



## HYDRODYNAMICS CONSULTANTS, INC.

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Environmental Engineering, Consulting, and Contracting

August 15, 2019

Jennifer Dorman, Environmental Program Associate  
Wisconsin Department of Natural Resources  
2300 Martin Luther King Drive  
Milwaukee, WI 53212

Re: WDNR BRRTS #02-41-552537  
Westwood Dry Cleaners  
8731 W. North Ave  
Wauwatosa, WI 53226

Dear Ms. Dorman:

Hydrodynamics Consultants, Inc. (HDC) is pleased to submit the attached 4<sup>th</sup> quarterly groundwater monitoring report for your review.

Please contact me at [Mike\\_Wan@HydrodynamicsConsultants.com](mailto:Mike_Wan@HydrodynamicsConsultants.com) or 630-724-0098 for any questions.

Regards,

A handwritten signature in black ink, appearing to read 'Mike Wan', with a long horizontal line extending to the right.

Mike (Minghua) Wan, PE

Maple Testing Services, Inc. D/B/A Hydrodynamics Consultants, Inc.

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5403 Patton Drive, Suite 215, Lisle, Illinois 60532

Tel. 630-724-0098 Fax 800-881-2051



**Quarterly Groundwater Monitoring Report**  
**(4<sup>th</sup> Sampling & Final Summary)**

**August 15, 2019**

**Prepared For:**

**Westwood Cleaners**  
**(WDNR BRRTS#02-41-552537)**  
**8731 West North Avenue**  
**Wauwatosa, Wisconsin 53226**

**Prepared By:**

**Hydrodynamics Consultants, Inc.**  
**5403 Patton Drive, Suite 215**  
**Lisle, Illinois 60532**



# HYDRODYNAMICS CONSULTANTS, INC.

Environmental Engineering, Consulting, and Contracting

August 15, 2019

Jennifer Dorman, Environmental Program Associate  
Wisconsin Department of Natural Resources  
2300 Martin Luther King Drive  
Milwaukee, WI 53212

Re: Quarterly Groundwater Monitoring Report (4<sup>th</sup> Sampling and Final Summary)  
WDNR BRRTS #02-41-552537, Westwood Dry Cleaners  
8731 W. North Ave, Wauwatosa, WI 53226

Dear Ms. Dorman:

Hydrodynamics Consultants, Inc. (HDC) is pleased to submit this Quarterly Groundwater Monitoring Status Report (4<sup>th</sup> Sampling) for your review and approval. The sampling activity is part of the scope of work in the approved site investigation plan. The protocols and procedure previously submitted by HDC and reviewed by WDNR were followed.

On September 16, 2018, HDC, Inc. crew members used GeoProbe systems to collect soil samples (NSB1-NSB12) from in and around the subject property. On the same day a sub-slab vapor sample from SV3 was completed. Groundwater monitoring well sampling (from MW1-MW6) and the remainder of the sub-slab vapor sampling (SV1, SV2, SV4, and SV5) took place during a second site visit on September 19, 2018.

To monitor the groundwater quality and flow pattern changes, on December 18, 2018, HDC's crew preformed the 2<sup>nd</sup> groundwater sampling from all of the existing monitoring wells MW1-MW6. The results of the groundwater analyses were reported in the Quarterly Groundwater Monitoring Status Report (2<sup>nd</sup> Sampling).

The 3<sup>rd</sup> quarterly sampling was completed on March 8, 2019. HDC's crew once again collected groundwater samples from all existing monitoring wells. The results of the groundwater analyses were reported in the Quarterly Groundwater Monitoring Status Report (3<sup>rd</sup> Sampling).

On July 13, 2019, HDC preformed the 4<sup>th</sup> groundwater sampling from all of the existing monitoring wells MW1-MW6. The results of the new sampling are included in Table 2. The laboratory analytical results have also been attached. Figure 4 is a diagram showing the locations of any cVOCs that have exceeded the screening levels. The estimated groundwater cVOC plume boundaries are also illustrated in Figure 4.

During the four quarterly sampling events, drycleaning solvent, tetrachloroethene (PCE) and its degraded byproducts, such as trichloroethene (TCE), cis-1,2-dichloroethene (DCE), and vinyl chloride (VC) have been detected. Groundwater samples confirm that up to 4300 µg/L of PCE, 140 µg/L of TCE, 29 µg/L of DCE, and 38 µg/L of VC have been present. The Wisconsin



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Administrative Code, Chapter NR 140 Enforcement Standard and Preventive Action Limit have been exceeded.

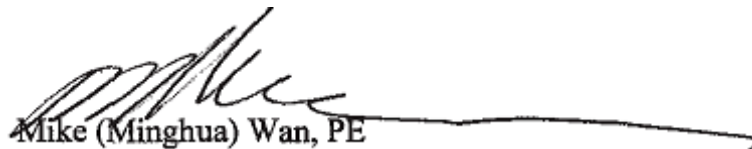
Based on the above sampling results, the subsurface unconfined groundwater table has been steadily flowing toward the west with a small southerly angle, and the cVOCs have increased towards the end of the sampling event (4<sup>th</sup> quarter).

To fully delineate the soil and groundwater contamination extent, HDC proposes to install 8 additional soil borings and to convert all of them to monitoring wells, to monitor the contaminants behavior quarterly for another year. If the groundwater contamination continues to be stable or attenuating, the site can pursue Final Case Closure with Continuing Obligations from the WDNR. However, if the cVOCs are found to be migrating off the property, further risk assessments may be warranted to determine whether active remediation is needed.

HDC appreciates your supports on this project. If you have any questions concerning this report, please feel free to contact me: Mike\_Wan@HydrodynamicsConsultants.com or 630-724-0098.

### Certifications

I, Mike (Minghua) Wan, hereby certify that I am a registered professional engineer in the State of Wisconsin, registered in accordance with the requirements of Ch. A-E 4, Wis. Adm. Code, that this document has been prepared in accordance with the Rules of Professional Conduct in Ch. A-E 8, Wis. Adm. Code, and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in Wis. Adm. Code."



Mike (Minghua) Wan, PE

Maple Testing Services, Inc. D/B/A Hydrodynamics Consultants, Inc.



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## 1.0 EXECUTIVE SUMMARY

Hydrodynamics Consultants, Inc. (HDC) is pleased to submit this Quarterly Groundwater Sampling Status Report (4<sup>th</sup> Sampling) for your review and approval. The sampling activity is part of the scope of work in the approved Site Investigation Plan. The protocols and procedure previously submitted by HDC and reviewed by WDNR were followed.

On September 16, 2018, HDC, Inc. crew members used GeoProbe systems to collect soil samples (NSB1-NSB12) from in and around the subject property. The results of the soil analyses are included in Table 1. On the same day a sub-slab vapor sample from SV3 was completed. Groundwater monitoring well sampling (from MW1-MW6) and the remainder of the sub-slab vapor sampling (SV1, SV2, SV4, and SV5) took place during a second site visit on September 19, 2018. The analytical results for groundwater have been tabulated in Table 2. The soil gas analytical results can be found in Table 3.

To monitor the groundwater quality and flow pattern changes, on December 18, 2018, Hydrodynamics Consultants, Inc. crew collected groundwater samples from all the existing monitoring wells MW1-MW6 (for 2<sup>nd</sup> Sampling). The results of the groundwater analyses indicate that drycleaning solvent, tetrachloroethene (PCE) and its degraded byproducts, such as trichloroethene (TCE), cis-1,2-dichloroethene (DCE), and vinyl chloride (VC) remain at this site.

The 3<sup>rd</sup> quarterly sampling was completed on March 8, 2019. HDC's crew once again collected groundwater samples from all existing monitoring wells MW1-MW6. The results of the sampling are included in Table 2. The results of the groundwater analyses indicate that drycleaning solvent, tetrachloroethene (PCE) and its degraded byproducts, such as trichloroethene (TCE), cis-1,2-dichloroethene (DCE), and vinyl chloride (VC) remain at this site.

On July 13, 2019, HDC performed the 4<sup>th</sup> groundwater sampling from all of the existing monitoring wells MW1-MW6. The results of the new sampling are included in Table 2. The laboratory analytical results have also been attached. Figure 4 is a diagram showing the locations of any VOCs that have exceeded the screening levels. The newest results of the groundwater analyses indicate that drycleaning solvent, tetrachloroethene (PCE) and its degraded byproducts, such as trichloroethene (TCE), cis-1,2-dichloroethene (DCE), and vinyl chloride (VC) remain at this site. Groundwater samples confirm that up to 4300 µg/L of PCE, 120 µg/L of TCE, 23 µg/L of DCE and 20 µg/L of VC remain at these wells. The Wisconsin Administrative Code, Chapter NR 140 Enforcement Standard and/or Preventive Action Limit have been exceeded.

By comparing the 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> groundwater sampling results, it appears that the cVOC concentrations in the groundwater samples are steady, except for the PCE concentrations in MW5 and MW6 which show an increase of PCE. No cVOC is present in monitoring wells, MW1, MW2, MW3, and MW4, with concentrations exceeding the enforcement standard and/or preventive action levels as stimulated in NR 140.



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To fully delineate the soil and groundwater contamination extent, HDC proposes to install 8 additional soil borings and to convert all of them to monitoring wells, to monitor the contaminant behavior quarterly for another year. If the groundwater contamination continues to be stable or attenuating, the site can pursue Final Case Closure with Continuing Obligations from the WDNR. However, if the cVOCs are found to be migrating off the property, further risk assessments may be warranted to determine whether active remediation is needed.



## **2.0 INTRODUCTION**

### **2.1 Location and Project Information**

1. Site Owner:

Dong Sin  
8371 West North Avenue  
Wauwatosa, WI 53226

2. Site Address:

8371 West North Avenue  
Wauwatosa, WI 53226

3. Site Location (Figure 1):

NE ¼ of the NW ¼ of Section 21, T07N, R21E, Milwaukee County, Wisconsin.

4. Environmental Consultant:

Mike Wan, PE, Project Manager  
Hydrodynamics Consultants, Inc.  
5403 Patton Drive, Suite 215  
Lisle, IL 60532  
Tel. 630-724-0098  
Email Mike\_Wan@HydrodynamicsConsultants.com

5. WDNR BRRS#:

02-41-552537

6. WDNR Project Manager:

Binyoti Amungwafor  
Wisconsin Department of Natural Resources  
2300 Martin Luther King Drive, Milwaukee, WI 53212  
Tel. 414-263-8607  
Email: Binyoti.Amingwafor@Wisconsin.gov

### **2.2 Site Location Map**

Please see attached Figure 1, Site Vicinity Map

### **2.3 Site Physiographical and Geological Information**

#### **2.3.1 Topography/Geology**



The general topography of land is flat with an elevation of approximately 705 feet above mean sea level (MSL). The local ground surface slopes gently toward the west or southwest.

No bedrock is encountered in the borings. According to the Glacial Deposit Map compiled by Wisconsin Geological & Natural History Survey in 1976, the site is located on the End Moraine deposit. The thickness of the glacial deposit is between 50' and 100' according to the Glacial Depth to Bedrock Map compiled by L.C. Trotta and R. D. Otter in 1973.

The closest surface water body is the Menomonee River which is approximately 1,600 feet to the west or southwest of the subject property.

The subsurface soil encountered in the soil borings is predominantly clay to silty clay from the surface down to the end of the borings at 16' below the ground surface, with thin lenses of silty fine sand/gravel being present in some borings.

### **2.3.2 Hydrogeology**

The site is located in the City of Wauwatosa where the ground surface is mostly covered with asphalt pavement or concrete. Surface water drains to the municipal storm water system through the manhole sumps in the parking lots and storm water grills along the edges of streets. Surface water may recharge to the groundwater table via infiltration in landscape areas or open fields where no surface barrier is present. The subject property is mostly covered with asphalt pavement or concrete slabs except for the lawn covered area to the west of the strip mall building. The groundwater study conducted through the monitoring wells at this site discovered that the local groundwater flows generally to the west or southwest, with high hydraulic conductivity as detailed in later sections of this report. The regional groundwater table may slightly slope to the west or southwest and discharge into the Menomonee River system located about 1,600 ft. southwest of the site. This water surface elevation at Menomonee River channel is about 656' above the mean sea level (or about 49' below the concrete floor at Westwood Cleaners).

### **2.4 Background Information**

The subject property is located on the southeast corner of the intersection of West North Avenue and North Ludington Avenue in the City of Wauwatosa, WI (See Site Vicinity Map, Figure 1).

According to our inquiry, the subject dry-cleaning plant has been operating there since 1985. Drycleaning solvent, tetrachloroethene or perchloroethene (perc or PCE) has been used and stored at this site since 1985. Prior to 1985, no known record indicates that the site had been involved with any hazardous materials. Therefore, PCE and its degraded compounds (such as trichloroethene (TCE), cis-1,2-dichloroethene (cDCE), and vinyl chloride (VC) (called chlorinated volatile organic compounds, cVOCs) are the only contaminants of concern (COCs) for this site. Based on our observation and inquiries of the owner, the subsurface contamination of PCE may have been from historical spills or incidental releases during the past drycleaning operation. Further PCE release is unlikely because the drycleaning facility has installed secondary containments under the



drycleaning machine and attention has been paid to proper storage and handling of the drycleaning generated wastes.

Hydrodynamics Consultants, Inc. (HDC) completed a preliminary site investigation on August 19, 2008. HDC performed limited soil boring and testing at the subject property to confirm the site conditions. Four (4) soil borings (SB1 to SB4) were advanced to a depth of 16' each boring and two soil samples were collected from each boring for laboratory analysis of volatile organic compounds (VOCs). The analytical results indicated the drycleaning solvent, tetrachloroethene and its degraded products are present at the site. Based on the laboratory analysis from samples collected from these 4 borings, up to 320 mg/kg of PCE was present in the borings (See Figure 3 Soil cVOC Distribution Map).

Based on the initial site inspection, HDC believes that the contamination is related to unknown incidental spills or releases of perchloroethene near the drycleaning machine and waste drums. Other similar incidents may also have taken place near the back door through which the drycleaning solvent was delivered and waste solvent drums were removed. The drycleaner owner has implemented secondary storage containers under the potential source containers in order to minimize the impact of any incidental releases or spills. It appears that this dry-cleaner operation is in compliance with all the regulatory requirements.

On August 7, 2018 the Wisconsin DNR approved HDC's Site Investigation Work Plan (SIWP), which was submitted in order to gain approval to conduct an Additional Site Investigation.

