HIGHLAND PARK, MICHIGAN

2020 STATE REVOLVING FUND PROJECT PLAN

Version 2 Draft

Office of the Water Department
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1. PROJECT BACKGROUND

1.1 DELINEATION OF STUDY AREA

The study area for the 2020 State Revolving Fund (2020 SRF) Project Plan encompasses the entire City of Highland Park (City). Highland Park, incorporated in 1918, is located in Wayne County within the Southeastern region of Michigan (T1S R11E). It is partly bordered by the City of Hamtramck and is encompassed by the City of Detroit. Refer to Figure 1 for the vicinity of the border. A general layout with the pipe sizing of the current Highland Park sewer system, which the SRF project aims to improve, is shown in Figure 2.

Figure 1: Vicinity Map of the City of Highland Park in Wayne County

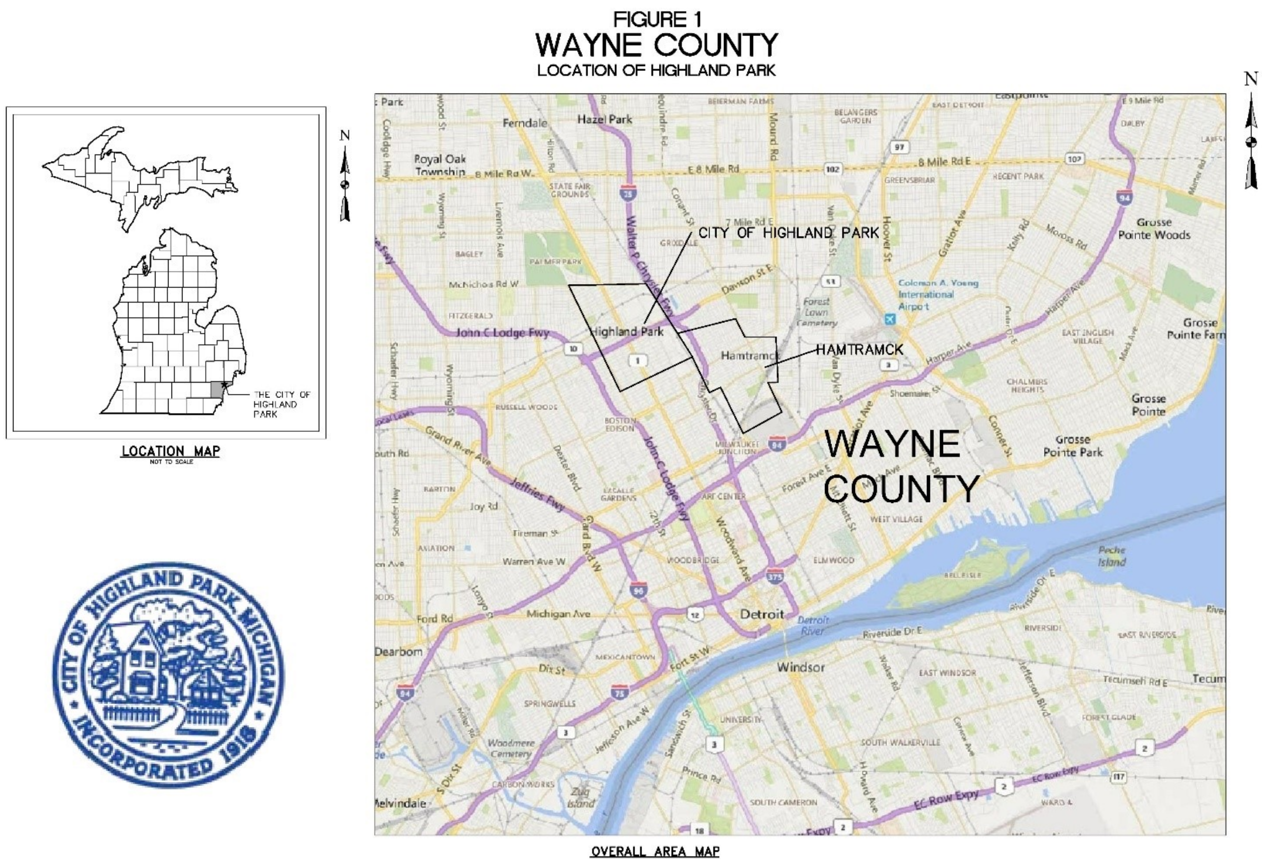

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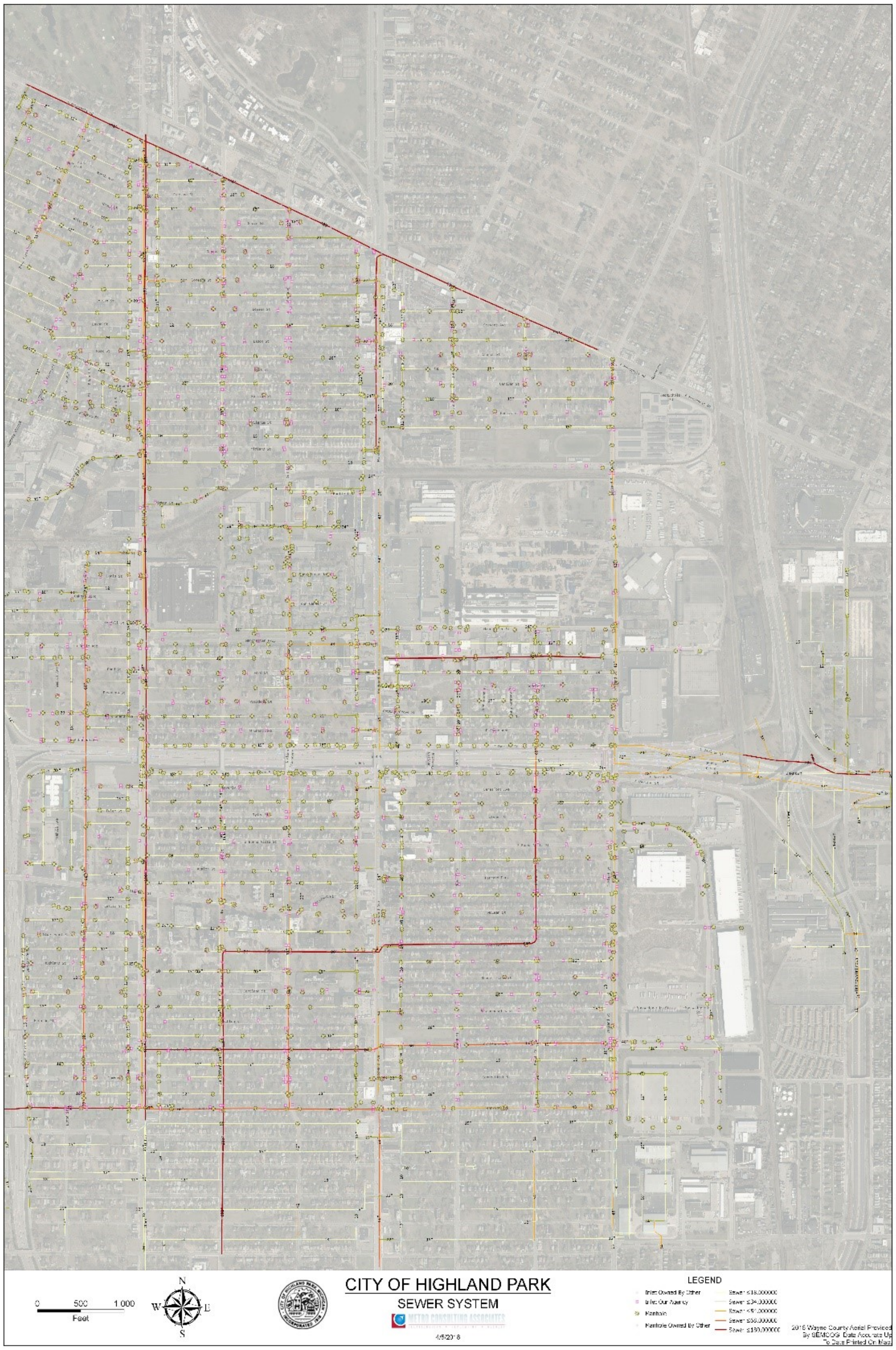
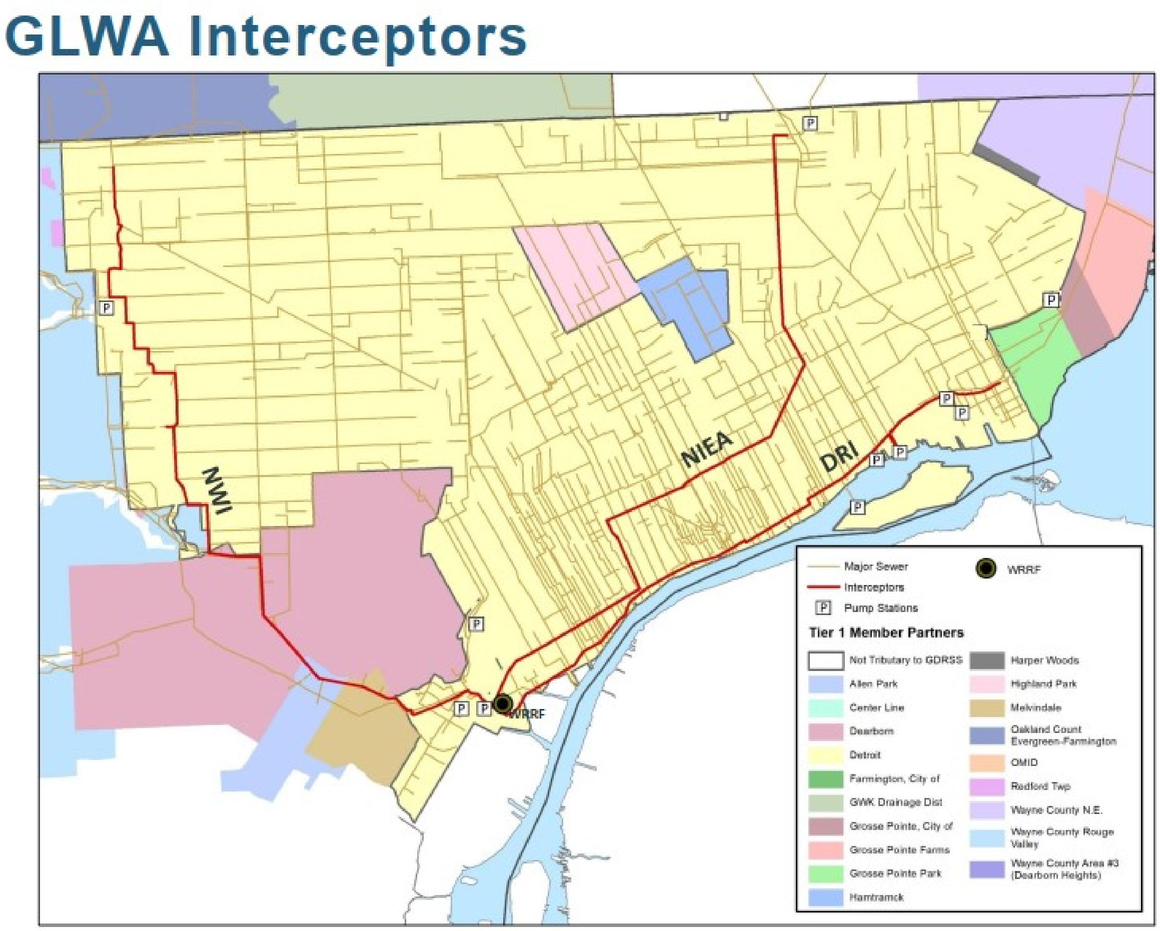
Figure 2: The City of Highland Park Sewer System



PROJECT BACKGROUND

The City of Highland Park has never owned a waste water treatment plant of its own; instead, the combined sewage had been sent to the Detroit Water and Sewage Department (DWSD) between the early 1900s up until 2015. Around this time, the Great Lakes Water Authority (GLWA) was formed and became the provider of sewer treatment services for the City of Highland Park. Figure 3, provided by GLWA, indicates locations of the three interceptors which connect all the communities to the Water Resource Recovery Facility (WRRF). GLWA owns major sewer lines that collect and run through the City. These lines run Highland Park's wastewater and stormwater into both the North Interceptor East Arm (NIEA) and the Northwest Interceptor (NWI). Appendix 1 contains maps provided by DWSD from 1996 of the sewer connections along the border between Detroit's system and Highland Park's system.

Figure 3: GLWA's Three Interceptors



*SOURCE: Great Lakes Water Authority WRRF Report

1.2 ENVIRONMENTAL CONDITIONS

1.2.1 CULTURAL CONDITIONS

The following list contains State Registered properties and areas noted in the Michigan Historic Sites database within the Highland Park City limits. This includes properties in the National and State Registers of Historic Places and Michigan Historic Markers. Certain properties are eligible to be listed as property in the National Historic Register based on the State Historic Property Office (SHPO) staff opinion. These properties are italicized below. The SHPO application for Section 106 Review, further research information, and City maps are included in Appendix 7.

- Highland Heights – Stevens' Subdivision Historic District (bounded by Woodward Ave., alley south of Buena Vista Ave., Oakland Ave., and alley south of Massachusetts)
- Chrysler Corporation former headquarters (12000 Oakland Ave)
- Trinity United Methodist Church (13100 Woodward Ave)
- *McGregor Public Library (12244 Woodward Ave)*
- *Boomer, Issac, - Haessler, Carl, House (39 Massachusetts Street)*
- *Highland heights Stevens Subdivision Extension Historic District (encompassing California, Connecticut, Tennyson Streets 2 blocks east of Woodward)*
- *Detroit Rescue Mission (13220 Woodward Ave)*

Letters have been sent to the Tribal Historic Preservation Officers (THPO) to ensure the proposed project will not affect any significant religious or cultural properties. The THPO lists the following tribal groups as having interest in the Wayne County area:

- Bay Mills Indian Community
- Burt Lake Band of Ottawa & Chippewa
- Grand River Band of Ottawa Indians
- Grand Travers Band of Ottawa and Chippewa Indians
- Hannahville Potawatomi Indian Community
- Keweenaw Bay Indian Community
- Lac Vieux Desert Band of Lake Superior
- Little River Band of Ottawa Indians
- Little Traverse Bay Band of Odawa
- Match-e-be-nash-shee-wish Band of Potawatomi Indians
- Nottawaseppi Band of Huron Potawatomi
- Pokagon Band of Potawatomi
- Saginaw Chippewa Indian Tribe of MI
- Sault Ste. Marie Tribe of Chippewa

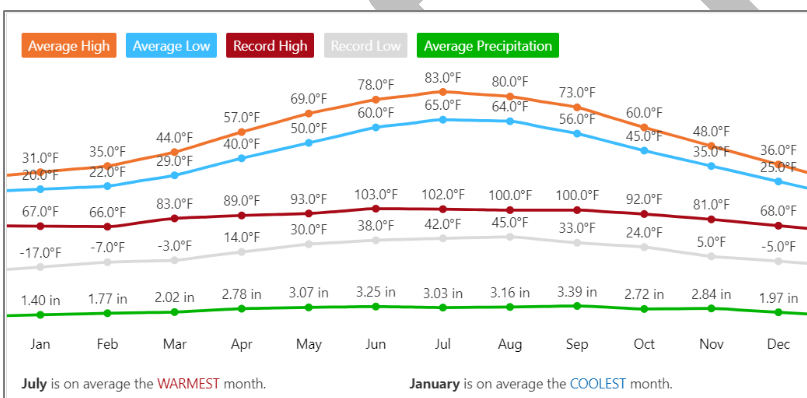
1.2.2 NATURAL CONDITIONS

1.2.2.1 Climate

Southeast Michigan, which includes Highland Park, has a climate heavily influenced by the Great Lakes. According to the Weather Channel's monthly weather data, shown below in Figure 4, the average annual temperature in Highland Park is 50.2° Fahrenheit. July, on average, is typically the warmest month in the area, while January is typically the coolest. In 2018, 103° Fahrenheit was the record high in the month of June, while in January, the record low was -17° Fahrenheit.

Precipitation is moderate and is distributed throughout the year. The average precipitation is around 2.62 inches per month. Throughout the entire year of 2018, there were 31.4 inches of rain and snow in Highland Park.

Figure 4: Highland Park Climate Details



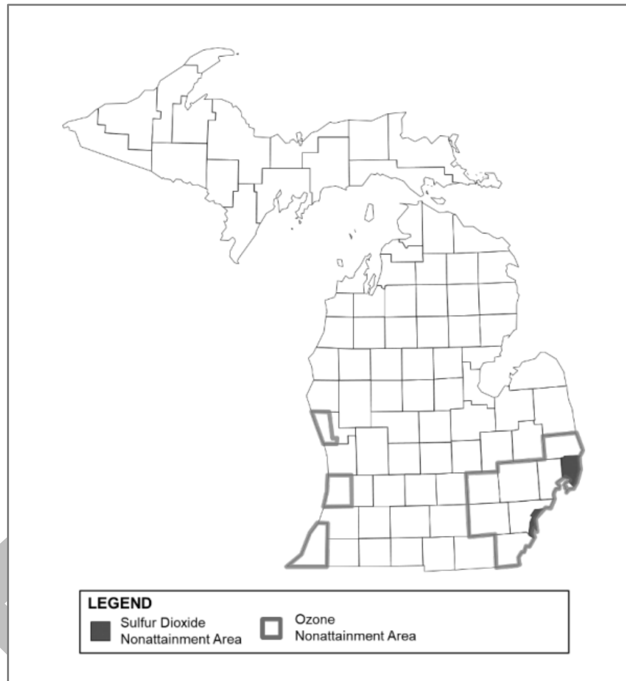
*SOURCE: The Weather Channel Monthly Weather Report

1.2.2.2 Air Quality

The MDEQ monitors the State of Michigan's air quality and provides an Air Quality Annual Report. The most recent report is from 2017 and is found in Appendix 8. Within this report, six criteria pollutants, established by the National Ambient Air Quality Standards (NAAQS), are monitored and summarized: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), Ozone (O_3), particulate matter smaller than 10 and 2.5 microns in diameter (PM_{10} and $PM_{2.5}$), and sulfur dioxide (SO_2). Areas within Michigan that exceed NAAQ standards are defined as "nonattainment areas." Southeastern Michigan, including Highland Park and Detroit, has historically been highly industrialized and is therefore the appropriate location to monitor the air quality for the entire State.

SO_2 and O_3 are two pollutants in the 2017 study that have exceeded the NAAQ standards. The nonattainment areas are illustrated in Figure 5. Highland Park lies within one of the nonattainment areas, as it violates the NAAQS standard ozone level of 0.070 ppm. The study indicates that, between the years 2014 and 2016, the ozone levels in that area were around 0.072, and in 2015–2017, the levels were around 0.076. Ground-level ozone occur during the hottest months of the year. Elevated levels of O_3 causes irritation in the airways, can reduce lung function, aggravate asthma and chronic lung disease, and inflame and damage the cells lining the lungs. The MDEQ indicates that symptoms of chest pain, shortness of breath, throat irritation, and cough can be increased by high O_3 levels. It can also cause long-term damage to the lungs. Vegetation and forests are impacted as well. When ozone levels are elevated, it is recommended to stay indoors to avoid any risks.

Figure 5: Attainment Status for the NAAQS



*SOURCE: MDEQ Air Quality Annual Report

1.2.2.3 Wetlands

There are no regulated wetlands present within the Highland Park City limits as seen in Figure 6.

Figure 6: National Wetland Inventory for Highland Park

*SOURCE: National Wetlands Inventory

1.2.2.4 Costal Zones or Great Lakes Shorelands

There are no coastal zones or Great Lakes Shorelands present within the Highland Park City limits.

1.2.2.5 Floodplains

The City of Highland Park is located within the Rouge River and Detroit River Watersheds; however, neither river is located within the City. The southern half of the City is located primarily in the Rouge River Watershed, while the northern half is located primarily in the Detroit River Watershed.

The Federal Emergency Management Agency (FEMA) provides a Flood Map for any location in the United States. As seen in Figure 7, Highland Park City limits are described as an area of minimal flood hazards; therefore, the City contains no Special Flood Hazard Areas (SFHAs). This data was refreshed April 2018.

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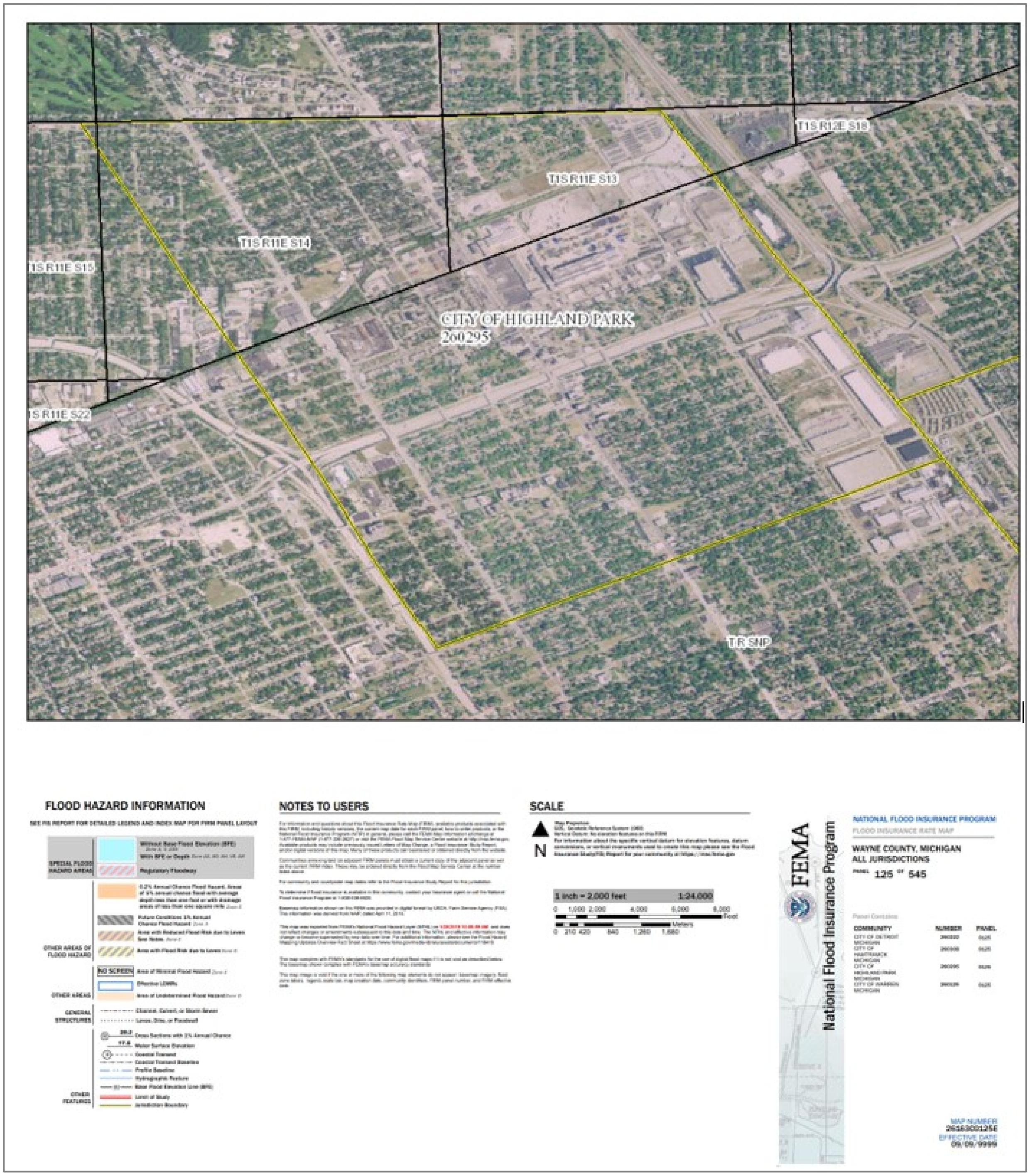
Figure 7: Flood Hazard Information for Highland Park



*SOURCE: FEMA's National Flood Hazard Layer Viewer

1.2.2.6 Natural or Wild Scenic Rivers

There are no rivers present within the Highland Park City limits that are designated as wild or scenic.

1.2.2.7 Major Surface Waters

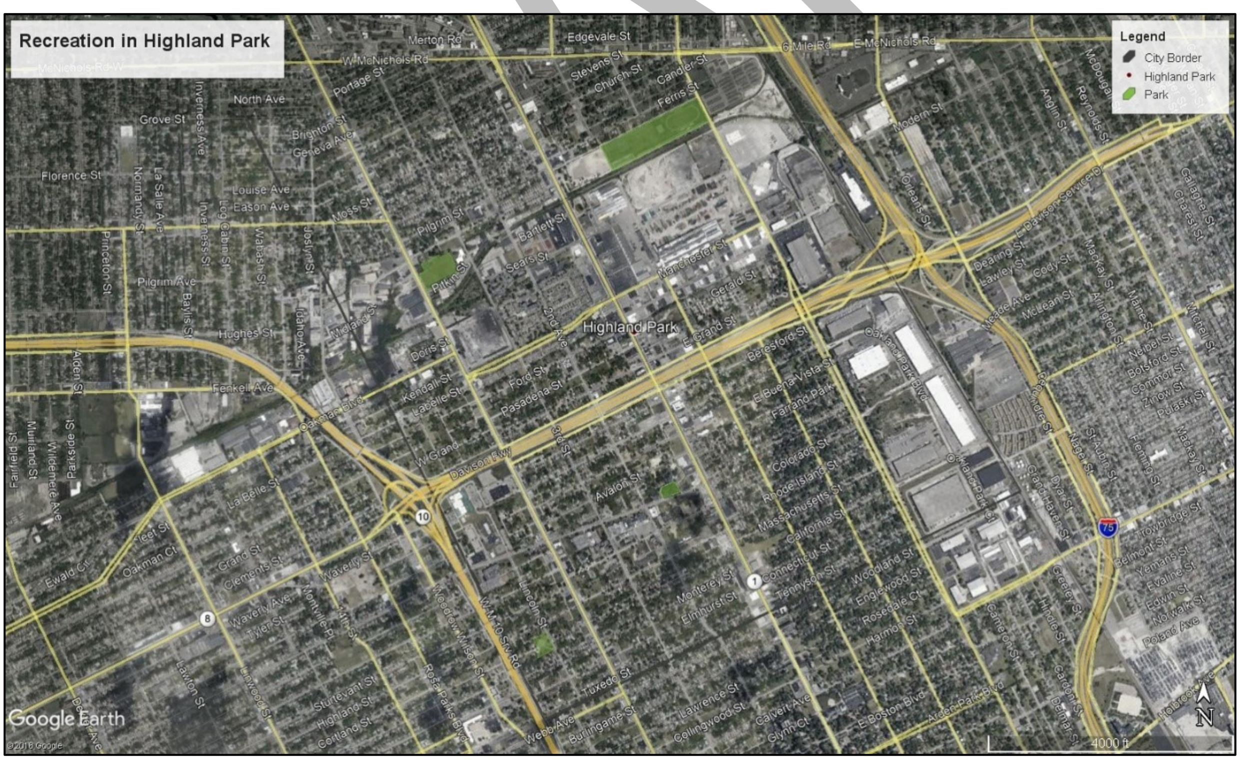
There are no major surface waters present within the Highland Park City limits.

1.2.2.8 Recreational Facilities

There are a few parks or outdoor recreational facilities within the City of Highland park, which can be seen in Figure 8. Ford Park, which is currently vacant, previously was a High School's outdoor track and field. It is located south of Ferris Street and to the west of Oakland Avenue. This land is now no longer in use. Ives Field is connected to the Highland Park Recreation Department, which is east of Hamilton Avenue and south of Midland Street. Baseball backstops are within the field, while two basketball courts are to the north. Glendale Park, also known as Mulford Place Park, is within Mulford Plaza to the north of Glendale Avenue. The park is approximately 1.2 acres and is not intended for recreational activities that require a large field. Martin Luther King Park, located at the end of Richton Street to the west of Lincoln Street, is intended for youth in the community. Play equipment and several benches are within the park.

There is no current plan to develop or expand any recreational areas within the City.

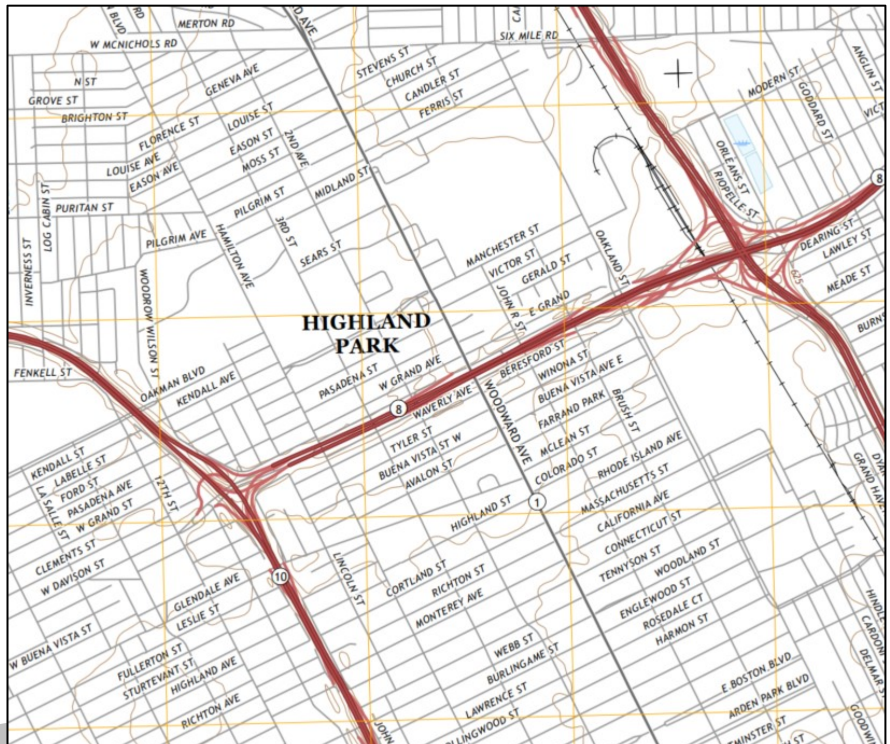
Figure 8: Recreational Areas in Highland Park



1.2.2.9 Topography

Highland Park is a relatively flat area. The elevation throughout the City ranges from 633.2 feet to 643 feet. The topographic map of Highland Park is shown below in Figure 9.

Figure 9: Topographic Map of The City of Highland Park



*SOURCE: USGS

1.2.2.10 Geology

There are no geological structures or formations within the City of Highland Park.

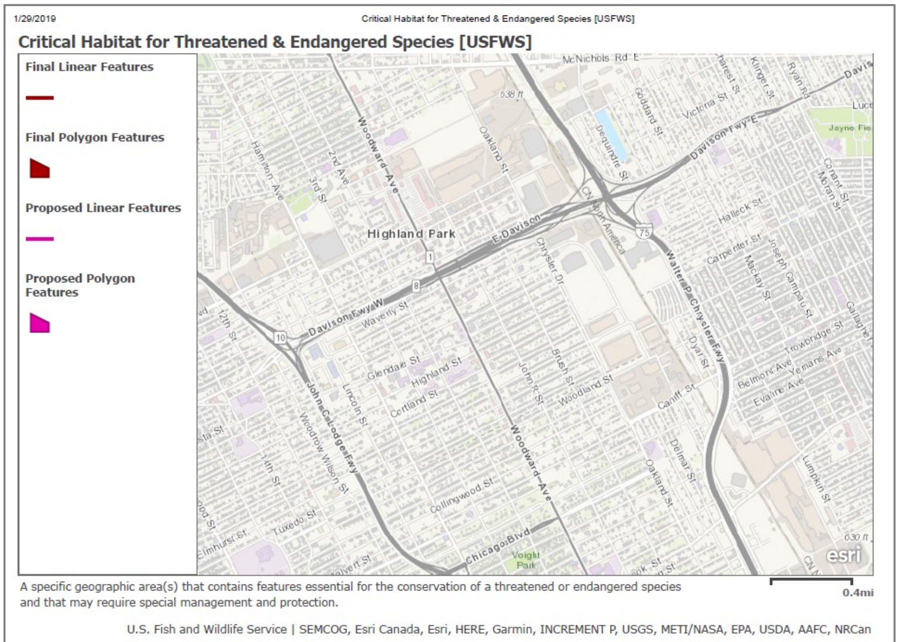
1.2.2.11 Agricultural Resources

There is no agricultural land within the Highland Park City limits.

1.2.2.12 Existing Plant/ Animal Communities

According to the US Fish and Wildlife Service's mapping system, there are no critical habitats for threatened and endangered species located within Highland Park (Figure 10). There are also no conservation easements present per the National Conservation Easement Database, which is illustrated in Figure 11 below. A letter will be sent to the Michigan Natural Feature Inventor for their input regarding threatened and endangered species in the area. This letter is included in Appendix 9.

Figure 10: Critical Habitat for Threatened and Endangered Species Database Map for Highland Park



*SOURCE: USFWS Critical Habitat for Threatened and Endangered Species

Figure 11: National Conservation Easement Database Map for Highland Park

*SOURCE: National Conservation Easement Database

1.2.2.13 Contamination of Soils

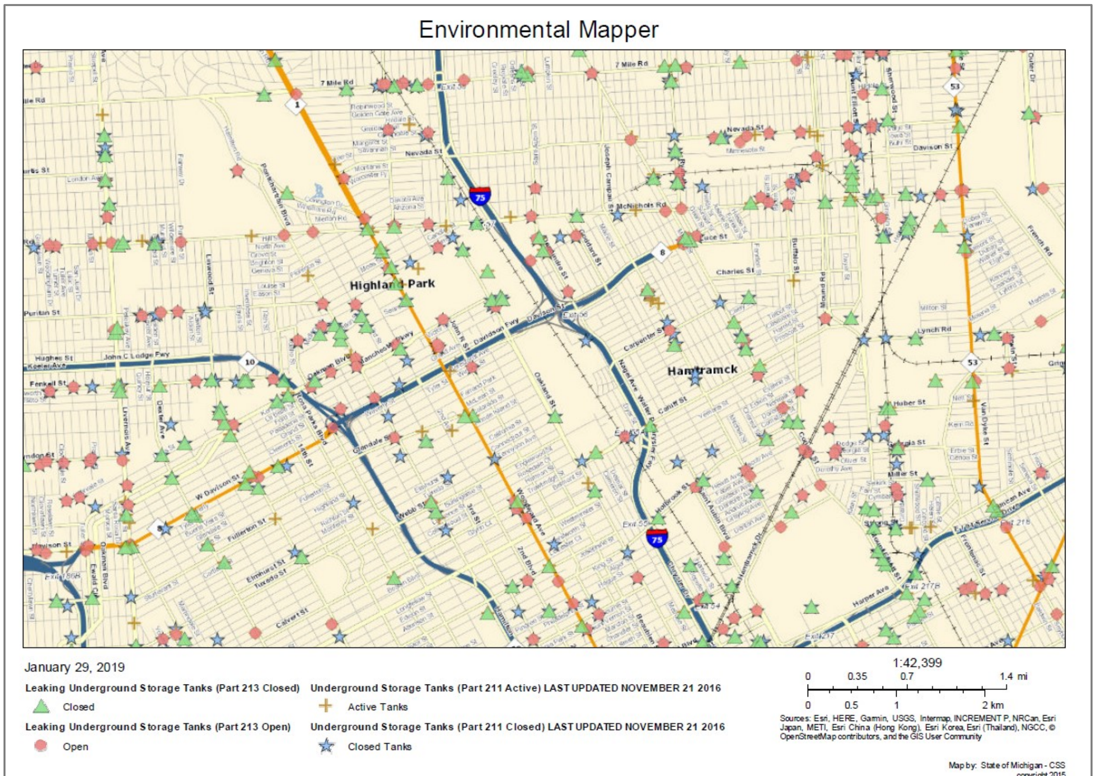
A map of all the underground storage tanks can be seen below in Figure 12, and an inventory of the facilities is attached in Appendix 3. According to the MDEQ Leaking Underground Storage Tanks (LUST) online database, there are 75 storage tanks within the City of Highland Park. 28 of these identified tanks are open. If any contaminated soils are encountered during construction, testing will take place where contamination is suspected to determine if there are hazardous materials, which is defined in 1994 PA 451, Part 111, Hazardous Waste Management. If hazardous materials are excavated, they will be disposed of in a Type II landfill.

A map from the National Cooperative Soil Survey can be found in Appendix 2. A majority of the soil in the City is defined as "Urban Land," while the remaining soil is determined as sandy loam. Data from the NCSS is shown in Table 1. Soil borings from past water main projects specify that most soil within the project areas is clayey soil. These records can be found in Appendix 2 along with the NCSS map.

Table 1: Soil in the City of Highland Park

Map Unit Name	Acres in AOI	Percent of AOI
Avoca-Urban land complex, 0 to 4 percent slopes	228.5	11.8%
Brems-Urban land complex, dense substratum, 0 to 4 percent slopes	142.6	7.4%
Udorthents artifacts, 0 to 4 percent slopes	15.5	0.8%
Midtown gravelly-artifactual sandy loam, 0 to 2 percent slopes	66.5	3.4%
Midtown-Urban land complex, 0 to 4 percent slopes	9.2	0.5%
Riverfront sandy loam, 0 to 4 percent slopes	30.0	1.6%
Shebeon-Avoca sandy loams, 0 to 4 percent slopes	3.2	0.2%
Shebeon-Urban land-Avoca complex, 0 to 4 percent slopes	761.0	39.3%
Urban land-Fortress family complex, dense substratum, 0 to 4 percent slopes	15.4	0.8%
Urban land-Riverfront complex, dense substratum, 0 to 4 percent slopes	664.6	34.3%

Figure 12: Underground Storage Tank Database Map for Highland Park



*SOURCE: DEQ Environmental Mapper

1.2.2.14 New/Increased Water Withdrawals

No projects proposed in this plan will require new or increased water withdrawals.

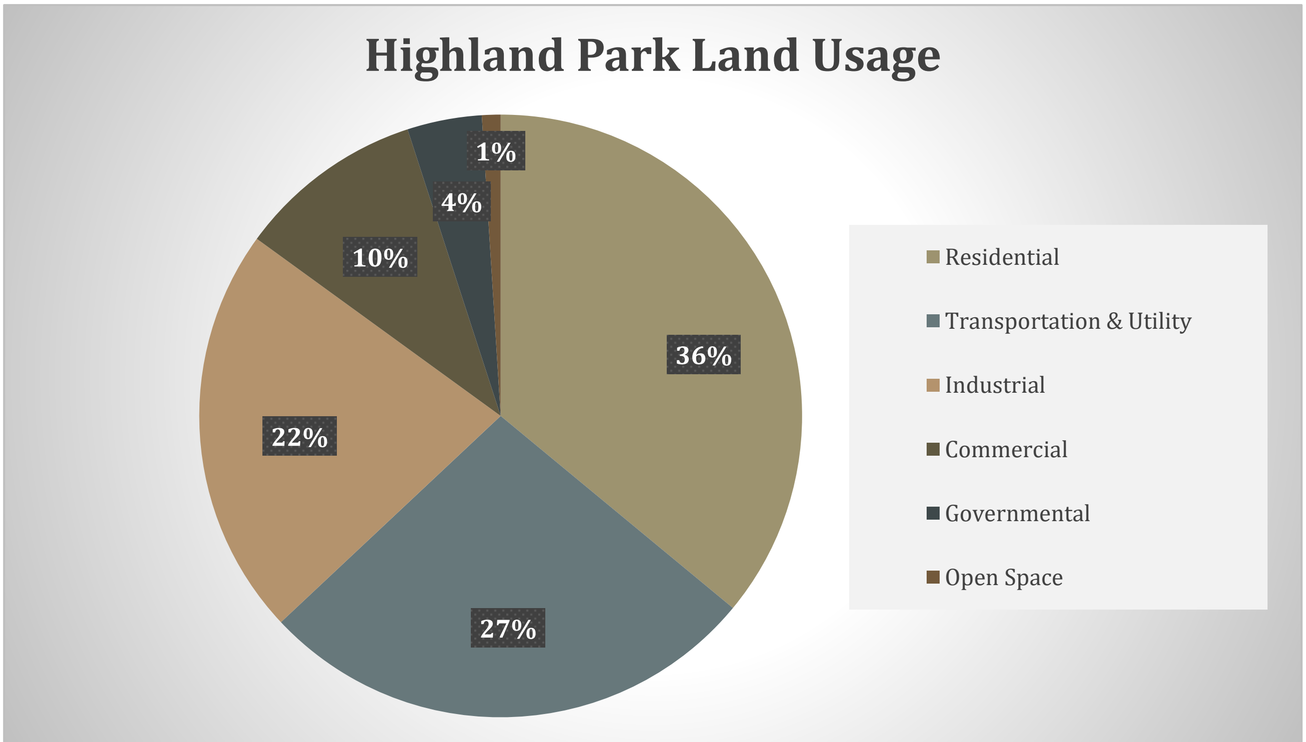
1.3 LAND USE

The City of Highland Park contains approximately 2.9 square miles (1,900 acres) of land. The area is primarily urban and is largely comprised of residential areas with some commercial and industrial usage, which is concentrated along Woodward Avenue, McNichols Road, and the southeast corner of the City. Highways I-75 and M10 border the City, while the Davison Freeway cuts through the center.

According to the City of Highland Park Zoning Ordinance, the land use in Highland Park, as of 2011, is comprised of 36% residential, 27% transportation and utility, 22% industrial, 10% commercial, 4% governmental, and 1% open space. There are no waterbodies or agricultural areas within the City limits. Open areas inside the City are limited to small, recreational city parks.

PROJECT BACKGROUND

Figure 13: Highland Park Land Usage

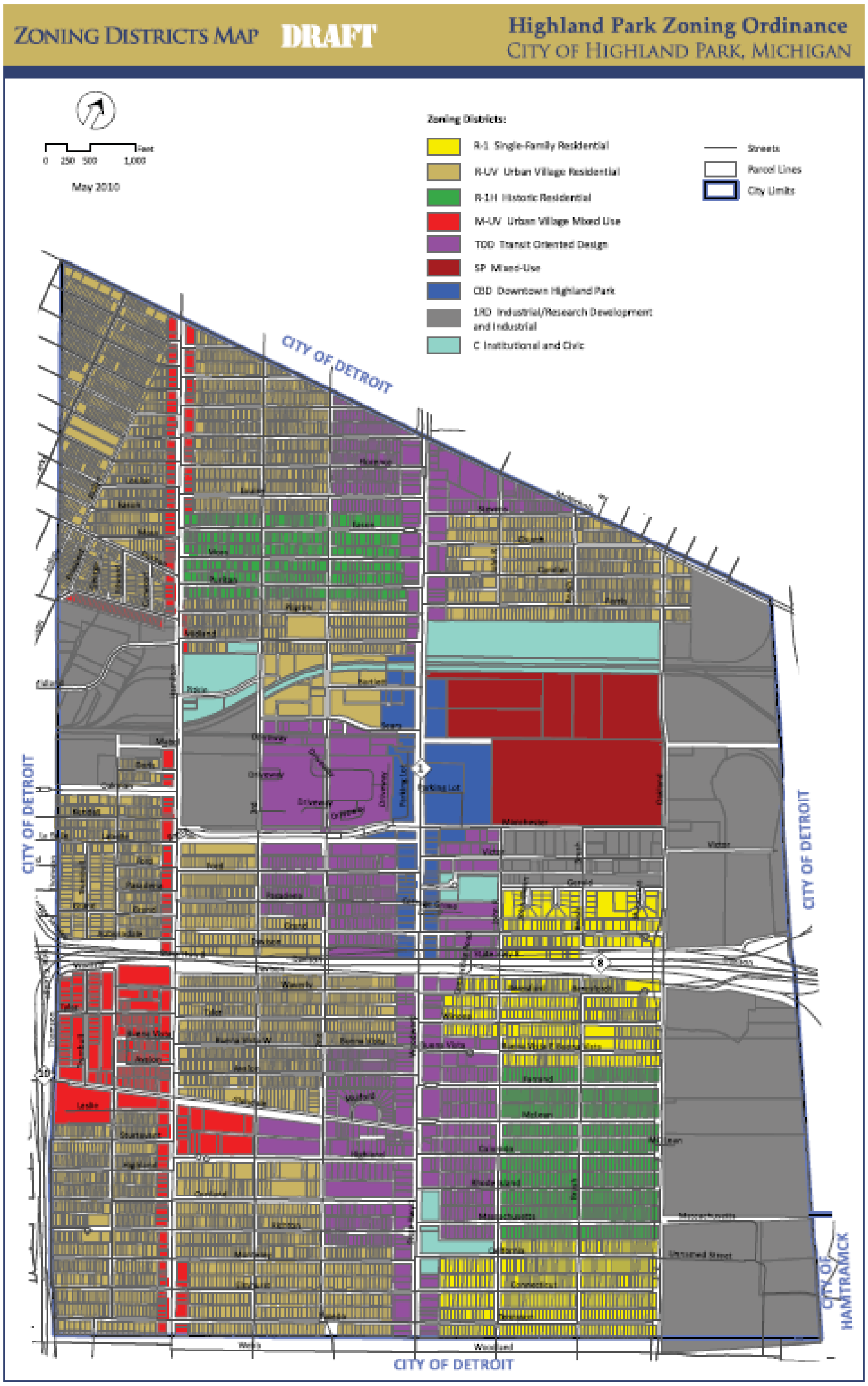


The 2011 zoning map of Highland Park is shown below in Figure 14. The map shows eight (8) Zoning Districts which differentiates the following groups: single family residential, historic residential, residential urban village, mixed-use urban village, transit-oriented development, central business district, industrial-research-development, and civic.

The City land usage and zoning are currently under evaluation and review. The objective is to bring up to date the zoning map and land usage within the City to attract and accommodate for new development.

PROJECT BACKGROUND

Figure 14: The City of Highland Park Zoning Map



1.4 POPULATION PROJECTIONS

At its peak in 1926, Highland Park had a population of 66,000 residents. Since the loss of industry throughout the years, the City has experienced a significant decline in population. This downturn did not just occur in Highland Park; the City of Detroit and several other communities in Wayne County similarly had a decline of residents. The population in Highland Park was 11,776 in 2010, according to the Southeast Michigan Council of Government (SEMCOG) census, and the current population, which was estimated July 1, 2018, by SEMCOG is around 11,398. The population of the City is constant year-round with no seasonal fluctuation.

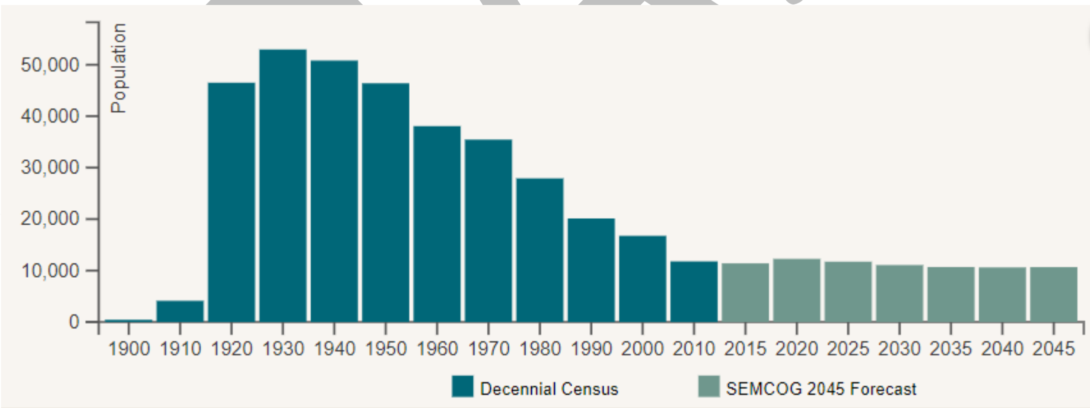
The SEMCOG predicts that the City's population will remain relatively consistent over the next 25 years, as shown in Table 2 and Figure 15 below; however, with the City planning for future development and property sales, the City anticipates the population to increase by approximately 5% per year. See Table 3 for the planned residential projections.

Table 2: SEMCOG Population Projects of Highland Park

2010 Population	2015 Estimate	2020 Forecast	2025 Forecast	2035 Forecast	2045 Forecast
11,776	11,398	12,267	11,722	10,687	10,670

SOURCES: U.S. CENSUS BUREAU AND SEMCOG

Figure 15: Population Chart of Highland Park



SOURCES: U.S. CENSUS BUREAU AND SEMCOG

Table 3: Planned Population Projection for 2019 through 2045

2019 Population	2020 Estimate	2021 Estimate	2022 Estimate	2023 Estimate	2024 Estimate	2025 Estimate	2035 Estimate	2045 Estimate
11,398	11,968	12,566	13,195	13,854	14,547	15,274	24,880	40,527

PROJECT BACKGROUND

1.5 ECONOMIC CHARACTERISTICS

1.5.1 2016 ECONOMIC CHARACTERISTICS

According to Data USA, the most recent data indicates the median household income in the City of Highland Park was $17,455 in 2016. The poverty rate was around 46.8%. There were 2,656 employees working within the City for admin, support, waste management, accommodation and food service, and utility companies. The largest industries are healthcare and social assistance, accommodation and food service, and manufacturing. The median property value within the City was $32,600.

1.5.2 FUTURE ECONOMIC CHARACTERISTICS

Development is beginning to increase in the City of Highland Park. With this, the City will be working with developers to increase the quality of the infrastructure within their purchased land. These improvements will boost the quality of the living conditions and attract future residents. Currently, the City of Highland Park is expected to see a population growth of 5% each year due to these changes.

1.6 COMPONENTS OF THE HIGHLAND PARK SEWER SYSTEM

1.6.1 EXISTING FACILITIES

Due to the lack of record keeping and communication in the past, the City's sewer system has become a puzzle. For years, the catch basins, pipes, and manholes were poorly maintained and began to fade below vegetation, sediment, soil, and debris. Recently, the City has begun identifying and locating the sewer infrastructure with assistance from the Stormwater, Asset Management, and Wastewater Program (SAW). The City has been able to further locate and begin cleaning and televising the Highland Park sewer system, assessing the conditions of the sewer piping and manhole structures, and meter the discharge points that flow into GLWA's collector pipes. All collected information is then inventoried into the City's Geographic Information System (GIS) database, which keeps records of inspection reports, conditions, photos, and general maintenance records.

1.6.1.1 Physical Conditions

A majority of the sewer manholes in Highland Park have been scanned with an Ibak Panoramo SI unit manhole scanner. This allows field crew the ability to visually inspect a structure without entering the manhole and provides a full 3D image. Once manhole field assessments are completed, a Manhole Assessment Certification Program (MACP) evaluation may be performed by a certified field member. The defects and the number of pipes within the structure are identified and given a MACP rating. The rating determined helps to prioritize rehabilitation and replacement of these structures. Each manhole receives a rating ranging from 1 to 5. The worst score rated, which is dependent on the severity of the defect, is a 5. In the City of Highland Park, 44% of the assessed manholes have been rated a 4 or 5.

The condition of the Highland Park sewer system is generally extremely poor. Much of what lies in the ground was first installed during the early 1900's. Several sink holes and pipe collapses have occurred over the years, yet few emergency replacements have been performed. With the SAW grant, the City has fortunately been able to begin to prioritize replacements by obtaining a better understanding of the entire sewer system. The manhole scans have helped piece together the puzzle and provided the Water Department a better understanding. Pipes have been discovered and inventoried in GIS by analyzing each individual scan and using the few records that remain. The connections between manholes were identified based on the depth and diameter of the pipe inverts shown in the scans.

To ensure the assumed sewer lines are properly located and to assess the pipe defects, sewer CCTV inspections are performed. While the sewers are being televised, a Pipeline Assessment Certification Program (PACP) assessment is completed for each line segment by a certified operator. The defects and other noticeable features recorded include root intrusions, mineral deposits, longitudinal cracks, circumference cracks, missing pipe, vertical alignment (sags), horizontal alignment, compromised structural integrity, and service lead connections. Similar to the sewer structure prioritization, the PACP scores are assessed and determine the need for replacement. The televising is still ongoing and is not expected to end until mid-2019; however, from what has already been rated, it is clear a majority of the system is in poor condition. About 75% of the evaluated pipes are rated a 4 or 5, which commonly include fractures or breaks. Sections of pipe identified with major structural defects become a high priority to rehabilitate.

Inflow and infiltration (I/I) is also a problem within the sewer system due to the overall age of the system. It is assumed that I/I is a larger problem in the combined sewer system, which is approximately 80% of the system, for it is older than the separated storm sewers. Because an I/I study has not yet been accomplished by the Water Department, specific dry weather or wet weather flows are unknown; however, a metering study is currently ongoing, which will provide flow data around the City border.

There are no sanitary sewer overflows (SSO) located in the City. However, two locations allow access flow from Highland Park's system into GLWA's system. One is located on the corner of Tuxedo Street and Hamilton Avenue, while the other is at Victor Street and Oakland Street. Both are designed to reduce the possibility of overflow from heavy rainfall in Highland Park's system.

Flooding has historically been a problem in certain locations throughout the City; however, the SAW grant has provided enough funding to allow operations to clean several pipelines where flooding has historically been an issue. The significant areas have been alleviated, yet flooding still may happen with considerable amounts of rainfall due to the abundance of broken catch basins. Another cause of flooding is from the absence of a street sweeping or catch basin cleaning programs. Sediment from the roads that have not yet been swept travel into the catch basins and accumulate, eventually blocking stormwater runoff from entering the sewer system. Scheduled plans to clear each inlet and sweep up the access sediment can alleviate the drainage problems.

1.6.1.2 Sewer Collection System

All of the City's combined wastewater is treated by GLWA. The Water Resource Recovery Facility (WRRF), which is located north of the Rouge River and just west of the Detroit River, is about 7.5 miles from Highland Park. As noted previously, the City's system flows into GLWA's major sewers that lead to the NIEA and NWI. A majority of the Highland Park wastewater collection system, excluding the few emergency replacements, is the original system, which was built in the early 1900's. The entire sewer system is moved by gravity; therefore, no back-up power is required to continue operations. No pump-stations, outfalls, septage receiving facilities, or system bypasses exist within the City sewer system. Based on assessment and historical documents, the pipes that run through the City alleys collect both sanitary flow and stormwater, while most of the pipes running beneath roadways typically collect primarily stormwater. Approximately 80% of the City collects combined flow, while the remaining water is stormwater runoff; both collect and go to the WRRF for treatment.

Industrial land owners have the highest sewer rates due to the majority of their land consisting of concrete surfaces and buildings, which are defined as impervious surfaces. Currently, the stormwater at industrial facilities collect on these impervious surfaces and flow directly into the City's combined sewers. 22% of the City is considered industrial. Much of this land is to the east of Oakland Avenue. Sections surround Midland Street, while the remaining land is scattered to the north of the Davison Freeway. The City of Highland Park Water Department is working with several of the industrial properties to reduce stormwater volume by increasing the amount of pervious surface, such as grass or gravel, throughout the property, by removing excessive pavement or buildings, and by promoting rain barrels, green roofs, and retention basins. This can significantly decrease the overall flow sent to GLWA for treatment.

In 2018, GLWA performed a metering study using Insertion Magnetic Meters (IMMs) placed at the three emergency water system connections between Highland Park and GLWA, which has been the City's water supplier since 2012. These meters are typically used as temporary meters; therefore, within the thirty months of metering, only fifteen months were recorded. Because of these issues, the total system demand was not accurately tracked. Based on the available data however, GLWA charges Highland Park based on the following water flows: 2.18 MGD average day flow, 2.79 MGD max day flow, and 2.86 MGD peak hour flow.

Because GLWA receives sewer flow from several different communities, it is difficult to determine the exact amount of sewage being sent to the WRRF for treatment. Charges from GLWA are based on a few different factors: 30% of the bill is determined by the water flow entering the system, which eventually becomes sanitary flow; the other 70% of the bill is based on I/I and wet-weather flow assumptions. In order to determine the proper charge for sewage treatment, the City of Highland Park Water Department has identified the thirty-two external connections with either GLWA or DWSD's sewer infrastructure. Of these, twenty manhole structures contain recently placed meters to collect data of the flow leaving or entering the City's system. The other twelve connections have been deemed as high-point locations or showed no evidence of flow entering or exiting the structures during dry and rainy events. For further details, please see the 2018 City of Highland Park Water Department Sewer Verification Connection Study (Appendix 4).

With the data from the meters, which were installed March 1, 2019, the City of Highland Park Water Department will gain understanding of the following information: the City's general conveyance of sewage; an estimation of the amount of flow that is generated during both dry and wet weather events on a daily, weekly, monthly, and yearly basis (taking into account the condition of the structures); and the appropriate amount of sewer flow attributed to the City of Highland Park; in addition to the amount of sewer entering the City from other sources outside of the municipal boundaries.

1.7 FISCAL SUSTAINABILITY PLAN

1.7.1 MANHOLE STRUCTURES

Structures have been inventoried by the Water Department through the coordination of planned field investigations and analyzing the available historical records. The field investigations utilized the Ibak Panoramo SI unit manhole scanner to safely record 3D images of the manhole structures within the City and allow the ability to rate the defects by performing MACP assessments. Some structures have not been located or rated due to vegetation overgrowth, the construction and development of buildings, paved over structures from pervious road improvements, structure removal during construction projects, or poor record keeping. As of today, 2409 manhole structures have been found and recorded in GIS. The City continues to identify and investigate sewer manholes. Currently, 60% of these structures have been identified as Level 2 structures, which indicates the defects are significant.

1.7.1.1 Evaluation and Condition

Before each manhole is scanned, a Level 1 assessment of the manhole is performed. This gathers basic information regarding the general condition of the manhole. The number of manholes with noticeably poor basic conditions are shown below in Table 4.

Table 4: Condition Observation

Cover Broken	Debris Present	Cover Cracked	Frame Broken	Full of Debris	Vegetation Present
1	170	1	8	25	18

Deposits, such as encrustation, grease, or debris, can clog pipes and caused surcharging within the manhole. Typically, signs of a past surcharge are identified by debris on the steps or bench or by water marks on the walls of the manhole structures. Based on the field assessment, 25% of the City's manholes had evidence of surcharging.

Of the Level 2 structures, 67% were given a MACP rating. Table 5 below estimates the percentage of MACP manhole ratings out of the assessed structures, which totaled approximately 940 manholes. Figure 16 illustrates examples of each MACP rating within Highland Park. Figure 17 locates each rated manhole on the City map of Highland Park.

