Detroit Water and Sewerage Department

Wastewater Master Plan

DWSD Project No. CS-1314

Conceptual Plan for Oakwood-Northwest Interceptor

Technical Memorandum
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Conceptual Plan For Oakwood-Northwest Interceptor

1. Overview

The objective of this task is to describe the future of the Oakwood-Northwest Interceptor (O-NWI) and evaluate whether improvements are needed. The operation of the northern portion of the O-NWI will be affected if the Upper Rouge Tunnel or a combined tunnel with Dearborn is constructed to reduce combined sewer overflows. This memo addresses how this will affect the status of the O-NWI with regards to its hydraulic capacity and structural integrity.

The southern portion of the O-NWI could also be affected by future proposed projects. The next phase of improvements to the Detroit Waste Water Treatment Plant (DWWTP) is anticipated in about 2030. Those improvements may provide an opportunity to improve the lower portion of the O-NWI to make it an interceptor that conveys all flow to the treatment works. The Corps of Engineers is considering removing the paved channel portion of the lower Rouge River, as part of the River Rouge Gateway Master Plan. If that were to happen, it would create an opportunity to install a new interceptor along the route at reduced costs if the projects were constructed at the same time.

2. Approach

The work in this task was divided into the following sub-tasks:

1. Data collection – collect existing plan and profile for the O-NWI as provided under contract CS-1314 drawing I-3A dated September 13, 2002. Obtain background information on the River Rouge Gateway Master Plan, Upper Rouge Tunnel, combined tunnel, and other projects affecting the future of the interceptor.

2. Collect pertinent mapping and GIS. Show the ownership of portions of the O-NWI (Wayne Co., DWSD).

3. Show the Hydraulic Grade Line (HGL) in the O-NWI under different conditions, i.e. average dry weather flow, average wet weather flow, and peak flow conditions in 2003, 2020, 2050.

4. Summarize existing information on the structural integrity of the Northwest Interceptor if reports are available.

5. Compare future hydraulic capacity needs, as determined by the modeling results mentioned in (3) above, and the requirements of the Long Term Combined Sewage Overflow (LTCSO) Control Program for the Detroit and Rouge Rivers.

6. Develop a plan and profile for a new interceptor, showing route and profile in relation to current and future connections; and potential connection to the stub constructed in Pump Station 2 at the DWWTP.

7. Prepare a description of O-NWI inspection requirements (assess soil conditions).

8. Develop a preliminary cost estimate for anticipated improvements.

3. Assessment of Existing Condition (adapted from CDM Notebook (2000) with amendments (2003)

3.1 Interceptor Major Components

The Northwest Interceptor (NWI) runs in a north-south direction, primarily on the eastern side of the Rouge River starting near Eight Mile Road. The NWI crosses beneath the Rouge River just south of Michigan Avenue and continues on the west bank of the Rouge before crossing the river just south of I-94. Just before the crossing of I-75, the NWI enters a regulator system (near Fort Street) that includes overflows to the Rouge River and a three barrel inverted siphon crossing of the river. The NWI discharges to the Oakwood Interceptor at this location. The Oakwood Interceptor continues to the Detroit wastewater treatment plant. Total length of the NWI, including the Oakwood Interceptor, is approximately 86,800 linear feet.

Figure 1 depicts the general location and major features of the O-NWI system. Figure 2 shows the ownership of the system. The City of Detroit owns the O-NWI. Wayne County owns the Rouge Valley Interceptor that crosses the NWI as well as the north siphon of the three siphons that cross the Rouge River near Fort Street.

The primary trunk sewers connected directly to the NWI include:

- Eight Mile Road (7'0" diameter)
- Pembroke (9'6")
- Puritan (6'6")
- Fenkell (7'9")
- Lyndon (7'0")
- Schoolcraft (8'0")

Sewage from the Oakwood District (Lyddesdale sewer) in Detroit flows by gravity to the Oakwood Pumping Station and is pumped to the O-NWI via a force main. Flows from the Oakwood Pumping Station enter the O-NWI just upstream of siphons crossing the