On September 16, 2018, HDC, Inc. crew members used GeoProbe systems to collect soil samples (NSB1-NSB12) from in and around the subject property. The results of the soil analyses are included in Table 1. On the same day a sub-slab vapor sample from SV3 was completed. Groundwater monitoring well sampling (from MW1-MW6) and the remainder of the sub-slab vapor sampling (SV1, SV2, SV4, and SV5) took place during a second site visit on September 19, 2018. The analytical results for groundwater have been tabulated in Table 2. The soil gas analytical results can be found in Table 3.

The analytical results of the soil, groundwater, and sub-slab vapor have been reported in the Site Investigation Report previously submitted to the DNR. Based on the analytical results, the contaminants of concern (COCs) found at this site are tetrachloroethene (PCE) and its degraded compounds, such as trichloroethene (TCE), cis-1,2-dichloroethene (cDCE), and/or vinyl chloride (VC).

The Site Investigation Report confirmed that up to 320,000 µg/Kg of PCE has been found in soil samples which exceed the Soil to Groundwater Pathway Residual Contaminant Level (RCL) of 4.5 µg/Kg and non-Industrial Direct Contact RCL of 30,700 µg/kg. Up to 3,970 µg/Kg of TCE has been found in soil samples which exceed the Soil to Groundwater Pathway RCL of 3.6 µg/Kg and non-Industrial Direct Contact RCL of 1,260 µg/Kg. No other cVOC was found in the soil samples with concentrations higher than the RCLs.



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Groundwater samples results in the Site Investigation Report indicate that up to 160 µg/L of PCE, 70 µg/L of TCE, and 38 µg/L of VC are present which exceeded the Enforcement Standards (ES) and Preventive Action Limits (PAL) published in Wisconsin Administrative Code, Chapter NR 140. Also, up to 26 µg/L of cDCE was found in the groundwater samples that exceeded the Preventive Action Limits.

As a result of the sub-slab vapor sampling in the Site Investigation Report, PCE (up to 1,200 µg/m<sup>3</sup>) and TCE (up to 4.2 µg/m<sup>3</sup>) have been found with concentrations exceeding both the residential and commercial Indoor Air Vapor Action Levels. However, all the cVOCs found in the vapor samples are below the US EPA's Vapor Risk Screening Levels (VRSL) for sub-slab vapor samples which are applicable to the sample results.

To monitor the groundwater quality and flow patterns, the second, third, and fourth groundwater sampling was completed on December 18, 2018, March 8, 2019, and July 13, 2019 respectively. This report will provide an update on the fourth groundwater sampling results.

The surrounding properties or store spaces have been used for commercial purposes without known involvement of any hazardous materials, except for petroleum products. Based on the ERRTS databases, a gasoline filling station is present on the northwest corner of the intersection of North Avenue and Ludington Avenue (8806 W North Avenue, WDNR BRRTS#: 03-41-100572). The gasoline station site was conditionally closed with proper GIS Registry. The property at 8901 West North Avenue, on the southwest corner of the intersection of North Avenue and Ludington Avenue (WDNR BRRTS#: 03-41-563748), was also used as a gasoline filling station. Petroleum release was found in that property. No further information was readily available for review.

There is no known risk at this time from the released cVOCs to the public health, safety, welfare, or the environment.



## 3.0 QUARTERLY GROUNDWATER MONITORING (2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> Sampling) RESULTS

### 3.1 Quarterly Groundwater Sampling Outline

On December 18, 2018, March 8, 2019, and July 13, 2019, Hydrodynamics Consultants, Inc. (HDC) crew members performed the 2<sup>nd</sup> round, 3<sup>rd</sup> round, and 4<sup>th</sup> round of water sampling from monitoring wells, MW1 to MW6. Please refer to the attached site map (Figure 2) for sampling locations.

During groundwater sampling, the following procedures are adhered to:

- Prior to groundwater sampling, the wells are measured with a water level indicator, and then purged with a designated disposal bailer for 3 times of the well volume or until they are mostly dry.
- When sufficiently recharged, a groundwater sample was then retrieved, with a designated PVC bailer equipped with a Teflon ball check valve at the bottom, from the well.
- Each groundwater sample retrieved was dispensed through a small PVC tube inserted in the bottom of the bailer into two 40-ml glass vials containing an HCL preserve.
- The sample containers are closed with Teflon-lined lids.
- After the vials are filled with water samples, we check to see if the vials are free of bubbles by holding the vials upside down. If bubbles are found, a new groundwater sample is collected from the well.
- Upon completion, groundwater samples are immediately stored in an ice-chilled cooler.

Proper decontamination procedures are followed during the groundwater sampling activities. A new PVC bailer is designed for each groundwater monitoring well. A new pair of gloves is used for collecting each groundwater sample. The water table indicator and tools are cleaned with soapy water and rinsed thoroughly before each use.

The Chain of Custody documentation is strictly adhered to during the groundwater sampling activities and during the delivery of the groundwater samples from the field to the laboratory.

During the field sampling activities, a waterproof pen is used to mark each groundwater sample container. The information marked on the sample containers includes, but is not limited to, the sample date and time, the sample identification, the sample locations, and any other applicable data.

All samples are generally picked up by an analytical laboratory on the next working day. Before they are picked up, they are stored in a cooler with ice packs. The cooler is stored in our refrigerator, which is set to 4°C. Collected groundwater samples are analyzed by Stat Analytical Corporation which is a laboratory accredited by WDNR.



A trip blank (MW-TB), and a duplicate sample from MW6 (MW6-2D) and MW5 (MW5-D), and a temperature blank are included with each groundwater sampling event. However, these samples are only analyzed when required.

Trip blanks are submitted for laboratory analysis to assess for potential contamination during handling, shipment, and storage of the investigative samples. Trip blanks are filled by the analytical laboratory with organic-free water and are kept with the investigative water samples throughout the field event. Field duplicate samples are collected for each investigative matrix (soil gas, sub-slab vapor, ambient air, indoor air, groundwater, and/or soil) as associated investigative samples. Field duplicate samples are processed, stored, packaged, and analyzed by the same methods as the other samples.

Decontamination water use is kept to a minimum, and typically 5-10 gallons of rinsate water is generated. The decontamination water is disposed on-site by evaporation over a hard surface.

### 3.2 Quarterly Groundwater (2<sup>nd</sup>) Sampling Results

A total of 8 groundwater samples, including 1 duplicate from MW6 and 1 trip blank, were analyzed for VOCs in accordance with USEPA Publication SW-846, Method 5035/8260B. The groundwater analytical results obtained are tabulated in Table 2. The groundwater COC distribution in the wells is illustrated in Figure 4. By comparing to the Wisconsin Administrative Code, Chapter NR 140 Enforcement Standard and Chapter NR 140 Preventive Action Limits, the following compounds are deemed as the contaminants of concern based on the groundwater sampling results.

**Tetrachloroethene (PCE):** up to 69 µg/L (78 µg/L in MW6-2D) of PCE was detected from various wells, which exceeded the groundwater Enforcement Standard (5 µg/l) and Preventive Action Limit as defined in the NR 140.

**Trichloroethene (TCE):** up to 140 µg/L of TCE was detected from various wells, which exceeded the groundwater Enforcement Standard (5 µg/l) and Preventive Action Limit as defined in the NR 140.

**Cis-1,2-Dichloroethene (cDCE):** up to 29 µg/L of DCE was detected from various wells, which exceeded the Preventive Action Limit as defined in the NR 140.

**Vinyl Chloride (VC):** up to 25 µg/L of VC was detected from various wells, which exceeded the groundwater Enforcement Standard (0.2 µg/l) and Preventive Action Limit as defined in the NR 140.

The groundwater sampling results confirmed that the groundwater quality have been impacted by the released PCE and its degraded compounds of TCE, cDCE, and VC at this site.

No contaminant was found in MW1, MW3, or MW4. In addition, no contaminant was detected in the trip blank sample, MW-TB. The duplicate sample from monitoring well MW6 (MW6-2D) contained similar concentrations of PCE, TCE, cDCE, and VC which confirmed the sampling and analysis process is accurate and reliable.

Bromodichloromethane (1.4 µg/L) and chloroform (1.3 µg/L) were also detected in samples collected in MW2 with concentrations exceeding the Enforcement Standard and/or Preventive Action Limits as shown in Chapter NR 140. However, these two chemicals may not come from the drycleaning operation since only tetrachloroethene (PCE) has been used by Westwood Cleaners. Based on our research on the internet, bromodichloromethane is mainly from fire extinguishing agent or water disinfection by chlorination, while the chloroform is mainly from precursors for manufacturing refrigerants or polytetrafluoroethylene (PTFE, or Teflon). Therefore, they may come from other unknown contamination sources, which are not contaminants of concern for this site.

### **3.3 Quarterly Groundwater (3<sup>rd</sup>) Sampling Results**

A total of 8 groundwater samples, including 1 duplicate from MW5 and 1 trip blank, were analyzed for VOCs in accordance with USEPA Publication SW-846, Method 5035/8260B. The groundwater analytical results obtained are tabulated in Table 2. The groundwater COC distribution in the wells is illustrated in Figure 4. By comparing to the Wisconsin Administrative Code, Chapter NR 140 Enforcement Standard and Chapter NR 140 Preventive Action Limits, the following compounds are deemed as the contaminants of concern based on the groundwater sampling results.

**Tetrachloroethene (PCE):** up to 370 µg/L of PCE was detected from various wells, which exceeded the groundwater Enforcement Standard (5 µg/l) and Preventive Action Limit as defined in the NR 140.

**Trichloroethene (TCE):** up to 75 µg/L of TCE was detected from various wells, which exceeded the groundwater Enforcement Standard (5 µg/l) and Preventive Action Limit as defined in the NR 140.

**Cis-1,2-Dichloroethene (cDCE):** up to 15 µg/L of DCE was detected from various wells, which exceeded the Preventive Action Limit as defined in the NR 140.

**Vinyl Chloride (VC):** up to 12 µg/L of VC was detected from various wells, which exceeded the groundwater Enforcement Standard (0.2 µg/l) and Preventive Action Limit as defined in the NR 140.

The groundwater sampling results confirmed that the groundwater quality have been impacted by the released PCE and its degraded compounds of TCE, cDCE, and VC at this site.



No contaminant was found in MW1, MW2, MW3, or MW4. In addition, no contaminant was detected in the trip blank sample, MW-TB.

The duplicated sample from monitoring well MW5 (MW5-3D) contained similar concentrations of PCE, TCE, cDCE, and VC which confirmed the sampling and analysis process is accurate and reliable.

### 3.4 Quarterly Groundwater (4<sup>th</sup>) Sampling Results

A total of 8 groundwater samples, including 1 duplicate from MW2 and 1 trip blank, were analyzed for VOCs in accordance with USEPA Publication SW-846, Method 5035/8260B. The groundwater analytical results obtained are tabulated in Table 2. The groundwater COC distribution in the wells is illustrated in Figure 4. By comparing to the Wisconsin Administrative Code, Chapter NR 140 Enforcement Standard and Chapter NR 140 Preventive Action Limits, the following compounds are deemed as the contaminants of concern based on the groundwater sampling results.

**Tetrachloroethene (PCE):** up to 4300 µg/L of PCE was detected from various wells, which exceeded the groundwater Enforcement Standard (5 µg/l) and Preventive Action Limit as defined in the NR 140.

**Trichloroethene (TCE):** up to 120 µg/L of TCE was detected from various wells, which exceeded the groundwater Enforcement Standard (5 µg/l) and Preventive Action Limit as defined in the NR 140.

**Cis-1,2-Dichloroethene (cDCE):** up to 23 µg/L of DCE was detected from various wells, which exceeded the Preventive Action Limit as defined in the NR 140.

**Vinyl Chloride (VC):** up to 20 µg/L of VC was detected from various wells, which exceeded the groundwater Enforcement Standard (0.2 µg/l) and Preventive Action Limit as defined in the NR 140.

The groundwater sampling results confirmed that the groundwater quality have been impacted by the released PCE and its degraded compounds of TCE, cDCE, and VC at this site.

No contaminant was found in MW1, MW2, MW3, or MW4. In addition, no contaminant was detected in the trip blank sample, MW-TB.

The duplicated sample from monitoring well MW2 (MW2-4D) contained identical concentrations of PCE, TCE, cDCE, and VC which confirmed the sampling and analysis process is accurate and reliable.



### 3.5 Quarterly Groundwater Table Elevation Monitoring Results

Prior to any groundwater disturbance, we conducted a water-table survey for monitoring wells MW1 through MW6. The top of the well casing of monitoring well MW6 was chosen as a survey reference point and assumed to be 100.00 feet site datum elevation. The relative elevation of the top of well casing for each well was then determined by level shooting and the distances between wells were directly measured using a wheel measure. The relative water-table elevation survey data can be summarized in Table 4.

A water table contour map for the relative water-table elevations collected on March 8, 2019 is constructed as shown in Figure 4. The groundwater flow trend is generally to the west with a converging factor toward MW5 and MW6 at this site. Groundwater from this site may discharge to the Menomonee River basin located approximately 1,600' southwest of the site. According to a Google Earth map, the water surface elevation at the Menomonee River is about 40' below the water table found at Westwood Cleaners site.

This groundwater table slope coincides with the local topography.





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**Table 4 Relative Water Table Elevation**

Well Number	Elevation of Well Casing (ft.)	Water Depth (ft.) 09/19/2018	Water Depth (ft.) 12/18/2018	Water Depth (ft.) 03/08/2019	Water Depth (ft.) 07/13/2019	Groundwater Table Elevation (ft.) 9/19/2018	Groundwater Table Elevation (ft.) 12/18/2018	Groundwater Table Elevation (ft.) 03/08/2019	Groundwater Table Elevation (ft.) 07/13/2019
MW1	98.49	8.72	9.55	9.22	9.35	89.77	88.94	89.27	89.14
MW2	99.12	8.97	8.35	8.01	8.15	90.15	90.77	91.11	90.97
MW3	100.76	10.23	10.06	9.75	9.65	90.53	90.7	91.01	91.11
MW4	98.88	8.44	8.15	7.81	7.9	90.44	90.73	91.07	90.98
MW5	99.95	9.61	9.89	9.55	9.85	90.34	90.06	90.4	90.1
MW6	100	9.76	9.89	9.54	9.75	90.24	90.11	90.46	90.25

Note: The top of casing at MW6 is used as 100.00 reference datum.

#### **4.0 CONCLUSIONS AND RECOMMENDATIONS**

To monitor the groundwater quality and flow pattern changes, on December 18, 2018, Hydrodynamics Consultants, Inc. crew collected groundwater samples from all the existing monitoring wells MW1-MW6 (for 2<sup>nd</sup> Sampling). The results of the groundwater analyses indicate that drycleaning solvent, tetrachloroethene (PCE) and its degraded byproducts, such as trichloroethene (TCE), cis-1,2-dichloroethene (DCE), and vinyl chloride (VC) remain at this site.