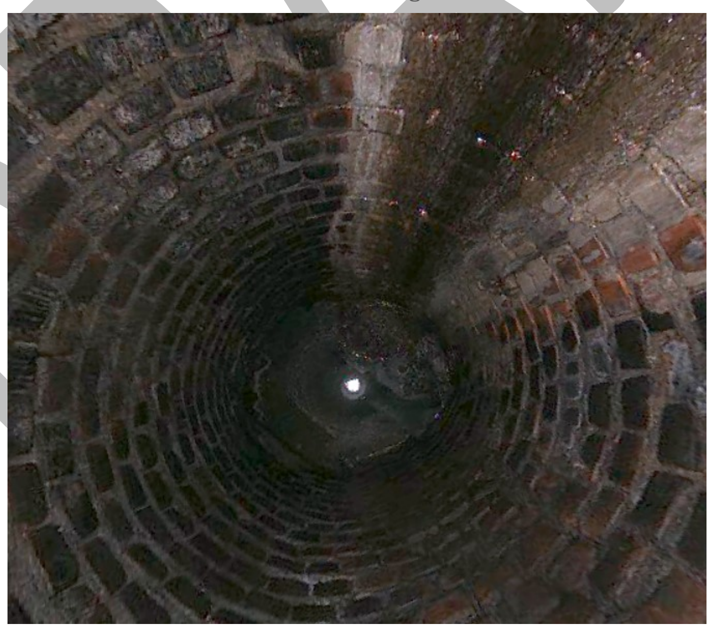
Table 5: MACP Ratings

MACP Score	
1	5%
2	21%
3	30%
4	32%
5	12%

Figure 16: Example MACP Rated Structures

MACP Rating 1

MACP Rating 2



MACP Rating 3

MACP Rating 4

PROJECT BACKGROUND

MACP Rating 5

Sinkhole Resulting from Several Structural Defects

Figure 17: MACP Rated Manhole Structures

1.7.2 SEWER PIPELINES

The City of Highland Park has roughly 105 miles of known sewer pipeline. The currently working GIS model of the Highland Park sewer system was created using the few records kept and several field inspections. Table 6 below contains the percentage pertaining to the total variety of pipe diameters within the City.

Table 6: Sewer System Pipe Diameters

Diameter	%
6"	0.20%
8"	0.38%
10"	4.31%
12"	20.31%
14"	0.05%
15"	18.61%
16"	0.05%
18"	11.18%
20"	2.51%
22"	1.34%
24"	4.04%
26"	0.09%
27"	0.55%
30"	1.12%
34"	0.11%
36"	2.93%
40"	0.05%
42"	1.47%
48"	4.66%
54"	3.02%
60"	2.86%
66"	0.53%
70"	0.69%
72"	1.30%
75"	0.16%
78"	0.58%
84"	0.63%
90"	0.19%
96"	0.18%
108"	0.40%
120"	0.73%
132"	0.78%
180"	2.36%
Unknown	11.65%

Within the City of Highland Park, 73% of the pipelines are City owned. The other 27% are owned by either GLWA, private users, or DWSD.

1.7.2.1 Evaluation and Condition

Video recording has been ongoing since January 2017. Today, about 480-line segments have been televised, and of these, 77 were recorded in the opposite direction due to an obstacle or blockage. These recordings allow certified inspectors to perform a PACP assessment to identify defects and characteristics of the line. Table 7 indicates the percentage of the total pipe material used throughout the City.

Table 7: Pipeline Material

Material	%
Brick	0.68%
Clay Tile	0.24%
Concrete (Non-Reinforced)	0.48%
Concrete Segments (Bolted)	0.10%
Concrete Segments (Unbolted)	0.07%
Plastic/Steel Composite	0.17%
Polyvinyl Chloride	0.03%
Reinforced Concrete	3.25%
Reinforced Plastic (Truss)	0.58%
Vitrified Clay	43.37%
Unknown	51.03%

Each line segment was given a rating based on the defects in the pipe. While the sewer pipe was being recorded, the certified operator coded each problem within the sewer pipe runs. At the end of each section, an overall rating is generated from the analysis. The pipeline receives a 1 through 5 rating with 5 being the worst rating, which is a high priority section to replace. A rating of 0 indicates new pipeline. Table 8 contains the percentages of ratings given to the televised segments.

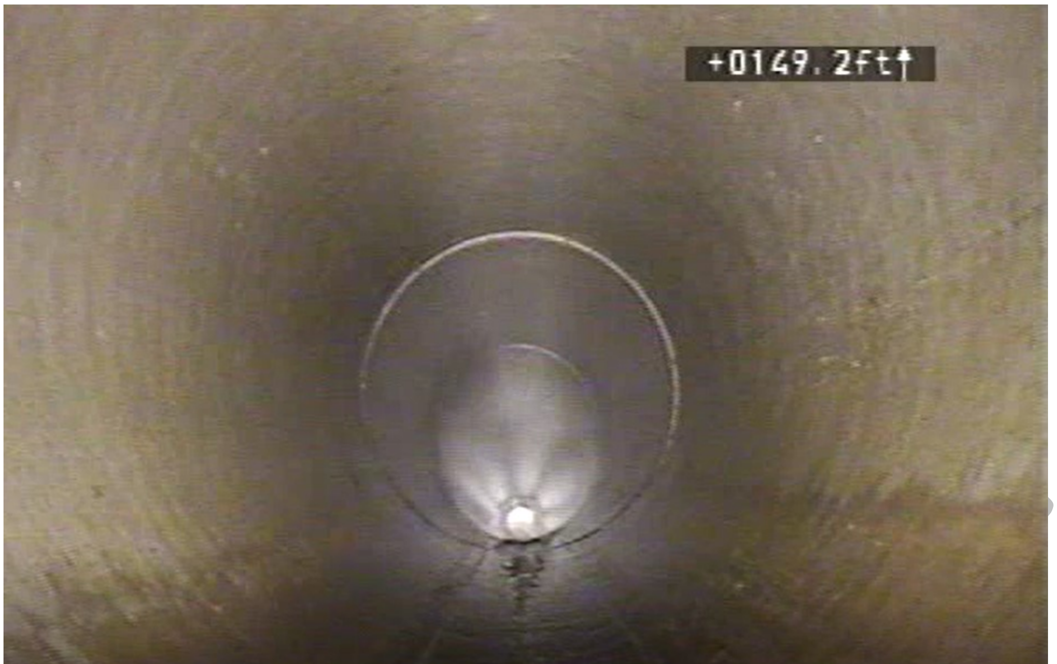
Table 8: PACP Rating for Televised Segments

PACP Rating	%
0	16.14%
1	3.70%
2	12.96%
3	18.52%
4	17.46%
5	31.22%

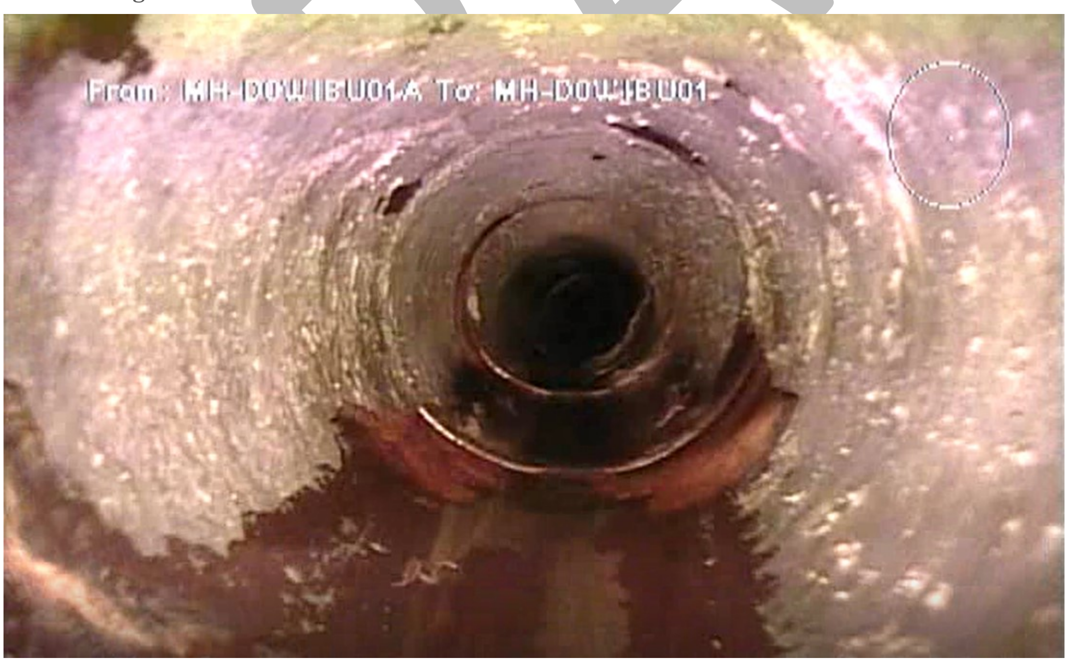
Figure 18 illustrates an example of each PACP rating within the City. Figure 19 locates the variety of PACP rated runs.

Figure 18: Examples of PACP Rated Pipe

PACP Rating 1



PACP Rating 2



PACP Rating 3

PACP Rating 4

PROJECT BACKGROUND

PACP Rating 5

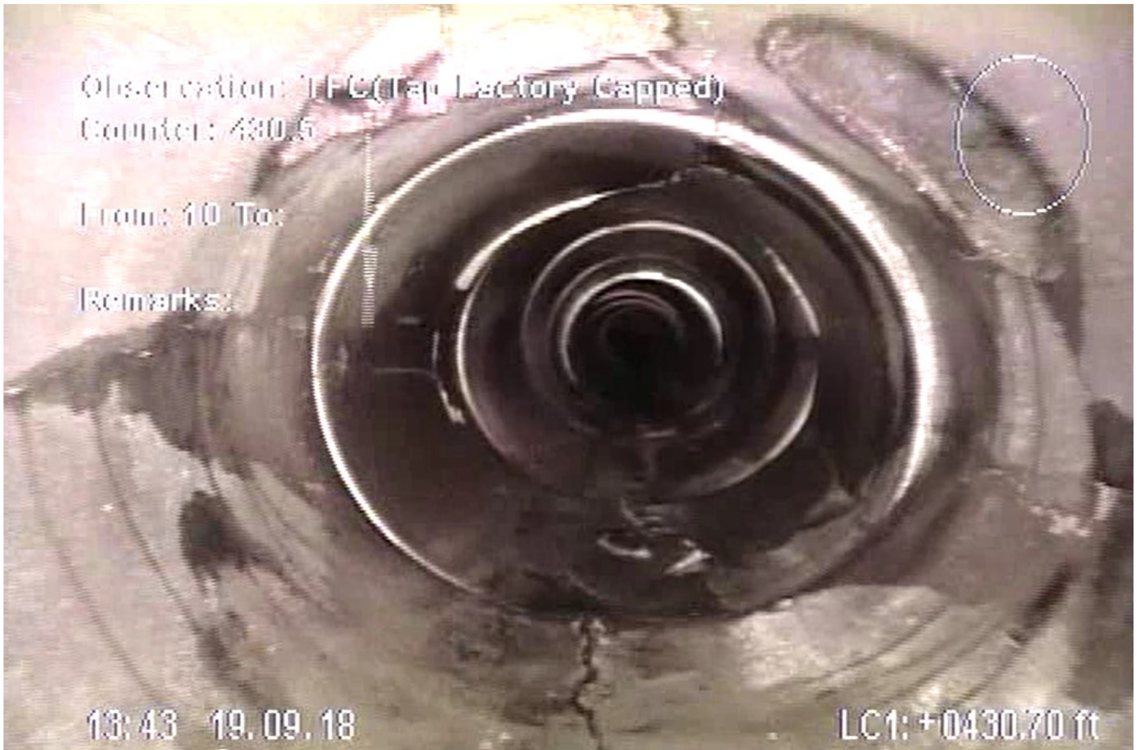
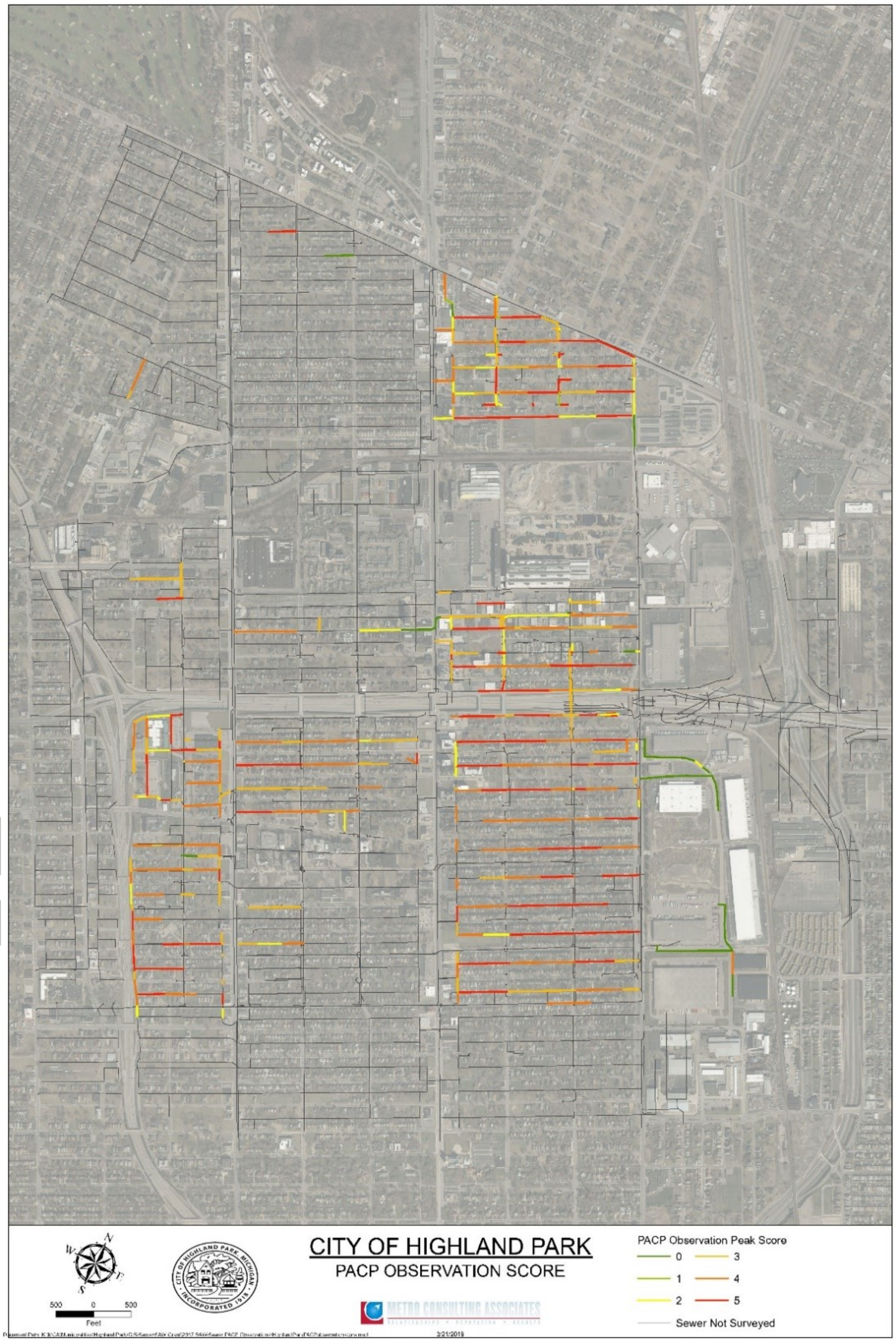


Figure 19: PACP Rated Sewer Segments



1.7.3 CATCH BASINS

1.7.3.1 Inventory

There are 2344 identified catch basins in the City of Highland Park, and a majority had not been properly maintained in a plethora of years. The City owns 79% of the catch basins inventoried within the GIS model. The remaining 21% are either privately owned or belong to DWSD.

1.7.3.2 Evaluation and Condition

Summer of 2017, the City received the funding to clean out the catch basins around the City. As of March 2019, 80% of the catch basins had been vacuumed and washed. The other 20% were either clear of any debris or inaccessible. During the cleaning, field inspections were performed to determine and document the diameter, material, and condition of the catch basin. At least 50% of these inspected catch basins within the City did not have sumps to capture sedimentation.

All of the catch basins identified had an access diameter of 24-inches, with the exception of one 17-inch access diameter and one 21-inch access diameter. Each of the identified structures were cast iron; however, one was identified as brick and one as clay tile. The remaining 5% of the catch basins had no defined material.

The condition of each catch basin was determined based on the amount of debris or sediment built up within the structure. Each catch basin was given a rating of 0 to 3, with 3 indicating the most debris. An inlet given a 0 did not require cleaning. The total catch basin conditions within Highland Park is shown in Table 9, and an example image of each condition is in Table 10.

Table 9: Condition of the Catch Basins

Condition Score	%
0	17%
1	54%
2	13%
3	13%
NR	3%

Table 10: Before and After Cleaning Conditions

Condition 1	
Before Cleaning	**After Cleaning**
	
Condition 2	
Before Cleaning	**After Cleaning**
	
Condition 3	
Before Cleaning	**After Cleaning**
	

PROJECT BACKGROUND

Figure 20: Catch Basin Ratings

1.8 NEED FOR PROJECT

The City of Highland Park sewer system is over 100 years old, and because of this, a majority of the components require replacing. Several structures and pipes are broken or near broken due to the lack of maintenance and extreme age. Infiltration and inflow results from the poorly-conditioned sewer system, which increases the cost and inefficiency to treat the City's outflow. Twelve (12) sink holes have occurred in 2018 where structures were unstable. Most have been backfilled; however, the few remaining cause safety problems to pedestrian and vehicular traffic, while also taking in water and debris from the surrounding area. It is vital for the City's sewer infrastructure to be assessed, evaluated, and repaired. Unaddressed sewer issues create ongoing maintenance problems and could result in costly repairs as well as potentially leading to significant catastrophic collapses.

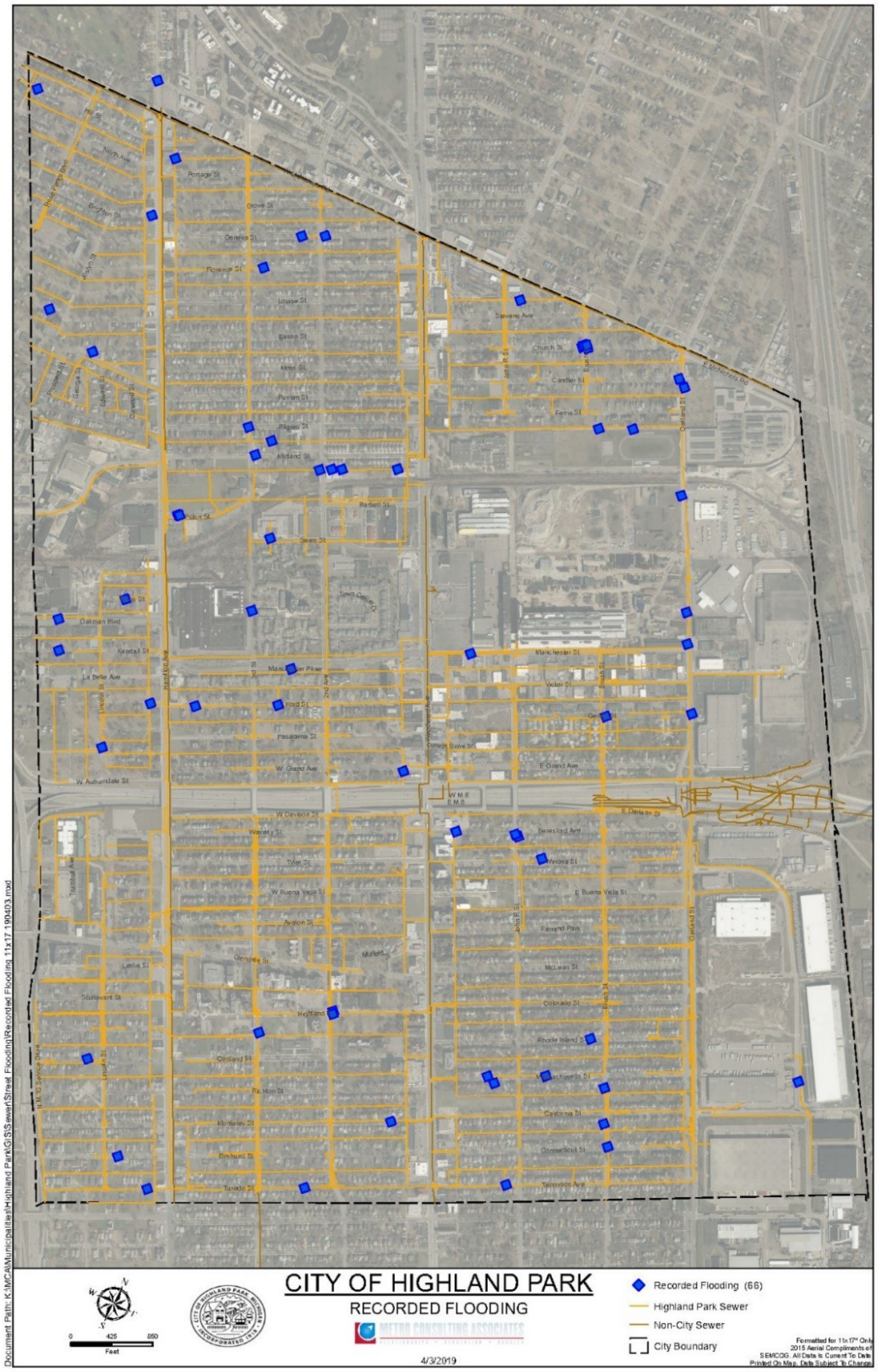
1.8.1 WATER QUALITY PROBLEMS

The majority of the Highland Park sewer system was installed during the early 1900's. Because it is well beyond a typical system design life of 20 to 30 years, the system can be assumed non-compliant to current standards. Throughout alleys, the collecting sewer should be, at a minimum, 10 feet below the ground surface within a residential area to accommodate basements; however, most of the existing lines are approximately 5.5-feet to 10-feet in depth. Generally, the sewer lines do meet setback requirements from drinking water mains.

Most of the soil throughout the City is clay, but a few locations with sandy soil have been discovered during recent water main projects. From what is known, there have been no permeability problems within the City. No ponding or breakout of sewage has been recorded in the past, yet there have been a few instances of sewage backing up into homes. Within the past year, three different roads have had an issue with sewer backups: two homes off of Prospect Street, three homes off of Sturtevant Street, and four homes off of Waverly Street. Each backup has been taken care of by CPI Contracting, and no problems have occurred since. Because the sewers were designed to be combined, collectors within residential areas are between 12-inch and 18-inch diameters; therefore, the pipes have a large capacity for both sewer and stormwater runoff, which results in fewer cases of backups within homes. Roots and other buildups are the main source of the flooding or drainage slowdowns within the City's sewer system.

The catch basins throughout the City have caused a problem for Highland Park. There have been several reports of streets and basements flooding in the past because of the lack of drainage; fortunately, due to ACT 51 funding, the City was able to clear sediment and other deposits within each of the catch basins, and drainage has improved significantly. Any current problems with drainage result primarily from the structural defects within the structures. One location off of Manchester Parkway near Woodward Avenue, for example, consistently floods due to the improper drainage from the broken catch basin. Locations where flooding has been problematic in the past are seen in Figure 21.

Figure 21: Recorded Flooding in Highland Park



Records of the past repairs and replacements on the sewer system have not been kept or maintained historically. However, since 2016, Daily Inspection Reports (IDR) have become a required method of documenting problems within the system from the City's field staff. Below in Table 11 is a sample of the repairs reported within the City.

Table 11: IDR Sewer Repairs

Type of Repair	Damage	Date of Reporting	Date of Repair	Repair Complete	Repair Comments
Frame Sunk/Broken	Major	23-Mar-17	N/A	No	
Sinkhole	Emergency	23-Mar-17	N/A	No	
Frame Sunk/Broken	Major	6-May-16	N/A	Yes	
Catch Basin Clogged	Major	16-Jan-17	4-Apr-17	Yes	jet washed 10 ft to repair clog
Catch Basin Clogged	Major	11-Apr-17	17-Apr-17	Yes	cleaned
Sewer Clogged	Major	28-Aug-17	28-Aug-17	Yes	Checked main sewer upstream and down stream. Sanitary sewer is opened and running.
Tree Roots	Minor	26-Apr-18	26-Apr-18	Yes	Spray foam sewer for tree roots
Tree Roots	Minor	26-Apr-18	26-Apr-18	Yes	Spray foam sewer for tree roots
Tree Roots	Minor	26-Apr-18	26-Apr-18	Yes	Spray foam sewer for tree roots

Historically, sewer wastewater quality tests have not been performed. All wastewater for treatment flows to the WRRF, which is owned by GLWA. November 2018, GLWA reported the applicable instream water quality standards and the quality conditions within the rivers in which the treated wastewater is disposed. The Rouge River has historically been a designated area of concern by the Great Lake International Joint Commission (IJC) due to poor water quality, poor aquatic life, and stream bank erosion. Water Quality improvements to reduce E. Coli and dissolved oxygen began around 1994 up until 2004, when finally, standards were met.

1.8.2 PROJECTED NEEDS FOR THE NEXT 20 YEARS

The City is still in the process of gathering the complete information of each asset in the sewer system. Within the next 20 years, the Highland Park Water Department is planning on performing several studies to gain a better understanding of the sewer infrastructure location and conditions. The sewer system is being recorded and assessed currently, and the plan is to complete this task by the end of 2019. Once the recordings are finished, the City of Highland Park can use the video footage and data to perform an I/I study and update the system GIS model. The I/I study will also use the data from the current metering study.

Twenty meters have been placed along the Highland Park border to determine the exact amount of flow entering and exiting the City. Data will be collected for six months in order to gather a better understanding of the flow volume. This information can be compared with the amount of precipitation and residential usage to calculate the I/I entering the sewer system.

The plan is to have an I/I study, complete an accurate GIS model, and locate sewer system defects by 2020. Once achieved, the Highland Park Water Department can prioritize and improve the aging sewer infrastructure by accomplishing the following tasks within the next 20 years:

- Replace all broken or collapsed piping
- Line segments with identified I/I
- Replace manhole structures rated 3 or greater
- Replace catch basins to include sump
- Replace any broken or poorly rated catch basins
- Insert cleanouts for each property

1.8.3 FUTURE ENVIRONMENT WITHOUT THE PROPOSED PROJECT

Within the City of Highland Park, 98% of the sewer system is well past the recommended design life. If repairs and replacements do not begin relativity soon, the City's sewer system may altogether fail, which could cause the following:

- Basement backups
- Flooding of major and minor roadways
- Unpredictable sink holes
- Increased sewer treatment costs due to large volumes of I/I

As mentioned within this report, the system has been poorly maintained and is roughly 90 years beyond the recommended design life.

2 ANALYSIS OF ALTERNATIVES

2.1 NO-ACTION ALTERNATIVE

The no-action alternative is not an option for the City of Highland Park collection sewer system. As mentioned before, the system is well past the recommended design life. Without replacements, the components will continue to fail. If improvements do not begin before long, it will become not only an unusable system, but the failed structures will become a safety problem for the citizens of Highland Park.

2.2 OPTIMUM PERFORMANCE OF EXISTING FACILITIES ALTERNATIVE

The existing design transports flow using gravity. In order to improve the performance, new pipe should ideally be placed to better the flow. The current conditions of the system slow water flow due to breakages, fractures, deposits, and corrosion within the pipes. Replacing the old system will improve drainage flow and ensure no flooding will occur. The current collection system has larger pipe diameters due to the combined sewer design; any problems with flooding that have occurred are due to clogging and excessive I/I. With replaced pipes, the City's system in 20-years (when the population is expected to double), will be able to withstand the City waste.

In order to optimize the current performance, a maintenance plan must be developed and regularly executed. Pipelines and catch basins are currently in the process of getting root balls, sedimentation, and grease deposits removed; however, in order to keep the current collection system at its best potential, the flow path must remain cleared. The catch basins within the City also do not meet the current drainage requirements. A majority of the inlets do not contain a sump. Any future replacement of a catch basin must include a sump.

2.3 WATER AND ENERGY EFFICIENCY

Because the sewer system is gravity run, no energy is used; however, the combined sewer increases the amount of water being treated, making it inefficient for GLWA to treat. By reusing stormwater or reducing the areas of impervious surfaces, the level of water flow will decrease significantly.

Currently, the Highland Park Water Department has begun working with industrial properties to reduce the volume of stormwater runoff. This program will increase the overall system water efficiency.

2.4 REGIONAL ALTERNATIVES

The Highland Park sewer system flows into the GLWA system to be treated. Because GLWA treats every community surrounding Highland Park, there are no other feasible regional alternatives.

2.5 ANALYSIS OF PRINCIPAL ALTERNATIVES

The main goals of the 2020 SRF Project are:

1. Replace catch basins within alleys or local roads and include the required sump
2. Perform point repairs on collapsed or broken pipe segments
3. Line sections of pipe assessed with a PACP rating equal to a score of 3 or greater
4. Replace manhole structures assessed with a MACP rating equal to a score of 3 or greater

To accomplish these goals, an analysis of the following alternatives is considered: material options and different methods of construction.

2.5.1.1 Material Options

As of today, catch basins are typically precast concrete. They are simple to install and can provide adequate drainage for stormwater runoff. More than 70% of the catch basins structures and manholes in Highland Park are brick. Brick has similar properties to precast concrete, but a significant difference stands out in the installation and cost. Any future manhole or inlet replacements will use precast concrete.

There are three materials considered for the pipeline replacements: polyvinyl chloride (PVC), high-density polyethylene (HDPE), or resin-saturated felt tube made of polyester for the cured-in place method of pipe replacement. Each of these materials are strong and resistant to corrosion; however, PVC is the most inexpensive option. Locations with broken or collapsed pipe will be replaced with PVC piping. The design life of PVC is around 50 years maximum, which is 20 years past the recommended sewer system design life.

2.5.1.2 Construction Methods

Construction methods typically used for repairing sewer systems include the following: open trench excavation, pipe bursting, or the cured-in place method. Open trench excavation will cause the most destruction and disturbances to the road and sidewalks, but if a structure or segment of broken pipe require replacement, this is the best option. It can also be cheaper than both pipe bursting and cured-in place depending on the amount of pavement removed.

Both pipe bursting and the cured-in place methods require some excavation, but only where the access pits are located. They both follow the existing path of the sewer main but are unable to repair collapsed or broken pipe. Pipe bursting is the most expensive method and uses HDPE pipe, which costs twice as much as PVC. Cured-in place method lines the existing pipe with a resin-saturated felt tube made of polyester that essentially replaces the existing sewer pipeline. This option is the least expensive method, but the liner pipe is the most expensive material.

Certain pipelines within the City are not within the required 10-foot depth in residential areas; however, because the system is a gravity sewer, placing segments of pipe deeper into the ground would require either a full system redesign or lift station. Because of this, current replacement projects are remaining within the same path of the City's sewer system; therefore, open-cut and cured-in place replacements are the best construction methods for Highland Park.

2.5.2 THE ENVIRONMENTAL EVALUATION

To minimize environmental or existing habit impacts, as well as any impacts to existing infrastructure, trenchless technology, specifically cured-in place replacements, should be utilized for most of the replacements. This significantly reduces the need for excavation construction methods traditionally used to install sewer utilities. Approximately 50% of the replacements will be constructed using open-cut technology, primarily where sewer main replacement will occur in conjunction with road replacement projects, locations where pipe is broken or collapsed, or where sewer structure replacements take place.

Implementation of projects contained in this plan will result only in short-term environmental impacts. Environmental impacts are restricted to only construction-related activities. All projects will be designed in accordance with local, county, and state regulations in regard to noise, soil erosion, and sedimentation control. Efforts will be made to minimize inconveniences to business and residents.

2.5.2.1 Climate

The climate will not have a significant impact on either of the construction methods of the proposed projects. Typically, construction projects can be completed during the spring, summer, and fall.

2.5.2.2 Wetlands

The proposed projects identified in the project plan are located within developed areas and replace existing infrastructure. Because of this, no wetlands will be affected by the projects.

2.5.2.3 Contamination

If any soils are encountered during construction are contaminated, testing will take place to determine if the materials are hazardous as defined in 1994 PA 451, Part 111, Hazardous Waste Management. If hazardous materials are excavated, regardless of construction method, they will be disposed of in a Type II landfill.

2.5.2.4 Wildlife

The USFWS County Distribution of Federally-Listed Endangered and Threatened Species (Section 7: Consolidation) within Wayne County lists six (6) species and critical habitat that “may be present” within the project areas are:

- The Indiana Bat, which habitat includes small to medium river and stream corridors with well-developed riparian woods; woodlots within one (1) to three (3) miles of small to medium rivers and streams; and upland forests, caves, and mines as hibernacula;
- The Northern Long-Eared Bat, which habitat includes caves and mines-swarming in surrounding wooded areas in autumn; roosts and forages in upland forests during spring and summer;
- The Rufa Red Knot, which habitat includes coastal areas during the migratory window of May 1 to September 30;
- The Eastern Massasauga, which habitat includes wet areas including wet prairies, marshes and low areas along rivers and lakes, adjacent uplands during part of the year, crayfish burrows, under logs and tree roots, or in small mammal burrows;

- The Northern Riffleshell, which habitat includes large streams and small rivers in firm sand of riffle areas; also occurs in Lake Erie;
- The Eastern Prairie Fringed Orchid, which habitat includes mesic to wet prairies and meadows.

The Indiana Bat may be affected, but it is not likely to be adversely affected due to type of construction proposed. In addition to the area being highly urban, which is paved and landscaped, no tree cutting is proposed to occur in which the Indiana bat would reside in. No existence of rivers or streams, nor caves and mines are located within the highly developed area.

The remaining species will not be affected by either of the proposed construction methods or materials. Tree removal is not proposed as part of the sewer system replacement projects. The contractor, during construction, and the engineer, during the design phase of these projects, will incorporate avoidance of any impacts to existing trees. Tree protection features will be incorporated into the development of the construction documents. Any excavated trenches will be outside of tree roots. If for some unforeseen reason, tree removal becomes necessary, a requirement shall be communicated to the contractor that tree removal can only occur between October 1st and March 31st. Noise volumes will be slightly above normal levels during periods of construction but is expected to have no effect on the Northern Long-Eared Bat, Rufa Red Knot, Eastern Massasauga, Northern Riffleshell, and Eastern Prairie Fringed Orchid, which are species listed within Wayne County on the County Distribution of Federally-listed Threatened, Endangered, Proposed, and Candidate Species.

2.5.2.5 Residuals

Residuals will not be generated by any projects in this plan.

2.5.3 IMPLEMENTABILITY AND PUBLIC PARTICIPATION

Two public hearings are scheduled for May 20th and June 3rd. This section will be completed after the public hearings pass. Any public input will be considered when choosing an alternative.

Because the City of Highland Park owns, operates, and maintains the sewer system throughout the City, it has all of the legal and institutional resources necessary to plan, design, construct, and operate the proposed sewer system improvements. The City will assess both user rates and mileage to finance bond payments for the bonding period of 30 years. All necessary agreements and ordinances will be submitted to the MDEQ for review.

While nearly all the City's sewer system needs replacing, the Water Department anticipates that covering all costs of such replacement would result in unaffordable customer rates. Therefore, the City seeks to work with private development to help offset costs and replace a significant portion of the costs.

2.5.4 TECHNICAL AND OTHER CONSIDERATIONS

2.5.4.1 I/I Removal

Though a I/I study has not yet been performed, it is clear infiltration and inflow is a problem in the City of Highland Park. Currently, meters have been placed in twenty (20) locations in connection to other municipality systems to measure the amount of outflow. Comparing the measured flow to the amount billed to the City's users will calculate the total I/I entering the system. Though the study has not been completed, evidence of infiltration and inflow exists through videos recorded during the pipeline televising and manhole scanning investigations. This project will reduce any I/I that may occur within the proposed location in the City, which should reduce the amount of unnecessary stormwater treatment.

2.5.4.2 Structural Integrity

The current conditions of the Highland Park sewer system are eligible for major rehabilitation projects. 20% of the sewer mains have been given a PACP rating. 59% of the pipeline has been given a rating over a 4. 40% of the manholes within the City have been given a MACP rating, and of these, 44% are determined a 4 or 5. The primary goal of the project is to replace the poorly rated segments and structures. If pipeline segments from manhole to manhole are rated a 3 or greater, they should be completely replaced or lined. If only small sections of each pipe are repaired, the remaining parts will require a replacement within the next few years; therefore, by replacing the entire line within an area, there will be consistency of design life and multiple disturbances will be avoided.

2.5.4.3 Growth Capacity

The current conditions of the sewer system slow down the combined flow due to breakages, fractures, deposits, and corrosion within the pipes. Replacing or lining the old system will improve drainage flow and ensure no flooding will occur. The current collection system has larger pipe diameters due to the combined sewer design; any problems with flooding that have occurred are due to clogging and excessive I/I. With replaced pipes, the City's system in 20-years, when the population is expected to double, will be able to withstand the City waste. Because the existing infrastructure was designed for a greater population, the capacity should be enough for new development in the City.

If current areas without sewers are developed in the future, a sewer line should be designed for the expected flow within the property. Developers will be responsible to pay for the cost to build each component within the proximity of their land. The current system should withstand the planned amounts of new development due to the combined sewer design involving larger capacities than a typical separated sewer; however, if the expected flow is to be greater than the current sewer capacity, the developer will be responsible to replace the components involved.

2.5.4.4 Reliability

The City of Highland Park sewer system is not completely reliable today due to the extreme age of the assets. The no-action alternative is therefore not an option. PVC and cured-in place pipes and precast structures, which are durable and dependable materials, are the most reliable options for the City sewer system.

3 SELECTED ALTERNATIVE

3.1 DESCRIPTION

The plan for the 2020 SRF project is to line or replace all of the rated pipe segments or manholes given a 3 or greater and upgrade the catch basins located in alleys or local roads within the southeastern corner of the City. Highland Park contains considerable unowned land; therefore, the proposed location for the 2020 SRF project encompasses the most populated residential area. This selected region of Highland Park coincides with the planned water main replacement projects occurring in the next five years as well. In 2021, water main replacements will take place within the same selected region as the proposed 2020 sewer replacement plan. Rehabilitating both underground utilities around this area within the next couple of years will improve the general infrastructure replacement efficiency and establish the complete infrastructure rehabilitation block by block method. This includes repairing each component of the water main, sewer system, road, and sidewalk within a block; therefore, in twenty years, everything within the same block will require replacement. This method increases efficiency and financial diligence, for planning utility work with other projects avoids future excavation and unnecessary replacement of the new components. It also avoids multiple public disturbances. Figure 22 below illustrates the proposed region, shaded in blue, for the 2020 SRF project plan.

SELECTED ALTERNATIVE

Figure 22: Proposed Project Location

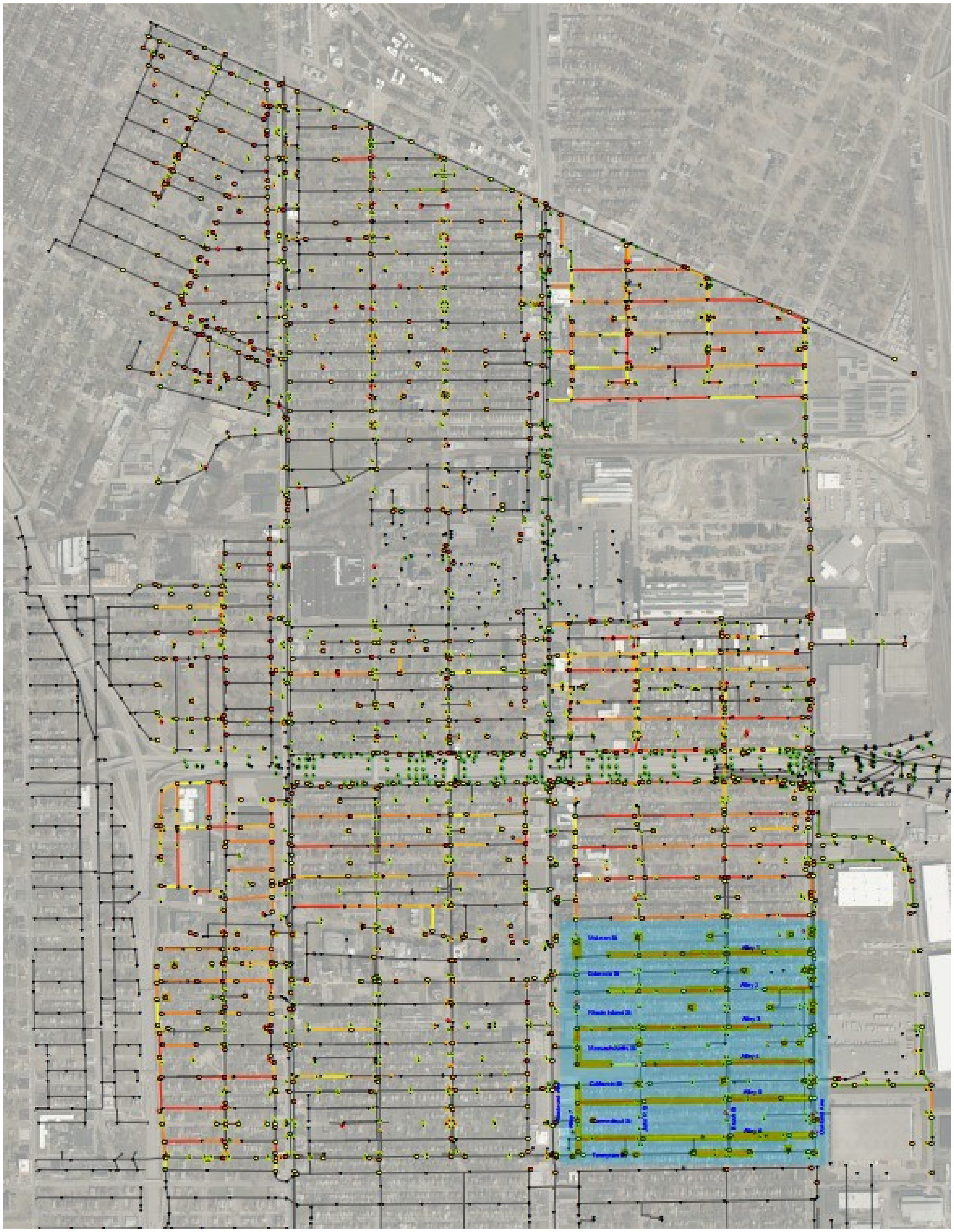
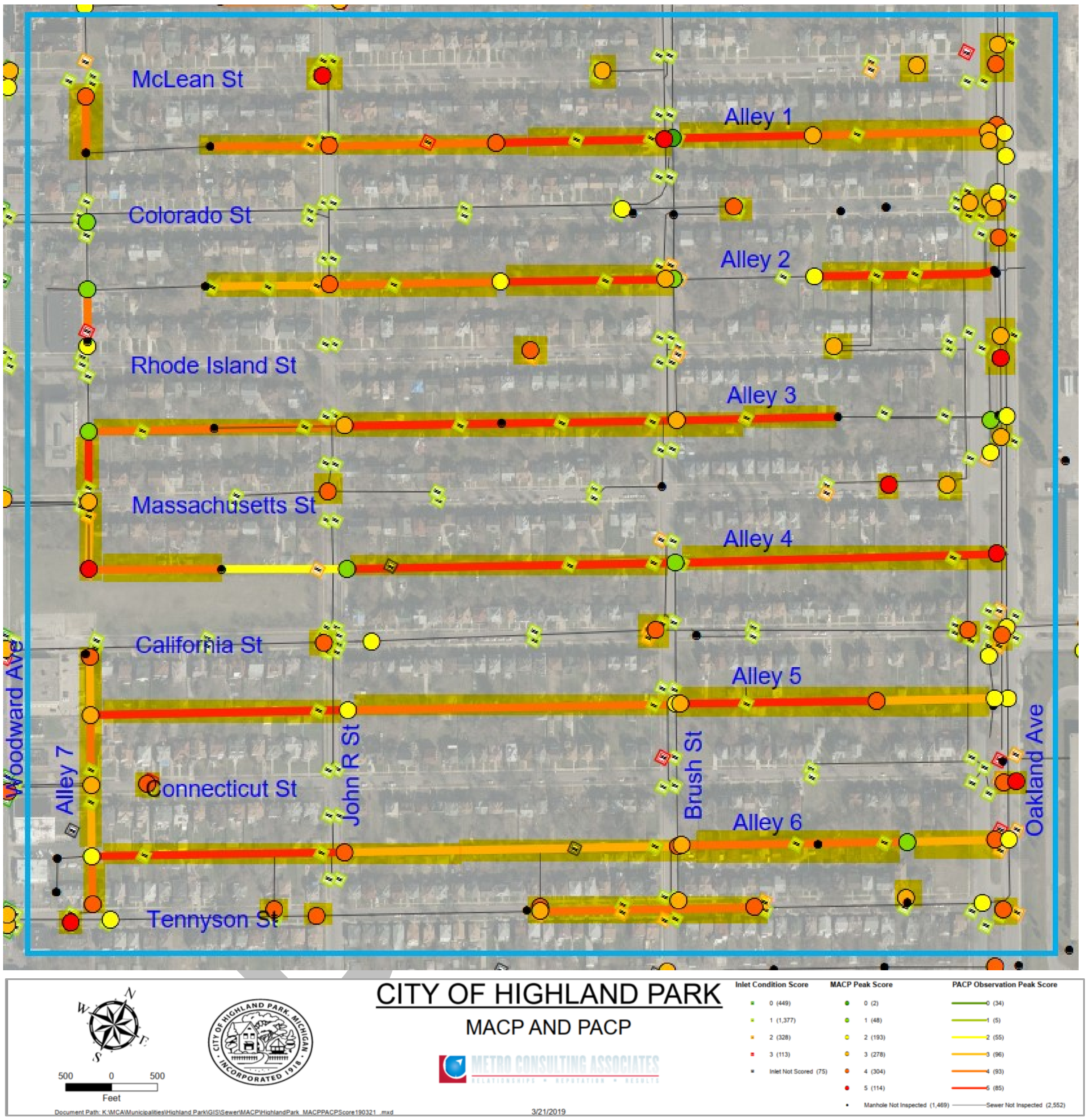


Figure 23 highlights the proposed components that have been assessed and require repairs.

Figure 23: Proposed Components to Repair or Replace



SELECTED ALTERNATIVE

3.2 DESIGN PARAMETERS

The primary intent of the project is to line roughly 2.7 miles of pipe segments with poor ratings, replace any section that is broken or collapsed, and replace 61 manhole structures that have been rated a 3 or greater. Within alleys or local roads, 111 catch basins have been determined to not have a sump or have a rating of a 3. Sewer mains will remain in the same general vicinity, for the cured-in place method lines the existing sewer pipes. Broken and collapsed segments will be repaired in the same locations using the open-cut method.

The layout of the system will remain fairly similar to the existing design. Pipe diameters should be equal to or just less than the current pipe diameter, while the depth and slope will stay consistent. Manholes will no longer be brick; instead, similarly designed precast concrete structures will be used. Catch basins no longer in compliance with the City standards will require a sump.

3.3 CONTROLLING FACTORS

The factors controlling the selected alternative and design are the condition of the current system, the budget, the line segments that have yet to be televised, and water main replacement projects.

3.4 SCHEDULE FOR DESIGN AND CONSTRUCTION

The following schedule, shown below in Table 12, is anticipated for completion of the sewer system replacement project listed in this project plan. The project is expected to be completed within the year 2020. The design stage is planned to begin in August, while all permits are anticipated to be submitted by the end of February. Bidding and award will be completed by the end of April, which leaves construction as the final step beginning in May and ending around December.

Table 12: Design and Construction Schedule

Proposed Location															
Year	**2019**			**2020**											
Month	**10**	**11**	**12**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Design															
Permits															
Bidding & Award															
Construction															

3.5 COST SUMMARY

3.5.1 AUTHORITY TO IMPLEMENT THE SELECTED ALTERNATIVE

Because the City of Highland Park owns, operates, and maintains the sewer system throughout the City, it has all of the legal and institutional resources necessary to plan, design, construct, and operate the proposed sewer system improvements. The City will assess both user rates and mileage to finance bond payments for the bonding period of 30 years. All necessary agreements and ordinances will be submitted to the MDEQ for review.

3.5.2 USER COSTS

The Water Department has determined a rough cost estimate for the project to be $2.5 million. Of this, the City will rely on coordination with the City's departments and other funding sources to determine the total amount borrowed. Below, in Table 13, the total project cost and user rates are estimated.

Table 13: 2020 SRF Project Cost

Sewer Rate Assumptions	FY2020	FY2021
Cost of Sewer Loan		$ 2,500,000
Sewer Loan Costs (assuming interest rate of 2.0% over 30 years)		$ 110,886
Projected Number of Metered Customers	2,943	3,090
Projected GLWA Sewer Costs	$ 4,751,041	$ 4,450,000

Sewer Rates	FY2020	FY2021
Sewer Readiness to Serve Charge (based on meter size)		
5/8"	$ 4.13	$ 4.98
3/4"	$ 6.20	$ 7.47
1"	$ 10.33	$ 12.45
1-1/2"	$ 20.65	$ 24.90
2"	$ 33.04	$ 39.84
3"	$ 66.08	$ 79.68
4"	$ 103.25	$ 124.50
6"	$ 206.50	$ 249.00
8"	$ 578.20	$ 697.20
10"	$ 867.30	$ 1,045.80
12"	$ 1,094.45	$ 1,319.70
Sewer Rate	$ 3.73	$ 3.83
Stormwater/Drainage Rate per acre	$ 346.78	$ 356.08

Assumptions:

1. Assumes increased metered customers at growth rate of 5% per year

2. Decrease in GLWA Sewer Costs related to decreased GLWA Water charges resulting from improvements made to water infrastructure.

3. Stormwater/Drainage Rate per acre reflects the charges for wet weather sewer runoff. This rate is charged to all customers based on the acreage of their parcel.

3.5.3 DISADVANTAGED COMMUNITY

The City of Highland Park is applying to the SRF as a disadvantaged community. A completed Disadvantaged Community Status Determination Worksheet is included in Appendix 6. It appears that the City meets the disadvantaged criterial as spelled out in the guidance document.

3.5.4 USEFUL LIFE

This section will be completed in future drafts.

4 ENVIRONMENTAL IMPACTS EVALUATION

4.1 DIRECT IMPACTS

4.1.1 EFFECTS ON HISTORICAL/ ARCHEOLOGICAL/ CULTURAL RESOURCES

The State Historical Preservation Officer, Tribal Historic Preservation Offices, Local Historic societies, and local and regional planning agencies will be contacted to verify that there are not historical or archeological sites being affected by the construction of these projects.

In the event that Native American remains or artifacts are discovered in the project area during construction, the tribal bands will be contacted prior to continuing construction.

4.1.2 EFFECTS ON EXISTING WATER QUALITY

The projects featured in this project plan will have no impact on surface water quality within the project area.

4.1.3 EFFECTS ON AIR QUALITY

Dust control methods, such as watering and street sweeping, will be utilized to keep dust to a minimum. All haul roads and public roadways will be swept daily and maintained to assure adequate dust control.

4.1.4 SOCIOECONOMIC CHANGES

The alternatives will provide benefit to the cultural environment in Highland Park. By upgrading the infrastructure, the City will have a system that has better reliability and affordable system demands. The risk of flooding from frequent clogs or breaks will also be reduced with the replacement projects. This can attract new development in Highland Park, which can help the City excel.

4.1.5 EFFECTS ON NATURAL HABITAT

Letters have been sent to the United States Fish and Wildlife Service and the Michigan Natural Features Inventory for their input regarding threatened and endangered species in the area. According to the US Fish and Wildlife Service's mapping system, there are no critical habitats for threatened or endangered species located within Highland Park. There are also no conservation easements present per the National Conservation Easement Database. Maps of these areas are included in the "*Environmental Conditions*" section above.

4.1.6 AESTHETIC CONCERNS

The aesthetics of the community will be largely unaffected by the proposed projects. However, in the areas where open cut construction occurs, sidewalks and streets will be restored to existing or better conditions.

4.1.7 FOSTERING OF COMMUNITY GROWTH

With improving the community's sewer system, the City of Highland Park will have an increase in sewer reliability and efficiency. Along with combined sewer replacements, parts of the roadways and sidewalks will be improved as well, having a positive impact on the aesthetics of the City's infrastructure. This will improve the appeal to future landowners and residents, encouraging the population to increase. The City has a goal to "Return to Excellence," and by replacing the failing parts of the system, the City can achieve this objective, which will lead to growth in the community.

4.2 INDIRECT IMPACTS

4.2.1 DEVELOPMENT CHANGES IN THE STUDY AREA

This project plan is to serve the level of development and population that existed when the sewer system was first designed and constructed. All included projects are to replace existing facilities resulting in no changes to development or land use. However, because the existing infrastructure was designed for a greater population, this will allow capacity for significant new development in the City.

4.2.2 LAND USE CHANGES

The proposed sewer main replacements included in this project plan take place primarily in residential areas. The entire City is a developed urban landscape. There are no anticipated impacts to the existing land usage or zoning at this time. Areas where construction is taking place will be restored to match or improve preconstruction conditions.

In the case that a sidewalk ramp will be affected, the ramp will be replaced with an American Disabilities Act (ADA) approved ramp.

4.2.3 CHANGES IN AIR OR WATER QUALITY DUE TO ENVIRONMENT

The proposed project alternatives will not impact the present air quality, ground water quality, or surface water quality negatively.

4.2.4 CHANGES IN NATURAL HABITATS

Since the City of Highland Park is a heavily urbanized area, and the project only proposes replacement of existing infrastructure with no new additions, it is not anticipated that any natural habitats will be affected by this project.

4.2.5 IMPACTS ON CULTURAL/ HISOTRICAL RESOURCES

There should be no impact on the City master plan, zoning, or ordinances.

4.2.6 AESTHEIC CONCERNS

The aesthetics of the community will be largely unaffected by the proposed projects. However, in the areas where open cut construction occurs, sidewalks, alleys, and streets will be restored to existing or better conditions.

4.2.7 RESOURCE CONSUMPTION OVER THE PROJECT'S USEFUL LIFE

Currently several leaks and breakages are causing large amounts of I/I flowing into the system. After the replacements within the system, the Water Department anticipates the inflow to significantly decrease due to the repair of leakage. Reduction of I/I will have a positive impact on user rates, which should further help the City finance this project.

4.3 CUMULATIVE IMPACTS

4.3.1 INCREASED POPULATION GROWTH AND DEVELOPMENT IMPACTS

As noted above, with improving the community's sewer system, the City of Highland Park will have an increase in reliability. Along with sewer system replacements, parts of the roadways and sidewalks will be improved as well, having a positive impact on the aesthetics of the City's infrastructure. This will improve the appeal to future landowners and residents, encouraging the population to increase. The City has a goal to "return to excellence," and by replacing the failing parts of the system, the City can achieve this objective, which will lead to growth in the community.

5 MITIGATION MEASURES

5.1 STRUCTURAL MEASURES

It will be necessary to mitigate direct impacts during construction. This will be accomplished through definition of construction hail routes and public notification regarding proposed construction activities.

Mitigation of short-term impacts include controlling noise through adherence to local noise ordinances, which specify permitted work hours for constriction activity; restricting dust from construction with dust controlling agents; improving safety and security by defining traffic and construction activities; and limiting the construction site access.

Soil erosion permits will be obtained, and erosion control measures will be maintained in good condition throughout the duration of construction activities. All areas will be permanently restored as soon as possible once the task is completed.

Archaeological finds are not anticipated during construction; however, any discoveries during construction will be immediately investigated, and the proper authorities will be contacted prior to continuing construction.

The decisions regarding specific construction methods will be made during the design phase of the project.

5.2 NON-STRUCTURAL MEASURES

The planned projects are not anticipated to impact any institutional, governmental, or private plans, policies, or regulations, or phasing of any facilities. There is no irreversible commitment of resources nor permanent damage to sensitive environments.

6 PUBLIC PARTICIPATION

6.1 PUBLIC MEETINGS ON PROJECT ALTERNATIVES

Two public hearings are scheduled for May 20th and June 3rd. This section will be completed after the public hearings pass.

6.2 THE FORMAL PUBLIC HEARING

6.2.1 PUBLIC HEARING ADVERTISEMENT

The plan is to request for public hearing notice around April 4th to the City Clerk. The meetings are currently scheduled for May 20th and June 3rd. This section will be completed after the public hearings pass.

6.2.2 PUBLIC HEARING TRANSCRIPT

Two public hearings are scheduled for May 20th and June 3rd. A verbatim transcript will be recorded by a court reported or transcribed by a stenographer. The transcript will include comments from the public. This section will be completed after the public hearings pass.

6.2.3 PUBLIC HEARING CONTENTS

Two public hearings are scheduled for May 20th and June 3rd. The discussing will include a description of the problems involving the sewer system and the principal alternatives considered, of the recommended alternative and the cost breakdown, of the project financing and user costs, and of the anticipated social and environmental impacts associated with the project. This section will be completed after the public hearings pass.

6.2.4 COMMENTS RECEIVED AND ANSWERED

Two public hearings are scheduled for May 20th and June 3rd. A typed list of the names and addresses of the attendees will be provided in the Appendix, as well as a copy of any written comments and the responses. Any changes that were made will be described. This section will be completed after the public hearings pass.

6.3 ADOPTION OF THE PROJECT PLAN

The adoption of the Project Plan is scheduled for June 17th.