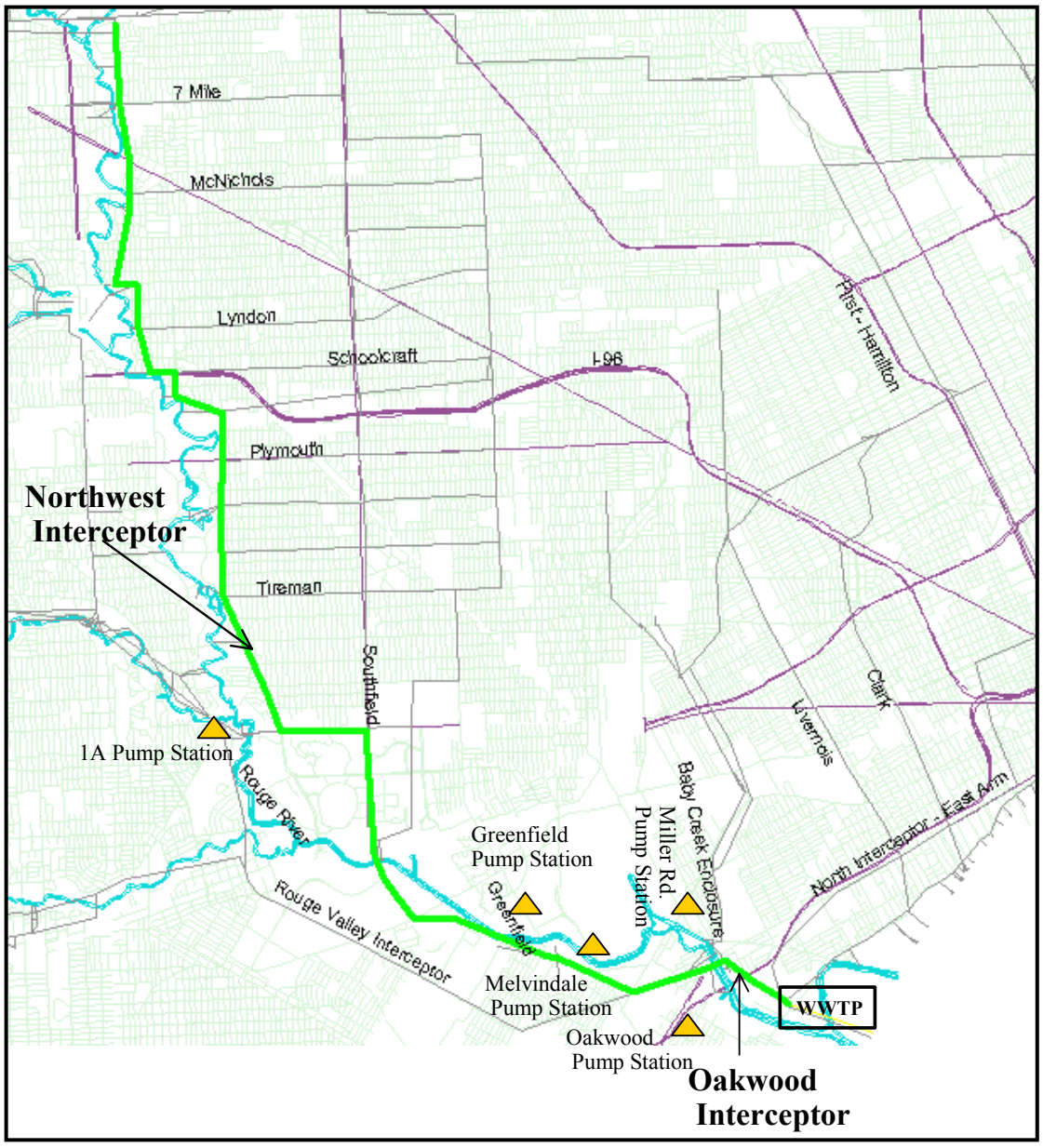

Figure 1. Plan View of Oakwood Northwest Interceptor

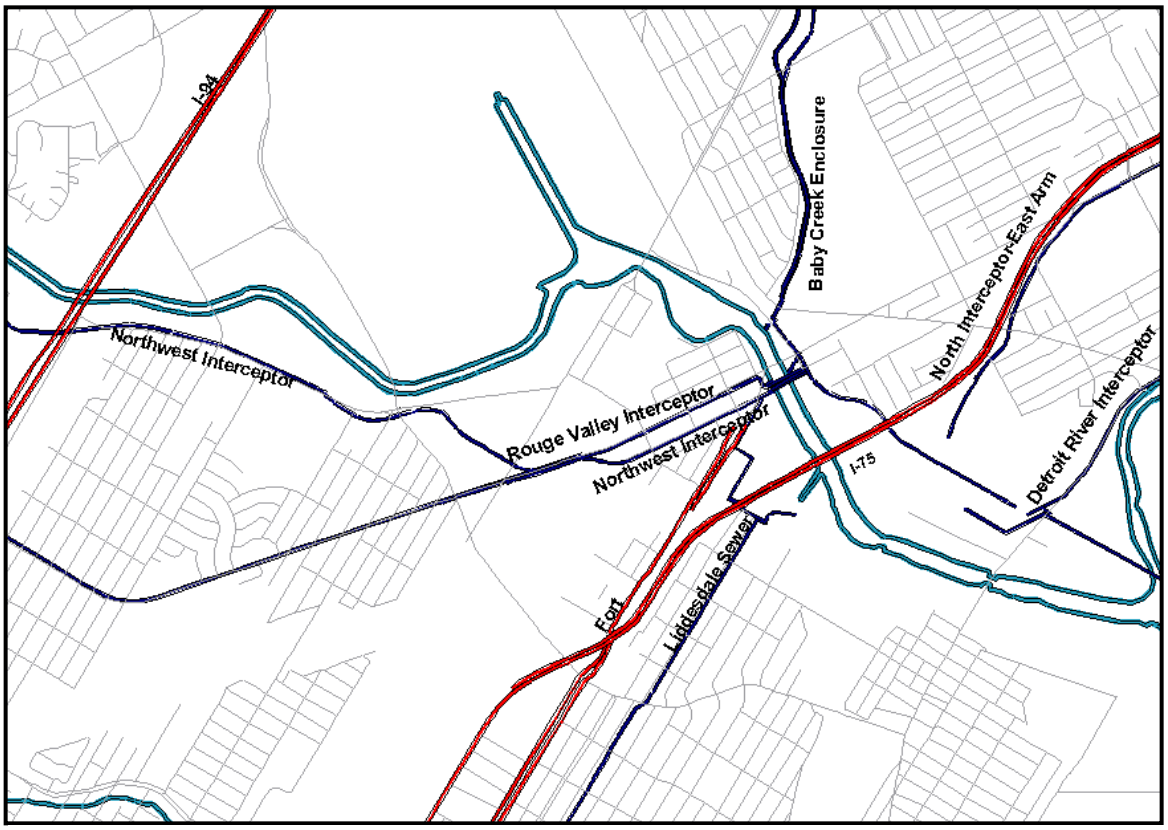

Figure 2. Ownership Of The System

Note: Wayne County Facilities include the Rouge Valley Interceptor and corresponding 6'-6" Siphon under the Rouge River. All other O-NWI facilities are owned by DWSD.

Rouge River. Sewage from the Hubbell and Southfield Sewer Districts is conveyed in twin barrel 13-foot 4-inch by 14-foot conduits to a location near the Rouge River. Most of these flows are then conveyed to the O-NWI by a 7-foot diameter connecting conduit. Most storm water flows are treated in the Hubbell Southfield Detention Basin with discharge to either the NWI or to the Rouge River.

There are 13 overflows directly connected to the NWI on the east side of the Rouge River. These overflows, as well as the overflows not directly connected to the NWI on the west side of the Rouge River, will be incorporated into the proposed Upper Rouge Tunnel, or a combination of wet weather combined system detention basins.

3.1.1 Pumping Stations

Several pumping stations discharge flows to the NWI. Conversion of the Puritan Pumping Station to a wet weather detention system was completed in 2000 by eliminating the station and constructing the Puritan-Fenkell and Seven Mile CSO basins. The Puritan-Fenkell basin includes a pump for dry weather flows. The

remaining DWSD pumping stations tributary to the O-NWI are the Oakwood Pumping Station and the Brennan Pools Pumping Station.

The Brennan Pools Pumping Station, located in Rouge Park, is a small facility serving a swimming pool and park toilet facilities. With a capacity of 4 cfs, the Brennan Pools Pumping Station has a negligible effect on total flows to the O-NWI. This system will continue to discharge to the O-NWI in the future.

The Oakwood Pumping Station is located on Sanders Avenue near the most southerly point of the O-NWI, just prior to the inverted siphon crossing of the Rouge River. This station handles combined wastewater flows from the Oakwood section of Detroit. Dry weather sanitary flows are pumped directly to the O-NWI. The dry weather pumps at this station have a capacity of 40 cfs. During storm events, combined flow that exceeds the capacity of the dry weather pumps is pumped directly to the Rouge River through CSO 054 (B50). Wet weather flow capacity to the Rouge River is 490 cfs. The station is currently undergoing rehabilitation, which is scheduled to be completed in 2004. Improvements to the station include pump replacement and reconditioning and increased capacity for pumping to the O-NWI. Future improvements will deal with flooding problems in the Oakwood District and provide a storage basin with screening and disinfection at CSO 054.

Lift Station lA is owned and operated by the Wayne County Division of Public Works as part of the Middle Rouge Interceptor system. Station 1A has been in operation since 1999. It can pump a total peak flow of over 400 cfs during peak storm events (10-year, 1-hour) through 3 connections to the O-NWI, but Wayne County contract capacity is limited to 380 cfs.

3.1.2 Special Structures and Systems

There are several important structures other than pumping station associated with the O-NWI that allow the system to function in accordance with the recommendations of the Long Term CSO plan and the NPDES discharge permit. Because the O-NWI is a combined sewer overflow system, flow control structures are located at various points to allow sewage flow into the Rouge River during some storm events. Currently there are 32 overflow points to the Rouge River south of Eight Mile Road. Thirteen of the overflows are located on the east bank of the Rouge River and are directly connected to the O-NWI. Each of the overflows consists of a dam (weir) located parallel to direction of flow, a channel connected directly to the Rouge River, and a backwater gate located in the discharge channel to prevent river water from flowing back into the O-NWI. Six of the overflows also serve as discharge points for relief sewers from the Southfield and Hubbell Sewage Districts. Another 19 overflows are located on the west side of the Rouge River. Although most of the west side overflows are not directly connected to the O-NWI, these overflows will be modified to direct flows to a CSO facility.

A flow meter was installed on the NWI, in 1998, south of Warren Road and north of I-94. Three other meters measure flow from the Middle Rouge Valley system and the Dearborn Greenfield Pumping system. There are eight flow level sensors on the NWI at various locations on the NWI between Seven Mile Road and the siphon crossing of the Rouge River.

The Warren-Pierson Control Gate is located directly on the NWI just north of Warren Road. This flow regulator was originally constructed as a pumping station at the original terminal point of the NWI in 1931. In the late 1950's, when the NWI was completed as far as the Oakwood Interceptor and DWWTP, the original pumping station was converted to a control gate structure that allows throttling of flow in the O-NWI system. The Warren Pierson Control Gate was rehabilitated in 2000.

Remote controlled motorized double leaf slide gate assemblies were installed at six outfall sites in 1998 to reduce overflows to the river and maximize conveyance of stormwater flows in the O-NWI. The leaf slide gates were installed at the following O-NWI CSOs:

- McNichols Sewer
- McNichols Relief Sewer
- Puritan Sewer
- Lyndon Sewer
- Lahser/Dolson Sewer
- West Chicago Sewer
- Tireman Sewer

The Hubbell-Southfield Control Regulator, although not located directly on the O-NWI, is an important component in the O-NWI system. When the gates on the Hubbell-Southfield Control Regulator are closed, combined sewage flows to the Hubbell-Southfield CSO basin for later release into the O-NWI when flow capacity becomes available.