The 3<sup>rd</sup> quarterly sampling was completed on March 8, 2019. HDC's crew once again collected groundwater samples from all existing monitoring wells MW1-MW6. The results of the groundwater analyses are included in Table 2. The laboratory analytical results have also been attached. Figure 4 is a diagram showing the locations of any VOCs that have exceeded the screening levels. The results of the groundwater analyses indicate that drycleaning solvent, tetrachloroethene (PCE) and its degraded byproducts, such as trichloroethene (TCE), cis-1,2-dichloroethene (DCE), and vinyl chloride (VC) remain at this site. The Wisconsin Administrative Code, Chapter NR 140 Enforcement Standard and/or Preventive Action Limit have been exceeded.

On July 13, 2019, HDC performed the 4<sup>th</sup> groundwater sampling from all of the existing monitoring wells MW1-MW6. The results of the new sampling are included in Table 2. The laboratory analytical results have also been attached. Figure 4 is a diagram showing the locations of any VOCs that have exceeded the screening levels. The newest results of the groundwater analyses indicate that drycleaning solvent, tetrachloroethene (PCE) and its degraded byproducts, such as trichloroethene (TCE), cis-1,2-dichloroethene (DCE), and vinyl chloride (VC) remain at this site. Groundwater samples confirm that up to 4300 µg/L of PCE, 120 µg/L of TCE, 23 µg/L of DCE and 20 µg/L of VC remain at these wells. The Wisconsin Administrative Code, Chapter NR 140 Enforcement Standard and/or Preventive Action Limit have been exceeded.

By comparing all of the groundwater sampling results, it appears that the cVOC concentrations in the groundwater samples are steady, except for the PCE concentrations in MW5 and MW6 which show an increase of PCE. No cVOC was found in monitoring wells, MW1, MW2, MW3, and MW4 with concentration exceeding the enforcement standard and/or preventive action levels as stimulated in NR 140.

The groundwater flow trend is still toward the west or southwest.

In conclusion, Hydrodynamics Consultants, Inc. believes that for the WDNR to consider this case for closure, the following additional site investigation should be completed:

1. Installation of 8 additional soil borings and converting them to monitoring wells to fully define the degree and extent of the soil and groundwater contamination (see Figure 5);



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Environmental Engineering, Consulting, and Contracting

2. Collection of 3 samples from each of the borings to determine the soil cVOC concentrations;
3. Completion of 4 quarterly groundwater sampling/monitoring events in all of the monitoring wells, including the new and existing wells, for a period of one year;
4. Completion of 4 quarterly sub-slab vapor sampling/monitoring events in all of the 5 vapor sampling ports (SV1 to SV5) installed in the concrete floor for a period of one year;
5. Preparation of an additional site investigation report, quarterly sampling reports, and annual monitoring reports to summarize the cVOC attenuation trends.

If the contaminant concentrations are found to be generally steady or decreasing, the site may apply for final case closure with the following continuing obligations: (1) maintaining the concrete floor inside the current Westwood Cleaners store as an engineered barrier to minimize any direct contact from the impacted soil below, (2) filing notifications to the adjoining properties that may be affected by the released cVOCs, and (3) enrolling the site in the GIS Registry system after the proper documents are recorded in the Milwaukee County Register's Office. However, if risks are found through the quarterly monitoring program, further site evaluation will be conducted to determine the proper remediation alternatives.

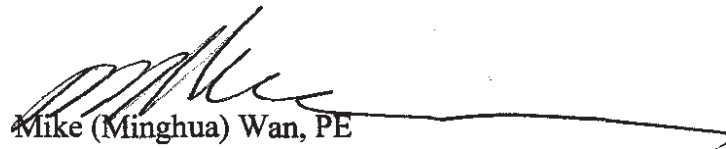


**5.0 CLOSING REMARKS**

The environmental assessment detailed in this report has been performed in accordance with generally accepted methods and practices of the environmental profession. The findings obtained in this project are believed to be reliable to the extent possible for the information gathered and for the scope and intent of the work mutually agreed upon by the client and HDC. HDC does not make any warrantee or guarantee, expressly or implied, to conditions that could not be considered in our report, because the conditions were not readily available, hidden, or not disclosed to our inquiries and investigations.

HDC appreciates the opportunity to be of service to you on this project. If you have any questions concerning this report, please feel free to contact my office.

Prepared by:

A handwritten signature in black ink, appearing to read "Mike Wan", is written over a horizontal line.

Mike (Minghua) Wan, PE  
Senior Engineer

Reviewed by

**Yong Yu, Ph.D.**  
Senior Project Manager

Maple Testing Services, Inc.  
D/B/A Hydrodynamics Consultants, Inc.

# **TABLES**

**Table 1 Soil VOC Analytical Results**

Sample ID:	SB1-A	SB1-B	SB2-A	SB2-B	SB3-A	SB3-B	SB4-A	SB4-B	NR 720 RCLs*			
Date:	8/19/2008								Groundwater Pathway RCL	Non-Industrial Direct Contact RCL	Industrial Direct Contact RCL	
Sampling Depth (ft)	1	6	1	6	1	6	1	6				
Depth to GW (ft)									µg/Kg	µg/Kg	µg/Kg	
<b>VOCs</b>												
cis-1,2-Dichloroethene	< 1430	< 25	< 625	< 26.6	< 312	< 29.9	< 412	< 27.8	41.2	156000	2040000	
Tetrachloroethene	<b>320000</b>	<b>685</b>	<b>178000</b>	<b>3990</b>	<b>103000</b>	<b>6850</b>	<b>25000</b>	<b>10800</b>	4.5	30700	153000	
Trichloroethene	<b>3970</b>	< 25	<b>2310</b>	<b>50.5 J</b>	< 312	< 29.9	< 412	< 27.8	3.6	1260	8810	
Vinyl chloride	< 1430	< 25	< 625	< 26.6	< 312	< 29.9	< 412	< 27.8	0.1	67	2030	

Notes:

\* RCL = Residual Contaminant Level per WDNR Remediation and Redevelopment Program

NR 720 RCLs are generic standards for the groundwater pathway for VOCs.

NS = No Standard

J - Analyte detected below reporting limit

All values in µg/Kg

Bold fonts/Shaded boxes indicate the levels exceed the Quality Standards.

**Table 1 Soil VOC Analytical Results**

Sample ID:	NSB1-A	NSB1-B	NSB1-C	NSB2-A	NSB2-B	NSB2-C	NR 720 RCLs*		
Date:	9/16/2018						Groundwater Pathway RCL	Non-Industrial Direct Contact RCL	Industrial Direct Contact RCL
Sampling Depth (ft)	2	8	16	2	8	16			
Depth to GW (ft)	8			8					
VOCs							µg/Kg	µg/Kg	µg/Kg
cis-1,2-Dichloroethene	< 4.8	< 4.7	< 4.6	< 4.8	< 3.8	< 4.2	41.2	156000	2040000
Tetrachloroethene	< 4.8	0.55 J	<b>17</b>	< 4.8	0.47 J	<b>38</b>	4.5	30700	153000
Trichloroethene	< 4.8	< 4.7	< 4.6	< 4.8	< 3.8	< 4.2	3.6	1260	8810
Vinyl chloride	< 4.8	< 4.7	< 4.6	< 4.8	< 3.8	< 4.2	0.1	67	2030

Notes:

\* RCL = Residual Contaminant Level per WDNR Remediation and Redevelopment Program

NR 720 RCLs are generic standards for the groundwater pathway for VOCs.

NS = No Standard

J - Analyte detected below reporting limit

All values in µg/Kg

Bold fonts/Shaded boxes indicate the levels exceed the Quality Standards.

**Table 1 Soil VOC Analytical Results**

Sample ID:	NSB3-A	NSB3-B	NSB3-C	NSB4-A	NSB4-B	NSB4-C	NR 720 RCLs*		
Date:	9/16/2018						Groundwater Pathway RCL	Non-Industrial Direct Contact RCL	Industrial Direct Contact RCL
Sampling Depth (ft)	2	8	16	2	8	16			
Depth to GW (ft)	10			8					
VOCs							µg/Kg	µg/Kg	µg/Kg
cis-1,2-Dichloroethene	< 5.5	< 4.2	< 4.1	< 4.9	< 4.6	< 4	<i>41.2</i>	<i>156000</i>	<i>2040000</i>
Tetrachloroethene	1.7 J	0.89 J	0.97 J	2.6 J	< 4.6	< 4	<i>4.5</i>	<i>30700</i>	<i>153000</i>
Trichloroethene	< 5.5	< 4.2	< 4.1	< 4.9	< 4.6	< 4	<i>3.6</i>	<i>1260</i>	<i>8810</i>
Vinyl chloride	< 5.5	< 4.2	< 4.1	< 4.9	< 4.6	< 4	<i>0.1</i>	<i>67</i>	<i>2030</i>

Notes:

RCL = Residual Contaminant Level per WDNR Remediation and Redevelopment Program

NR 720 RCLs are generic standards for the groundwater pathway for VOCs.

NS = No Standard

J - Analyte detected below reporting limit

All values in µg/Kg

Bold fonts/Shaded boxes indicate the levels exceed the Quality Standards.



**Table 1 Soil VOC Analytical Results**

Sample ID:	NSB5-A	NSB5-B	NSB5-C	NSB6-A	NSB6-B	NSB6-C	NR 720 RCLs*		
Date:	9/16/2018						Groundwater Pathway RCL	Non-Industrial Direct Contact RCL	Industrial Direct Contact RCL
Sampling Depth (ft)	2	8	16	2	8	15			
Depth to GW (ft)	9			9					
VOCs							µg/Kg	µg/Kg	µg/Kg
cis-1,2-Dichloroethene	< 4.5	< 270	< 4.2	< 290	4.3 J	< 6	41.2	156000	2040000
Tetrachloroethene	<b>210</b>	<b>2100</b>	< 4.2	<b>6300</b>	<b>1500</b>	1.4 J	4.5	30700	153000
Trichloroethene	< 4.5	<b>53 J</b>	< 4.2	<b>750</b>	<b>60</b>	< 6	3.6	1260	8810
Vinyl chloride	< 4.5	< 270	< 4.2	< 290	<b>2.7 J</b>	< 6	0.1	67	2030

Notes:

\* RCL = Residual Contaminant Level per WDNR Remediation and Redevelopment Program

NR 720 RCLs are generic standards for the groundwater pathway for VOCs.

NS = No Standard

J - Analyte detected below reporting limit

All values in µg/Kg

Bold fonts/Shaded boxes indicate the levels exceed the Quality Standards.

**Table 1 Soil VOC Analytical Results**

Sample ID:	NSB7-A	NSB7-B	NSB7-C	NSB8-A	NSB8-B	NSB8-C	NR 720 RCLs*		
Date:	9/16/2018						Groundwater Pathway RCL	Non-Industrial Direct Contact RCL	Industrial Direct Contact RCL
Sampling Depth (ft)	2	8	16	2	8	16			
Depth to GW (ft)	6			8					
VOCs							µg/Kg	µg/Kg	µg/Kg
cis-1,2-Dichloroethene	< 4.2	< 4.5	< 4.9	< 4.3	< 5.2	< 4.6	<i>41.2</i>	<i>156000</i>	<i>2040000</i>
Tetrachloroethene	4.2 J	< 11	< 4.9	< 4.3	< 5.2	< 4.6	<i>4.5</i>	<i>30700</i>	<i>153000</i>
Trichloroethene	< 4.2	< 4.5	< 4.9	< 4.3	2.2 J	< 4.6	<i>3.6</i>	<i>1260</i>	<i>8810</i>
Vinyl chloride	< 4.2	< 4.5	< 4.9	< 4.3	< 5.2	< 4.6	<i>0.1</i>	<i>67</i>	<i>2030</i>

Notes:

\* RCL = Residual Contaminant Level per WDNR Remediation and Redevelopment Program

NR 720 RCLs are generic standards for the groundwater pathway for VOCs.

NS = No Standard

J - Analyte detected below reporting limit

All values in µg/Kg

Bold fonts/Shaded boxes indicate the levels exceed the Quality Standards.

**Table 1 Soil VOC Analytical Results**

Sample ID:	NSB9-A	NSB9-B	NSB9-C	NSB10-A	NSB10-B	NSB10-C	NR 720 RCLs*		
Date:	9/16/2018						Groundwater Pathway RCL	Non-Industrial Direct Contact RCL	Industrial Direct Contact RCL
Sampling Depth (ft)	2	8	16	2	6	15			
Depth to GW (ft)	8			6					
VOCs							µg/Kg	µg/Kg	µg/Kg
cis-1,2-Dichloroethene	< 5	8	< 4.1	< 4.8	< 4.6	< 4.3	41.2	156000	2040000
Tetrachloroethene	<b>14</b>	< 5.2	< 4.1	<b>1400</b>	<b>160</b>	< 4.3	4.5	30700	153000
Trichloroethene	< 5	<b>4.9 J</b>	< 4.1	<b>19</b>	<b>13</b>	< 4.3	3.6	1260	8810
Vinyl chloride	< 5	< 5.2	< 4.1	< 4.8	< 4.6	< 4.3	0.1	67	2030

Notes:

\* RCL = Residual Contaminant Level per WDNR Remediation and Redevelopment Program

NR 720 RCLs are generic standards for the groundwater pathway for VOCs.

NS = No Standard

J - Analyte detected below reporting limit

All values in µg/Kg

Bold fonts/Shaded boxes indicate the levels exceed the Quality Standards.

**Table 1 Soil VOC Analytical Results**

Sample ID:	NSB11-A	NSB11-B	NSB11-C	NSB12-A	NSB12-B	NSB12-C	NR 720 RCLs*		
Date:	9/16/2018						Groundwater Pathway RCL	Non-Industrial Direct Contact RCL	Industrial Direct Contact RCL
Sampling Depth (ft)	2	6	15	2	6	15			
Depth to GW (ft)	6			6					
VOCs							µg/Kg	µg/Kg	µg/Kg
cis-1,2-Dichloroethene	< 4.8	< 4.6	< 4.9	< 4.2	< 4.7	< 3.7	41.2	156000	2040000
Tetrachloroethene	<b>67</b>	<b>220</b>	< 4.9	< 4.2	<b>27</b>	< 3.7	4.5	30700	153000
Trichloroethene	< 4.8	< 4.6	< 4.9	< 4.2	< 4.7	< 3.7	3.6	1260	8810
Vinyl chloride	< 4.8	< 4.6	< 4.9	< 4.2	< 4.7	< 3.7	0.1	67	2030

Notes:

\* RCL = Residual Contaminant Level per WDNR Remediation and Redevelopment Program

NR 720 RCLs are generic standards for the groundwater pathway for VOCs.