APPENDICES

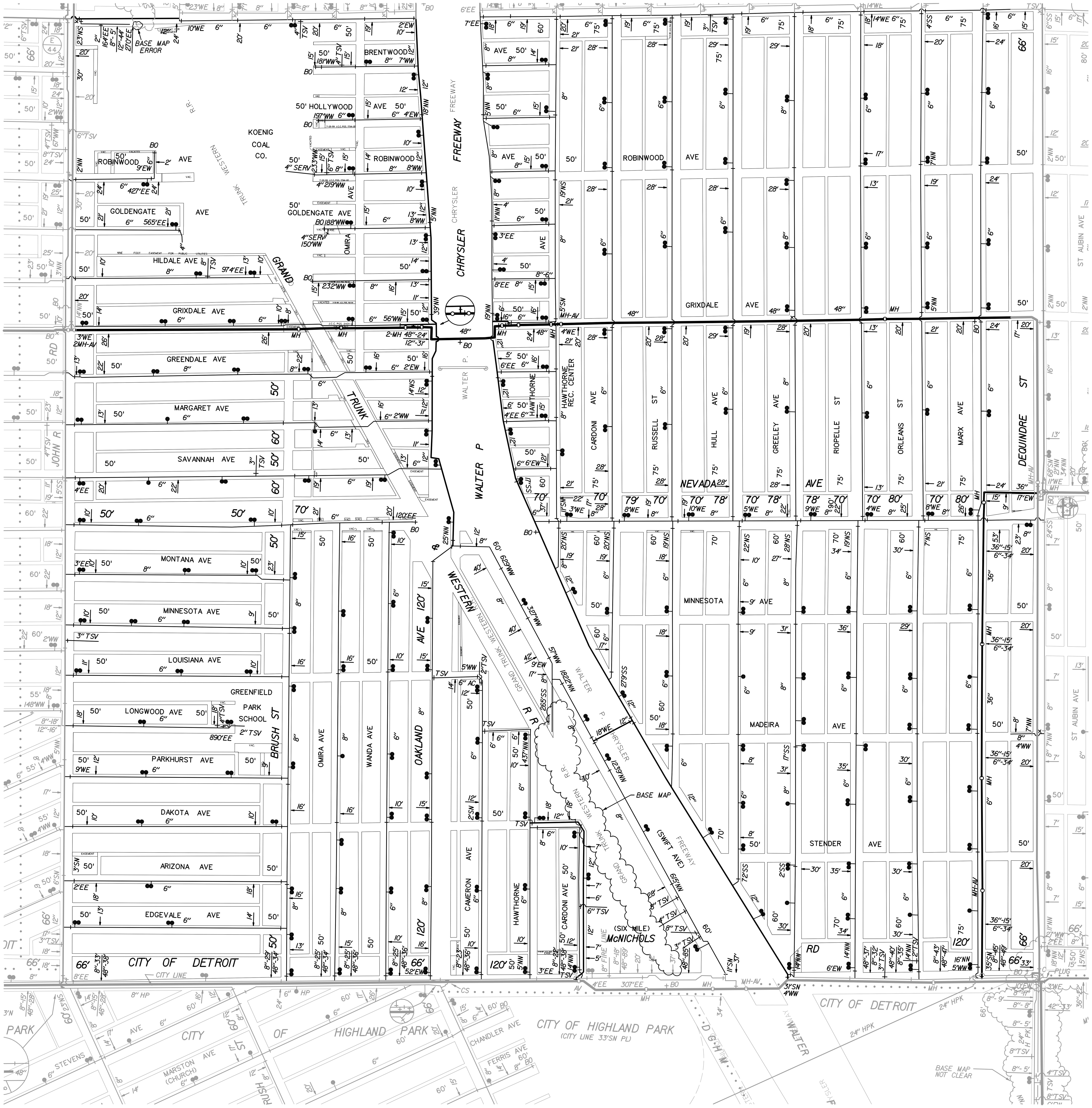
APPENDIX 1
SEWER CONNECTION MAPS PROVIDED BY DWSD

20-R

20-Q

19-Q

21-Q



20-P 21-P

WATER MAP

CITY OF DETROIT

SCALE: 1" = 300'
0 300 600

DWSD SEC. MAP NUMBER: 20-Q

NOTES:

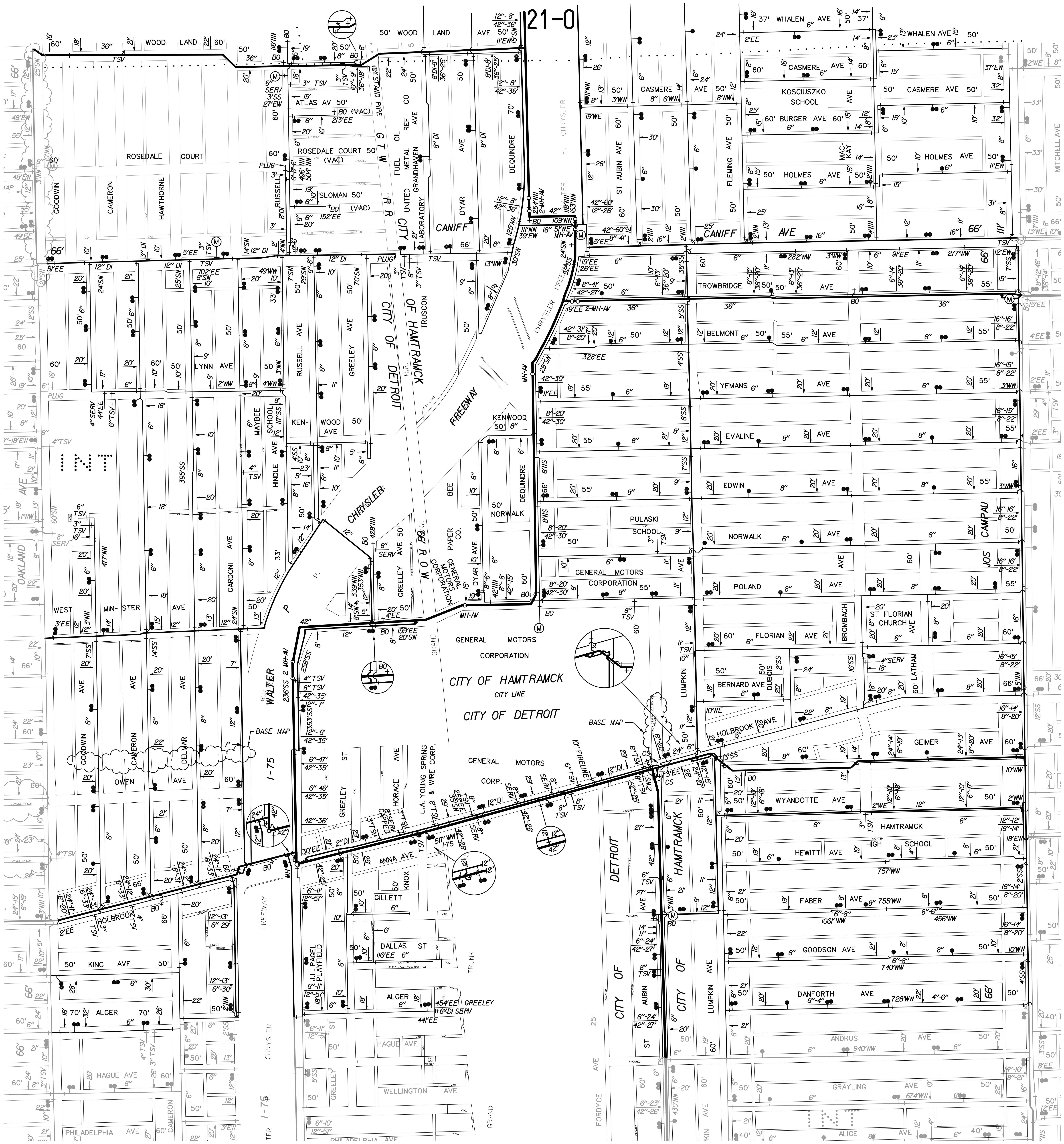
NAME	DATE
DIGITIZED BY: CEA, INC.	09-25-96
CHECKED BY: DWSD	09-25-96
LOG	
REVISED THRU:	
PRINT DATE:	12-7-98

NORTH

STATE PLANE

21-O

21-N



20-N

22-N

21-M

WATER & SEWERAGE DETROIT DEPT.

WATER MAP

CITY OF DETROIT

SCALE: 1" = 300'

0 300 600

DWSD SEC. MAP NUMBER:

21-N

NOTES:

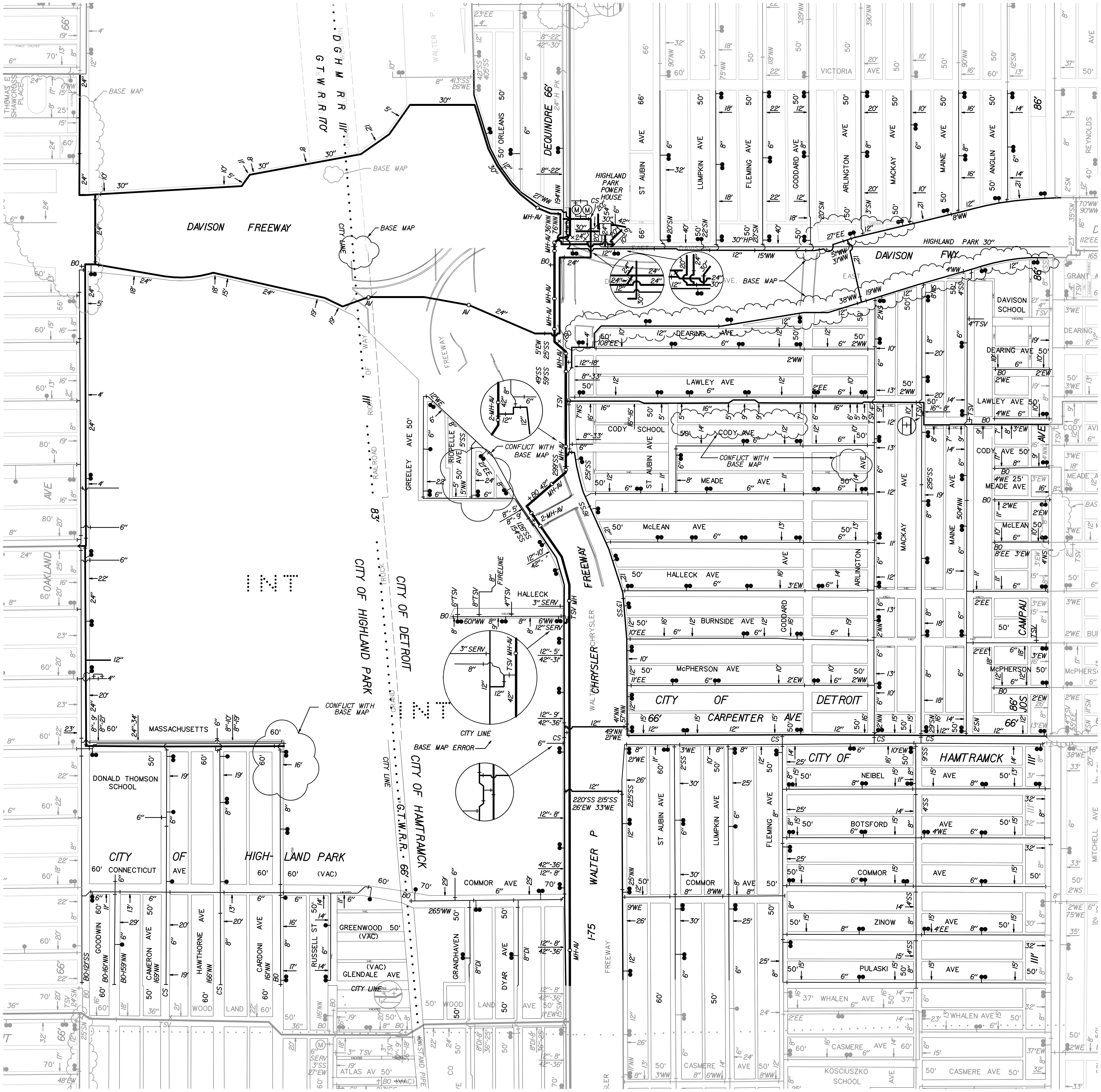
NAME	DATE
DIGITIZED BY: CEA, INC.	10-21-96
CHECKED BY: DWSD	10-21-96
LOG	
REVISED THRU:	
PRINT DATE:	12-12-98

NORTH

STATE PLANE

21-P 21-O

20-O 22-O



21-N

WATER MAP	CITY OF DETROIT
SCALE: 1" = 300' (0 300 600)	DWSD SEC. MAP NUMBER: 21-O

NOTES:

NAME	DATE
DIGITIZED BY: CEA, INC.	10-15-96
CHECKED BY: DWSD	10-15-96
LOG	
REVISED THRU:	
PRINT DATE:	12-12-98

NORTH

STATE PLANE

20-Q 21-Q 21-P

20-P 20-O 22-O

21-O

WATER & SEWERAGE DETROIT DEPT.

WATER MAP	CITY OF DETROIT
SCALE: 1" = 300' (0 300 600)	DWSD SEC. MAP NUMBER: 21-P

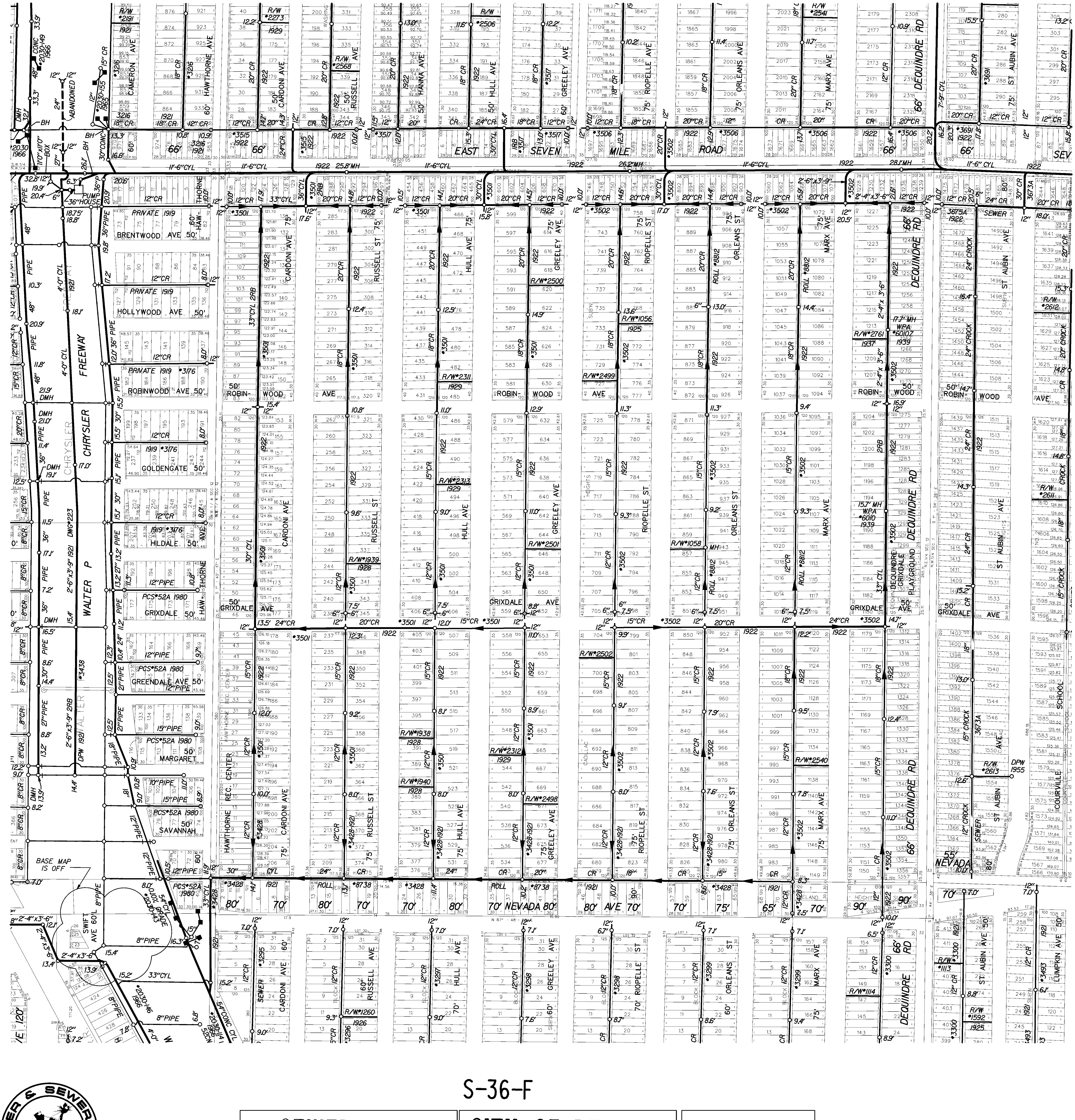
NOTES:

NAME	DATE
DIGITIZED BY: CEA, INC.	11-12-96
CHECKED BY: DWSD	11-12-96
LOG	
REVISED THRU:	
PRINT DATE:	12-12-98

NORTH

STATE PLANE

S-36-B



S-45-C

S-36-F

WATER & SEWERAGE DEPT. DETROIT

SEWER MAP	CITY OF DETROIT
SCALE: 1" = 200' (0, 200, 400)	DWSD SEC. MAP NUMBER: S-36-A
NOTES:	

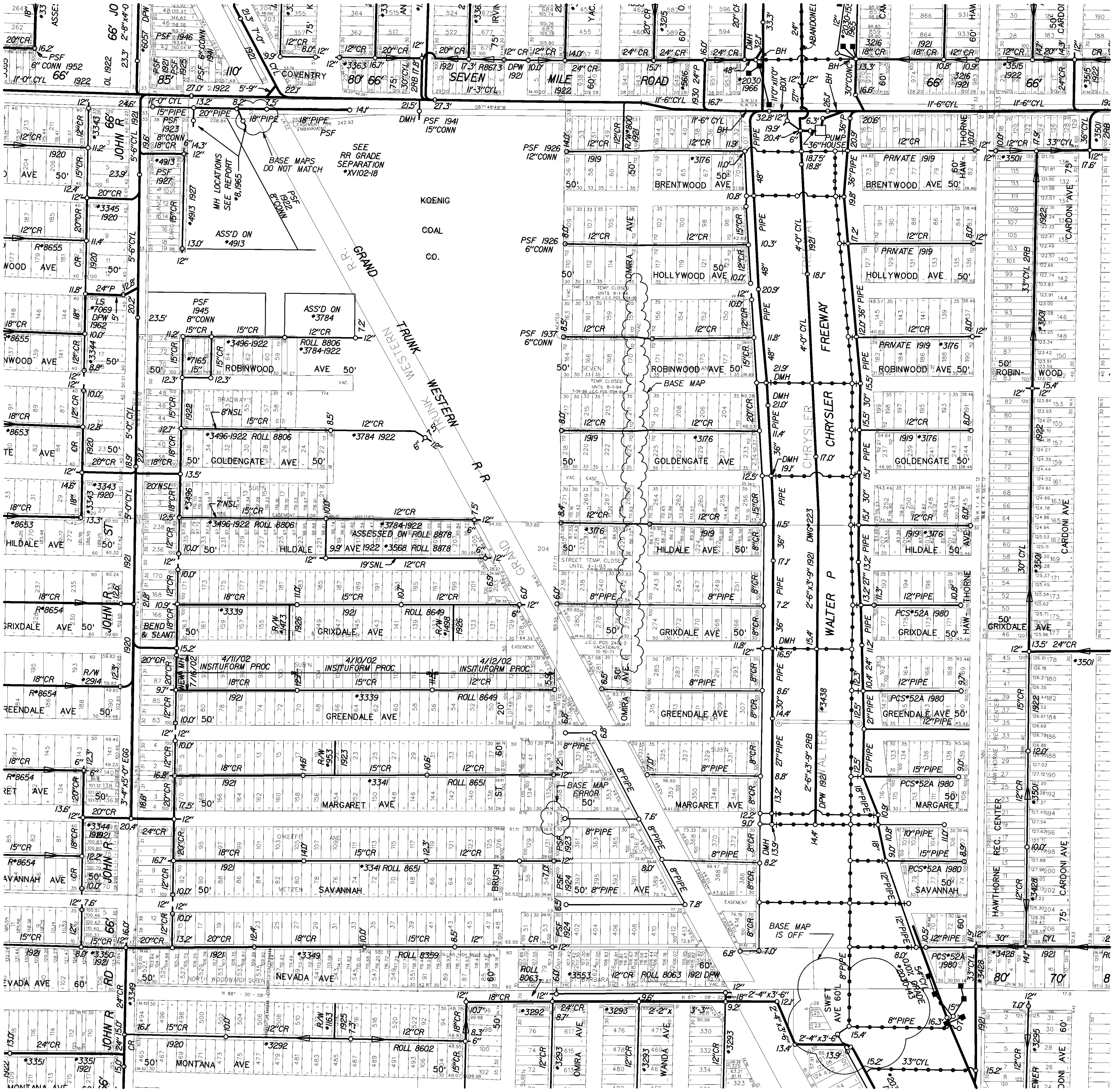
NAME	DATE
DIGITIZED BY: CEA, INC.	04-25-96
CHECKED BY: DWSD	04-25-96
LOG	
REVISED THRU:	12-31-03
PRINT DATE:	02-25-99

NORTH

STATE PLANE

S-37-E

S-36-C



S-36-A

S-36-E

SEWER MAP	CITY OF DETROIT
SCALE: 1" = 200' (0, 200, 400)	DWSD SEC. MAP NUMBER: S-36-B

NOTES:

NAME	DATE
DIGITIZED BY: CEA, INC.	08-26-96
CHECKED BY: DWSD	08-26-96
LOG	
REVISED THRU:	
PRINT DATE:	02-25-99

NORTH

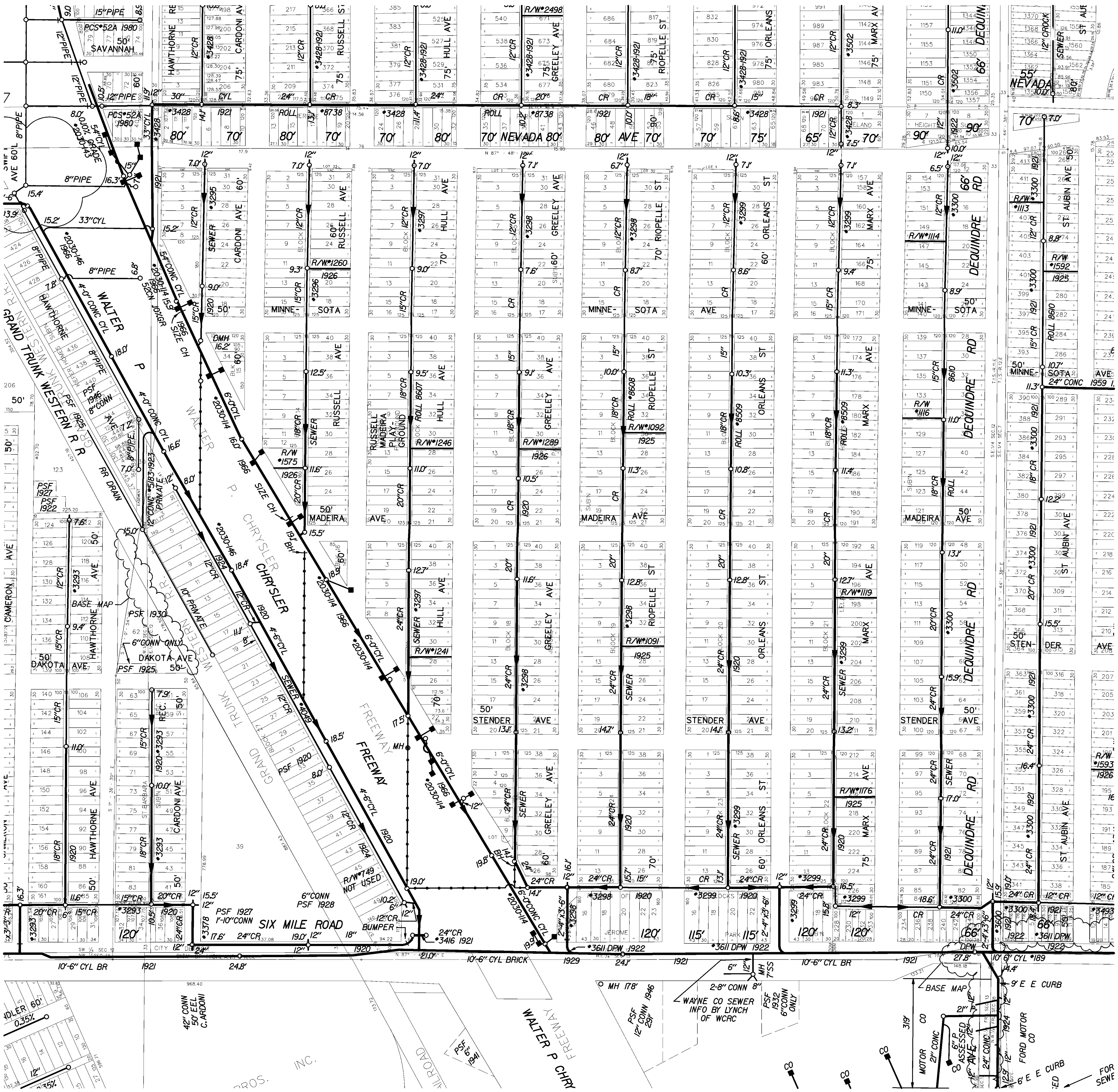
STATE PLANE

S-36-A

S-36-F

S-36-E

S-45-D



S-44-C

WATER & SEWERAGE DEPT. DETROIT

SEWER MAP	CITY OF DETROIT
SCALE: 1" = 200' (0, 200, 400)	DWSD SEC. MAP NUMBER: S-36-F
NOTES:	

NAME	DATE
DIGITIZED BY: CEA, INC.	08-26-96
CHECKED BY: DWSD	08-26-96
LOG	
REVISED THRU:	12-31-03
PRINT DATE:	02-25-99

NORTH

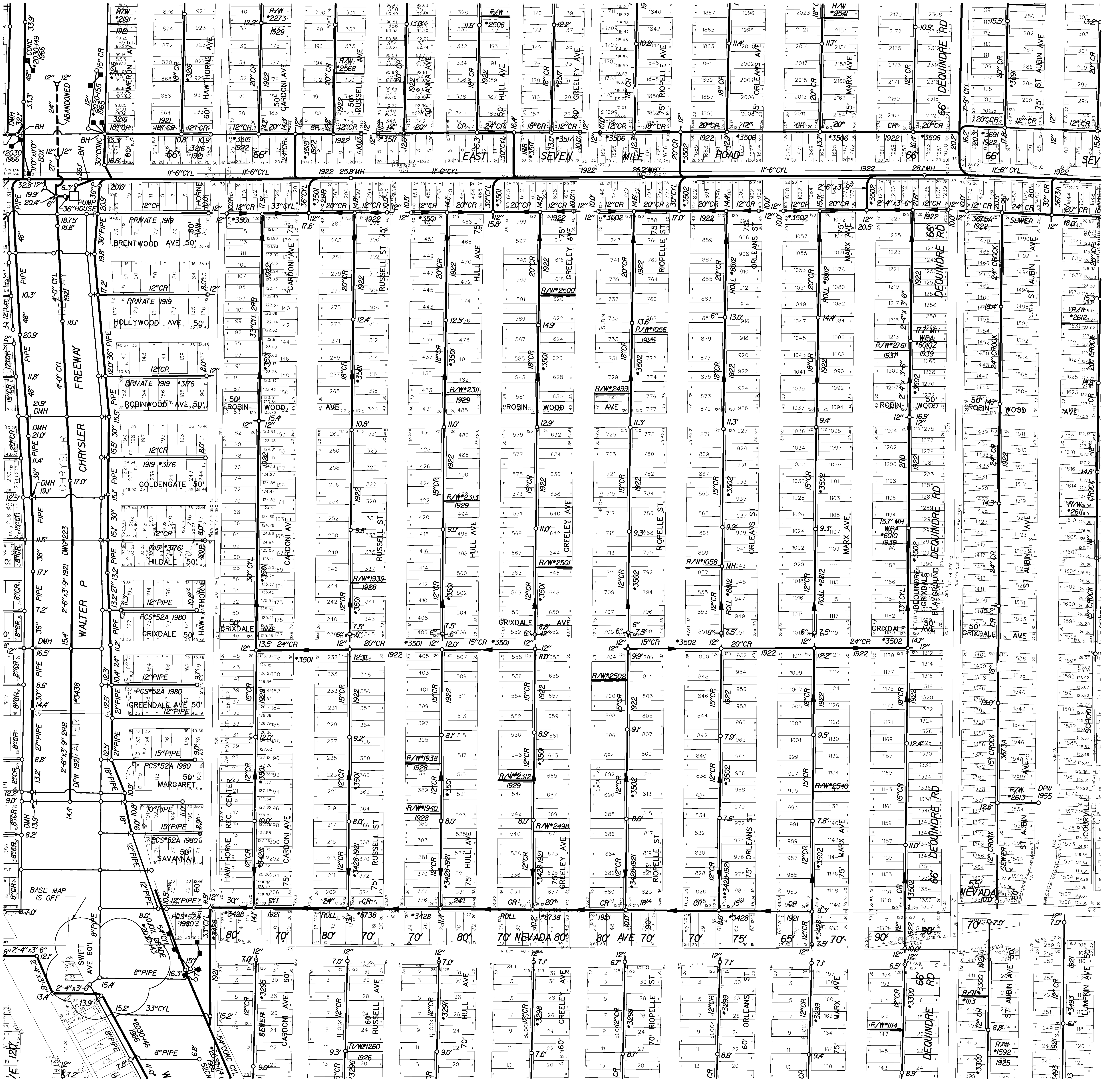
STATE PLANE

S-37-F

S-36-A

S-36-B

S-45-C



S-36-F

WATER & SEWERAGE DEPT. DETROIT

SEWER MAP	CITY OF DETROIT
SCALE: 1" = 200' (0, 200, 400)	DWSD SEC. MAP NUMBER: S-36-A

NOTES:

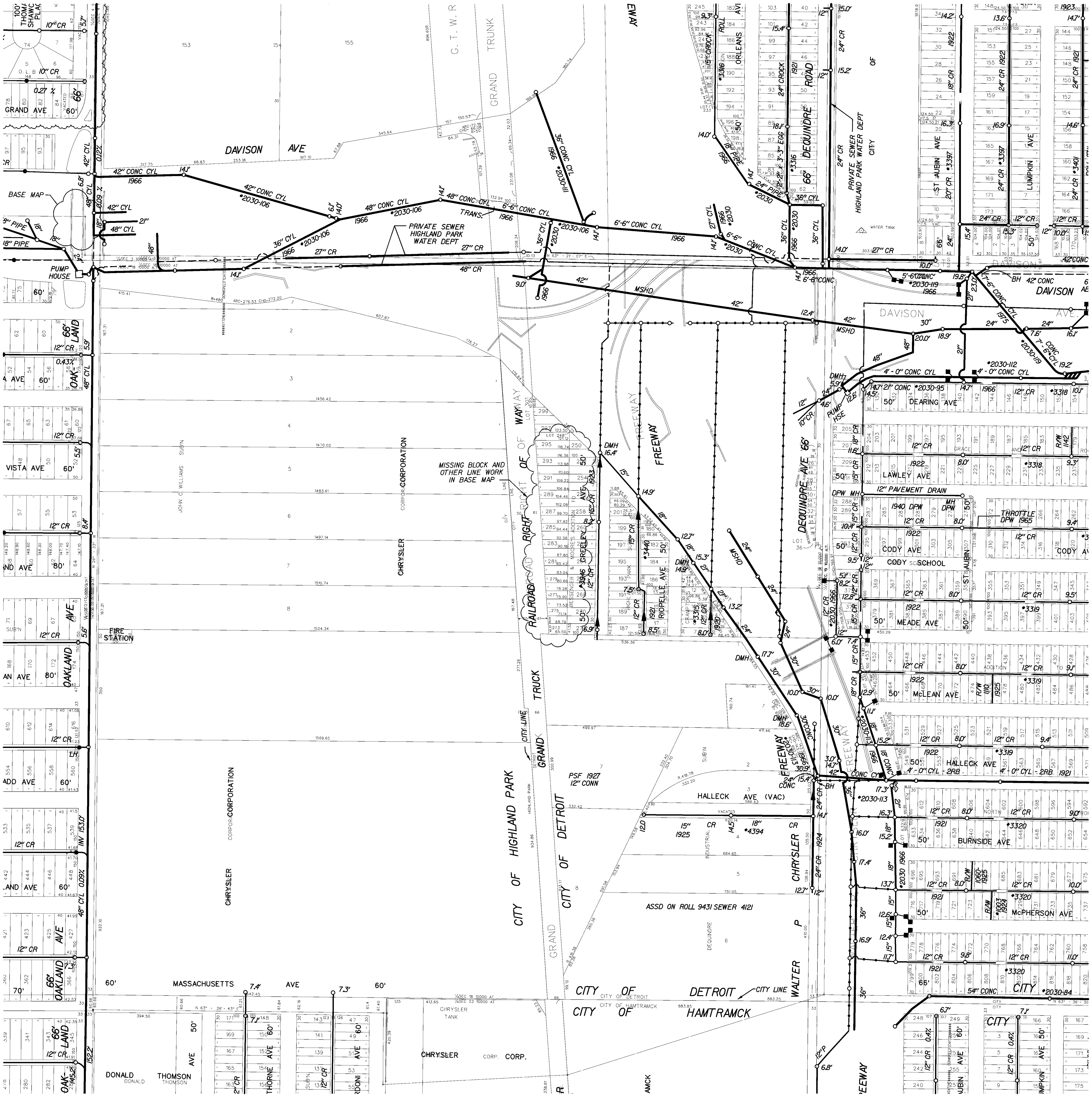
NAME	DATE
DIGITIZED BY: CEA, INC.	04-25-96
CHECKED BY: DWSD	04-25-96
LOG	
REVISED THRU:	12-31-03
PRINT DATE:	02-25-99

NORTH

STATE PLANE

S-44-D S-43-C

S-33-A



S-43-B

S-43-D

WATER & SEWERAGE DETROIT DEPT.

SEWER MAP	CITY OF DETROIT
SCALE: 1" = 200' (0 200 400)	DWSD SEC. MAP NUMBER: S-43-C
REVISED THRU: 12-31-03	

	DATE
DIGITIZED BY: CEA. INC.	
E. LEWIS	03-01-96
M. A. ROBERTS SR.	11-14-96
CHECKED BY DWSD:	
PRINT DATE:	02-25-00

NORTH

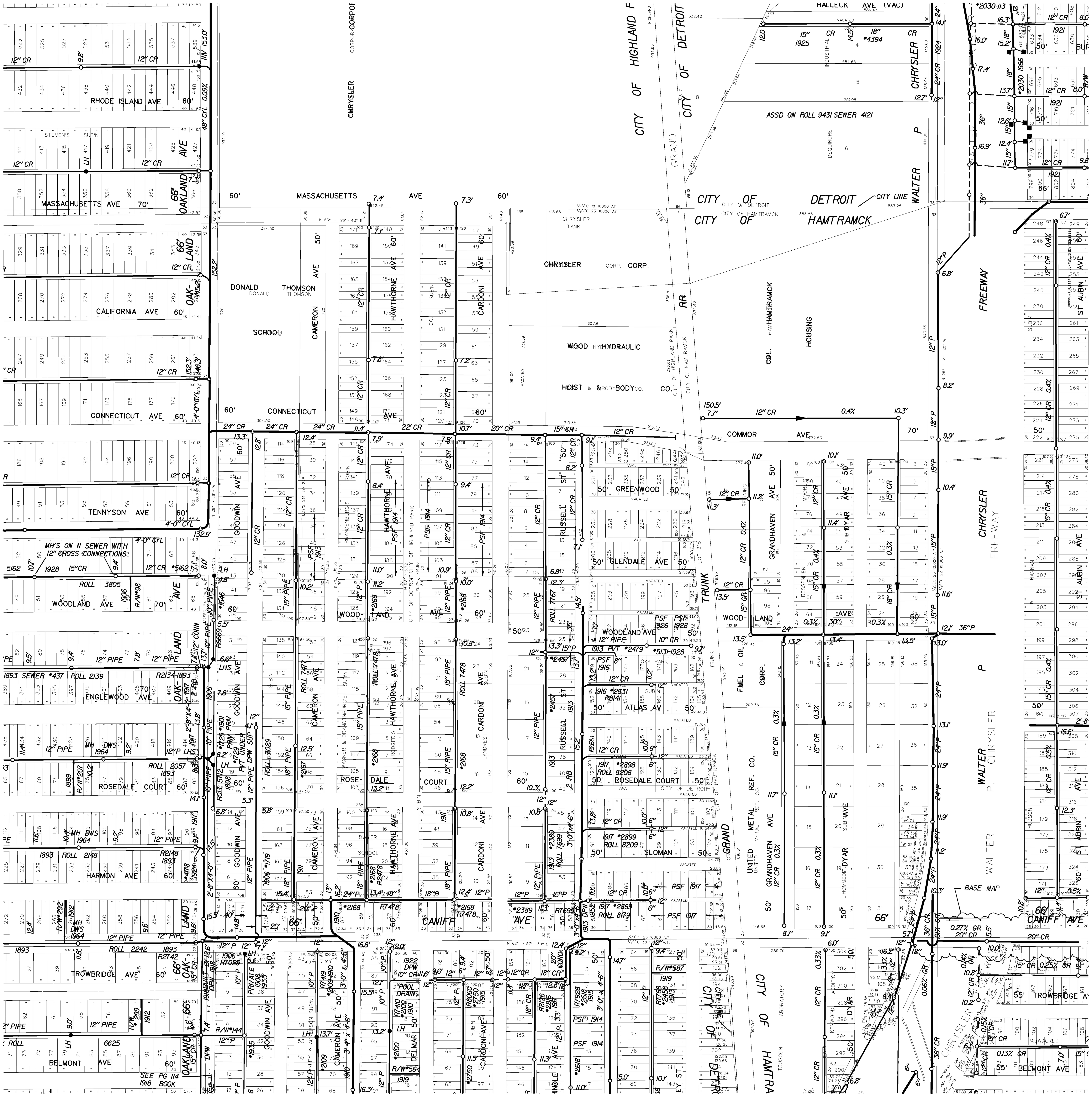
STATE PLANE

S-43-C

S-43-D

S-33-F

S-43-E



S-42-C

WATER & SEWERAGE DEPT. DETROIT

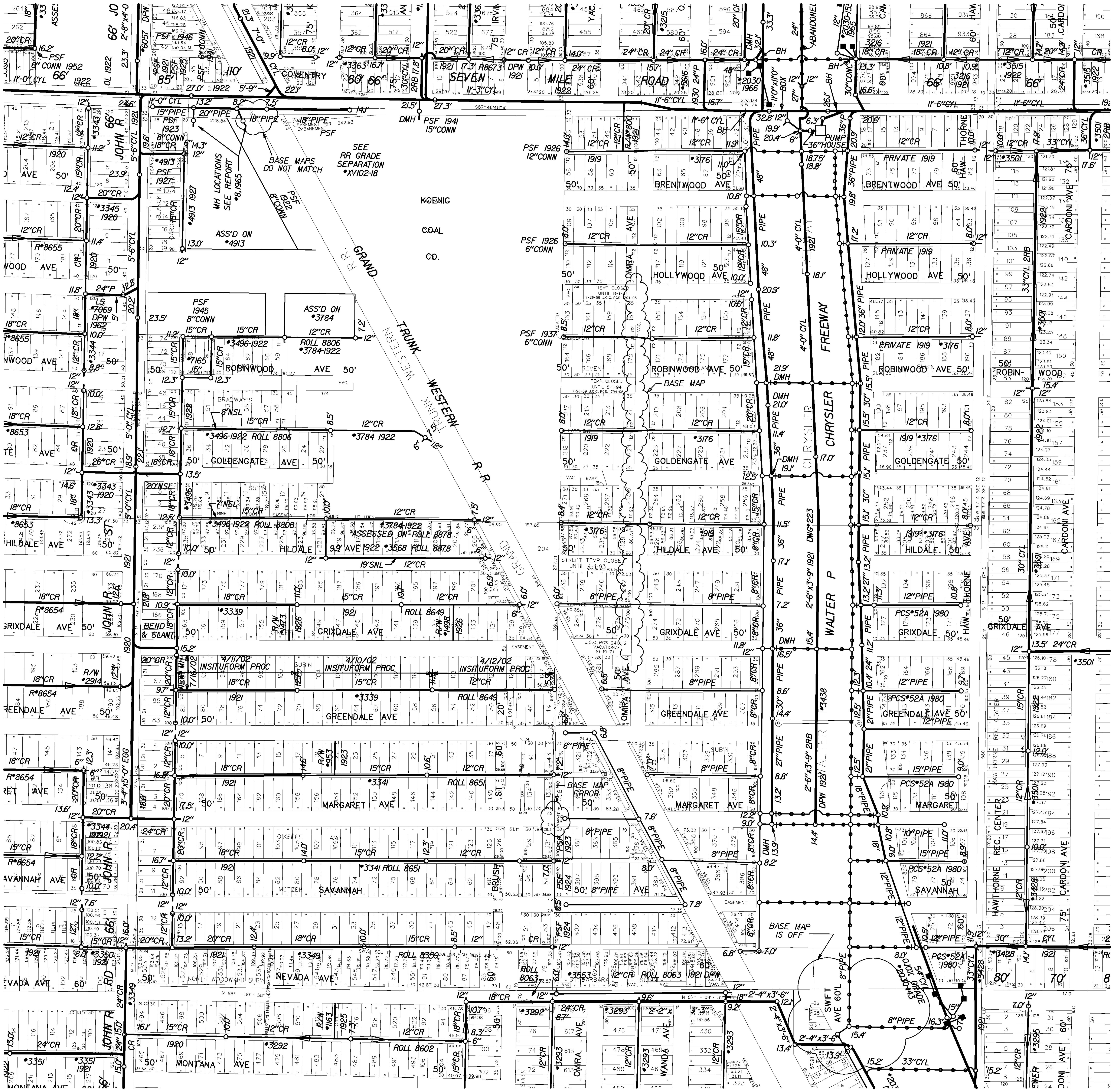
SEWER MAP	CITY OF DETROIT
SCALE: 1" = 200' (0 200 400)	DWSD SEC. MAP NUMBER: S-43-D
REVISED THRU:	

DIGITIZED BY: CEA. INC.	DATE
W. A. ROBERTS SR.	03-25-96
TODD TROUT	06-12-96
CHECKED BY DWSD:	
PRINT DATE:	9-14-00

NORTH

STATE PLANE

S-36-C



S-36-A

SEWER MAP	CITY OF DETROIT
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NOTES:	

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CHECKED BY: DWSD	08-26-96
LOG	
REVISED THRU:	
PRINT DATE:	02-25-99

NORTH

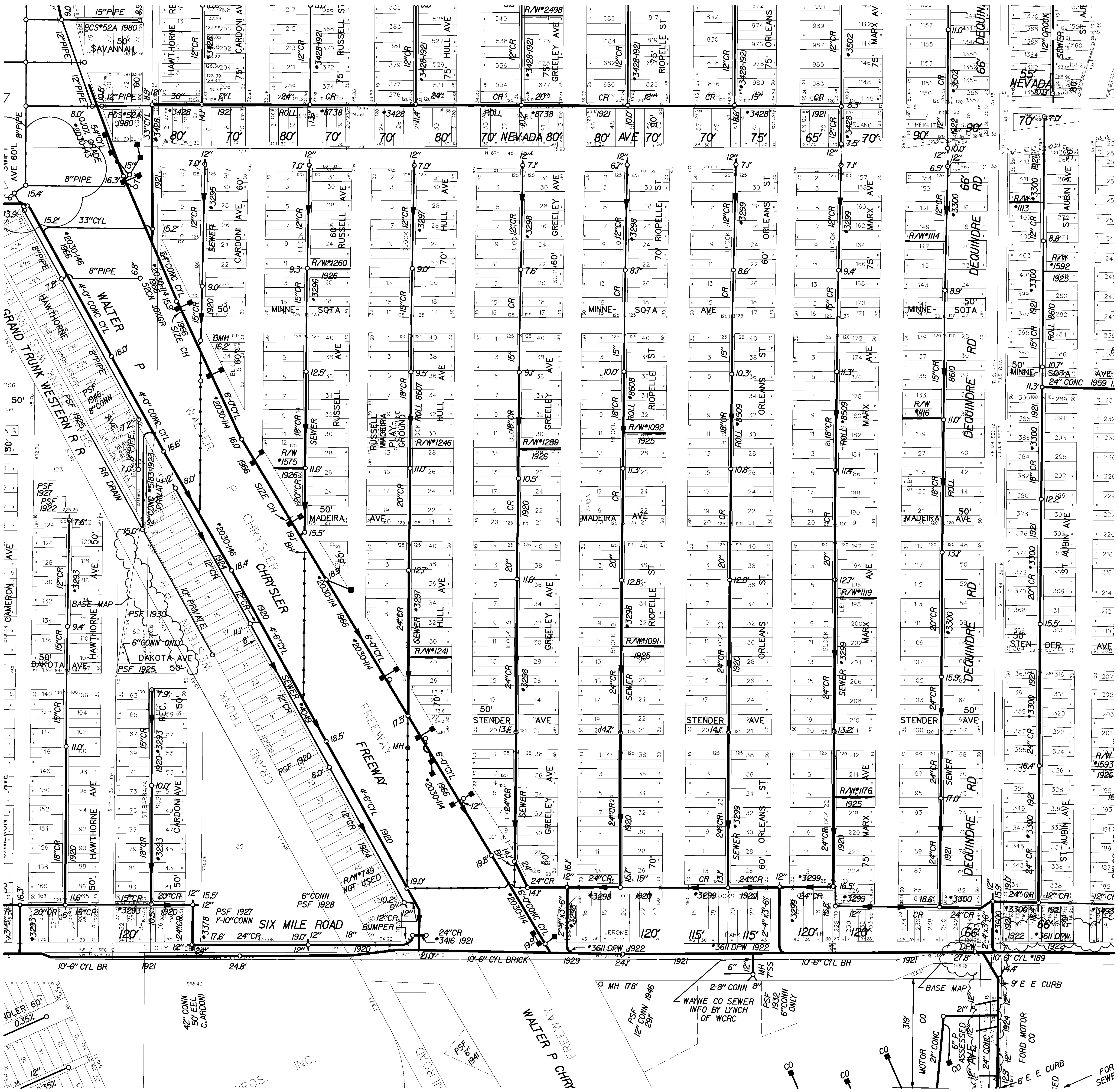
STATE PLANE

S-36-A

S-36-F

S-36-E

S-45-D



S-44-C

SEWER MAP

CITY OF DETROIT

SCALE: 1" = 200'

0 200 400

DWSD SEC. MAP NUMBER:

S-36-F

NOTES:

NAME	DATE
DIGITIZED BY: CEA, INC.	08-26-96
CHECKED BY: DWSD	08-26-96
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REVISED THRU:	12-31-03
PRINT DATE:	02-25-99

WATER & SEWERAGE DEPT. DETROIT

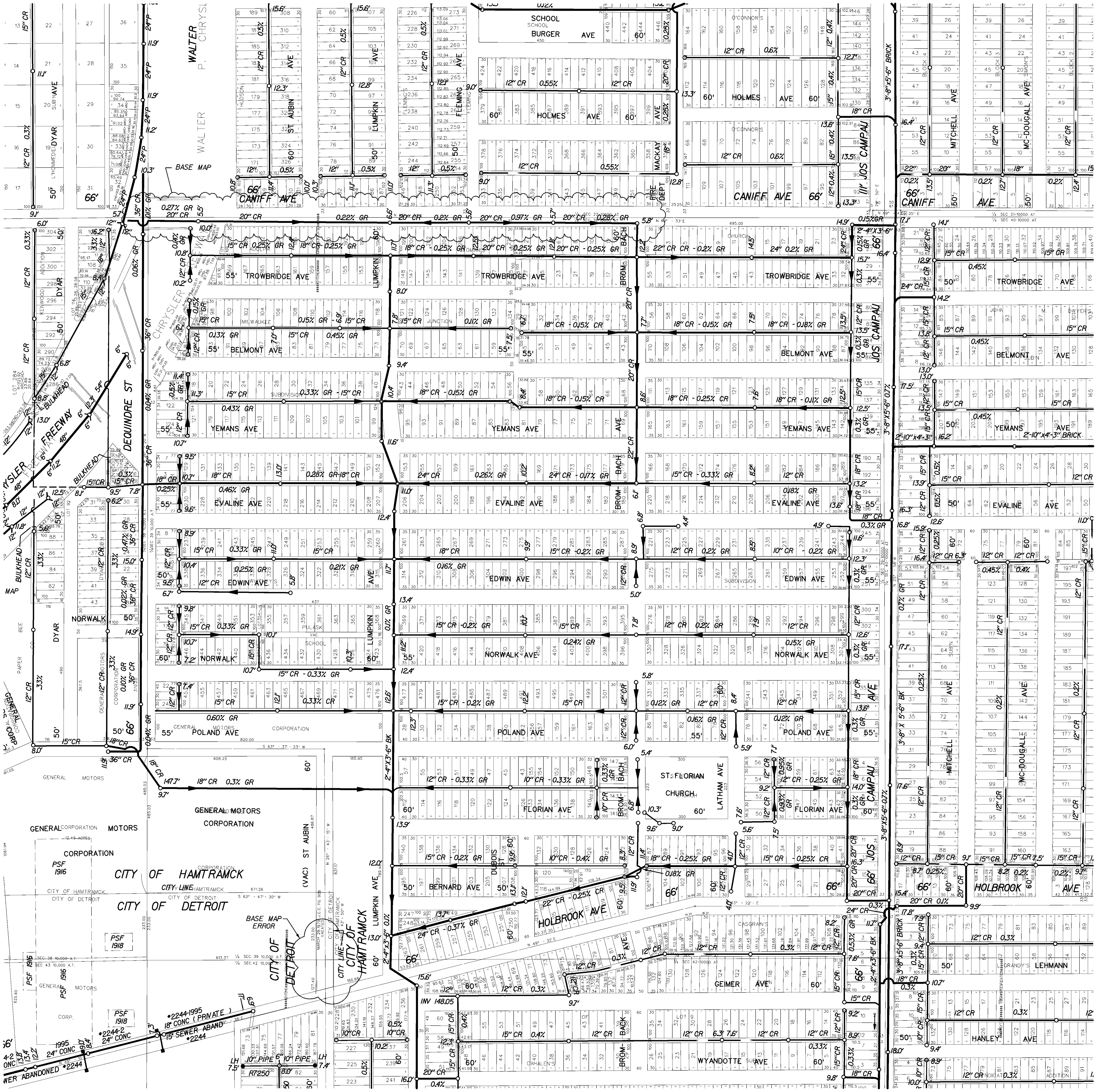
NORTH

STATE PLANE

S-43-E

S-42-B

S-42-C



S-42-A

S-42-E

WATER & SEWERAGE DEPT. DETROIT

SEWER MAP	CITY OF DETROIT
SCALE: 1" = 200' (0 200 400)	DWSD SEC. MAP NUMBER: S-42-B
REVISED THRU:	

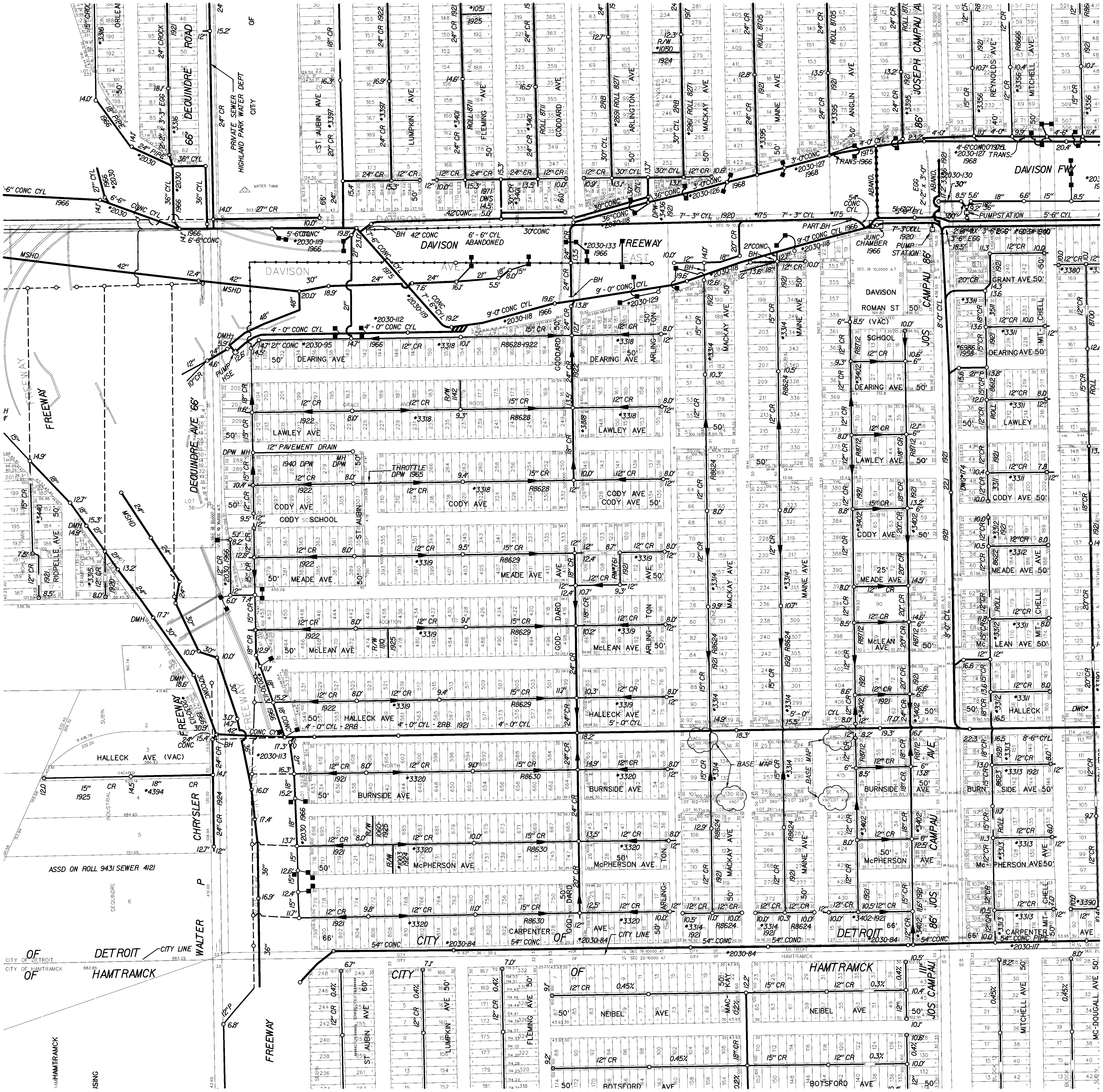
	DATE
DIGITIZED BY: CEA. INC.	01-24-96
M. A. ROBERTS SR.	03-09-96
TODD TROUT	
CHECKED BY DWSD:	
PRINT DATE:	02-25-00

NORTH

STATE PLANE

S-44-E S-43-B

S-43-C S-43-A



S-43-E

SEWER MAP	CITY OF DETROIT

SCALE: 1" = 200'
0 200 400

DWSD SEC. MAP NUMBER: S-43-B

REVISED THRU: 12-31-03

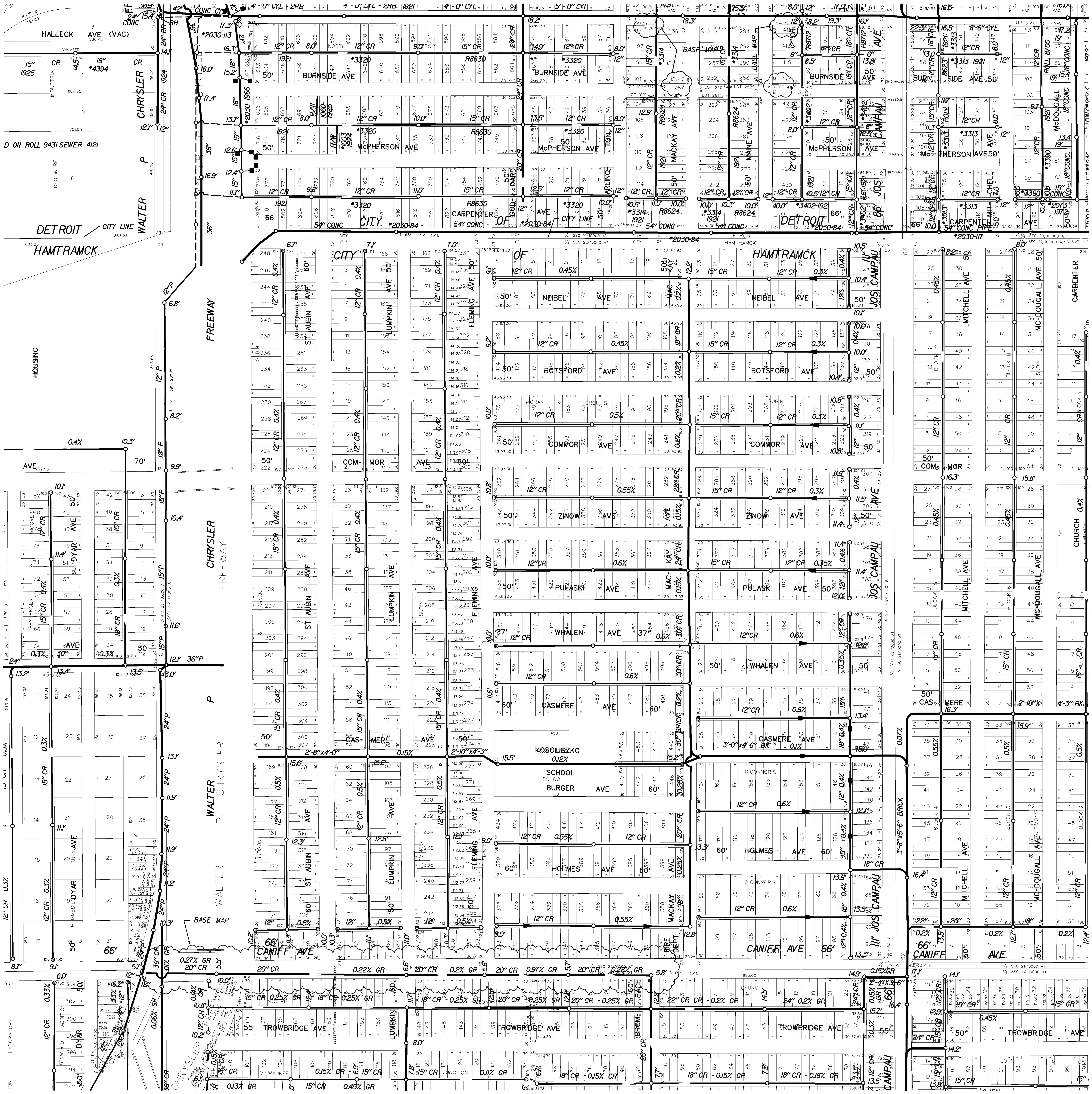
DIGITIZED BY: CEA, INC.	DATE
E. LEWIS	03-01-96
M. A. ROBERTS SR.	11-12-96
CHECKED BY DWSD:	
PRINT DATE:	02-25-00

NORTH

STATE PLANE

S-43-B S-43-E

S-43-D



S-43-F

S-42-B

SEWER MAP	CITY OF DETROIT
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REVISED THRU:	