3.1.3 CSO Basins

Several of the CSOs along the Rouge have been eliminated or upgraded to improve the quality of the Rouge River waters. Three detention basins were added in 1999 to mitigate wet weather CSOs: Seven Mile Detention Basin at CSO 058 (B53), Puritan-Fenkell (Eliza Howell Park) Detention Basin at CSO 070 and CSO 071 (B75 and B76), and Hubbell-Southfield Detention Basin at CSO 058 (B53).

The Hubbell-Southfield Detention Basin came on-line in 1999 with a storage capacity of 22 million gallons. Flows entering the basin are treated by settling of solids and skimming of floatables in the waste stream. The system is designed to discharge a peak flow of 86 cfs to the O-NWI.

The Puritan-Fenkell Detention Basin went on-line in 1999 to treat flows from CSO 070 and CSO 071. This basin replaced the Puritan Pumping Station. The Puritan-Fenkell Detention Basin includes 2.2 million gallons of storage and treats flows by settling, skimming of floatables and disinfection.

The Seven Mile Road detention basin eliminates untreated overflows from CSO 076 and 078. This 2.3 million gallon basin treats flows generated by a 1-inch (one year, one hour) rain event by settling, skimming and disinfection.

3.1.4 System Hydraulics

Communities that have contracts to discharge to the O-NWI include Dearborn, Melvindale, Allen Park, and Farmington. Redford Township and Dearborn Heights also contribute minor flows to the O-NWI. The Wayne County Rouge Valley Sewage Disposal District also has contracted with DWSD to discharge flows to the O-NWI. Wayne County's Middle Rouge Interceptor discharges to the O-NWI just south of the Hubbell-Southfield discharge. The Middle Rouge Interceptor receives flows from Livonia, Westland, Plymouth Township, Garden City, Northville and Novi. The communities that have contractual rights to discharge flow to the O-NWI are referred to as first-tier customers. Communities that discharge to the Wayne County system are referred to as second tier communities. Figures 3 and 4 are schematic depictions of contractual flow inputs and relative locations.

The O-NWI receives combined sewage and storm water flows from the Rouge Sewer District in Detroit. The O-NWI also receives flow from parts of Wayne County west of Detroit, including some flows from the Rouge Valley Disposal District, Allen Park, Melvindale, part of the City of Dearborn, and part of the City of Farmington in Oakland County. Just upstream of the Oakwood Interceptor, the NWI receives flows from the Hubbell-Southfield Interceptor system. Several relief sewers in the Hubbell-Southfield system are also connected to overflows integral to the O-NWI.

The O-NWI has adequate capacity to convey dry weather flows to the Detroit WWTP through the year 2050 without overflows to the Rouge River. The O-NWI has limited wet weather conveyance capacity; it generally can convey runoff from a 0.2 inch rainfall without overflows to the Rouge River. The City of Detroit and other tributary communities, including Dearborn, Dearborn Heights, Allen Park and Melvindale, are essentially built out and should contribute the same or lesser flows in the future due to residential downspout disconnection, residential catch basin restriction and other CSO program Base Element Improvements. Although some additional development will occur in areas served by the Wayne County Middle Rouge Interceptor, additional flows that exceed the current contract limit for the 10-year 1-hour storm event for the Wayne County Lift Station lA should not be allowed.

The target Hydraulic Grade Line (HGL) for the O-NWI is defined in the Long Term CSO Control Plan as the HGL associated with the maximum amount of flow that can be transported without raising water elevations in the interceptor and tributary sewers to levels that cause basement and/or street flooding.

Flows from the Baby Creek Sewer District in Detroit, the Rouge Valley Sewage Disposal District Rouge Valley Interceptor and the Dearborn Miller Road Pumping Station are discharged to the Oakwood Interceptor immediately downstream of the NWI. These large sewers, although not directly connected to the NWI have an important impact on the flow capacity of the NWI.

The O-NWI currently functions as a combined sewer and will continue to do so in the future. Significant separation of storm water flows from sanitary sewage flows is not planned in the O-NWI service area. Some sewer separation may occur in the O-NWI tributary area including removal of roof downspouts. Ongoing infiltration and inflow (I/I) removal projects may also lessen extraneous flow to the system.

Figures 5 and 6 show the design HGL for the O-NWI (10 year, 1 hour – summer condition).

In summary, the Oakwood-Northwest Interceptor is required to convey tributary dry weather flows to the Detroit Wastewater Treatment Plant. It has the capacity to do so now. It has adequate capacity for future dry weather flows as well.

The design criteria for the proposed Upper Rouge Tunnel, in terms of design peak flows and dewater the tunnel, are based on the present configuration and no significant changes are necessary or anticipated to accommodate the tunnel.

