2017	7.0	**122**	**355**	< 0.2	**7,240**	24.9
		ICO7-TW-NE10-BOS	9/26/2016	104	0.98 J	**1,060**	0.52 J	240	7.9
			1/12/2017	9.4	**189**	**436**	< 0.2	**4,000**	23.7
ICO7-TW-SE10	Injection Area	ICO7-TW-SE10-TOS	9/26/2016	135	< 0.39	**1,530**	< 0.04	294	6.0
			1/12/2017	51.2	< 0.39	< 15.5	< 0.04	**4,220**	8.0
		ICO7-TW-SE10-TOS -DUP	9/26/2016	135	< 0.39	**1,560**	< 0.04	294	5.9
			1/12/2017	51.2	0.40 J	17.3 J	< 0.04	**3,940**	7.8
		ICO7-TW-SE10-BOS	9/26/2016	120	0.69 J	**1,780**	0.21 J	238	6.6
			1/12/2017	39.9	0.77 J	< 15.5	0.06 J	**4,770**	9.8

Notes:
All results in micrograms per liter (µg/L)
PAL - Preventive Action Limit, Wisconsin Administrative Code NR 140.10 Table 1, February 2017; concentrations above PAL are underlined
ES - Enforcement Standard, Wisconsin Administrative Code NR 140.10 Table 1, February 2017; **concentrations above ES are bold-underlined**
* Wells were abandoned during other site remedial activities
J = Estimated value [1]
Samples for iron and manganese were filtered (dissolved metals results)
Samples for barium, chromium, lead, and nickel analysis were not filtered (total metals results)

Table 5
Baseline and Post-Injection Groundwater General Chemistry Parameters
Former Kenosha Engine Plant ISCO Pilot Test

Location	Relative Location to ISCO Test Area	Field ID	Sample Date	Chloride	Sulfate	Total Organic Carbon
			PAL:	125	125	NE
			ES:	250	250	NE
ISCO Pilot Test Area Permanent Wells						
MW-302	Injection Area	CS3-MW-302	9/23/2016	173	**511**	21.2
			1/11/2017	96.6	**854**	236
PZ-302	Injection Area	CS3-PZ-302	9/23/2016	**334**	**283**	4.1 J
			1/12/2017	**310**	**1,590**	499
MW-317	Down-Gradient	CS3-MW-317	9/26/2016	135	**358**	7.8 J
			1/11/2017	115	**474**	9.7
		CS-3-MW-317 DUP	1/11/2017	113	**470**	9.7
PZ-317	Down-Gradient	CS3-PZ-317	9/23/2016	187	123	< 0.25
			1/11/2017	201	122	< 0.25
MW-354*	Up-Gradient	CS3-MW-354	9/26/2016	37.5 J	117	6.1
		CS3-MW-354 DUP	9/26/2016	36.7 J	114	6.3
PZ-354*	Up-Gradient	CS3-PZ-354	9/26/2016	130	141	< 0.25
ISCO Pilot Test Area Temporary Wells						
ICO1-TW-SE5	Injection Area	ICO1-TW-SE5-TOS	9/23/2016	65.2	**304**	12.6
			1/11/2017	222	**346**	15.3
		ICO1-TW-SE5-BOS	9/23/2016	**288**	**496**	4.9 J
			1/11/2017	231	**366**	14.5
ICO1-TW-SE7.5	Injection Area	ICO1-TW-SE7.5-TOS	9/23/2016	102	**303**	14.3
			1/11/2017	184	**414**	16.6
		ICO1-TW-SE7.5-BOS	9/23/2016	**390**	**435**	1.6 J
			1/11/2017	203	**439**	14.8
ICO6-TW-NE5	Injection Area	ICO6-TW-NE5-TOS	9/23/2016	163	**513**	13.8
			1/11/2017	113	**644**	113
		ICO6-TW-NE5-BOS	9/23/2016	221	**471**	11.5
			1/11/2017	127	**864**	306
ICO6-TW-NE7.5	Injection Area	ICO6-TW-NE7.5-TOS	9/23/2016	187	**461**	14.6
			1/12/2017	130	**791**	152
		ICO6-TW-NE7.5-BOS	9/23/2016	231	**435**	11.5
			1/12/2017	134	**860**	244
ICO7-TW-NE10	Injection Area	ICO7-TW-NE10-TOS	9/26/2016	177	**494**	12.6
			1/12/2017	63.5	**915**	417
		ICO7-TW-NE10-BOS	9/26/2016	207	**463**	12.2
			1/12/2017	68.7	**919**	486
ICO7-TW-SE10	Injection Area	ICO7-TW-SE10-TOS	9/26/2016	185	**422**	14.6
			1/12/2017	154	**452**	16.7
		ICO7-TW-SE10-TOS -DUP	9/26/2016	178	**462**	14.9
			1/12/2017	157	**454**	16.0
		ICO7-TW-SE10-BOS	9/26/2016	203	**531**	12.4
			1/12/2017	164	**451**	17.6

Notes:
All results in milligrams per liter (mg/L)
PAL - Preventive Action Limit, Wisconsin Administrative Code NR 140.10 Table 2, February 2017;
concentrations above PAL are underlined
ES - Enforcement Standard, Wisconsin Administrative Code NR 140.10 Table 2, February 2017;
concentrations above ES are bold-underlined
NE - PAL and ES are not established for this analyte
* Wells were abandoned during other site remedial activities
J = Estimated value



NOTES

1. TOPOGRAPHIC MAP FROM USGS: http://store.usgs.gov/b2c_usgs/usgs/maplocator/ DATED 2013

1000 0 1000 2000

FEET

N

AECOM

1555 RiverCenter Dr
Milwaukee, WI 53212
414.944.6080
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SITE LOCATION
KENOSHA ENGINE PLANT
CITY OF KENOSHA
KENOSHA, WISCONSIN

Drawn :	SAE	7/3/2017
Checked:	LLA	7/3/2017
Approved:	SP	7/7/2017
PROJECT NUMBER	60518412	
FIGURE NUMBER	1	

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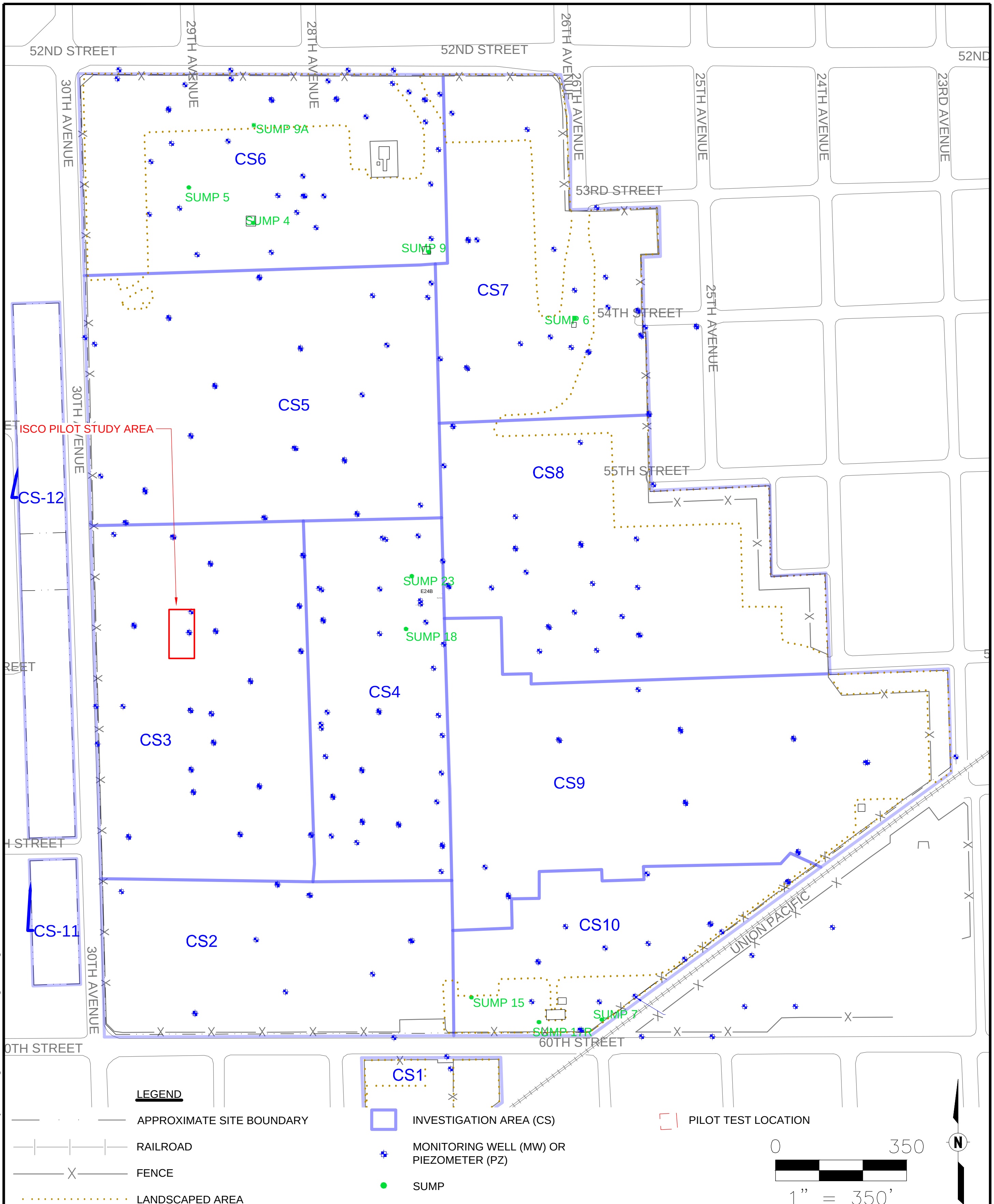

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SITE LAYOUT
KENOSHA ENGINE PLANT
CITY OF KENOSHA
KENOSHA, WISCONSIN

Drawn :	SAE	7/3/2017
Checked:	LLA	7/3/2017
Approved:	SP	7/7/2017
PROJECT NUMBER	60518412	
FIGURE NUMBER	2	

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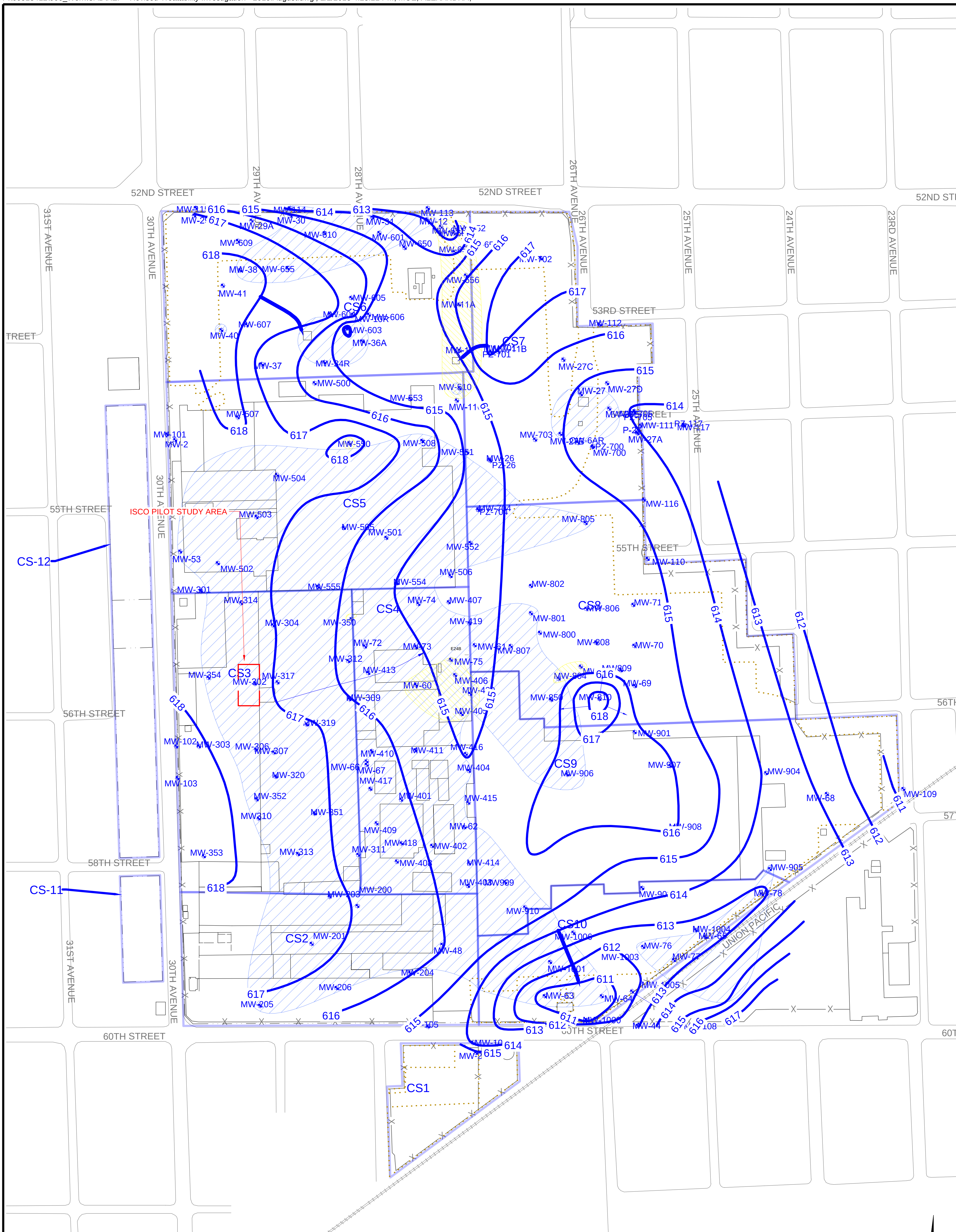

LEGEND

APPROXIMATE SITE BOUNDARY

RAILROAD

FENCE

INVESTIGATION AREA (CS)

LANDSCAPED AREAS

MONITORING WELL (MW)

615.21 GROUNDWATER ELEVATIONS

GROUNDWATER CONTOURS

FLOW DIRECTION

CVOC CONTAMINANT PLUME

PVOC AND PAH CONTAMINANT PLUME

NOTES

1. GROUNDWATER FLOW AND PLUME DATA FROM MONITORING WELLS
2. DATA COLLECTED IN DECEMBER 2014

0 300

1" = 300'

N

Drawn :	SAE 7/3/2017
Checked:	LLA 7/3/2017
Approved:	SP 7/7/2017
PROJECT NUMBER	60518412
FIGURE NUMBER	3

GROUNDWATER FLOW & EXTENT OF CONTAMINATION AT THE WATER TABLE - DECEMBER 2014
KENOSHA ENGINE PLANT
CITY OF KENOSHA
KENOSHA, WISCONSIN

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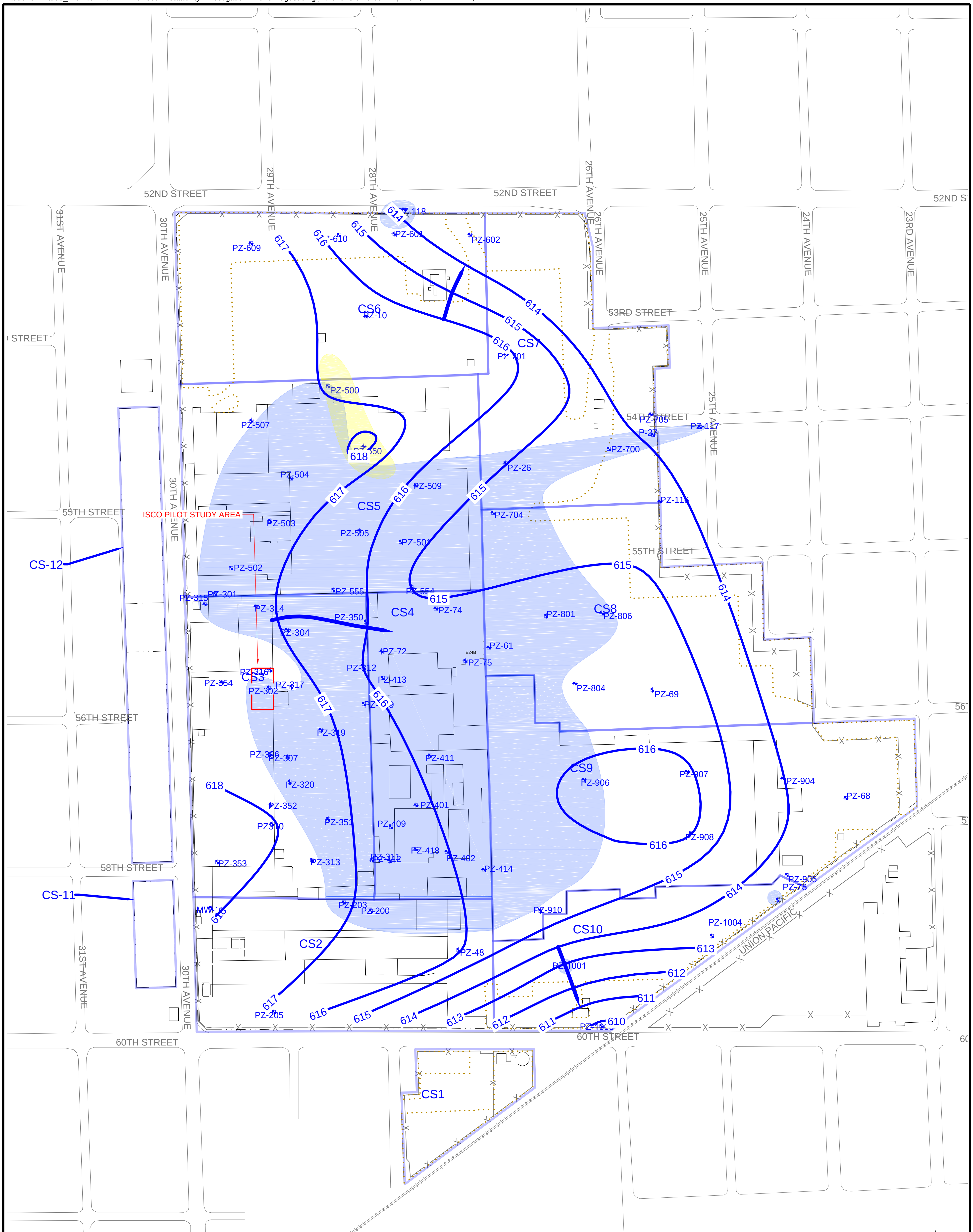
P:\60518412\900_Work\CAD\KEP - Revised Treatability Investigation - 2015.August.dwg ; 1/4/2018 9:40:08 AM; MOE, ALEXANDRA; ----



LEGEND

APPROXIMATE SITE BOUNDARY	
RAILROAD	
FENCE	
INVESTIGATION AREA (CS)	
LANDSCAPED AREAS	
PIEZOMETER (PZ)	
615.21	GROUNDWATER ELEVATIONS
GROUNDWATER CONTOURS	
FLOW DIRECTION	
CVOC CONTAMINANT PLUME	
PVOC AND PAH CONTAMINANT PLUME	

NOTES

1. GROUNDWATER FLOW AND PLUME DATA FROM PIEZOMETERS
2. DATA COLLECTED IN DECEMBER 2014

0 300

1" = 300'

N

GROUNDWATER FLOW & EXTENT OF CONTAMINATION ABOVE CLAY TILL AQUITARD

DECEMBER 2014

KENOSHA ENGINE PLANT

CITY OF KENOSHA

KENOSHA, WISCONSIN

Drawn: SAE 7/3/2017

Checked: LLA 7/3/2017

Approved: SP 7/7/2017

PROJECT NUMBER 60518412

FIGURE NUMBER 4

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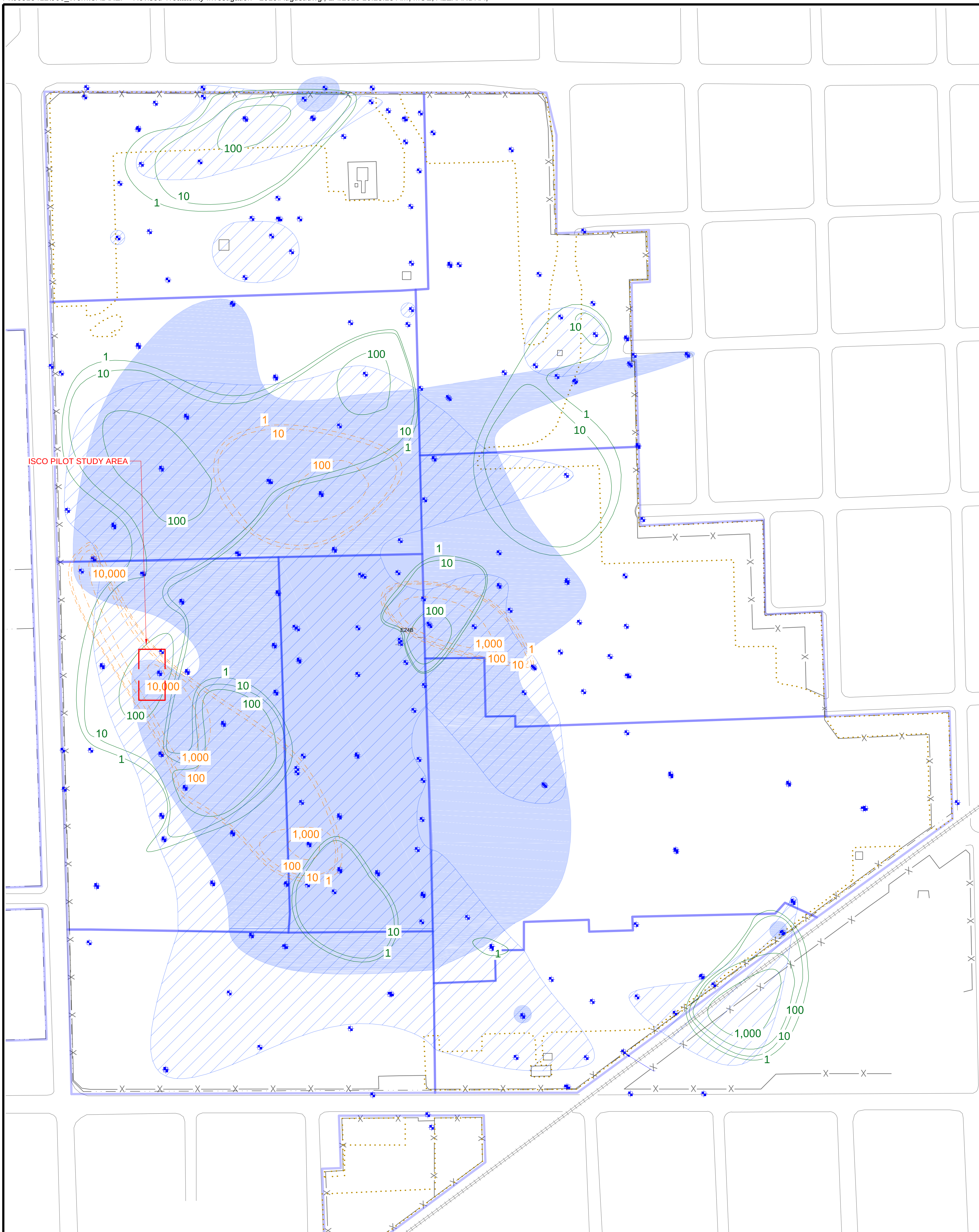