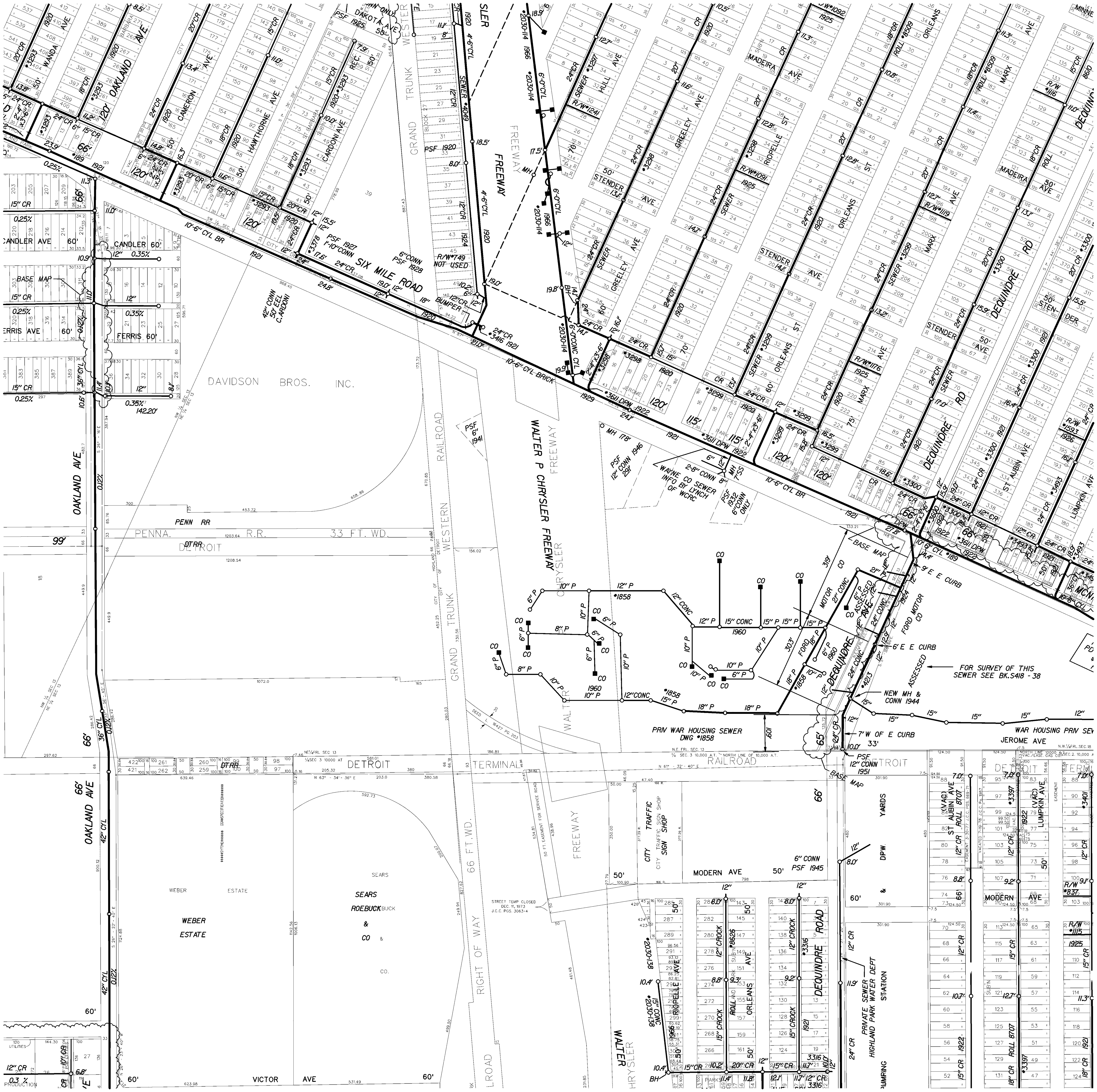
DIGITIZED BY: CEA, INC.	DATE
W. A. ROBERTS SR.	03-25-96
TODD TROUT	06-12-96
CHECKED BY DWSD:	
PRINT DATE:	02-29-00

NORTH

STATE PLANE

S-36-E S-36-F S-44-C

S-34-A



S-44-B

S-44-D

WATER & SEWERAGE DEPT. DETROIT

SEWER MAP	CITY OF DETROIT
SCALE: 1" = 200' (0 200 400)	DWSD SEC. MAP NUMBER: S-44-C
REVISED THRU: 12-31-03	

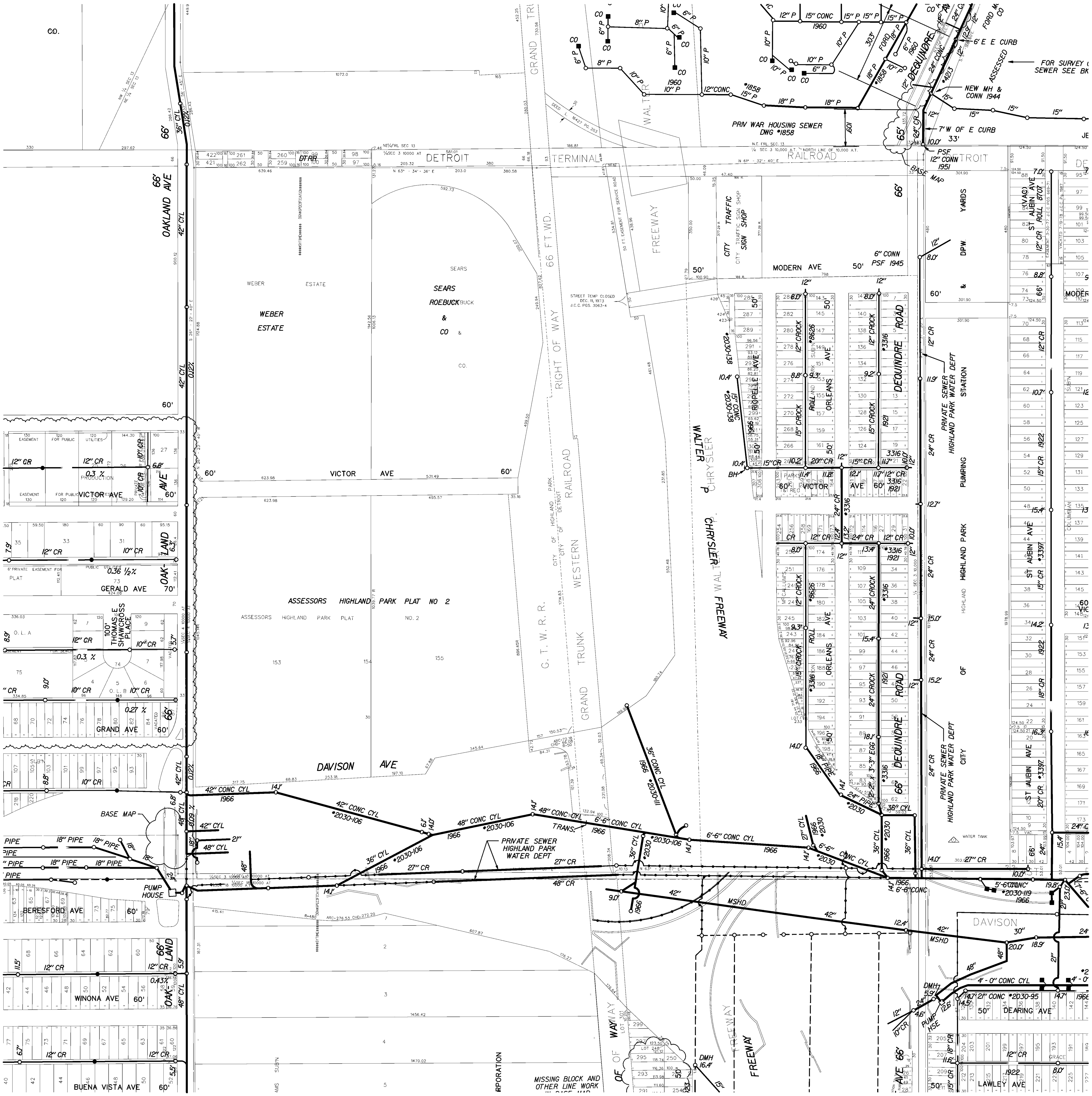
	DATE
DIGITIZED BY: CEA, INC.	
A. HASKINS II	02-02-96
TODD TROUT	10-31-96
CHECKED BY DWSD:	
PRINT DATE:	02-29-00

NORTH

STATE PLANE

S-44-C S-44-D

S-34-F



S-44-E

S-43-C

WATER & SEWERAGE DEPT. DETROIT

SEWER MAP

CITY OF DETROIT

SCALE: 1" = 200'
0 200 400

DWSD SEC. MAP NUMBER: S-44-D

REVISED THRU: 12-31-03

DIGITIZED BY: CEA, INC.	DATE
A. HASKINS II	04-08-95
M. A. ROBERTS SR. /G. AZIZ	05-20-96
CHECKED BY DWSD:	
PRINT DATE:	02-29-00

NORTH

STATE PLANE

APPENDIX 2
INVENTORY OF UNDERGROUND STORAGE TANKS IN HIGHLAND PARK

Department of Environmental Quality

Leaking Underground StorageTank

Search Results

Records 1 to 10 of 26 for Site City: Highland Park; Site Status: Closed;
Click on the Site ID for tank and release information. Click on the Site Name for GPS information.

* **Owner Details (Owner may not reflect the current owner and is not necessarily the Lust liable party. For Lust liable party information please contact the RRD district office for the given site.)**

Site ID	Site Name	Site Address	Owner Name	Owner Address
00007864	All-chem Corporation	15120 3rd St Highland Park, MI 48203 (313) 865-3600	All-Chem Corp	15120 3rd St Highland Park, MI 48203 (313) 865-3600
00005701	Amoco #0161	12551 Woodward/Glendale Highland Park, MI 48203 (228) 805-2035	Barrick Enterprises #40 LLC	4338 Delemere Ct Royal Oak, MI 48073 (313) 883-8001
00005701	Amoco Oil #0161	12551 Woodward/Glendale Highland Park, MI 48203 (228) 805-2035	Barrick Enterprises #40 LLC	4338 Delemere Ct Royal Oak, MI 48073 (313) 883-8001
00040627	Bluebird Baking Co	15135 HAMILTON AVE HIGHLAND PARK, MI 48203 314-259-7073	Sara Lee Bakery Group Inc	8400 Maryland Ave St Louis, MO 63105 314-259-7073
00019077	Chrysler Corp	12000 CHRYSLER DR HIGHLAND PARK, MI 48288 (313) 493-2486	Chrysler Group LLC	1000 Chrysler Dr Cims:481-02-27 Auburn Hills, MI 48326 (248) 512-4707
00038109	City Of Detroit Former Detroit S	MANCHESTER PKWY & SECOND AVE HIGHLAND PARK, MI 48203 (313) 252-0353	City of Highland Park	12050 Woodward Ave Highland Park, MI 48203 (313) 459-6726
00007543	Commercial Carriers M & G Convoy	15100 Oakland St Highland Park, MI 48203 (734) 258-2169	M & G Convoy Inc	E-4111 ANDOVER RD BLOOMFIELD HILLS, MI 48302 (734) 258-2169
00019327	Dairy Fresh Foods	15004 3rd Street Highland Park, MI 48203 (313) 961-3072	New Center Community Mental Health Services	2051 W Grand Blvd Detroit, MI 48208 (313) 961-3072
00008153	Eastown Distribtors	14400 Oakland St Highland Park, MI 48203 (313) 867-6900	Eastown Distributors Company	14400 Oakland Ave. Highland Park, MI 48203 (313) 867-6900
00010489	Fast Lane Gas Inc	12803 Hamilton Ave Highland Park, MI 48203 (313) 520-0056	Citgo Fuel	12803 Hamilton St Highland Park, MI 48203 (313) 883-6145

Page 1 of 3
[First Page] [Previous Page] [Next Page] [Last Page]

Leaking Underground StorageTank

Search Results

Records 11 to 20 of 26 for Site City: Highland Park; Site Status: Closed;

Click on the Site ID for tank and release information. Click on the Site Name for GPS information.

*** Owner Details (Owner may not reflect the current owner and is not necessarily the Lust liable party. For Lust liable party information please contact the RRD district office for the given site.)**

Site ID	Site Name	Site Address	Owner Name	Owner Address
00042049	Guardian Armored	15045 Hamilton Highland Park, MI 48203 (313) 300-2965	Guardian Security Service	15045 Hamilton Highland Park, MI 48203 (313) 300-2965
00003649	Highland Park Auto Serv.	16070 Woodward Ave Highland Park, MI 48203 (313) 869-2525	H.P Auto Serv	16070 Woodward Ave Highland Park, MI 48203 (313) 869-2525
00003649	Highland Park Auto Service	16070 Woodward Ave Highland Park, MI 48203 (313) 869-2525	H.P Auto Serv	16070 Woodward Ave Highland Park, MI 48203 (313) 869-2525
00036552	Joseph El Sayed (former)	15903 Woodward Ave Highland Park, MI 48203 (313) 445-0506	Michael Nassar	15903 Woodward Ave Highland Park, MI 48203 (313) 869-8889
00036552	Joseph El-sayed, Inc.	15903 Woodward Ave Highland Park, MI 48203 (313) 445-0506	Michael Nassar	15903 Woodward Ave Highland Park, MI 48203 (313) 869-8889
00018186	Marathon Unit #2756	12524 Woodward Ave Highland Park, MI 48203 (313) 865-6260	Highland Pk Makki Investment Co	12524 Woodward Ave Highland Park, MI 48203 (313) 865-6260
00037107	Mazel-tov Corporation	1200 E MCNICHOLS RD HIGHLAND PARK, MI 48203 (313) 620-9045	Mazel-Tov Corp	PO Box 37 Clarkston, MI 48347 (313) 620-9045
00006305	Mckesson Drug Co	14100 Oakland St Highland Park, MI 48203 (313) 868-9876	Mckesson Drug Co	14100 Oakland St Highland Park, MI 48203 (313) 868-9876
00037849	Missant Trucking	350 Victor St Highland Park, MI 48203 (313) 867-6432	Missant Prop Two	350 Victor St Highland Park, MI 48203 (313) 883-0544
00038737	Office Depot, Inc.	16350 WOODWARD AVE HIGHLAND PARK, MI 48203 (407) 274-7792	Office Depot Inc	2200 Germantown Rd Delray Beach, FL 33445 (407) 274-7792

Page 2 of 3

[First Page] [Previous Page] [Next Page] [Last Page]

Leaking Underground StorageTank

Search Results

Records 21 to 26 of 26 for Site City: Highland Park; Site Status: Closed;

Click on the Site ID for tank and release information. Click on the Site Name for GPS information.

* **Owner Details (Owner may not reflect the current owner and is not necessarily the Lust liable party. For Lust liable party information please contact the RRD district office for the given site.)**

Site ID	Site Name	Site Address	Owner Name	Owner Address
00036907	Riverview Family Health Center	12523 THIRD AVE HIGHLAND PARK, MI 48203 (313) 499-4071	Detroit Macomb Hospital Corp	12000 E 12 MILE RD HIGHLAND PARK, MI 48203 (313) 499-4071
00021044	Sears Roebuck & Co #1160	15001 WOODWARD AVE HIGHLAND PARK, MI 48203 (708) 286-8864	Sears Roebuck & Co	3333 Beverly Rd Dept 824C A2-158B Hoffman Estates, IL 60179 (847) 286-5530
00010489	Shell Service Station	12803 Hamilton Ave Highland Park, MI 48203 (313) 520-0056	Citgo Fuel	12803 Hamilton St Highland Park, MI 48203 (313) 883-6145
00001842	Silver's	341 VICTOR AVE HIGHLAND PARK, MI 48203 (313) 867-6432	F.J.W Realty	365 Victor St Highland Park, MI 48203 (313) 867-6432
00040982	Skygroup Inc	385 Midland St Highland Park, MI 48203 734-459-7730	Skygroup Inc	19215 W 8 Mile Rd Detroit, MI 48219 7344597730
00021519	Snethcamp Chrysler Plymouth	16400 Woodward Ave Highland Park, MI 48203 (313) 868-3300	Bill Snethkamp	16400 Woodward Ave Highland Park, MI 48203 (313) 868-3300

Page 3 of 3
[First Page] [Previous Page] [Next Page] [Last Page]

Leaking Underground StorageTank

Search Results

Records 1 to 10 of 24 for Site City: Highland Park; Site Status: Open;

Click on the Site ID for tank and release information. Click on the Site Name for GPS information.

*** Owner Details (Owner may not reflect the current owner and is not necessarily the Lust liable party. For Lust liable party information please contact the RRD district office for the given site.)**

Site ID	Site Name	Site Address	Owner Name	Owner Address
00005721	Amoco #5140	17013 Hamilton Ave Highland Park, MI 48203 (313) 862-2229	17013 Hamilton LLC	30825 26 MIle Rd New Haven, MI 48048 (586) 749-7444
00038154	Chrome Craft Corp.	318 Midland St Highland Park, MI 48203 (248) 353-7620	Chrome Craft Corp	318 Midland St Highland Park, MI 48203 (313) 868-2444
00007159	City Of Highland Park - Engine H	16099 HAMILTON HIGHLAND PARK, MI 48203 (313) 852-7318	City of Highland Park	12050 Woodward Ave Highland Park, MI 48203 (313) 459-6726
00014568	City Of Highland Pk - Fire Stati	30 Gerald St Highland Park, MI 48203 (313) 252-0225	City of Highland Park	12050 Woodward Ave Highland Park, MI 48203 (313) 459-6726
00014570	City Of Highland Pk - Police Sta	25 Gerald St Highland Park, MI 48203 (313) 252-0225	City of Highland Park	12050 Woodward Ave Highland Park, MI 48203 (313) 459-6726
00014571	City Of Highland Pk - Police Sta	20 Gerald St Highland Park, MI 48203 (313) 252-0225	City of Highland Park	12050 Woodward Ave Highland Park, MI 48203 (313) 459-6726
50002068	Davison Fwy 3340 Woodrow & Wils	NW Corner Davison Fwy/Woodrow Wilson Highland Park, MI 99999 ( ) -	Unknown	
50006047	Former Gas Station (FAC10000199)		NRT	
00042149	Former Gasoline Station/Church	14015 Hamilton Ave Highland Park, MI 48203 (248) 371-6479	Comerica Bank/CB Richard Ellis	PO Box 75000 Mail Code 7807 Detroit, MI 48275 (248) 371-5479
00039242	Former Hamilton Rd Gas	13519 Hamilton Rd Highland Park, MI 48203 (248) 569-3103	Unknown	

Page 1 of 3
[First Page] [Previous Page] [Next Page] [Last Page]

Leaking Underground StorageTank

Search Results

Records 11 to 20 of 24 for Site City: Highland Park; Site Status: Open;

Click on the Site ID for tank and release information. Click on the Site Name for GPS information.

*** Owner Details (Owner may not reflect the current owner and is not necessarily the Lust liable party. For Lust liable party information please contact the RRD district office for the given site.)**

Site ID	Site Name	Site Address	Owner Name	Owner Address
50005306	Former Mobil Station		Exxon Mobil	I-55 Arsanal Rd Rm 259 Joilet, IL 60494 815-521-76588
00037168	Gabrielle Ltd Dividend Housing Development	14201 Second Ave Highland Park, MI 48203 (810) 225-2800	Gabrielle II/MHT LDHA LLC	32600 Telegraph Rd Ste 102 Bingham Farms, MI 48025 (248) 833-0550
00003772	Helm Inc	14310 Hamilton Ave Highland Park, MI 48203 (313) 898-2123	MRA Investment	3200 W Warren Detroit, MI 48208 (313) 898-2123
00003772	Helm Inc.	14310 Hamilton Ave Highland Park, MI 48203 (313) 898-2123	MRA Investment	3200 W Warren Detroit, MI 48208 (313) 898-2123
00007542	M & G Convoy Inc So Oaklan Yd	13900 OAKLAND AVE HIGHLAND PARK, MI 48203 (734) 258-2169	M & G Convoy Inc	E-4111 ANDOVER RD BLOOMFIELD HILLS, MI 48302 (734) 258-2169
00039039	MDOT Row Former John R Gas	13400 John R Rd. @ Auburndale Highland Park, MI 48203 (248) 569-3103	MDOT	18101 West 9 Mile Rd Southfield, MI 48075 586-731-9283
00005721	MO & Sons Petro Inc	17013 Hamilton Ave Highland Park, MI 48203 (313) 862-2229	17013 Hamilton LLC	30825 26 MIle Rd New Haven, MI 48048 (586) 749-7444
00038620	Rayford Jackson	15910 Third Highland Park, MI 48207 (313) 537-2693	State of Michigan (MLBFTA)	
00038620	Rayford Jackson Property (former)	15910 Third Highland Park, MI 48207 (313) 537-2693	State of Michigan (MLBFTA)	
00010035	Sanders Country Home Bakery	100 Oakman Blvd Highland Park, MI 48203 (313) 868-5700	Sanders Country Home Bakery	100 Oakman Blvd Highland Park, MI 48203 (313) 868-5700

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[First Page] [Previous Page] [Next Page] [Last Page]

Leaking Underground StorageTank

Search Results

Records 21 to 24 of 24 for Site City: Highland Park; Site Status: Open;

Click on the Site ID for tank and release information. Click on the Site Name for GPS information.

* **Owner Details (Owner may not reflect the current owner and is not necessarily the Lust liable party. For Lust liable party information please contact the RRD district office for the given site.)**

Site ID	Site Name	Site Address	Owner Name	Owner Address
00012813	Webb Operating	11731 Hamilton Ave Highland Park, MI 48203 (313) 999-7149	Webb Operating	11731 Hamilton Ave Highland Park, MI 48203 (313) 670-5248
00012813	Webb operating Inc	11731 Hamilton Ave Highland Park, MI 48203 (313) 999-7149	Webb Operating	11731 Hamilton Ave Highland Park, MI 48203 (313) 670-5248
00041299	Woodward Manchester Co LLC	91 Manchester Highland Park, MI 48203 248-486-5100	Woodward Manchester Co LLC	91 Manchester Highland Park, MI 48203 313-865-3154
50001920	Woodward Gas (former) MDOT	79 + 43 Woodward Rd Highland Park, MI 48203 (248) 569-3103	Unknown	

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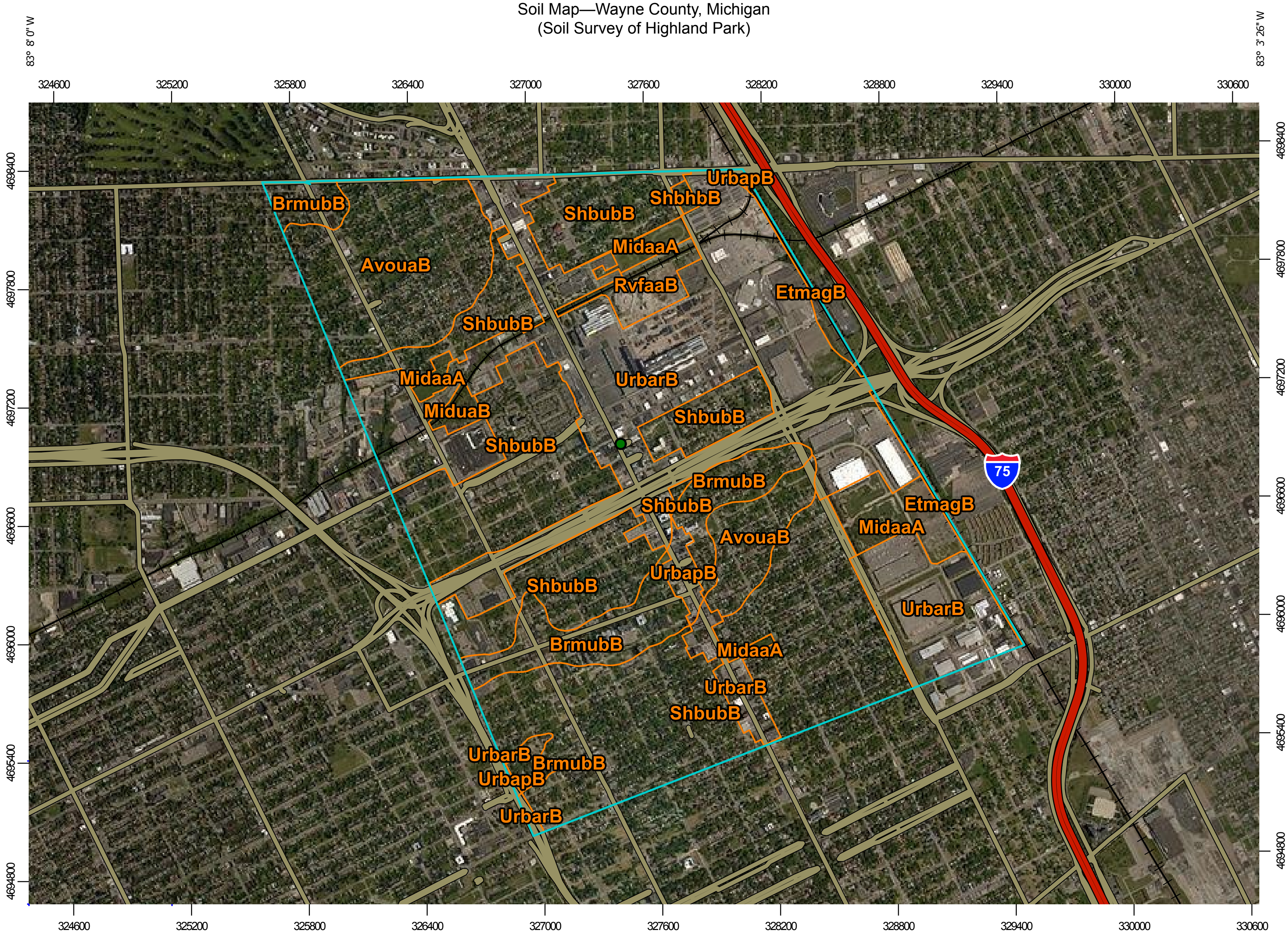
[First Page] [Previous Page] [Next Page] [Last Page]

APPENDIX 3

NATIONAL COOPERATIVE SOIL SURVEY MAP FOR THE CITY OF HIGHLAND PARK

Soil Map—Wayne County, Michigan
(Soil Survey of Highland Park)



Map Scale: 1:28,600 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 400, 800, 1600, 2400

Feet: 0, 1000, 2000, 4000, 6000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Wayne County, Michigan
Survey Area Data: Version 4, Sep 11, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 31, 2014—Jun 15, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AvouaB	Avoca-Urban land complex, 0 to 4 percent slopes	228.5	11.8%
BrmubB	Brems-Urban land complex, dense substratum, 0 to 4 percent slopes	142.6	7.4%
EtmagB	Udorthents artifacts, 0 to 4 percent slopes	15.5	0.8%
MidaaA	Midtown gravelly-artifactual sandy loam, 0 to 2 percent slopes	66.5	3.4%
MiduaB	Midtown-Urban land complex, 0 to 4 percent slopes	9.2	0.5%
RvfaaB	Riverfront sandy loam, 0 to 4 percent slopes	30.0	1.6%
ShbhbB	Shebeon-Avoca sandy loams, 0 to 4 percent slopes	3.2	0.2%
ShbubB	Shebeon-Urban land-Avoca complex, 0 to 4 percent slopes	761.0	39.3%
UrbapB	Urban land-Fortress family complex, dense substratum, 0 to 4 percent slopes	15.4	0.8%
UrbarB	Urban land-Riverfront complex, dense substratum, 0 to 4 percent slopes	664.6	34.3%
Totals for Area of Interest		**1,936.5**	**100.0%**

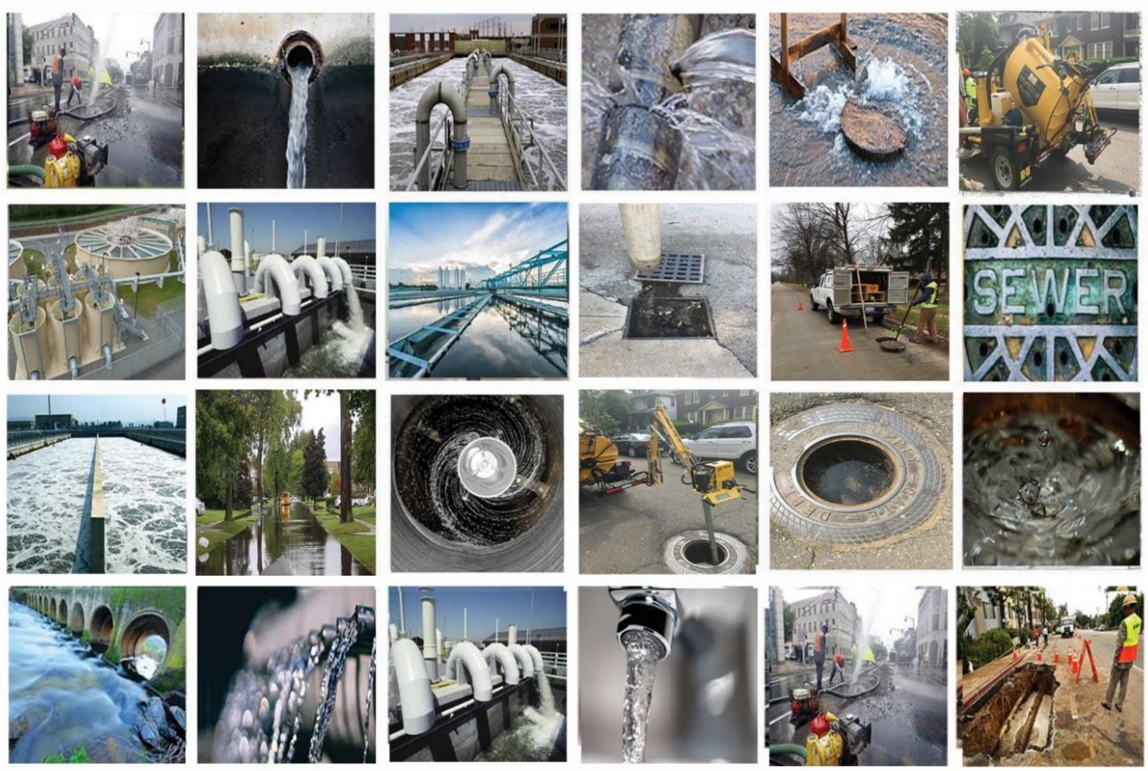
APPENDIX 4

CITY OF HIGHLAND PARK WATER DEPARTMENT SEWER VERIFICATION CONNECTION STUDY

CITY OF HIGHLAND PARK

2018 City of Highland Park Water Department
Sewer Verification Connection Study

RELATIONSHIPS ▪ REPUTATION ▪ RESULTS



Submitted by:

Highland Park Water Department
Damon L. Garrett, PE, Director
14110 Woodward Avenue
Highland Park, MI 48203

Dated: December 31, 2018

Contents

PROJECT SUMMARY

PROJECT DESCRIPTION

The City of Highland Park has been sending combined sewage to the Detroit Water and Sewerage Department (DWSD) since the early 1900s for treatment. As the City of Detroit expanded its municipal boundaries over many decades, both cities' sewer systems were interconnected. With the lack of communication and open exchange of data between governmental agencies, the loss of construction records, and other documentation graphically and hydraulically showing the connectivity of the systems, it was problematic to determine the volume of sewage originating from Highland Park and how the City of Highland Park was billed for sewer treatment services by DWSD. Even more, after the formation of the Great Lakes Water Authority (GLWA) in 2015, and its separation from DWSD, GLWA became the provider of sewer treatment services for the City of Highland Park and the two entered into litigation over the cost and actual volume of sewer flow attributable to the City, other contractual issues, and supply of emergency water. Since the largest component of the bill from GLWA is attributed to sewer treatment, the City of Highland Park Water Department was tasked with determining the connectivity to both GLWA and DWSD sewer infrastructure. Performing this task would assist the City of Highland Park in gaining an understanding of the following information: the City's general conveyance of sewage; an estimation of the amount of flow that is generated during both dry and wet weather events on a daily, weekly, monthly, and yearly basis (taking into account the condition of the structures); and the appropriate amount of sewer flow attributed to the City of Highland Park, in addition to the amount of sewage entering the City from other sources outside of the municipal boundaries. As part of this study, ascertaining flow directions was critical to ultimately identifying future locations of flow meters for the City of Highland Park becoming a metered community, more accurate billing with GLWA, assistance with the current lawsuit and other pending litigation.

The study has been broken down into two phases as follows:

- <u>Phase 1</u> was intended to identify any external connections of the City of Highland Park's sewer infrastructure with either GLWA or DWSD's sewer infrastructure. As historical records from GLWA, DWSD, and the City of Highland Park have not been kept to the level of detail needed to identify the cross connections, the City of Highland Park Water Department employed various field methods to determine these connection points. The methods utilized includes creating a base map utilizing existing GLWA, DWSD, and Highland Park construction drawings, sewer section maps, and other records. For determining the condition of the selected manholes that proposed sewer meters would be installed in, the Water Department has performed 3D optical manhole scans with a Panoramo SI manhole scanner; performed National Association of Sewer Services Companies (NASSCO) MACP manhole assessments, identified inverts, sizes, and locations; and finally performed CCTV of selected sewer lines to determine flow direction into and out of the City of Highland Park. The findings showcased thirty-two (32) proposed metered manhole structures. This information was the basis of the City of Highland Park Water Department's initial presentation at the Wastewater Analytical Task Force (WATF) committee to begin discussions with GLWA on accurately metering the City of Highland Park.

- Phase 2 consisted of further investigations on the interior of the City of Highland Park and additional manhole assessments on the sewer structures. In addition, structures are analyzed to ensure no other possible connections exist to either the GLWA or DWSD systems. Meter locations, initially determined from phase 1, were further analyzed and condensed from thirty-two proposed (32) metered manhole structures down to twenty (20) proposed metered manhole structures. Third-party investigation and analysis have been utilized as necessary.

- Depending on funding for sewer meters, other budgetary constraints, and pending receipt of specifications and other documents requested from GLWA, the Water Department is planning to complete a report by the winter of 2019. It is anticipated that the report will contain daily, weekly and monthly volumetric information from sewer, inflow and infiltration, weather related events, general findings and recommendations for any additional locations for metering or structures in need of immediate repair or rehabilitation, based on the manhole condition assessments. In an effort to continue discussions with GLWA, recommendations for proposed meter locations for future billing purposes will be included pending receipt of meter related specifications and other documents requested from GLWA in 2018.

PHASE 1 & 2 SUMMARY

Phase 1, used to determine sewer connections between Highland Park, GLWA, and DWSD, uncovered thirty-two (32) proposed metering connections, divided up into four (4) general categories:

1) Outgoing
2) Incoming
3) Incoming/Outgoing
4) High-point

During Phase 2, the thirty-two (32) proposed metering connections between Highland Park, GLWA, and DWSD (from Phase 1) were reduced from 32 verified proposed metering connections to twenty (20) proposed metered manhole structures.

In total, twenty-eight (28) connections have been analyzed during Phase 2 for flow direction, invert depths via CCTV, and 3D optical manhole scans to determine positive incoming and/or outgoing flow. Locations observed in the high-point category were removed from the metered manhole list after several field visits that were performed during dry days and rainy events. The findings showed no evidence of flow entering or exiting these high-point structures, and thus it was determined to allocate metering resources only to structures producing noticeable flow.

Additional flow analysis and other investigative techniques are necessary on the City's sewer system to expose other proposed connections and determine whether the high-point connections should be bulk headed, preventing any sewer overflows from DWSD and/or GLWA from entering the City of Highland Park sewer system. Considerations should include possible temporary metering of the high-point locations, pending schedule and other budgetary constraints.

PHASE 2 FINDINGS

The connections that have been identified as part of the more detailed Phase 2 portion of the Highland Park Water Department Preliminary Sewer Verification Connection Study fall into four (4) categories:

1) Connections with confirmed outgoing flow into GLWA system
2) Connections with confirmed incoming flow from the DWSD system
3) Connections with overflow outgoing flow into GLWA system
4) High-point connections between the City of Highland Park and DWSD sewer systems

There are twenty (20) total proposed metered connections represented in this Phase 2 study with eight (8) non-metered manhole structures denoted as high-point locations. Exhibit 1 and 2 show the overall study area and individual proposed meter locations. Due to numerous visits to the high-point locations by field staff during and after rainy events, it was determined that these locations were unnecessary to be metered as part of the current study. As observed and documented during designated rain events, these manhole structures experienced little to no flow either to or from the City of Highland Park's sewer. The following tables are a summary of the Phase 2 findings:

FOURTEEN (14) CONNECTIONS WITH CONFIRMED OUTGOING FLOW

Meter ID No.	Flow Category	MACP Score	Comment
1	Outgoing	3121	36" outgoing northeast
2	Outgoing	5141	12" outgoing northeast
3	Outgoing	2111	30" outgoing north
4	Outgoing	4100	70" outgoing northeast
5	Outgoing	2200	24" outgoing east
6	Outgoing	3121	48" outgoing northeast
7	Outgoing	2200	oval shaped pipe outgoing north
9	Outgoing	5141	42" outgoing east
10	Outgoing	4131	78" outgoing west to GLWA 180"
11	Outgoing	4432	120" outgoing south
12	Outgoing	2112	70" outgoing west
13	Outgoing	4223	egg shaped pipe outgoing west
19	Outgoing	3221	18" outgoing south
32	Outgoing	3223	96" outgoing west to GLWA 180"

FIVE (5) CONNECTIONS WITH CONFIRMED INCOMING FLOW

Meter ID No.	Flow Category	MACP Score	Comment
14	Incoming	3111	24" incoming from south
15	Incoming	4131	12" incoming from southeast
18	Incoming	3222	15" incoming from south
31	Incoming	2321	12" incoming from west
33	Incoming	n/a	12" incoming from south

ONE (1) CONNECTION WITH CONFIRMED OVERFLOW OUTGOING FLOW

Meter ID No.	Flow Category	MACP Score	Comment
21	Overflow Outgoing	2111	72" overflow to GLWA 180"

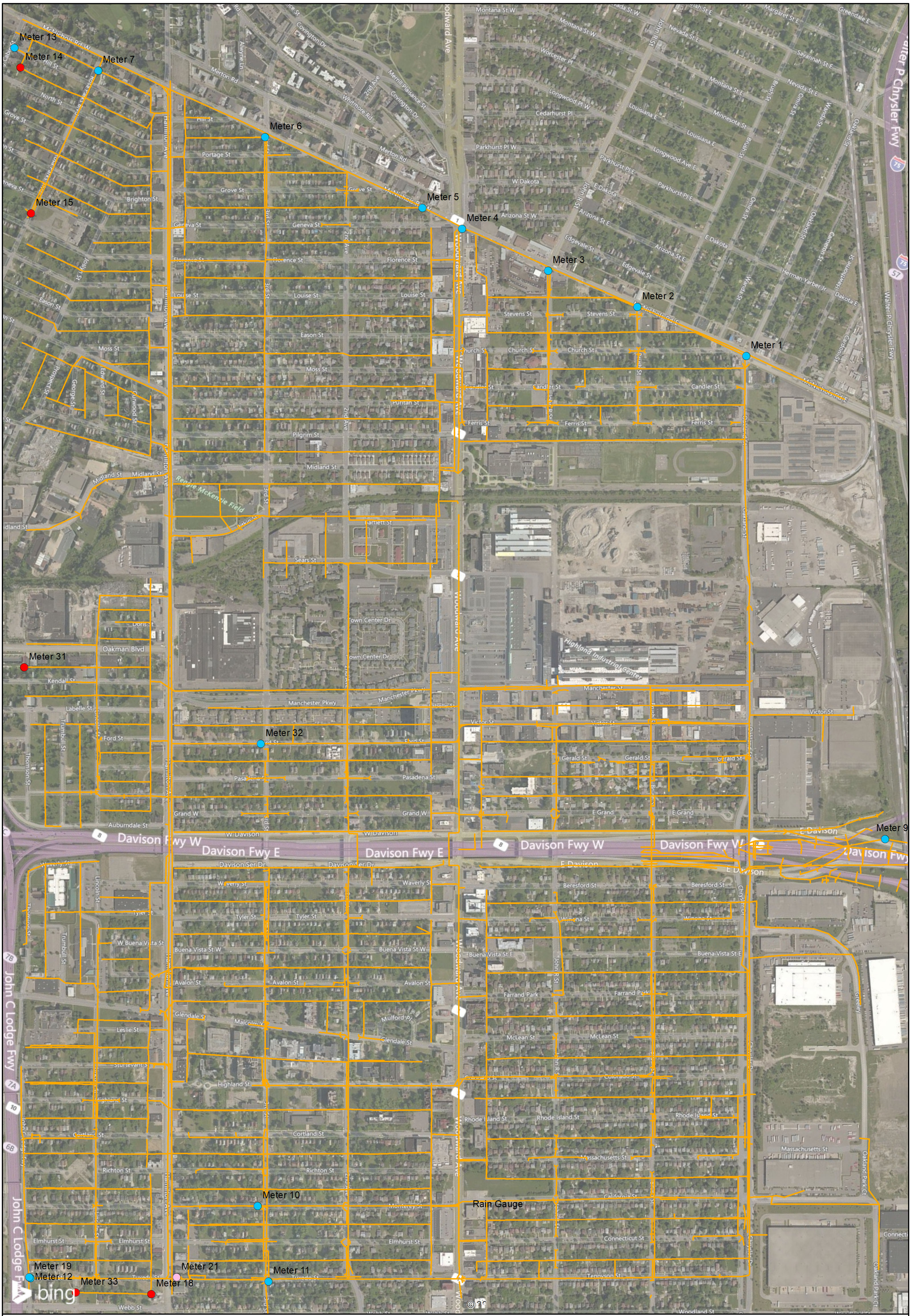
Office of the Water Department
Director – Damon L. Garrett, PE
Metro Consulting Associates, LLC

EIGHT (8) CONNECTIONS BETWEEN HIGHLAND PARK AND DWSD SEWER SYSTEMS AS HIGH POINTS [1]

Manhole ID No.	Flow Category	MACP Score	Comment
MH-A0NOGR01	High-point	3222	12" high-point
MH-A0GRBR01	High-point	4112	12" high-point
MG-A0BRGE01	High-point	4100	12" high-point
MH-A0GEFL01	High-point	3122	12" high-point
MH-A0FLLO01	High-point	n/a	12" high-point
MH-A0LOEA01	High-point	3312	12" high-point
MH-A0EAPU01	High-point	4231	12" high-point
MH-A0JOPR03	High-point	4122	12" high-point

[1] Depending on size of storm-event or surcharge in either system (Highland Park or DWSD), these locations have the potential to produce flow in both directions due to location of high elevation within structure

Exhibit 1
Overall Project Map



400 0 400

Feet

CITY OF HIGHLAND PARK

PHASE 2 SEWER METERING LOCATIONS

METRO CONSULTING ASSOCIATES

RELATIONSHIPS • REPUTATION • RESULTS

LEGEND

- Incoming (5)
- Outgoing (14)
- Overflow Outgoing (1)
- Highland Park Sewer

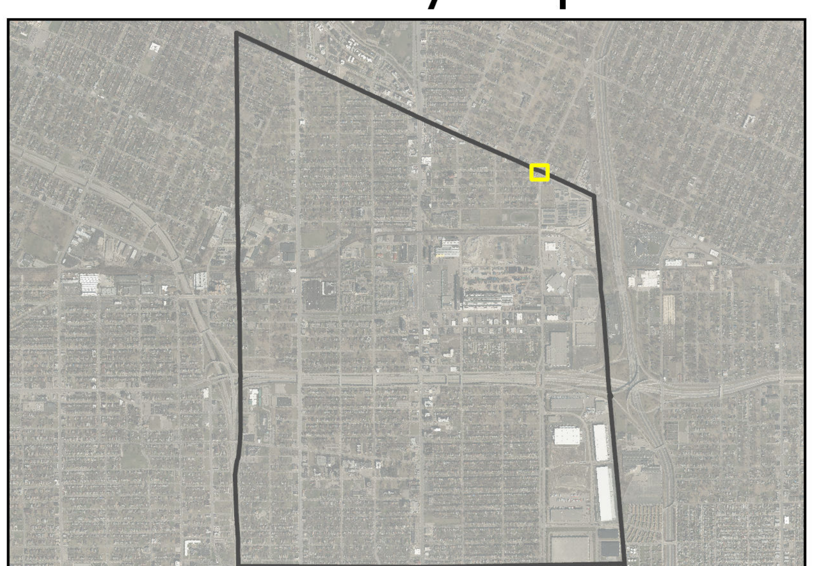
3/6/2019

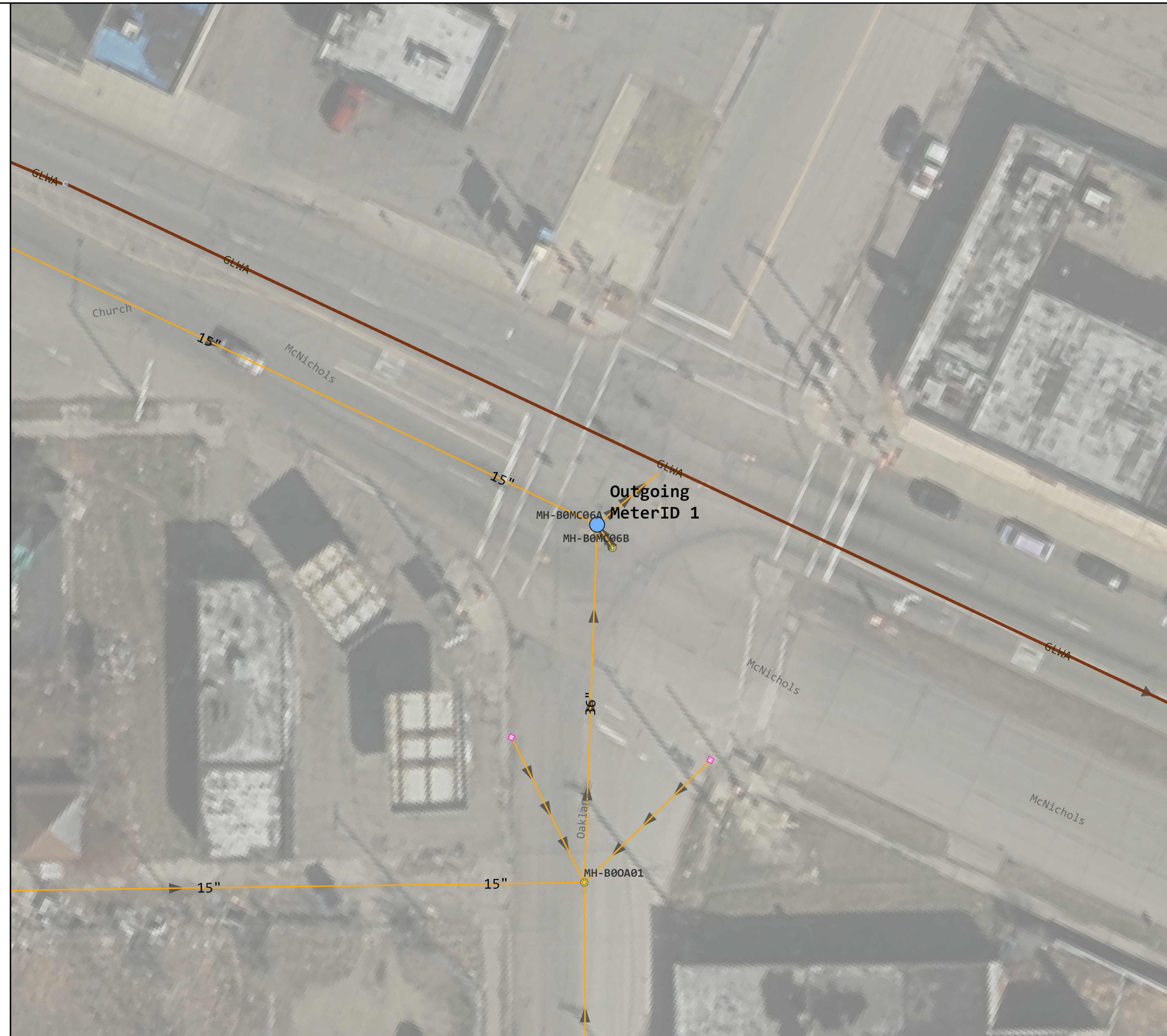
Exhibit 2
Metering Locations

Manhole Scan Image of MeterID 1 Outgoing Invert at 5.80 & Sewer 10ft South of Structure

MACP Score: 3121

Vicinity Map





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Feet

FORMATTED FOR 11"x17" ONLY

CITY OF HIGHLAND PARK

POTENTIAL METERING LOCATIONS

METRO CONSULTING ASSOCIATES

7/19/2018

LEGEND

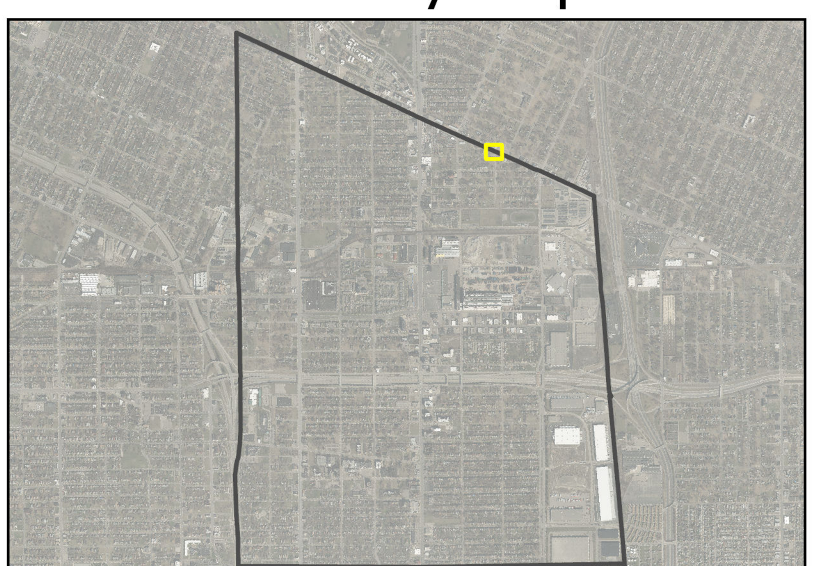
- High Point Connection = 9
- Incoming Connection = 8
- Outgoing Connection = 13
- Outgoing/Incoming = 2
- Highland Park Manhole
- Non City Manhole
- Highland Park Sewer
- Non City Sewer

2015 WAYNE COUNTY AERIAL PROVIDED BY SEMCOG. ALL DATA WITHIN MAP CURRENT TO DATE PRINTED. DATA IS SUBJECT TO CHANGE WITHOUT NOTICE

Manhole Scan Image of MeterID 2
Outgoing Invert at 5.80

MACP Score: 5141

Vicinity Map



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Feet

FORMATTED FOR 11"x17" ONLY

CITY OF HIGHLAND PARK

POTENTIAL METERING LOCATIONS

METRO CONSULTING ASSOCIATES

7/19/2018

LEGEND

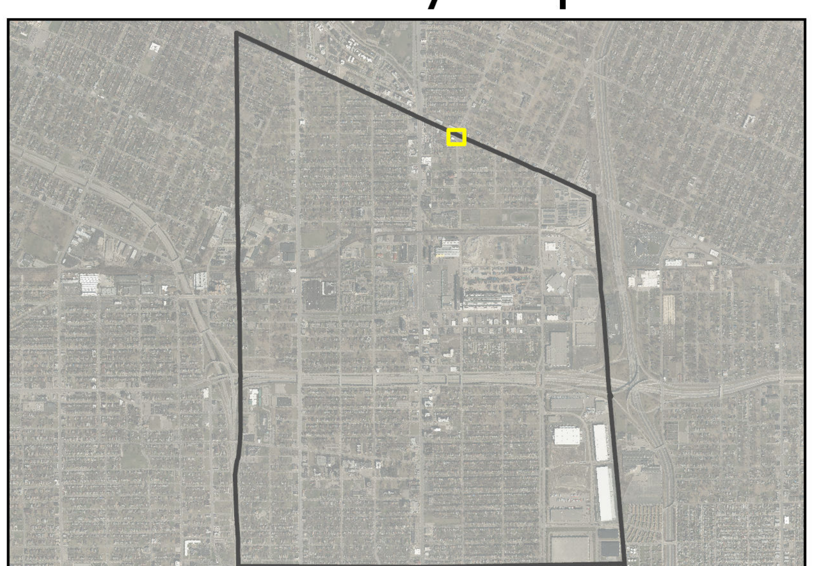
- High Point Connection = 9
- Incoming Connection = 8
- Outgoing Connection = 13
- Outgoing/Incoming = 2
- Highland Park Manhole
- Non City Manhole
- Highland Park Sewer
- Non City Sewer

2015 WAYNE COUNTY AERIAL PROVIDED BY SEMCOG. ALL DATA WITHIN MAP CURRENT TO DATE PRINTED. DATA IS SUBJECT TO CHANGE WITHOUT NOTICE

Manhole Scan Image of MeterID 3
Outgoing Invert at 15.85

MACP Score: 2111

Vicinity Map



FORMATTED FOR 11"x17" ONLY

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Feet

CITY OF HIGHLAND PARK

POTENTIAL METERING LOCATIONS

METRO CONSULTING ASSOCIATES

7/19/2018

LEGEND

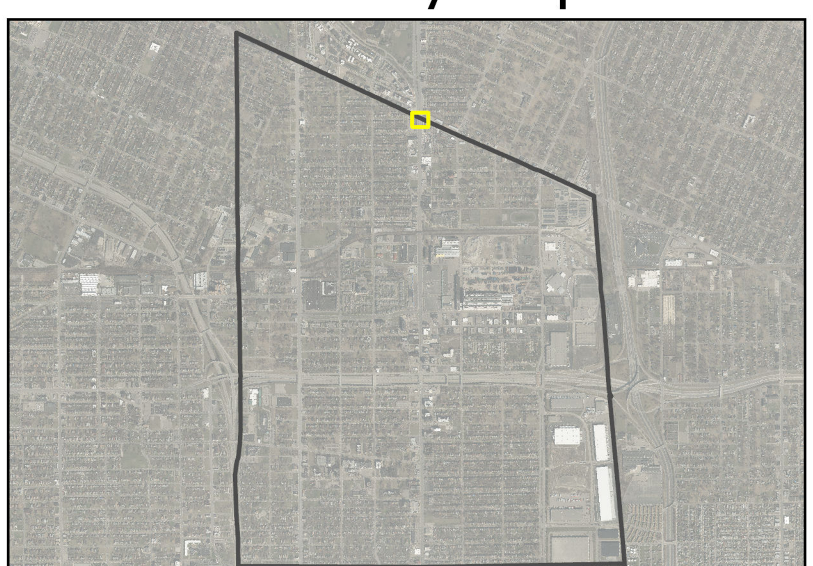
- High Point Connection = 9
- Incoming Connection = 8
- Outgoing Connection = 13
- Outgoing/Incoming = 2
- Highland Park Manhole
- Non City Manhole
- Highland Park Sewer
- Non City Sewer

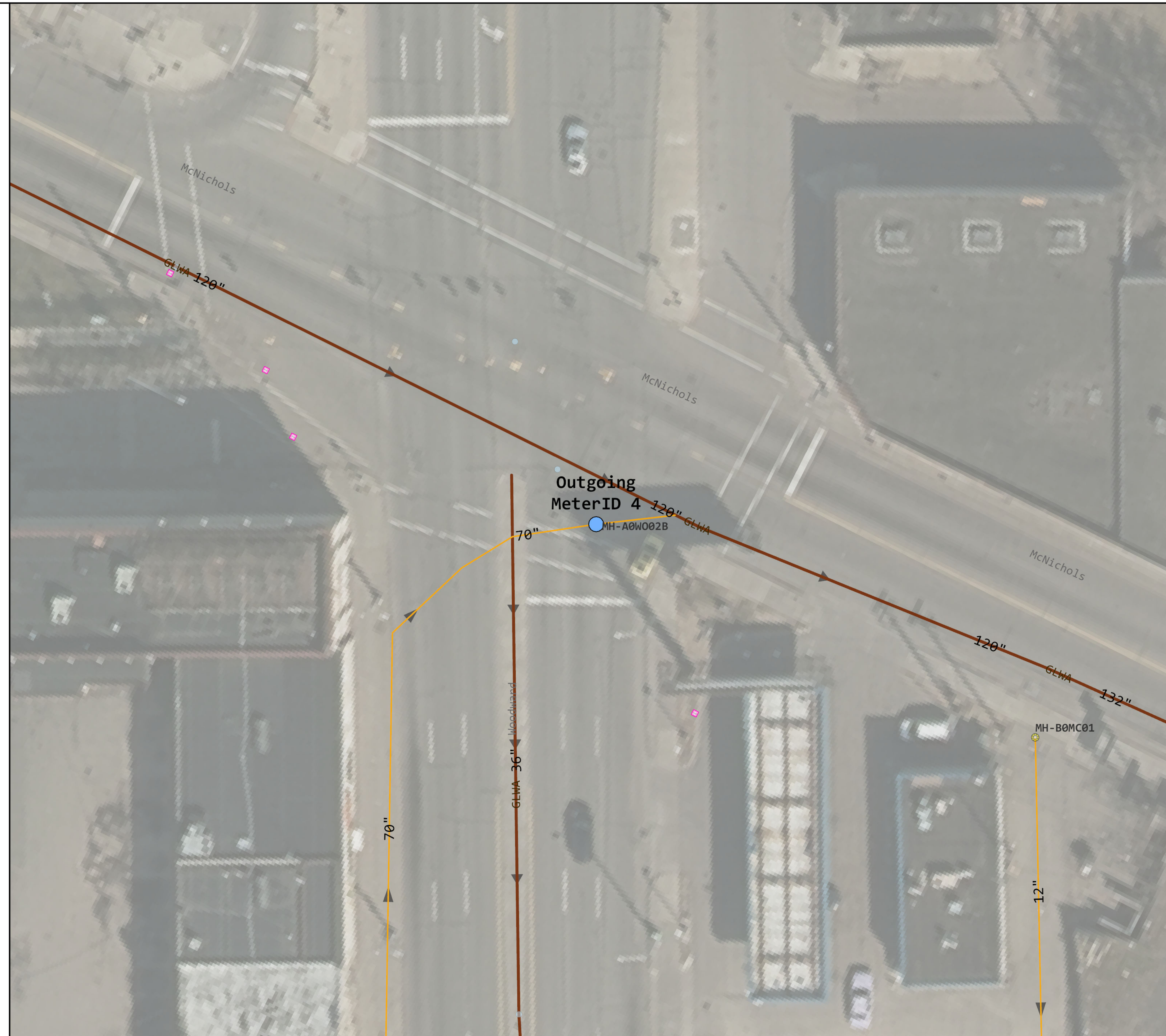
2015 WAYNE COUNTY AERIAL PROVIDED BY SEMCOG. ALL DATA WITHIN MAP CURRENT TO DATE PRINTED. DATA IS SUBJECT TO CHANGE WITHOUT NOTICE