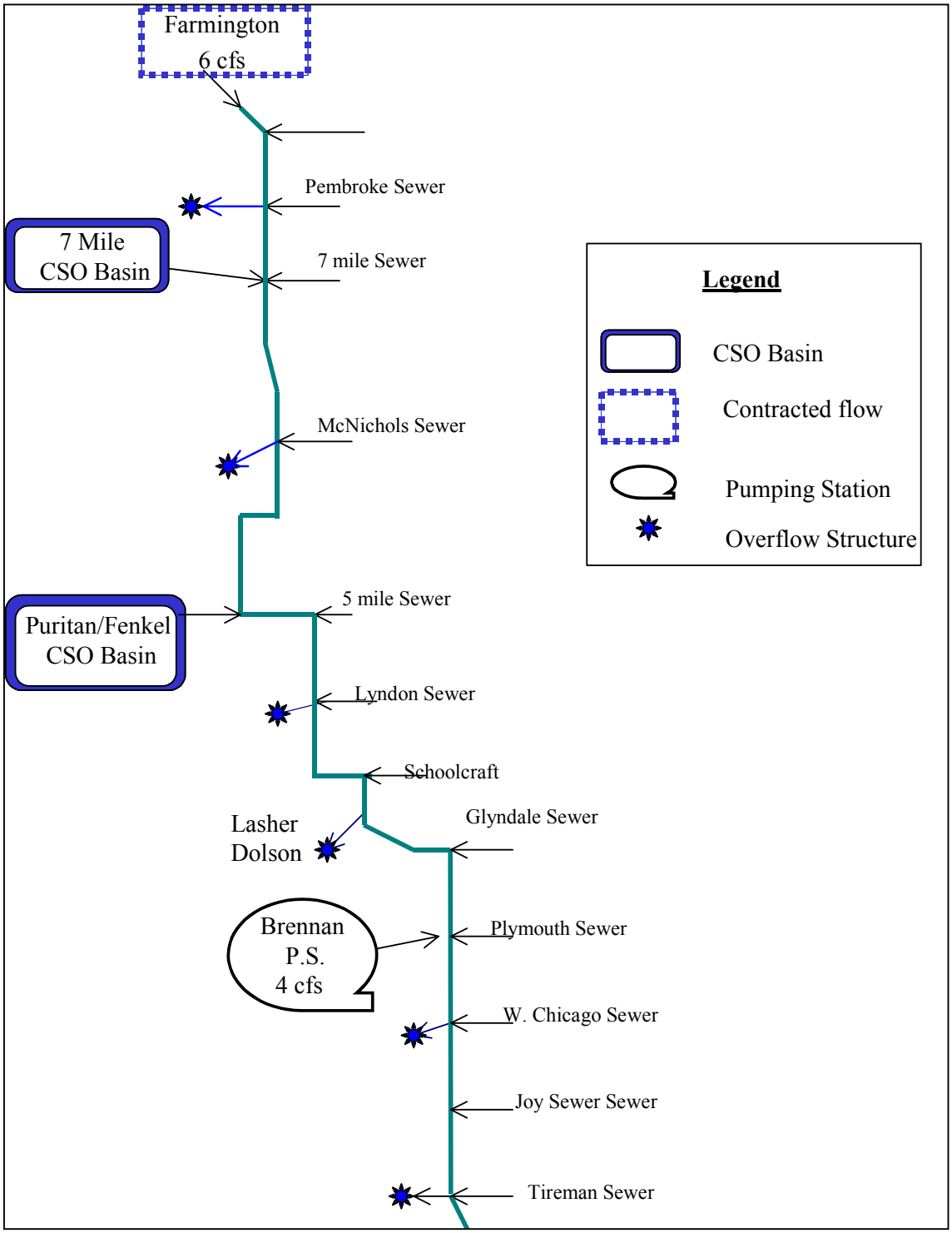

Figure 3. Northwest Interceptor Flow Diagram (1 of 2) From 8 Mile to Tireman

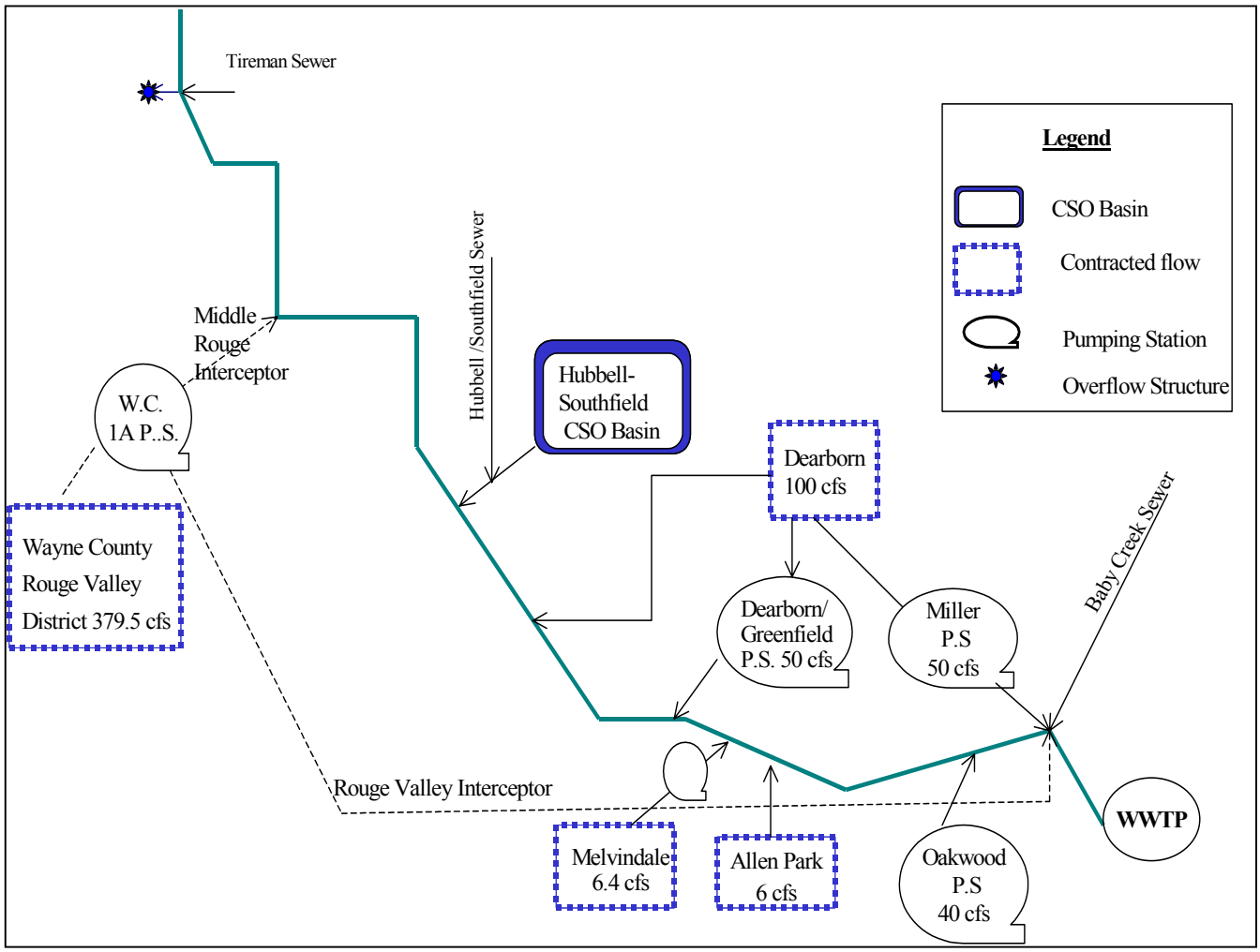

Figure 4. Northwest Interceptor Flow Diagram (2 of 2) From Tireman to WWTP

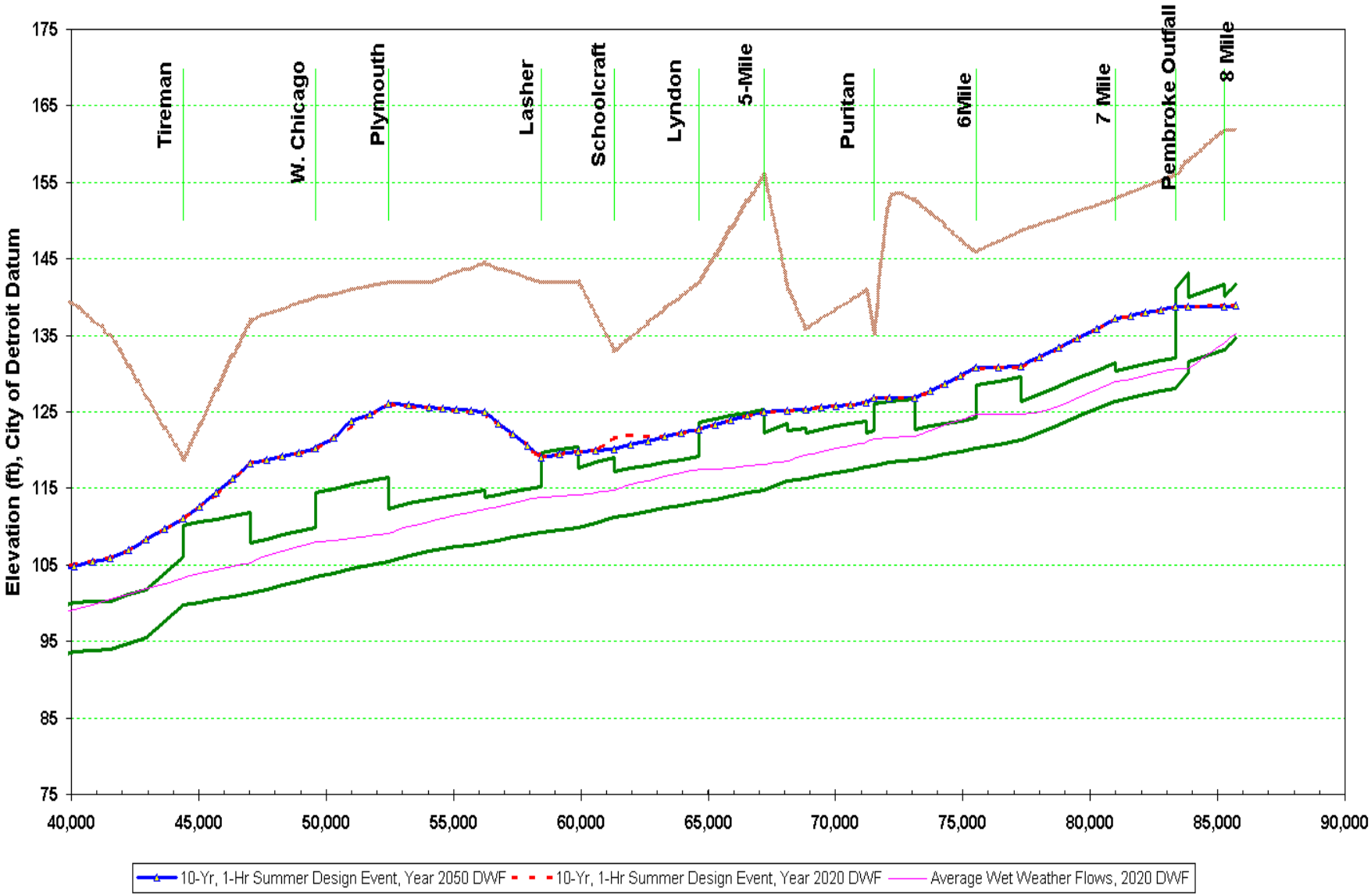

Figure 5. Hydraulic Grade line in the NWI (1 of 2)