LEGEND

- APPROXIMATE SITE BOUNDARY
- RAILROAD
- FENCE
- INVESTIGATION AREA (CS)
- LANDSCAPED AREAS
- MONITORING WELL (MW) OR PIEZOMETER (PZ)
- FLOW DIRECTION
- SHALLOW CVOC CONTAMINANT PLUME (December 2014)
- DEEP CVOC CONTAMINANT PLUME (December 2014)
- SHALLOW TRICHLOROETHENE (TCE) ISOCONCENTRATION CONTOURS (CONCENTRATIONS IN UG/L) (September 2014)
- DEEP TCE ISOCONCENTRATION CONTOURS (CONCENTRATIONS IN UG/L) (September 2014)

N

0 250

1" = 250'

FIGURE NUMBER 5

PROJECT NUMBER 60518412

Approved: SP 7/7/2017

Checked: LLA 7/3/2017

Drawn: SAE 7/3/2017

GROUNDWATER CONTAMINATION PLUME EXTENT & TCE ISOCONCENTRATIONS
(DECEMBER & SEPTEMBER 2014)
KENOSHA ENGINE PLANT
CITY OF KENOSHA
KENOSHA, WISCONSIN

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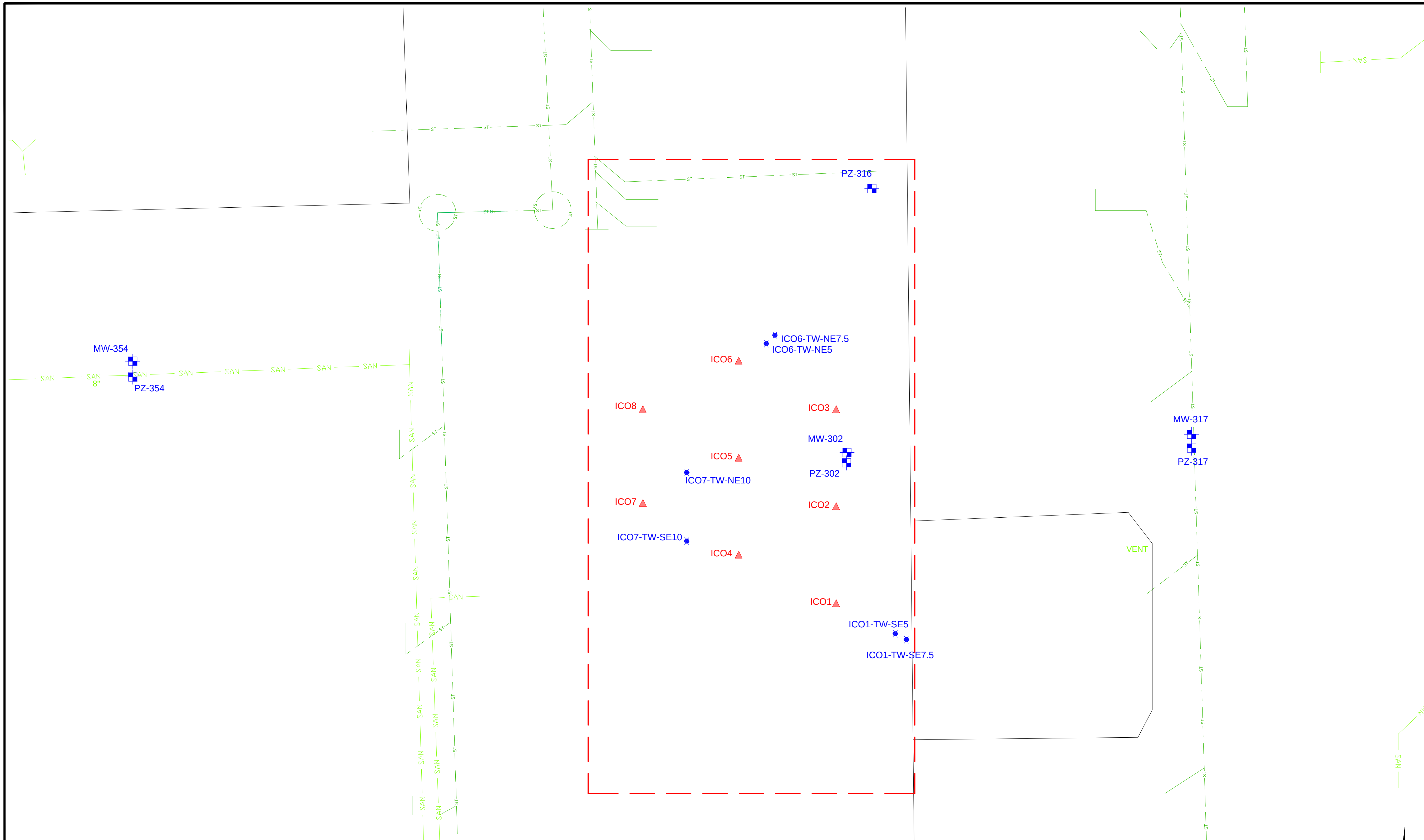

LEGEND

MONITORING WELL (MW) OR PIEZOMETER (PZ) FOR ISCO PILOT TEST MONITORING

ISCO PILOT INJECTION LOCATION

TEMPORARY WELL (TW) FOR ISCO MONITORING

STORM SEWER (APPROXIMATE LOCATION)

SANITARY SEWER (APPROXIMATE LOCATION) (8" inch diameter pipe)

FORMER BUILDING INTERIOR WALL

ISCO PILOT STUDY AREA

0 20

1" = 20'

N

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414.944.6080
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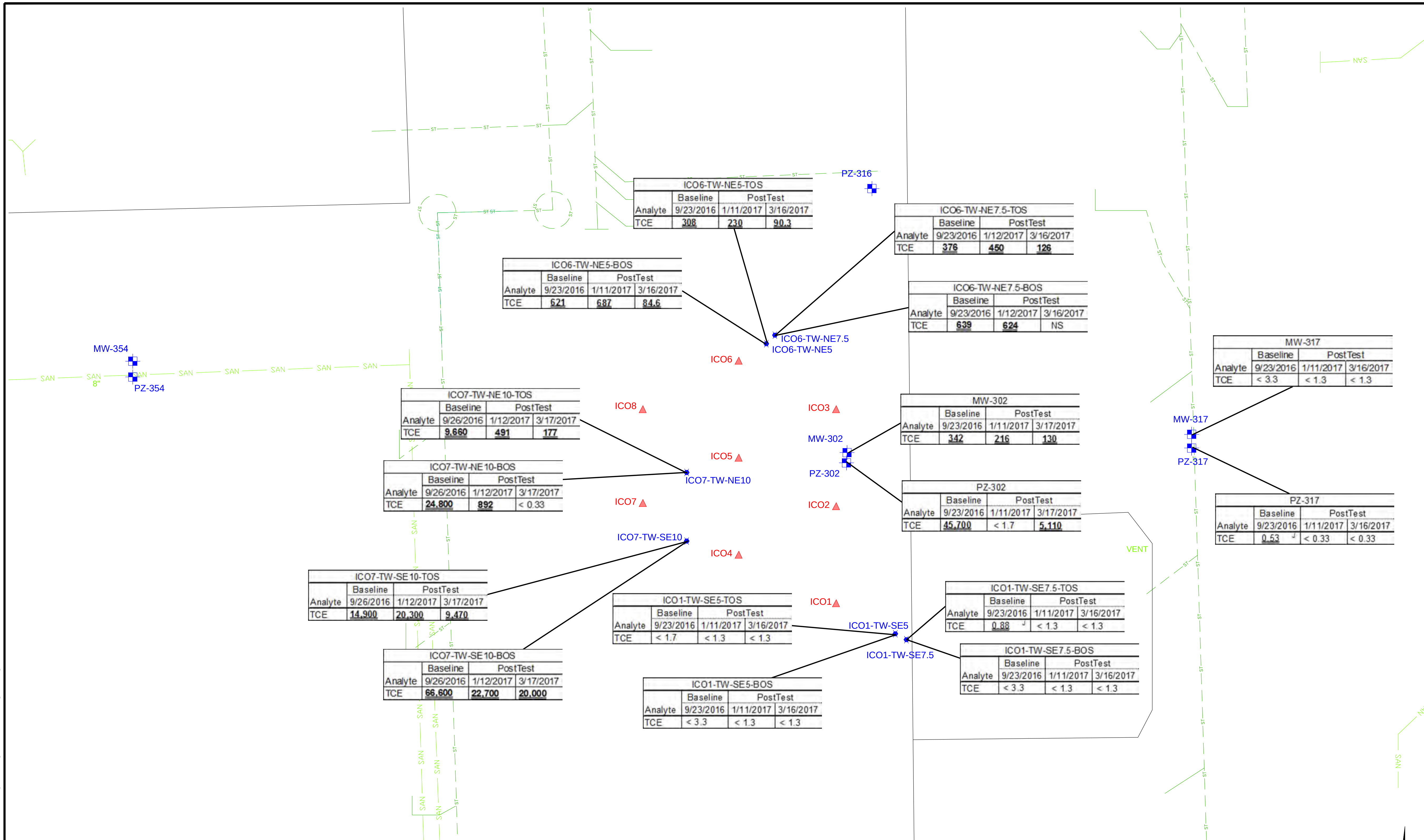
ISCO PILOT STUDY LAYOUT
KENOSHA ENGINE PLANT
CITY OF KENOSHA
KENOSHA, WISCONSIN

Drawn :	ANM	7/3/2017
Checked:	LLA	7/3/2017
Approved:	SP	7/7/2017
PROJECT NUMBER	60518412	
FIGURE NUMBER	6	



ICO6-TW-NE5-TOS

Analyte	Baseline 9/23/2016	PostTest 1/11/2017	PostTest 3/16/2017
TCE	308	230	90.3

ICO6-TW-NE5-BOS

Analyte	Baseline 9/23/2016	PostTest 1/11/2017	PostTest 3/16/2017
TCE	621	687	84.6

ICO6-TW-NE7.5-TOS

Analyte	Baseline 9/23/2016	PostTest 1/12/2017	PostTest 3/16/2017
TCE	376	450	126

ICO6-TW-NE7.5-BOS

Analyte	Baseline 9/23/2016	PostTest 1/12/2017	PostTest 3/16/2017
TCE	639	624	NS

MW-317

Analyte	Baseline 9/23/2016	PostTest 1/11/2017	PostTest 3/16/2017
TCE	< 3.3	< 1.3	< 1.3

ICO7-TW-NE10-TOS

Analyte	Baseline 9/26/2016	PostTest 1/12/2017	PostTest 3/17/2017
TCE	**9,660**	491	177

ICO7-TW-NE10-BOS

Analyte	Baseline 9/26/2016	PostTest 1/12/2017	PostTest 3/17/2017
TCE	**24,800**	892	< 0.33

MW-302

Analyte	Baseline 9/23/2016	PostTest 1/11/2017	PostTest 3/17/2017
TCE	342	216	130

PZ-302

Analyte	Baseline 9/23/2016	PostTest 1/11/2017	PostTest 3/17/2017
TCE	**45,700**	< 1.7	**5,110**

PZ-317

Analyte	Baseline 9/23/2016	PostTest 1/11/2017	PostTest 3/16/2017
TCE	0.53 J	< 0.33	< 0.33

ICO7-TW-SE10-TOS

Analyte	Baseline 9/26/2016	PostTest 1/12/2017	PostTest 3/17/2017
TCE	**14,900**	**20,300**	**9,470**

ICO7-TW-SE10-BOS

Analyte	Baseline 9/26/2016	PostTest 1/12/2017	PostTest 3/17/2017
TCE	**66,600**	**22,700**	**20,000**

ICO1-TW-SE5-TOS

Analyte	Baseline 9/23/2016	PostTest 1/11/2017	PostTest 3/16/2017
TCE	< 1.7	< 1.3	< 1.3

ICO1-TW-SE5-BOS

Analyte	Baseline 9/23/2016	PostTest 1/11/2017	PostTest 3/16/2017
TCE	< 3.3	< 1.3	< 1.3

ICO1-TW-SE7.5-TOS

Analyte	Baseline 9/23/2016	PostTest 1/11/2017	PostTest 3/16/2017
TCE	0.88 J	< 1.3	< 1.3

ICO1-TW-SE7.5-BOS

Analyte	Baseline 9/23/2016	PostTest 1/11/2017	PostTest 3/16/2017
TCE	< 3.3	< 1.3	< 1.3

LEGEND

- MONITORING WELL (MW) OR PIEZOMETER (PZ) FOR ISCO PILOT TEST MONITORING
- ISCO PILOT INJECTION LOCATION
- TEMPORARY WELL (TW) FOR ISCO MONITORING
- STORM SEWER (APPROXIMATE LOCATION)
- SANITARY SEWER (APPROXIMATE LOCATION) (8" inch diameter pipe)
- FORMER BUILDING INTERIOR WALL
- ISCO PILOT STUDY AREA

Notes:
1. All results in micrograms per liter (µg/L)
2. TCE = trichloroethene
3. PAL - Preventive Action Limit, Wisconsin Administrative Code NR 140.10 Table 1, February 2017; concentrations above PAL are underlined
4. ES - Enforcement Standard, Wisconsin Administrative Code NR 140.10 Table 1, February 2017; **concentrations above ES are bold-underlined**
5. J = Estimated value

0 20
1" = 20'

N

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TCE CONCENTRATIONS IN GROUNDWATER BASELINE AND POST-INJECTION MONITORING RESULTS KENOSHA ENGINE PLANT CITY OF KENOSHA KENOSHA, WISCONSIN

Drawn :	ANM	7/3/2017
Checked:	LLA	7/3/2017
Approved:	SP	7/7/2017
PROJECT NUMBER	60518412	
FIGURE NUMBER	7	

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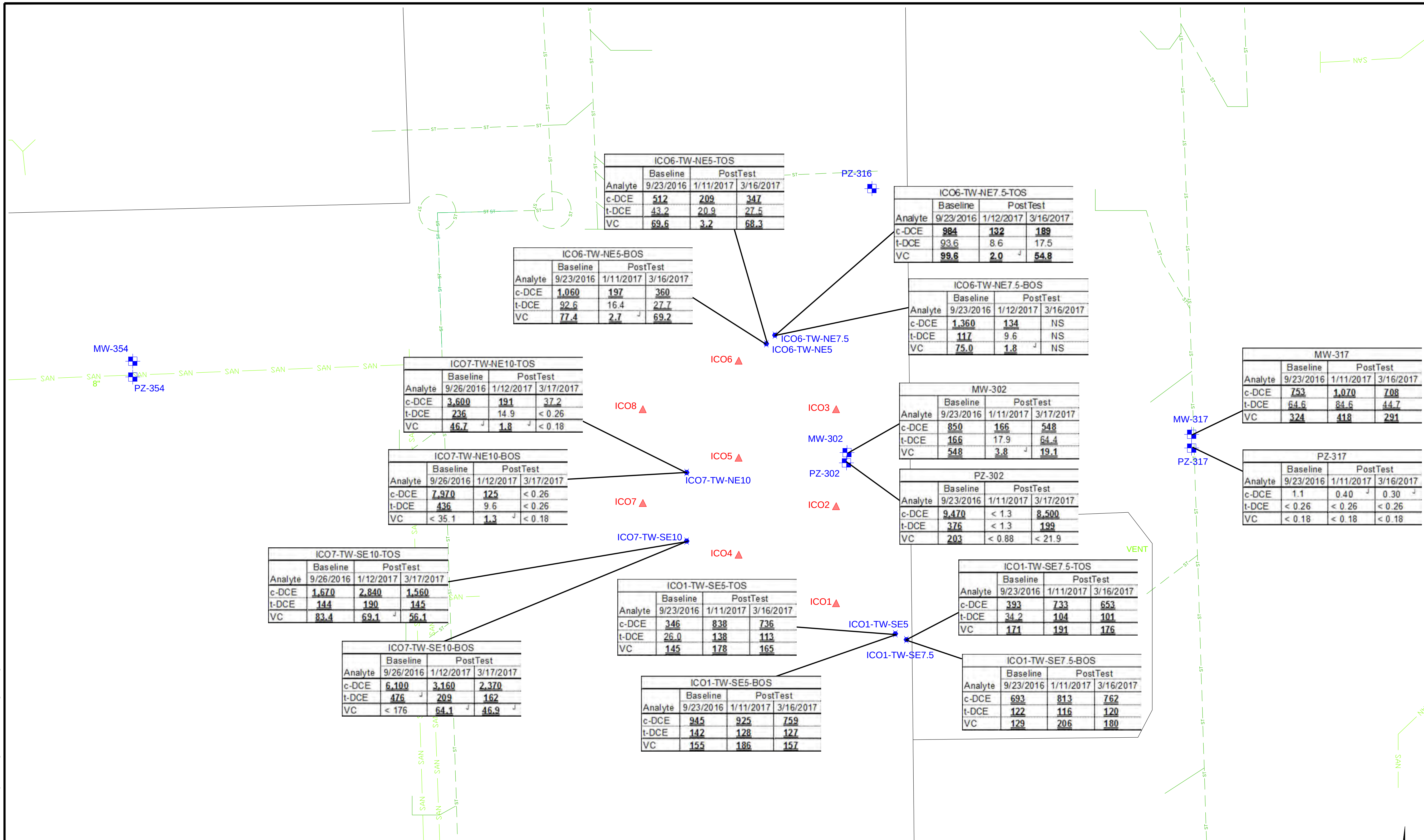

ICO6-TW-NE5-TOS

Analyte	Baseline 9/23/2016	PostTest 1/11/2017	PostTest 3/16/2017
c-DCE	512	209	347
t-DCE	43.2	20.9	27.5
VC	69.6	3.2	68.3

ICO6-TW-NE5-BOS

Analyte	Baseline 9/23/2016	PostTest 1/11/2017	PostTest 3/16/2017
c-DCE	1,060	197	360
t-DCE	92.6	16.4	27.7
VC	77.4	2.7 J	69.2

ICO6-TW-NE7.5-TOS

Analyte	Baseline 9/23/2016	PostTest 1/12/2017	PostTest 3/16/2017
c-DCE	984	132	189
t-DCE	93.6	8.6	17.5
VC	99.6	2.0 J	54.8

ICO6-TW-NE7.5-BOS

Analyte	Baseline 9/23/2016	PostTest 1/12/2017	PostTest 3/16/2017
c-DCE	1,360	134	NS
t-DCE	117	9.6	NS
VC	75.0	1.8 J	NS

ICO7-TW-NE10-TOS

Analyte	Baseline 9/26/2016	PostTest 1/12/2017	PostTest 3/17/2017
c-DCE	3,600	191	37.2
t-DCE	236	14.9	< 0.26
VC	46.7 J	1.8 J	< 0.18

ICO7-TW-NE10-BOS

Analyte	Baseline 9/26/2016	PostTest 1/12/2017	PostTest 3/17/2017
c-DCE	7,970	125	< 0.26
t-DCE	436	9.6	< 0.26
VC	< 35.1	1.3 J	< 0.18

MW-302

Analyte	Baseline 9/23/2016	PostTest 1/11/2017	PostTest 3/17/2017
c-DCE	850	166	548
t-DCE	166	17.9	64.4
VC	548	3.8 J	19.1

PZ-302

Analyte	Baseline 9/23/2016	PostTest 1/11/2017	PostTest 3/17/2017
c-DCE	9,470	< 1.3	8,500
t-DCE	376	< 1.3	199
VC	203	< 0.88	< 21.9

MW-317

Analyte	Baseline 9/23/2016	PostTest 1/11/2017	PostTest 3/16/2017
c-DCE	753	1,070	708
t-DCE	64.6	84.6	44.7
VC	324	418	291

PZ-317

Analyte	Baseline 9/23/2016	PostTest 1/11/2017	PostTest 3/16/2017
c-DCE	1.1	0.40 J	0.30 J
t-DCE	< 0.26	< 0.26	< 0.26
VC	< 0.18	< 0.18	< 0.18

ICO7-TW-SE10-TOS

Analyte	Baseline 9/26/2016	PostTest 1/12/2017	PostTest 3/17/2017
c-DCE	1,670	2,840	1,560
t-DCE	144	190	145
VC	83.4	69.1 J	56.1

ICO7-TW-SE10-BOS

Analyte	Baseline 9/26/2016	PostTest 1/12/2017	PostTest 3/17/2017
c-DCE	6,100	3,160	2,370
t-DCE	476 J	209	162
VC	< 176	64.1 J	46.9 J

ICO1-TW-SE5-TOS

Analyte	Baseline 9/23/2016	PostTest 1/11/2017	PostTest 3/16/2017
c-DCE	346	838	736
t-DCE	26.0	138	113
VC	145	178	165

ICO1-TW-SE5-BOS

Analyte	Baseline 9/23/2016	PostTest 1/11/2017	PostTest 3/16/2017
c-DCE	945	925	759
t-DCE	142	128	127
VC	155	186	157

ICO1-TW-SE7.5-TOS

Analyte	Baseline 9/23/2016	PostTest 1/11/2017	PostTest 3/16/2017
c-DCE	393	733	653
t-DCE	34.2	104	101
VC	171	191	176