NS = No Standard

J - Analyte detected below reporting limit

All values in µg/Kg

Bold fonts/Shaded boxes indicate the levels exceed the Quality Standards.

**Table 2 - 1st Quarterly Groundwater VOC Analytical Results**

Sample ID:	MW1	MW1-D	MW2	MW3	MW4	MW5	MW6	MW-TB	Groundwater Quality Standards	
Date:	9/19//2018							9/18/2018	NR 140 ES	NR 140 PAL
Depth to Water (ft):	8.72	8.72	8.97	10.23	8.44	9.61	9.76			
<b>VOCs</b>									<b>µg/L</b>	<b>µg/L</b>
cis-1,2-Dichloroethene	< 5	< 5	0.69	< 5	< 5	<b>26</b>	<b>8.6</b>	< 5	70	7
Tetrachloroethene	< 5	< 5	<b>6.3</b>	< 5	< 5	<b>160</b>	<b>110</b>	< 5	5	0.5
Trichloroethene	< 5	< 5	< 5	< 5	< 5	<b>70</b>	<b>11</b>	< 5	5	0.5
Vinyl chloride	< 2	< 2	< 2	< 2	< 2	<b>38</b>	<b>3.3</b>	< 2	0.2	0.02

Notes:

NR 140 ES = Wisconsin Administrative Code, Chapter NR 140 Enforcement Standard  
 NR 140 PAL = Wisconsin Administrative Code, Chapter NR 140 Preventive Action Limit  
 Sample ID with " - D" and "TB" refer to duplicate and trip blank, respectively  
 NS = No Standard

Bold fonts/Shaded boxes indicate the levels exceed the Quality Standards.  
 J - Analyte detected below reporting limit  
 All values in µg/L

**Table 2 - 2nd Quarterly Groundwater VOC Analytical Results**

Sample ID:	MW1-2	MW2-2	MW3-2	MW4-2	MW5-2	MW6-2	MW6-2 D	MW-TB	Groundwater Quality Standards	
Date:	12/18/2018								NR 140 ES	NR 140 PAL
Depth to Water (ft):	9.55	8.35	10.06	8.15	9.89	9.89	9.89			
VOCs									µg/L	µg/L
Bromodichloromethane	< 5	<b>1.4</b>	< 5	< 5	< 5	< 5	< 5	< 5	<b>0.6</b>	<b>0.06</b>
Chloroform	< 5	<b>1.3</b>	< 5	< 5	< 5	< 5	< 5	< 5	<b>6</b>	<b>0.6</b>
cis-1,2-Dichloroethene	< 5	< 5	< 5	< 5	<b>29</b>	<b>17</b>	<b>13</b>	< 5	<b>70</b>	<b>7</b>
Tetrachloroethene	< 5	<b>12</b>	< 5	< 5	<b>66</b>	<b>69</b>	<b>78</b>	< 5	<b>5</b>	<b>0.5</b>
Trichloroethene	< 5	< 5	< 5	< 5	<b>140</b>	<b>36</b>	<b>41</b>	< 5	<b>5</b>	<b>0.5</b>
Vinyl chloride	< 2	< 2	< 2	< 2	<b>25</b>	<b>2.2</b>	<b>2.4</b>	< 2	<b>0.2</b>	<b>0.02</b>

Notes:

NR 140 ES = Wisconsin Administrative Code, Chapter NR 140 Enforcement Standard  
 NR 140 PAL = Wisconsin Administrative Code, Chapter NR 140 Preventive Action Limit  
 NS = No Standard,  
 Sample ID with " - D" and "TB" refer to duplicate and trip blank, respectively

J - Analyte detected below reporting limit  
 All values in µg/L  
 Bold fonts/Shaded boxes indicate the levels exceed the Quality Standards.

**Table 2 - 3rd Quarterly Groundwater VOC Analytical Results**

Sample ID:	MW1-3	MW2-3	MW3-3	MW4-3	MW5-3	MW5-3D	MW6-3	MW-TB	Groundwater Quality Standards	
Date:	3/8/2019								NR 140 ES	NR 140 PAL
Depth to Water (ft):	9.22	8.01	9.75	7.81	9.55	9.55	9.54		µg/L	µg/L
<b>VOCs</b>									<b>µg/L</b>	<b>µg/L</b>
Bromodichloromethane	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	0.6	0.06
Chloroform	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	6	0.6
cis-1,2-Dichloroethene	< 5	< 5	< 5	< 5	<b>15</b>	<b>15</b>	<b>12</b>	< 5	70	7
Tetrachloroethene	< 5	< 5	< 5	< 5	<b>270</b>	<b>260</b>	<b>370</b>	< 5	5	0.5
Trichloroethene	< 5	< 5	< 5	< 5	<b>75</b>	<b>70</b>	<b>52</b>	< 5	5	0.5
Vinyl chloride	< 2	< 2	< 2	< 2	<b>12</b>	<b>12</b>	<b>5.7</b>	< 2	0.2	0.02

Notes:

NR 140 ES = Wisconsin Administrative Code, Chapter NR 140 Enforcement Standard  
 NR 140 PAL = Wisconsin Administrative Code, Chapter NR 140 Preventive Action Limit  
 NS = No Standard,  
 Sample ID with " - D" and "TB" refer to duplicate and trip blank, respectively

J - Analyte detected below reporting limit  
 All values in µg/L  
 Bold fonts/Shaded boxes indicate the levels exceed the Quality Standards.

**Table 2 - 4th Quarterly Groundwater VOC Analytical Results**

Sample ID:	MW1-4	MW2-4	MW2-4D	MW3-4	MW4-4	MW5-4	MW6-4	MW-TB4	Groundwater Quality Standards	
Date:	7/13/2019								NR 140 ES	NR 140 PAL
Depth to Water (ft):	9.35	8.15	8.15	9.65	7.9	9.85	9.75		µg/L	µg/L
<b>VOCs</b>									µg/L	µg/L
Bromodichloromethane	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	0.6	0.06
Chloroform	<1	<1	<1	<1	<1	<1	<1	<1	6	0.6
cis-1,2-Dichloroethene	<5	4.4 J	4.4 J	<5	<5	<b>23</b>	<b>7.8</b>	<5	70	7
Tetrachloroethene	<5	<b>53</b>	<b>53</b>	<5	<5	<b>4300</b>	<b>550</b>	<5	5	0.5
Trichloroethene	<5	<b>18</b>	<b>18</b>	<5	<5	<b>120</b>	<b>41</b>	<5	5	0.5
Vinyl chloride	<2	<2	<2	<2	<2	<b>20</b>	<2	<2	0.2	0.02

Notes:

NR 140 ES = Wisconsin Administrative Code, Chapter NR 140 Enforcement Standard  
 NR 140 PAL = Wisconsin Administrative Code, Chapter NR 140 Preventive Action Limit  
 NS = No Standard,  
 Sample ID with " - D" and "TB" refer to duplicate and trip blank, respectively

J - Analyte detected below reporting limit  
 All values in µg/L  
 Bold fonts/Shaded boxes indicate the levels exceed the Quality Standards.



**Table 3 Vapor VOC Analytical Results**

Sample ID:	SV3	SV3-D	SV1	SV2	SV4	SV5	Indoor Air Vapor Action Levels (VAL)*		Sub-Slab Vapor Risk Screening Levels (VRSL)*	
Sampling Date:	9/16/2018		9/19/2018				Residential	Small Commercial	Residential	Small Commercial
VOCs							µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>
cis-1,2-Dichloroethene	< 2.9	< 6.6	< 2.7	< 2.9	< 3.0	< 5.6	NS	NS	NS	NS
Tetrachloroethene	<b>300</b>	<b>300</b>	17	<b>1200</b>	<b>52</b>	<b>63</b>	<i>41.7</i>	<i>175</i>	<i>1390</i>	<i>5840</i>
Trichloroethene	<b>4.2</b>	<b>3.6 J</b>	< 3.7	<b>100</b>	< 4.1	< 7.7	<i>2.09</i>	<i>8.76</i>	<i>69.5</i>	<i>292</i>
Vinyl chloride	< 1.8	< 4.1	< 1.7	< 1.8	< 1.9	< 3.5	<i>1.68</i>	<i>27.9</i>	<i>55.9</i>	<i>929</i>

Notes:

\* US EPA Vapor Intrusion Screening Levels (VISL) Calculator (Default Results)

J - Analyte detected below reporting limit

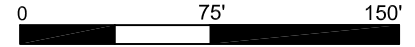
Bold fonts/Shaded boxes indicate the levels exceed the Quality Standards.

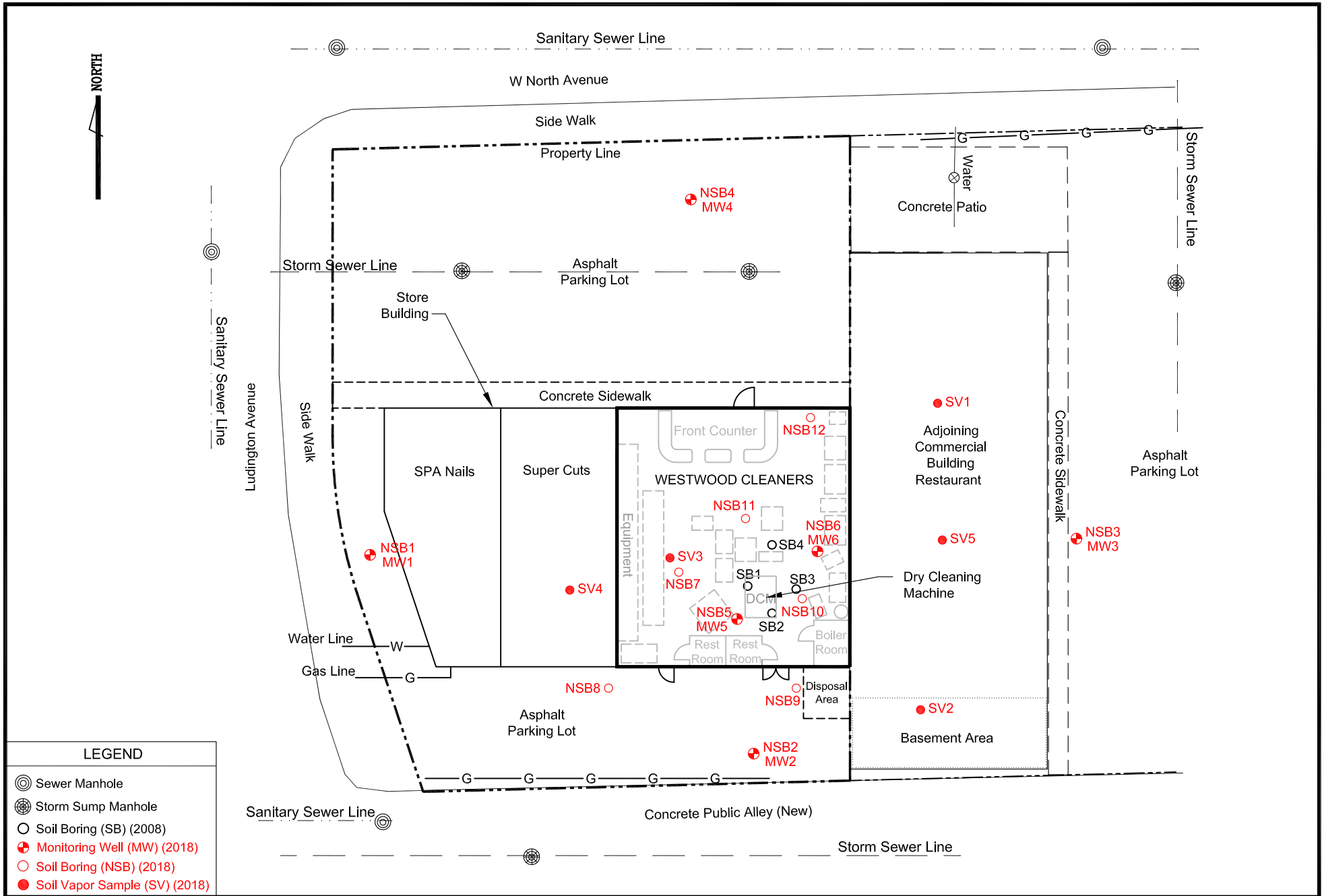
# **FIGURES**

# Figure 1 Site Vicinity Map

WDNR BRRTS #02-41-552537/Milwaukee County  
Westwood Cleaners  
8751 W. North Avenue, Wauwatosa, WI 53226