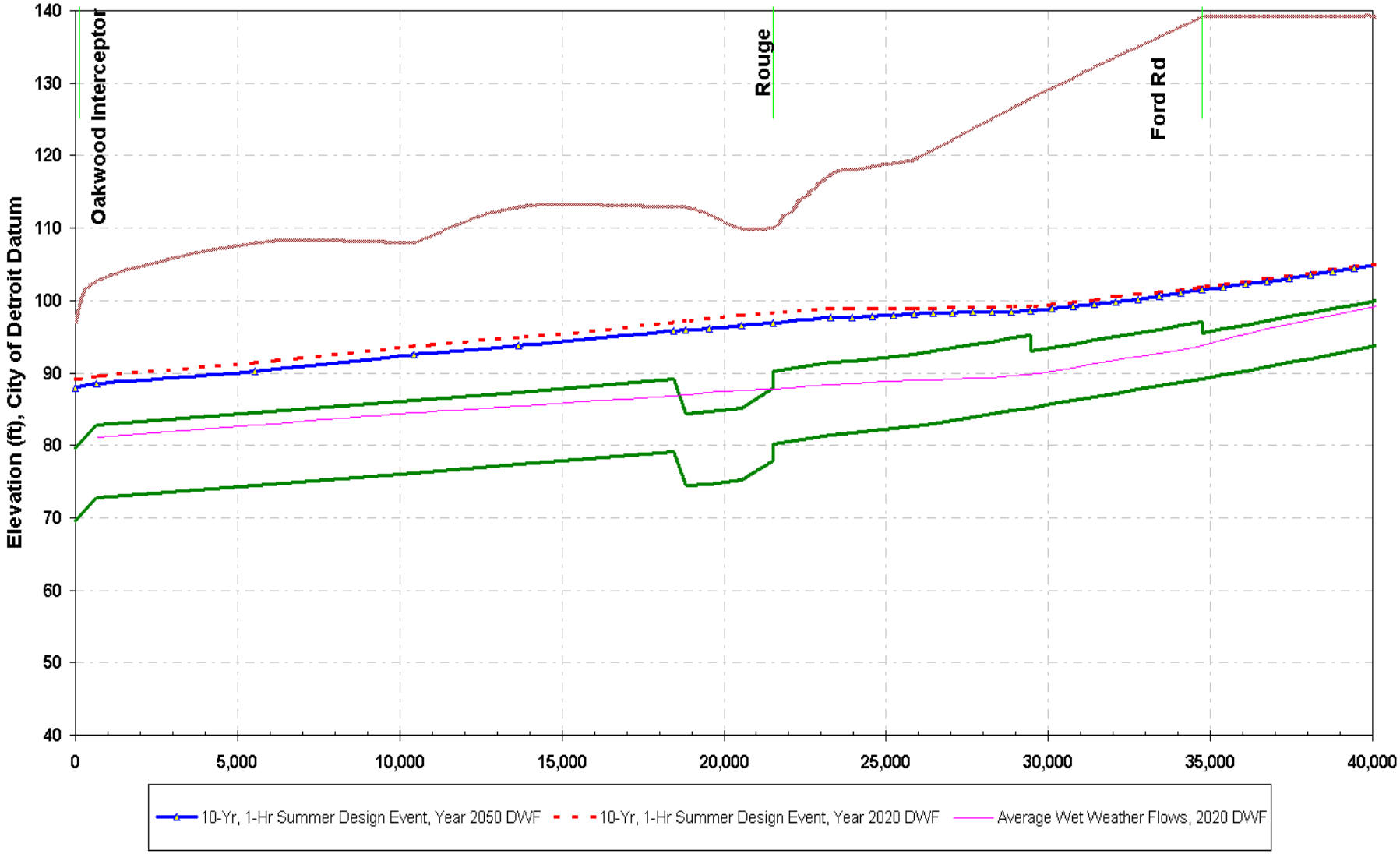

Figure 6. Hydraulic Grade Line in the NWI (2 of 2)

3.2 Physical Condition

The NWI was constructed between 1929 and 1931 to intercept numerous lateral and trunk sewer discharges to the Rouge River. Trunk sewer construction in the Rouge District continued westward towards the Rouge after construction of the NWI. Flows in the NWI were initially conveyed to the Warren Pierson Pump Station and pumped to discharge points on the Rouge or Detroit Rivers. Following construction of the DWWTP, NWI flows were discharged to that facility for treatment. In the late 1950's, the NWI was extended to include the Oakwood Interceptor with complete gravity flow to the DWWTP. The Warren Pierson Pump Station was converted to a sluice gate system capable of throttling or stopping pipeline flow in the interceptor. The NWI discharges to the Oakwood Interceptor south of Oakwood Boulevard near the I-75 crossing of the Rouge River.

All pipe segments of the NWI are cylindrical and were constructed primarily of cast-in-place reinforced concrete with several sections constructed of brick masonry. Sections of cast in place concrete vary from 10-inch to 16-inch thickness. The pipeline was constructed by a combination of open-cut excavation and tunneling. Tunneled sections were installed with steel liner plates.

The NWI has operated continuously, some sections for over 70 years, with no reported significant operating problems. Typically, all sewers larger than 4-ft diameter are regularly inspected by personnel of the DWSD by walkthroughs, except sewers that are inaccessible because of depth of sewage, flow velocity or other safety considerations.

Sections of several tributary sewers to the NWI were inspected during the 1980's and 1990's. The Southfield Sewer in particular showed some signs of deterioration including hairline cracks, spalling of concrete, joint leaks and some structural failure.

Most of the outfall structures gates associated with the NWI overflows were inspected as part of the LTCSO Control Plan. Outfall 060 (B56, 57 & 58) was identified as requiring long term rehabilitation. Outfall B80 (074) was rehabilitated under CS-1158, Task 1.

The overflow structures were also inspected as part of the LTCSO Control Plan. Two segments of the NWI, as shown on Table 1 and the Figures in Appendix A, were relined in 2000. Table 1 also shows the year during which the sewer segments were constructed. Some or the segments are over 70 years old.