ICO1-TW-SE7.5-BOS

Analyte	Baseline 9/23/2016	PostTest 1/11/2017	PostTest 3/16/2017
c-DCE	693	813	762
t-DCE	122	116	120
VC	129	206	180

LEGEND

- MONITORING WELL (MW) OR PIEZOMETER (PZ) FOR ISCO PILOT TEST MONITORING
- ISCO PILOT INJECTION LOCATION
- TEMPORARY WELL (TW) FOR ISCO MONITORING
- STORM SEWER (APPROXIMATE LOCATION)
- SANITARY SEWER (APPROXIMATE LOCATION) (8" inch diameter pipe)
- FORMER BUILDING INTERIOR WALL
- ISCO PILOT STUDY AREA

Notes:
1. All results in micrograms per liter (µg/L)
2. c-DCE = cis-1,2-dichloroethene
3. t-DCE = trans-1,2-dichloroethene
4. VC = vinyl chloride
5. PAL - Preventive Action Limit, Wisconsin Administrative Code NR 140.10 Table 1, February 2017; concentrations above PAL are underlined
6. ES - Enforcement Standard, Wisconsin Administrative Code NR 140.10 Table 1, February 2017; **concentrations above ES are bold-underlined**
7. J = Estimated value

0 20
1" = 20'

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DCE & VC CONCENTRATIONS IN GROUNDWATER BASELINE AND POST-INJECTION MONITORING RESULTS
KENOSHA ENGINE PLANT
CITY OF KENOSHA
KENOSHA, WISCONSIN

Drawn :	ANM	7/3/2017
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Appendix B ERD Pilot Test Results

Tables and Figures

Tables

Table 1
Groundwater Depth Measurements and Elevations
Kenosha Engine Plant ERD Pilot Test

Well Name	**MW-61**		**PZ-61**		**PZ-75**		**MW-807**		**ERD1-TW-NW10**		**ERD6-TW-NW10**		**ERD6-TW-NW15**	
Ground Elevation (ft)	624.08		624.08		623.97		623.91		624.00		624.00		624.00	
Top of Casing Elevation (ft)	623.78		623.87		623.83		626.23		--		--		--	
Top of Screen Elevation (ft)	616.48		603.57		604.83		618.28		--		--		--	
Screen Length (ft)	10		2.5		5		10		15		15		15	
Well Bottom (ft)	17.30		22.80		24.00		17.95		22.00		22.00		22.00	
Relative Location to ISCO Test Area	Injection Area		Injection Area		Up-Gradient		Down-Gradient (far)		Side-Gradient		Up-/Side-Gradient		Up-/Side-Gradient	
Date	Groundwater Depth	Groundwater Elevation	Groundwater Depth	Groundwater Elevation	Groundwater Depth	Groundwater Elevation	Groundwater Depth	Groundwater Elevation	Groundwater Depth	Groundwater Elevation	Groundwater Depth	Groundwater Elevation	Groundwater Depth	Groundwater Elevation
9/6-8/2011	9.53	614.25	NI	NI	9.60	614.23	NI	NI	NI	NI	NI	NI	NI	NI
11/2/2011	9.48	614.30	9.65	614.22	9.41	614.42	NI	NI	NI	NI	NI	NI	NI	NI
1/23/2012	9.60	614.18	9.77	614.10	9.89	613.94	NI	NI	NI	NI	NI	NI	NI	NI
4/12/2012	9.60	614.18	9.78	614.09	9.93	613.90	NI	NI	NI	NI	NI	NI	NI	NI
6/11/2012	9.69	614.09	9.84	614.03	9.94	613.89	NI	NI	NI	NI	NI	NI	NI	NI
5/07-20/2014	9.01	614.77	9.12	614.75	9.42	614.41	10.82	615.41	NI	NI	NI	NI	NI	NI
9/22/2014	9.19	614.59	9.33	614.54	9.22	614.61	10.85	615.38	NI	NI	NI	NI	NI	NI
12/1/2014	9.20	614.58	9.24	614.63	9.20	614.63	11.00	615.23	NI	NI	NI	NI	NI	NI
3/20/2015	9.23	614.55	9.43	614.44	9.44	614.39	11.30	614.93	NI	NI	NI	NI	NI	NI
6/23/2015	8.91	614.87	9.17	614.70	9.36	614.47	10.48	615.75	NI	NI	NI	NI	NI	NI
9/21/2015	8.91	614.87	9.06	614.81	9.36	614.47	10.06	616.17	NI	NI	NI	NI	NI	NI
4/13/2016	8.62	615.16	8.86	615.01	9.18	614.65	10.10	616.13	NI	NI	NI	NI	NI	NI
9/26-27/2016	9.73	614.05	9.56	614.31	9.48	614.35	10.89	615.34	9.35	614.65	10.10	613.90	10.16	613.84
12/13/2016	9.30	614.48	9.53	614.34	9.61	614.22	11.31	614.92	9.38	614.62	10.18	613.82	10.21	613.79
12/14/2016	9.32	614.46	9.53	614.34	9.62	614.21	10.33	615.90	9.10	614.90	10.19	613.81	10.23	613.77
3/7/2017	9.02	614.76	9.24	614.63	9.40	614.43	10.85	615.38	9.05	614.95	9.84	614.16	9.91	614.09
3/17/2017	9.04	614.74	4.55	619.32	9.43	614.40	10.05	616.18	9.09	614.91	9.30	614.70	9.61	614.39
6/14-15/2017	9.06	614.72	9.30	614.57	9.40	614.43	11.17	615.06	9.14	614.86	9.90	614.10	9.97	614.03
9/14/2017	9.27	614.51	9.48	614.39	9.24	614.59	11.53	614.70	9.34	614.66	10.08	613.92	10.11	613.89
3/21/2018	9.18	614.60	9.38	614.49	9.24	614.59	11.21	615.02	9.30	614.70	10.08	613.92	10.11	613.89
	0.71		0.32		0.08		0.04		0.30		0.26		0.25	

Notes:

Groundwater depth measured in feet below measure point (top of casing for MWs and PZs, ground elevation for TWs)

-- = temporary wells not surveyed; adjacent ground elevation used to estimate groundwater elevation

NI = well not installed at time of measurement

Table 2
Baseline and Post-Injection Field Paramaters Results Summary
Kenosha Engine Plant ERD Pilot Test

Well Name	Location Relative to ERD Test Area	Field ID	Sample Date	pH (std. units)	DO (mg/L)	ORP (mV)	Conductivity (µS/cm)	Temperature (°C)
ERD Pilot Test Area Permanent Wells								
MW-61	Injection Area	CS8-MW-61	9/26/2016	7.10	0.31	-119.9	2.368	18.66
			3/6/2017	6.98	0.78	20.4[1]	1.492	11.57
			3/17/2017	7.02	1.17[1]	-190.1	1.298	9.11
			6/15/2017	7.03	0.23	-133.3	1.554	17.62
			9/13/2017	7.00	0.48	-199.1	1.367	18.11
			3/21/2018	9.28[1]	0.94	-115.8	1.753	9.43
PZ-61	Injection Area	CS8-PZ-61	9/26/2016	6.96	0.43	-91.0	2.970	15.97
			3/6/2017	7.23[1]	3.08[1]	31.0[1]	1.617	12.81
			6/15/2017	5.87	0.19	-149.2	6.045	14.58
			9/13/2017	5.64	0.78	-69.6	4.247	16.39
			3/21/2018	6.51	0.29	-59.0	1.725	11.14
MW-75*	Up-Gradient	CS4-MW-75	9/26/2016	7.08	0.53	-102.0	0.954	17.90
PZ-75	Up-Gradient	CS4-PZ-75	9/26/2016	7.06	0.31	-107.3	2.103	16.91
			3/6/2017	6.86	5.48[1]	194.7[1]	0.902	12.06
			6/14/2017	7.06	0.41	-87.5	1.826	17.15
			9/14/2017	7.22	0.61	-103.4	1.762	16.83
			3/22/2018	7.02	0.53	44.3[1]	2.147	11.46
MW-807	Down-Gradient (far)	CS8-MW-807	9/26/2016	8.24	6.58	42.7	0.393	20.14
			3/6/2017	6.96	6.97	194.8	0.330	11.43
			6/14/2017	7.57	4.90	76.0	0.365	22.34
			9/14/2017	7.66	2.32	8.4	0.958	19.46
			3/22/2018	7.75	6.89	50.3	0.526	8.32
ERD Pilot Test Area Temporary Wells								
ERD1-TW-NW10	Side-Gradient	ERD1-TW-NW10-TOS	9/27/2016	7.12	0.86	-108.9	2.278	17.24
			3/6/2017	7.09	--	-43.2	1.553	10.97
			3/17/2017	7.52	0.60	-44.0	2.303	9.68
			6/15/2017	7.18	0.74	-142.3	1.742	15.28
			9/14/2017	7.17	0.66	-109.2	1.643	18.08
			3/22/2018	9.41[1]	2.24[1]	-222.8	1.953	9.15
		ERD1-TW-NW10-BOS	9/27/2016	6.90	0.88	-109.8	4.972	16.49
			3/6/2017	6.89	--	-78.5	5.022	12.61
			3/17/2017	7.46	0.44	-79.0	4.009	10.20
			6/15/2017	6.99	0.78	-139.2	2.611	16.65
			9/14/2017	6.75	0.83	-196.5	5.047	18.46
			3/22/2018	12.16[1]	0.82	-240.9	4.887	11.16
ERD6-TW-NW10	Up-/Side Gradient	ERD6-TW-NW10-TOS	9/27/2016	6.99	0.64	-119.1	2.314	17.54
			3/6/2017	6.98	2.37[1]	-51.8	1.507	11.33
			6/14/2017	6.57	0.31	-117.2	1.927	16.51
			9/13/2017	7.00	1.59[1]	-115.0	1.788	19.47
			3/21/2018	4.82[1]	1.02[1]	-152.4	1.647	9.42
		ERD6-TW-NW10-BOS	9/27/2016	7.01	0.33	-124.5	3.202	16.50
			3/6/2017	7.08	2.09[1]	-44.0[1]	3.099	12.30
			6/14/2017	5.84	0.18	-119.0	2.191	16.16
			9/13/2017	6.03	0.45	-70.3	3.528	18.99
			3/21/2018	7.11	0.87	-171.1	1.908	10.40
ERD6-TW-NW15	Up-/Side Gradient	ERD6-TW-NW15-TOS	9/27/2016	7.17	0.36	-101.4	2.727	17.72
			3/6/2017	7.03	0.42	-79.7	2.093	11.10
			6/14/2017	5.92	1.40[1]	-95.6	1.820	13.69
			9/13/2017	6.67	1.03[1]	-126.3	1.821	17.36
			3/21/2018	7.17	0.50	-89.8	1.596	8.99
		ERD6-TW-NW15-BOS	9/27/2016	7.12	0.48	-104.4	4.577	16.29
			3/6/2017	6.95	0.37	-81.8	3.494	12.37
			6/14/2017	5.96	1.11[1]	-119.6	3.261	14.58
			9/13/2017	6.14	1.36[1]	-120.2	2.870	16.83
			3/21/2018	6.83	0.49	-68.6	2.401	10.76
ERD8-TW-SW15*	Injection Area	ERD8-TW-SW15 TOS	9/27/2016	7.19	0.33	-105.6	2.389	17.41
		ERD8-TW-SW15 BOS	9/27/2016	7.15	0.53	-113.2	6.271	17.07

Notes:
DO = disolved oxygen
ORP = oxidation-reduction potential
-- = not measured
* wells abandoned during other site remedial activities
mg/L = milligrams per liter
mV = millivolts
µS/cm = microSiemens per centimeter
ºC = degrees Celsius
TOS = top of screen
BOS = bottom of screen
[1] measurement is suspect, due to possible instrument error.

Table 3
Baseline and Post-Injection Alkalinity, Anions, Total Organic Carbon, and Dissolved Gases Results Summary
Kenosha Engine Plant ERD Pilot Test

Well Name	Location Relative to ERD Test Area	Field ID	Sample Date	Alkalinity (mg/L)	Anions			Total Organic Carbon (mg/L)	Dissolved Gases		
					Chloride (mg/L)	Sulfate (mg/L)	Sulfide (mg/L)		Ethene (ug/L)	Ethane (ug/L)	Methane (ug/L)
ERD Pilot Test Area Permanent Wells											
MW-61	Injection Area	CS8-MW-61	3/23/2015	NA	1,010	17.5	< 2	NA	191	95.4	2,030
			9/24/2015	511	874	< 100	< 2	0.56	192	100	942
			12/15/2015	NA	847	65.1	< 2	0.47 J	122	73.7	917
			9/26/2016	519	431	67.0	NA	1.9 J	98.8	27.1	705
			3/17/2017	NA	NA	NA	NA	4.1	NA	NA	NA
			6/15/2017	397	431	5.7 J	NA	1.9 J	244	30.9	2,720
			9/13/2017	428	350	25.8	< 1.2	2.5	195	23.6	1,870
			3/21/2018	389	551	29.4 J	NA	0.94	74.1	70.0	1,390
			DUP	418	599	32.5 J	NA	0.98	87.2	82.3	1,240
PZ-61	Injection Area	CS8-PZ-61	9/24/2015	282	1,190	59.9	< 2	< 0.17	6.4	10.7	283
			12/15/2015	NA	1,600	70.7	< 2	0.2 J	3.9 J	6.1	273
			9/26/2016	342	1,710	64.6	NA	< 1.5	4.3 J	6.6	271
			6/15/2017	1,660	1,750	< 100	NA	4,840	27.1	8.3	279
			9/13/2017	1,320	1,020	13.4 J	< 1.2	5,680	54.0	34.8	403
			3/21/2018	1,460	360	< 20.0	NA	2,050	68.9	9.2	4,460
MW-75*	Up-Gradient	CS4-MW-75	9/26/2016	479	138	180	NA	24.0 J	1.2 J	2.9 J	194
PZ-75	Up-Gradient	CS4-PZ-75	9/26/2016	357	488	57.9	NA	3.2 J	< 0.52	11.8	278
			3/17/2017	NA	NA	NA	NA	0.52 J	NA	NA	NA
			6/14/2017	399	539	102	NA	1.1 J	2.4 J	15.5	436
			9/14/2017	397	506	118	< 1.2	10.3	23.3	12.1	542
			3/22/2018	417	542	103	NA	3.1	52.1	11.7	716
MW-807	Down-Gradient (far)	CS8-MW-807	9/26/2016	121	47.4 J	40.3 J	NA	2.0 J	4.9 J	< 0.58	< 1.4
			3/17/2017	NA	NA	NA	NA	1.8	NA	NA	NA
			6/14/2017	< 176	35.0	33.9	NA	1.0	< 0.52	< 0.58	< 1.4
			9/14/2017	287	169	45.2	< 1.2	0.54 J	10.6	5.0 J	218
			3/22/2018	221	29.1	48.4	NA	1.5	< 0.52	< 0.58	< 1.4
ERD Pilot Test Area Temporary Wells											
ERD1-TW-NW10	Side-Gradient	ERD1-TW-NW10-TOS	9/27/2016	NA	NA	NA	NA	1.6 J	NA	NA	NA
			3/17/2017	NA	NA	NA	NA	0.5 J	NA	NA	NA
			6/15/2017	511	741	9.5	NA	9.5	4.0 J	63.0	1,770
			9/14/2017	473	462	< 20.0	< 1.2	1.5 J	5.8	105	2,650
			3/22/2018	520	533	32.7 J	NA	3.4	177	85.1	1,880
		ERD1-TW-NW10-BOS	9/27/2016	NA	NA	NA	NA	< 2.5	NA	NA	NA
			DUP	NA	NA	NA	NA	< 2.5	NA	NA	NA
			3/17/2017	NA	NA	NA	NA	0.4 J	NA	NA	NA
			6/15/2017	504	944	13.7 J	NA	10.1	13.5	64.5	1,790
			9/14/2017	553	1,200	34.1 J	< 1.2	21.5	95.8	39.3	770
			3/22/2018	590	1,170	15.4 J	NA	7.3	1,190	54.0	7,890

Table 3
Baseline and Post-Injection Alkalinity, Anions, Total Organic Carbon, and Dissolved Gases Results Summary
Kenosha Engine Plant ERD Pilot Test

Well Name	Location Relative to ERD Test Area	Field ID	Sample Date	Alkalinity (mg/L)	Anions: Chloride (mg/L)	Anions: Sulfate (mg/L)	Anions: Sulfide (mg/L)	Total Organic Carbon (mg/L)	Dissolved Gases: Ethene (ug/L)	Dissolved Gases: Ethane (ug/L)	Dissolved Gases: Methane (ug/L)
ERD6-TW-NW10	Up-/Side Gradient	ERD6-TW-NW10-TOS	9/27/2016	NA	NA	NA	NA	< 1.5	NA	NA	NA
			6/14/2017	776	278	< 5.0	NA	606	57.0	14.8	1,290
			9/13/2017	569	499	< 10.0	< 1.2	102	128	70.2	1,860
			3/21/2018	473	329	< 20.0	NA	58.7	51.9	86.1	2,660
		ERD6-TW-NW10-BOS	9/27/2016	NA	NA	NA	NA	< 1.5	NA	NA	NA
			6/14/2017	548 [J]	379	< 5.0	NA	1,430	104	21.0	771
			9/13/2017	717	709	< 20.0	< 1.2	1,260	209	28.1	1,450
			3/21/2018	406	408	< 20.0	NA	23.2	28.6	32.0	2,070
ERD6-TW-NW15	Up-/Side Gradient	ERD6-TW-NW15-TOS	9/27/2016	NA	NA	NA	NA	< 1.5	NA	NA	NA
			6/14/2017	419 [J]	684	< 5.0	NA	368	136	22.0	1,720
			9/13/2017	541	558	< 20.0	< 1.2	130	193	55.8	2,930
			3/21/2018	465	349	< 20.0	NA	5.6	189	167	6,860
		ERD6-TW-NW15-BOS	9/27/2016	NA	NA	NA	NA	< 1.5	NA	NA	NA
			6/14/2017	405 [J]	795	< 5.0	NA	887	240	33.7	2,270
			9/13/2017	692	658	< 20.0	< 1.2	448	336	80.4	3,360
			3/21/2018	556	457	< 20.0	NA	206	94.2	62.6	5,790
ERD8-TW-SW15*	Injection Area	ERD8-TW-SW15-TOS	9/27/2016	NA	NA	NA	NA	< 1.5	NA	NA	NA
		ERD8-TW-SW15-BOS	9/27/2016	NA	NA	NA	NA	< 2.5	NA	NA	NA
			ES	--	250 [a]	250 [a]	--	--	--	--	--
			PAL	--	125 [a]	125 [a]	--	--	--	--	--

Notes:
ug/L = micrograms per liter
mg/L = milligrams per liter
[J] = estimated value
PAL = Preventive Action Limit, Wisconsin Administrative Code NR 140.12 (Public Welfare Groundwater Quality Standards) Table 2, February 2017.
ES = Enforcement Standard, Wisconsin Administrative Code NR 140.12 (Public Welfare Groundwater Quality Standards) Table 2, February 2017.
[a] = PAL and ES are Public Welfare Groundwater Quality Standards; concentrations above the ES and PAL are not highlighted.
Alkalinity = total as $CaCO_3$
* wells abandoned during other site remedial activities

Table 4
Baseline and Post-Injection VOCs Results Summary
Kenosha Engine Plant ERD Pilot Test

Well Name	Location Relative to ERD Test Area	Field ID	Sample Date	Benzene (ug/L)	Chloro-ethane (ug/L)	1,1-DCE (ug/L)	c-DCE (ug/L)	t-DCE (ug/L)	Toluene (ug/L)	TCE (ug/L)	Vinyl Chloride (ug/L)	Xylene (Total) (ug/L)
ERD Pilot Test Area Permanent Wells												
MW-61	Injection Area	CS8-MW-61	4/11/2012	**12.1** J	< 24.2	**15.0** J	**6,690**	**294**	< 16.8	**223**	**2,460**	< 65
			5/22/2014	< 25	< 18.7	< 20.5	**4,550**	**191**	< 25	**308**	**1,950**	< 75
			9/24/2014	< 25	< 18.7	< 20.5	**6,470**	**215**	< 25	**485**	**3,430**	< 75
			12/3/2014	< 25	< 18.7	< 20.5	**5,910**	**183**	< 25	**391**	**3,180**	< 75
			3/23/2015	< 10	< 7.5	**13.4** J	**4,750**	**216**	< 10	**389**	**3,290**	< 30
			9/24/2015	< 20	< 15	< 16.4	**4,170**	**159**	< 20	**410**	**2,490**	< 60
			12/15/2015	< 12.5	< 9.4	< 10.3	**3,490**	**135**	< 12.5	**383**	**1,760**	< 37.5
			9/26/2016	**13.0** J	< 9.4	< 10.3	**2,740**	*47.1*	< 12.5	**242**	**1,130**	< 37.5
			6/15/2017	**16.0** J	< 9.4	< 10.3	**1,420**	*42.6*	< 12.5	**61.4**	**760**	< 37.5
			DUP	**19.1** J	< 9.4	< 10.3	**1,280**	*44.7*	< 12.5	**68.6**	**752**	< 37.5
			9/13/2017	**18.8** J	< 7.5	< 8.2	**2,160**	**103**	< 10.0	**111**	**835**	< 30
			3/21/2018	**16.6** J	< 9.4	< 10.3	**2,540**	< 6.4	< 12.5	**104**	**3,280**	< 37.5
			DUP	**16.3** J	< 9.4	< 10.3	**2,560**	< 6.4	< 12.5	**116**	**3,140**	< 37.5
PZ-61	Injection Area	CS8-PZ-61	4/11/2012	< 20.5	< 48.5	< 28.5	**9,180**	**108**	< 33.5	**2,610**	**129**	< 130
			DUP	< 16.4	< 38.8	< 22.8	**8,600**	**137**	< 26.8	**2,480**	**125**	< 104
			5/22/2014	< 50	< 37.5	< 41	**7,660**	**135**	< 50	**2,770**	**124**	< 150
			DUP	< 50	< 37.5	< 41	**7,760**	**129**	< 50	**2,820**	**109**	< 150
			9/24/2014	< 50	< 37.5	< 41	**8,770**	**145**	< 50	**2,950**	**132**	< 150
			DUP	< 50	< 37.5	< 41	**8,450**	**136**	< 50	**2,760**	**130**	< 150
			12/3/2014	< 50	< 37.5	< 41	**7,120**	**290**	< 50	**1,840**	**118**	< 150
			DUP	< 25	< 18.7	**20.8** J	**7,220**	**196**	< 25	**1,770**	**114**	< 75
			3/23/2015	< 50	< 37.5	< 41	**7,560**	**135**	< 50	**2,220**	**108**	< 150
			DUP	< 25	< 18.7	< 20.5	**7,930**	**143**	< 25	**2,670**	**117**	< 75
			9/24/2015	< 50	< 37.5	< 41	**6,760**	**127**	< 50	**1,420**	**130**	< 150
			12/15/2015	< 25	< 18.7	< 20.5	**6,330**	**117**	< 25	**1,490**	**123**	< 75
			9/26/2016	< 25	< 18.7	< 20.5	**6,410**	< 12.8	< 25	**1,430**	**114**	< 75
			6/15/2017	< 25	< 18.7	< 20.5	**5,290**	*78.0*	32.5 J	**251**	**272**	< 75
			9/13/2017	< 25.0	< 18.7	< 20.5	**2,880**	< 12.8	< 25.0	**37.9** J	**203**	< 75
			3/21/2018	< 5.0	< 3.7	< 4.1	**1,210**	< 2.6	< 5.0	*4.2* J	**81.2**	< 15
MW-75*	Up-Gradient	CS4-MW-75	9/26/2016	**87.5**	< 0.37	< 0.41	1.4	< 0.26	3.7	< 0.33	**27.4**	64.4
PZ-75	Up-Gradient	CS4-PZ-75	4/12/2012	< 2.0	< 4.8	< 2.8	< 4.2	< 4.4	< 3.4	< 2.4	**515**	< 13
			5/30/2014	< 0.5	< 0.37	< 0.41	< 0.26	< 0.24	< 0.5	< 0.33	**328** J-	< 1.5
			9/30/2014	< 0.5	< 0.37	< 0.41	0.27 J	< 0.26	< 0.5	< 0.33	**109**	< 1.5
			12/9/2014	< 0.5	< 0.37	< 0.41	< 0.26	< 0.26	< 0.5	< 0.33	**45.8**	< 1.5
			9/26/2016	< 0.5	< 0.37	< 0.41	< 0.26	< 0.26	< 0.5	< 0.33	**9.0**	< 1.5
			6/14/2017	< 0.5	< 0.37	< 0.41	< 0.26	< 0.26	< 0.5	< 0.33	**18.6**	< 1.5
			9/14/2017	< 0.50	< 0.37	< 0.41	< 0.26	< 0.26	< 0.50	< 0.33	**65.1**	< 1.5
			3/22/2018	< 2.5	< 1.9	< 2.1	< 1.3	< 1.3	< 2.5	< 1.7	**673**	< 7.5