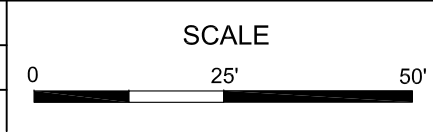
SCALE





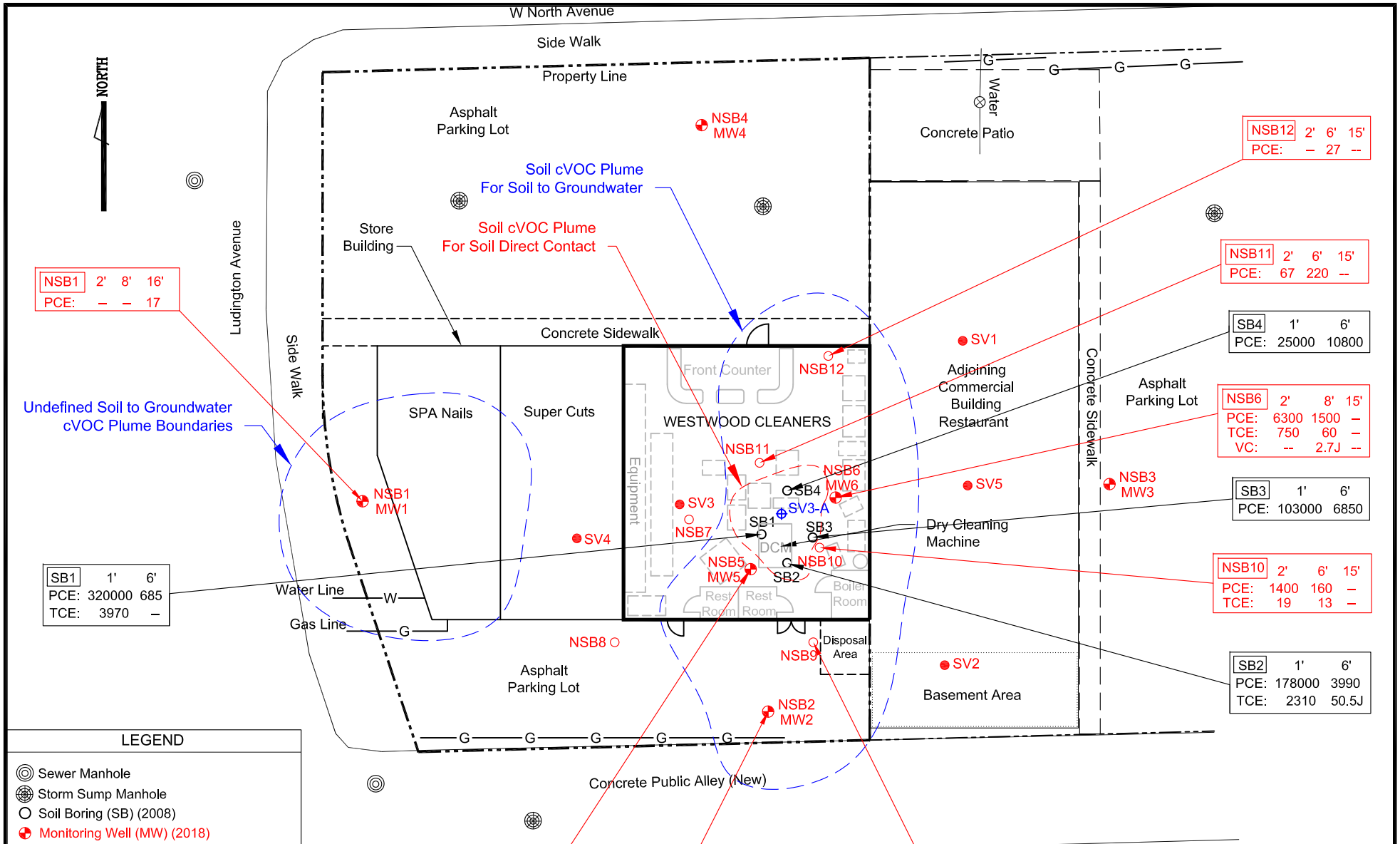
LEGEND	
⊙	Sewer Manhole
⊕	Storm Sump Manhole
○	Soil Boring (SB) (2008)
⊕	Monitoring Well (MW) (2018)
○	Soil Boring (NSB) (2018)
●	Soil Vapor Sample (SV) (2018)

SITE NAME	Westwood Dry Cleaners (#02-41-552537)	FIGURE NO.	2
FIGURE NAME	Site Map with Utility Lines		
ADDRESS	8731 West North Avenue, Wauwatosa, WI 53226		



**HYDRODYNAMICS CONSULTANTS, INC.**

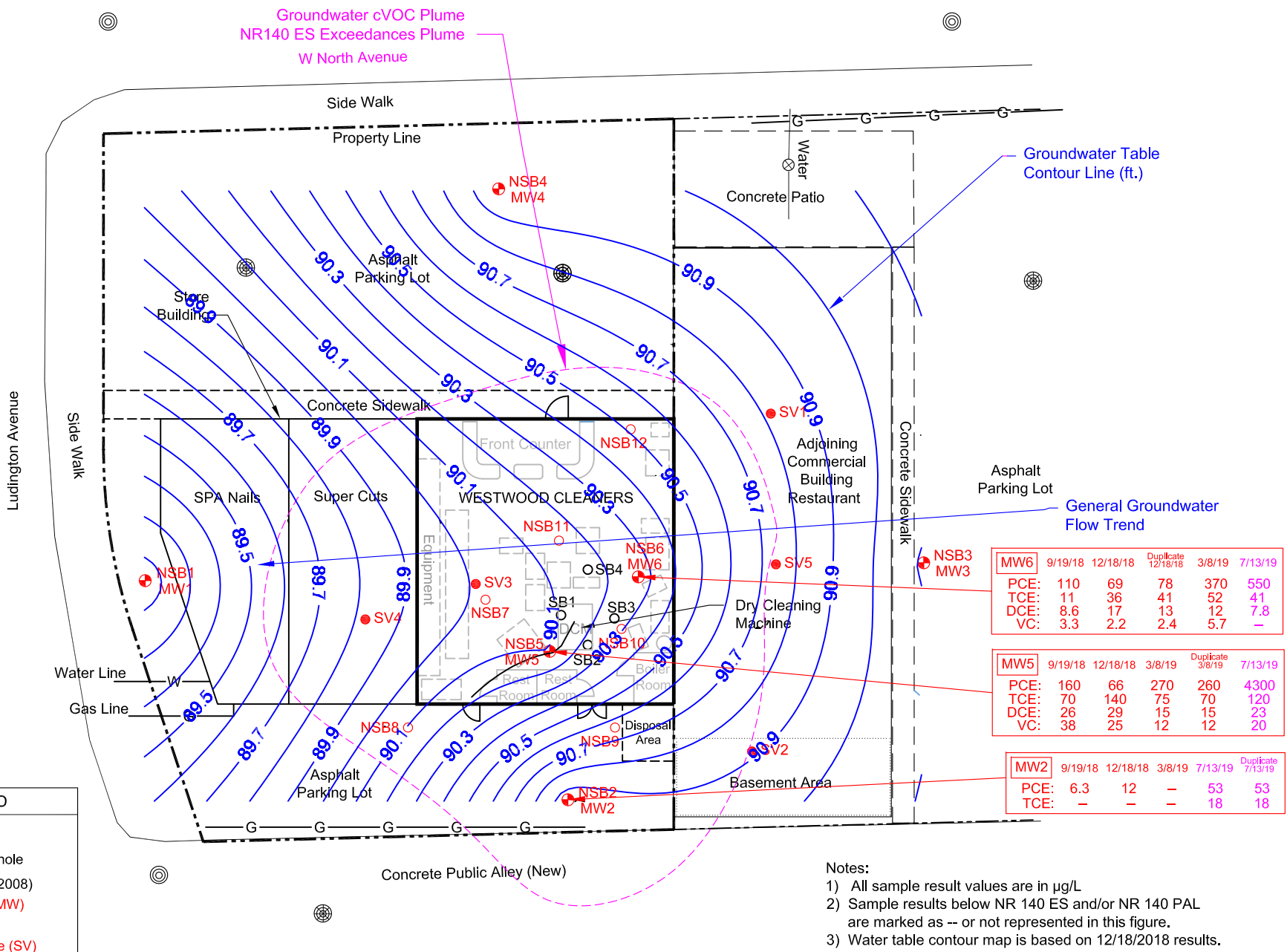
5403 Patton Dr. Unit 215, Lisle, IL 60532  
 Tel: (630) 724-0098, HydrodynamicsConsultants.com



**Notes:**

- 1) All sample result values are in µg/Kg
- 2) Sample results below NR 720 RCLs are marked as -- or not represented in this figure.
- 3) J - Analyte detected below reporting limit

<b>SITE NAME</b>	Westwood Dry Cleaners (#02-41-552537)	<b>FIGURE NO.</b>	3	<b>SCALE</b> 	<b>HYDRODYNAMICS CONSULTANTS, INC.</b> 5403 Patton Dr. Unit 215, Lisle, IL 60532 Tel: (630) 724-0098, HydrodynamicsConsultants.com
<b>FIGURE NAME</b>	Soil cVOC Isoconcentration Plume Map				
<b>ADDRESS</b>	8731 West North Avenue, Wauwatosa, WI 53226				



MW6	9/19/18	12/18/18	Duplicate 12/18/18	3/8/19	7/13/19
PCE:	110	69	78	370	550
TCE:	11	36	41	52	41
DCE:	8.6	17	13	12	7.8
VC:	3.3	2.2	2.4	5.7	--

MW5	9/19/18	12/18/18	3/8/19	Duplicate 3/8/19	7/13/19
PCE:	160	66	270	260	4300
TCE:	70	140	75	70	120
DCE:	26	29	15	15	23
VC:	38	25	12	12	20

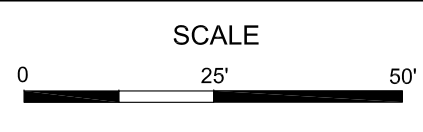
  

MW2	9/19/18	12/18/18	3/8/19	7/13/19	Duplicate 7/13/19
PCE:	6.3	12	--	53	53
TCE:	--	--	--	18	18

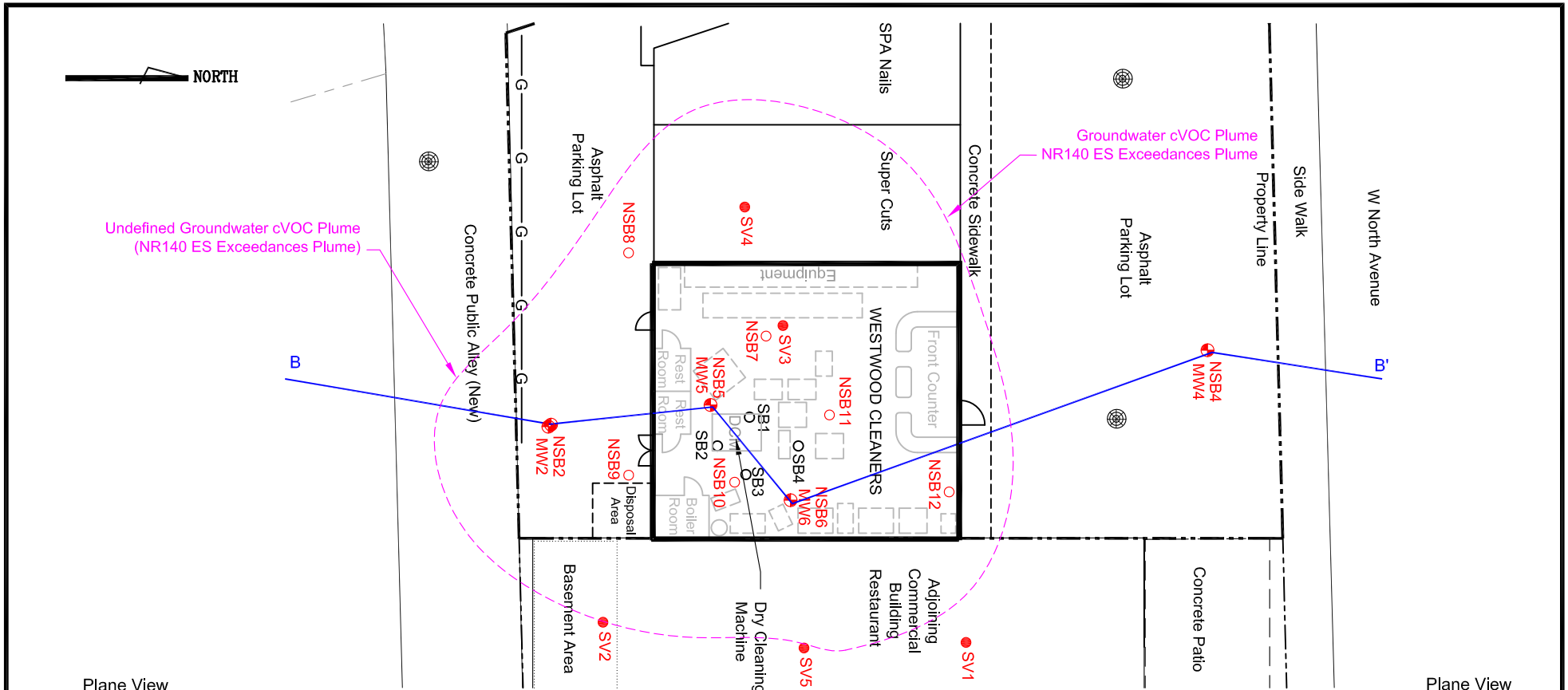
LEGEND	
⊙	Sewer Manhole
⊕	Storm Sump Manhole
○	Soil Boring (SB) (2008)
⊕	Monitoring Well (MW)
○	Soil Boring (NSB)
●	Soil Vapor Sample (SV)

- Notes:
- 1) All sample result values are in µg/L
  - 2) Sample results below NR 140 ES and/or NR 140 PAL are marked as -- or not represented in this figure.
  - 3) Water table contour map is based on 12/18/2018 results.

SITE NAME	Westwood Dry Cleaners (#02-41-552537)	FIGURE NO.	4
FIGURE NAME	Groundwater cVOC Distribution Map & Groundwater Table Contour		
ADDRESS	8731 West North Avenue, Wauwatosa, WI 53226		



**HYDRODYNAMICS CONSULTANTS, INC.**  
 5403 Patton Dr. Unit 215, Lisle, IL 60532  
 Tel: (630) 724-0098, HydrodynamicsConsultants.com