Table 1. Oakwood-Northwest Interceptor Age and Material

SEWER STATION		Approximat Location of	SEWER CONSTRUCTION			
D.S. STA	U.S. STA	Major Rd/Sewer to D.S. Sta.	MATERIAL	YEAR	CONTRACT	DWG #
0	4,820	WWTP Pump Station	Concrete	1940	Oakwood Interceptor	1616, 1617
4,820	5,520	Oakwood Interceptor	Concrete	1950	IO - 2	C - 30 - 54
4,820	4,820		Concrete	1960	IO - 2	C - 30 - 54
5,520	5,520		Concrete	1950	IO - 2	C - 30 - 54
5,520	10,620	Fort St.	Concrete	1950	PW-1406	1810 - 3
10,620	12,712		Concrete	1950	PW-1406	1810 - 4
12,712	17,968		Concrete	1950	PW-1407	1810 - 4, 5
17,968	20,415	Greenfield Rd.	Concrete	1950	PW-1408	1810 - 5
20,415	22,020		Concrete	1950	PW-1408	1810 - 6
22,020	23,707		Concrete	1950	PW-1408	1810 - 6
23,707	23,912	Rotunda	Concrete	1950	PW-1408	1810 - 6
23,912	24,520		Concrete	1950	PW-1408	1810 - 6
24,520	25,522		Concrete	1931	Southfield Rd Sewer	1309
25,522	26,452	Hubbell - Southfield	Concrete	1931	Southfield Rd Sewer	1309
26,452	26,482		Concrete	1931	Southfield Rd Sewer	1309
26,482	30,629		Concrete	1928	Mill Rd Sewer Sec. 1	1066
30,629	34,284	Michigan	Concrete	1928	Mill Rd Sewer Sec. 1	1067
34,284	34,309		Relined Concrete	2000	Ford Rd Sewer	N
34,309	38,864		Concrete	1955	Ford Rd Sewer	N
38,864	39,231		Relined Concrete	2000	Ford Rd Sewer	N
39,231	39,590		Concrete	1955	Ford Rd Sewer	N
39,590	44,590	Evergreen	Concrete	1958	PW - 3023	1907 - 3, 4, 5
44,590	46,390		Concrete	1958	PW - 3023	1907 - 5
46,390	49,233		N	1929	River Rouge Int. Sec. 3	1145
49,233	49,533	Tireman	N	1929	Bonaparte Ave Sewer Sec. 1	1110
49,533	52,043		N	1929	River rouge Int. Sec. 4	1146
52,043	52,681	W. Chicago	N	1930	Plymouth Ave Sewer Sec. 1	1202
52,681	54,827		N	1930	Plymouth Ave Sewer Sec. 1	1203
54,827	59,642		N	1929	River Rouge Int. Sec. 5	1147
59,642	60,846		N	1929	River Rouge Int. Sec. 5	1148
60,846	62,274		N	1929	Lahser - Schoolcraft Sewer Sec. 1	1080
62,274	63,596		N	1929	River Rouge Int. East Sec. 6	1095
63,596	64,368		N	1929	River Rouge Int. East Sec. 6	1095
64,368	65,988		N	1929	River Rouge Int. East Sec. 6	1096
65,988	66,703		N	1929	River Rouge Int. East Sec. 6	1096
66,703	69,262		N	1929	Fenkell Ave. Arm Sec. 1	1033
69,262	70,202	Puritan	N	1929	River Rouge Int. East Sec. 7	1115
70,202	70,992		N	1929	River Rouge Int. East Sec. 7	1115
70,992	73,292		N	1929	River Rouge Int. East Sec. 7	1115
73,292	73,567		N	1929	River Rouge Int. East Sec. 7	1115
73,567	74,805		N	1929	Puritan Ave. Sewer	1083
74,805	77,215		Brick	1929	River Rouge Int. East Sec. 8	1149
77,215	77,355	Six Mile	N	1929	Six Mile Road Sewer Sec. 1	976
77,355	79,107		N	1929	Berg Rd Sewer Sec. 1	1150
79,107	80,144		N	1929	Berg Rd Sewer Sec. 1	1150
80,144	82,821		N	1929	Berg Rd Sewer Sec. 2	1151
82,821	82,822	7 Mile	N	1929	Berg Rd Sewer Sec. 2	1151
82,822	85,146		Brick	1929	Berg Rd Sewer Sec. 3	1152
85,146	85,180		Concrete	1929	Frisbee Ave. Sewer	1205
85,180	85,443		Concrete	1929	Frisbee Ave. Sewer	1205
85,443	86,849		Brick	1929	Berg Rd Sewer Sec. 4	1284

A summary of construction statistics of the Oakwood-Northwest Interceptor is provided below:

Oakwood-Northwest Interceptor Construction by Time Periods:

Year	to Year	Length, ft
1925	1935	50,200
1935	1945	4,800
1945	1955	24,600
1955	1965	6,800
2000		400

Oakwood-Northwest Interceptor Construction Material:

	Length, ft
Brick	6,100
Concrete	46,300
Unknown	34,000
Relined Concrete	400

4. Summary of Existing and Future Projects in the Vicinity of the O-NWI

4.1 LTCSO and Updated LTCSO

The Long Term Combined Sewer Overflow Plan (LTCSO) was published in 1996 and updated in 2000. The plan includes an Upper Rouge Tunnel to control all CSOs upstream of Warren Avenue. The basis of the plan and details are well documented. Separately, the City of Dearborn is developing plans for a CSO Control Tunnel within their community. Consideration was given to potentially combining the two tunnels, but the current plan is for these projects to proceed separately. Analysis and recommendations regarding the O-NWI are made on the assumption that these tunnel projects will remain separate. This is consistent with the basis of the hydraulic model data provided.

The LTCSO does not require any significant changes to the O-NWI. The plan for CSO control for the tributary area to the O-NWI consists of retaining all small wet weather flows in the piping system by the use of existing and future retaining dams, and overflowing larger volumes to the future Upper Rouge Tunnel. The LTCSO assumes that the O-NWI will remain in the current location and capacity. Figure 7 shows components of the Long Term CSO Control Plan.