Table 4
Baseline and Post-Injection VOCs Results Summary
Kenosha Engine Plant ERD Pilot Test

Well Name	Location Relative to ERD Test Area	Field ID	Sample Date	Benzene (ug/L)	Chloro-ethane (ug/L)	1,1-DCE (ug/L)	c-DCE (ug/L)	t-DCE (ug/L)	Toluene (ug/L)	TCE (ug/L)	Vinyl Chloride (ug/L)	Xylene (Total) (ug/L)
MW-807	Down-Gradient (far)	CS8-MW-807	5/22/2014	*1.2*	< 0.37	< 0.41	0.27 [J]	< 0.24	< 0.5	*0.76* [J]	**8.8**	< 1.5
			9/23/2014	< 0.5	< 0.37	< 0.41	< 0.26	< 0.26	< 0.5	< 0.33	**7.2**	< 1.5
			12/3/2014	< 0.5	< 0.37	< 0.41	< 0.26	< 0.26	< 0.5	< 0.33	< 0.18	< 1.5
			3/23/2015	< 0.5	< 0.37	< 0.41	< 0.26	< 0.26	< 0.5	< 0.33	**80.4**	< 1.5
			9/26/2016	< 0.5	< 0.37	< 0.41	< 0.26	< 0.26	< 0.5	*0.92* [J]	< 0.18	< 1.5
			6/14/2017	< 0.5	< 0.37	< 0.41	< 0.26	< 0.26	< 0.5	*0.64* [J]	< 0.18	< 1.5
			9/14/2017	< 0.50	< 0.37	< 0.41	< 0.26	< 0.26	< 0.50	*0.62* [J]	64.8	< 1.5
			3/22/2018	< 0.50	< 0.37	< 0.41	< 0.26	< 0.26	< 0.50	*0.56* [J]	< 0.18	< 1.5
ERD Pilot Test Area Temporary Wells												
ERD1-TW-NW10	Side-Gradient	ERD1-TW-NW10-TOS	9/27/2016	< 1	*225*	< 0.82	**101**	< 0.51	< 1	**194**	**3.8**	< 3
			6/15/2017	< 2	*119*	< 1.6	**329**	4.2	< 2	**13.0**	**24.0**	< 6
			9/14/2017	< 2.0	*149*	< 1.6	**335**	4.2	< 2.0	*3.5* [J]	**27.2**	< 6
			DUP	< 2.5	*149*	< 2.1	**428**	5.3	< 2.5	*4.8* [J]	**31.2**	< 7.5
			3/22/2018	< 0.50	*134*	< 0.41	**158**	< 0.26	< 0.50	*0.76* [J]	**36.4**	< 1.5
		ERD1-TW-NW10-BOS	9/27/2016	< 5	13.4	< 4.1	**816**	2.9 [J]	< 5	**1,180**	**25.5**	< 15
			DUP	< 5	13.6	< 4.1	**832**	< 2.6	< 5	**1,150**	**25.3**	< 15
			6/15/2017	< 2.5	*97.9*	< 2.1	**628**	11.4	< 2.5	**84.9**	**46.3**	< 7.5
			9/14/2017	< 20.0	< 15.0	< 16.4	**1,710**	79.8	< 20.0	**61**	**105**	< 60
			3/22/2018	< 0.50	15.6	*1.2*	**578**	< 0.26	< 0.50	**5.3**	**138**	< 1.5
ERD6-TW-NW10	Up-/Side Gradient	ERD6-TW-NW10-TOS	9/27/2016	**5.6** [J]	73.3	< 4.1	**747**	< 2.6	< 5	**5.3** [J]	**228**	< 15
			6/14/2017	**5.2**	38.7	< 0.82	**150**	< 0.51	2.9	*0.97* [J]	**133**	< 3
			9/13/2017	**5.2**	54	< 0.41	*30.5*	0.48 [J]	1.5	0.45 [J]	**125**	< 1.5
			3/21/2018	*2.7*	< 0.75	< 0.82	*16.4*	< 0.51	< 1.0	< 0.66	**218**	< 3
		ERD6-TW-NW10-BOS	9/27/2016	**5.8** [J]	21.7	*5.9* [J]	**1,800**	< 2.6	< 5	**10.6**	**305**	< 15
			6/14/2017	**5.3**	8.5	*1.7* [J]	**475**	2.9	4.8	*1.4* [J]	**189**	3.6 [J]
			9/13/2017	**5.1**	26.7	< 2.1	**433**	3.1 [J]	4.0 [J]	< 1.7	**388**	< 7.5
			3/21/2018	*2.5* [J]	< 1.5	< 1.6	*49.3*	< 1.0	< 2.0	< 1.3	**456**	< 6
ERD6-TW-NW15	Up-/Side Gradient	ERD6-TW-NW15-TOS	9/27/2016	**8.9**	53.8	*2.2* [J]	**689**	< 1.3	< 2.5	< 1.7	**259**	< 7.5
			6/14/2017	**6.8**	62.6	< 2.1	**472**	3.4 [J]	2.7 [J]	< 1.7	**710**	< 7.5
			9/13/2017	**8.3**	16.9	< 0.41	2.2	< 0.26	1.1	< 0.33	**24.0**	1.1 [J]
			3/21/2018	**6.7**	< 0.37	< 0.41	*11.6*	< 0.26	0.72 [J]	< 0.33	**60.4**	< 1.5
		ERD6-TW-NW15-BOS	9/27/2016	< 10	11.8 [J]	< 8.2	**1,980**	**120**	< 10	< 6.6	**152**	< 30
			6/14/2017	< 10	*82.8*	< 8.2	**798**	< 5.1	< 10	< 6.6	**995**	< 30
			9/13/2017	**7.0**	19.0	< 0.41	**123**	1.3	1.8	< 0.33	**104**	1.5 [J]
			3/21/2018	**5.8**	< 0.37	< 0.41	*58.6*	< 0.26	0.93 [J]	< 0.33	**115**	< 1.5
ERD8-TW-SW15*	Injection Area	ERD8-TW-SW15-TOS	9/27/2016	**79.1**	< 15	< 16.4	**4,520**	*45.5*	< 20	< 13.2	**2,520**	< 60
		ERD8-TW-SW15-BOS	9/27/2016	**40.0**	< 1.9	< 2.1	**563**	< 1.3	< 2.5	< 1.7	**983**	< 7.5
			PAL	0.5	80	0.7	7	20	160	0.5	0.02	400
			ES	5	400	7	70	100	800	5	0.2	2,000

Notes:
ug/L = micrograms per liter
[J] = estimated value [J-] = estimated value, may be biased low
PAL = Preventive Action Limit, Wisconsin Administrative Code NR 140.10 Table 1, February 2017; concentrations above PAL are in *underlined italics*.
ES = Enforcement Standard, Wisconsin Administrative Code NR 140.10 Table 1, February 2017; concentrations above ES are in **bold**.
Only compounds with at least one confirmed detection above the PAL are shown
* wells abandoned during other site remedial activities

Table 5
Baseline and Post-Injection Metals Results Summary
Kenosha Engine Plant ERD Pilot Test

Well Name	Location Relative to ERD Test Area	Field ID	Sample Date	Barium (ug/L)	Chromium (ug/L)	Iron, Total (ug/L)	Iron, Dissolved (ug/L)	Lead (ug/L)	Nickel (ug/L)
ERD Pilot Test Area Permanent Wells									
MW-61	Injection Area	CS8-MW-61	3/23/2015	NA	NA	3,700	3,480	NA	NA
			9/24/2015	NA	NA	3,280	3,060	NA	NA
			12/15/2015	NA	NA	2,960	3,180	NA	NA
			9/26/2016	*432*	< 0.39	2,190	2,320	0.07 J	0.18 J
			6/15/2017	297	< 1	3,010	2,990	< 0.2	< 0.4
			DUP	298	< 1	3,100	2,930	< 0.2	< 0.4
			9/13/2017	294	< 1.0	1,590	1,800	< 0.20	< 0.40
			3/21/2018	322	< 1.0	2,220	2,250	0.46 J	< 0.40
			DUP	339	< 1.0	2,240	2,300	< 0.20	< 0.40
PZ-61	Injection Area	CS8-PZ-61	9/24/2015	NA	NA	3,540	3,420	NA	NA
			12/15/2015	NA	NA	3,660	3,560	NA	NA
			9/26/2016	*404*	< 0.39	3,050	3,390	0.23 J	1.6
			6/15/2017	*549*	*11.6* J	312,000	296,000	0.98 J	7.0
			9/13/2017	*1,670*	< 10.2	968,000	896,000	< 0.98	4.4 J
			3/21/2018	*1,260*	< 10.2	570,000	756,000	*6.5* J	4.8 J
MW-75*	Up-Gradient	CS4-MW-75	9/26/2016	207	0.77 J	1,780	1,880	0.79 J	4.5
PZ-75	Up-Gradient	CS4-PZ-75	9/26/2016	238	0.61 J	2,670	1,810	*1.6*	2.8
			6/14/2017	249	< 1	3,020	< 15.5	0.23 J	2.5
			9/14/2017	236	< 1.0	3,890	4,090	< 0.20	6.3
			3/22/2018	223	< 1.0	614	400	0.75 J	10.2
MW-807	Down-Gradient (far)	CS8-MW-807	9/26/2016	124	*43.9*	31,600	< 12.9	**18.8**	*33.6*
			6/14/2017	48.1	*15.8*	9,680	24.5 J	*5.6*	9.9
			9/14/2017	51.8	< 1.0	419	278	0.23 J	0.77 J
			3/22/2018	39.1	*10.5*	4,100	84.6 J	*2.2*	4.2
ERD Pilot Test Area Temporary Wells									
ERD1-TW-NW10	Side-Gradient	ERD1-TW-NW10-TOS	6/15/2017	339	< 1	4,500	4,580	0.22 J	0.42 J
			9/14/2017	258	< 1.0	2,640	3,090	0.31 J	< 0.40
			DUP	275	< 1.0	2,750	2,970	< 0.39	< 0.40
			3/22/2018	246	< 1.0	2,180	1,850	< 0.20	< 0.40
		ERD1-TW-NW10-BOS	6/15/2017	*523*	< 1	5,650	5,800	< 0.2	< 0.4
			9/14/2017	*919*	< 5.1	10,100	10,500	< 0.98	< 2.0
			3/22/2018	*659*	< 5.1	6,980	6,030	< 0.20	< 2.0
ERD6-TW-NW10	Up-/Side Gradient	ERD6-TW-NW10-TOS	6/14/2017	158	3.4 J	21,100	< 15.5	< 0.2	2.5
			9/13/2017	206	1.1 J	19,500	21,000	< 0.20	1.0 J
			3/21/2018	152	*10.2*	31,000	27,600	0.26 J	6.8
		ERD6-TW-NW10-BOS	6/14/2017	196	3.3 J	55,800	43,900	0.38 J	2.2
			9/13/2017	*710*	< 5.1	138,000	120,000	< 0.98	< 2.0
			3/21/2018	173	4.2	16,200	9,030	< 0.20	3.4

Table 5
Baseline and Post-Injection Metals Results Summary
Kenosha Engine Plant ERD Pilot Test

Well Name	Location Relative to ERD Test Area	Field ID	Sample Date	Barium (ug/L)	Chromium (ug/L)	Iron, Total (ug/L)	Iron, Dissolved (ug/L)	Lead (ug/L)	Nickel (ug/L)
ERD6-TW-NW15	Up-/Side Gradient	ERD6-TW-NW15-TOS	6/14/2017	378	< 1	25,400	1,090	< 0.2	0.5 [J]
			9/13/2017	282	< 1.0	29,400	34,300	< 0.20	< 0.40
			3/21/2018	79.8	< 1.0	6,700	7,140	< 0.20	0.78 [J]
		ERD6-TW-NW15-BOS	6/14/2017	*482*	< 1	34,100	6,770	< 0.2	0.44 [J]
			9/13/2017	*574*	1.4 [J]	44,200	50,100	< 0.39	0.89 [J]
			3/21/2018	283	8.9	33,800	32,000	1.3	5.8
			PAL	400	10	150 [a]	150 [a]	1.5	20
			ES	2,000	100	300 [a]	300 [a]	15	100

Notes:
ug/L = micrograms per liter
[J] = estimated value
PAL = Preventive Action Limit, Wisconsin Administrative Code NR 140.10 Table 1, February 2017; concentrations above PAL are in *underlined italics*.
ES = Enforcement Standard, Wisconsin Administrative Code NR 140.10 Table 1, February 2017; concentrations above ES are in **bold**.
[a] = PAL and ES are Public Welfare Groundwater Quality Standards; concentrations above the ES and PAL are not highlighted.
* wells abandoned during other site remedial activities

Table 6
Baseline and Post-Injection Volatile Fatty Acids Results Summary
Kenosha Engine Plant ERD Pilot Test

Well Name	Location Relative to ERD Test Area	Field ID	Sample Date	Acetic Acid (mg/L)	Butyric Acid (mg/L)	Formic Acid (mg/L)	Hexanoic Acid (mg/L)	i-Hexanoic Acid (mg/L)	i-Pentanoic Acid (mg/L)	Lactic Acid (mg/L)	Pentanoic Acid (mg/L)	Propionic Acid (mg/L)	Pyruvic Acid (mg/L)
ERD Pilot Test Area Permanent Wells													
MW-61	Injection Area	CS8-MW-61	9/26/2016	0.33 [Jb]	0.07 [Jb]	0.26 [Jb]	< 0.07	< 0.04	< 0.07	0.09 [Jb]	0.17 [J]	< 0.09	< 0.07
			6/15/2017	7.4	0.37 [J]	< 0.69	< 0.38	< 0.41	< 0.055	< 0.2	< 0.12	0.18 [J]	< 0.16
			9/13/2017	3.0	< 0.055	0.36 [Jb]	< 0.095	< 0.11	< 0.098	0.38 [Jb]	< 0.082	< 0.055	< 0.089
PZ-61	Injection Area	CS8-PZ-61	9/26/2016	0.31 [Jb]	< 0.07	0.27 [Jb]	< 0.07	< 0.04	< 0.07	0.099 [Jb]	0.22 [J]	< 0.09	< 0.07
			6/15/2017	1,300	1,400	63	8.0	5.7	2.5 [J]	140	55	760	6.5 [J]
			9/13/2017	3,200	2,600	96 [Jb]	48	9.6	9.6 [J]	4.5	270	1,900	15 [J]
MW-75*	Up-Gradient	CS4-MW-75	9/26/2016	0.089 [Jb]	0.0074 [Jb]	0.063 [Jb]	< 0.007	< 0.004	< 0.007	0.012 [Jb]	0.031 [J]	< 0.009	< 0.007
PZ-75	Up-Gradient	CS4-PZ-75	9/26/2016	0.3 [Jb]	0.094 [Jb]	0.2 [Jb]	< 0.07	< 0.04	< 0.07	0.076 [Jb]	0.07 [J]	< 0.09	< 0.07
			6/14/2017	0.4 [Jb]	< 0.14	0.76 [J]	< 0.38	< 0.41	< 0.055	< 0.2	< 0.12	< 0.061	< 0.16
			9/14/2017	0.31 [J]	< 0.055	0.72 [Jb]	0.097 [J]	< 0.11	< 0.098	0.18 [Jb]	< 0.082	< 0.055	< 0.089
MW-807	Down-Gradient (far)	CS8-MW-807	9/26/2016	0.039 [Jb]	< 0.007	0.046 [Jb]	0.025 [J]	< 0.004	< 0.007	0.0092 [Jb]	0.034 [J]	< 0.009	< 0.007
			6/14/2017	0.55 [Jb]	0.14 [J]	1.7 [J]	< 0.38	< 0.41	< 0.055	< 0.2	< 0.12	0.1 [J]	< 0.16
			9/14/2017	0.42 [J]	< 0.055	0.9	< 0.095	< 0.11	< 0.098	0.19 [Jb]	< 0.082	< 0.055	< 0.089
ERD Pilot Test Area Temporary Wells													
ERD1-TW-NW10	Side-Gradient	ERD1-TW-NW10-TOS	6/15/2017	21	0.54 [J]	1.1 [J]	< 0.38	< 0.41	< 0.055	< 0.2	< 0.12	11	< 0.16
			9/14/2017	0.26 [J]	< 0.055	0.55 [Jb]	< 0.095	< 0.11	< 0.098	0.2 [Jb]	< 0.082	< 0.055	< 0.089
		ERD1-TW-NW10-BOS	6/15/2017	35	1.3	1.2 [J]	< 0.38	< 0.41	< 0.055	< 0.2	< 0.12	18	< 0.16
			9/14/2017	64	0.28 [J]	0.5 [Jb]	< 0.095	< 0.11	< 0.098	0.15 [Jb]	0.31 [J]	36	0.24 [J]
ERD6-TW-NW10	Up-/Side Gradient	ERD6-TW-NW10-TOS	6/14/2017	600	44	3.3	5.4	0.41 [J]	1.7	8.7	4.9	350	2.3
			9/13/2017	110	13	0.99 [Jb]	1.3 [J]	< 0.11	0.84 [J]	0.17 [Jb]	4.7	54	3.1
		ERD6-TW-NW10-BOS	6/14/2017	660	150	5.7	4.0	0.82 [J]	1.9	8.6	9.1	380	3.0
			9/13/2017	970	480	11	19	2.6	4.0	7.3	65	450	17
ERD6-TW-NW15	Up-/Side Gradient	ERD6-TW-NW15-TOS	6/14/2017	230	82	2.5	0.94 [J]	0.6 [J]	0.79 [J]	0.28 [J]	4.8	96	1.2
			9/13/2017	160	14	0.92 [Jb]	2.1	< 0.11	0.53 [J]	< 0.11	2.3	42	2.4
		ERD6-TW-NW15-BOS	6/14/2017	350	170	10 [J]	1.2 [J]	1.2 [J]	0.8 [J]	7.1 [J]	9.4	150	1.5
			9/13/2017	370	160	1.8 [Jb]	2.9	0.8 [J]	0.69 [J]	< 1.1	13	220	3.5

Notes:
mg/L = milligrams per liter
[J] = estimated value
[b] = analyte present in method blank and considered laboratory contamination (value is within 5 times the blank concentration, taking into consideration sample dilutions)
* wells abandoned during other site remedial activities