Manhole Scan Image of MeterID 4
Outgoing Invert at 23.50

MACP Score: 4100

Vicinity Map





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Feet

CITY OF HIGHLAND PARK

POTENTIAL METERING LOCATIONS

METRO CONSULTING ASSOCIATES

7/19/2018

LEGEND

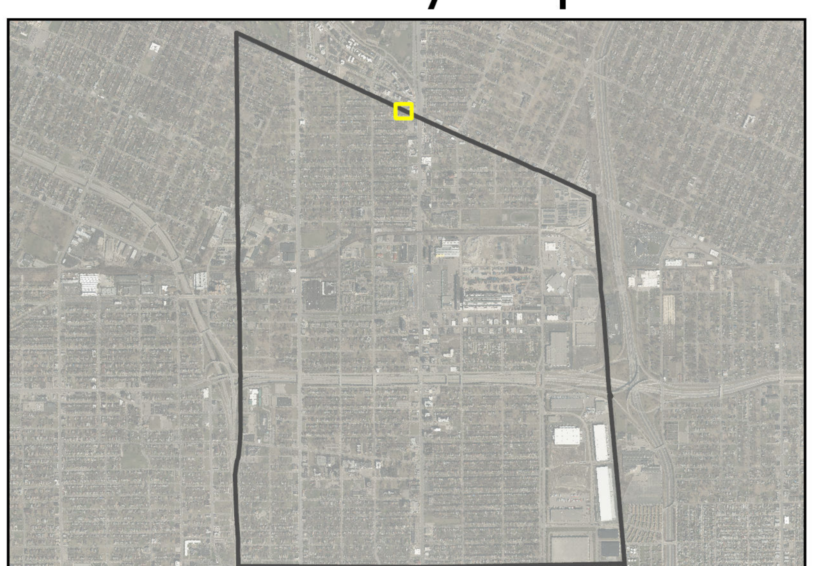
- High Point Connection = 9
- Incoming Connection = 8
- Outgoing Connection = 13
- Outgoing/Incoming = 2
- Highland Park Manhole
- Non City Manhole
- Highland Park Sewer
- Non City Sewer

2015 WAYNE COUNTY AERIAL PROVIDED BY SEMCOG. ALL DATA WITHIN MAP CURRENT TO DATE PRINTED. DATA IS SUBJECT TO CHANGE WITHOUT NOTICE

Manhole Scan Image of MeterID 5
Outgoing Invert at 9.25

MACP Score: 2200

Vicinity Map



FORMATTED FOR 11"x17" ONLY

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Feet

CITY OF HIGHLAND PARK

POTENTIAL METERING LOCATIONS

METRO CONSULTING ASSOCIATES

7/19/2018

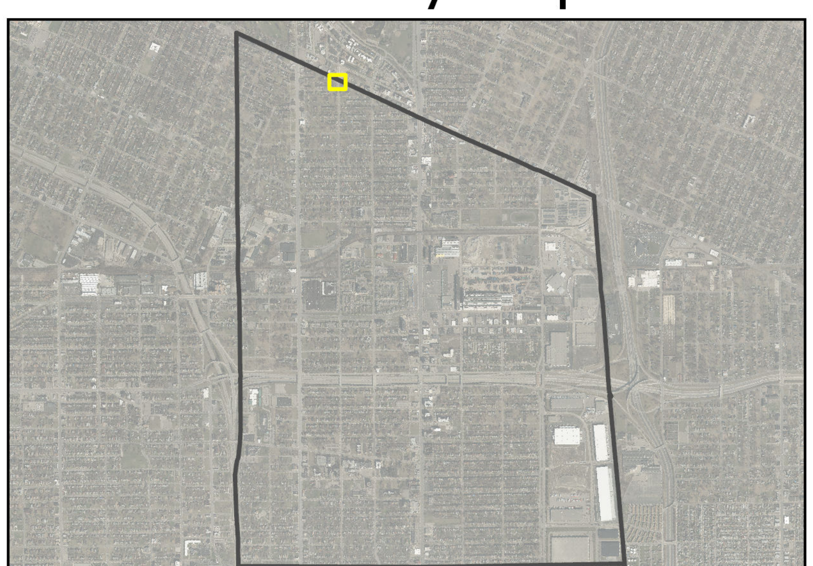
LEGEND

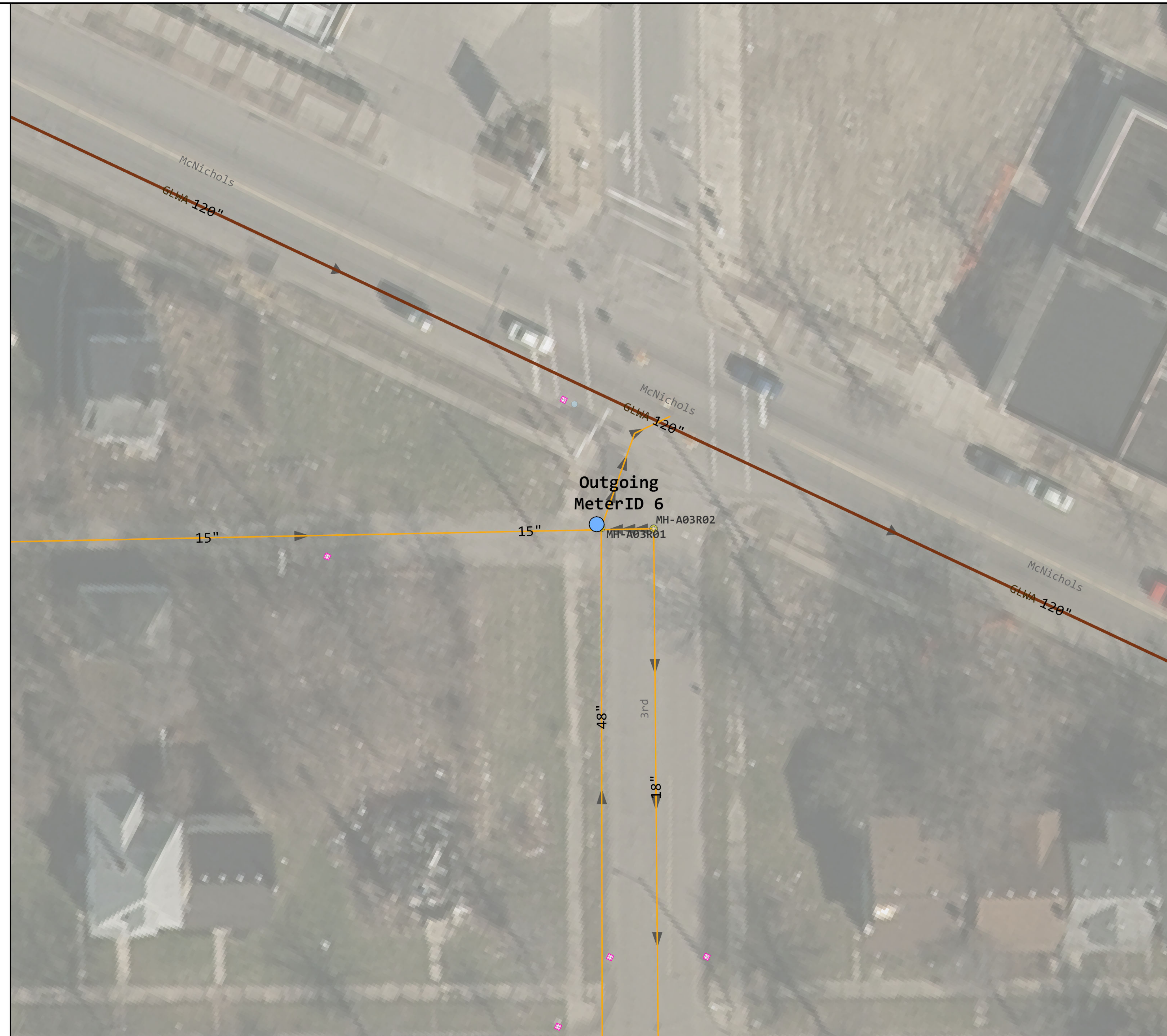
- High Point Connection = 9
- Incoming Connection = 8
- Outgoing Connection = 13
- Outgoing/Incoming = 2
- Highland Park Manhole
- Non City Manhole
- Highland Park Sewer
- Non City Sewer

Manhole Scan Image of MeterID 6
Outgoing Invert at 22.65

MACP Score: 3121

Vicinity Map





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Feet

FORMATTED FOR 11"x17" ONLY

CITY OF HIGHLAND PARK

POTENTIAL METERING LOCATIONS

METRO CONSULTING ASSOCIATES

7/19/2018

LEGEND

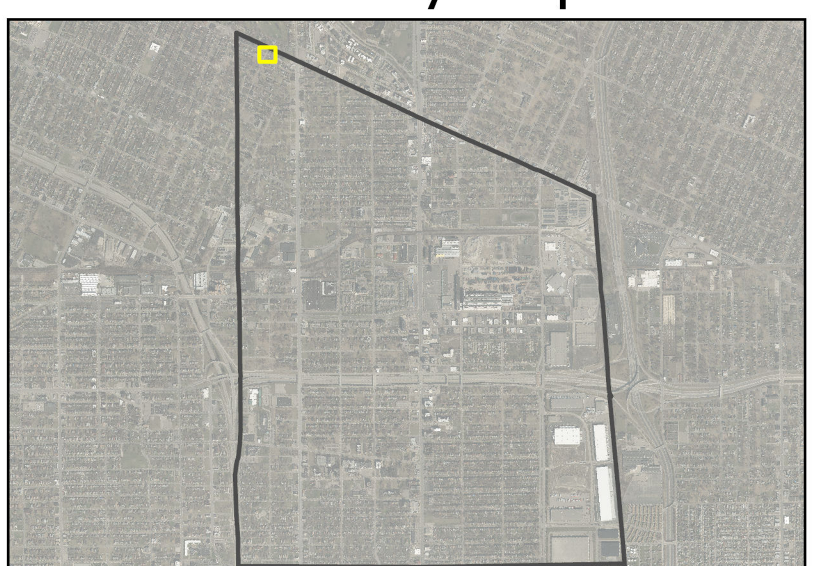
- High Point Connection = 9
- Incoming Connection = 8
- Outgoing Connection = 13
- Outgoing/Incoming = 2
- Highland Park Manhole
- Non City Manhole
- Highland Park Sewer
- Non City Sewer

2015 WAYNE COUNTY AERIAL PROVIDED BY SEMCOG. ALL DATA WITHIN MAP CURRENT TO DATE PRINTED. DATA IS SUBJECT TO CHANGE WITHOUT NOTICE

Manhole Scan Image of MeterID 7
Outgoing Invert at 25.53

MACP Score: 2200

Vicinity Map



FORMATTED FOR 11"x17" ONLY

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Feet

CITY OF HIGHLAND PARK

POTENTIAL METERING LOCATIONS

METRO CONSULTING ASSOCIATES

7/19/2018

LEGEND

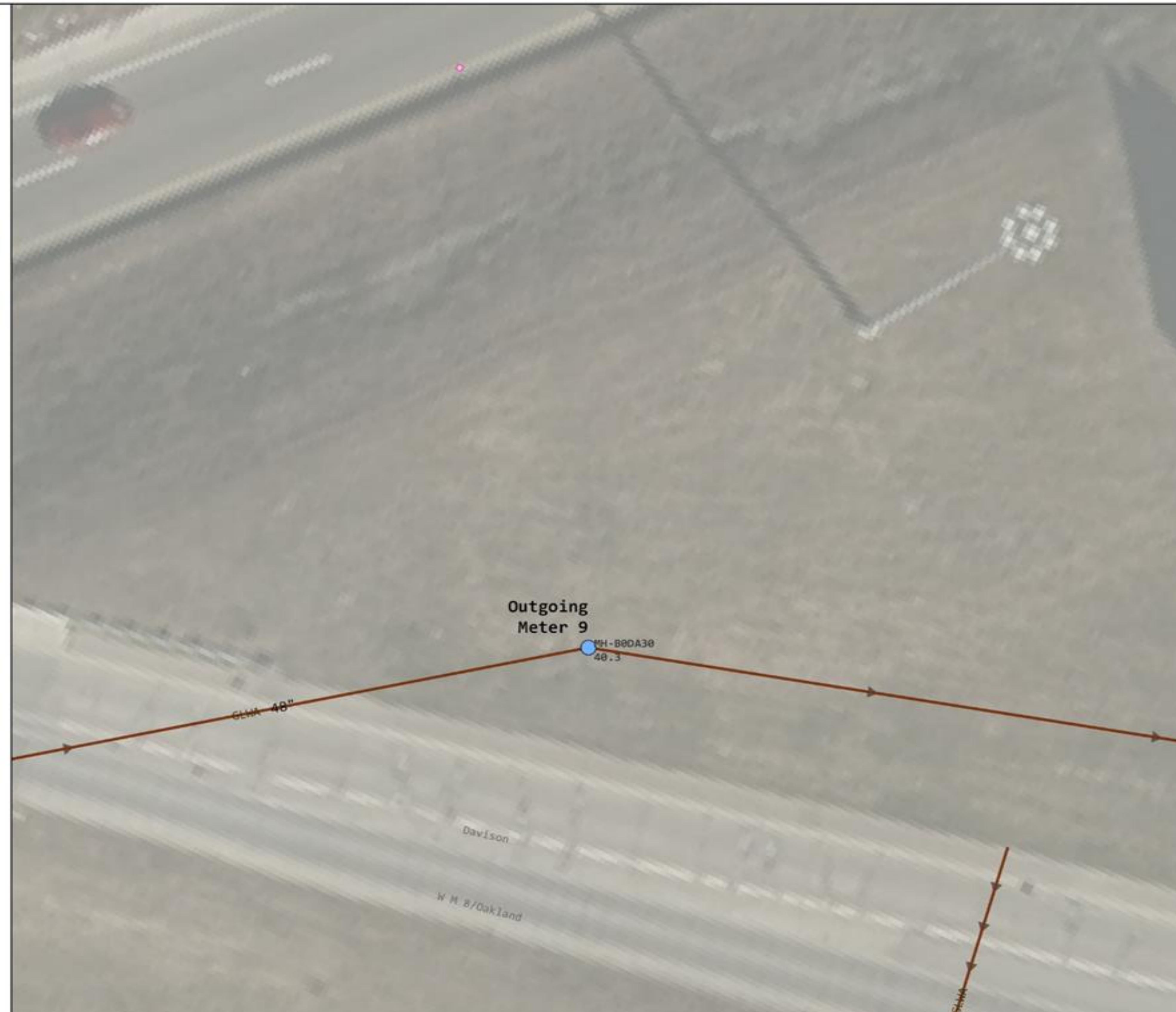
- High Point Connection = 9
- Incoming Connection = 8
- Outgoing Connection = 13
- Outgoing/Incoming = 2
- Highland Park Manhole
- Non City Manhole
- Highland Park Sewer
- Non City Sewer

2015 WAYNE COUNTY AERIAL PROVIDED BY SEMCOG. ALL DATA WITHIN MAP CURRENT TO DATE PRINTED. DATA IS SUBJECT TO CHANGE WITHOUT NOTICE

Manhole Scan Image of Meter ID 9 Outgoing Invert at 40.3

MACP Score: 2111

Vicinity Map



FORMATTED FOR 11"x17" ONLY

10 0 10
Feet

CITY OF HIGHLAND PARK

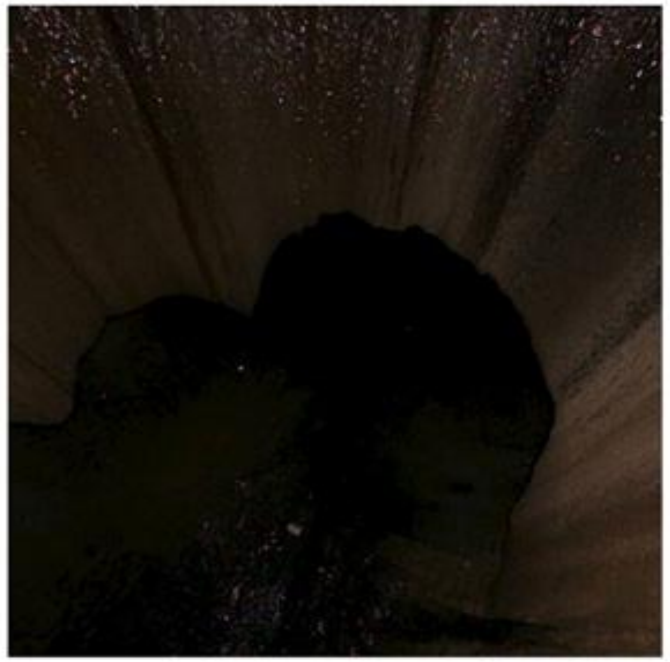
POTENTIAL METERING LOCATIONS

2/6/2019

LEGEND

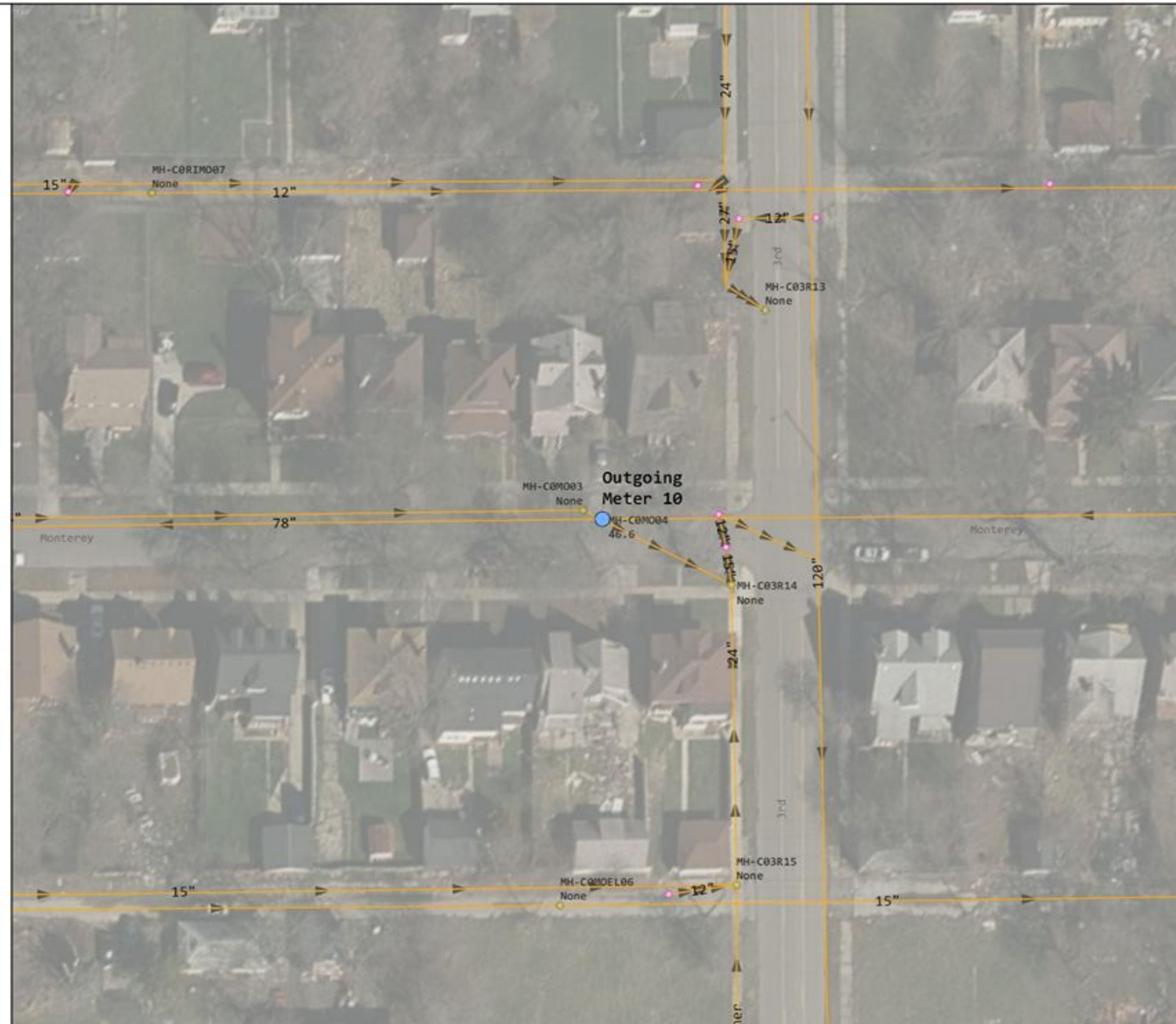
- Highland Park Manhole
- Non City Manhole
- Highland Park Sewer
- Non City Sewer
- High Point Connection = 13
- Incoming Connection = 5
- Outgoing Connection = 14
- Outgoing/Incoming = 1

Manhole Scan Image of Meter ID 10
Outgoing Invert at 46.60



MACP Score: 4131

Vicinity Map



FORMATTED FOR 11"x17" ONLY

25 0 25
Feet

CITY OF HIGHLAND PARK

POTENTIAL METERING LOCATIONS

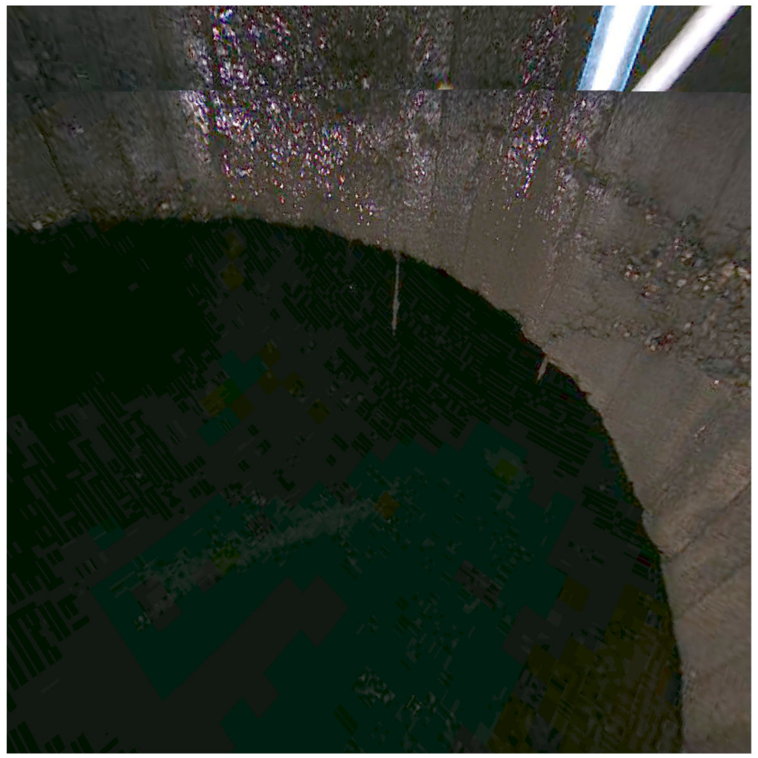
2/6/2019

LEGEND

- Highland Park Manhole
- Non City Manhole
- Highland Park Sewer
- Non City Sewer
- High Point Connection = 13
- Incoming Connection = 5
- Outgoing Connection = 14
- Outgoing/Incoming = 1

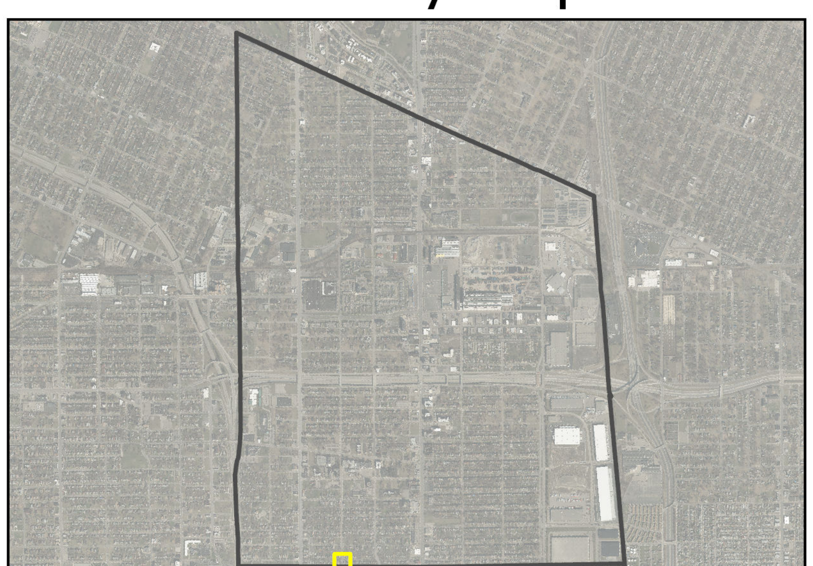
2015 WAYNE COUNTY AERIAL PROVIDED BY SEMCOG. ALL DATA WITHIN MAP CURRENT TO DATE PRINTED. DATA IS SUBJECT TO CHANGE WITHOUT NOTICE

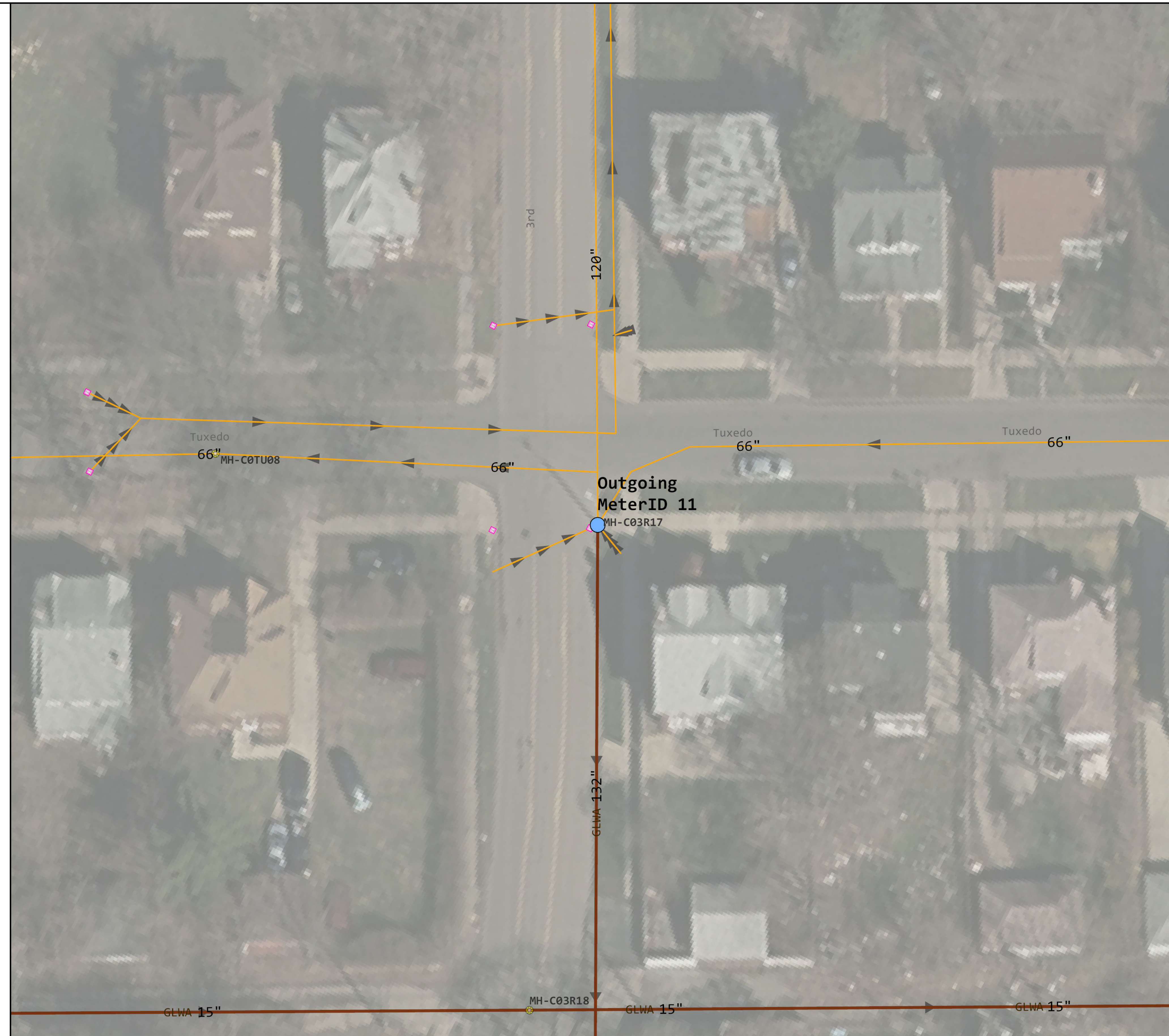
Manhole Scan Image of MeterID 11
Outgoing Invert at 30.55



MACP Score: 4432

Vicinity Map





N W E S

25 0 25
Feet

FORMATTED FOR 11"x17" ONLY

CITY OF HIGHLAND PARK

POTENTIAL METERING LOCATIONS

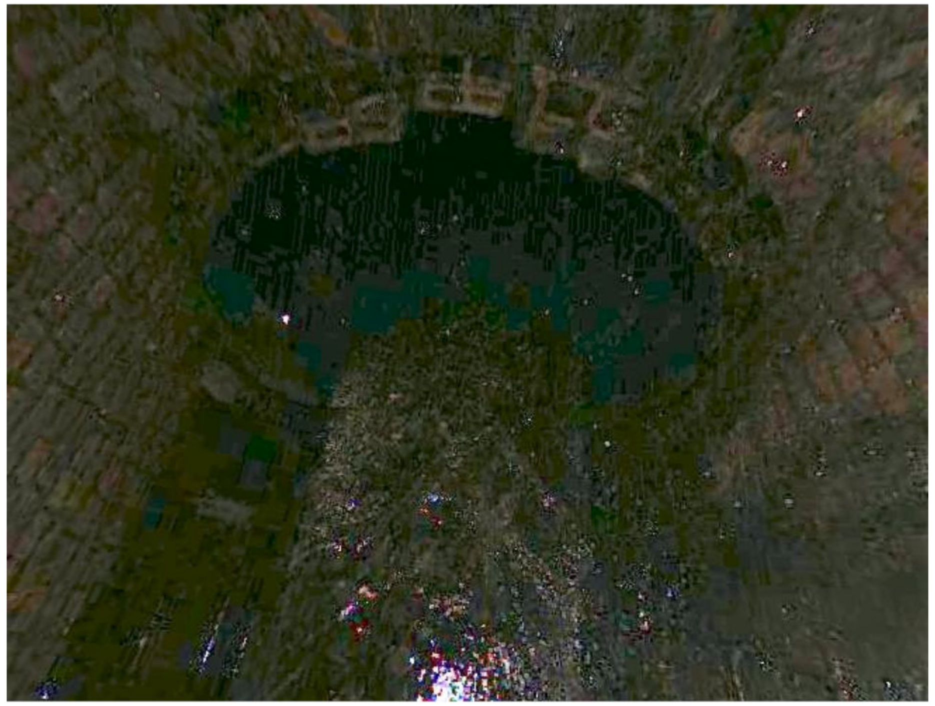
METRO CONSULTING ASSOCIATES

7/19/2018

LEGEND

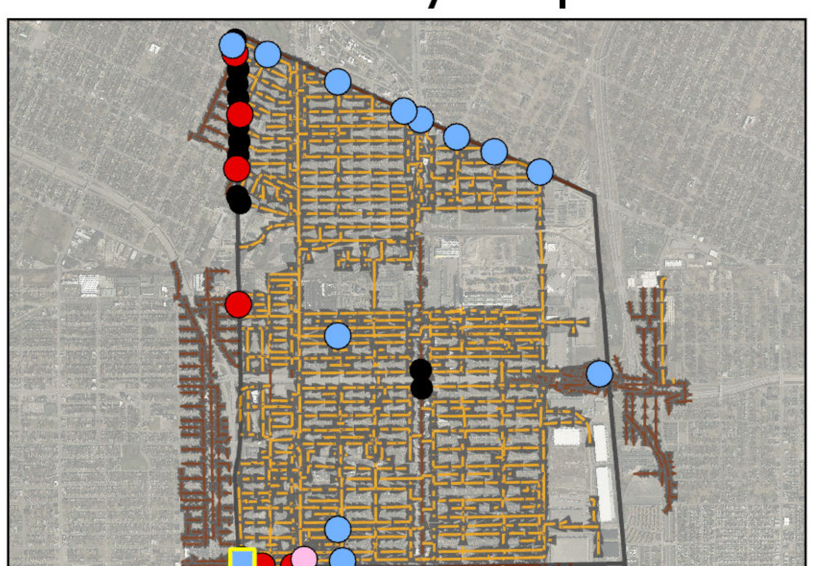
- High Point Connection = 9
- Incoming Connection = 8
- Outgoing Connection = 13
- Outgoing/Incoming = 2
- Highland Park Manhole
- Non City Manhole
- Highland Park Sewer
- Non City Sewer

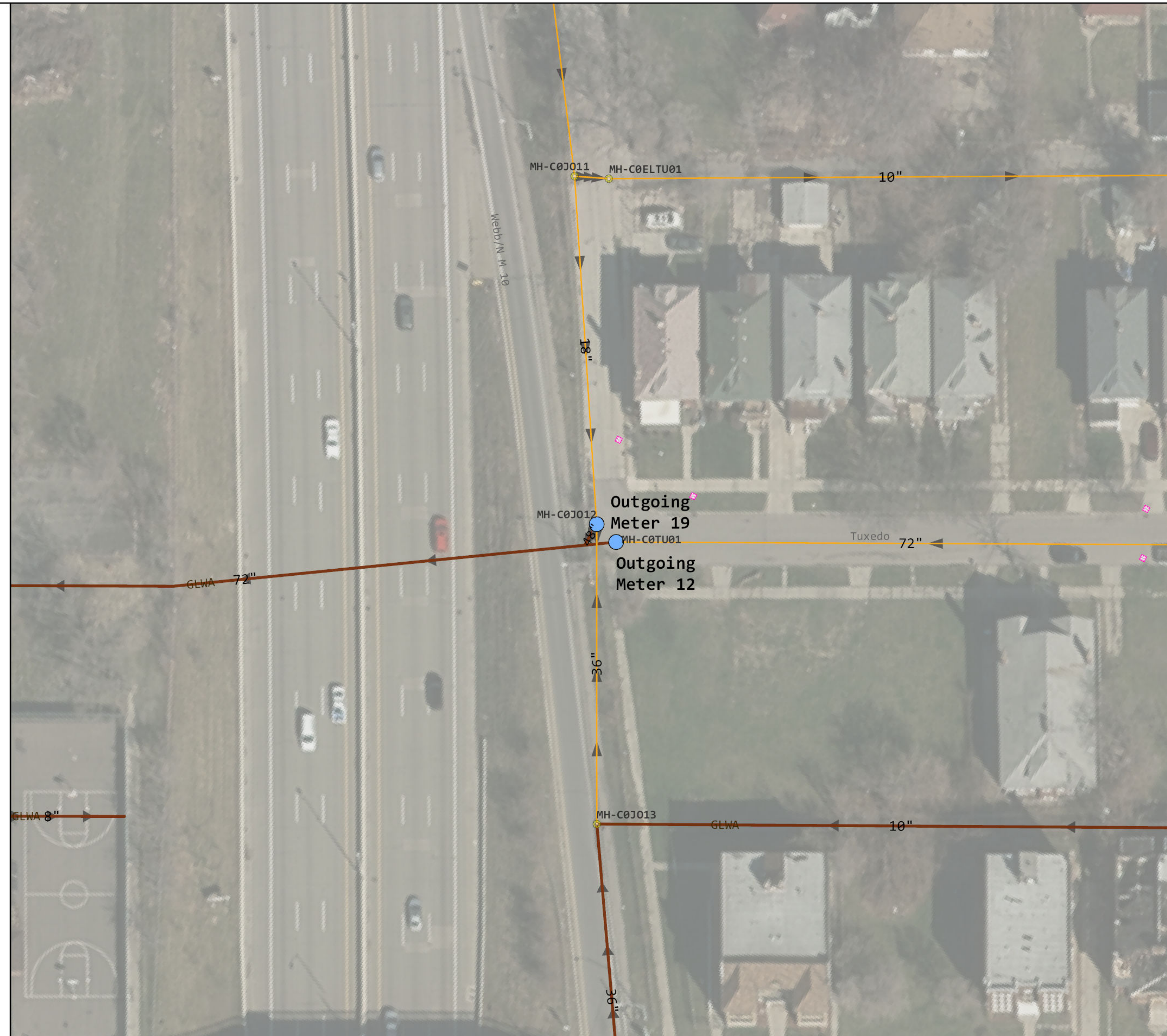
Manhole Scan Image of Meter ID 12
Outgoing Invert at 30.25



MACP Score: 2112

Vicinity Map





FORMATTED FOR 11"x17" ONLY

25 0 25
Feet

CITY OF HIGHLAND PARK

POTENTIAL METERING LOCATIONS

METRO CONSULTING ASSOCIATES

3/7/2019

LEGEND

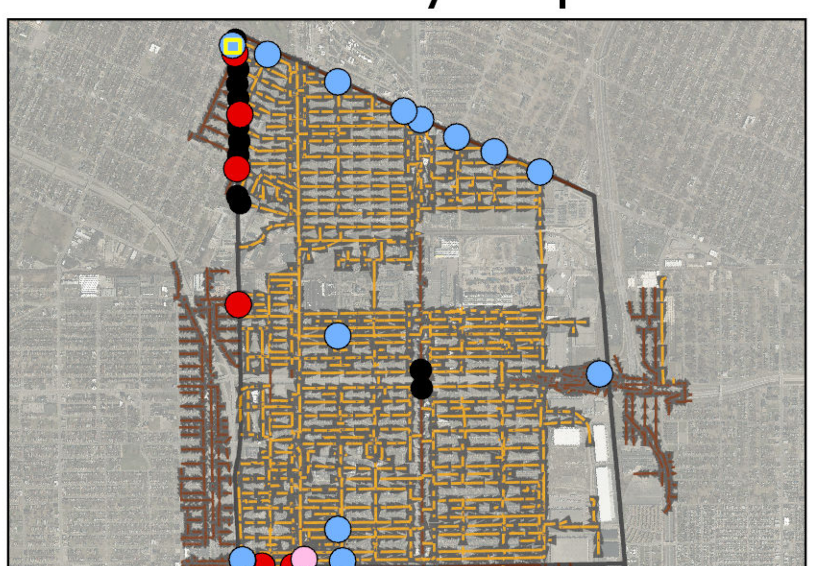
- Highland Park Manhole
- Non City Manhole
- Highland Park Sewer
- Non City Sewer
- High Point Connection = 13
- Incoming Connection = 5
- Outgoing Connection = 14
- Outgoing/Incoming = 1

2015 WAYNE COUNTY AERIAL PROVIDED BY SEMCOG. ALL DATA WITHIN MAP CURRENT TO DATE PRINTED. DATA IS SUBJECT TO CHANGE WITHOUT NOTICE

Manhole Scan Image of Meter ID 13
Outgoing Invert at 7.48

MACP Score: 3221

Vicinity Map



15 0 15
Feet

FORMATTED FOR 11"x17" ONLY

CITY OF HIGHLAND PARK

POTENTIAL METERING LOCATIONS

METRO CONSULTING ASSOCIATES

3/7/2019

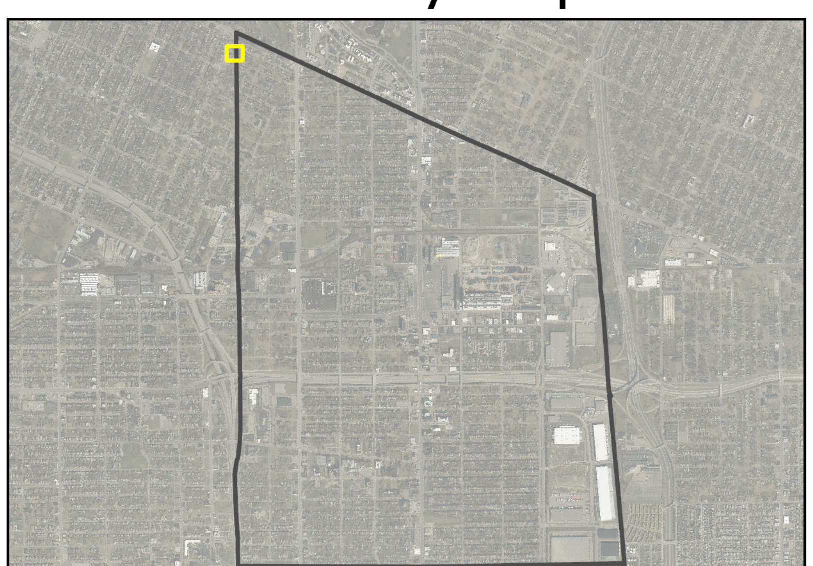
LEGEND

- Highland Park Manhole
- Non City Manhole
- Highland Park Sewer
- Non City Sewer
- High Point Connection = 13
- Incoming Connection = 5
- Outgoing Connection = 14
- Outgoing/Incoming = 1

Manhole Scan Image of MeterID 14 Incoming Invert at 12.20

MACP Score: 3111

Vicinity Map



N W E S

25 0 25
Feet

FORMATTED FOR 11"x17" ONLY

CITY OF HIGHLAND PARK

POTENTIAL METERING LOCATIONS

METRO CONSULTING ASSOCIATES

7/19/2018

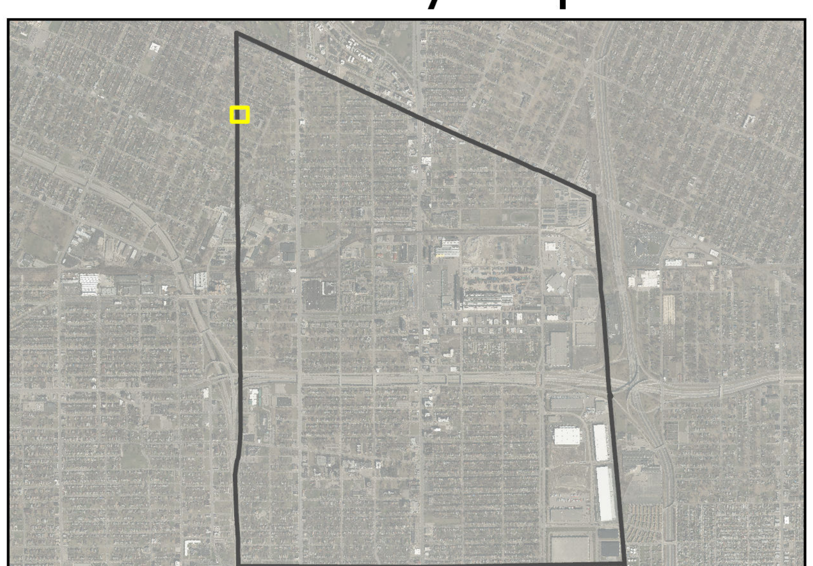
LEGEND

- High Point Connection = 9
- Incoming Connection = 8
- Outgoing Connection = 13
- Outgoing/Incoming = 2
- Highland Park Manhole
- Non City Manhole
- Highland Park Sewer
- Non City Sewer

Manhole Scan Image of MeterID 15
Incoming Invert at 7.48

MACP Score: 4131

Vicinity Map



FORMATTED FOR 11"x17" ONLY

25 0 25
Feet

CITY OF HIGHLAND PARK

POTENTIAL METERING LOCATIONS

METRO CONSULTING ASSOCIATES

7/19/2018

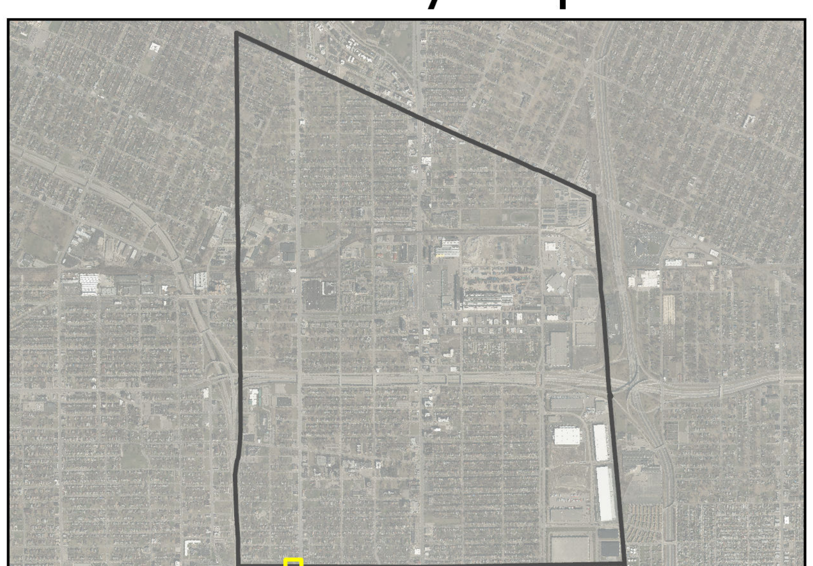
LEGEND

- High Point Connection = 9
- Incoming Connection = 8
- Outgoing Connection = 13
- Outgoing/Incoming = 2
- Highland Park Manhole
- Non City Manhole
- Highland Park Sewer
- Non City Sewer

Manhole Scan Image of MeterID 18
Incoming Invert at 9.08

MACP Score: 3222

Vicinity Map



FORMATTED FOR 11"x17" ONLY

25 0 25
Feet

CITY OF HIGHLAND PARK

POTENTIAL METERING LOCATIONS

METRO CONSULTING ASSOCIATES

7/19/2018

LEGEND

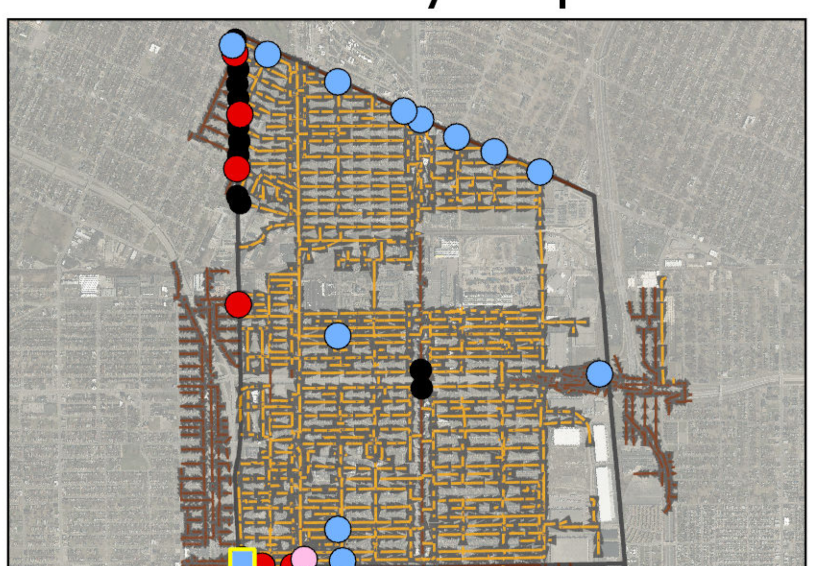
- High Point Connection = 9
- Incoming Connection = 8
- Outgoing Connection = 13
- Outgoing/Incoming = 2
- Highland Park Manhole
- Non City Manhole
- Highland Park Sewer
- Non City Sewer

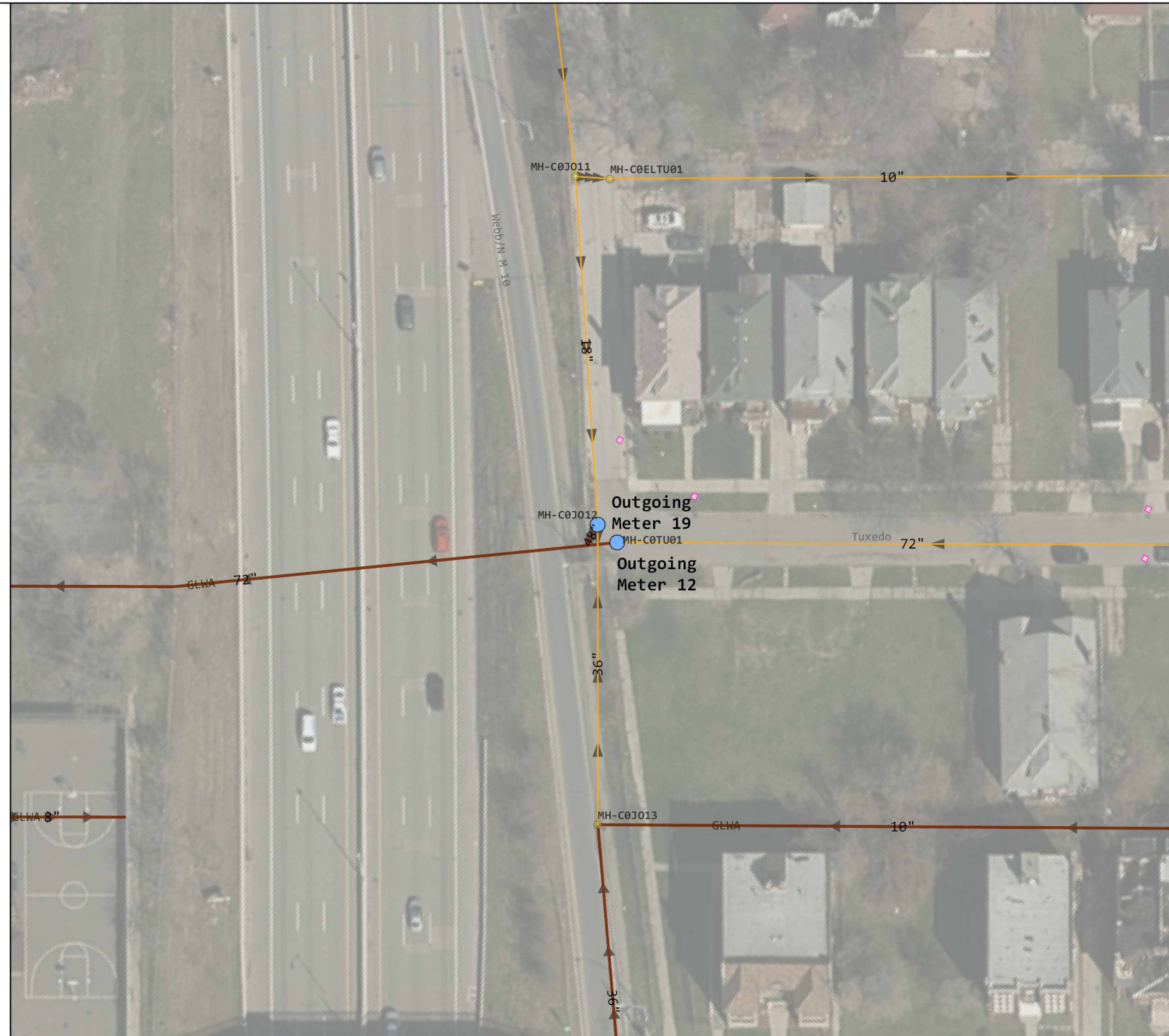
2015 WAYNE COUNTY AERIAL PROVIDED BY SEMCOG. ALL DATA WITHIN MAP CURRENT TO DATE PRINTED. DATA IS SUBJECT TO CHANGE WITHOUT NOTICE

Manhole Scan Image of Meter ID 19
Outgoing Invert at 19.76

MACP Score: 3221

Vicinity Map





FORMATTED FOR 11"x17" ONLY

25 0 25

Feet

CITY OF HIGHLAND PARK

POTENTIAL METERING LOCATIONS

METRO CONSULTING ASSOCIATES

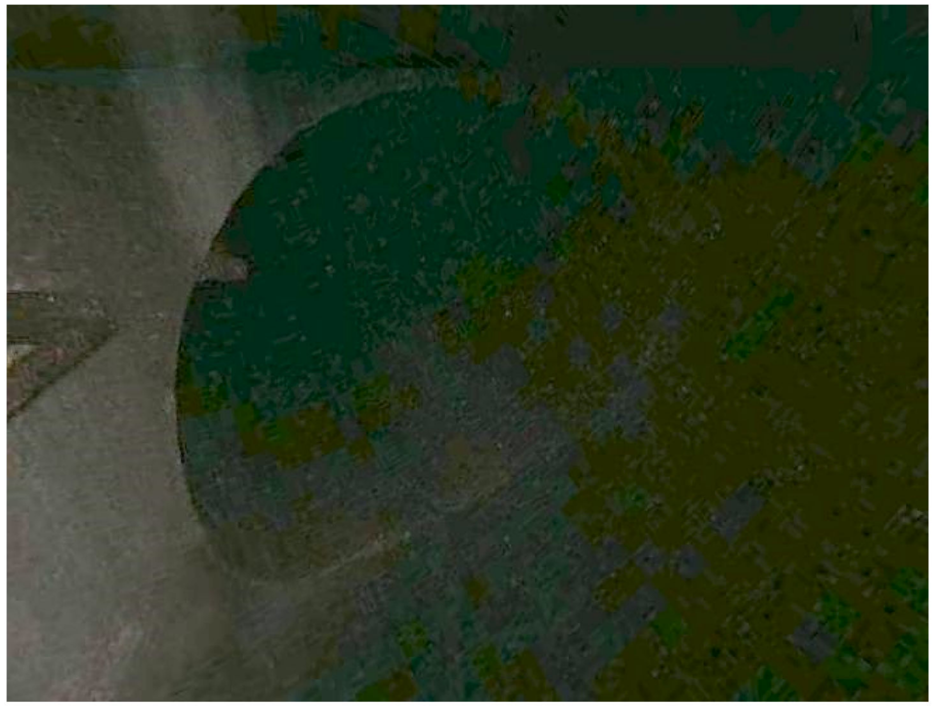
3/7/2019

LEGEND

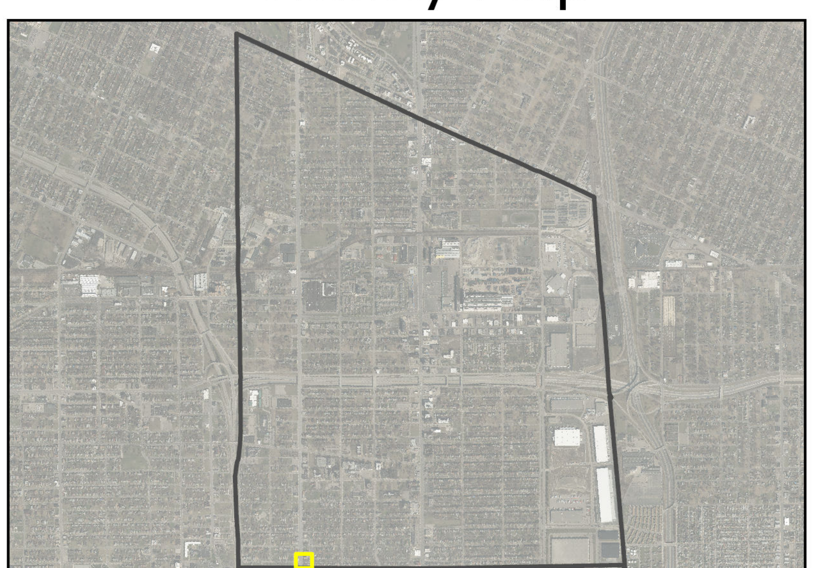
- Highland Park Manhole
- Non City Manhole
- Highland Park Sewer
- Non City Sewer
- High Point Connection = 13
- Incoming Connection = 5
- Outgoing Connection = 14
- Outgoing/Incoming = 1

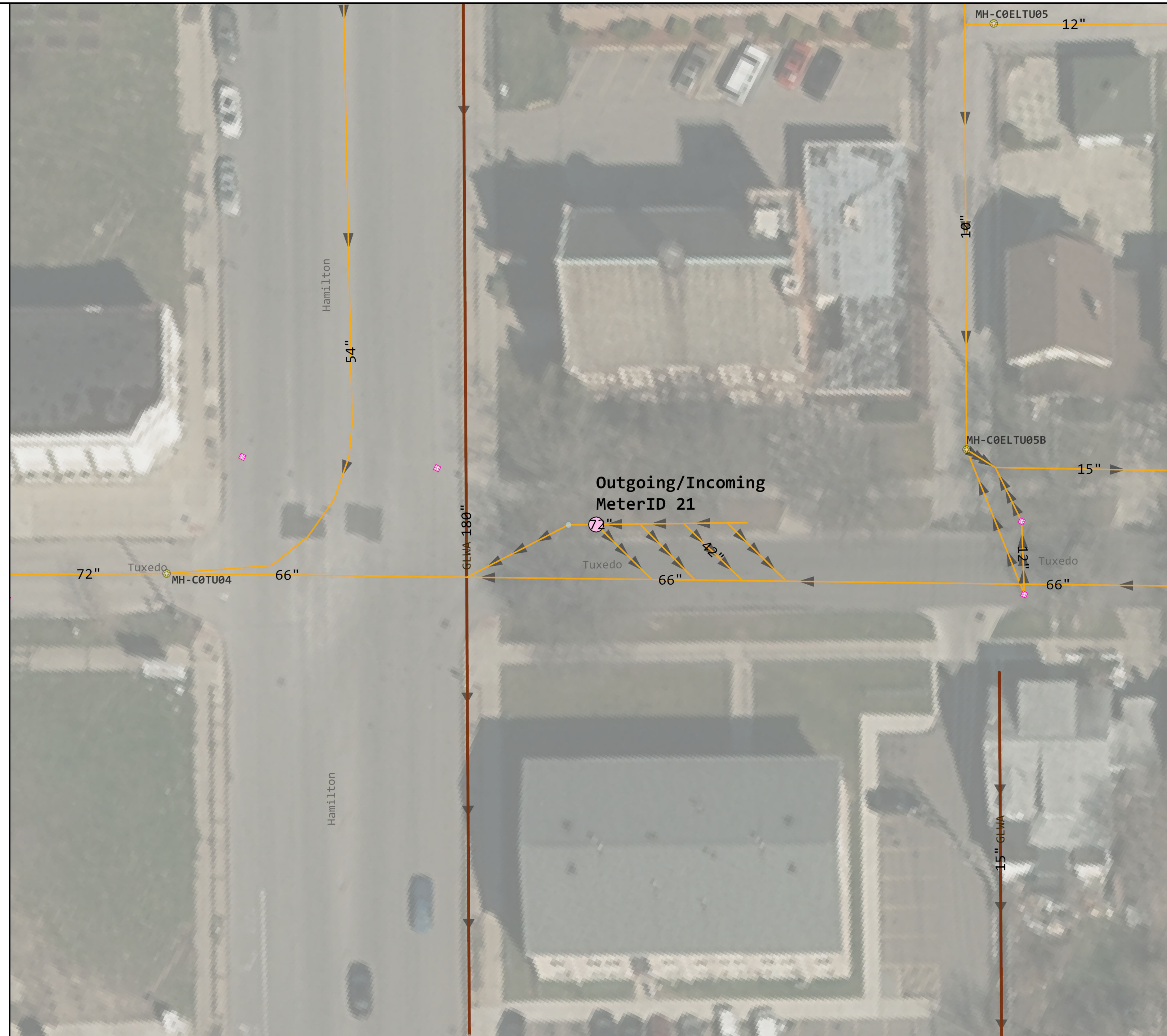
2015 WAYNE COUNTY AERIAL PROVIDED BY SEMCOG. ALL DATA WITHIN MAP CURRENT TO DATE PRINTED. DATA IS SUBJECT TO CHANGE WITHOUT NOTICE