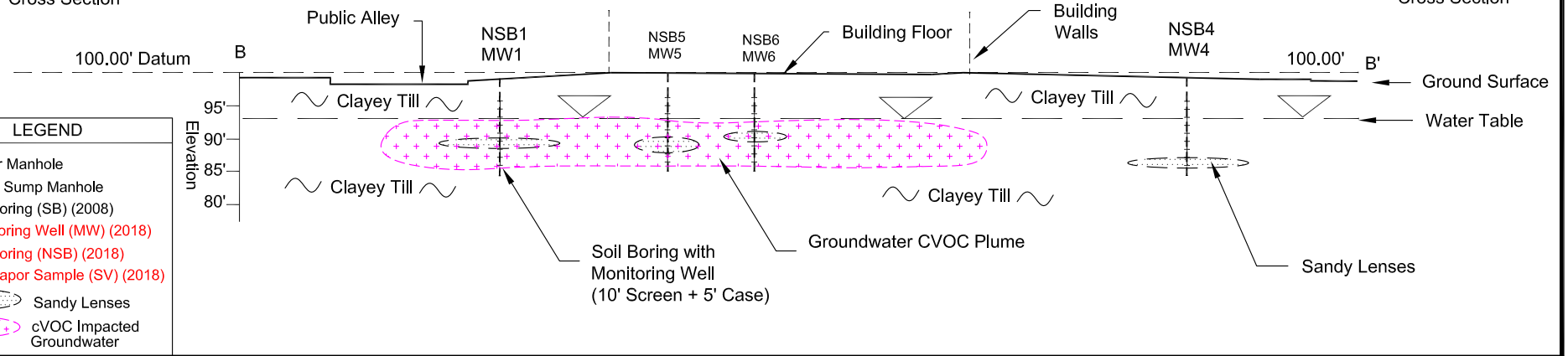


Plane View

Plane View

Cross Section

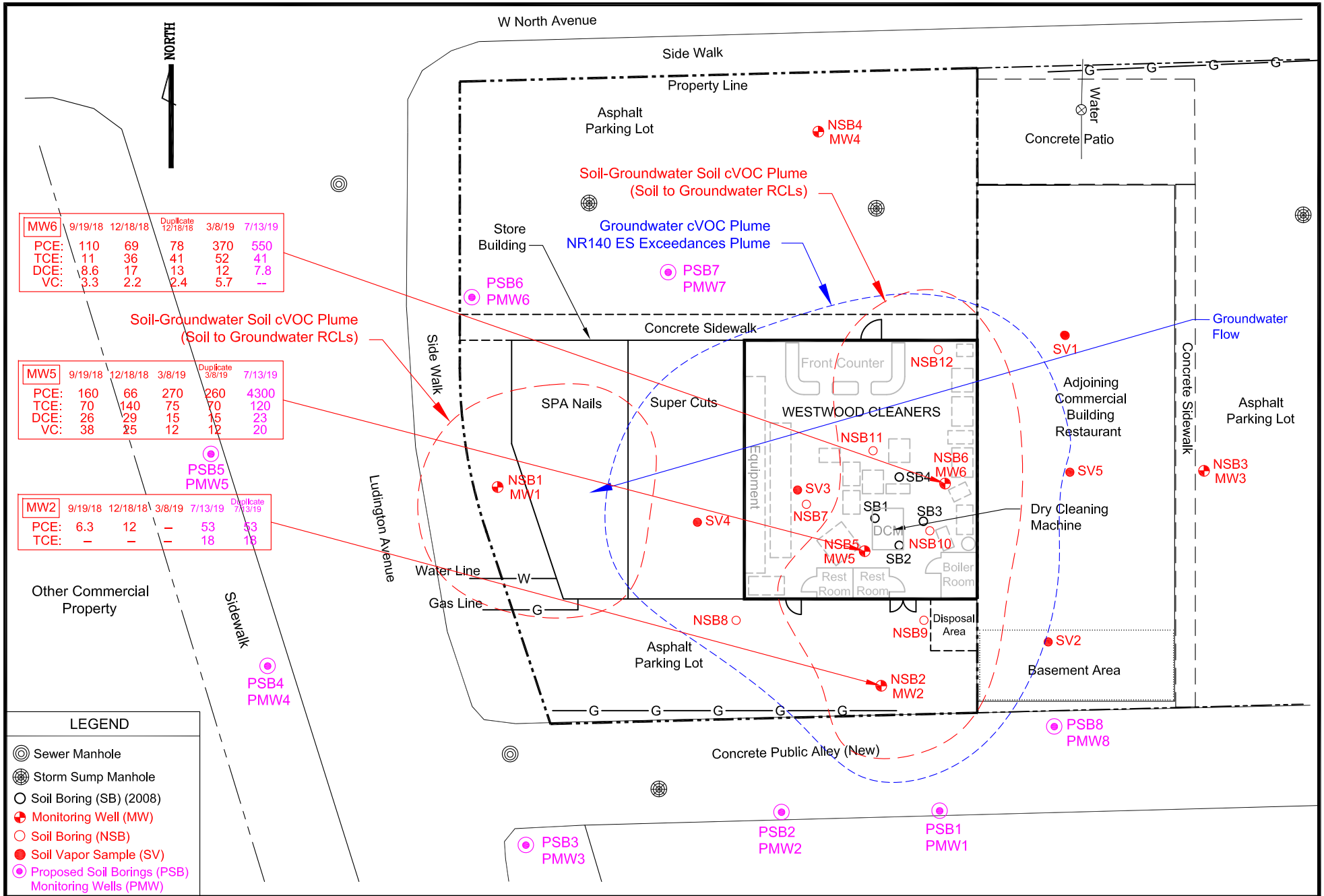
Cross Section



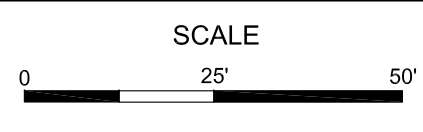
LEGEND

- ⊙ Sewer Manhole
- ⊙ Storm Sump Manhole
- Soil Boring (SB) (2008)
- Monitoring Well (MW) (2018)
- Soil Boring (NSB) (2018)
- Soil Vapor Sample (SV) (2018)
- ⊖ Sandy Lenses
- ⊖ cVOC Impacted Groundwater

SITE NAME	Westwood Dry Cleaners (#02-41-552537)	FIGURE NO.	4a	<b>SCALE</b> 0                      25'                      50' 	<b>HYDRODYNAMICS CONSULTANTS, INC.</b> 5403 Patton Dr. Unit 215, Lisle, IL 60532 Tel: (630) 724-0098, HydrodynamicsConsultants.com
FIGURE NAME	B-B' Groundwater cVOC & Geological Cross Section				
ADDRESS	8731 West North Avenue, Wauwatosa, WI 53226				



SITE NAME	Westwood Dry Cleaners (#02-41-552537)	FIGURE NO.	5
FIGURE NAME	Proposed Additional Soil Boring and Monitoring Well Location Map		
ADDRESS	8731 West North Avenue, Wauwatosa, WI 53226		



**HYDRODYNAMICS CONSULTANTS, INC.**  
 5403 Patton Dr. Unit 215, Lisle, IL 60532  
 Tel: (630) 724-0098, HydrodynamicsConsultants.com



**APPENDIX I**  
**SAMPLE CHAIN-OF-CUSTODY AND**  
**LABORATORY ANALYTICAL RESULTS**

**STAT** Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

July 22, 2019

Hydrodynamics Consultant, Inc.  
5403 Patton Drive  
Lisle, IL 60532

Telephone: (630) 724-0098  
Fax: (800) 881-2051

Analytical Report for STAT Work Order: 19070781 Revision 0

RE: Westwood Cleaners, 8731 West North Ave., Wauwatosa, WI 53226

Dear Dr. Yong Yu:

STAT Analysis received 8 samples for the referenced project on 7/15/2019 2:46:00 PM. The analytical results are presented in the following report.

All analyses were performed in accordance with the requirements specified in WI DNR Chapter NR 149 (Certification Number 399099910). Analyses were performed in accordance with methods as referenced on the analytical report.

All analyses were performed within established holding time criteria, and all Quality Control criteria met EPA or laboratory specifications except when noted in the Case Narrative or Analytical Report. A listing of accredited methods/parameters can also be provided.

For sample results requiring adjustment for dilutions, the detection and reporting limits are adjusted for the corresponding dilution factor. Analytical results expressed on a dry weight basis have units of mg/Kg-dry or  $\mu\text{g}/\text{Kg-dry}$  on the analytical report. Corresponding reporting limits are adjusted for dry weight.

Thank you for the opportunity to serve you and I look forward to working with you in the future. If you have any questions regarding the enclosed materials, please contact me at (312) 733-0551.

Sincerely,



Craig Chawla  
Project Manager

*The information contained in this report and any attachments is confidential information intended only for the use of the individual or entities named above. The results of this report relate only to the samples as received and tested. If you have received this report in error, please notify us immediately by phone. This report shall not be reproduced, except in its entirety, unless written approval has been obtained from the laboratory. This analytical report shall become property of the Customer upon payment in full. Otherwise, STAT will be under no obligation to support, defend or discuss the analytical report.*

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**Client:** Hydrodynamics Consultant, Inc.**Project:** Westwood Cleaners, 8731 West North Ave., Wauwatos**Work Order Sample Summary****Work Order:** 19070781 Revision 0

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<b>Lab Sample ID</b>	<b>Client Sample ID</b>	<b>Tag Number</b>	<b>Collection Date</b>	<b>Date Received</b>
19070781-001A	MW 1-4		7/13/2019 11:29:00 AM	7/15/2019
19070781-002A	MW 2-4		7/13/2019 11:35:00 AM	7/15/2019
19070781-003A	MW 2-4D		7/13/2019 11:39:00 AM	7/15/2019
19070781-004A	MW 3-4		7/13/2019 11:46:00 AM	7/15/2019
19070781-005A	MW 4-4		7/13/2019 11:52:00 AM	7/15/2019
19070781-006A	MW 5-4		7/13/2019 12:01:00 PM	7/15/2019
19070781-007A	MW 6-4		7/13/2019 12:09:00 PM	7/15/2019
19070781-008A	MW TB4		7/13/2019 9:07:00 AM	7/15/2019

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Accreditations: WI DNR 399099910; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Report Date: July 22, 2019

**ANALYTICAL RESULTS**

Print Date: July 22, 2019

CLIENT: Hydrodynamics Consultant, Inc.

Client Sample ID: MW 1-4

Work Order: 19070781 Revision 0

Tag Number:

Project: Westwood Cleaners, 8731 West North Ave., Wauwatosa,

Collection Date: 7/13/2019 11:29:00 AM

Lab ID: 19070781-001A

Matrix: AQUEOUS

Analyses	Result	LOQ	LOD	Qualifier	Units	DF	Date Analyzed
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**Volatile Organic Compounds by GC/MS****SW8260B (SW5030B)**

Prep Date:

Analyst: **MJK**

Acetone	ND	0.020	0.0031		mg/L	1	7/16/2019
Benzene	ND	0.0050	0.0002		mg/L	1	7/16/2019
Bromodichloromethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
Bromoform	ND	0.0010	0.0003		mg/L	1	7/16/2019
Bromomethane	ND	0.0050	0.002		mg/L	1	7/16/2019
2-Butanone	ND	0.020	0.0016		mg/L	1	7/16/2019
Carbon disulfide	ND	0.010	0.0003		mg/L	1	7/16/2019
Carbon tetrachloride	ND	0.0050	0.001		mg/L	1	7/16/2019
Chlorobenzene	ND	0.0050	0.0002		mg/L	1	7/16/2019
Chloroethane	ND	0.010	0.0005		mg/L	1	7/16/2019
Chloroform	ND	0.0010	0.0001		mg/L	1	7/16/2019
Chloromethane	ND	0.010	0.0003		mg/L	1	7/16/2019
Dibromochloromethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,1-Dichloroethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,2-Dichloroethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,1-Dichloroethene	ND	0.0050	0.0004		mg/L	1	7/16/2019
cis-1,2-Dichloroethene	ND	0.0050	0.0002		mg/L	1	7/16/2019
trans-1,2-Dichloroethene	ND	0.0050	0.0005		mg/L	1	7/16/2019
1,2-Dichloropropane	ND	0.0050	0.0001		mg/L	1	7/16/2019
cis-1,3-Dichloropropene	ND	0.0010	0.0002		mg/L	1	7/16/2019
trans-1,3-Dichloropropene	ND	0.0010	0.0001		mg/L	1	7/16/2019
Ethylbenzene	ND	0.0050	0.0003		mg/L	1	7/16/2019
2-Hexanone	ND	0.020	0.0002		mg/L	1	7/16/2019
4-Methyl-2-pentanone	ND	0.020	0.0007		mg/L	1	7/16/2019
Methylene chloride	ND	0.0050	0.0002		mg/L	1	7/16/2019
Methyl tert-butyl ether	ND	0.0050	0.0003		mg/L	1	7/16/2019
Styrene	ND	0.0050	0.0003		mg/L	1	7/16/2019
1,1,2,2-Tetrachloroethane	ND	0.0050	0.0001		mg/L	1	7/16/2019
Tetrachloroethene	ND	0.0050	0.0003		mg/L	1	7/16/2019
Toluene	ND	0.0050	0.0004		mg/L	1	7/16/2019
1,1,1-Trichloroethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,1,2-Trichloroethane	ND	0.0050	0.0001		mg/L	1	7/16/2019
Trichloroethene	ND	0.0050	0.0003		mg/L	1	7/16/2019
Vinyl chloride	ND	0.0020	0.0003		mg/L	1	7/16/2019
Xylenes, Total	ND	0.015	0.001		mg/L	1	7/16/2019

ND - Not Detected at the LOD

LOD/LOQ - Limit of Detection / Limit Of Quantitation for the analysis

**Qualifiers:**

J - Analyte detected below LOQ

S - Spike Recovery outside accepted recovery limits

B - Analyte detected in the associated Method Blank

R - RPD outside accepted recovery limits

HT - Sample received past holding time

E - Value above quantitation range

\* - Non-accredited parameter

H - Holding time exceeded

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Accreditations: WI DNR 399099910; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Report Date: July 22, 2019

**ANALYTICAL RESULTS**

Print Date: July 22, 2019

CLIENT: Hydrodynamics Consultant, Inc.

Client Sample ID: MW 2-4

Work Order: 19070781 Revision 0

Tag Number:

Project: Westwood Cleaners, 8731 West North Ave., Wauwatosa,

Collection Date: 7/13/2019 11:35:00 AM

Lab ID: 19070781-002A

Matrix: AQUEOUS

Analyses	Result	LOQ	LOD	Qualifier	Units	DF	Date Analyzed
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**Volatile Organic Compounds by GC/MS**

SW8260B (SW5030B)

Prep Date:

Analyst: MJK

Acetone	ND	0.020	0.0031		mg/L	1	7/16/2019
Benzene	ND	0.0050	0.0002		mg/L	1	7/16/2019
Bromodichloromethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
Bromoform	ND	0.0010	0.0003		mg/L	1	7/16/2019
Bromomethane	ND	0.0050	0.002		mg/L	1	7/16/2019
2-Butanone	ND	0.020	0.0016		mg/L	1	7/16/2019
Carbon disulfide	ND	0.010	0.0003		mg/L	1	7/16/2019
Carbon tetrachloride	ND	0.0050	0.001		mg/L	1	7/16/2019
Chlorobenzene	ND	0.0050	0.0002		mg/L	1	7/16/2019
Chloroethane	ND	0.010	0.0005		mg/L	1	7/16/2019
Chloroform	ND	0.0010	0.0001		mg/L	1	7/16/2019
Chloromethane	ND	0.010	0.0003		mg/L	1	7/16/2019
Dibromochloromethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,1-Dichloroethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,2-Dichloroethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,1-Dichloroethene	ND	0.0050	0.0004		mg/L	1	7/16/2019
cis-1,2-Dichloroethene	0.0044	0.0050	0.0002	J	mg/L	1	7/16/2019
trans-1,2-Dichloroethene	ND	0.0050	0.0005		mg/L	1	7/16/2019
1,2-Dichloropropane	ND	0.0050	0.0001		mg/L	1	7/16/2019
cis-1,3-Dichloropropene	ND	0.0010	0.0002		mg/L	1	7/16/2019
trans-1,3-Dichloropropene	ND	0.0010	0.0001		mg/L	1	7/16/2019
Ethylbenzene	ND	0.0050	0.0003		mg/L	1	7/16/2019
2-Hexanone	ND	0.020	0.0002		mg/L	1	7/16/2019
4-Methyl-2-pentanone	ND	0.020	0.0007		mg/L	1	7/16/2019
Methylene chloride	ND	0.0050	0.0002		mg/L	1	7/16/2019
Methyl tert-butyl ether	ND	0.0050	0.0003		mg/L	1	7/16/2019
Styrene	ND	0.0050	0.0003		mg/L	1	7/16/2019
1,1,2,2-Tetrachloroethane	ND	0.0050	0.0001		mg/L	1	7/16/2019
Tetrachloroethene	0.053	0.0050	0.0003		mg/L	1	7/16/2019
Toluene	ND	0.0050	0.0004		mg/L	1	7/16/2019
1,1,1-Trichloroethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,1,2-Trichloroethane	ND	0.0050	0.0001		mg/L	1	7/16/2019
Trichloroethene	0.018	0.0050	0.0003		mg/L	1	7/16/2019
Vinyl chloride	ND	0.0020	0.0003		mg/L	1	7/16/2019
Xylenes, Total	ND	0.015	0.001		mg/L	1	7/16/2019

**Qualifiers:**

ND - Not Detected at the LOD

J - Analyte detected below LOQ

B - Analyte detected in the associated Method Blank

HT - Sample received past holding time

\* - Non-accredited parameter

LOD/LOQ - Limit of Detection / Limit Of Quantitation for the analysis

S - Spike Recovery outside accepted recovery limits

R - RPD outside accepted recovery limits

E - Value above quantitation range

H - Holding time exceeded

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Accreditations: WI DNR 399099910; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Report Date: July 22, 2019

**ANALYTICAL RESULTS**

Print Date: July 22, 2019

CLIENT: Hydrodynamics Consultant, Inc.