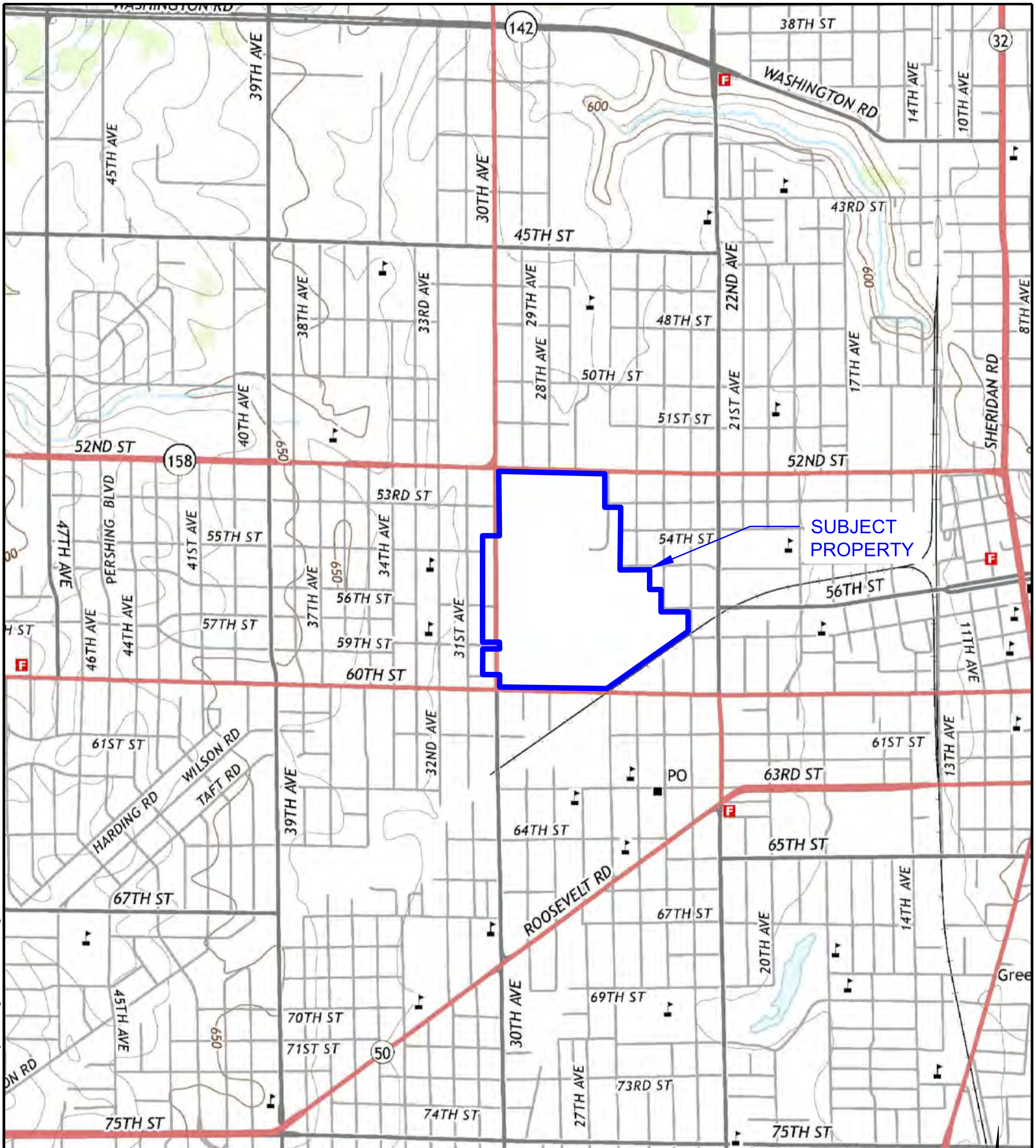
Table 7
Baseline and Post-Injection Microbial Populations Results Summary
Kenosha Engine Plant ERD Pilot Test

Well Name	Location Relative to ERD Test Area	Field ID	Sample Date	*DHC* (cells/mL)	tceA (cells/mL)	bvcA BAV1 (cells/mL)	vcrA (cells/mL)	MGN (cells/mL)	APS (cells/mL)
ERD Pilot Test Area Permanent Wells									
MW-61	Injection Area	CS8-MW-61	9/26/2016	< 5.00E-01	1.28E+02	4.36E+04	3.13E+05	1.79E+04	8.09E+03
			6/15/2017	5.10E+01	5.48E+04	1.04E+05	1.52E+06	9.05E+04	5.69E+04
			9/13/2017	1.79E+01	8.94E+04	9.40E+04	6.09E+05	2.96E+04	5.99E+04
			3/21/2018	3.60E+00	2.77E+03	5.61E+03	5.90E+04	1.85E+03	2.04E+03
PZ-61	Injection Area	CS8-PZ-61	9/26/2016	< 5.00E-01	1.00E+01	3.82E+02	5.61E+04	2.94E+01	2.69E+01
			6/15/2017	4.56E+02	1.16E+03	7.36E+02	1.04E+03	< 2.94E+01	4.42E+02
			9/13/2017	1.64E+02	5.86E+02	1.79E+04	1.96E+04	3.39E+03	8.51E+03
			3/21/2018	2.39E+02	3.46E+04	5.06E+03	1.24E+06	4.79E+03	1.84E+03
MW-75*	Up-Gradient	CS4-MW-75	9/26/2016	8.08E+01	6.76E+02	7.50E+03	1.51E+05	1.29E+03	1.47E+03
PZ-75	Up-Gradient	CS4-PZ-75	9/26/2016	< 5.00E-01	3.83E+02	1.08E+02	4.51E+04	1.21E+01	9.80E+00
			6/14/2017	< 5.00E-01	1.58E+03	1.79E+02	1.56E+05	4.51E+01	2.60E+03
			9/14/2017	< 5.00E-01	3.42E+01	3.45E+02	9.78E+03	2.04E+01	1.78E+03
			3/22/2018	2.00E-01 J	1.40E+00 J	9.20E+00	2.64E+04	2.70E+00	2.54E+01
MW-807	Down-Gradient (far)	CS8-MW-807	9/26/2016	< 1.10E+00	1.10E+00 J	< 1.10E+00	1.39E+02	< 1.10E+00	< 1.10E+00
			6/14/2017	< 4.00E+00	1.87E+01 J	< 4.00E+00	< 4.00E+01	< 4.00E+00	< 4.00E+00
			9/14/2017	< 1.00E+00	< 1.02E+01	< 1.00E+00	< 1.02E+01	< 1.00E+00	< 1.00E+00
			3/22/2018	< 2.50E+00	< 2.50E+01	< 2.50E+00	< 2.50E+01	< 2.50E+00	< 2.50E+00
ERD Pilot Test Area Temporary Wells									
ERD1-TW-NW10	Side-Gradient	ERD1-TW-NW10-TOS	6/15/2017	3.33E+01	2.22E+04	3.05E+04	1.37E+06	2.64E+04	4.58E+04
			9/14/2017	1.01E+01	1.54E+02	8.04E+03	4.40E+03	1.61E+03	1.73E+04
			3/22/2018	7.39E+03	1.81E+03	2.56E+04	2.57E+04	4.83E+03	1.41E+04
		ERD1-TW-NW10-BOS	6/15/2017	8.26E+01	2.25E+04	4.34E+04	1.98E+06	4.65E+04	8.08E+04
			9/14/2017	2.09E+04	9.32E+03	1.13E+05	2.48E+04	3.09E+04	1.60E+05
			3/22/2018	1.66E+04	2.08E+04	5.08E+04	8.89E+04	5.25E+03	1.97E+04
ERD6-TW-NW10	Up-/Side Gradient	ERD6-TW-NW10-TOS	6/14/2017	7.60E+01	2.10E+04	1.41E+04	5.08E+02	3.14E+03	5.20E+03
			9/13/2017	1.23E+02	3.51E+04	1.55E+05	1.22E+04	2.05E+04	6.44E+04
			3/21/2018	9.86E+02	7.74E+05	4.00E+04	2.37E+05	2.99E+04	2.85E+04
		ERD6-TW-NW10-BOS	6/14/2017	2.72E+02	3.61E+04	5.97E+03	7.35E+02	6.82E+02	9.16E+02
			9/13/2017	1.95E+01	3.09E+03	1.86E+04	1.27E+03	3.15E+03	4.24E+03
			3/21/2018	4.60E+02	6.92E+05	3.94E+04	3.30E+05	1.80E+04	2.07E+04
ERD6-TW-NW15	Up-/Side Gradient	ERD6-TW-NW15-TOS	6/14/2017	4.49E+01	8.31E+04	1.14E+04	9.32E+03	2.59E+03	3.98E+03
			9/13/2017	3.68E+01	2.55E+04	2.09E+04	2.46E+03	2.66E+03	1.32E+04
			3/21/2018	4.92E+02	5.65E+05	1.81E+04	5.16E+05	4.83E+03	7.58E+03
		ERD6-TW-NW15-BOS	6/14/2017	4.52E+01	7.89E+03	3.39E+03	4.33E+02	6.86E+02	1.51E+03
			9/13/2017	3.81E+01	2.64E+04	3.24E+04	4.00E+03	5.43E+03	1.70E+04
			3/21/2018	5.68E+02	4.54E+05	1.68E+04	3.56E+05	3.54E+03	5.74E+03

Notes:
cells/mL = cells per milliliter
J = estimated value
* wells abandoned during other site remedial activities

DHC = *Dehalococcoides spp.*
tceA = tce Reductase functional gene encoding reductive dehalogenases, TCE to DCE and vinyl chloride
bvcA (BAV1) = BAV1 vinyl chloride Reductase functional gene encoding reductive dehalogenases, vinyl chloride to ethene
vcrA = vinyl chloride Reductase functional gene encoding reductive dehalogenases, vinyl chloride to ethene
APS = Sulphur-Reducing Bacteria MGN = Methanogens

Figures



NOTES

1. TOPOGRAPHIC MAP FROM USGS: http://store.usgs.gov/b2c_usgs/usgs/maplocator/ DATED 2013

1000 0 1000 2000

FEET

N

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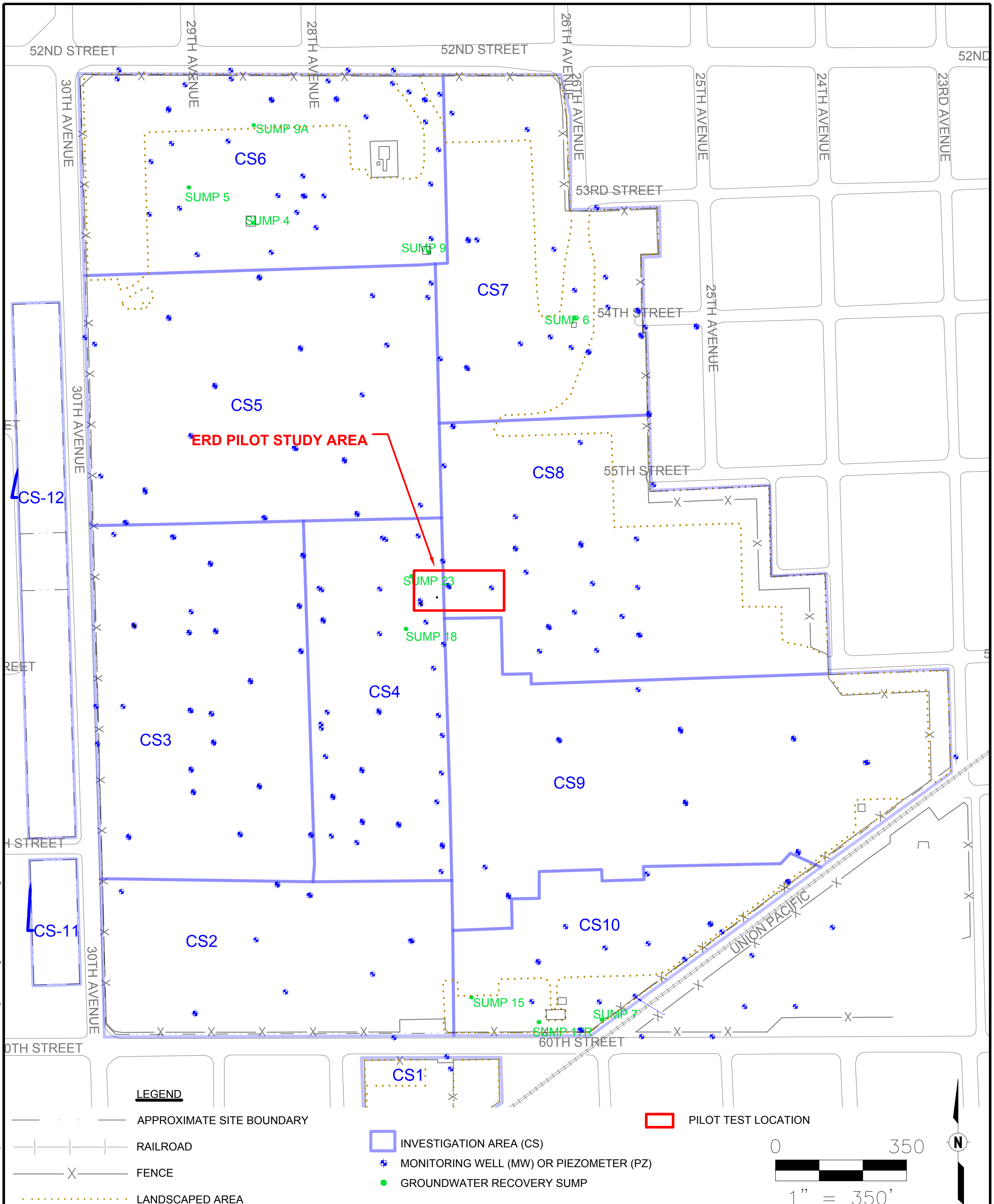
SITE LOCATION
KENOSHA ENGINE PLANT
CITY OF KENOSHA
KENOSHA, WISCONSIN

Drawn :	SAE	7/3/2017
Checked:	LLA	7/3/2017
Approved:	SP	7/7/2017
PROJECT NUMBER	60518412	
FIGURE NUMBER	1	



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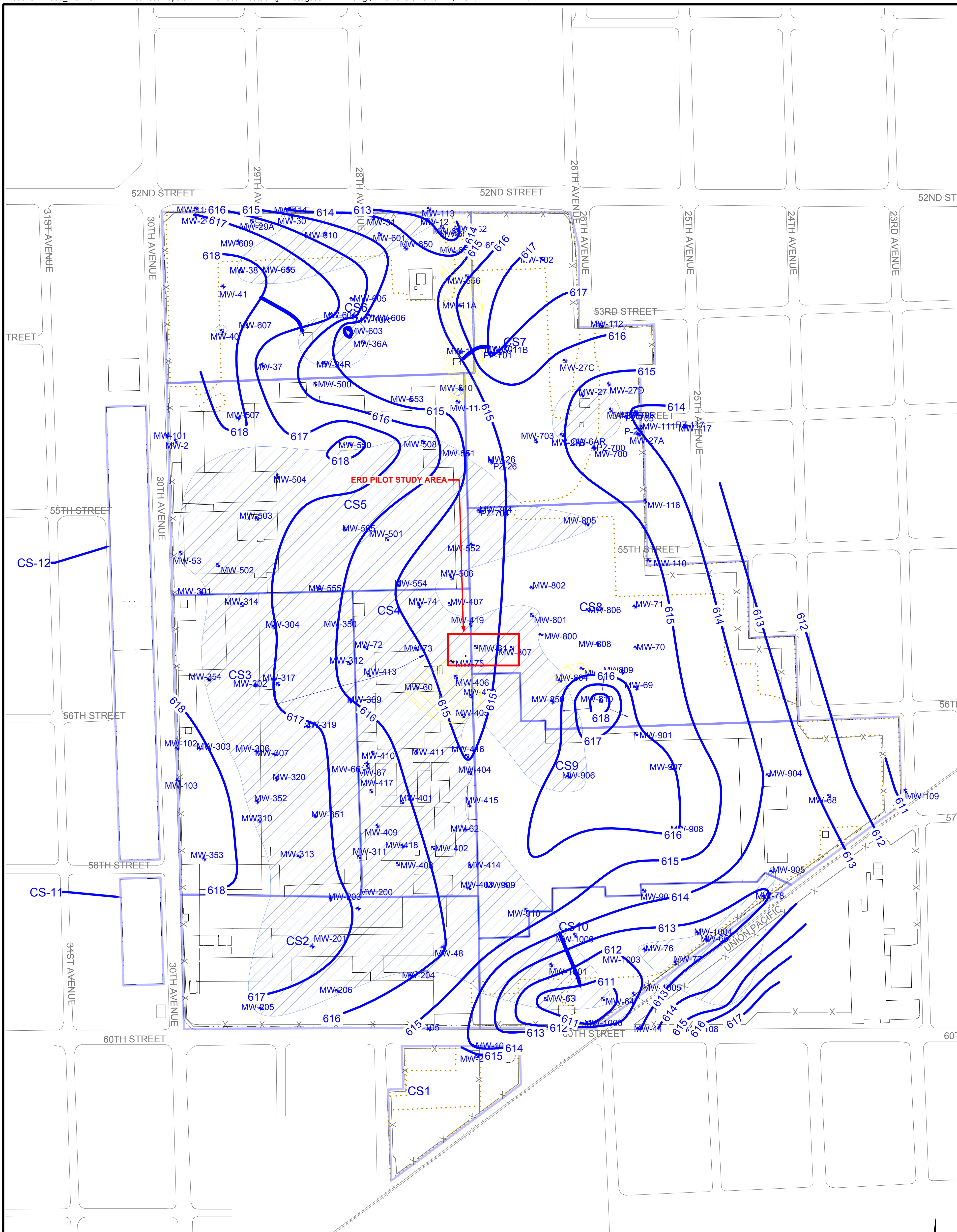
SITE LAYOUT
KENOSHA ENGINE PLANT
CITY OF KENOSHA
KENOSHA, WISCONSIN

Drawn :	SAE	7/3/2017
Checked:	LLA	7/3/2017
Approved:	SP	7/7/2017
PROJECT NUMBER	60518412	
FIGURE NUMBER	2	



LEGEND

APPROXIMATE SITE BOUNDARY

RAILROAD

FENCE

INVESTIGATION AREA (CS)

LANDSCAPED AREAS

MONITORING WELL (MW)

615.21 GROUNDWATER ELEVATIONS

GROUNDWATER CONTOURS

FLOW DIRECTION

CVOC CONTAMINANT PLUME

PVOC AND PAH CONTAMINANT PLUME

NOTES

1. GROUNDWATER FLOW AND PLUME DATA FROM MONITORING WELLS
2. DATA COLLECTED IN DECEMBER 2014

0 300

1" = 300'

N

GROUNDWATER FLOW & EXTENT OF CONTAMINATION AT THE WATER TABLE - DECEMBER 2014
KENOSHA ENGINE PLANT
CITY OF KENOSHA
KENOSHA, WISCONSIN

Drawn: SAE 7/3/2017

Checked: LLA 7/3/2017

Approved: SP 7/7/2017

PROJECT NUMBER 60518412

FIGURE NUMBER 3

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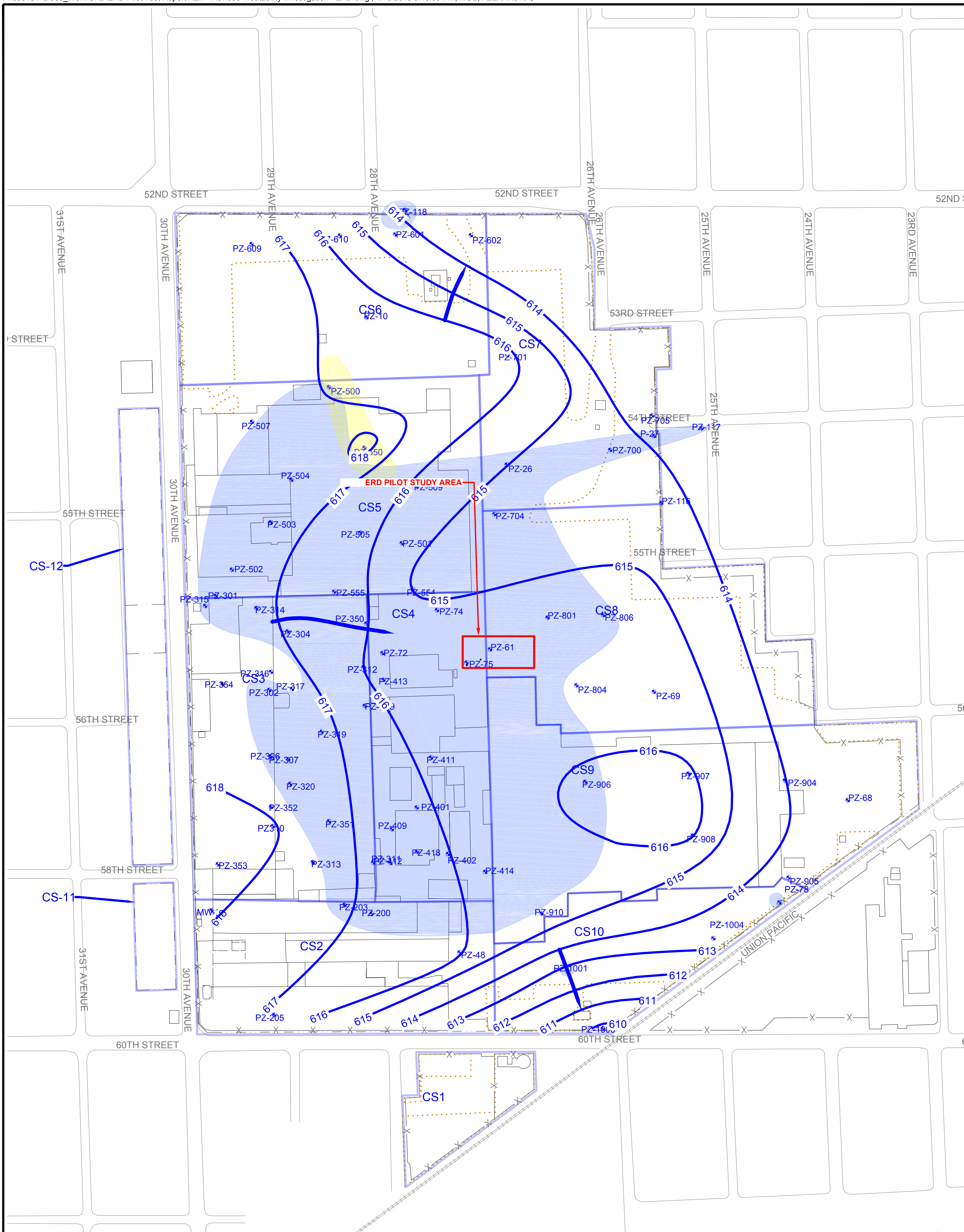

LEGEND

	APPROXIMATE SITE BOUNDARY		PIEZOMETER (PZ)		CVOC CONTAMINANT PLUME
	RAILROAD	615.21	GROUNDWATER ELEVATIONS		PVOC AND PAH CONTAMINANT PLUME
	FENCE		GROUNDWATER CONTOURS		
	INVESTIGATION AREA (CS)		FLOW DIRECTION		
	LANDSCAPED AREAS				

NOTES

1. GROUNDWATER FLOW AND PLUME DATA FROM PIEZOMETERS
2. DATA COLLECTED IN DECEMBER 2014

0 300
1" = 300'
N

GROUNDWATER FLOW & EXTENT OF CONTAMINATION ABOVE CLAY TILL AQUITARD
DECEMBER 2014
KENOSHA ENGINE PLANT
CITY OF KENOSHA
KENOSHA, WISCONSIN