CCTV Image of MeterID 21 Outgoing/Incoming at 49.68



Vicinity Map





FORMATTED FOR 11"x17" ONLY

25 0 25
Feet

CITY OF HIGHLAND PARK

POTENTIAL METERING LOCATIONS

METRO CONSULTING ASSOCIATES

7/19/2018

LEGEND

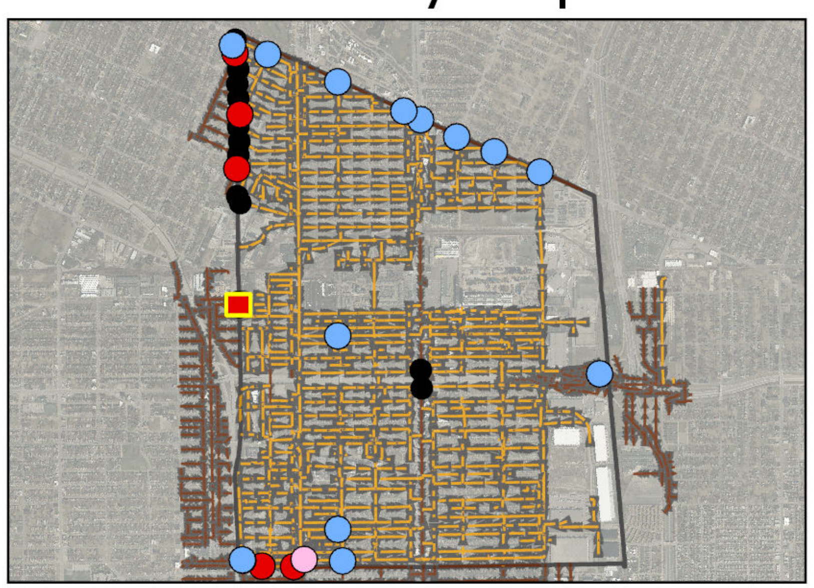
- High Point Connection = 9
- Incoming Connection = 8
- Outgoing Connection = 13
- Outgoing/Incoming = 2
- Highland Park Manhole
- Non City Manhole
- Highland Park Sewer
- Non City Sewer

2015 WAYNE COUNTY AERIAL PROVIDED BY SEMCOG. ALL DATA WITHIN MAP CURRENT TO DATE PRINTED. DATA IS SUBJECT TO CHANGE WITHOUT NOTICE

Manhole Scan Image of Meter ID 31
Incoming Invert at 6.81

MACP Score: 2321

Vicinity Map



FORMATTED FOR 11"x17" ONLY

25 0 25
Feet

CITY OF HIGHLAND PARK

POTENTIAL METERING LOCATIONS

METRO CONSULTING ASSOCIATES

2/7/2019

LEGEND

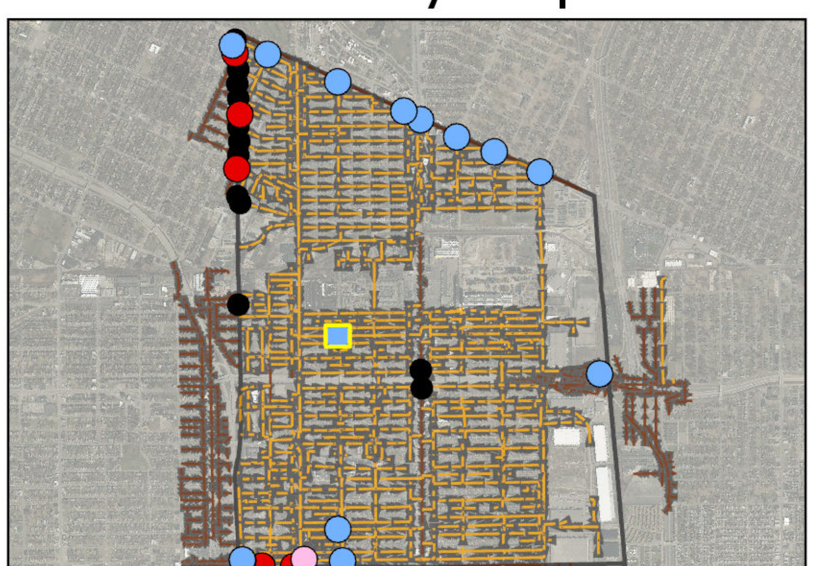
- Highland Park Manhole
- Non City Manhole
- Highland Park Sewer
- Non City Sewer
- High Point Connection = 13
- Incoming Connection = 5
- Outgoing Connection = 14
- Outgoing/Incoming = 1

2015 WAYNE COUNTY AERIAL PROVIDED BY SEMCOG. ALL DATA WITHIN MAP CURRENT TO DATE PRINTED. DATA IS SUBJECT TO CHANGE WITHOUT NOTICE

Manhole Scan Image of Meter ID 32
Outgoing Invert at 41.62

MACP Score: 3223

Vicinity Map



25 0 25

Feet

FORMATTED FOR 11"x17" ONLY

CITY OF HIGHLAND PARK

POTENTIAL METERING LOCATIONS

METRO CONSULTING ASSOCIATES

2/6/2019

LEGEND

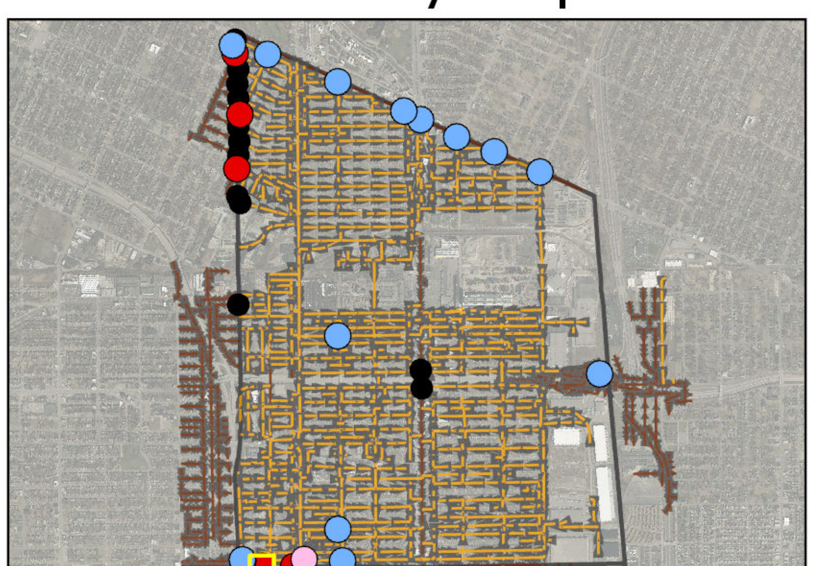
- Highland Park Manhole
- Non City Manhole
- Highland Park Sewer
- Non City Sewer
- High Point Connection = 13
- Incoming Connection = 5
- Outgoing Connection = 14
- Outgoing/Incoming = 1

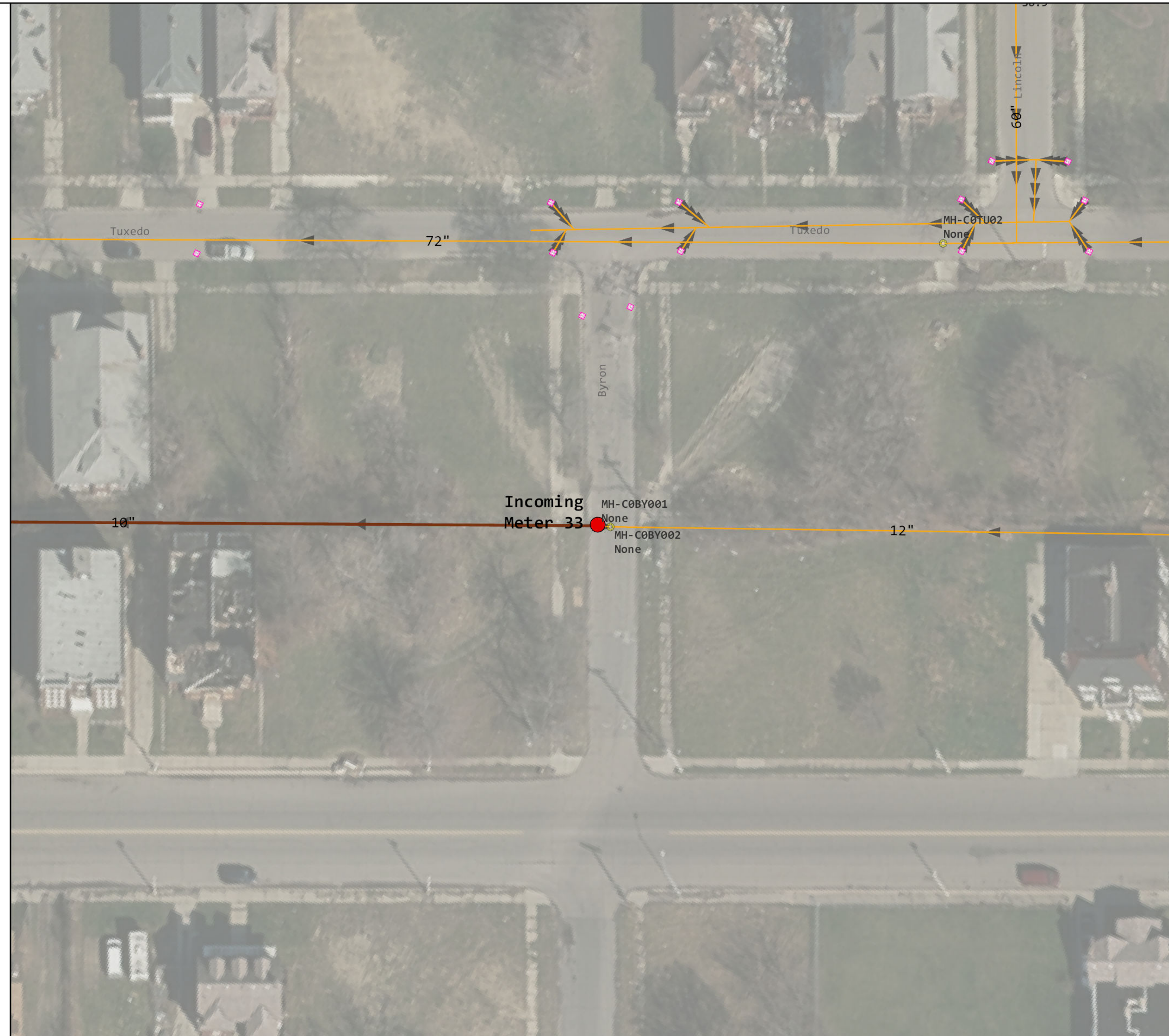
2015 WAYNE COUNTY AERIAL PROVIDED BY SEMCOG. ALL DATA WITHIN MAP CURRENT TO DATE PRINTED. DATA IS SUBJECT TO CHANGE WITHOUT NOTICE

Manhole Scan Image of Meter ID 33
Incoming Invert at 10.01

MACP Score: 2100

Vicinity Map





FORMATTED FOR 11"x17" ONLY

25 0 25
Feet

CITY OF HIGHLAND PARK

POTENTIAL METERING LOCATIONS

METRO CONSULTING ASSOCIATES

2/6/2019

LEGEND

- Highland Park Manhole
- Non City Manhole
- Highland Park Sewer
- Non City Sewer
- High Point Connection = 13
- Incoming Connection = 5
- Outgoing Connection = 14
- Outgoing/Incoming = 1

2015 WAYNE COUNTY AERIAL PROVIDED BY SEMCOG. ALL DATA WITHIN MAP CURRENT TO DATE PRINTED. DATA IS SUBJECT TO CHANGE WITHOUT NOTICE

Exhibit 3
MACP Rating System

MACP RATING SYSTEM

The manhole Assessment Certification Program (MACP) rating system is a shorthand expression representing the number of occurrences for the two highest severity grades within a manhole, on a grading scale of 1 to 5. The four-character score can be broken down as follows:

Character 1: The highest severity grade occurring in the manhole

Character 2: The total number of occurrences of the highest severity grade, with occurrences numbering above nine noted as follows:

10–14 = A
15–19 = B
20–24 = C
And so on…

Character 3: The second highest severity grade occurring in the manhole

Character 4: The total number of occurrences of the second highest severity grade, with occurrences numbering above nine noted as follows:

10–14 = A
15–19 = B
20–24 = C
And so on…

<u>Example</u>

The score of 462A shows that this manhole has no grade 5 or grade 3 defects, but it does have six grade 4 defect and ten to fourteen grade 2 defects.

APPENDIX 5
PUBLIC HEARING

CITY OF HIGHLAND PARK

Return to Excellence

Hubert Yopp
Mayor

CITY OF HIGHLAND PARK
RESOLUTION No.

A RESOLUTION REQUESTING PUBLIC HEARING AND COMMENT FOR STATE REVOLVING FUND PROJECT PLAN APPLICATION FOR THE CITY OF HIGHLAND PARK

WHEREAS, it is necessary for the City of Highland Park Water Department to address sewer improvements; and

WHEREAS, it is the intent of the Water Department Director that, if funds are awarded, shall be applied to improvements identified in the 2020 SRF Project Plan Application for the City of Highland Park; and

WHEREAS, all comments received from citizens at a duly advertised public hearing will be documented; and

BE IT RESOLVED, that the City of Highland Park City Council approves public hearings to be held at the regular City Council Meetings on May 20th and June 3rd, to receive these comments regarding the 2020 SRF Project Plan Application, this 15th day of April 2019.

PASSED AND ADOPTED, this 15th day of April 2019 by the votes of Highland Park City Council.

YEAS______________ NAYS___________

Vote Certified by the City Clerk

____
Brenda Green

City of Highland Park

NOTICE OF PUBLIC HEARING

The City of Highland Park will hold a public hearing on proposed sewer distribution improvement projects for the purpose of receiving comments from interested persons.

A public hearing will be held at the regularly scheduled Highland Park City Council meeting at 7:00 pm on May 20, 2019, at Highland Park City Hall, 12050 Woodward Avenue, Highland Park, MI 48203. A second public hearing will be held at the regularly scheduled Highland Park City Council meeting at 7:00pm on June 3, 2019, at Highland Park City Hall, 12050 Woodward Avenue, Highland Park, MI 48203.

The purpose of the proposed project is to upgrade aging sewer main, manhole structures, and catch basins, in addition to improving reliability and redundancy of the system.

Project construction will involve replacement of sewer, manhole structures, and catch basins in areas of the city based on the condition of the components and the number of residents within that area.

The estimated cost for the proposed project is estimated to be $5,000,000. The financing of the project is funded from a loan from the State Revolving Fund (SRF), which is to be paid for by sewer user fees.

Copies of the documents detailing the proposed project are available for inspection starting Thursday, April 18, 2019 at the following locations:

Robert B. Blackwell Municipal Building
12050 Woodward Avenue
Highland Park, MI 48203

Highland Park Water Department and City Engineering
Department Customer Service Center
14110 Woodward Avenue
Highland Park, MI 48203

Written comments received before the public comment period is closed on June 3, 2019, will be included in the final project plan. Written comments should be sent to:

City of Highland Park Water Department and City Engineering Department Customer Service Center
Mr. Damon L. Garrett, PE
Water Department Director
14110 Woodward Avenue
Highland Park, MI 48203

APPENDIX 6
DISADVANTAGED COMMUNITY STATUS DETERMINATION

APPENDIX 7
SHPO SECTION 106 APPLICATION

APPENDIX 8
MDEQ AIR QUALITY ANNUAL REPORT

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

AIR QUALITY ANNUAL REPORT

2017

Michigan Department of Environmental Quality | *www.michigan.gov/air* | 800-662-9278

Photo: MDOT Photography Unit

Air Quality Annual Report

2017

INTRODUCTION

The federal Clean Air Act (CAA) requires the United States Environmental Protection Agency (USEPA) to establish National Ambient Air Quality Standards (NAAQS) for six criteria pollutants considered harmful to public health and the environment. Criteria pollutants are the pollutants for which the USEPA must describe the characteristics and potential health and welfare effects. These standards define the maximum permissible concentration of criteria pollutants in the air (see **Table 1.1**).

The six criteria pollutants are monitored by the Michigan Department of Environmental Quality (DEQ), Air Quality Division (AQD). These criteria pollutants are:

- Carbon monoxide (CO),
- Lead (Pb),
- Nitrogen dioxide (NO_2),
- Ozone (O_3),
- Particulate matter smaller than 10 and 2.5 microns in diameter (PM_{10} and $PM_{2.5}$, respectively), and
- Sulfur dioxide (SO_2).

Chapters 2 through **7** provide information on each of the six criteria pollutants and include:

- Michigan's monitoring requirements for 2017,
- Attainment/nonattainment status,
- Monitoring site locations (tables and maps show all the monitors active in 2017), and
- Air quality trends from 2012-2017 broken down by location.[1]

The 2017 data for each criteria pollutant is available in **Appendix A.**

The AQD also monitors air toxics. Air toxics are other hazardous air pollutants that can affect human health and the environment.[2] This data can be found in **Appendix B.**

The purpose of this report is to provide a snapshot of Michigan's 2017 air quality data, air quality trends, overview of the monitoring network (available in much greater detail in the 2018 Network Review),[3] air toxics monitoring program, and other AQD programs, such as MIair and the Emissions Inventory.[4]

---

[1] Air quality trends are based on actual statewide monitored readings, which are also listed in the USEPA's Air Quality Subsystem Quick Look Report Data at www3.epa.gov/airtrends/

[2] An Overview of Michigan Air Toxic Rules is available on the AQD website at www.michigan.gov/deqair (select "Permits," then "Toxics Laws and Rules.")

[3] Available online at www.michigan.gov/documents/deq/deq-aqd-amu-2018_air_monitoring_network_review__565062_7.pdf

[4] Online information about criteria pollutants and air toxics, along with this and previous Annual Air Quality Reports, are available via the AQD's website at www.michigan.gov/deqair (select "Monitoring).

TABLE OF CONTENTS

CHAPTER 1: BACKGROUND INFORMATION

This section summarizes the development of the NAAQS (see Appendix D) and how compliance with these standards is determined. Also included is an overview of Michigan's air sampling network, long-term air quality trends, and the variety of monitoring techniques and requirements used to ensure quality data is obtained.

National Ambient Air Quality Standards (NAAQS)

Under Section 109 of the CAA, the USEPA established a primary and secondary NAAQS for each pollutant for which air quality criteria have been issued. The primary standard is designed to protect the public health with an adequate margin of safety, including the health of the most susceptible individuals in a population, such as children, the elderly, and those with chronic respiratory ailments. Factors in selecting the margin of safety for the primary standard include the nature and severity of the health effects involved and the size of the sensitive population at risk. Secondary standards are chosen to protect public welfare (personal comfort and well-being) and the environment by limiting economic damage, impacts on visibility and climate, and harmful effects on soil, water, crops, vegetation, wildlife, and buildings.

In addition, the NAAQS have various averaging times to address health impacts. Short averaging times reflect the potential for acute (immediate) effects, whereas long-term averaging times are designed to protect against chronic (long-term) effects.

NAAQS have been established for CO, Pb, NO_2, PM, O_3, and SO_2. **Table 1.1** lists the primary and secondary NAAQS, averaging time and concentration level for each criteria pollutant in effect in 2017. The concentrations are listed as parts per million (ppm), micrograms per cubic meter ($\mu g/m^3$), and/or milligrams per cubic meter (mg/m^3).

Table 1.1: NAAQS in Effect during 2017 for Criteria Pollutants

Pollutant	Primary (health) Level	Primary Averaging Time	Secondary (welfare) Level	Secondary Averaging Time
Carbon Monoxide (CO) 8-hour average	9 ppm (10 mg/m^3)	8-hour average, not to be exceeded more than once per year *(1971)*	None*	None*
Carbon Monoxide (CO) 1-hour average	35 ppm (40 mg/m^3)	1-hour average, not to be exceeded more than once per year *(1971)*	None*	None*
Lead (Pb)	0.15 µg/m^3	Maximum rolling 3-month average *(2008)*	Same as Primary	Same as Primary
Nitrogen Dioxide (NO_2) Annual mean	0.053 ppm (100 µg/m^3)	Annual mean *(1971)*	Same as Primary	Same as Primary
Nitrogen Dioxide (NO_2) 1-hour average	0.100 ppm	98^{th} percentile of 1-hour average, averaged over 3 years *(2010)*	None	None
Particulate Matter (PM_{10})	150 µg/m^3	24-hour average, not to be exceeded more than once per year over 3 years *(1987)*	Same as Primary	Same as Primary
Particulate Matter ($PM_{2.5}$) Annual average	12.0 µg/m^3	Annual mean averaged over 3 years *(2012)*	15.0 µg/m^3	Annual mean
Particulate Matter ($PM_{2.5}$) 24-hour average	35 µg/m^3	98^{th} percentile of 24-hour concentration, averaged over 3 years *(2006)*	Same as Primary	Same as Primary
Ozone (O_3)	0.070 ppm	Annual 4^{th} highest 8-hour daily max averaged over 3 years *(2015)*	Same as Primary	Same as Primary
Sulfur Dioxide (SO_2)	0.075 ppm	99^{th} percentile of 1-hour daily max averaged over 3 years *(2010)*	0.5 ppm	3 hours

*****In 1985, the USEPA revoked the secondary standard for CO (for public welfare) due to a lack of evidence of adverse effects on public welfare at or near ambient concentrations.

To demonstrate compliance with the NAAQS, the USEPA has defined specific criteria for each pollutant, which are summarized in **Table 1.2.**

Table 1.2: Criteria for the Determination of Compliance with the NAAQS

Pollutant	Criteria for Compliance
CO	Compliance with the CO standard is met when the second highest, non-overlapping, 35 ppm, 1-hour average standard and/or the 9 ppm, 8-hour average standard is not exceeded more than once per year.
Pb	Compliance with the Pb standard is met when daily values collected for three consecutive months are averaged and do not exceed the 0.15 $\mu g/m^3$ standard.
NO_2	Compliance is met when the annual arithmetic mean concentration does not exceed the 0.053 ppm standard and the 98th percentile* of the daily maximum 1-hour concentration averaged over 3 years does not exceed 100 ppb.
PM_{10}	The 24-hour PM_{10} primary and secondary standards are met when 150 $\mu g/m^3$ is not exceeded more than once per year on average over 3 years.
$PM_{2.5}$	The annual $PM_{2.5}$ primary and secondary standards are met when the annual arithmetic mean concentration is less than or equal to 12 $\mu g/m^3$ and 15 $\mu g/m^3$, respectively. The 24-hour $PM_{2.5}$ primary and secondary standards are met when the 3-year average of the 98th percentile** 24-hour concentration is less than or equal to 35 $\mu g/m^3$.
O_3	The 8-hour O_3 primary and secondary standards are met when the 3-year average of the 4th highest daily maximum 8-hour average concentration is less than or equal to 0.070 ppm.
SO_2	To determine compliance, the 99th percentile*** 1-hour concentration averaged over a 3-year period does not exceed 0.075 ppm, and the 3-hour average concentration shall not exceed 0.5 ppm more than once per calendar year.

*****98th percentile daily maximum 1-hour value* is the value below which nominally 98 percent of all daily maximum 1-hour concentration values fall, using the ranking and selection method specified in section 5.2 of appendix S of CFR Part 50.
****** *98th percentile* is the daily value out of a year of $PM_{2.5}$ monitoring data below which 98 percent of all daily values fall using the ranking and selection method specified in section 4.5(a) of appendix N of CFR Part 50.
******* *99th percentile daily maximum 1-hour value* is the value below which nominally 99 percent of all daily maximum 1-hour concentration values fall, using the ranking and selection method specified in section 5 of appendix T of CFR Part 50.

As part of the USEPA's grant to the DEQ, the AQD provides an annual Network Review document[5] of all monitoring data collected from the previous year and recommendations on any network changes. These recommendations are based on each monitor's exceedance history, changes in population distribution, and modifications to federal monitoring requirements under the CAA. Under the amended air monitoring regulations that began in 2007, states are required to solicit public comment (in May of each year) on their future air monitoring network design prior to submitting the annual review to the USEPA in July.

[5] Most recent Network Reviews are available online at:
https://www.michigan.gov/deq/0,4561,7-135-3310_70316_4195---,00.html

Michigan Air Sampling Network

The Michigan Air Sampling Network (MASN) is operated by the DEQ's AQD, along with other governmental agencies. For instance, the O_3 and $PM_{2.5}$ monitors in Manistee County and Chippewa County are tribal monitors handled by the Little River Band of Ottawa Indians and the Inter-tribal Council of Michigan, respectively. **Figure 1.1** shows the 2017 MASN monitoring sites. **Figures 1.2** and **1.3** are pictures of two monitoring stations; one at Seney and the other at Livonia Roadway, respectively.

The MASN consists of federal reference method (FRM) monitors that enable continuous monitoring for the gaseous pollutants CO, $NO_{2,}$ O_3, and $SO_{2;}$ PM monitors that measure particulate concentrations over a 24-hour period; and high-volume samplers for Pb. In addition, continuous $PM_{2.5}$ and PM_{10} monitors provide real-time hourly data. $PM_{2.5}$ chemical speciation monitors determine the chemical composition of $PM_{2.5}$. The MASN data is also used to provide timely reporting to the DEQ's air quality reporting web page (discussed in **Chapter 9**). The types of monitoring conducted in 2017 and the MASN locations are shown in **Table 1.3.**

The **NCore network** began January 1, 2011, as part of the USEPA's 2006 amended air monitoring requirements. NCore is a multi-pollutant network that integrates several advance measurement systems for particles, pollutant gases, and meteorology. This information will support scientific studies ranging across technological, health, and atmospheric process disciplines. Michigan has two NCore sites; Allen Park and Grand Rapids-Monroe Street. Further information on the effects of these criteria pollutants is provided in **Chapters 2** through **7**.

The **Near-road Monitoring Network** focuses on vehicle emissions and how they disperse near roadways. In 2011 Michigan took over the USEPA's pre-existing near-roadway site at Eliza Howell Park in Detroit. A second near-road site was added in Livonia in January 2015. Data from these sites are presented in **Chapters 2** and **5.**

Figure 1.1: 2017 MASN Monitoring Sites

Figure 1.2: Seney Monitoring Site

Figure 1.3: Livonia Roadway Monitoring Site

Table 1.3 Types of Monitoring Conducted in 2017 and MASN Location

Area	AIRS ID	Site Name	CO	NO_2	Trace NO_y	O_3	PM_{10}	$PM_{2.5}$	$PM_{2.5}$ TEOM	$PM_{2.5}$ Speciation	SO_2	Trace SO_2	VOC	Carbonyls	Trace Metals	Wind Speed & Direction, Temp.	Relative Humidity	Solar Radiation	Barometric Pressure
Detroit-Ann Arbor	260910007	Tecumseh				√		√	√	√+E						√			√
	260990009	New Haven				√		√								√	√	√	
	260991003	Warren				√													
	261250001	Oak Park				√		√								√			
	261470005	Port Huron				√		√	√		√					√			
	261470031	Port Huron-Rural St.													√@+Pb				
	261610008	Ypsilanti				√		√	√							√			√
	261630001	Allen Park	√*		√	√	√	√	√	√+A		√			√@+Pb	√	√		√
	261630005	River Rouge					√							√	√@	√			
	261630015	Detroit-W. Fort St.					√	√		√	√		√	√	√@	√	√		√
	261630016	Detroit-Linwood						√											
	261630019	Detroit-E. 7 Mile		√		√		√								√	√		√
	261630025	Livonia						√											
	261630027	Detroit-W. Jefferson													√@				
	261630033	Dearborn					√	√	√	√+EA			√	√	√ + Pb	√	√		√
	261630036	Wyandotte						√											
	261630039	Detroit-W. Lafayette						√	√							√			
	261630093	Eliza Howell-Roadway	√	√		√										√			
	261630094	Eliza Howell-Downwind	√	√		√										√	√		√
	261630095	Livonia-Roadway	√	√				√								√	√		√
	261630097	NMH 48217							√		√		√		√ + Pb				
Flint	260490021	Flint				√		√	√							√			√
	260492001	Otisville				√										√			
Grand Rapids	261390005	Jenison				√										√			
	261390011	West Olive									√					√			
	260810007	Grand Rapids-Wealthy						√											
	260810020	Grand Rapids-Monroe	√*		√	√	√	√	√	√		√			√@+Pb	√			√
	260810022	Evans				√										√			
Lansing/East Lansing	260650012	Lansing		√		√		√	√		√					√			√
	260370001	Rose Lake				√													
Monroe Co	261150006	Sterling State Park						√			√					√			
Huron Co	260630007	Harbor Beach				√										√			
Bay Co	260170014	Bay City						√	√							√			
Missaukee Co	261130001	Houghton Lake		√		√		√	√							√			√
Allegan Co	260050003	Holland				√		√								√	√	√	√
Benzie Co	260190003	Benzonia				√													
Berrien Co	260210014	Coloma				√		√								√			
Cass Co	260270003	Cassopolis				√										√			
Kalamazoo Co	260770008	Kalamazoo				√		√	√							√			
Manistee Co	261010922	Manistee $				√		√								√		√	√
Mason Co	261050007	Scottville				√										√			
Muskegon Co	261210039	Muskegon-Green				√										√			
Schoolcraft Co	261530001	Seney Nat'l Wildlife				√			√							√	√	√	√
Chippewa Co	260330901	Sault Ste. Marie $				√		√	√							√			
Ionia Co	260670002	Belding-Reed St.													√@+Pb	√			
	260670003	Belding-Merrick St.													√@+Pb				

√ = Data Collected
\# = Mn only
@ = Mn, As, Cd, Ni
Pb = Lead
$ = Tribal monitor
* = Trace CO monitor
E = EC/OC monitor
A = Aethalometer monitor

Quality Assurance

The AQD's Air Monitoring Unit (AMU) ensures that all data collected and reported is of high quality and meets federal requirements. The AMU has a quality system in place that includes a Quality Assurance Project Plan (QAPP), standard operating procedures (SOPs), standardized forms and documentation policies, and a robust audit and assessment program.

The monitoring network adheres to the requirements in Title 40 of the Code of Federal Regulations (CFR), Parts 50, 53, and 58. This ensures that the monitors are correctly sited, operated in accordance to the federal reference methods, and adhere to the quality assurance requirements.

Quality assurance checks are conducted by site operators at the frequencies required in the regulations and unit procedures. Independent audits are conducted by the AMU's Quality Assurance (QA) Team, which has a separate reporting line of supervision. The quality assurance checks and audits are reported to the USEPA each quarter.

External audits are conducted annually by the USEPA. The USEPA conducts Performance Evaluation Program (PEP) audits for $PM_{2.5}$ samplers and the National Performance Audit Program (NPAP) checks for the gaseous monitors. The USEPA also conducts program-wide Technical Systems Audits (TSAs) every three years to evaluate overall program operations and assess adequacy of documentation and records retention. External audits are also conducted on the laboratory operations for certain analytical techniques using performance evaluation samples.

Long-term Trends

Congress passed the CAA in 1970; however, Michigan has had a long-standing history of environmental awareness well before the Act was established. In 1887, Detroit was the first city in Michigan to adopt an air quality ordinance, which declared that the dense smoke from burning coal was a public nuisance.

The USEPA is required to review the criteria pollutant standards every five years. Over time, based upon toxicological data, the standards (NAAQS) have been tightened to better protect public health (see Appendix D). Areas that meet the NAAQS are considered to be in "attainment." Locations where air pollution levels persistently exceed the NAAQS may be designated as "nonattainment." The tightening standards are why some areas in the state may be designated to nonattainment from attainment even though monitoring shows that air quality continues to improve.

Due to the vast availability of historical data, criteria pollutant data from Southeast Michigan are shown in **Figures 1.4** through **1.9.** These figures show how the ambient levels and the standards for these pollutants have changed over the last 35-plus years. Since Southeast Michigan is highly industrialized, it is a good indicator of the air quality improvement for the rest of the state.

Figure 1.4: Historical Ozone at the DEQ's Detroit E. 7 Mile Site shows the ozone levels at the Detroit E. 7 Mile Road site. This graph shows how the standard changed from a 1-hour average of 0.120 ppm to an 8-hour average of 0.08 ppm in 1997. The standard was further lowered to 0.075 ppm in 2008 and to 0.070 ppm at the end of 2015.

Figure 1.4: Historical 1-hour and 8-hour Ozone at E. 7 Mile

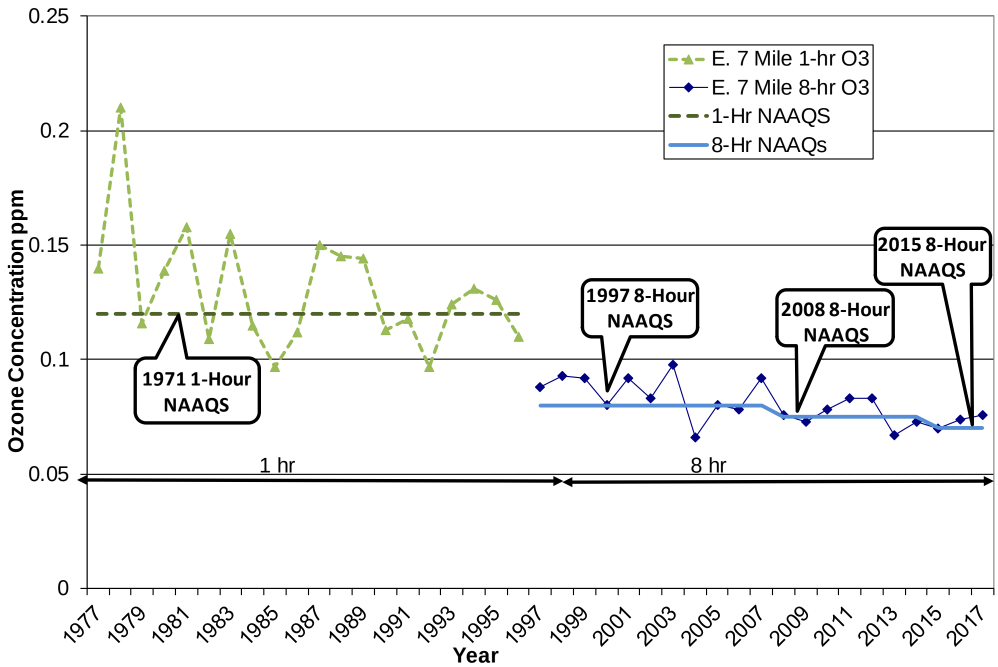


Figure 1.5: Historical Annual and 1-hour SO_2 Averages at Detroit–W. Fort Street (SWHS)
This figure shows the SO_2 trend for the old annual standard and the new 1-hour standard for W. Fort Street (Southwest High School [SWHS]) in Detroit. In 2010, the USEPA changed the standard from an annual average to 99th percentile of a 1-hour standard in which the SO_2 concentration cannot exceed 0.075 ppm averaged over 3 years. This resulted in nonattainment status for a portion of Wayne County (see **Chapter 4** for additional details). Even though the area is in nonattainment for the 1-hour SO_2 standard, levels of SO_2 have decreased significantly over the years.

Figure 1.5: Historical Annual and 1-hour SO_2 Averages at W. Fort St.

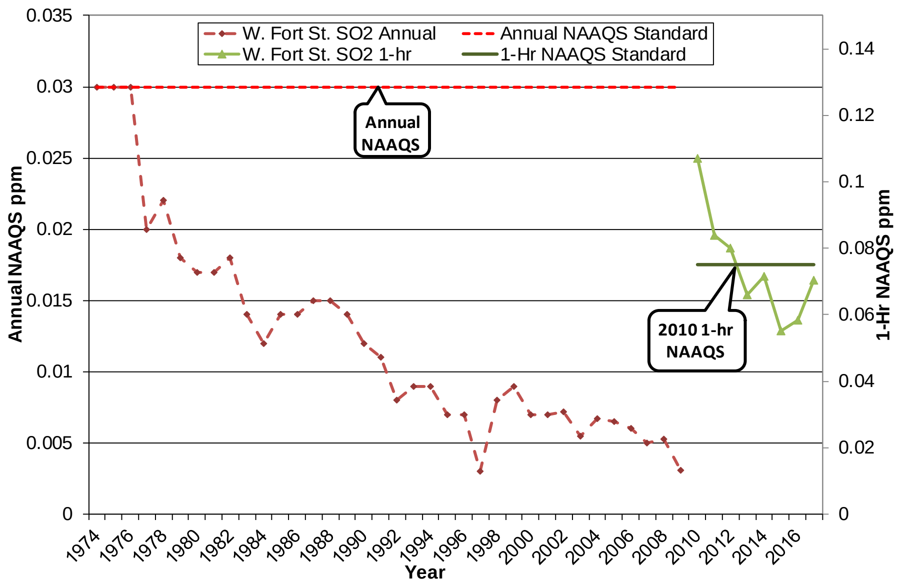


Figure 1.6 shows the CO trend at Allen Park to be well below the 1-hour standard of 35 ppm, which has not changed since 1971.

Figure 1.6: Historical 1-hour CO Averages at Allen Park

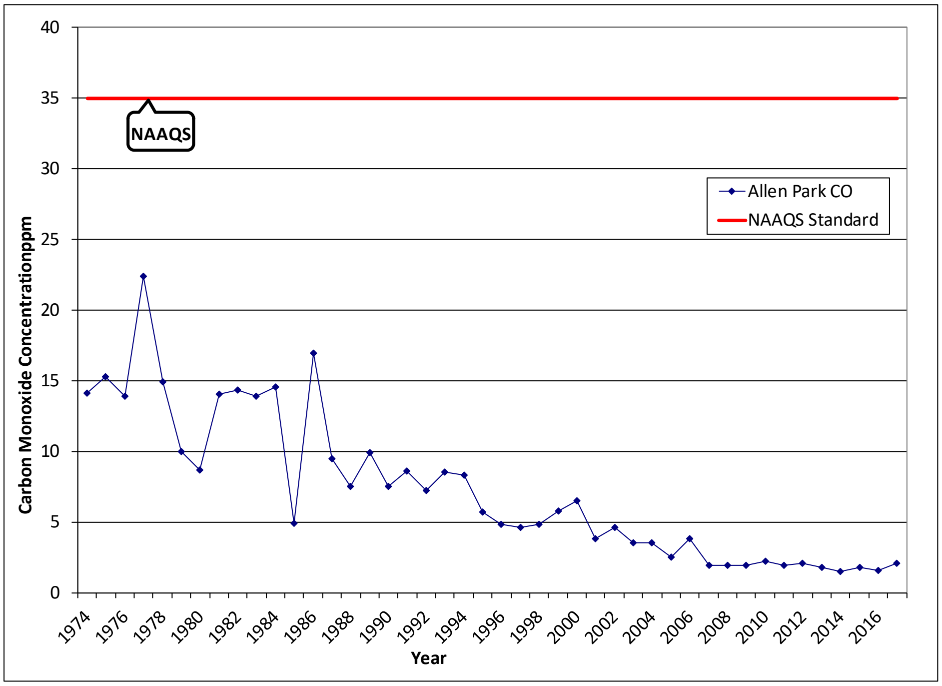


Figure 1.7 shows the trend for lead at Dearborn. Lead (Pb) is of concern because it is harmful to the neurological development of children. The largest decrease in Pb in the air is due to the removal of Pb in gasoline. By 1975, most newly manufactured vehicles no longer required leaded gasoline, and as a result, there was a dramatic decrease in ambient Pb levels. In 1996, the USEPA banned the sale of leaded fuel for use in on-road vehicles. The graph also shows the decrease in the Pb standard that occurred in 2008.

Figure 1.7: Historical Quarterly/3-month Averages for Lead at Dearborn

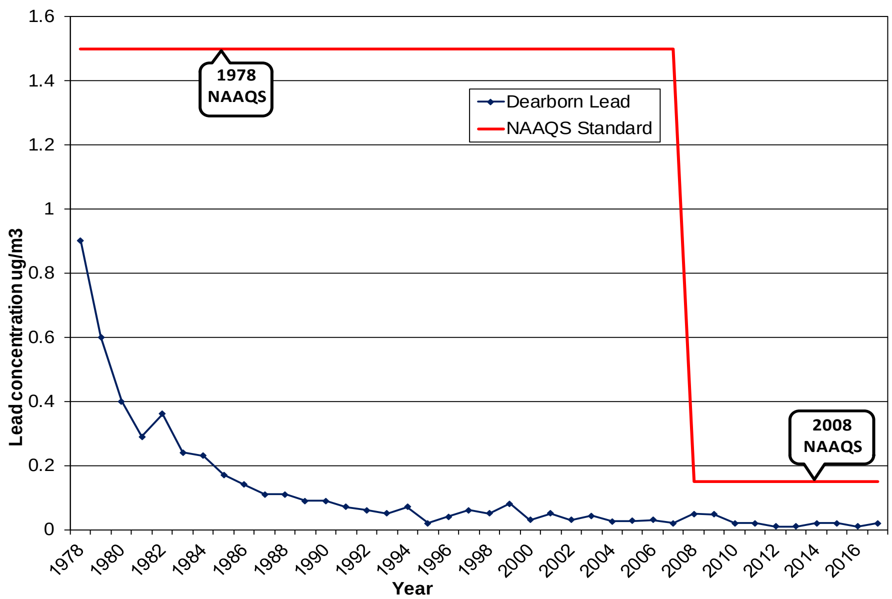


Figure 1.8 shows the trend for NO_2, which has been well below the annual standard of 53 ppb and shows a downward trend. In 2010, the USEPA added a 1-hour standard of the 98th percentile not to exceed 100 ppb averaged over 3 years. One-hour NO_2 concentrations in Michigan have also remained well below the standard.

Figure 1.8: Historical Annual and 1-hour NO_2 at E. 7 Mile Road.

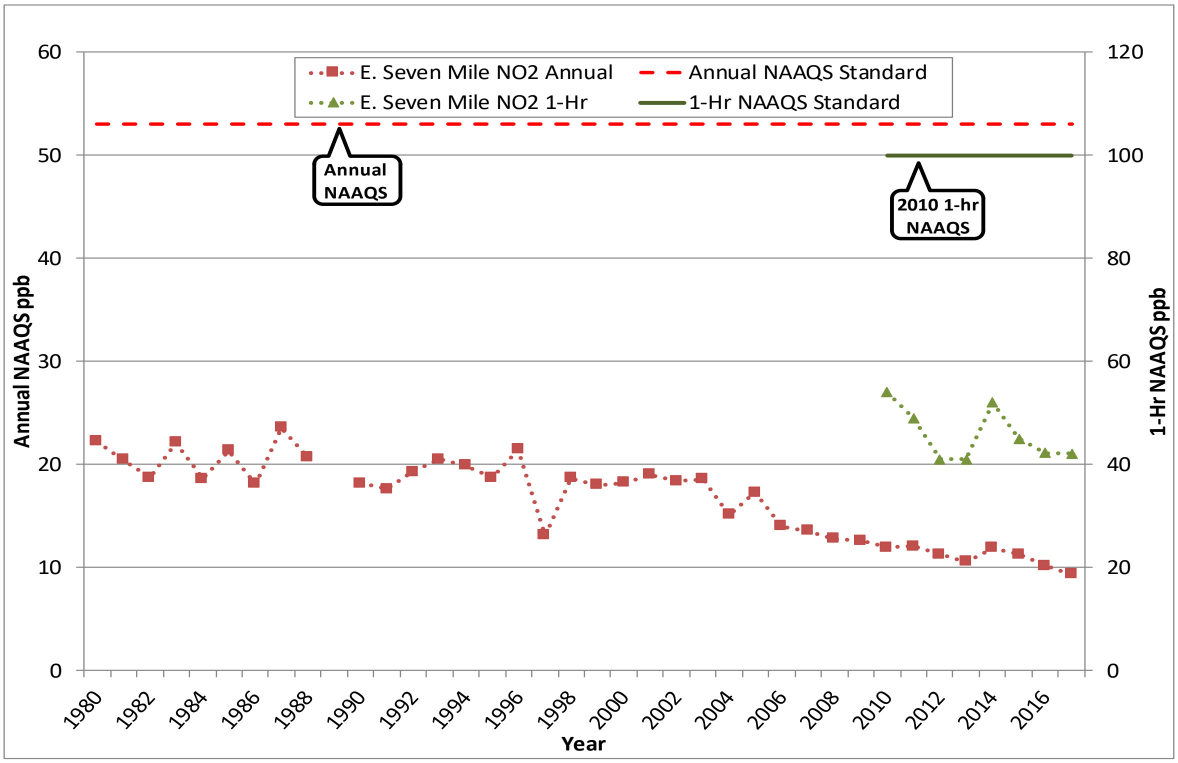
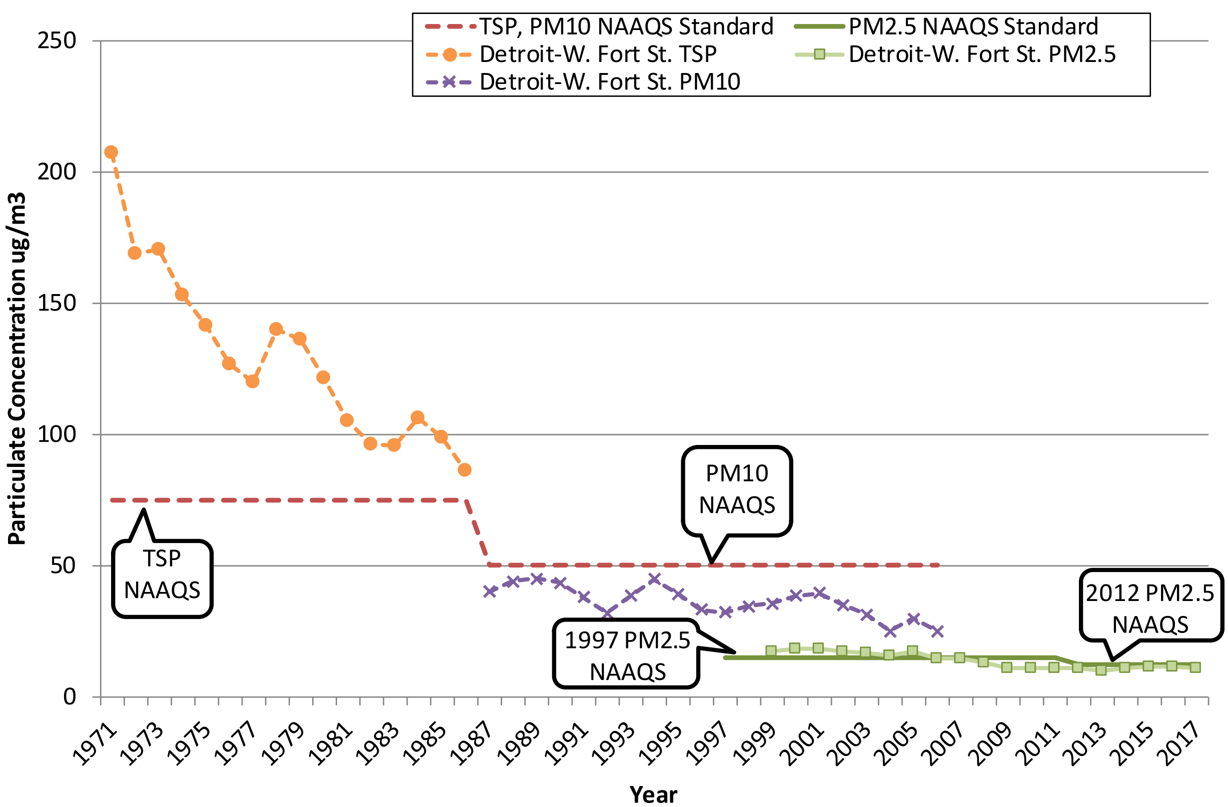


Figure 1.9 shows the trends for particulate matter. In 1971, the USEPA promulgated an annual and 24-hour particulate standard based on total suspended particulates (TSP). In 1987, the USEPA changed the standard to PM_{10}. Health studies indicated that particles smaller than 10 microns affect respiration. In 1997, the USEPA added additional NAAQS for a smaller particle fraction size, $PM_{2.5}$, which can get deeper into the lungs and possibly into the blood stream. In 2006, the USEPA revoked the PM_{10} annual standard but kept the PM_{10} 24-hour standard. The $PM_{2.5}$ 24-hour standard was also reduced from 65 µg/m^3 to 35 µg/m^3. In 2012, the USEPA again reduced the annual standard from 15 µg/m^3 to 12 µg/m^3. Particulate trends show that particulate concentrations have decreased, and the state is in compliance for all particulate NAAQS; however, Michigan has had past nonattainment issues in Southeast Michigan for TSP, PM_{10} and $PM_{2.5}$.

Figure 1.9: Historical Annual Particulate Matter at W. Fort St. (SWHS).



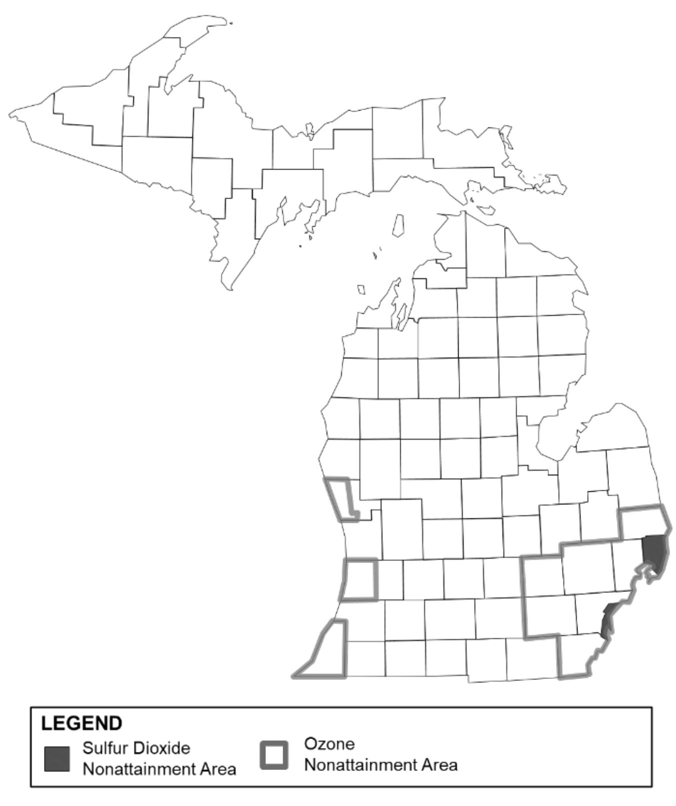
Current Attainment Status

Areas of the state that are below the NAAQS concentration level are called attainment areas. The entire state of Michigan is in attainment for the following pollutants:

- CO
- Pb
- NO_2
- Particulate Matter

Nonattainment areas are those that have concentrations over the NAAQS level. Portions of the state are in nonattainment for SO_2 and O_3 (see map). Nonattainment status for O_3 will be effective in late summer of 2018.

Figure 1.10: Attainment Status for the National Ambient Air Quality Standards



CHAPTER 2: CARBON MONOXIDE (CO)

Carbon monoxide is a gas formed during incomplete burning of fuel. CO is colorless, odorless, and tasteless, and is lethal at elevated concentrations. Levels peak during colder months primarily due to cold temperatures that affect combustion efficiency of engines. The CO NAAQS is 9 ppm for the second highest 8-hour average and 35 ppm for the second highest 1-hour average. Its sources and effects are provided below.

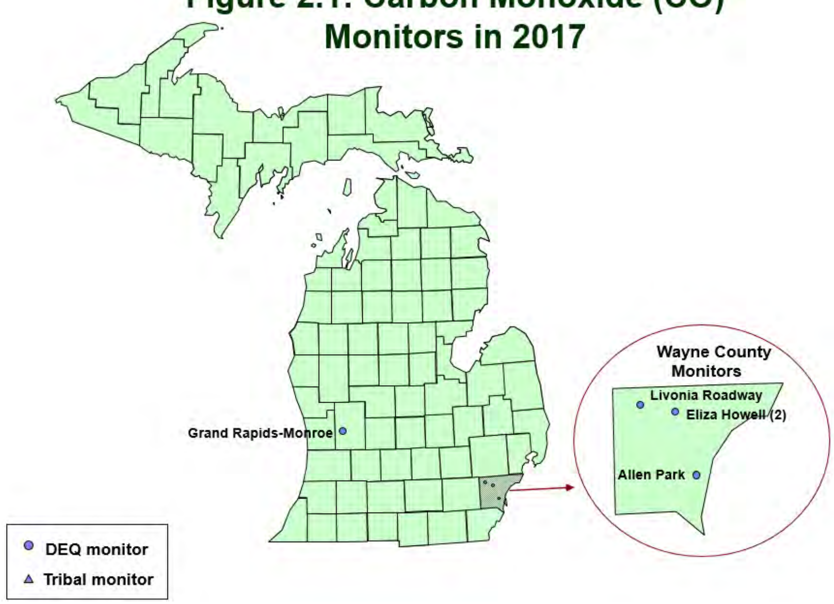
Sources: CO is given off whenever fuel or other carbon-based materials are burned. Outdoor exposure sources include automobile exhaust, industrial processes (metal processing and chemical production), and non-vehicle fuel combustion. Natural sources include volcanos, forest fires and photochemical reactions in the atmosphere. Indoor exposure sources include wood stoves and fireplaces, gas ranges with continuous pilot flame ignition, unvented gas or kerosene heaters, and cigarette smoke.

Effects: CO enters the bloodstream through the lungs, where it displaces oxygen delivered to the organs and tissues. Elevated levels can cause visual impairment, interfere with mental acuity by reducing learning ability and manual dexterity, and can decrease work performance in the completion of complex tasks. In extreme cases, unconsciousness and death can occur. CO also alters atmospheric photochemistry contributing to the formation of ground-level O_3, which can trigger serious respiratory problems.

Population most at risk: Those who suffer from cardiovascular (heart and respiratory) disease, fetuses, infants and the elderly are most at risk for exposure to elevated levels of CO. People with angina and peripheral vascular disease are especially at risk, as their circulatory systems are already compromised and less efficient at carrying oxygen; however, elevated CO levels can also affect healthy people.

Figure 2.1 shows the location of each CO monitor that operated in 2017. The Eliza Howell Park and Livonia sites are required under the Near-roadway Network. A second downwind site at Eliza Howell Park provides a comparison to the near-roadway sites. The other two sites, Grand Rapids and Allen Park, are where CO (lower detection levels 1 ppm-50 ppm) is being monitored as part of the NCore Network.

Figure 2.1: Carbon Monoxide (CO) Monitors in 2017



Figures 2.2 and **2.3** show CO emission sources and CO emissions by county (courtesy of the USEPA's State and County Emission Summaries).

Figure 2.2: CO Emissions by Source Sector

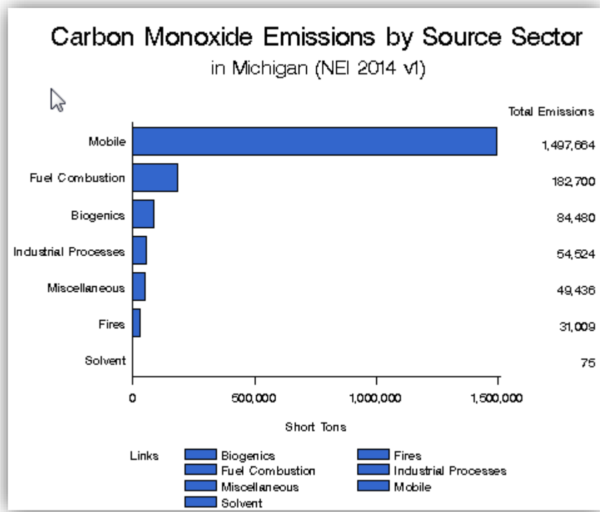
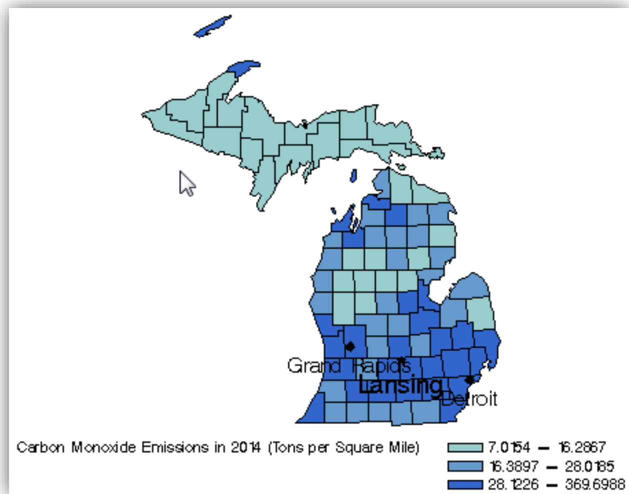
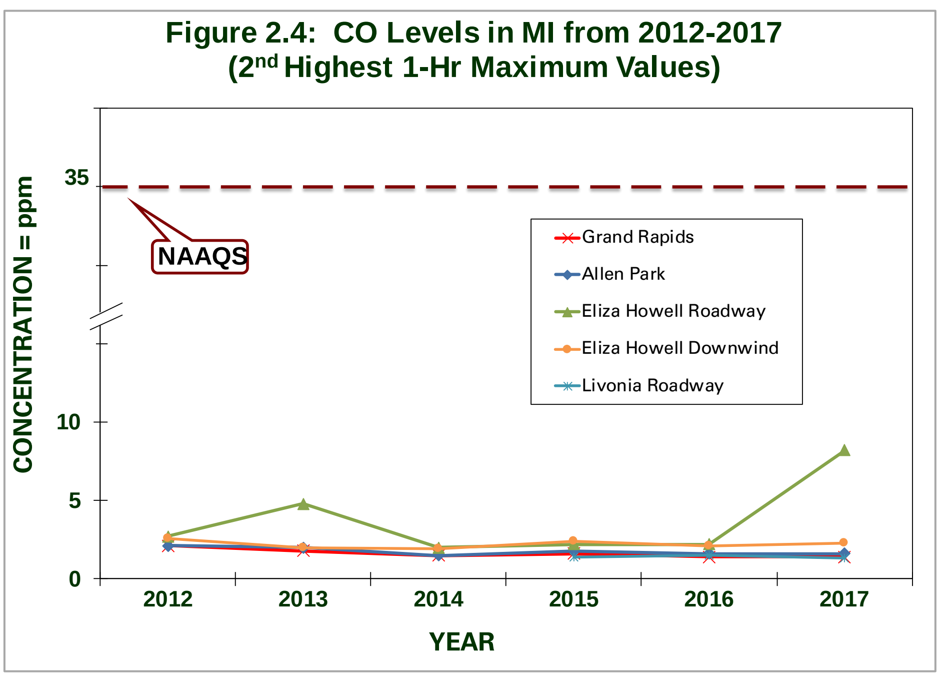


Figure 2.3: CO Emissions in 2014



Near-roadway Monitoring: On August 31, 2011, the USEPA approved design changes to part of the CO ambient monitoring network. This network, now referred to as the near-roadway network, is focused on high traffic urban roads in Core-Based Statistical Areas (CBSAs) with more than one million people. The DEQ took over two of the USEPA's pre-existing, near-roadway sites at Eliza Howell Park, Detroit in June 2011. In January 2015, the second required near-road site started sampling in Livonia.