Client Sample ID: MW 2-4D

Work Order: 19070781 Revision 0

Tag Number:

Project: Westwood Cleaners, 8731 West North Ave., Wauwatosa,

Collection Date: 7/13/2019 11:39:00 AM

Lab ID: 19070781-003A

Matrix: AQUEOUS

Analyses	Result	LOQ	LOD	Qualifier	Units	DF	Date Analyzed
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**Volatile Organic Compounds by GC/MS**

SW8260B (SW5030B)

Prep Date:

Analyst: MJK

Acetone	ND	0.020	0.0031		mg/L	1	7/16/2019
Benzene	ND	0.0050	0.0002		mg/L	1	7/16/2019
Bromodichloromethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
Bromoform	ND	0.0010	0.0003		mg/L	1	7/16/2019
Bromomethane	ND	0.0050	0.002		mg/L	1	7/16/2019
2-Butanone	ND	0.020	0.0016		mg/L	1	7/16/2019
Carbon disulfide	ND	0.010	0.0003		mg/L	1	7/16/2019
Carbon tetrachloride	ND	0.0050	0.001		mg/L	1	7/16/2019
Chlorobenzene	ND	0.0050	0.0002		mg/L	1	7/16/2019
Chloroethane	ND	0.010	0.0005		mg/L	1	7/16/2019
Chloroform	ND	0.0010	0.0001		mg/L	1	7/16/2019
Chloromethane	ND	0.010	0.0003		mg/L	1	7/16/2019
Dibromochloromethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,1-Dichloroethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,2-Dichloroethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,1-Dichloroethene	ND	0.0050	0.0004		mg/L	1	7/16/2019
cis-1,2-Dichloroethene	0.0044	0.0050	0.0002	J	mg/L	1	7/16/2019
trans-1,2-Dichloroethene	ND	0.0050	0.0005		mg/L	1	7/16/2019
1,2-Dichloropropane	ND	0.0050	0.0001		mg/L	1	7/16/2019
cis-1,3-Dichloropropene	ND	0.0010	0.0002		mg/L	1	7/16/2019
trans-1,3-Dichloropropene	ND	0.0010	0.0001		mg/L	1	7/16/2019
Ethylbenzene	ND	0.0050	0.0003		mg/L	1	7/16/2019
2-Hexanone	ND	0.020	0.0002		mg/L	1	7/16/2019
4-Methyl-2-pentanone	ND	0.020	0.0007		mg/L	1	7/16/2019
Methylene chloride	ND	0.0050	0.0002		mg/L	1	7/16/2019
Methyl tert-butyl ether	ND	0.0050	0.0003		mg/L	1	7/16/2019
Styrene	ND	0.0050	0.0003		mg/L	1	7/16/2019
1,1,2,2-Tetrachloroethane	ND	0.0050	0.0001		mg/L	1	7/16/2019
Tetrachloroethene	0.053	0.0050	0.0003		mg/L	1	7/16/2019
Toluene	ND	0.0050	0.0004		mg/L	1	7/16/2019
1,1,1-Trichloroethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,1,2-Trichloroethane	ND	0.0050	0.0001		mg/L	1	7/16/2019
Trichloroethene	0.018	0.0050	0.0003		mg/L	1	7/16/2019
Vinyl chloride	ND	0.0020	0.0003		mg/L	1	7/16/2019
Xylenes, Total	ND	0.015	0.001		mg/L	1	7/16/2019

**Qualifiers:**

ND - Not Detected at the LOD

J - Analyte detected below LOQ

B - Analyte detected in the associated Method Blank

HT - Sample received past holding time

\* - Non-accredited parameter

LOD/LOQ - Limit of Detection / Limit Of Quantitation for the analysis

S - Spike Recovery outside accepted recovery limits

R - RPD outside accepted recovery limits

E - Value above quantitation range

H - Holding time exceeded

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Accreditations: WI DNR 399099910; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Report Date: July 22, 2019

**ANALYTICAL RESULTS**

Print Date: July 22, 2019

CLIENT: Hydrodynamics Consultant, Inc.

Client Sample ID: MW 3-4

Work Order: 19070781 Revision 0

Tag Number:

Project: Westwood Cleaners, 8731 West North Ave., Wauwatosa,

Collection Date: 7/13/2019 11:46:00 AM

Lab ID: 19070781-004A

Matrix: AQUEOUS

Analyses	Result	LOQ	LOD	Qualifier	Units	DF	Date Analyzed
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**Volatile Organic Compounds by GC/MS**

SW8260B (SW5030B)

Prep Date:

Analyst: MJK

Acetone	ND	0.020	0.0031		mg/L	1	7/16/2019
Benzene	ND	0.0050	0.0002		mg/L	1	7/16/2019
Bromodichloromethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
Bromoform	ND	0.0010	0.0003		mg/L	1	7/16/2019
Bromomethane	ND	0.0050	0.002		mg/L	1	7/16/2019
2-Butanone	ND	0.020	0.0016		mg/L	1	7/16/2019
Carbon disulfide	ND	0.010	0.0003		mg/L	1	7/16/2019
Carbon tetrachloride	ND	0.0050	0.001		mg/L	1	7/16/2019
Chlorobenzene	ND	0.0050	0.0002		mg/L	1	7/16/2019
Chloroethane	ND	0.010	0.0005		mg/L	1	7/16/2019
Chloroform	ND	0.0010	0.0001		mg/L	1	7/16/2019
Chloromethane	ND	0.010	0.0003		mg/L	1	7/16/2019
Dibromochloromethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,1-Dichloroethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,2-Dichloroethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,1-Dichloroethene	ND	0.0050	0.0004		mg/L	1	7/16/2019
cis-1,2-Dichloroethene	ND	0.0050	0.0002		mg/L	1	7/16/2019
trans-1,2-Dichloroethene	ND	0.0050	0.0005		mg/L	1	7/16/2019
1,2-Dichloropropane	ND	0.0050	0.0001		mg/L	1	7/16/2019
cis-1,3-Dichloropropene	ND	0.0010	0.0002		mg/L	1	7/16/2019
trans-1,3-Dichloropropene	ND	0.0010	0.0001		mg/L	1	7/16/2019
Ethylbenzene	ND	0.0050	0.0003		mg/L	1	7/16/2019
2-Hexanone	ND	0.020	0.0002		mg/L	1	7/16/2019
4-Methyl-2-pentanone	ND	0.020	0.0007		mg/L	1	7/16/2019
Methylene chloride	ND	0.0050	0.0002		mg/L	1	7/16/2019
Methyl tert-butyl ether	ND	0.0050	0.0003		mg/L	1	7/16/2019
Styrene	ND	0.0050	0.0003		mg/L	1	7/16/2019
1,1,2,2-Tetrachloroethane	ND	0.0050	0.0001		mg/L	1	7/16/2019
Tetrachloroethene	ND	0.0050	0.0003		mg/L	1	7/16/2019
Toluene	ND	0.0050	0.0004		mg/L	1	7/16/2019
1,1,1-Trichloroethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,1,2-Trichloroethane	ND	0.0050	0.0001		mg/L	1	7/16/2019
Trichloroethene	ND	0.0050	0.0003		mg/L	1	7/16/2019
Vinyl chloride	ND	0.0020	0.0003		mg/L	1	7/16/2019
Xylenes, Total	ND	0.015	0.001		mg/L	1	7/16/2019

ND - Not Detected at the LOD

LOD/LOQ - Limit of Detection / Limit Of Quantitation for the analysis

**Qualifiers:**

J - Analyte detected below LOQ

S - Spike Recovery outside accepted recovery limits

B - Analyte detected in the associated Method Blank

R - RPD outside accepted recovery limits

HT - Sample received past holding time

E - Value above quantitation range

\* - Non-accredited parameter

H - Holding time exceeded

**STAT Analysis Corporation**

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: WI DNR 399099910; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Report Date: July 22, 2019

**ANALYTICAL RESULTS**

Print Date: July 22, 2019

CLIENT: Hydrodynamics Consultant, Inc.

Client Sample ID: MW 4-4

Work Order: 19070781 Revision 0

Tag Number:

Project: Westwood Cleaners, 8731 West North Ave., Wauwatosa,

Collection Date: 7/13/2019 11:52:00 AM

Lab ID: 19070781-005A

Matrix: AQUEOUS

Analyses	Result	LOQ	LOD	Qualifier	Units	DF	Date Analyzed
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**Volatile Organic Compounds by GC/MS****SW8260B (SW5030B)**

Prep Date:

Analyst: **MJK**

Acetone	ND	0.020	0.0031		mg/L	1	7/16/2019
Benzene	ND	0.0050	0.0002		mg/L	1	7/16/2019
Bromodichloromethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
Bromoform	ND	0.0010	0.0003		mg/L	1	7/16/2019
Bromomethane	ND	0.0050	0.002		mg/L	1	7/16/2019
2-Butanone	ND	0.020	0.0016		mg/L	1	7/16/2019
Carbon disulfide	ND	0.010	0.0003		mg/L	1	7/16/2019
Carbon tetrachloride	ND	0.0050	0.001		mg/L	1	7/16/2019
Chlorobenzene	ND	0.0050	0.0002		mg/L	1	7/16/2019
Chloroethane	ND	0.010	0.0005		mg/L	1	7/16/2019
Chloroform	ND	0.0010	0.0001		mg/L	1	7/16/2019
Chloromethane	ND	0.010	0.0003		mg/L	1	7/16/2019
Dibromochloromethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,1-Dichloroethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,2-Dichloroethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,1-Dichloroethene	ND	0.0050	0.0004		mg/L	1	7/16/2019
cis-1,2-Dichloroethene	ND	0.0050	0.0002		mg/L	1	7/16/2019
trans-1,2-Dichloroethene	ND	0.0050	0.0005		mg/L	1	7/16/2019
1,2-Dichloropropane	ND	0.0050	0.0001		mg/L	1	7/16/2019
cis-1,3-Dichloropropene	ND	0.0010	0.0002		mg/L	1	7/16/2019
trans-1,3-Dichloropropene	ND	0.0010	0.0001		mg/L	1	7/16/2019
Ethylbenzene	ND	0.0050	0.0003		mg/L	1	7/16/2019
2-Hexanone	ND	0.020	0.0002		mg/L	1	7/16/2019
4-Methyl-2-pentanone	ND	0.020	0.0007		mg/L	1	7/16/2019
Methylene chloride	ND	0.0050	0.0002		mg/L	1	7/16/2019
Methyl tert-butyl ether	ND	0.0050	0.0003		mg/L	1	7/16/2019
Styrene	ND	0.0050	0.0003		mg/L	1	7/16/2019
1,1,2,2-Tetrachloroethane	ND	0.0050	0.0001		mg/L	1	7/16/2019
Tetrachloroethene	ND	0.0050	0.0003		mg/L	1	7/16/2019
Toluene	ND	0.0050	0.0004		mg/L	1	7/16/2019
1,1,1-Trichloroethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,1,2-Trichloroethane	ND	0.0050	0.0001		mg/L	1	7/16/2019
Trichloroethene	ND	0.0050	0.0003		mg/L	1	7/16/2019
Vinyl chloride	ND	0.0020	0.0003		mg/L	1	7/16/2019
Xylenes, Total	ND	0.015	0.001		mg/L	1	7/16/2019

ND - Not Detected at the LOD

LOD/LOQ - Limit of Detection / Limit Of Quantitation for the analysis

**Qualifiers:**

J - Analyte detected below LOQ

S - Spike Recovery outside accepted recovery limits

B - Analyte detected in the associated Method Blank

R - RPD outside accepted recovery limits

HT - Sample received past holding time

E - Value above quantitation range

\* - Non-accredited parameter

H - Holding time exceeded



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Accreditations: WI DNR 399099910; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Report Date: July 22, 2019

**ANALYTICAL RESULTS**

Print Date: July 22, 2019

CLIENT: Hydrodynamics Consultant, Inc.