Drawn: SAE 7/3/2017
Checked: LLA 7/3/2017
Approved: SP 7/7/2017
PROJECT NUMBER 60518412
FIGURE NUMBER 4

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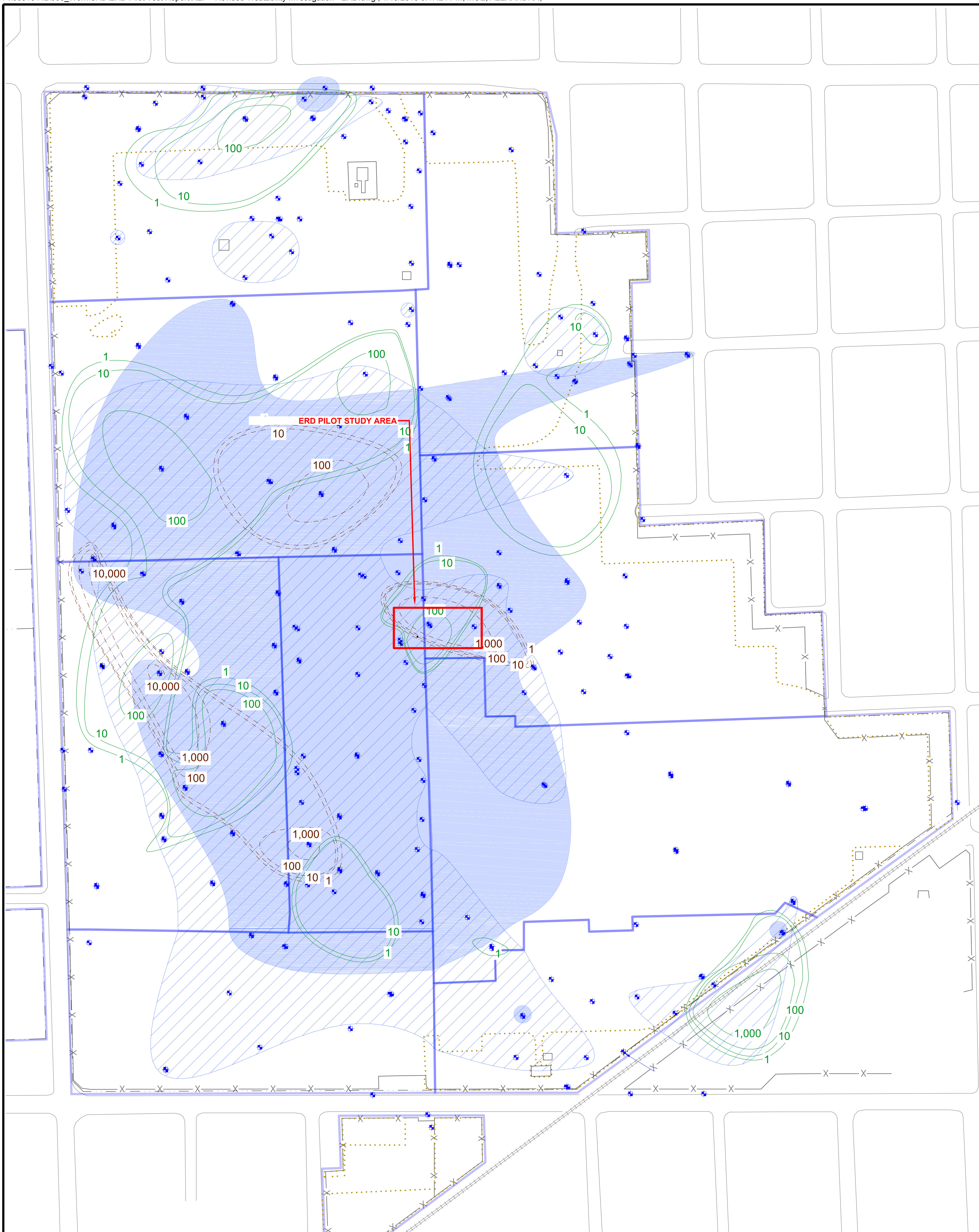

LEGEND

- APPROXIMATE SITE BOUNDARY
- RAILROAD
- FENCE
- INVESTIGATION AREA (CS)
- LANDSCAPED AREAS
- MONITORING WELL (MW) OR PIEZOMETER (PZ)
- FLOW DIRECTION
- SHALLOW CVOC CONTAMINANT PLUME (December 2014)
- DEEP CVOC CONTAMINANT PLUME (December 2014)
- SHALLOW TRICHLOROETHENE (TCE) ISOCONCENTRATION CONTOURS (CONCENTRATIONS IN UG/L) (September 2014)
- DEEP TCE ISOCONCENTRATION CONTOURS (CONCENTRATIONS IN UG/L) (September 2014)

N

0 250

1" = 250'

FIGURE NUMBER 5

PROJECT NUMBER 60518412

Approved: SP 7/7/2017

Checked: LLA 7/3/2017

Drawn: SAE 7/3/2017

GROUNDWATER CONTAMINATION PLUME EXTENT & TCE ISOCONCENTRATIONS
DECEMBER & SEPTEMBER 2014
KENOSHA ENGINE PLANT
CITY OF KENOSHA
KENOSHA, WISCONSIN

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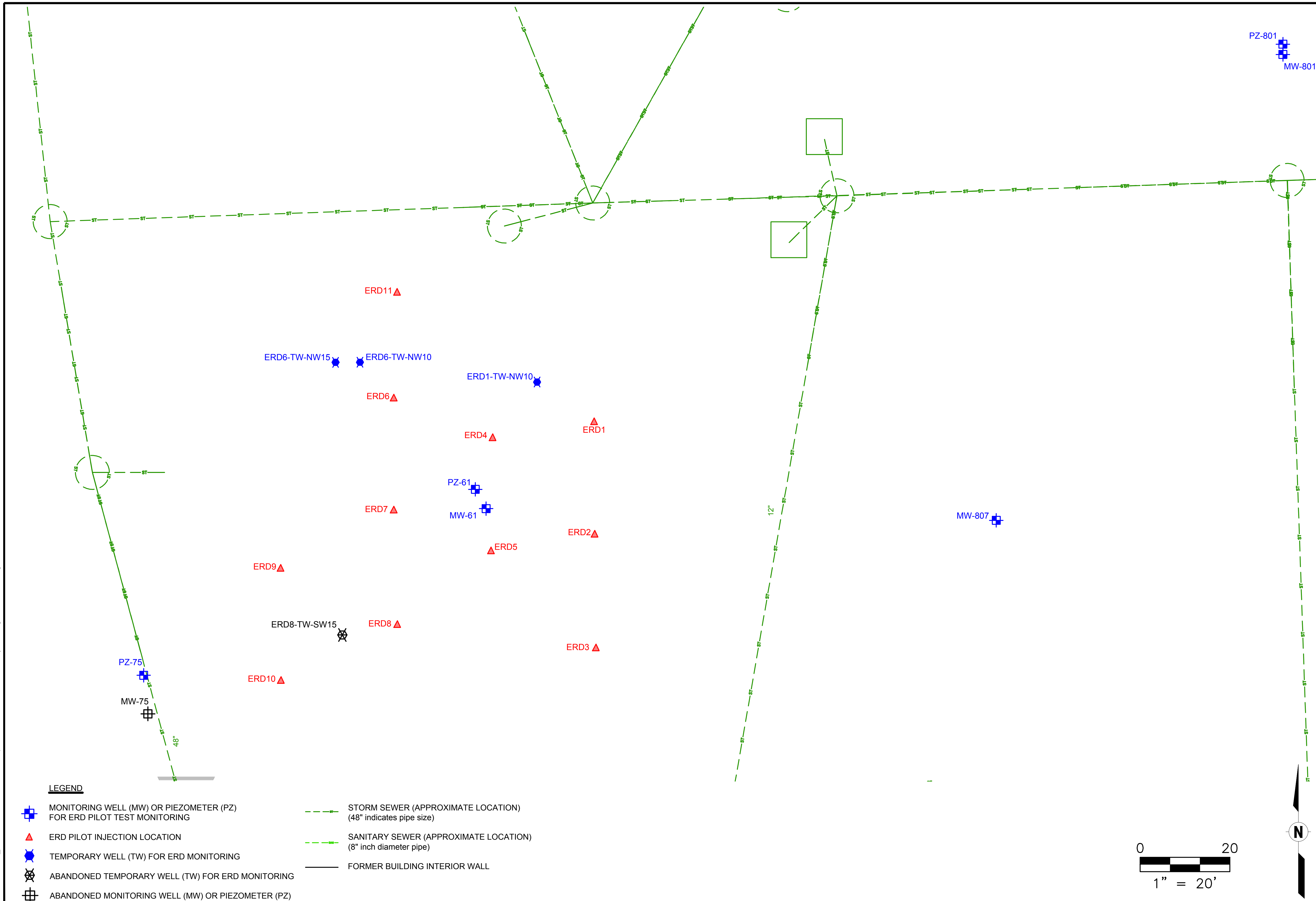

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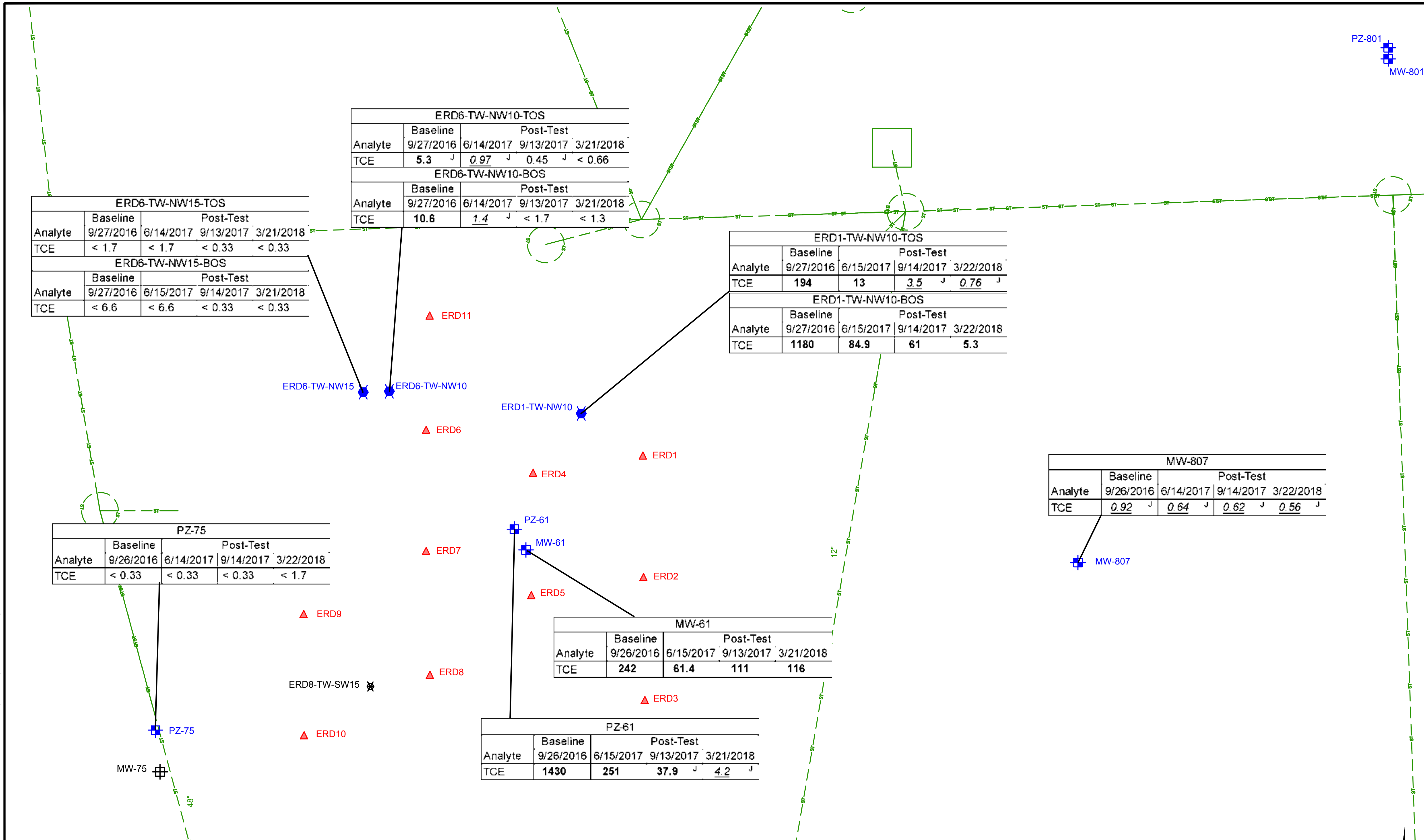
ERD PILOT STUDY LAYOUT
KENOSHA ENGINE PLANT
CITY OF KENOSHA
KENOSHA, WISCONSIN

Drawn :	SAE	7/3/2017
Checked:	LLA	7/3/2017
Approved:	KWB	7/7/2017

PROJECT NUMBER 60518412

FIGURE NUMBER 6



ERD6-TW-NW10-TOS

Analyte	Baseline 9/27/2016	Post-Test 6/14/2017	Post-Test 9/13/2017	Post-Test 3/21/2018
TCE	**5.3** J	*0.97* J	0.45 J	< 0.66

ERD6-TW-NW10-BOS

Analyte	Baseline 9/27/2016	Post-Test 6/14/2017	Post-Test 9/13/2017	Post-Test 3/21/2018
TCE	**10.6**	*1.4* J	< 1.7	< 1.3

ERD6-TW-NW15-TOS

Analyte	Baseline 9/27/2016	Post-Test 6/14/2017	Post-Test 9/13/2017	Post-Test 3/21/2018
TCE	< 1.7	< 1.7	< 0.33	< 0.33

ERD6-TW-NW15-BOS

Analyte	Baseline 9/27/2016	Post-Test 6/15/2017	Post-Test 9/14/2017	Post-Test 3/21/2018
TCE	< 6.6	< 6.6	< 0.33	< 0.33

ERD1-TW-NW10-TOS

Analyte	Baseline 9/27/2016	Post-Test 6/15/2017	Post-Test 9/14/2017	Post-Test 3/22/2018
TCE	**194**	**13**	*3.5* J	*0.76* J

ERD1-TW-NW10-BOS

Analyte	Baseline 9/27/2016	Post-Test 6/15/2017	Post-Test 9/14/2017	Post-Test 3/22/2018
TCE	**1180**	**84.9**	**61**	**5.3**

MW-807

Analyte	Baseline 9/26/2016	Post-Test 6/14/2017	Post-Test 9/14/2017	Post-Test 3/22/2018
TCE	*0.92* J	*0.64* J	*0.62* J	*0.56* J

PZ-75

Analyte	Baseline 9/26/2016	Post-Test 6/14/2017	Post-Test 9/14/2017	Post-Test 3/22/2018
TCE	< 0.33	< 0.33	< 0.33	< 1.7

MW-61

Analyte	Baseline 9/26/2016	Post-Test 6/15/2017	Post-Test 9/13/2017	Post-Test 3/21/2018
TCE	**242**	**61.4**	**111**	**116**

PZ-61

Analyte	Baseline 9/26/2016	Post-Test 6/15/2017	Post-Test 9/13/2017	Post-Test 3/21/2018
TCE	**1430**	**251**	**37.9** J	*4.2* J

LEGEND

- MONITORING WELL (MW) OR PIEZOMETER (PZ) FOR ERD PILOT TEST MONITORING
- ERD PILOT INJECTION LOCATION
- TEMPORARY WELL (TW) FOR ERD MONITORING
- ABANDONED TEMPORARY WELL (TW) FOR ERD MONITORING
- ABANDONED MONITORING WELL (MW) OR PIEZOMETER (PZ)
- STORM SEWER (APPROXIMATE LOCATION) (48" indicates pipe size)
- SANITARY SEWER (APPROXIMATE LOCATION) (8" inch diameter pipe)
- FORMER BUILDING INTERIOR WALL

Notes:
1. All results in micrograms per liter (µg/L)
2. TCE = trichloroethene
3. PAL - Preventive Action Limit, Wisconsin Administrative Code NR 140.10 Table 1, February 2017 exceedances are *underlined italics*.
4. ES - Enforcement Standard, Wisconsin Administrative Code NR 140.10 Table 1, February 2017, exceedances are **bold**.
5. J = Estimated value
6. TOS = Top of Screen
7. BOS = Bottom of Screen

0 20
1" = 20'

N

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TCE CONCENTRATIONS IN GROUNDWATER BASELINE & POST-INJECTION MONITORING RESULTS KENOSHA ENGINE PLANT ERD PILOT TEST

CITY OF KENOSHA
KENOSHA, WISCONSIN

Drawn :	SAE 7/3/2017
Checked:	LLA 7/3/2017
Approved:	KWB 7/7/2017
PROJECT NUMBER	60518412
FIGURE NUMBER	7

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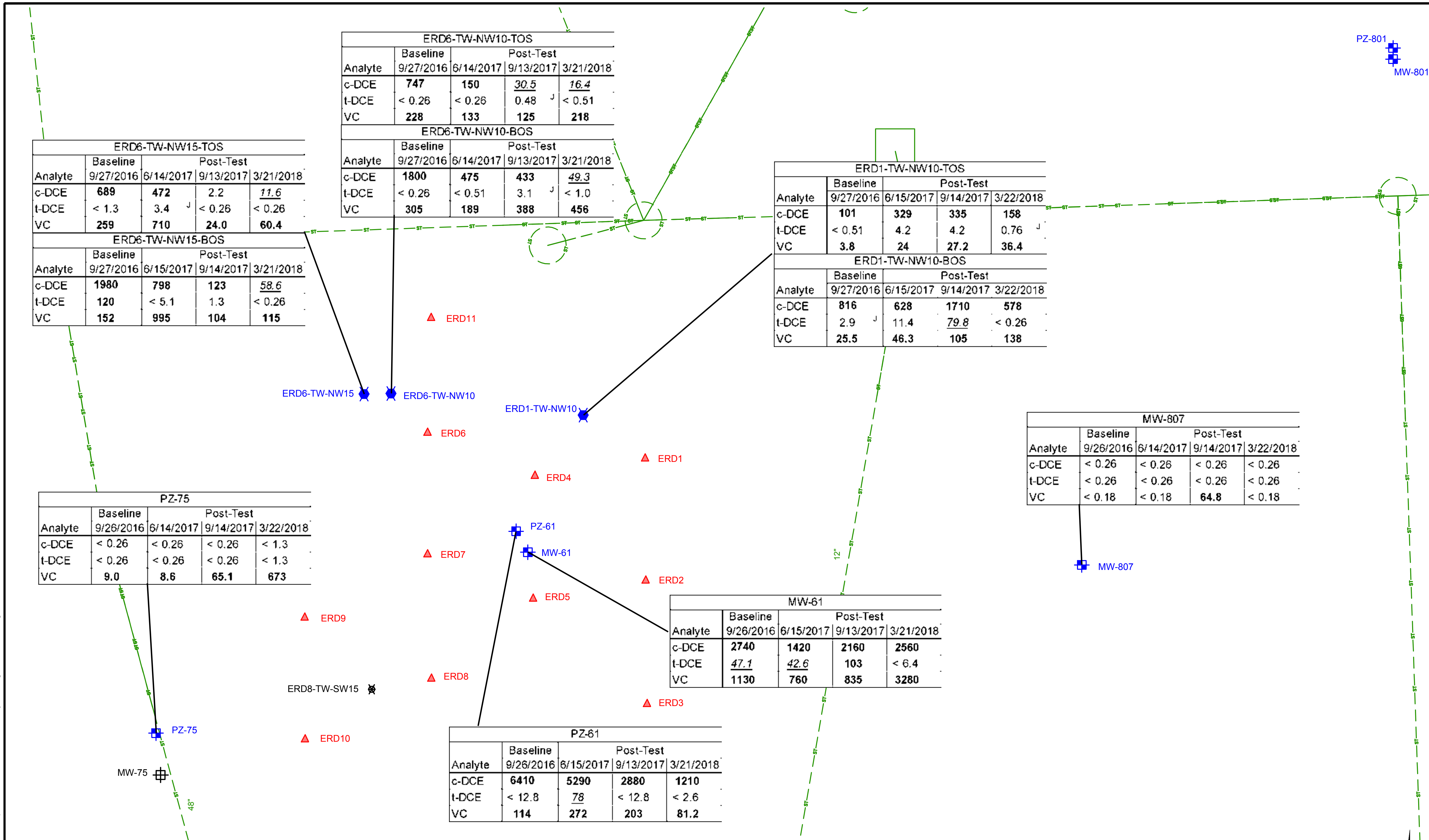

ERD6-TW-NW15-TOS

Analyte	Baseline 9/27/2016	Post-Test 6/14/2017	Post-Test 9/13/2017	Post-Test 3/21/2018
c-DCE	**689**	**472**	2.2	*11.6*
t-DCE	< 1.3	3.4 J	< 0.26	< 0.26
VC	**259**	**710**	**24.0**	**60.4**

ERD6-TW-NW15-BOS

Analyte	Baseline 9/27/2016	Post-Test 6/15/2017	Post-Test 9/14/2017	Post-Test 3/21/2018
c-DCE	**1980**	**798**	**123**	*58.6*
t-DCE	**120**	< 5.1	1.3	< 0.26
VC	**152**	**995**	**104**	**115**

ERD6-TW-NW10-TOS

Analyte	Baseline 9/27/2016	Post-Test 6/14/2017	Post-Test 9/13/2017	Post-Test 3/21/2018
c-DCE	**747**	**150**	*30.5*	*16.4*
t-DCE	< 0.26	< 0.26	0.48 J	< 0.51
VC	**228**	**133**	**125**	**218**

ERD6-TW-NW10-BOS

Analyte	Baseline 9/27/2016	Post-Test 6/14/2017	Post-Test 9/13/2017	Post-Test 3/21/2018
c-DCE	**1800**	**475**	**433**	*49.3*
t-DCE	< 0.26	< 0.51	3.1 J	< 1.0
VC	**305**	**189**	**388**	**456**