Figure 2.4 shows the maximum second highest 1-hour CO level trends for Michigan from 2012-2017, which demonstrates that there have not been any exceedances of the 1-hour CO NAAQS.



CHAPTER 3: LEAD (PB)

Lead is a highly toxic metal found in coal, oil, and other fuels. It is also found in older paints, municipal solid waste and sewage sludge, and may be released to the atmosphere during combustion. On November 12, 2008, the USEPA lowered the Pb NAAQS from a maximum quarterly average of 1.5 µg/m^3 to a 3-month rolling average of 0.15 µg/m^3. Its sources and effects are presented below.

Sources: With the phase-out of leaded gas in the 1970s, the major sources of Pb emissions have been due to ore and metals processing and piston-engine aircraft operating on leaded aviation fuel. Other industrial sources include Pb acid battery manufacturers, waste incinerators, and utilities. The highest air concentrations of Pb are usually found near lead smelters.

Effects: Exposure occurs through the inhalation or ingestion of Pb in food, water, soil, or dust particles. Pb primarily accumulates in the body's blood, bones, and soft tissues, and adversely affects the nervous system as well as the cardiovascular system, reproductive system, blood, kidneys and other organs.

Population most at risk: Fetuses and children are most at risk since low levels of Pb may cause central nervous system damage. Excessive Pb exposure during the early years of life is associated with lower IQ scores and neurological impairment (seizures, mental develop-ment, and behavioral disorders). Even at low doses, lead exposure is associated with changes in fundamental enzymatic, metabolic, and homeostatic mechanisms in the body, and Pb may be a factor in high blood pressure and subsequent heart disease.

Figure 3.1: Lead (Pb) Monitors in 2017

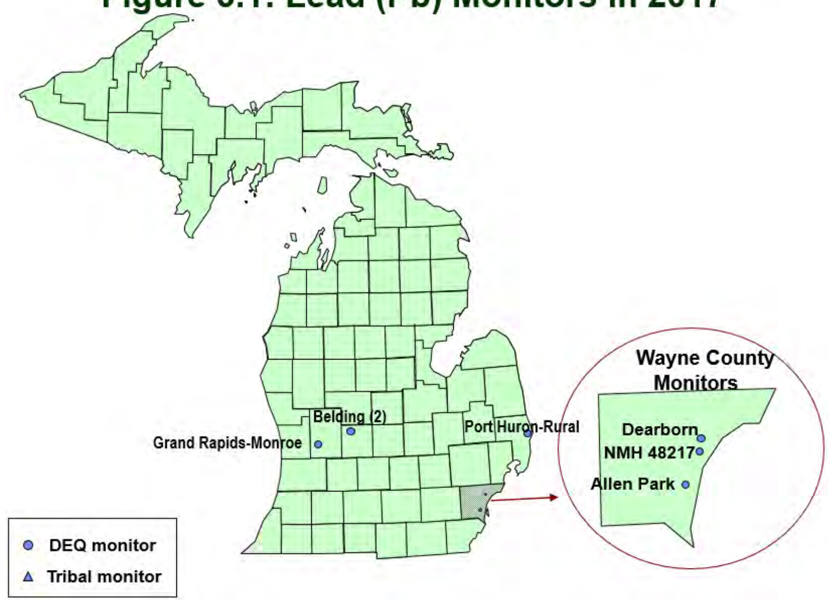


Figure 3.1 shows the location of the Pb monitors in the MASN in 2017.

Figures 3.2 and **3.3** show Pb emission sources and Pb emissions by county (courtesy of the USEPA's State and County Emission Summaries).

Figure 3.2: Pb Emissions by Source Sector

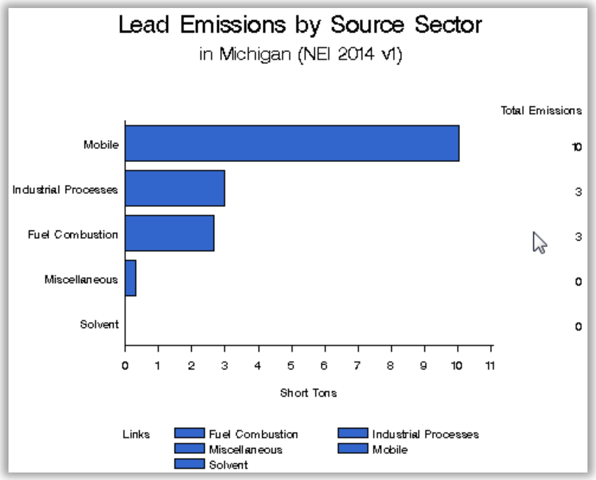
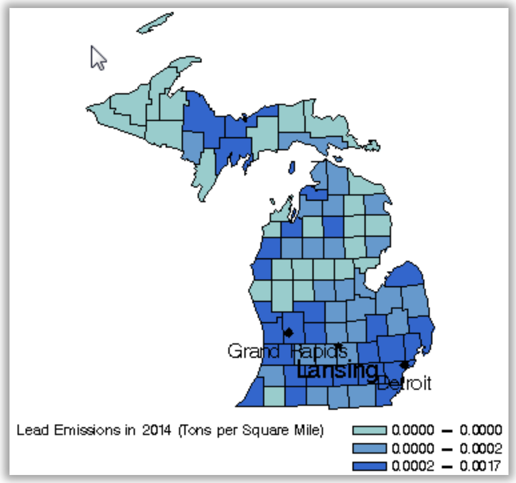


Figure 3.3: Pb Emissions in 2014



On November 12, 2008, the USEPA modified the Pb NAAQS by reducing the level of the standard from a maximum quarterly average of 1.5 µg/m^3 to a 3-month rolling average of 0.15 µg/m^3. The monitoring network design was modified to consist of source-oriented monitors and population-oriented monitors.

Figure 3.4: Lead Levels in Michigan from 2012-2017 (Maximum 3-Month Average Values)

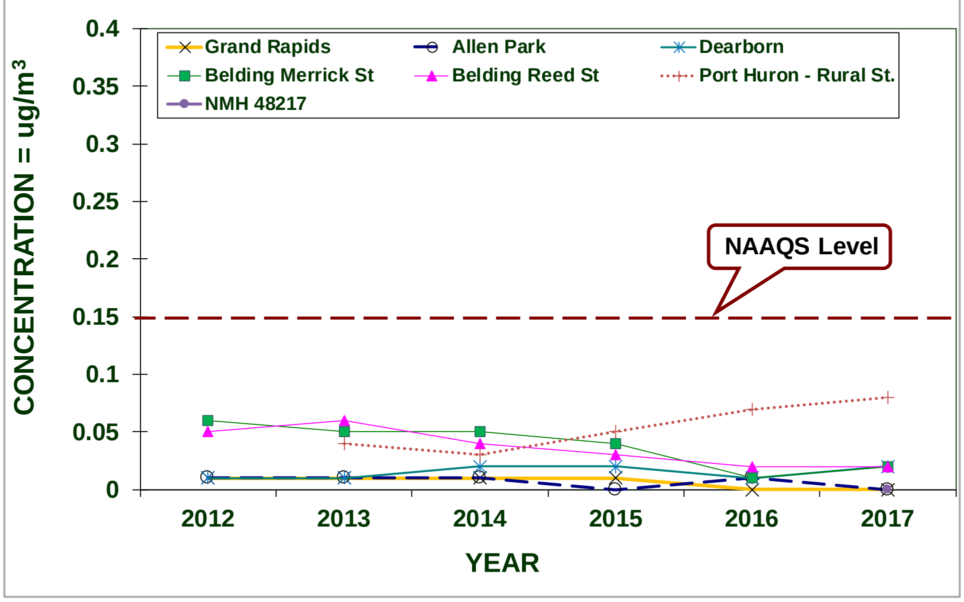


Figure 3.4 shows the maximum 3-month rolling average values for Pb from 2012 to 2017. As part of the 2008 Pb NAAQS, the DEQ is required to monitor near stationary Pb sources emitting more than 1/2 ton per year. The DEQ currently has three point-source Pb monitoring sites: Rural St. in Port Huron (started November 2012), Merrick St. in Belding (started January 2010), and Reed St. in Belding (started July 2011). The two sites in Belding previously were above the standard, but values for both the sites have been below the NAAQS for the past five years. Belding was predesignated to attainment on July 31, 2017.

All Pb monitor sites in Michigan are below the standard. The Dearborn site is part of the National Air Toxics Trend Sites (NATTS) and monitors lead and trace metals, both as total suspended particulate (TSP) and PM_{10}. Lead measurements as $PM_{2.5}$ are also made throughout the $PM_{2.5}$ speciation network.

Chapter 4: Sulfur Dioxide (SO_2)

Sulfur dioxide is a gas formed by the burning of sulfur-containing material. Odorless at typical ambient concentrations, SO_2 can react with other atmospheric chemicals to form sulfuric acid. At higher concentrations it has a pungent, irritating odor similar to a struck match. When sulfur-bearing fuel is burned, the sulfur is oxidized to form SO_2, which then reacts with other pollutants to form aerosols. These aerosols can form particles in the air causing increases in $PM_{2.5}$ levels. In liquid form, it is found in clouds, fog, rain, aerosol particles, and in surface films on these particles. In June 2010, the USEPA changed the primary SO_2 standard to a 99th percentile of 1-hour concentrations not to exceed 0.075 ppm, averaged over a 3-year period. The secondary standard has not changed and is a 3-hour average that cannot exceed 0.5 ppm once per year. Its sources and effects are presented below.

Sources: Coal-burning power plants are the largest source of SO_2 emissions. Other sources include industrial processes such as extracting metal from ore, and non-road transportation sources, and natural sources such as volcanoes. SO_2 and particulate matter are often emitted together.

Effects: Exposure to elevated levels can aggravate symptoms in asthmatics and cause respiratory problems in healthy groups as well. SO_2 and NOx together are the major precursors to acid rain and are associated with the acidification of soils, lakes, and streams, as well as accelerated corrosion of buildings and monuments.

Population most at risk: Asthmatics, children, and the elderly are especially sensitive to SO_2 exposure. Asthmatics receiving short-term exposures during moderate exertion may experience reduced lung function and symptoms, such as wheezing, chest tightness, or shortness of breath. Depending on the concentration, SO_2 may also cause symptoms in people who do not have asthma.

Figure 4.1: Sulfur Dioxide (SO_2) Monitors in 2017

Figure 4.1 shows the location of each SO_2 monitor that operated in 2017. The two NCore sites, Allen Park and Grand Rapids, have trace SO_2 monitors that have lower detection limits than traditional SO_2 monitors.

Figures 4.2 and **4.3** show SO_2 emission sources and SO_2 emissions by county (courtesy of the USEPA's State and County Emission Summaries).

Figure 4.2: SO_2 Emissions by Source Sector

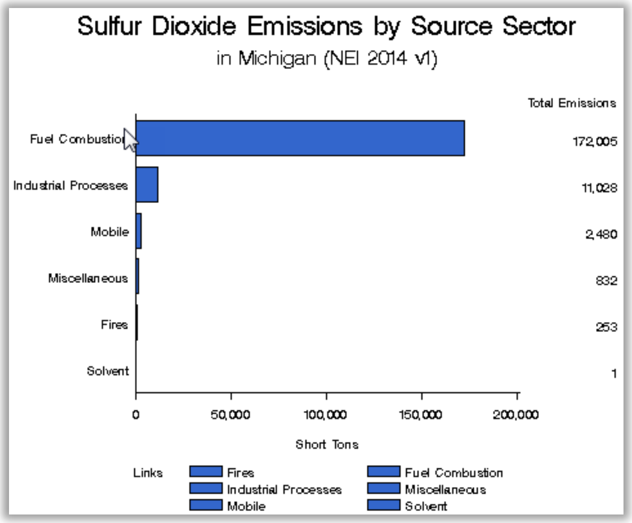
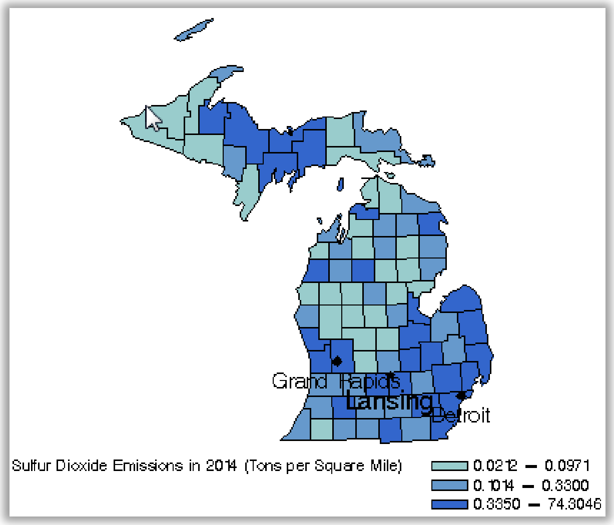


Figure 4.3: SO_2 Emissions in 2014



Historically, Michigan had been in attainment for SO_2 since 1982 with levels consistently well below the annual SO_2 NAAQS. However, in 2010, the USEPA changed the SO_2 NAAQS to a 1-hour standard, which showed that the SO_2 monitor at W. Fort Street (SWHS) in Detroit did not meet the new NAAQS. SO_2 concentrations have decrease at this site and are currently under the NAAQS, although modeling concentrations are not below the NAAQS. In September 2016, a portion of St. Clair County was also designated as nonattainment by the USEPA based on emissions and modeling (see **Figure 1.10**).

The NCore sites, Grand Rapids and Allen Park, monitor for trace SO_2. For trend purposes, all SO_2 data are graphed together in **Figure 4.4**. Jenison and Port Huron were added to the SO_2 network in December 2011, and Sterling State Park in Monroe County was added to the SO_2 network in December 2012. The Jenison monitor was shut down on January 1, 2014 and was later moved to West Olive, where it started sampling in January 2015.

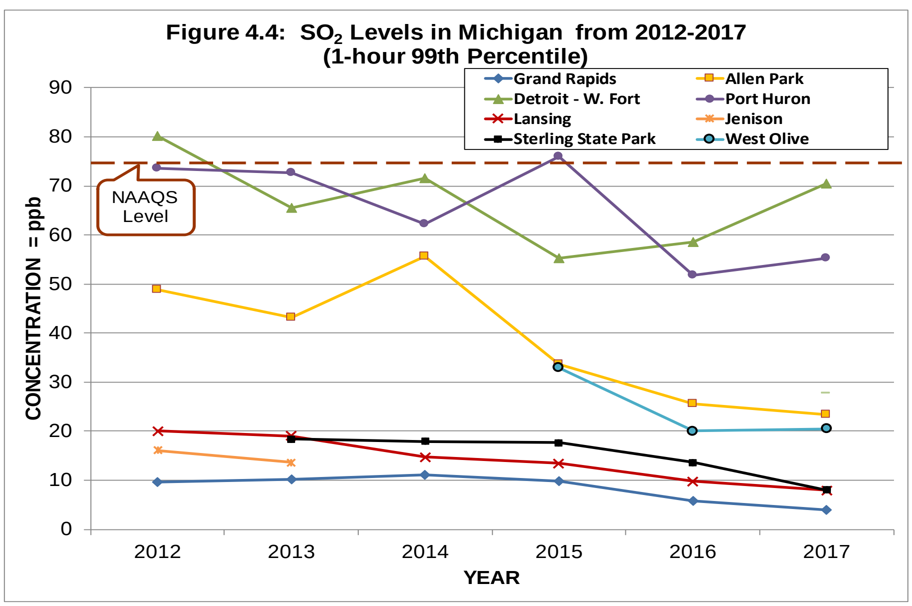


Figure 4.4: SO_2 Levels in Michigan from 2012-2017 (1-hour 99th Percentile)

CHAPTER 5: NITROGEN DIOXIDE (NO_2)

Nitrogen dioxide is a reddish-brown, highly reactive gas formed through oxidation of nitric oxide (NO). Upon dilution, it becomes yellow or invisible. High concentrations produce a pungent odor and lower levels have an odor similar to bleach. NO_X is the term used to describe the sum of NO, NO_2, and other nitrogen oxides. NO_X can lead to the formation of O_3 and NO_2 and can react with other substances in the atmosphere to form particulate matter or acidic products that are deposited in rain (acid rain), fog, or snow. Since 1971, the primary and secondary standard for NO_2 was an annual mean of 0.053 ppm. In January 2010, the USEPA added a 1-hour NO_2 standard of 100 ppb, taking the form of the 98th percentile averaged over three years. The sources and effects of NO_2 are as follows:

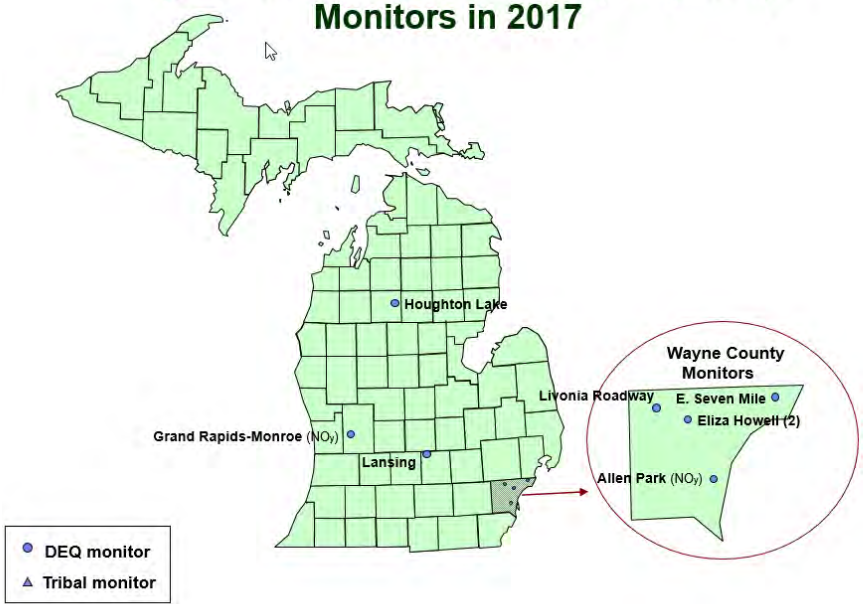
Sources: NO_X compounds and their transformed products occur both naturally and as a result of human activities. Natural sources of NO_X are lightning, forest fires, bacterial processes in soil, and stratospheric intrusion. Stratospheric intrusion is when the stratospheric air descends towards the surface of the earth and mixes with the air at breathing level. Ammonia and other nitrogen compounds produced naturally are important in the cycling of nitrogen through the ecosystem. The major sources of man-made (anthropogenic) NO_x emissions come from high-temperature combustion processes such as those occurring in automobiles and power plants. Home heaters and gas stoves produce substantial amounts of NO_2 in indoor settings.

Effects: Exposure to NO_2 occurs through the respiratory system, irritating the lungs. Short-term NO_2 exposures (i.e., less than three hours) can produce coughing and changes in airway responsiveness and pulmonary function. Evidence suggests that long-term exposures to NO_2 may lead to increased susceptibility to respiratory infection and may cause structural alterations in the lungs. Exercise increases the ventilation rate and hence exposure to NO_2. Nitrate particles and NO_2 can block the transmission of light, resulting in visibility impairment (i.e., smog or haze). Deposition of nitrogen can lead to fertilization, eutrophication, or acidification of terrestrial, wetland, and aquatic systems.

Population most at risk: Individuals with pre-existing respiratory illnesses and asthmatics are more sensitive to the effects of NO_2 than the general population. Short-term NO_2 exposure can increase respiratory illnesses in children.

Figure 5.1 shows the location of all NO_2 monitors that operated in 2017. The E. 7 Mile monitor in Detroit is a downwind urban scale site that measures NO_2. The Detroit Eliza Howell (roadway and downwind sites) and Livonia sites measure NO_2 in a near-road environment. The NCore sites, Grand Rapids and Allen Park, monitor NO_Y, which includes NO_X, nitric acid and organic and inorganic nitrates (however, only NO_2 monitors can be used for attainment/nonattainment purposes). In addition, in 2010, the AQD added NO_2 monitors at Lansing and Houghton Lake to provide background information for modeling applications.

Figure 5.1: Nitrogen Dioxide (NO_2) / NO_y Monitors in 2017



Figures 5.2 and **5.3** show NO_2 emission sources and NO_2 emissions by county (courtesy of the USEPA's State and County Emission Summaries).

Figure 5.2: NO_2 Emissions by Source Sector

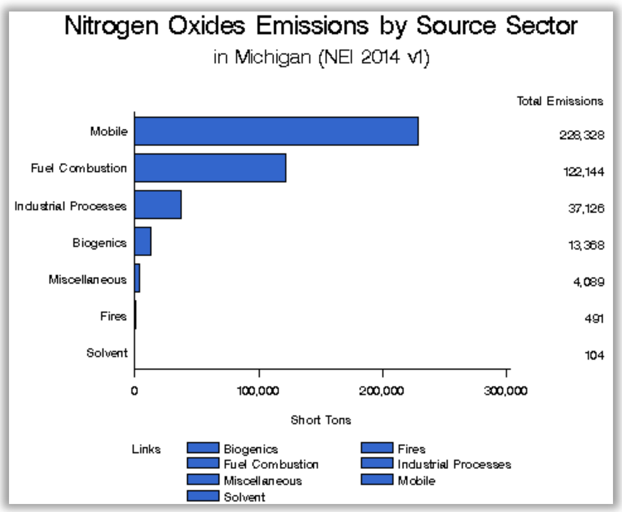
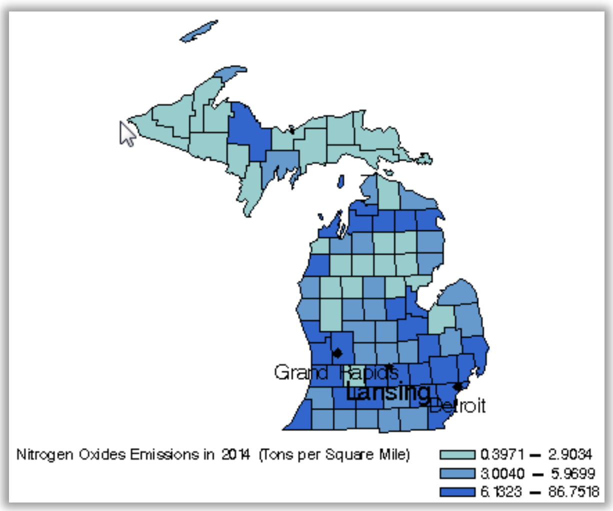
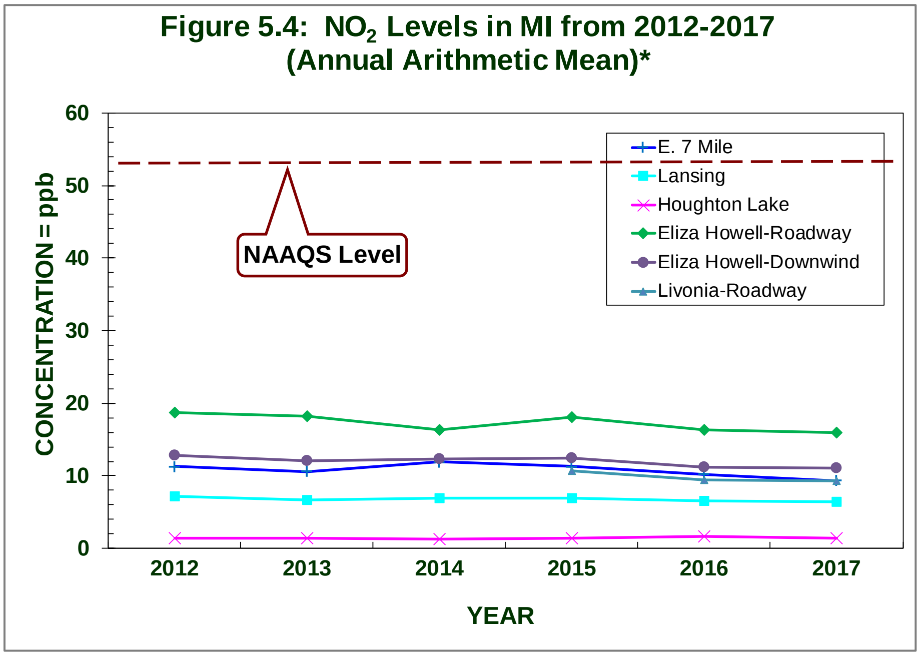


Figure 5.3: NO_2 Emissions in 2014



Michigan's ambient NO_2 levels have always been well below the NAAQS. Since March 3, 1978, all areas in Michigan have been in attainment for the annual NO_2 NAAQS. As shown in **Figure 5.4**, all monitoring sites have had an annual NO_2 concentration at less than half of the 0.053 ppm NAAQS. As such, when the USEPA lowered the NO_2 NAAQS in 2010, they designated Michigan as unclassifiable/attainment, since the existing NO_2 network did not provide adequate evidence that the NAAQS was met in all areas; however, there were no violations of the NO_2 standard. Thus, unclassifiable/attainment better reflects the current air quality conditions.

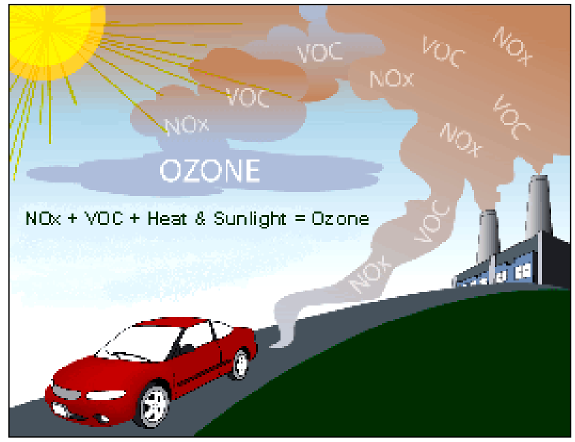


*Since Allen Park and Grand Rapids are monitoring NO_Y, those sites are not included in graph.

Even though there are no nonattainment areas for NO_2 in Michigan and monitoring for attainment purposes is not required, monitors continue to operate to support photochemical model validation work.

CHAPTER 6: OZONE (O_3)

Ground-level O_3 is created by reactions involving nitrogen oxides (NO_X) and volatile organic compounds (VOCs), or hydrocarbons, in the presence of sunlight as the illustration to the right depicts (image courtesy of the USEPA). These reactions usually occur during the hot summer months as ultraviolet radiation from the sun initiates a sequence of photochemical reactions. In Earth's upper atmosphere (the stratosphere), O_3 helps by absorbing much of the sun's ultraviolet radiation, but in the lower atmosphere (the troposphere), ozone is an air pollutant. O_3 is also a key ingredient of urban smog and can be transported hundreds of miles under certain meteorological conditions. Ozone levels are often higher in rural areas than in cities due to transport to regions downwind from the actual emissions of NO_X and VOCs. Shoreline monitors along Lake Michigan often measure high ozone concentrations due to transport from upwind states. The ozone NAAQS was revised by the USEPA and became effective in November 2015. It is a 3-year average of the 4th highest daily maximum 8-hour average concentration that must not exceed 0.070 ppm. The sources and effects of ozone follow.



Sources: Major sources of NO_X and VOCs are engine exhaust, emissions from industrial facilities, combustion from power plants, gasoline vapors, chemical solvents, and biogenic emissions from natural sources. Ground-level O_3 can also be transported hundreds of miles under certain wind regimes. As a result, the long-range transport of air pollutants impacts the air quality of regions downwind from the actual area of formation.

Effects: Elevated O_3 exposure can irritate airways, reduce lung function, aggravate asthma and chronic lung diseases like emphysema and bronchitis, and inflame and damage the cells lining the lungs. Other effects include increased respiratory related hospital admissions with symptoms such as chest pain, shortness of breath, throat irritation, and cough. O_3 may also reduce the immune system's ability to fight off bacterial infections in the respiratory system, and long-term, repeated exposure may cause permanent lung damage. O_3 also impacts vegetation and forest ecosystems, including agricultural crop and forest yield reductions, diminished resistance to pests and pathogens, and reduced survivability of tree seedlings.

Population most at risk: Individuals most susceptible to the effects of O_3 exposure include those with a pre-existing or chronic respiratory disease, children who are active outdoors and adults who actively exercise or work outdoors.

Figure 6.1 shows all O_3 air quality monitors active in Michigan at the beginning of the 2017 ozone season.

Figures 6.2 and **6.3** show VOC emission sources and VOC emissions by county (courtesy of the USEPA's State and County Emission Summaries).

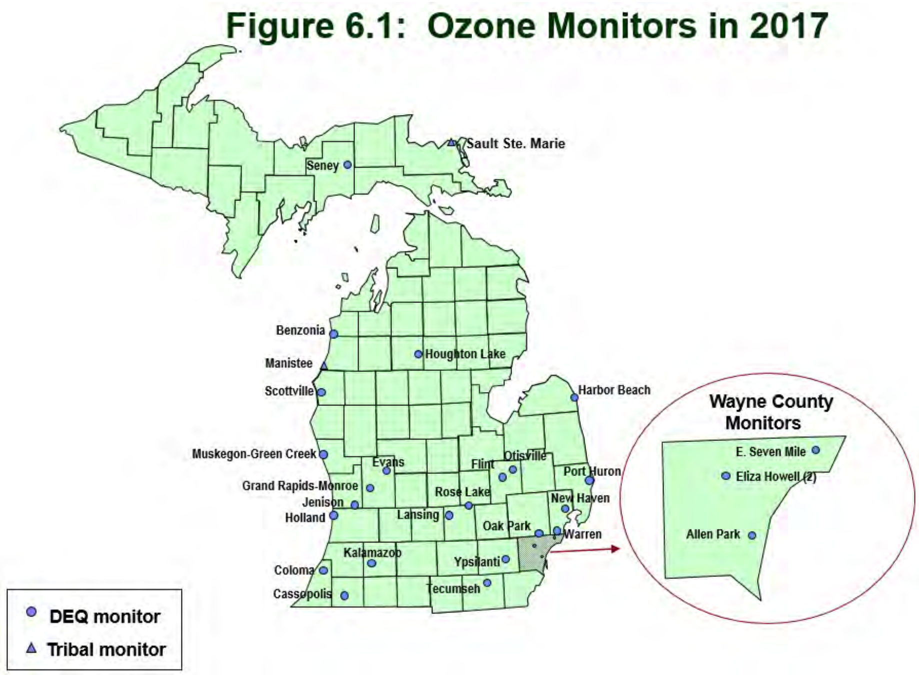


Figure 6.2: VOC Emissions by Source Sector

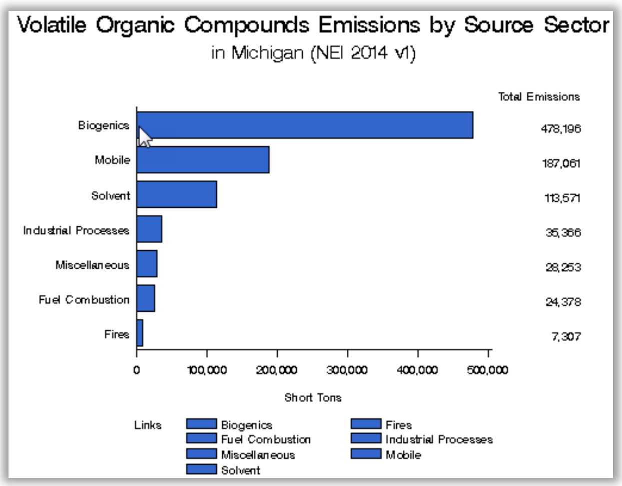
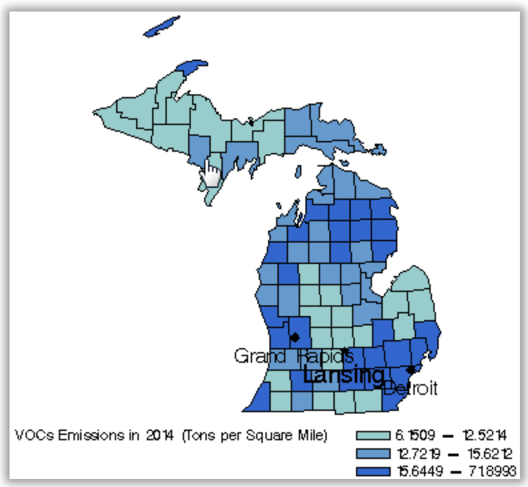


Figure 6.3: VOC Emissions in 2014



The USEPA revised the primary 8-hour ozone NAAQS to 0.070 ppm in November 2015, which became effective for the 2016 ozone season. To attain the 2015 standard, the 3-year average of the 4th highest daily maximum 8-hour average concentration within an area must not exceed 0.070 ppm. The secondary 8-hour ozone NAAQS was also revised, making it identical to the primary standard.

In 2017, several monitors violated the 2015 standard of 0.070 ppm. The AQD has recommended several counties be designated as nonattainment. The USEPA made their final designations for the 2015 standard on April 30, 2018, which will be effective August 3, 2018. Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw and Wayne Counties were designated nonattainment in Southeast Michigan, and all of Berrien County, and portions of Allegan and Muskegon Counties were designated nonattainment.

The O_3 monitoring season in Michigan was from April 1 through September 30, the hottest portion of the year. In 2017, the ozone season was extended to March 1 through October 31, based on the 2015 NAAQS. During this time O_3 monitoring data is available for the public via the AQD's website (discussed in **Chapter 9**). However, year-round O_3 monitoring is conducted at the following four sites: Allen Park, Grand Rapids, Houghton Lake, and Lansing. This data helps in attainment designations, and urban air quality and population exposure assessments.

Table 6.1: 3-Year Average of the 4th Highest 8-hour Ozone Values from 2013-2015, 2014-2016, 2015-2017 (concentrations in ppm).

Numbers in bold indicate 3-year averages over the 2015 ozone standard of 0.070 ppm for 2014-2016 and 2015-2017, for 2013-2015 bold numbers indicate values below 0.075 ppm.

Areas	County	Monitor Sites	2013-2015*	2014-2016*	2015-2017*
Detroit-Ann Arbor	Lenawee	Tecumseh	0.065	0.067	0.066
	Macomb	New Haven	0.071	**0.072**	0.066
		Warren	0.066	0.067	0.064
	Oakland	Oak Park	0.066	0.069	0.069
	St. Clair	Port Huron	0.072	**0.073**	0.067
	Washtenaw	Ypsilanti	0.066	0.067	0.068
	Wayne	Allen Park	0.064	0.065	0.067
		Detroit-E. 7 Mile	0.070	**0.072**	**0.076**
Flint	Genesee	Flint	0.066	0.068	0.064
		Otisville	0.067	0.069	0.063
Grand Rapids	Ottawa	Jenison	0.068	0.070	0.065
	Kent	Grand Rapids	0.067	0.069	0.064
		Evans	0.066	0.067	0.066
Muskegon Co	Muskegon	Muskegon	0.074	**0.075**	**0.074**
Allegan Co	Allegan	Holland	0.075	**0.075**	**0.071**
Huron	Huron	Harbor Beach	0.065	0.068	0.064
Kalamazoo-Battle Creek	Kalamazoo	Kalamazoo	0.067	0.069	0.068
Lansing-East Lansing	Ingham	Lansing	0.065	0.067	0.066
	Clinton	Rose Lake	0.064	0.067	0.062
Benton Harbor	Berrien	Coloma	0.073	**0.074**	0.069
Benzie Co	Benzie	Benzonia	0.068	0.069	0.065
Cass Co	Cass	Cassopolis	0.068	0.070	**0.072**
Chippewa Co	Chippewa	Sault Ste. Marie	0.059	0.059	0.051
Mason Co	Mason	Scottville	0.068	0.070	0.064
Missaukee Co	Missaukee	Houghton Lake	0.064	0.067	0.062
Manistee Co	Manistee	Manistee	0.067	0.068	0.065
Schoolcraft Co	Schoolcraft	Seney	0.068	0.070	0.056

* Only 2014-2016 and 2015-2017 data are subject to the 2015 NAAQS level of 0.070 ppm; the previous year's level was 0.075 ppm from the 2008 NAAQS standard.

Tables 6.2 and **6.3** highlight the number of days when two or more O_3 monitors exceeded 0.070 ppm. It also specifies in which month they occurred and the temperature range.

Table 6.2: 2017 West Michigan Ozone Season

table of number of days when 2 or more monitors exceed 70 ppb ozone concentrations compared to daily high temperatures per month for west Michigan in 2017.

Daily High Temperature Range			2017 WEST MICHIGAN OZONE SEASON															
			March		April		May		June		July		August		September		October	
					Days	O_3 Days	Days	O_3 Days	Days	O_3 Days	Days	O_3 Days	Days	O_3 Days	Days	O_3 Days	Days	O_3 Days
	>=	95	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
90	<=	94	0	0	0	0	0	0	4	1	1	0	0	0	3	1	0	0
85	<=	89	0	0	0	0	2	0	5	3	10	0	4	0	3	0	0	0
80	<=	84	0	0	2	0	0	0	7	1	16	0	13	0	6	0	4	0
75	<=	79	0	0	2	0	6	0	8	0	4	0	8	0	4	0	4	0
70	<=	74	1	0	5	0	6	0	4	0	0	0	4	0	5	0	3	0
65	<=	69	0	0	5	0	8	0	2	0	0	0	2	0	5	0	7	0
60	<=	64	0	0	3	0	4	0	0	0	0	0	0	0	1	0	1	0
55	<=	59	3	0	5	0	2	0	0	0	0	0	0	0	0	0	4	0
50	<=	54	6	0	4	0	1	0	0	0	0	0	0	0	0	0	4	0
49	<=		21	0	4	0	2	0	0	0	0	0	0	0	0	0	4	0
Totals			**31**	**0**	**30**	**0**	**31**	**0**	**30**	**5**	**31**	**0**	**31**	**0**	**30**	**1**	**31**	**0**

Days: Number of days during month when the daily high temperature falls within the specified temperature range.
O_3 Days: Number of days, during specified temperature range, when two or more area monitors exceeded 70 ppb.

For West Michigan, there were five O_3 exceedance days in June, and one day in September when ozone exceeded 0.070 ppm at two or more ozone monitors. The temperatures for those days ranged between 80°F and 94°F.

Table 6.3: 2017 Southeast Michigan Ozone Season

Daily High Temperature Range			2017 SOUTHEAST MICHIGAN OZONE SEASON															
			March		April		May		June		July		August		September		October	
					Days	O_3 Days	Days	O_3 Days	Days	O_3 Days	Days	O_3 Days	Days	O_3 Days	Days	O_3 Days	Days	O_3 Days
	>=	95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90	<=	94	0	0	0	0	0	0	3	0	1	0	0	0	3	1	0	0
85	<=	89	0	0	0	0	3	0	10	1	13	1	9	1	4	0	1	0
80	<=	84	0	0	1	0	1	0	5	0	14	0	13	0	5	0	3	0
75	<=	79	1	0	5	0	3	0	7	0	3	0	5	0	6	0	2	0
70	<=	74	0	0	4	0	6	0	4	0	0	0	4	0	5	0	9	0
65	<=	69	0	0	3	0	7	0	1	0	0	0	0	0	7	0	5	0
60	<=	64	2	0	7	0	6	0	0	0	0	0	0	0	0	0	0	0
55	<=	59	5	0	5	0	2	0	0	0	0	0	0	0	0	0	5	0
50	<=	54	2	0	4	0	2	0	0	0	0	0	0	0	0	0	2	0
49	<=		21	0	1	0	1	0	0	0	0	0	0	0	0	0	4	0
Totals			**31**	**0**	**30**	**0**	**31**	**0**	**30**	**1**	**31**	**1**	**31**	**1**	**30**	**1**	**31**	**0**

Days: Number of days during month when the daily high temperature falls within the specified temperature range.
O_3 Days: Number of days, during specified temperature range, when two or more area monitors exceeded 70 ppb.

For Southeast Michigan, there was one day in each of the months of June, July, August, and September when ozone exceeded 0.070 ppm at two or more ozone monitors. The temperature for those days ranged between 85°F and 94°F.

Table 6.4 gives a breakdown of the O_3 days and the specific monitors that went over the standard in western, central/upper, and eastern Michigan.

Table 6.4: 8-Hour Exceedance Days (>0.070 ppm) and Locations

Date	Monitors with Exceedances of the Ozone Standard			Total
	Western Michigan	Central / Upper Michigan	Eastern Michigan	
06/02/2017	Holland			1
06/04/217	Cassopolis, Coloma			2
06/09/2017	Cassopolis, Coloma, Muskegon, Kalamazoo			4
06/10/2017	Benzonia, Cassopolis, Holland, Muskegon, Scottville, Manistee	Houghton Lake, Seney	Tecumseh, E. 7 Mile, New Haven, Port Huron	12
06/11/2017	Muskegon			1
06/12/2017	Holland, Muskegon			2
06/15/2017	Holland, Cassopolis, Coloma			3
07/06/2017	Cassopolis		New Haven, Port Huron, Oak Park, Warren, E. 7 Mile	6
7/7/2017			E. 7 Mile	1
07/18/2017	Cassopolis		E. 7 Mile	2
7/19/2017			E. 7 Mile	1
07/21/2017			Ypsilanti	1
08/01/217			New Haven, E. 7 Mile	2
8/10/2017			E. 7 Mile	1
09/23/2017			Oak Park, Ypsilanti	2
09/26/2017	Benzonia, Muskegon			2
			TOTAL	43

On June 10, 2017, there were 12 monitors and on July 6, 2017, there were six monitor readings that exceeded the level of the standard. The site with the most exceedances in the western region of Michigan was Cassopolis with six. The central / upper Michigan site with the most exceedances were Seney and Houghton Lake with one. The monitor at E. 7 Mile had seven exceedances in eastern Michigan.

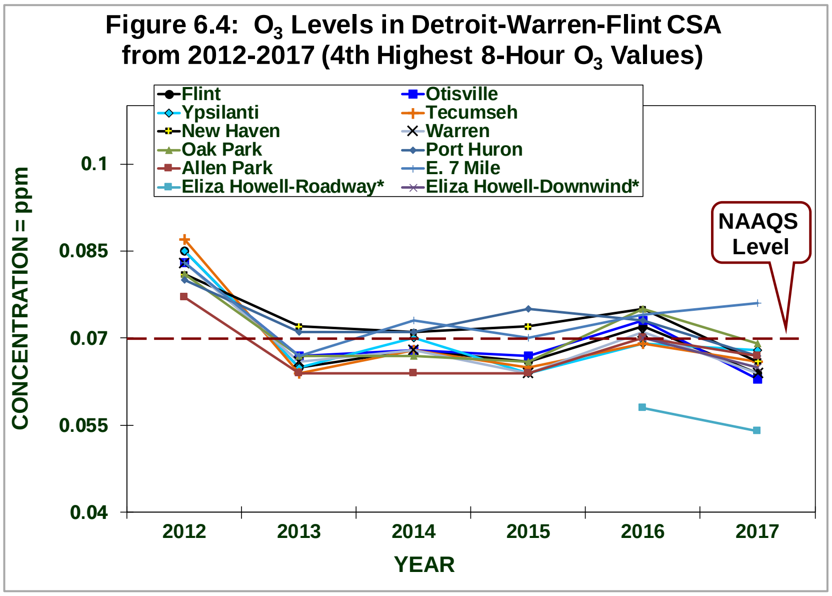


Figure 6.4: O_3 Levels in Detroit-Warren-Flint CSA from 2012-2017 (4th Highest 8-Hour O_3 Values)

Figure 6.4 shows the 4th highest 8-hour O_3 values for Southeast Michigan monitoring sites from 2012-2017. Detroit E. 7 Mile site violated the 3-year standard.

*Note: The two Eliza Howell sites are part of a 2-year special study. Ozone monitoring will not continue after the 2-year study.

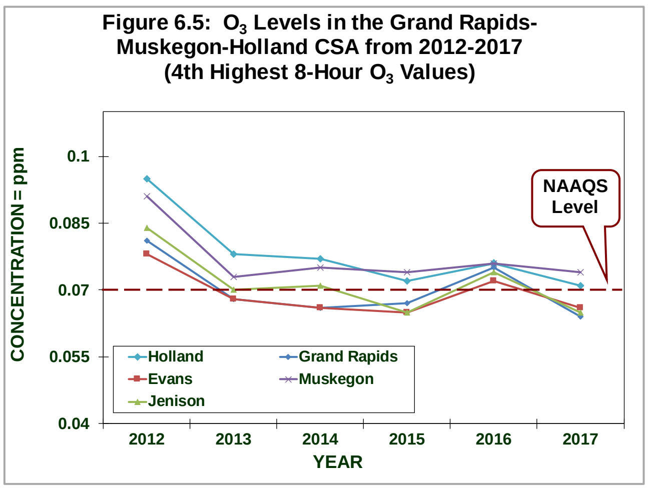


Figure 6.5: O_3 Levels in the Grand Rapids-Muskegon-Holland CSA from 2012-2017 (4th Highest 8-Hour O_3 Values)

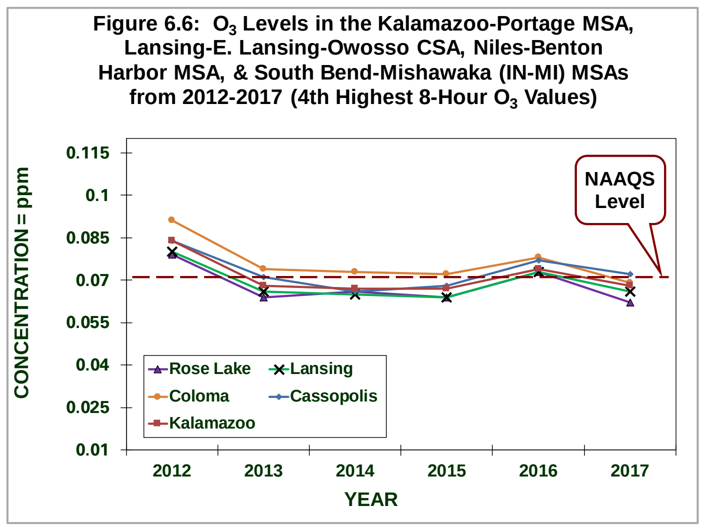


Figure 6.6: O_3 Levels in the Kalamazoo-Portage MSA, Lansing-E. Lansing-Owosso CSA, Niles-Benton Harbor MSA, & South Bend-Mishawaka (IN-MI) MSAs from 2012-2017 (4th Highest 8-Hour O_3 Values)

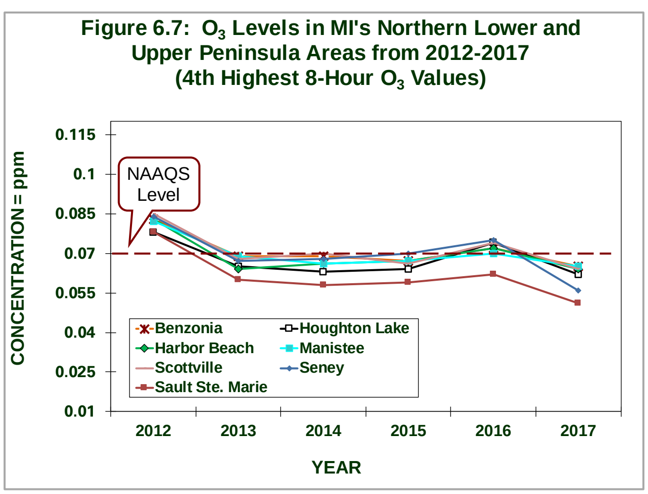


Figure 6.7: O_3 Levels in MI's Northern Lower and Upper Peninsula Areas from 2012-2017 (4th Highest 8-Hour O_3 Values)

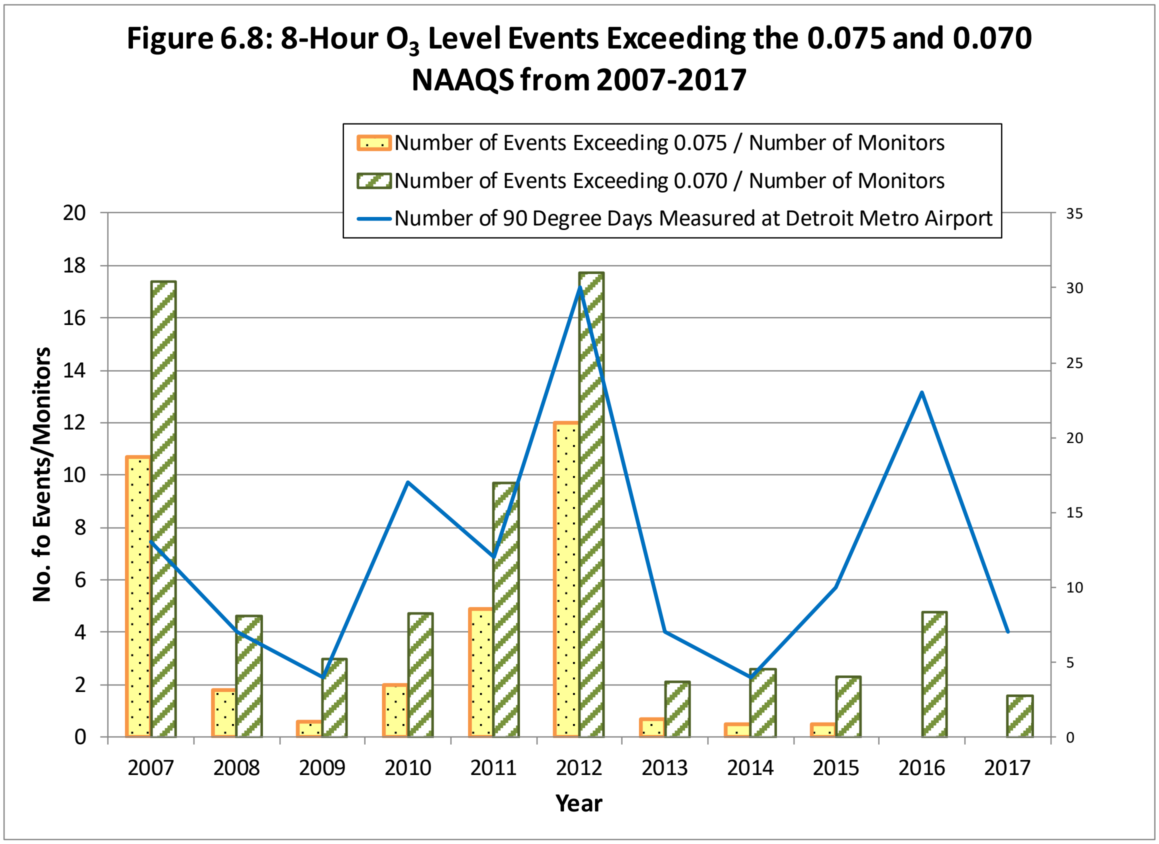
Figure 6.5 shows the 4th highest 8-hour O_3 values for Grand Rapids-Muskegon-Holland CSA. Muskegon and Holland violated the 3-year standard.

Figure 6.6 shows 4th highest 8-hour O_3 values for mid-Michigan. Cassopolis violated the 3-year standard.

Figure 6.7 shows 4th highest 8-hour O_3 values for Northern Lower and Upper Peninsula. No sites violated the 3-year standard.

Figure 6.8 shows 8-hour O3 readings ≥ 0.070 ppm and ≥ 0.075 with the number of 90°F days (≥ 90°F) measured at the Detroit Metropolitan Airport. The total number of Southeastern Michigan area 8-hour readings above the standard (events) was divided by the number of monitors that were in operation each year to provide a relative indication of the frequency of elevated 8-hour O_3 values.

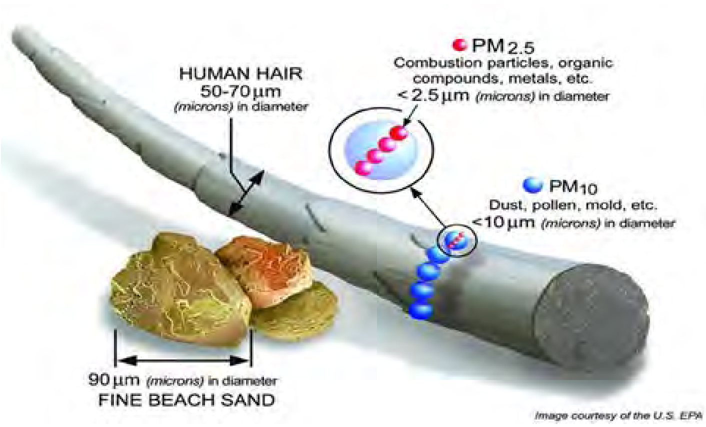
Since the ozone NAAQS level changed from 0.075 ppm to 0.070 ppm staring in the 2016 ozone season, Figure 6.8 shows the events/monitors at the 0.075 ppm level and the additional days that would be included at the 0.070 ppm level. Since 2016 and following years are subject to the 0.070 NAAQS standard, it only shows the events exceeding the 0.070 ppm level.



This comparison shows the influence of temperature with respect to elevated O3 levels. Over the past 10 years, a typical summer would have an average of 12.2 days with the maximum daily temperature exceeding 90°F. Over the time period from 2007 through 2017, the highest number of 90°F days occurred in 2012 (30 days), while the lowest number occurred in 2009 and 2014 (four days).

CHAPTER 7: PARTICULATE MATTER (PM_{10}, $PM_{10\text{-}2.5}$, $PM_{2.5}$, $PM_{2.5}$ CHEMICAL SPECIATION AND TSP)

Particulate matter (PM) is a general term used for a mixture of solid particles and liquid droplets (aerosols) found in the air. These are further categorized according to size; larger particles with diameters of less than 50 micrometers (µm) are classified as total suspended particulates (TSP). PM_{10} consists of “coarse particles” less than 10 µm in diameter (about one-seventh the diameter of a human hair) and $PM_{2.5}$ are much smaller “fine particles” equal to or less than 2.5 µm in diameter. PM_{10} has a 24-hour average standard of 150 µg/m^3 not to be exceeded more than once per year over 3 years. $PM_{2.5}$ has an annual average standard of 12 µg/m^3, and a 98th percentile 24-hour concentration of 35 µg/m^3 averaged over 3 years. The sources and effects of PM are as follows:



Sources: PM can be emitted directly (primary) or may form in the atmosphere (secondary). Most man-made particulate emissions are classified as TSP. PM_{10} consists of primary particles that can originate from power plants, various manufacturing processes, wood stoves and fireplaces, agriculture and forestry practices, fugitive dust sources (road dust and windblown soil), and forest fires. $PM_{2.5}$ can come directly from primary particle emissions or through secondary reactions that include VOCs, SO_2, and NO_X emissions originating from power plants, motor vehicles (especially diesel trucks and buses), industrial facilities, and other types of combustion sources.

Effects: Exposure to PM can aggravate existing cardiovascular ailments and even cause death in susceptible populations. PM may affect breathing and the cellular defenses of the lungs and has been linked with heart and lung disease. Smaller particles (PM_{10} or smaller) pose the greatest problems, because they can penetrate deep in the lungs and possibly into the bloodstream. PM is the major cause of reduced visibility in many parts of the United States. $PM_{2.5}$ is considered a primary visibility-reducing component of urban and regional haze. Airborne particles impact vegetation ecosystems and damage paints, building materials and surfaces. Deposition of acid aerosols and salts increases corrosion of metals and impacts plant tissue.

Population most at risk: People with heart or lung disease, the elderly, and children are at highest risk from exposure to PM.

PM_{10}

Since October 1996, all areas in Michigan have been in attainment with the PM_{10} NAAQS. Due to the recent focus upon $PM_{2.5}$ and because of the relatively low concentrations of PM_{10} measured in recent years, Michigan's PM_{10} network has been reduced to a minimum level. **Table 1-3** identifies the locations of PM_{10} monitoring stations that were operating in Michigan during 2016. These monitors are located mostly in the state's largest populated urban areas: four in the Detroit area and one in Grand Rapids. To better characterize the nature of particulate matter in Michigan, many of the existing PM_{10} monitors are co-located with $PM_{2.5}$ monitors in population-oriented areas.

Figure 7.1: PM_{10} Monitors in 2017

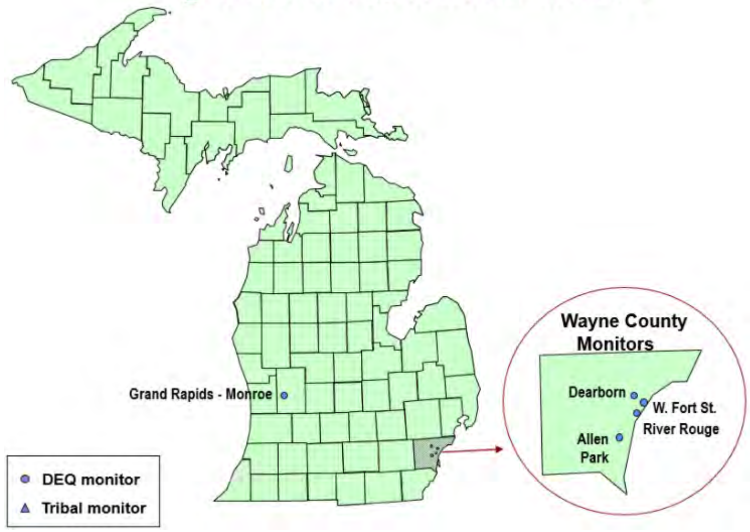


Figure 7.1 shows the location of each PM_{10} monitor.

Figures 7.2 and **7.3** show PM_{10} emission sources and PM_{10} emissions by county (courtesy of the USEPA's State and County Emission Summaries).