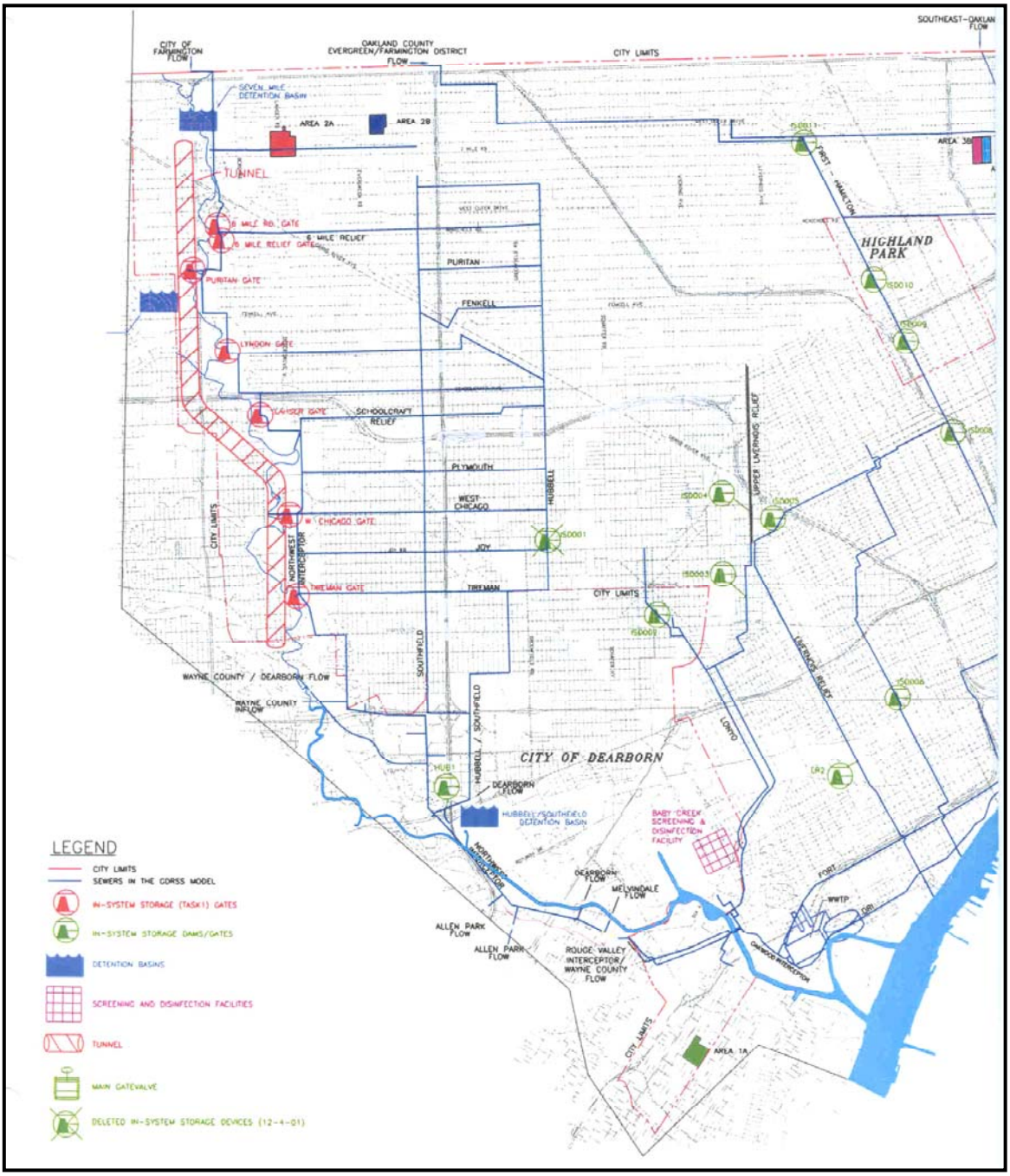

Figure 7. LTCSO Control Plan Components

Note: Obtained from the 2000 update of the LTCSO

4.2 Upper Rouge Tunnel

A CSO storage/treatment tunnel along the Rouge River will be constructed from the vicinity of Seven Mile Road extending to Warren. When constructed, this system will control overflows from CSO 059 through CSO 069, CSO 072 through CSO 075, CSO 077 and CSO 079. The tunnel will be a conventional deep rock tunnel with a 22.5-foot diameter and over 7 miles of length. Flows will enter the tunnel through drop shaft systems, which will provide disinfection and screening of flows. Combined sewage stored in the tunnel will be pumped out and discharged to the O-NWI via a new connecting sewer. Storm flows exceeding the capacity of the tunnel would be discharged to the Rouge River through existing and new outfall structures.

4.3 Dearborn Tunnel

The City of Dearborn submitted its Basis of Design Report for the Dearborn CSO Control Program to MDEQ in October 2000. The Basis of Design report presented the recommended alternative for controlling CSO discharges to the Rouge River from Outfalls 001 through 015, and Outfall 020 in the East and West Dearborn sewer districts.

Initial phases will eliminate CSO discharges from Outfalls 013, 014 and 015. Latter phases will eliminate CSO discharges from Outfalls 001 through 012, and 020. The City of Dearborn has plans to separate the sewers tributary to Outfall 019. Outfalls 016, 017 and 021 will be addressed separately and will be included in the latter Basis of Design Report. Outfall 023 will be controlled after all outfalls upstream of it are controlled.

In the early 1990s, various alternatives were considered by the City of Dearborn to eliminate CSO discharges to the Rouge River. As a result, construction of an 18-foot diameter rock tunnel was started in 1994 to control discharges from initial phase outfalls. However, construction was halted in 1995 as the Contractor encountered large quantities of groundwater containing hydrogen sulfide. Subsequently, the City of Dearborn entered into a new Administrative Consent Order (ACO) with the Michigan Department of Environmental Quality (MDEQ), which extended the schedule for the construction of the City of Dearborn CSO control program. The new ACO calls for initial phase construction to be completed by January 1, 2004 and latter phase construction to be completed by January 1, 2008.

4.4 River Rouge Gateway Master Plan

The Rouge River Gateway Master Plan (RRGMP) is a cooperative effort by the Rouge River Gateway Partnership to "restore life to a damaged river and its urban surroundings." The RRGMP is a diverse stakeholder group of Wayne County and municipal officials, cultural institutions, and private businesses formed to represent common interests in the corridor. They have identified 36 projects in the Rouge River corridor from Ford Road to the Detroit River that constitute the Master Plan. Some of

the projects are underway. Some of the projects have undefined implementation schedules. The Northwest Interceptor traverses the corridor. Figure 8 shows the O-NWI and the identified projects of the RRGMP.

The removal of the concrete embankments of the Rouge River (RRGMP Project no. 9) would consist of removing concrete channel pavement from the banks to a few feet below the normal water level. This construction does not appear to be conducive to mutual benefit of tunnel construction in the area.

Several bike paths and bridges are now under construction from Ford Road to the river confluence near Michigan Avenue. The bridges have H-piles that are as much as 60 feet deep. The construction of the bridges must be coordinated with the construction of the Dearborn Tunnel project or any improvements to the sewers.

The Delray residential area of Detroit is designated in the RRGMP as a future "clean industrial" area that will provide a "buffer" between the heavy industrial sites in the WWTP area and the mouth of the River and the residential areas to the north. This may constitute a re-plat of the area to be redeveloped. Part of this redevelopment would include a greenbelt and pathway that would include public access roads, bike paths, and necessary utility easements. This proposed greenbelt might be used as a sewer easement if determined to be necessary. Such an easement could be mutually beneficial to the WWMP improvements and the interests of the Rouge River Gateway Partnership. (See discussion in Sections 1.6 and 1.7.)

The Oakwood Interceptor passes through the Delray area. The existing easement may be used or combined with a parallel public easement to facilitate Gateway Master Plan and sewer usage.

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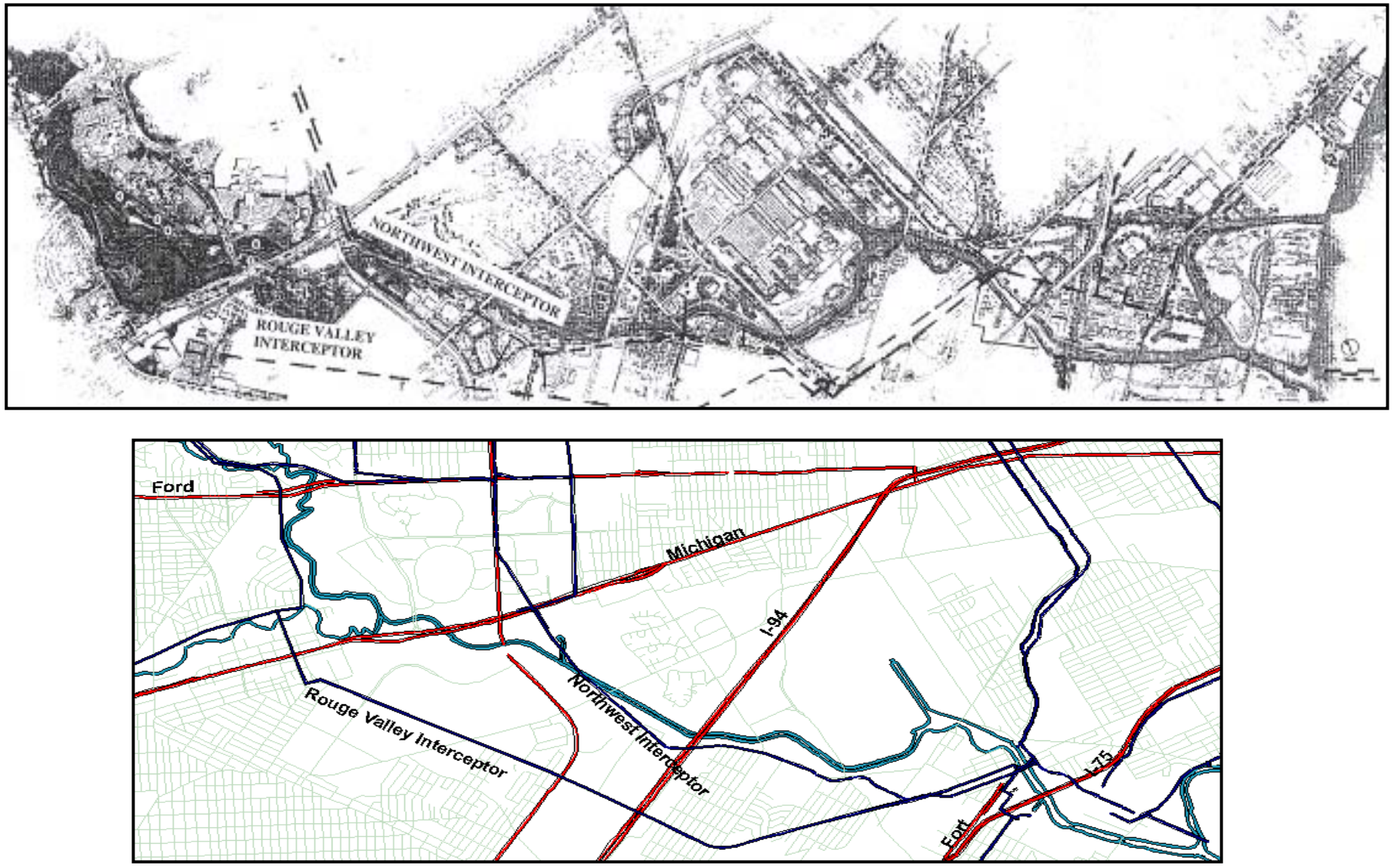


Figure 8. NWI and Rouge Valley Interceptor locations on RR Gateway Master Plan

5. Assessment of Future Condition

There does not appear to be any reason to modify the Oakwood-Northwest Interceptor with respect to capacity, hydraulic efficiency, or alignment. The LTCSO Plan has been developed under the assumption that the O-NWI will remain as is. The dewatering rates of the proposed Dearborn and Upper Rouge Tunnels are to be determined by the existing capacity and conveyance of the O-NWI. Assumed dewatering rates of the proposed tunnels have been included in the GDRSS model of the O-NWI.