ERD1-TW-NW10-TOS

Analyte	Baseline 9/27/2016	Post-Test 6/15/2017	Post-Test 9/14/2017	Post-Test 3/22/2018
c-DCE	**101**	**329**	**335**	**158**
t-DCE	< 0.51	4.2	4.2	0.76 J
VC	**3.8**	**24**	**27.2**	**36.4**

ERD1-TW-NW10-BOS

Analyte	Baseline 9/27/2016	Post-Test 6/15/2017	Post-Test 9/14/2017	Post-Test 3/22/2018
c-DCE	**816**	**628**	**1710**	**578**
t-DCE	2.9 J	11.4	*79.8*	< 0.26
VC	**25.5**	**46.3**	**105**	**138**

MW-807

Analyte	Baseline 9/26/2016	Post-Test 6/14/2017	Post-Test 9/14/2017	Post-Test 3/22/2018
c-DCE	< 0.26	< 0.26	< 0.26	< 0.26
t-DCE	< 0.26	< 0.26	< 0.26	< 0.26
VC	< 0.18	< 0.18	**64.8**	< 0.18

PZ-75

Analyte	Baseline 9/26/2016	Post-Test 6/14/2017	Post-Test 9/14/2017	Post-Test 3/22/2018
c-DCE	< 0.26	< 0.26	< 0.26	< 1.3
t-DCE	< 0.26	< 0.26	< 0.26	< 1.3
VC	**9.0**	**8.6**	**65.1**	**673**

MW-61

Analyte	Baseline 9/26/2016	Post-Test 6/15/2017	Post-Test 9/13/2017	Post-Test 3/21/2018
c-DCE	**2740**	**1420**	**2160**	**2560**
t-DCE	*47.1*	*42.6*	**103**	< 6.4
VC	**1130**	**760**	**835**	**3280**

PZ-61

Analyte	Baseline 9/26/2016	Post-Test 6/15/2017	Post-Test 9/13/2017	Post-Test 3/21/2018
c-DCE	**6410**	**5290**	**2880**	**1210**
t-DCE	< 12.8	*78*	< 12.8	< 2.6
VC	**114**	**272**	**203**	**81.2**

LEGEND

- MONITORING WELL (MW) OR PIEZOMETER (PZ) FOR ERD PILOT TEST MONITORING
- ERD PILOT INJECTION LOCATION
- TEMPORARY WELL (TW) FOR ERD MONITORING
- ABANDONED TEMPORARY WELL (TW) FOR ERD MONITORING
- ABANDONED MONITORING WELL (MW) OR PIEZOMETER (PZ)
- STORM SEWER (APPROXIMATE LOCATION) (48" indicates pipe size)
- SANITARY SEWER (APPROXIMATE LOCATION) (8" inch diameter pipe)
- FORMER BUILDING INTERIOR WALL

Notes:
1. All results in micrograms per liter (µg/L)
2. c-DCE = cis-1,2-dichloroethene
3. t-DCE = trans-1,2-dichloroethene
4. VC = vinyl chloride
5. PAL - Preventive Action Limit, Wisconsin Administrative Code NR 140.10 Table 1, February 2017 exceedances are *underlined italics*.
6. ES - Enforcement Standard, Wisconsin Administrative Code NR 140.10 Table 1, February 2017, exceedances are **bold**.
7. J = Estimated value
8. TOS = Top of Screen
9. BOS = Bottom of Screen

0 20
1" = 20'

N

AECOM

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DCE & VC CONCENTRATIONS IN GROUNDWATER BASELINE & POST-INJECTION MONITORING RESULTS
KENOSHA ENGINE PLANT ERD PILOT TEST
CITY OF KENOSHA
KENOSHA, WISCONSIN

Drawn :	SAE	7/3/2017
Checked:	LLA	7/3/2017
Approved:	KWB	7/7/2017
PROJECT NUMBER	60518412	
FIGURE NUMBER	8	

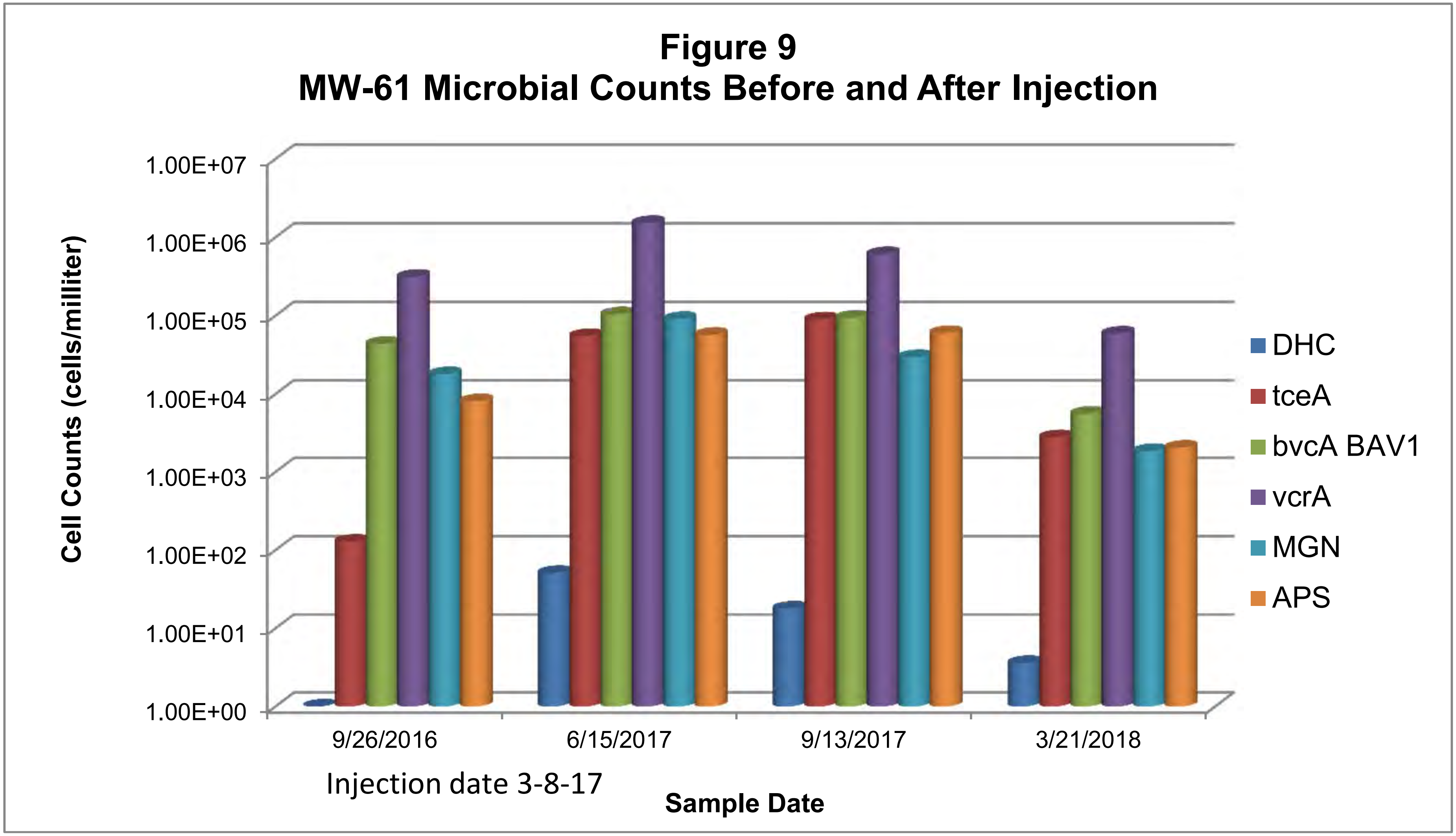


Figure 9
MW-61 Microbial Counts Before and After Injection
Cell Counts (cells/milliter)
1.00E+07
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
9/26/2016
6/15/2017
9/13/2017
3/21/2018
Injection date 3-8-17
Sample Date
DHC
tceA
bvcA BAV1
vcrA
MGN
APS

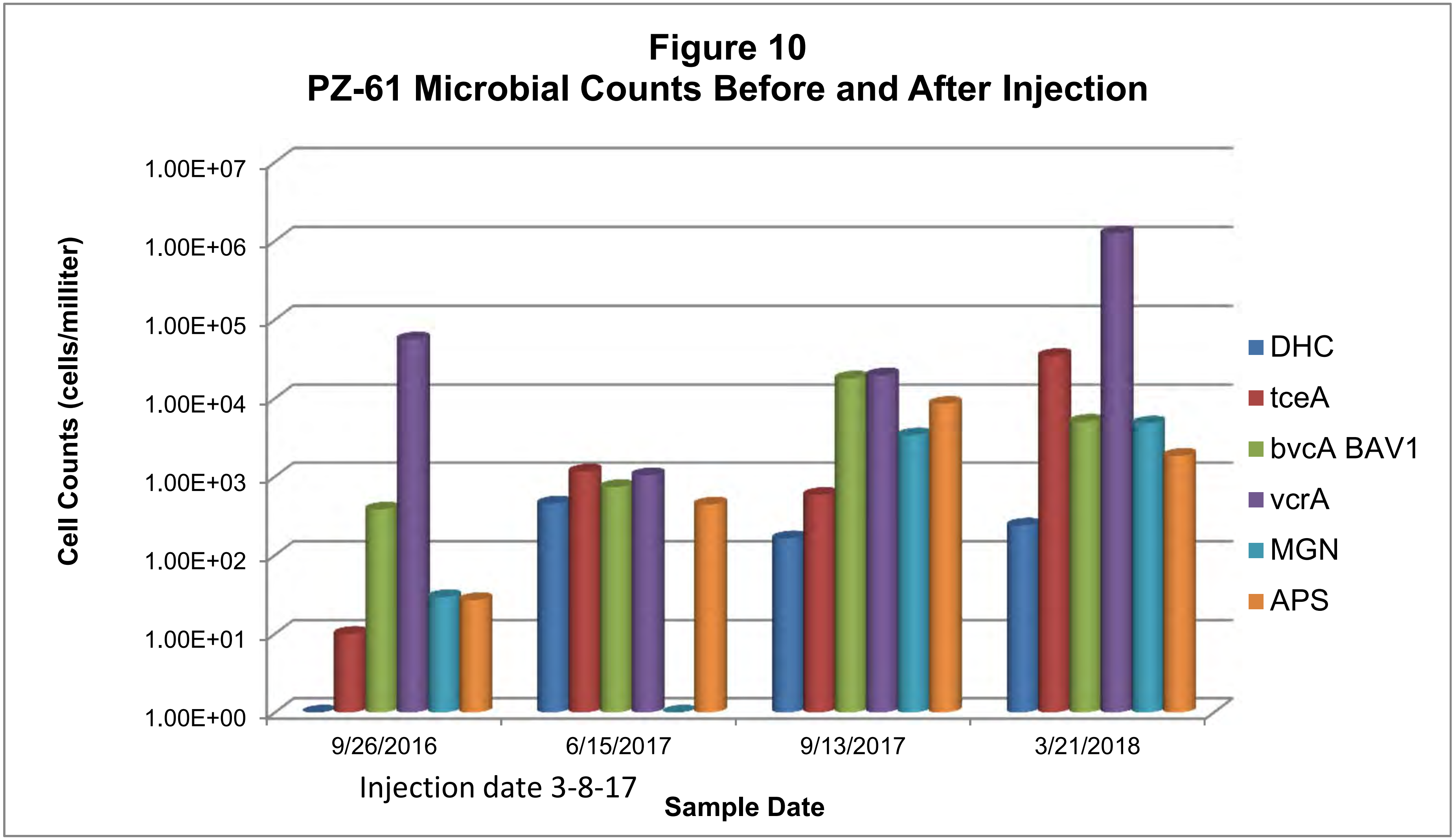


Figure 10
PZ-61 Microbial Counts Before and After Injection
Cell Counts (cells/milliter)
1.00E+07
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
9/26/2016
6/15/2017
9/13/2017
3/21/2018
Injection date 3-8-17
Sample Date
DHC
tceA
bvcA BAV1
vcrA
MGN
APS

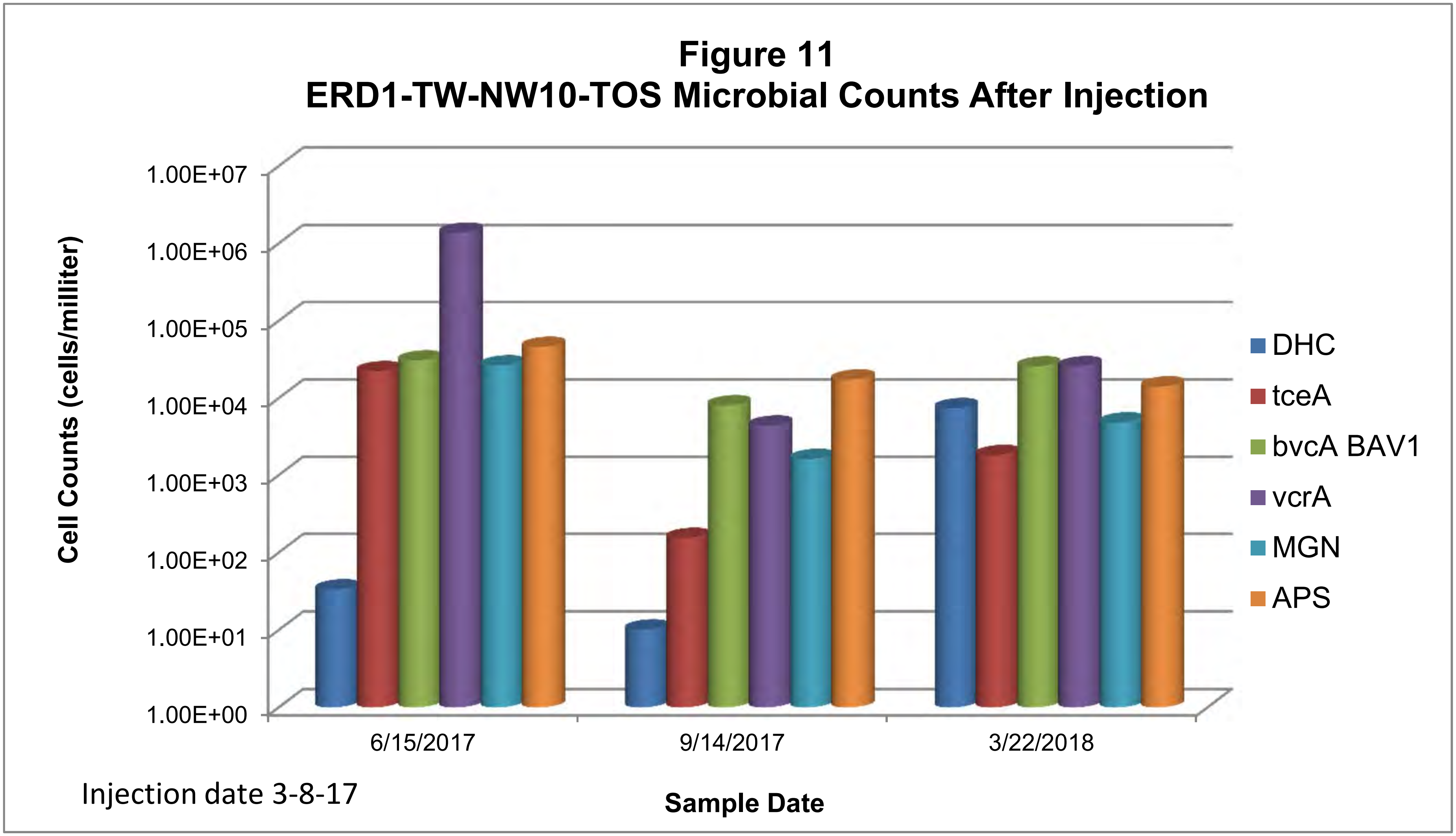
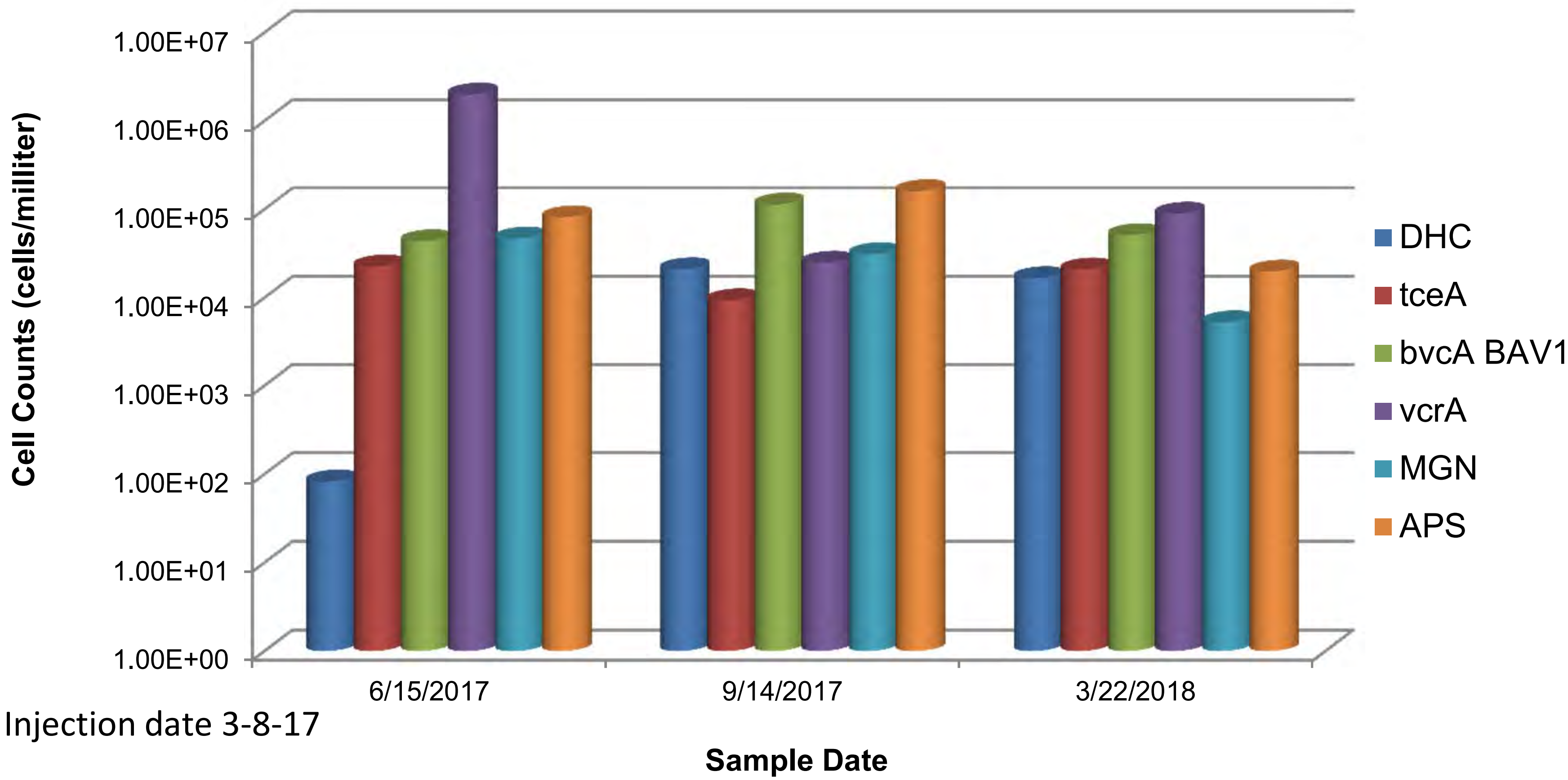


Figure 11
ERD1-TW-NW10-TOS Microbial Counts After Injection
Cell Counts (cells/milliter)
1.00E+07
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
6/15/2017
9/14/2017
3/22/2018
Sample Date
DHC
tceA
bvcA BAV1
vcrA
MGN
APS
Injection date 3-8-17

Figure 12
ERD1-TW-NW10-BOS Microbial Counts After Injection



Injection date 3-8-17

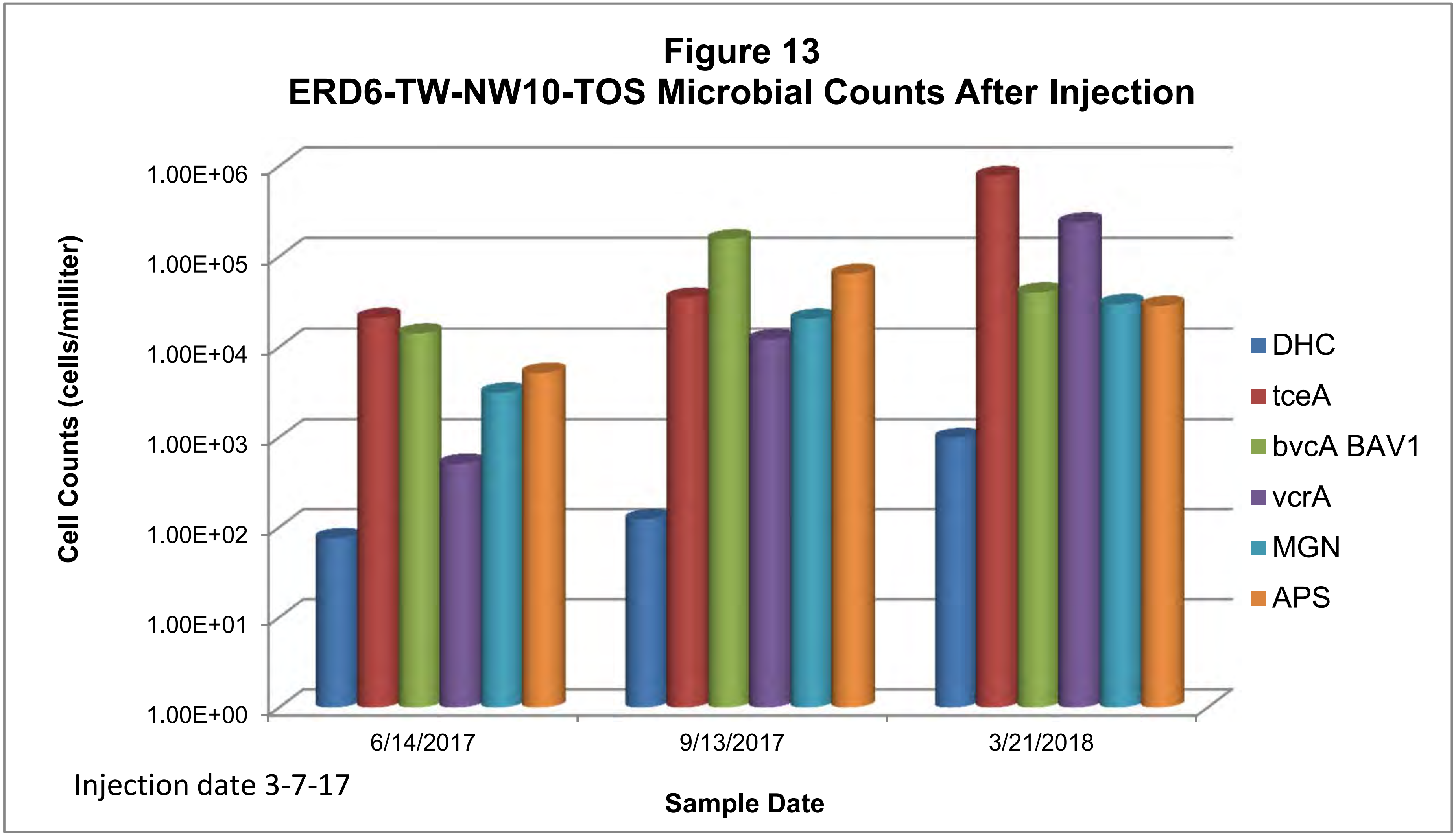


Figure 13
ERD6-TW-NW10-TOS Microbial Counts After Injection
Cell Counts (cells/milliter)
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
6/14/2017
9/13/2017
3/21/2018
Sample Date
DHC
tceA
bvcA BAV1
vcrA
MGN
APS
Injection date 3-7-17