Figure 7.2: PM_{10} Emissions by Source Sector

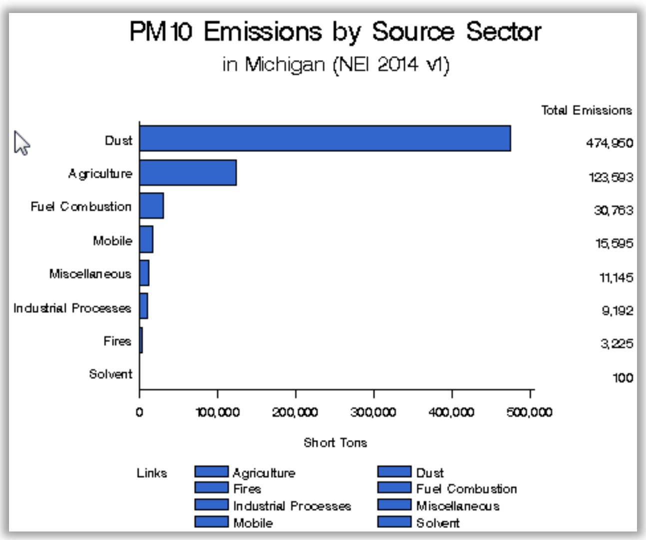


Figure 7.3: PM_{10} Emissions in 2014

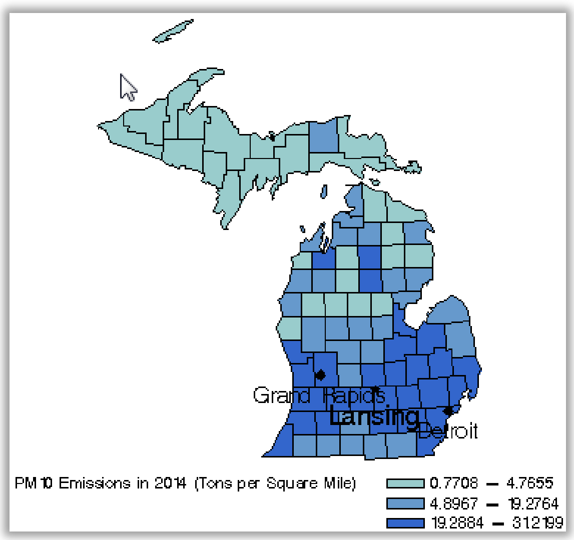
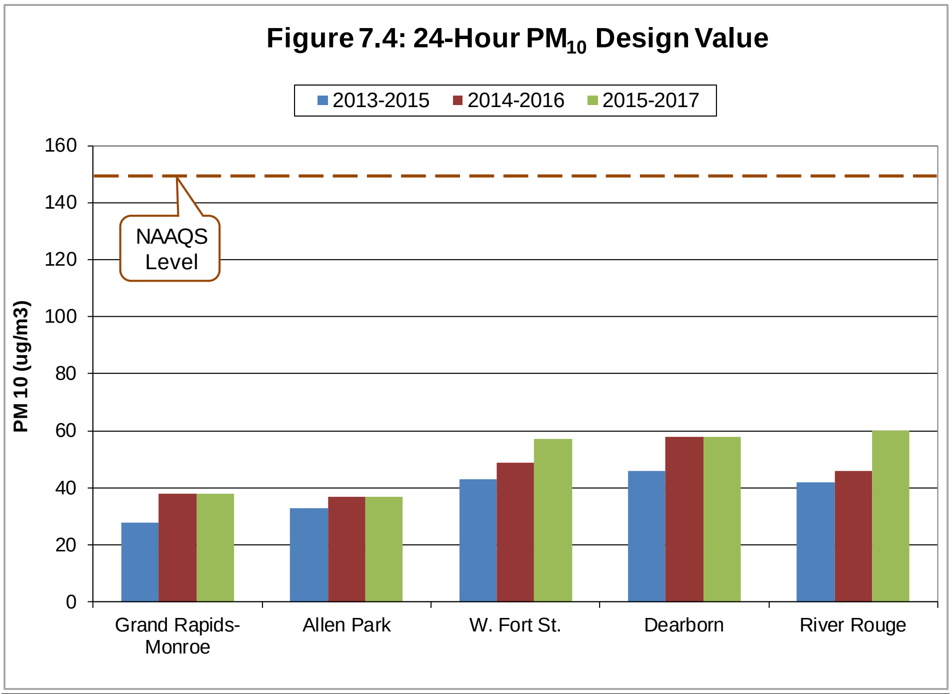
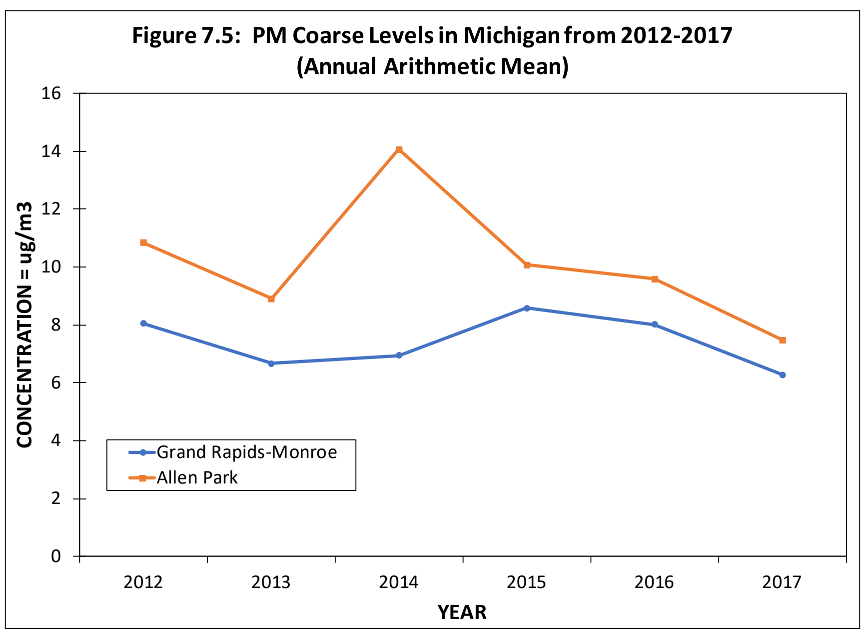


Figure 7.4 shows the PM_{10} levels in Michigan compared to the 24-hour average of 150 µg/m³. This standard must not be exceeded on average more than once per year over a 3-year period. The design value is the 4th highest value over a 3-year period. The PM_{10} levels at all sites in Michigan are well below the national standard.



$PM_{10-2.5}$

The 2006 amended air monitoring regulations specified that measurements of PM_{10}-$PM_{2.5}$ needed to be added to the NCore sites.[6] The DEQ began PM course (PM_{10}-$_{2.5}$) monitoring at Allen Park and Grand Rapids-Monroe Street in 2010. **Figure 7.5** shows the $PM_{10-2.5}$ levels in Michigan.



[6] Current information can be found at https://www3.epa.gov/ttn/amtic/ncoreguidance.html.

$PM_{2.5}$

The USEPA designated Michigan in attainment of the 1997 annual $PM_{2.5}$ standard of 15 µg/m^3 and the 2006 24-hour $PM_{2.5}$ standard of 35 µg/m^3 in August 2013. In December 2012, the USEPA revised the annual primary standard to 12 µg/m^3 while the annual secondary standard remained at 15 µg/m^3. The primary and secondary 24-hour standard remained at 35 µg/m^3. In December 2014, the USEPA determined that no area in Michigan violated the 2012 standard and the state was classified as unclassifiable/attainment.

Fine particulate matter ($PM_{2.5}$) is measured using three techniques: Federal Reference Method (FRM), Continuous Methods, and Chemical Speciation Methods. These methods are described in more detail below.

$PM_{2.5}$ FRM Monitoring: The concentrations of $PM_{2.5}$ measured over a 24-hour time period are determined using the filter-based gravimetric FRM. Only data generated by the FRM monitors are used for comparisons to the NAAQS in Michigan. The sites are located in urban, commercial, and residential areas where people are exposed to $PM_{2.5}$.

Continuous $PM_{2.5}$ Monitoring: Continuous monitoring is beneficial as it provides real-time hourly data that supplements the $PM_{2.5}$ data collected by FRM monitors. This data forms the basis of the information reported on AIRNow and MIair.

Chemical Speciation Monitoring: Speciated monitoring provides a better understanding of the chemical composition of $PM_{2.5}$ material and better characterizes background levels.

Figure 7.6 shows the location of each $PM_{2.5}$ monitor.

Figure 7.6: $PM_{2.5}$ Monitors in 2017

$PM_{2.5}$ FRM Monitoring Network: $PM_{2.5}$ FRM monitors are deployed to characterize background or regional $PM_{2.5}$ transport collectively from upwind sources. On March 31, 2017 the $PM_{2.5}$ FRM was shut down at the Sault Ste. Marie tribal monitor. The USEPA did not renew their contract and funding for the FRM monitor; however, a continuous $PM_{2.5}$ monitor (BAM) continues to operate at this site.

Four $PM_{2.5}$ FRM monitoring sites are co-located with PM_{10} monitors to allow for $PM_{2.5}$ and PM_{10} comparisons.[7] Co-located PM_{10} and $PM_{2.5}$ sites include Grand Rapids-Monroe, Dearborn, Allen Park, and Detroit's W. Fort Street (SWHS).

Continuous $PM_{2.5}$ Network: Short-term measurements of $PM_{2.5}$ or PM_{10} are updated on an hourly basis using Tapered Element Oscillating Microbalance (TEOM) instruments. At least one continuous TEOM is required at the NCore $PM_{2.5}$ monitoring site in a metropolitan area with a population greater than one million. Both Detroit (Allen Park) and Grand Rapids (Monroe) meet this requirement.[8] Under the revised 2006 air monitoring regulations, 50 percent of the FRM monitoring sites are now required to have a continuous $PM_{2.5}$ monitor. For Michigan, there are 26 FRM monitoring sites, 13 of which also have TEOMs. The DEQ initially operated all TEOM units with an inlet temperature of 50ºC, but this high inlet temperature was volatilizing nitrate levels during the winter months. Therefore, the DEQ began operating TEOMs with a 30°C inlet temperature October through March and a 50°C inlet temperature between April and September.

$PM_{2.5}$ Chemical Speciation Monitoring Network: Single event Met-One Speciation Air Sampling System (SASS) monitors are used throughout Michigan's speciation network and are placed in population-oriented stations in both urban and rural locations. $PM_{2.5}$ chemical speciation samples are collected over a 24-hour period and analyzed to determine various components of $PM_{2.5}$. There are five SASS monitors operating in Michigan. Houghton Lake, Port Huron and Sterling State Park monitors were shut down on January 24, 2015, due to lack of funding. The primary objectives of the chemical speciation monitoring sites are to provide data that will be used to determine sources of poor air quality and to support the development of attainment strategies. Historical speciation data for Michigan indicates that $PM_{2.5}$ is made up of 30 percent nitrate compounds, 30 percent sulfate compounds, 30 percent organic carbon,[9] and 10 percent unidentified or trace elements.

Continuous $PM_{2.5}$ Speciation Monitoring (EC/OC and Aethalometer) Network: To determine diurnal changes in $PM_{2.5}$ composition, the DEQ operates two aethalometers and two elemental carbon/organic carbon (EC/OC) monitors.

- Aethalometers measure carbon black, a combustion by-product typical of transportation sources, by concentrating particulate on a filter tape and measuring changes in optical transmissivity and absorption. The DEQ's aethalometers are located at Allen Park and Dearborn.
- The EC/OC instruments measure elemental carbon using pyrolysis coupled with a nondispersive infrared detector to separate the elemental and organic carbon fractions. EC/OC instruments are located at Dearborn and Tecumseh. The EC/OC instrument began to malfunction at Dearborn in September 2017 and was later shut down.

[7] Requirements for $PM_{2.5}$ FRM sites are obtained from the Revised Requirements for Designation of Reference and Equivalent Methods for $PM_{2.5}$ and Ambient Air Quality Surveillance for PM [62 FR 38763]; Guidance for Using Continuous Monitors in $PM_{2.5}$ Monitoring Networks [EPA-454/R-98-012, May 1998]; and Appendix N to Part 50 - Interpretation of the National Ambient Air Quality Standards for PM [40 CFR Part 50, July 1, 1998].
[8] Under the Guidance for Using Continuous Monitors in $PM_{2.5}$ Monitoring Networks [EPA-454/R-98-012, May 1998].
[9] To better understand the chemical composition of the organic carbon fraction, a number of studies have been conducted in Southeast Michigan to further investigate organic carbon. Information can be found in the Michigan 2012 Ambient Air Monitoring Network Review, available at http://www.michigan.gov/documents/deq/deq-aqd-aqe-2012-Air-Mon-Network-Review_357137_7.pdf

Table 1.3 in chapter 1 shows all of Michigan's $PM_{2.5}$ FRM monitoring stations operating in 2016 and denotes which sites have TEOM, SASS, Aethalometer or EC/OC monitors in operation.

Figures 7.7 and **7.8** show $PM_{2.5}$ emission sources and $PM_{2.5}$ emissions by county (from the USEPA's State and County Emission Summaries).

Figure 7.7: $PM_{2.5}$ Emissions by Source Sector

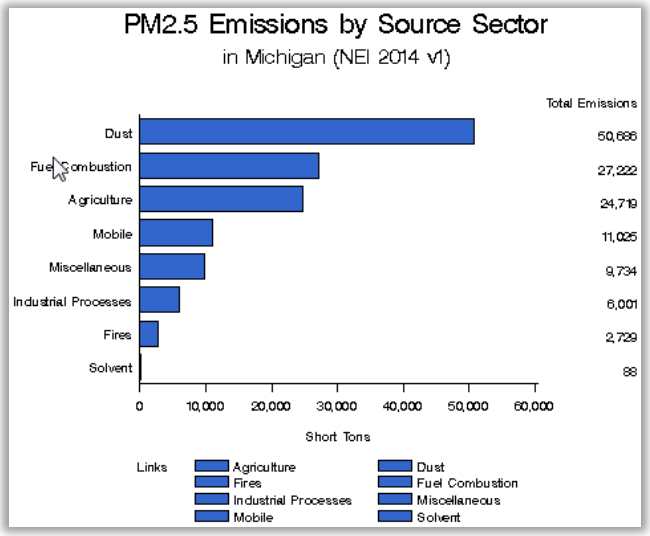


Figure 7.8: $PM_{2.5}$ Emissions in 2014

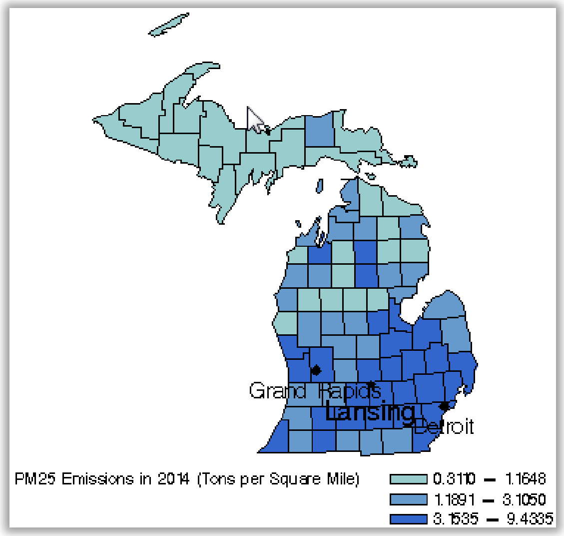


Table 7.1 provides the 3-year average of the annual mean $PM_{2.5}$ concentrations for 2015-2017. Michigan's levels are below the 12 µg/m^3 primary standard.[10] Stations labeled #2 provide a precision estimate of the overall measurement and operate on a one-in-six sampling schedule. All other monitors are sampled on a one-in-three-day schedule, except for Allen Park #1, which samples daily.

Table 7.1: 3-Year Average of the Annual Mean $PM_{2.5}$ Concentrations

Areas	County	Monitoring Sites	2015	2016	2017	2015-2017 Mean
Detroit-Ann Arbor	Lenawee	Tecumseh	8.58	7.46	7.34	8.0
	Livingston					
	Macomb	New Haven	9.73	7.51	7.41	8.4
	Oakland	Oak Park	9.37	7.87	8.11	8.7
	St. Clair	Port Huron	9.51	7.77	8.01	8.7
	Washtenaw	Ypsilanti #1	9.56	7.84	7.93	8.8
		Ypsilanti #2	9.08	8.06	8.32	8.7
	Wayne	Allen Park	9.66	8.72	8.47	9.2
		Detroit-Linwood	10.18	8.94	8.99	9.5
		Detroit-E. 7 Mile	9.79	8.11	7.88	8.9
		Detroit-W. Fort St.	11.26	11.32	11.01	11.1
		Detroit-W. Lafayette	9.12	8.38	7.93*	8.5
		Wyandotte	8.62	7.70	7.18	8.3
		Dearborn #1	11.50	10.67	10.57	11.1
		Dearborn #2	11.65	10.52	10.82	11.2
		Livonia	9.31	8.16	7.98	8.7
		Livonia-Roadway	9.53	8.53	8.46	8.8
Flint	Genesee	Flint	8.16	7.18	7.10	7.8
	Lapeer					
Grand Rapids	Ottawa	Jenison				
	Kent	Grand Rapids-Wealthy	9.37	8.79	9.15	9.3
		Grand Rapids #1	9.30	8.16	8.12	8.8
		Grand Rapids #2	10.37	8.48	8.31	9.1
Allegan Co	Allegan	Holland	7.88	6.99	7.49	7.8
Monroe Co	Monroe	Luna Pier				
		Sterling State Park	9.26	7.75	7.71	8.2
Kalamazoo-Battle Creek	Calhoun					
	Kalamazoo	Kalamazoo #1	8.90	8.09	8.03	8.7
		Kalamazoo #2	9.34	8.25	8.36	8.9
	Van Buren					
Lansing-East Lansing	Ingham	Lansing	8.56	7.31	7.23	8.1
	Clinton					
	Eaton					
Benton Harbor	Berrien	Coloma	8.15	7.35	7.99	8.0
Bay Co	Bay	Bay City	7.74	6.84	6.75	7.4
Missaukee Co	Missaukee	Houghton Lake	5.59	4.87	4.81	5.2
Manistee Co	Manistee	Manistee	6.37	5.50	5.84	6.0
Chippewa Co	Chippewa	Sault Ste. Marie #1	5.79*	5.04*	6.10*	5.6
		Sault Ste. Marie #2	6.18*	5.03*	5.88*	5.7

*Indicates mean does not meet completeness criteria.

[10] For comparison to the standard, the average annual means is rounded to the nearest 0.1 µg/m^3.

Table 7.2 provides the 24-hour 98th percentile $PM_{2.5}$ concentrations for 2015-2017 showing Michigan's levels are below the 35 µg/m^3 standard (3-year average).[11]

Table 7.2: 24-Hour 98th Percentile $PM_{2.5}$ Values Averaged over 3 Years						
Areas	County	Monitoring Sites	2015	2016	2017	2015-2017 Mean
Detroit-Ann Arbor	Lenawee	Tecumseh	25.2	15.1	17.5	21
	Livingston					
	Macomb	New Haven	31.6	20.1	17.0	26
	Oakland	Oak Park	29.6	19.8	20.1	24
	St. Clair	Port Huron	28.7	19.1	19.2	24
	Washtenaw	Ypsilanti #1	25.9	17.6	18.8	23
		Ypsilanti #2	20.6	17.4	19.0	21
	Wayne	Allen Park	23.1	20.3	21.8	23
		Detroit-Linwood	27.1	22.5	25.0	24
		Detroit-E. 7 Mile	25.6	19.5	16.6	22
		Detroit-W. Fort St.	27.1	25.6	30.0	26
		Detroit-W. Lafayette	22.4	20.5	19.5	23
		Wyandotte	21.1	18.8	19.3	22
		Dearborn #1	28.1	25.8	24.5	27
		Dearborn #2	24.7	24.7	23.5	25
		Livonia	26.8	19.9	19.1	24
		Livonia-Roadway	25.2	21.4	19.0	23
Flint	Genesee	Flint	22.3	18.8	16.8	22
	Lapeer					
Grand Rapids	Ottawa	Jenison				
	Kent	Grand Rapids-Wealthy	25.5	22.7	26.2	24
		Grand Rapids #1	25.6	19.5	22.6	23
		Grand Rapids #2	24.3	19.5	22.8	24
Allegan Co	Allegan	Holland	21.2	17.2	24.6	21
Monroe Co	Monroe	Luna Pier				
		Sterling State Park	25.7	18.3	20.5	23
Kalamazoo-Battle Creek	Calhoun					
	Kalamazoo	Kalamazoo #1	22.3	20.1	22.6	22
		Kalamazoo #2	21.3	20.2	22.5	24
	Van Buren					
Lansing-East Lansing	Ingham	Lansing	24.5	18.0	17.1	22
	Clinton					
	Eaton					
Benton Harbor	Berrien	Coloma	19.4	17.2	26.2	19
Bay Co	Bay	Bay City	23.3	19.6	22.4	21
Missaukee Co	Missaukee	Houghton Lake	17.9	12.4	14.9	16
Manistee Co	Manistee	Manistee	19.3	12.6	19.2	16
Chippewa Co	Chippewa	Sault Ste. Marie #1	15.8	11.3	25.3	14
		Sault Ste. Marie #2	16.4	10.8	16.4	13

*Indicates mean does not meet completeness criteria.

[11] The 98th percentile value was obtained from the USEPA AQS. For the purpose of comparing calculated values, the 3-year 24-hour average is rounded to the nearest 1 µg/m^3.

Figures 7.9 through **7.12** illustrate the current annual mean $PM_{2.5}$ trend for each monitoring site in Michigan. For clarity, the monitoring sites within the Detroit-Warren-Flint CSA have been broken down into two graphs.

Figure 7.9 shows those sites in Wayne County, and **Figure 7.10** shows the remaining counties within the CSA.

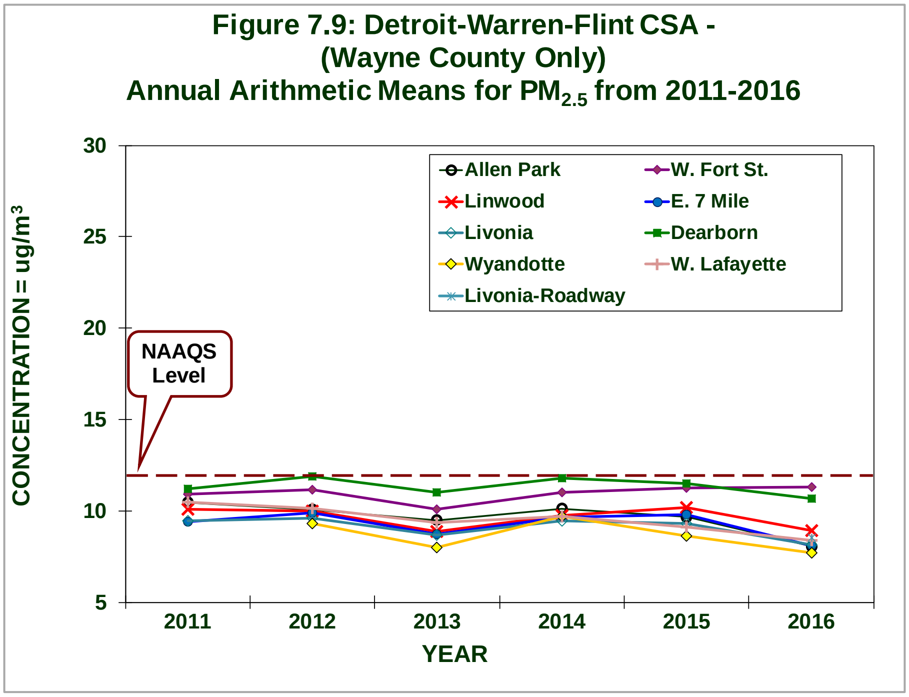
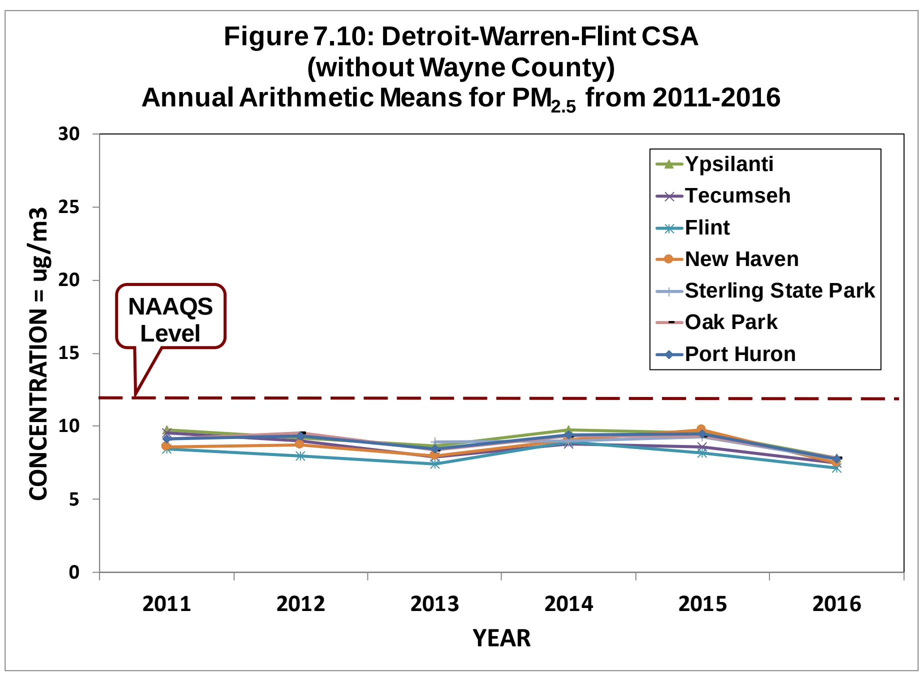


Figure 7.9 shows the 2017 levels in Wayne County remained below the $PM_{2.5}$ NAAQS standard. Historically, Dearborn has had the highest concentrations in the state, but W. Fort St. now has the highest concentrations.

Figure 7.10 contains the remainder of those sites in the Detroit-Warren-Flint CSA that are outside of Wayne County. These sites also show readings in 2017 to be below the $PM_{2.5}$ NAAQS.



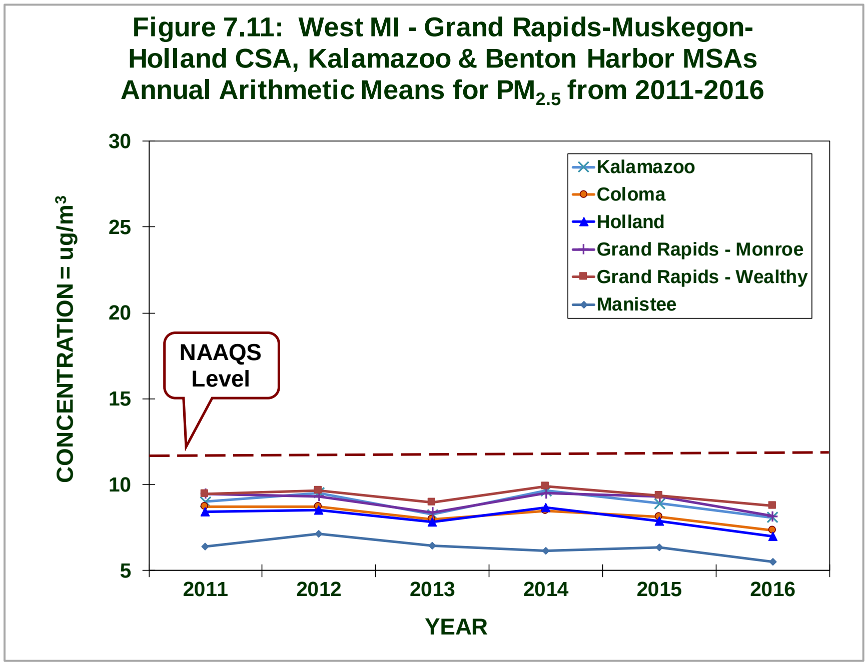


Figure 7.11 combines the $PM_{2.5}$ monitoring sites located in West Michigan-Grand Rapids-Muskegon-Holland CSA, Kalamazoo and Benton Harbor MSAs. All sites are below the annual $PM_{2.5}$ NAAQS.

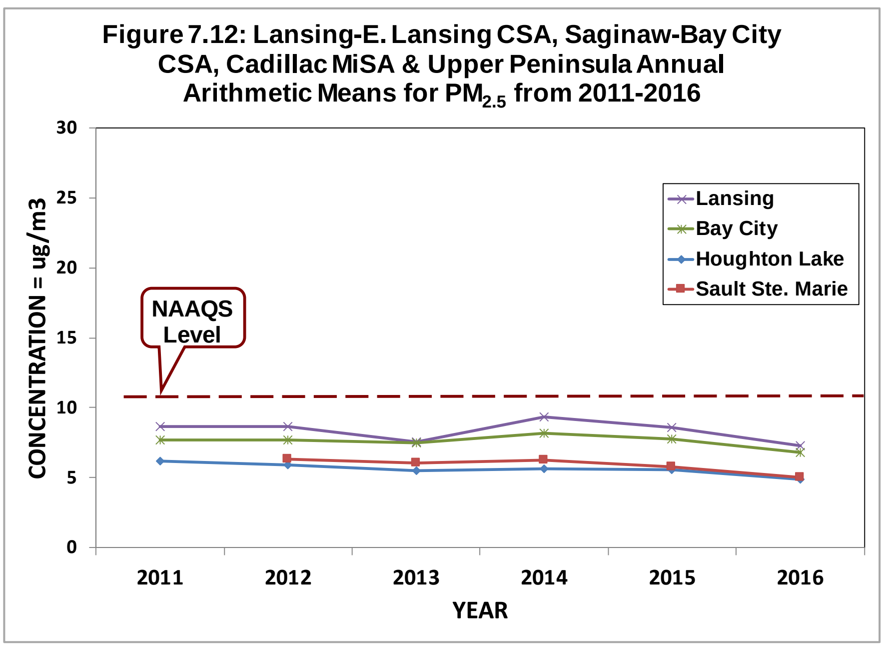


Figure 7.12 displays the remaining monitoring sites in the Northern Lower and Upper Peninsula. All of these sites are below the annual $PM_{2.5}$ NAAQS standard.

CHAPTER 8: TOXIC AIR POLLUTANTS

In addition to the six criteria pollutants discussed in previous chapters, the AQD monitors for a wide variety of substances classified as toxic air pollutants, and/or Hazardous Air Pollutants (HAPs). Under the Clean Air Act, the USEPA specifically addresses a group of 187 HAPs. Under Michigan's air regulations, Toxic Air Contaminants (TACs) are defined as all non-criteria pollutants that may be *"…harmful to public health or the environment when present in the outdoor atmosphere in sufficient quantities and duration."* The definition of TACs lists 42 substances that are not TACs, indicating that all others are TACs. The sources and effects of toxics are as follows:

Sources: Air toxics come from a variety of mobile, stationary, and indoor man-made sources as well as outdoor natural sources. Mobile sources include motor vehicles, stationary sources include industrial factories and power plants, indoor sources include household cleaners, and natural sources include forest fires and eruptions from volcanoes.

Effects: Once air toxics enter the body, there is a wide range of potential health effects. They include: the aggravation of asthma; irritation to the eyes, nose, and throat; carcinogenicity; developmental toxicity (birth defects); nervous system effects; and, various other effects on internal organs. Some effects appear after a shorter period of exposure, while others may appear after long-term exposure or after a long period of time has passed since the exposure ended. Most toxic effects are not unique to one substance, and some effects may be of concern only after the substance has deposited to the ground or to a water body (e.g., mercury, dioxin), followed by exposure through an oral pathway such as the eating of fish or produce. This further complicates the assessment of air toxics concerns due to the broad range of susceptibility that various people may have.

Population most at risk: People with asthma, children, and the elderly are generally at the highest risk for health effects from exposure to air toxics**.**

Air Toxics can be categorized as:

- *Metals:* Examples include aluminum, arsenic, beryllium, barium, cadmium, chromium, cobalt, copper, iron, mercury, manganese, molybdenum, nickel, lead, vanadium, and zinc.
- *Organic Substances*: Further divided into sub-categories that include -
  - VOCs, include benzene (found in gasoline), perchloroethylene (emitted from some dry-cleaning facilities), and methylene chloride (a solvent and paint stripper used by industry);
  - carbonyl compounds (formaldehyde, acetone, and acetaldehyde);
  - semi-volatile compounds (SVOCs);
  - polycyclic aromatic hydrocarbons (PAHs)/polynuclear aromatic hydrocarbons (PNAs);
  - pesticides and;
  - polychlorinated biphenyls (PCBs).
- *Other substances*: Asbestos, dioxin, and radionuclides such as radon.

Because air toxics are such a large and diverse group of substances, regulatory agencies sometimes further refine these classifications to address specific concerns.

For example:

- Some initiatives have targeted those substances that are *persistent, bioaccumulative* and *toxic* (PBT), such as mercury, which accumulates in body tissues.
- The USEPA has developed an Integrated *Urban Air Toxics Strategy* with a focus on 30 substances (the Urban HAPs List).[12]

The evaluation of air toxics levels is difficult due to several factors.

- There are no health-protective NAAQS. Instead, air quality assessments utilize various short- and long-term screening levels and health-based levels estimated to be safe considering the critical effects of concern for specific substances.
- There is incomplete toxicity information for many substances. For some air toxics, the analytical detection limits are too high to consistently measure the amount present, and in some cases, the risk assessment-based levels are below the detection limits.
- Data gaps are present regarding the potential for interactive toxic effects for co-exposure to multiple substances present in emissions and in ambient air. Air toxics also pose a challenge due to monitoring and analytical methods that are either unavailable for some compounds or cost-prohibitive for others (e.g., dioxins).

These factors make it difficult to accurately assess the potential health concerns of all air toxics. Nevertheless, it is feasible and important to characterize the potential health hazards and risks associated with many air toxics.

Table 8.1 shows the monitoring stations and what air toxic was monitored at each station in 2016. This table can also be found in **Appendix B** with the Air Toxics Monitoring Summary.

The $PM_{2.5}$ speciation network was reduced due to USEPA funding cuts. In January 2015, the DEQ shut down three monitors at Houghton Lake in Missaukee County, Sterling State Park in Monroe County, and Port Huron in St. Clair County.

Table 8.1: 2017 Toxics Sampling Sites

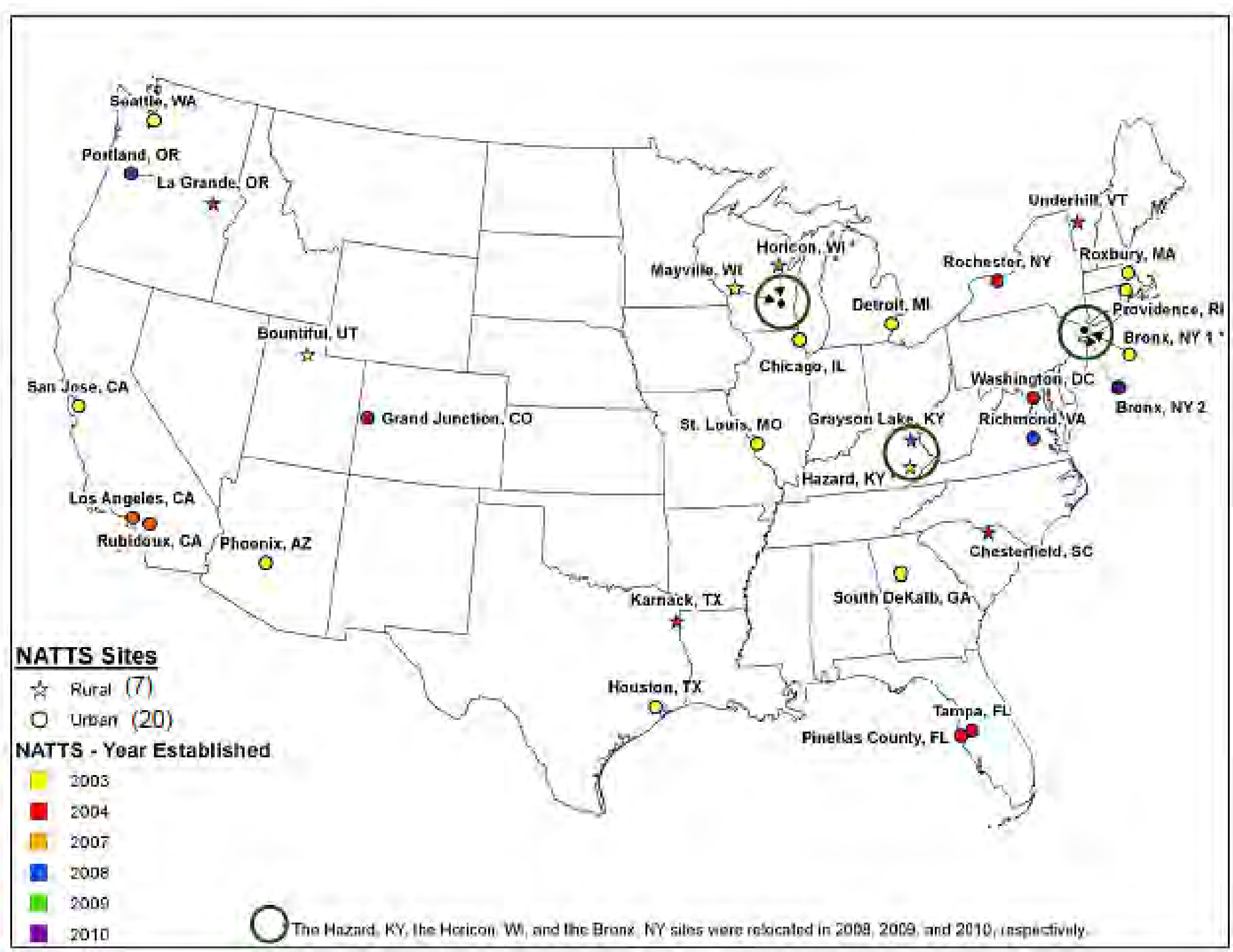
Site Name	VOC	Carbonyl	PAHs	Metals TSP	Metals PM_{10}	Speciated $PM_{2.5}$
Allen Park				x	x	x
Dearborn	x	x	x	x	x	x
Detroit-W. Fort St.	x	x		x	Mn	x
Detroit-W. Jefferson				x		
Grand Rapids-Monroe				x		x
Belding-Merrick St.				x		
Belding-Reed St.				x		
NMH 48217	x		x	x		
Port Huron-Rural St.				x		
River Rouge		x		x	Mn	
Tecumseh						x

[12] USEPA's Air Toxics website: Urban Strategy is located at https://www.epa.gov/urban-air-toxics.

National Monitoring Efforts and Data Analysis

The USEPA administers national programs that identify air toxics levels, detect trends, and prioritize air toxics research. The DEQ participates in these programs. In addition, the AQD operates a site in Dearborn that is part of the USEPA's NATTS. The purpose of the NATTS network is to detect trends in high-risk air toxics such as benzene, formaldehyde, chromium, and 1,3-butadiene and to measure the progress of air toxics regulatory programs at the national level. Currently, the NATTS network contains 27 stations; 20 urban and 7 rural (see **Figure 8.1**). The USEPA requires that the NATTS sites measure VOCs, carbonyls, PAHs and trace metals on a once-every-six-day sampling schedule. Hexavalent chromium is no longer required at NATTS sites and data collection was discontinued July 2013. The Dearborn NATTS site measures trace metals as TSP, PM_{10}, and $PM_{2.5}$.

Figure 8.1: National Air Toxics Trends Sites.



CHAPTER 9: MIAIR – AIR QUALITY INFORMATION IN REAL-TIME

MIair is the internet tool that provides real-time air quality information via the DEQ's web page. The www.deqmiair.org hotlink opens to the current Air Quality Index (AQI) map and displays air quality forecasts for "today" and "tomorrow." **MIair** also hosts EnviroFlash, the automated air quality notification system.

Air Quality Index

The Air Quality Index (AQI) is a simple tool developed to communicate current air quality information to the public. The current day's color-coded AQI values, ranging from Good to Hazardous (**Table 9.1**), are displayed in a forecast table and as dots on a Michigan map.

As can be seen from the annual summaries in **Appendix C**, air quality in Michigan is generally in the Good or Moderate range. An area will occasionally fall into the Unhealthy for Sensitive Groups range, but rarely reaches Unhealthy levels.

MIair includes an "Air Quality Index Fact Sheet" link: www.michigan.gov/documents/deq/deq-aqd-aqifacts_273090_7.pdf which contains activity recommendations based on the AQI levels.

Air Quality Forecasts

AQD meteorologists provide air pollution forecasts to alert the public when air pollution levels may become elevated. *Action!* Days are declared when levels are expected to reach or exceed the Unhealthy for Sensitive Groups AQI health indicator. On *Action!* Days, businesses, industry, government and the public are encouraged to reduce air pollution levels by limiting vehicle use, refueling only after 6 PM, carpooling, walking, biking or taking public transit, deferring the use of gasoline-powered lawn and recreation equipment, limiting the use of volatile chemicals and curtailing all burning. More information on voluntary air pollution control measures can be found under the *Action!* Days tab on **MIair**.

Air Quality Notification

EnviroFlash is a free service that provides automated air quality (AQI) and ultraviolet (UV) forecasts to subscribers. Those enrolled receive e-mail or mobile phone text messages when the health level they select is predicted to occur. AIRNow iPhone and Android applications deliver ozone and fine particle air quality forecasts plus detailed real-time information that can be used to better protect health when planning daily activities. To learn more about this program, select the **MIair** button from Michigan's Air Quality page www.michigan.gov/air. To receive notices, choose the "Air Quality Notification" tab and click the "Enroll in AQI EnviroFlash" link. Michigan's EnviroFlash network has the potential to reach up to 98% of the state's population.

AIRNow

The DEQ supplies Michigan air monitoring data to AIRNow, the USEPA's nation-wide air quality mapping system. Information about AIRNow is available at www.epa.gov/airnow or you can select the AIRNow hot link at the bottom of each **MIair** web page.

Table 9.1: AQI Colors and Health Statements

AQI Color, Category and Value	Particulate Matter ($\mu g/m^3$) 24-hour	Ozone (ppm) 8-hour/1-hour	Carbon Monoxide (ppm) 8-hour	Sulfur Dioxide (ppm) 24-hour	Nitrogen Dioxide (ppm) 1-hour
GREEN: Good 1- 50	None	None	None	None	None
YELLOW: Moderate 51- 100	Unusually sensitive people should consider reducing prolonged or heavy exertion.	Unusually sensitive people should consider reducing prolonged or heavy exertion.	None	None	None
ORANGE: Unhealthy for Sensitive Groups 101- 150	People with heart or lung disease, children, and older adults should reduce prolonged or heavy exertion.	People with heart or lung disease, children & older adults, and people who are active outdoors should reduce prolonged or heavy exertion.	People with heart disease, such as angina, should limit heavy exertion and avoid sources of CO, such as heavy traffic.	People with asthma should consider limiting outdoor exertion.	NONE
RED: Unhealthy 151- 200	People with heart or lung disease, children, and older adults should avoid prolonged or heavy exertion. Everyone should reduce prolonged or heavy exertion.	People with heart or lung disease, children & older adults, and people who are active outdoors should avoid prolonged or heavy exertion. Everyone should reduce prolonged or heavy exertion.	People with heart disease, such as angina, should reduce moderate exertion and avoid sources of CO, such as heavy traffic.	Children, Asthmatics, and People with heart or lung disease should reduce outdoor exertion.	None
PURPLE: Very Unhealthy 201- 300	People with heart or lung disease, children, and older adults should avoid all physical exertion outdoors. Everyone else should limit outdoor exertion.	People with heart or lung disease, children & older adults, and people who are active outdoors should avoid all physical exertion outdoors. Everyone else should limit outdoor exertion.	People with heart disease, such as angina, should avoid exertion and sources of CO, such as heavy traffic.	Children, asthmatics, and people with heart or lung disease should avoid outdoor exertion; everyone should reduce outdoor exertion.	Children and people with respiratory disease, such as asthma, should reduce outdoor exertion.
MAROON: Hazardous 301- 500	People with heart or lung disease, children, and older adults should remain indoors. Everyone should avoid prolonged or heavy exertion.	People with heart or lung disease, children, and older adults should remain indoors. Everyone should avoid all outdoor exertion.	People with heart disease, such as angina, should avoid exertion and sources of CO, such as heavy traffic. Everyone else should limit heavy exertion.	Children, Asthmatics, and people with heart or lung disease should remain indoors. Everyone should avoid outdoor exertion.	Children and People with respiratory disease, such as asthma, should avoid outdoor exertion.

CHAPTER 10: METEOROLOGICAL INFORMATION

Figures 10.1 through **10.3** show average daily temperatures and **Figures 10.4** through **10.6** show total monthly precipitation amounts compared to their climatic norms for sites in the Northern, Southern Lower and Upper Peninsula. These figures were constructed by averaging data from several National Weather Service stations and therefore are not meant to be representative of any one single location in Michigan. Instead, they are intended to depict the regional trends that occurred during the year 2017.

Figure 10.1: Southern Lower Peninsula
Observed Average Monthly Temperatures vs.
Normal Average Monthly Temperatures

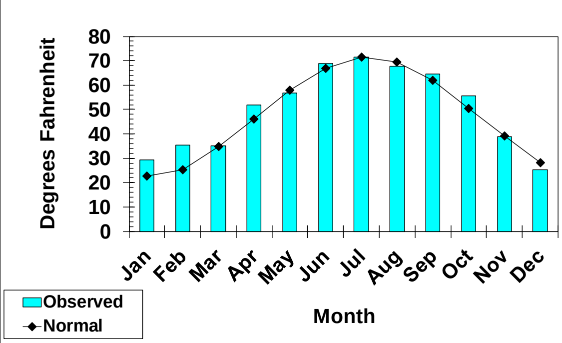


Figure 10.2: Northern Lower Peninsula
Observed Average Monthly Temperatures vs.
Normal Average Monthly Temperatures

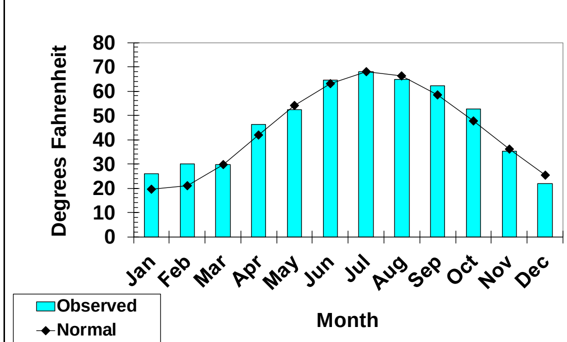


Figure 10.3: Upper Peninsula
Observed Average Monthly Temperatures vs.
Normal Average Monthly Temperatures

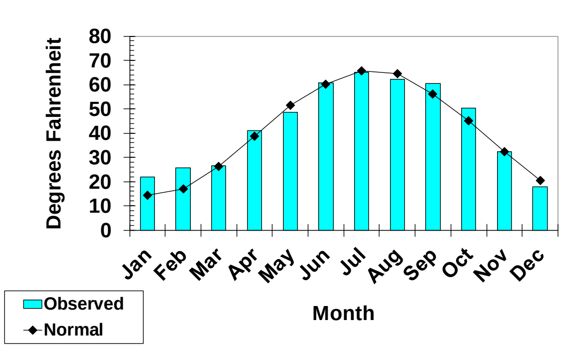


Figure 10.4: Southern Lower Peninsula
Observed Monthly Precipitation vs.
Normal Monthly Precipitation

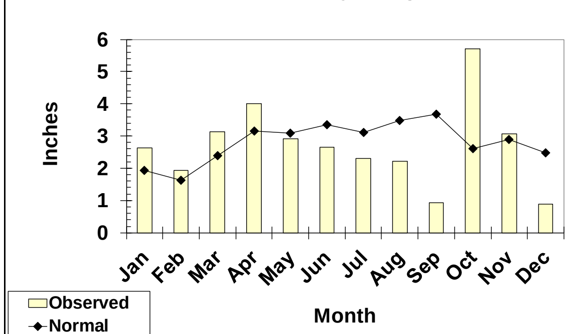


Figure 10.5: Northern Lower Peninsula
Observed Monthly Precipitation vs.
Normal Monthly Precipitation

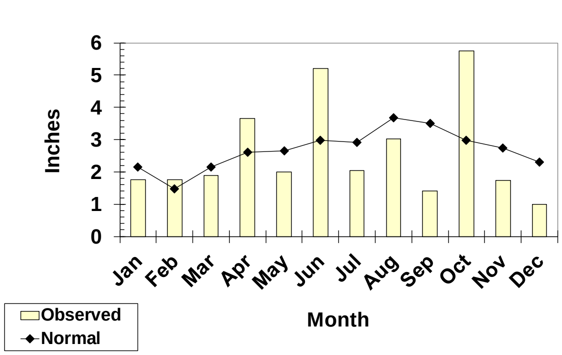
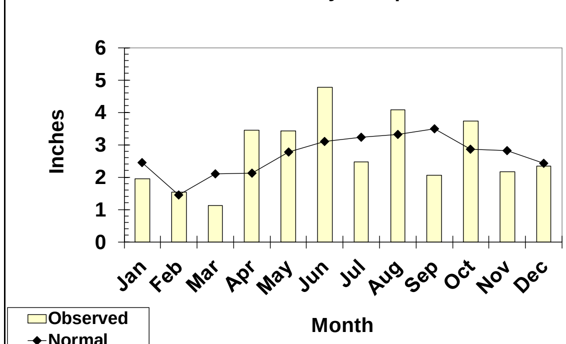


Figure 10.6: Upper Peninsula
Observed Monthly Precipitation vs.
Normal Monthly Precipitation



The weather plays a significant role in air quality and can either help increase or decrease the amount of pollution in the air. High temperatures, sun and longer days (i.e., more daylight hours) are conducive to ozone formation, whereas rain tends to wash pollutants out of the air. *Action!* Days are declared when levels are expected to reach or exceed the Unhealthy for Sensitive Groups AQI health indicator; specifically, when meteorological conditions are conducive for the formation of elevated ground-level O_3 or $PM_{2.5}$ concentrations.

Table 10.1 Shows that there were some *Action!* Days declared during the summer of 2017.

Table 10.1: *Action!* Days Declared During Summer 2017

Location	Year	Number	Dates
Ann Arbor	2017	4	6/11, 6/12, 7/18, 7/21
Benton Harbor	2017	4	6/10, 6/11, 6/12, 7/18
Detroit	2017	3	6/11, 7/18, 7/21
Grand Rapids	2017	3	6/10, 6/11, 6/12
Ludington	2017	2	6/10, 6/11

CHAPTER 11: SPECIAL PROJECTS

Near-road Air Toxics Grant: The DEQ is currently working on two special projects. The first project is a Community Scale Air Toxics Ambient Monitoring (CSATAM) grant. In 2015, the DEQ applied for a CSATAM grant to study near-roadway emissions at three sites in Detroit: Eliza Howell Near-road, Eliza Howell Downwind, and Livonia Near-road. The grant involved two years of monitoring at these sites, with an intensive 3-month sampling period when additional samples and increased sampling frequency were employed. The additional measurements at these sites are listed in **Table 11.1**. The 3-month intensive sampling period allowed for the analysis of toxic compounds that are more labor intensive to collect. The schedule for the intensive period was delayed due to road construction at the Livonia Near-road site but ran May through July 2017. The sampling phase of this project ended, and the data analysis phase has begun. The data analysis phase will continue through the end of 2018, after which a final report will be developed.

Table 11.1. Types of Measurements, Duration and Purpose at Near-road Sites

Measurement	Duration	Purpose
Hourly Black Carbon (BC[1])	2 years	Characterize diesel PM
Hourly BTEX	2 years	Characterize benzene and mobile source indicators
Hourly PM	2 years	Characterize hourly particulate matter
Hourly NO/NO_2/NOx	2 years	Mandated near-road measurement
Hourly CO	2 years	Mandated near-road measurement
Hourly Ozone	2 years	Help differentiate NOx and NO_2 concentrations
Hourly UFP[2]	6-12 months	Determine Ultra Fine Particulate Matter (UFP) levels, which have acute and likely chronic health affects
Hourly PM_{10} toxic metals	1 month	Use high–time-resolution measurements to apportion roadway influence, upwind versus downwind, and variations with traffic
Every other day 24-hour TSP toxic metals	3 months	Obtain full suite of toxics metals, for comparison among near-road and urban sites, apportion roadway influence
Every other day 24-hour carbonyls	3 months	Obtain toxics formaldehyde, acetaldehyde, acrolein to best determine risk from these air toxics
Meteorology	2 years	Provide capability to differentiate upwind from downwind
Traffic counts	2 years	Provide data on traffic patterns to link traffic mix and speed to air toxics concentrations

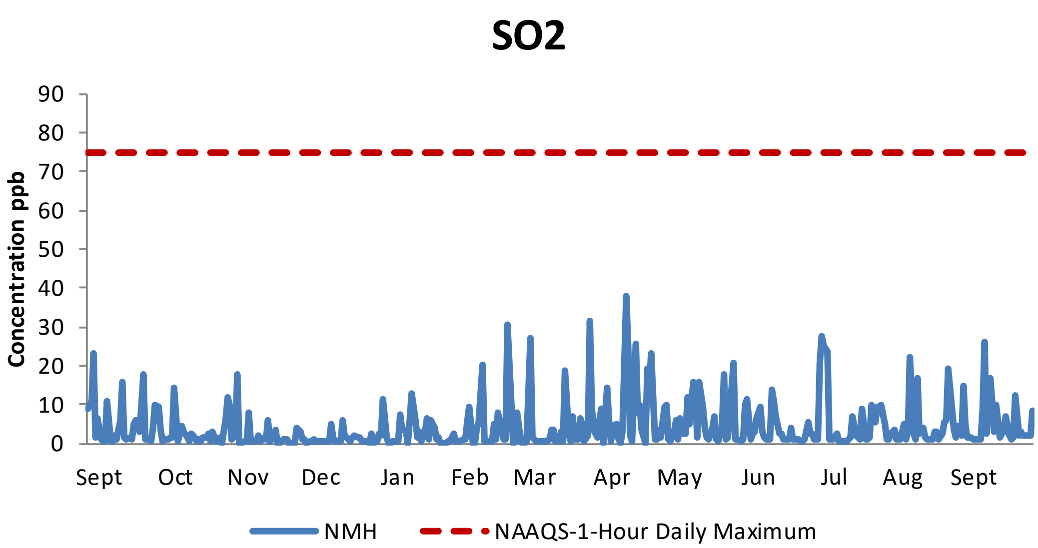
[1] BC is a marker for diesel particulate matter (DPM), which the USEPA has concluded ranks with the other substances that the national-scale assessment suggests pose the greatest relative risk; see https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=29060

[2] Mobile sources are a key source of exposure to ambient UFP emissions. Epidemiological studies have so far been inconclusive regarding UFP toxicity, but more data are needed, as discussed in detail in Health Effects Institute Perspectives.

[3] Understanding the Health Effects of Ambient Ultrafine Particles is available at: www.healtheffects.org/system/files/Perspectives3.pdf

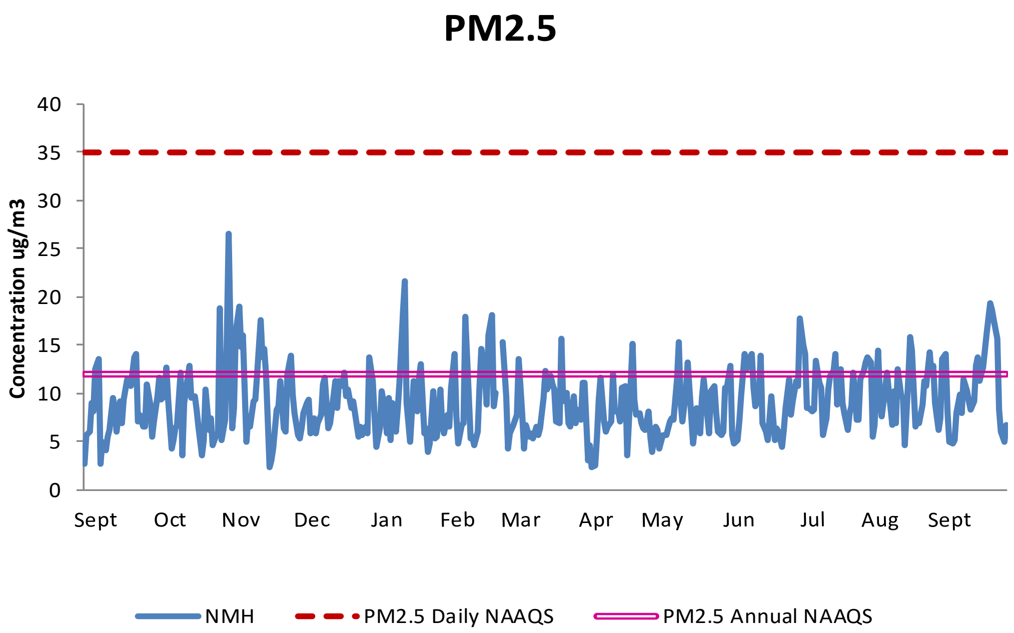
Community Monitoring Project: The second special purpose monitoring project resulted from a request from community members in the Detroit 48217 ZIP code for an air monitoring station in their neighborhood. The 48217 community has many industrial sources located in and around it. In a collaborative effort, the DEQ was able to establish an air monitoring station in the community for a 1-year study. The monitor site, known as “NMH 48217,” is located at New Mount Hermon Baptist Church at 3225 South Deacon Street in Detroit. The site monitored for SO_2, continuous $PM_{2.5}$, VOCs, PAHs, TSP metals, hydrochloric acid, sulfuric acid, and hydrogen cyanide. Sampling was conducted in September 2016 through September 2017. The data was analyzed at the end of the 1-year study and a final report was developed, which is available on www.michigan.gov/48217monitoring. The study found that all sampled compounds were below the levels of concern with the exception of two samples of sulfuric acid. At the completion of the study, all of the parameters were discontinued except for continuous $PM_{2.5}$, and SO_2; and the list of TSP metals was reduced to arsenic, cadmium, manganese, nickel, and lead. Figure 11.1 shows the 1-hour maximum SO_2 per day and Figure 11.2 shows the daily $PM_{2.5}$ concentrations. See Appendix B-1 for a summary of the other air pollutants sampled at this site, or the 48217 ZIP Code Project[13] page for more information and the complete report[14].

Figure 11.1. 1-Hour Maximum SO_2 Concentrations per Day at NMH 48217



[13] See www.michigan.gov/deqair (select “Monitoring”) for the 48217 ZIP Code Project web page.
[14] See the complete 48217 Project Report at www.michigan.gov/deqair, (select “Monitoring.”)

Figure 11.2. Daily $PM_{2.5}$ Concentrations at NMH 48217



APPENDIX 9
LETTER TO USFWS