Client Sample ID: MW 5-4

Work Order: 19070781 Revision 0

Tag Number:

Project: Westwood Cleaners, 8731 West North Ave., Wauwatosa,

Collection Date: 7/13/2019 12:01:00 PM

Lab ID: 19070781-006A

Matrix: AQUEOUS

Analyses	Result	LOQ	LOD	Qualifier	Units	DF	Date Analyzed
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**Volatile Organic Compounds by GC/MS****SW8260B (SW5030B)**

Prep Date:

Analyst: **MJK**

Acetone	ND	0.020	0.0031		mg/L	1	7/16/2019
Benzene	ND	0.0050	0.0002		mg/L	1	7/16/2019
Bromodichloromethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
Bromoform	ND	0.0010	0.0003		mg/L	1	7/16/2019
Bromomethane	ND	0.0050	0.002		mg/L	1	7/16/2019
2-Butanone	ND	0.020	0.0016		mg/L	1	7/16/2019
Carbon disulfide	ND	0.010	0.0003		mg/L	1	7/16/2019
Carbon tetrachloride	ND	0.0050	0.001		mg/L	1	7/16/2019
Chlorobenzene	ND	0.0050	0.0002		mg/L	1	7/16/2019
Chloroethane	ND	0.010	0.0005		mg/L	1	7/16/2019
Chloroform	ND	0.0010	0.0001		mg/L	1	7/16/2019
Chloromethane	ND	0.010	0.0003		mg/L	1	7/16/2019
Dibromochloromethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,1-Dichloroethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,2-Dichloroethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,1-Dichloroethene	ND	0.0050	0.0004		mg/L	1	7/16/2019
cis-1,2-Dichloroethene	0.023	0.0050	0.0002		mg/L	1	7/16/2019
trans-1,2-Dichloroethene	0.0036	0.0050	0.0005	J	mg/L	1	7/16/2019
1,2-Dichloropropane	ND	0.0050	0.0001		mg/L	1	7/16/2019
cis-1,3-Dichloropropene	ND	0.0010	0.0002		mg/L	1	7/16/2019
trans-1,3-Dichloropropene	ND	0.0010	0.0001		mg/L	1	7/16/2019
Ethylbenzene	ND	0.0050	0.0003		mg/L	1	7/16/2019
2-Hexanone	ND	0.020	0.0002		mg/L	1	7/16/2019
4-Methyl-2-pentanone	ND	0.020	0.0007		mg/L	1	7/16/2019
Methylene chloride	ND	0.0050	0.0002		mg/L	1	7/16/2019
Methyl tert-butyl ether	ND	0.0050	0.0003		mg/L	1	7/16/2019
Styrene	ND	0.0050	0.0003		mg/L	1	7/16/2019
1,1,2,2-Tetrachloroethane	ND	0.0050	0.0001		mg/L	1	7/16/2019
Tetrachloroethene	4.3	0.50	0.03		mg/L	100	7/17/2019
Toluene	ND	0.0050	0.0004		mg/L	1	7/16/2019
1,1,1-Trichloroethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,1,2-Trichloroethane	ND	0.0050	0.0001		mg/L	1	7/16/2019
Trichloroethene	0.12	0.0050	0.0003		mg/L	1	7/16/2019
Vinyl chloride	0.020	0.0020	0.0003		mg/L	1	7/16/2019
Xylenes, Total	ND	0.015	0.001		mg/L	1	7/16/2019

**Qualifiers:**

ND - Not Detected at the LOD

J - Analyte detected below LOQ

B - Analyte detected in the associated Method Blank

HT - Sample received past holding time

\* - Non-accredited parameter

LOD/LOQ - Limit of Detection / Limit Of Quantitation for the analysis

S - Spike Recovery outside accepted recovery limits

R - RPD outside accepted recovery limits

E - Value above quantitation range

H - Holding time exceeded

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Accreditations: WI DNR 399099910; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Report Date: July 22, 2019

**ANALYTICAL RESULTS**

Print Date: July 22, 2019

CLIENT: Hydrodynamics Consultant, Inc.

Client Sample ID: MW 6-4

Work Order: 19070781 Revision 0

Tag Number:

Project: Westwood Cleaners, 8731 West North Ave., Wauwatosa,

Collection Date: 7/13/2019 12:09:00 PM

Lab ID: 19070781-007A

Matrix: AQUEOUS

Analyses	Result	LOQ	LOD	Qualifier	Units	DF	Date Analyzed
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**Volatile Organic Compounds by GC/MS**

SW8260B (SW5030B)

Prep Date:

Analyst: MJK

Acetone	ND	0.020	0.0031		mg/L	1	7/16/2019
Benzene	ND	0.0050	0.0002		mg/L	1	7/16/2019
Bromodichloromethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
Bromoform	ND	0.0010	0.0003		mg/L	1	7/16/2019
Bromomethane	ND	0.0050	0.002		mg/L	1	7/16/2019
2-Butanone	ND	0.020	0.0016		mg/L	1	7/16/2019
Carbon disulfide	ND	0.010	0.0003		mg/L	1	7/16/2019
Carbon tetrachloride	ND	0.0050	0.001		mg/L	1	7/16/2019
Chlorobenzene	ND	0.0050	0.0002		mg/L	1	7/16/2019
Chloroethane	ND	0.010	0.0005		mg/L	1	7/16/2019
Chloroform	ND	0.0010	0.0001		mg/L	1	7/16/2019
Chloromethane	ND	0.010	0.0003		mg/L	1	7/16/2019
Dibromochloromethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,1-Dichloroethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,2-Dichloroethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,1-Dichloroethene	ND	0.0050	0.0004		mg/L	1	7/16/2019
cis-1,2-Dichloroethene	0.0078	0.0050	0.0002		mg/L	1	7/16/2019
trans-1,2-Dichloroethene	ND	0.0050	0.0005		mg/L	1	7/16/2019
1,2-Dichloropropane	ND	0.0050	0.0001		mg/L	1	7/16/2019
cis-1,3-Dichloropropene	ND	0.0010	0.0002		mg/L	1	7/16/2019
trans-1,3-Dichloropropene	ND	0.0010	0.0001		mg/L	1	7/16/2019
Ethylbenzene	ND	0.0050	0.0003		mg/L	1	7/16/2019
2-Hexanone	ND	0.020	0.0002		mg/L	1	7/16/2019
4-Methyl-2-pentanone	ND	0.020	0.0007		mg/L	1	7/16/2019
Methylene chloride	ND	0.0050	0.0002		mg/L	1	7/16/2019
Methyl tert-butyl ether	ND	0.0050	0.0003		mg/L	1	7/16/2019
Styrene	ND	0.0050	0.0003		mg/L	1	7/16/2019
1,1,2,2-Tetrachloroethane	ND	0.0050	0.0001		mg/L	1	7/16/2019
Tetrachloroethene	0.55	0.050	0.003		mg/L	10	7/16/2019
Toluene	ND	0.0050	0.0004		mg/L	1	7/16/2019
1,1,1-Trichloroethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,1,2-Trichloroethane	0.019	0.0050	0.0001		mg/L	1	7/16/2019
Trichloroethene	0.041	0.0050	0.0003		mg/L	1	7/16/2019
Vinyl chloride	ND	0.0020	0.0003		mg/L	1	7/16/2019
Xylenes, Total	ND	0.015	0.001		mg/L	1	7/16/2019

**Qualifiers:**

ND - Not Detected at the LOD

J - Analyte detected below LOQ

B - Analyte detected in the associated Method Blank

HT - Sample received past holding time

\* - Non-accredited parameter

LOD/LOQ - Limit of Detection / Limit Of Quantitation for the analysis

S - Spike Recovery outside accepted recovery limits

R - RPD outside accepted recovery limits

E - Value above quantitation range

H - Holding time exceeded

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Accreditations: WI DNR 399099910; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Report Date: July 22, 2019

**ANALYTICAL RESULTS**

Print Date: July 22, 2019

CLIENT: Hydrodynamics Consultant, Inc.

Client Sample ID: MW TB4

Work Order: 19070781 Revision 0

Tag Number:

Project: Westwood Cleaners, 8731 West North Ave., Wauwatosa,

Collection Date: 7/13/2019 9:07:00 AM

Lab ID: 19070781-008A

Matrix: AQUEOUS

Analyses	Result	LOQ	LOD	Qualifier	Units	DF	Date Analyzed
<b>Volatile Organic Compounds by GC/MS</b>							
		<b>SW8260B (SW5030B)</b>					
				Prep Date:			Analyst: <b>MJK</b>
Acetone	ND	0.020	0.0031		mg/L	1	7/16/2019
Benzene	ND	0.0050	0.0002		mg/L	1	7/16/2019
Bromodichloromethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
Bromoform	ND	0.0010	0.0003		mg/L	1	7/16/2019
Bromomethane	ND	0.0050	0.002		mg/L	1	7/16/2019
2-Butanone	ND	0.020	0.0016		mg/L	1	7/16/2019
Carbon disulfide	ND	0.010	0.0003		mg/L	1	7/16/2019
Carbon tetrachloride	ND	0.0050	0.001		mg/L	1	7/16/2019
Chlorobenzene	ND	0.0050	0.0002		mg/L	1	7/16/2019
Chloroethane	ND	0.010	0.0005		mg/L	1	7/16/2019
Chloroform	ND	0.0010	0.0001		mg/L	1	7/16/2019
Chloromethane	ND	0.010	0.0003		mg/L	1	7/16/2019
Dibromochloromethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,1-Dichloroethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,2-Dichloroethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,1-Dichloroethene	ND	0.0050	0.0004		mg/L	1	7/16/2019
cis-1,2-Dichloroethene	ND	0.0050	0.0002		mg/L	1	7/16/2019
trans-1,2-Dichloroethene	ND	0.0050	0.0005		mg/L	1	7/16/2019
1,2-Dichloropropane	ND	0.0050	0.0001		mg/L	1	7/16/2019
cis-1,3-Dichloropropene	ND	0.0010	0.0002		mg/L	1	7/16/2019
trans-1,3-Dichloropropene	ND	0.0010	0.0001		mg/L	1	7/16/2019
Ethylbenzene	ND	0.0050	0.0003		mg/L	1	7/16/2019
2-Hexanone	ND	0.020	0.0002		mg/L	1	7/16/2019
4-Methyl-2-pentanone	ND	0.020	0.0007		mg/L	1	7/16/2019
Methylene chloride	ND	0.0050	0.0002		mg/L	1	7/16/2019
Methyl tert-butyl ether	ND	0.0050	0.0003		mg/L	1	7/16/2019
Styrene	ND	0.0050	0.0003		mg/L	1	7/16/2019
1,1,2,2-Tetrachloroethane	ND	0.0050	0.0001		mg/L	1	7/16/2019
Tetrachloroethene	ND	0.0050	0.0003		mg/L	1	7/16/2019
Toluene	ND	0.0050	0.0004		mg/L	1	7/16/2019
1,1,1-Trichloroethane	ND	0.0050	0.0002		mg/L	1	7/16/2019
1,1,2-Trichloroethane	ND	0.0050	0.0001		mg/L	1	7/16/2019
Trichloroethene	ND	0.0050	0.0003		mg/L	1	7/16/2019
Vinyl chloride	ND	0.0020	0.0003		mg/L	1	7/16/2019
Xylenes, Total	ND	0.015	0.001		mg/L	1	7/16/2019

<b>Qualifiers:</b>	ND - Not Detected at the LOD	LOD/LOQ - Limit of Detection / Limit Of Quantitation for the analysis
	J - Analyte detected below LOQ	S - Spike Recovery outside accepted recovery limits
	B - Analyte detected in the associated Method Blank	R - RPD outside accepted recovery limits
	HT - Sample received past holding time	E - Value above quantitation range
	* - Non-accredited parameter	H - Holding time exceeded

# STAT Analysis Corporation

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 e-mail address: [STATinfo@STATAnalysis.com](mailto:STATinfo@STATAnalysis.com) A I H A accredited 10248, N V L A P accredited 101202-0

## CHAIN OF CUSTODY RECORD

No: \_\_\_\_\_ Page: 1 of 1

Company: Hydrodynamics Consultant, Inc.								P.O. No.:		/														
Project Number:				Client Tracking No.:				Quote No.:																
Project Name: Westwood Cleaners																								
Location/Address: 8731 West North Ave., Wauwatosa, WI 53226																								
Sampler(s): Yinong Han																								
Report To: Yong Yu				Phone: (630) 724-0098																				
QC Level: 1    2    3    4				Fax: (800) 881-2051																				
Regulatory Program: NPEDS/MWRD RCRA SDWA SRP TACO Other:										Turn Around:														
										Results Needed:														
										am pm														
Client Sample Number/Description:	Date Taken	Time Taken	Matrix	Comp.	Grab.	Preserv.	No. of Containers	VOCS														Remarks	Lab No.:	
MW 1-4	7/13/19	11:29	W		X	Yes	2	X																001
MW 2-4	7/13/19	11:35	W			Yes	2	X																002
MW 2-4D	7/13/19	11:39	W			Yes	2	X																003
MW 3-4	7/13/19	11:46	W			Yes	2	X																004
MW 4-4	7/13/19	11:52	W			Yes	2	X																005
MW 5-4	7/13/19	12:01	W			Yes	2	X																006
MW 6-4	7/13/19	12:09	W			Yes	2	X																007
MW-TB4	7/13/19	9:07	W			Yes	2	X																008
Relinquished By: (Signature) <i>[Signature]</i>								Date/Time: 7/15/19		Laboratory Use:					Sample Verification:					Work Order No.: 19070781				
Received By: (Signature) <i>[Signature]</i>								Date/Time: 7/15/19 13:22		- Container OK					Yes <input type="checkbox"/> No <input type="checkbox"/>					Preservation Code:				
Relinquished By: (Signature) <i>[Signature]</i>								Date/Time: 7/15/19 14:46		- Samples Leaking					Yes <input type="checkbox"/> No <input type="checkbox"/>					A = None B = HNO C = NaOH				
Received By: (Signature) <i>[Signature]</i>								Date/Time: 7/15/19 14:46		- Refrigerated (Temp: 3.8 °C)					Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>					D = H <sub>2</sub> SO <sub>4</sub> E = HCl F = 5035/EnCore				
Relinquished By: (Signature)								Date/Time:		- Sample Labels Match Sample ID					Yes <input type="checkbox"/> No <input type="checkbox"/>									

**Sample Receipt Checklist**

Client Name HYDRODYNAMICS

Date and Time Received: 7/15/2019 2:46:00 PM

Work Order Number 19070781

Received by: CHB

Checklist completed by: [Signature] 7/15/19  
Signature Date

Reviewed by: AA 7/17/19  
Initials Date

Matrix: Carrier name STAT Analysis

- Shipping container/cooler in good condition? Yes  No  Not Present
- Custody seals intact on shipping container/cooler? Yes  No  Not Present
- Custody seals intact on sample bottles? Yes  No  Not Present
- Chain of custody present? Yes  No
- Chain of custody signed when relinquished and received? Yes  No
- Chain of custody agrees with sample labels/containers? Yes  No
- Samples in proper container/bottle? Yes  No
- Sample containers intact? Yes  No
- Sufficient sample volume for indicated test? Yes  No
- All samples received within holding time? Yes  No
- Container or Temp Blank temperature in compliance? Yes  No  Temperature 3.8 °C
- Water - VOA vials have zero headspace? No VOA vials submitted  Yes  No
- Water - Samples pH checked? Yes  No  Checked by: \_\_\_\_\_
- Water - Samples properly preserved? Yes  No  pH Adjusted? \_\_\_\_\_

Any No response must be detailed in the comments section below.

-----

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Client / Person contacted: \_\_\_\_\_ Date contacted: \_\_\_\_\_ Contacted by: \_\_\_\_\_

Response: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_