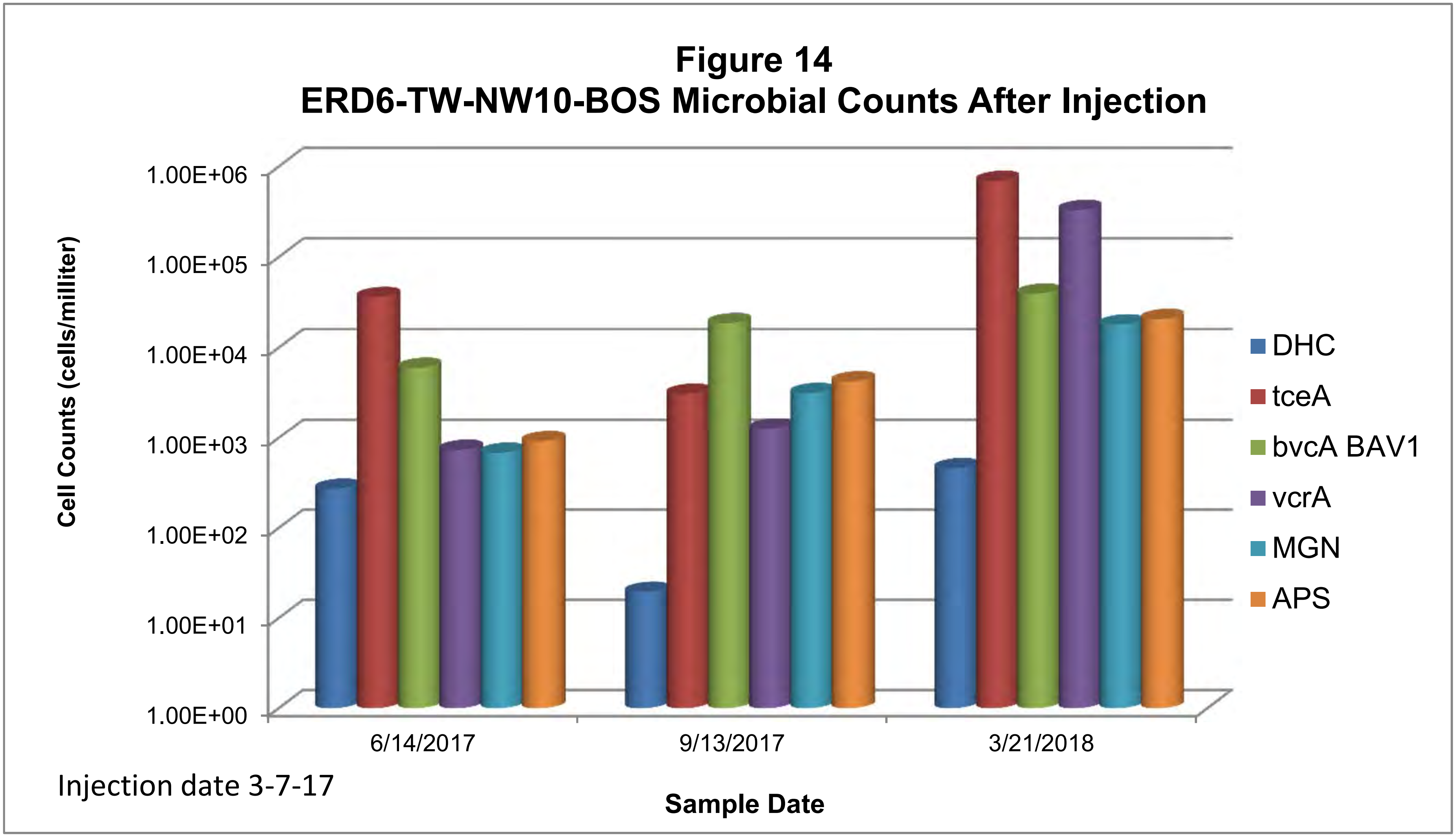


Figure 14
ERD6-TW-NW10-BOS Microbial Counts After Injection
Cell Counts (cells/milliter)
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
6/14/2017
9/13/2017
3/21/2018
Sample Date
DHC
tceA
bvcA BAV1
vcrA
MGN
APS
Injection date 3-7-17

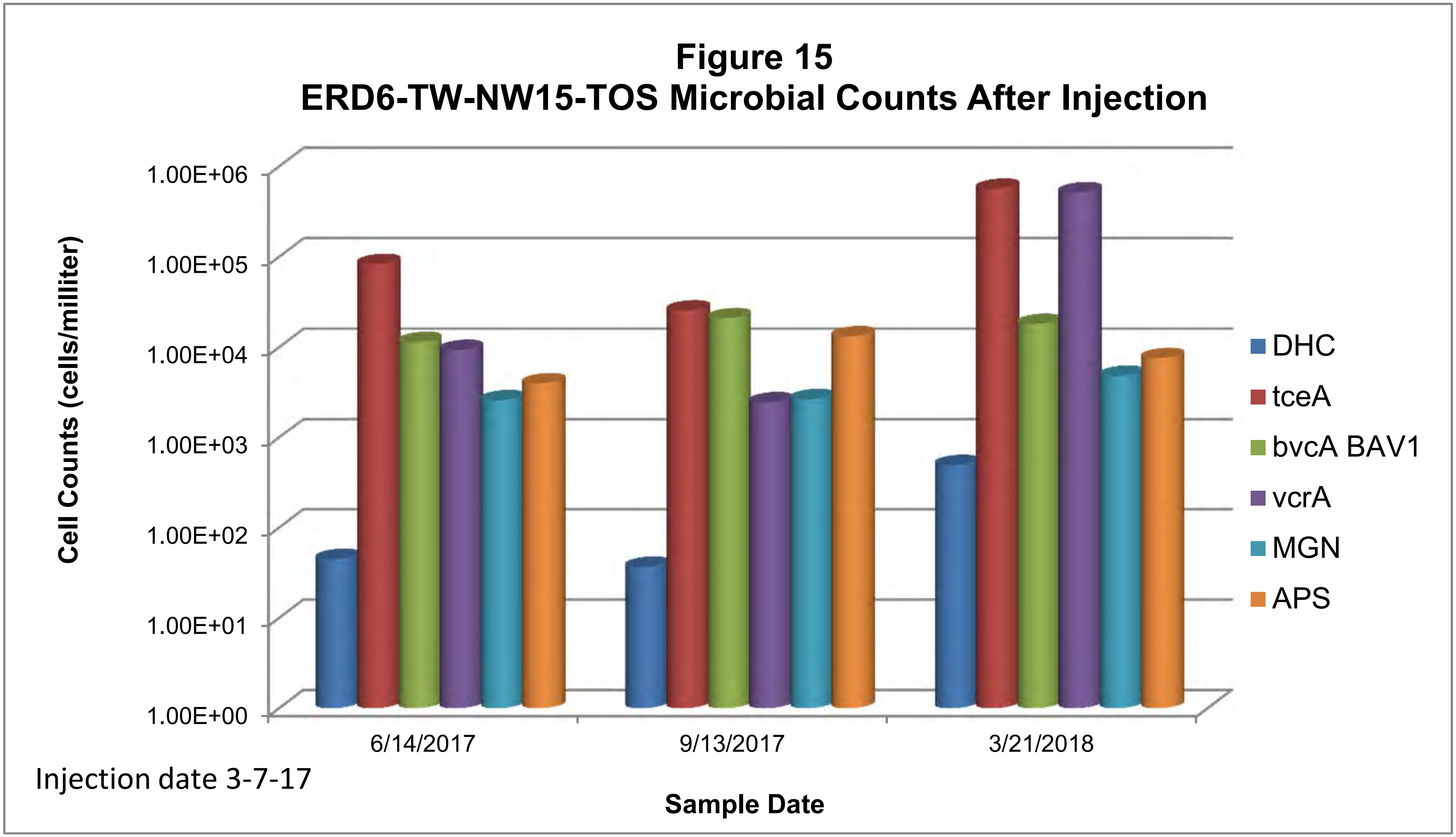


Figure 15
ERD6-TW-NW15-TOS Microbial Counts After Injection
Cell Counts (cells/milliter)
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
6/14/2017
9/13/2017
3/21/2018
Injection date 3-7-17
Sample Date
DHC
tceA
bvcA BAV1
vcrA
MGN
APS

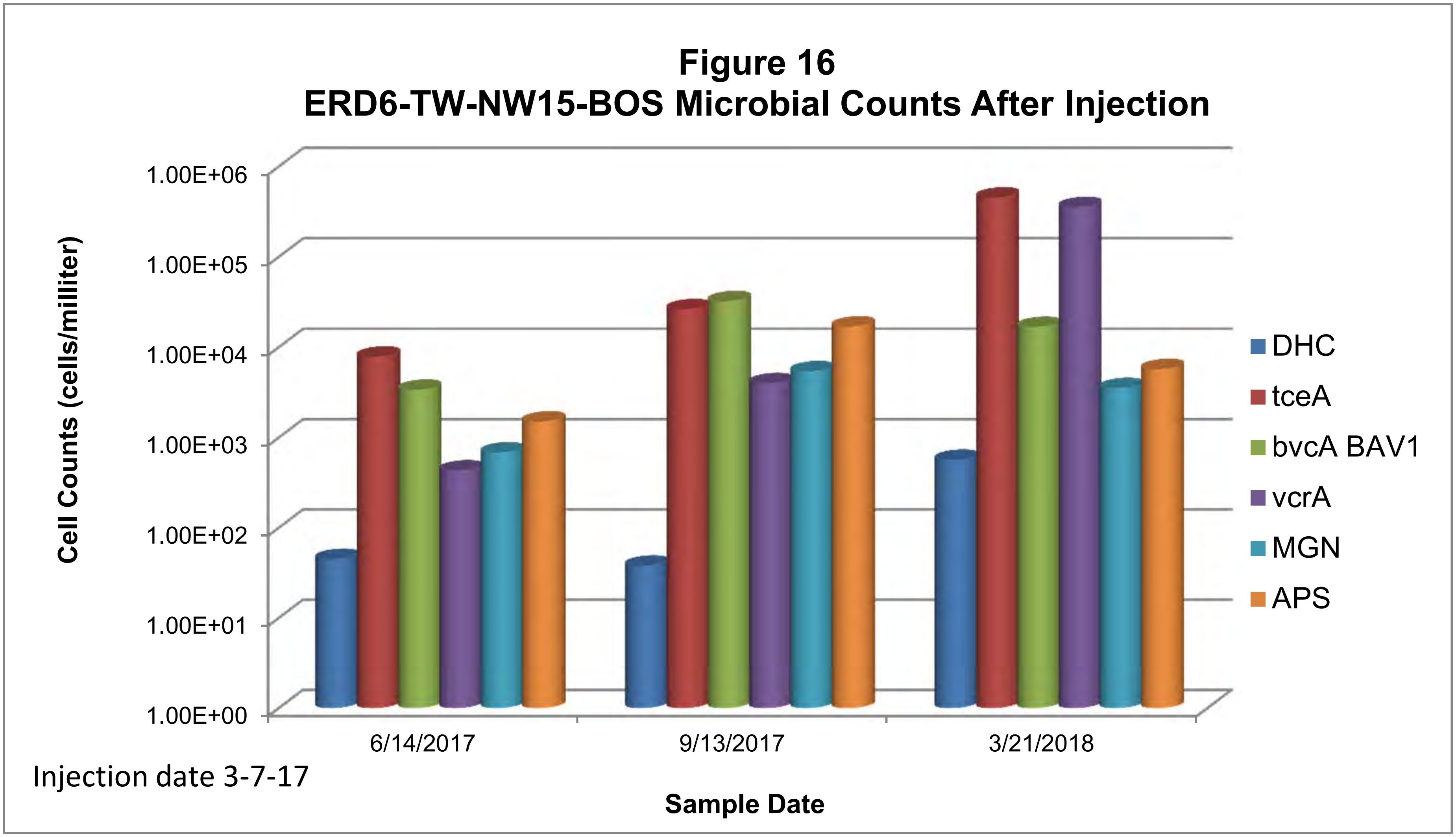


Figure 16
ERD6-TW-NW15-BOS Microbial Counts After Injection
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
Cell Counts (cells/milliter)
6/14/2017
9/13/2017
3/21/2018
Sample Date
Injection date 3-7-17
DHC
tceA
bvcA BAV1
vcrA
MGN
APS

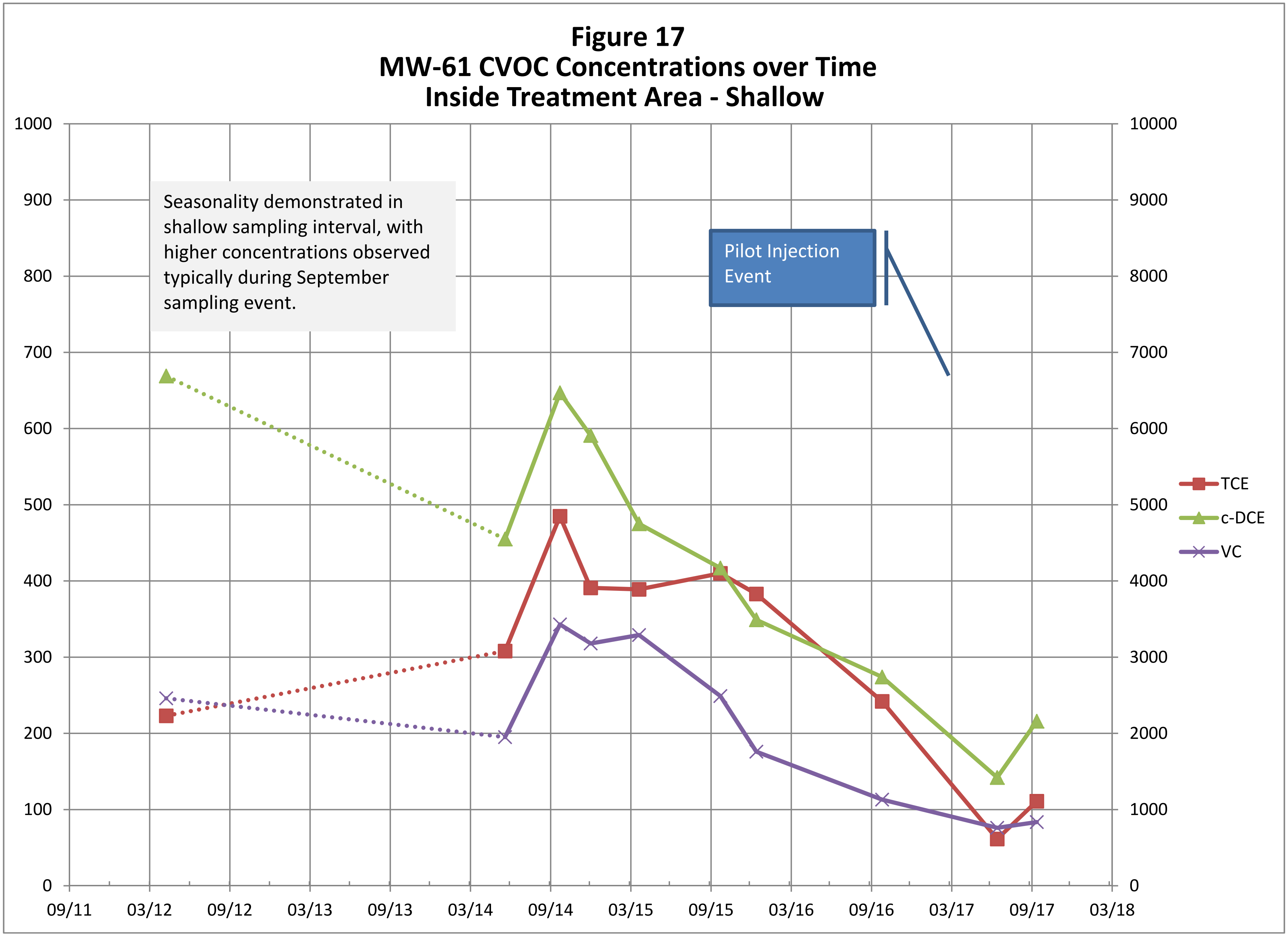


Figure 17
MW-61 CVOC Concentrations over Time
Inside Treatment Area - Shallow
Seasonality demonstrated in shallow sampling interval, with higher concentrations observed typically during September sampling event.
Pilot Injection Event
TCE
c-DCE
VC
1000
900
800
700
600
500
400
300
200
100
0
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
09/11
03/12
09/12
03/13
09/13
03/14
09/14
03/15
09/15
03/16
09/16
03/17
09/17
03/18

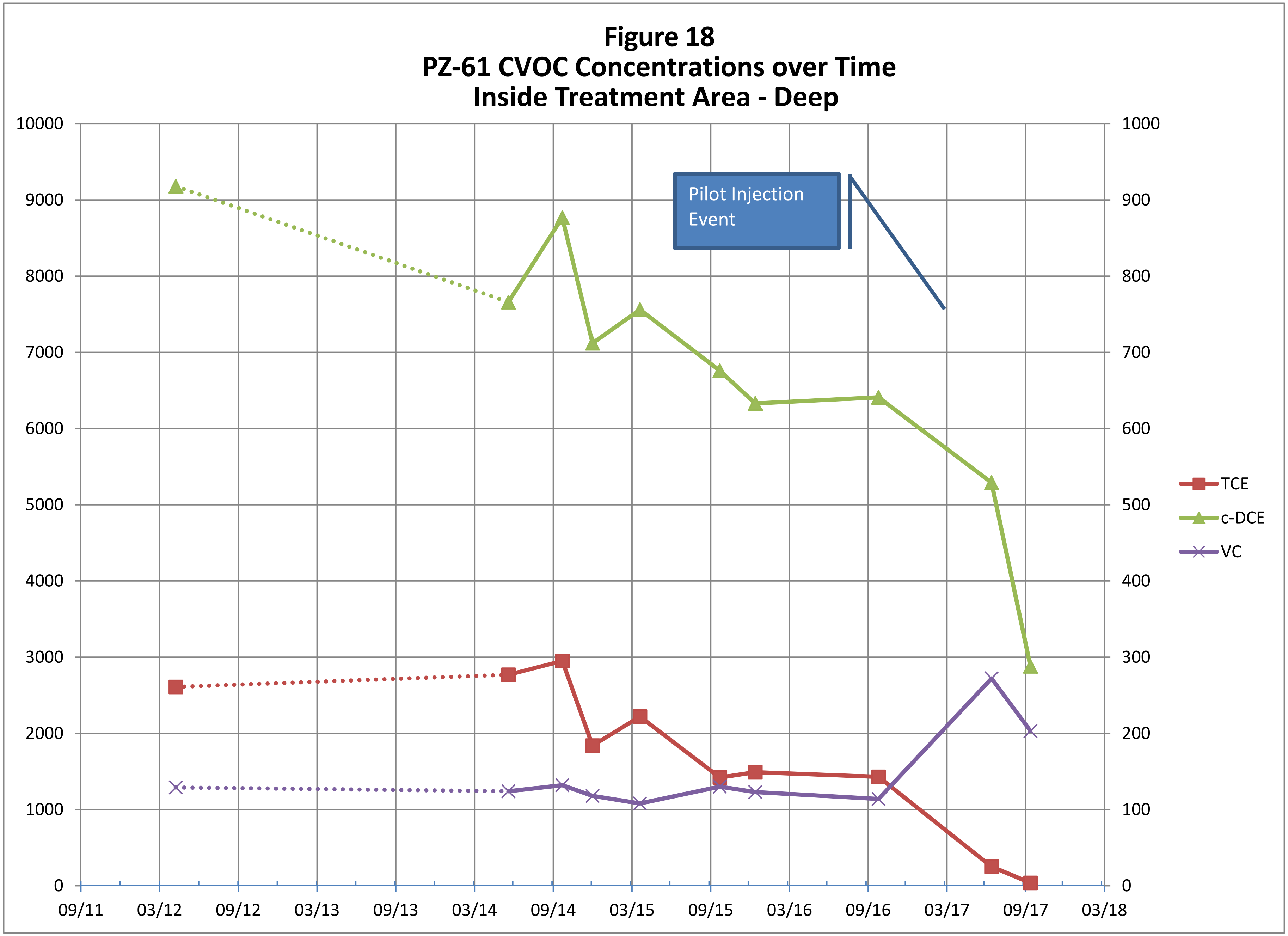


Figure 18
PZ-61 CVOC Concentrations over Time
Inside Treatment Area - Deep
Pilot Injection Event
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
1000
900
800
700
600
500
400
300
200
100
0
09/11
03/12
09/12
03/13
09/13
03/14
09/14
03/15
09/15
03/16
09/16
03/17
09/17
03/18
TCE
c-DCE
VC