It is recognized that segments of the O-NWI were constructed around 1930. Some segments built in 1950's required lining of deteriorated sewer walls. It is recommended, therefore, that a thorough examination of the O-NWI be performed to determine the structural integrity, conveyance impedance by debris, and long term reliability of each segment of the sewer.

6. Emergency Operation and Redundancy

The O-NWI serves a large tributary area and essentially functions independently from the Detroit River Interceptor and the North Interceptor - East Arm. There is limited redundancy in the system to allow temporary movement of significant wet weather flows from the O-NWI in the event of a pipe failure or other emergency event.

The Warren - Pierson Control Structure allows throttling of flows in the O-NWI in the vicinity of Warren Road. Partial closure of gates at Warren - Pierson during a dry weather period would allow for partial dewatering of the O-NWI south of Warren Road to the siphon crossing of the Rouge River.

There is, however, potential to provide dry weather flow bypass for most, if not all, of the system to facilitate emergency construction, repair, or inspection of the facilities. The new Upper Rouge Tunnel would provide some storage capacity for O-NWI flows in the event of an emergency during dry weather. The Southfield sewer could be used as alternative conveyance via pumping to tributaries during low flow to facilitate inspection of the Upper Rouge segments. Temporary bulkheads could be placed in the O-NWI to allow flow to the future Upper Rouge River Tunnel during maintenance and inspection.

Closing the Warren Pierson gate, in conjunction with diverting flow upstream, could allow inspection of the O-NWI immediately downstream of the gate.

Dry weather flow could be diverted to the Rouge Valley Interceptor to bypass the lower sections of the Northwest Interceptor by insertion of temporary bulkheads to facilitate maintenance and inspection.

Temporary plugs and control gates can be used to bypass dry weather flow between the inverted siphons across the Rouge River to facilitate maintenance and inspection of the siphons.

There is a cross connection with a temporary bulkhead between the Rouge Valley Interceptor and the O-NWI in the Oakwood district. There is also a bulkhead in the 10'-0" Southfield Sewer that diverts Southfield freeway flows from the north to the east and out of the O-NWI. These structures can be used to facilitate bypass flows.

In summary, the inspection and maintenance or repair of the Northwest Interceptor from Fort Street to the north can be accomplished through a series of temporary diversion flow structures, pumps, and operations of existing facilities as shown on Figure 9. Details of diversion are dependent on the extent of the inspections to be made. A budget cost has been included as an allowance for temporary facilities needed for these diversion structures.

The Oakwood Interceptor does not have a parallel sewer that could carry dry weather flow to the plant. The Oakwood Interceptor is a 12'-9" cylinder sewer with concrete walls 12-inch to 16-inch thick. The sewer was constructed as a monolithic concrete secondary conduit in a primary liner installed by tunnel construction. The sewer has tiles on the interior to the spring line.

Dry weather flow in the Oakwood Interceptor cannot be diverted. Therefore, a parallel conduit capable of carrying peak dry weather flow from the junction chambers downstream of the O-NWI Rouge River siphons to Pump Station No. 2 of the Detroit WWTP is recommended. This parallel sewer would facilitate inspection and maintenance of the main interceptor during dry weather flow. The parallel sewer must be capable of carrying the peak hour dry weather flow of 309 cfs.

The available drop from Oakwood Interceptor at the O-NWI siphon receiving chambers to the inlet in Pump Station No. 2 dedicated to the Northwest district is approximately 30 feet. The 8/10 point of the Oakwood Interceptor at the siphon receiving chambers is 80 feet (City Datum). Assuming an allowance for routing and junction drops, a minimum of 20 feet is available for the sewer that may be as long as 4,000 feet, suggesting that a .5% slope is available. The Oakwood Interceptor is 12'-9" at the siphon junctions. The receiving opening in PS 2 is 10'-0" diameter. The maximum economical sewer size within this range is 7'-0" diameter in a 10'-0" tunnel. Assuming that a 7'-0" sewer is used at .5% slope, the capacity would be 450 cfs, which is more than the dry weather flow of 309 cfs.

If placed parallel to the existing Oakwood Interceptor and in direct route from the siphon chambers to Pump Station No.2, the redundant sewer may be only 3,200 feet long. For the purposes of this report in developing capital improvements projections, a 7'-0" sewer at 4,000 foot length is assumed.

It should be noted that the operating levels of Pump Station No. 2 are between 72 and 76 feet City Datum and the full capacity of the proposed sewer would not be realized under these operating conditions. Therefore, the available drop for a redundant sewer under normal operational conditions would be 8 feet. Assuming a hydraulic difference of 8 feet, the conveyance in the 7'-0" sewer at 3,400 feet would equal the dry weather flow of 309 cfs.

The soils in the vicinity of the siphon receiving chambers are very soft gray silty clays with traces of sand and gravel per Wayne County construction documents. A similar description is given in the Oakwood Interceptor construction drawings describing the soil as "blue" clay with trace sand and gravel. The soils are suitable for tunnel construction. The Oakwood Interceptor was constructed as a tunnel.

The Oakwood Interceptor was constructed in a tunnel through the Delray area. This 12'-9" sewer is in a 30' wide easement. The parallel sewer may be constructed in or adjacent to the easement but maintenance and construction restrictions limit this possibility.

7. Recommendations

7.1 Location of a new interceptor

To facilitate maintenance and enhance reliability in the Oakwood segment of the Oakwood-Northwest Interceptor, a parallel dry weather flow sewer is recommended. Potential locations of the sewer are indicated in Figure 10. Figure 11 is a profile of the proposed sewer. These locations could be coordinated with the Rouge River Gateway Master Plan Delray Redevelopment greenbelt for an easement. The Parallel Oakwood Interceptor is assumed to be 7'-0" diameter constructed in a 10'-0" tunnel passing through the Delray area at 4,000 feet or less. The existing Oakwood Interceptor easement may also be considered as a possible route.

7.2 Conveyance System

It is recommended to inspect the entire Northwest Interceptor for structural integrity. An improvement plan for repair of the system should be developed from the inspection. Based on the age and construction of the segments, it is expected that some of the sewer must be relined or replaced to ensure structural integrity to year 2050. For the purposes of this report in planning for future improvements, it is assumed that 20 percent (17,400 feet) of the Northwest Interceptor will need to be relined and another 10 percent (8,700 feet) will need to be replaced over the next 50 years.

7.3 Cost Summary

Table 2 represents cost estimates of recommendations 1.7.1 and 1.7.2 described above.

8. Findings and Conclusion

The Oakwood-Northwest Interceptor will function as a combined sewer in the future as it has in the past. It will convey all dry weather flows to the Detroit Wastewater Treatment Plant. Control of higher flows will include diversion of excess flow to the proposed Upper Rouge Tunnel. Segments of the sewer are over 70 years old and the entire sewer should be inspected. It is expected that portions of the sewer should be repaired by either lining or replacement. A sewer parallel to the Oakwood Interceptor that is capable of conveying a minimum of dry weather flow should be considered in capital improvement programs to facilitate maintenance of this section.

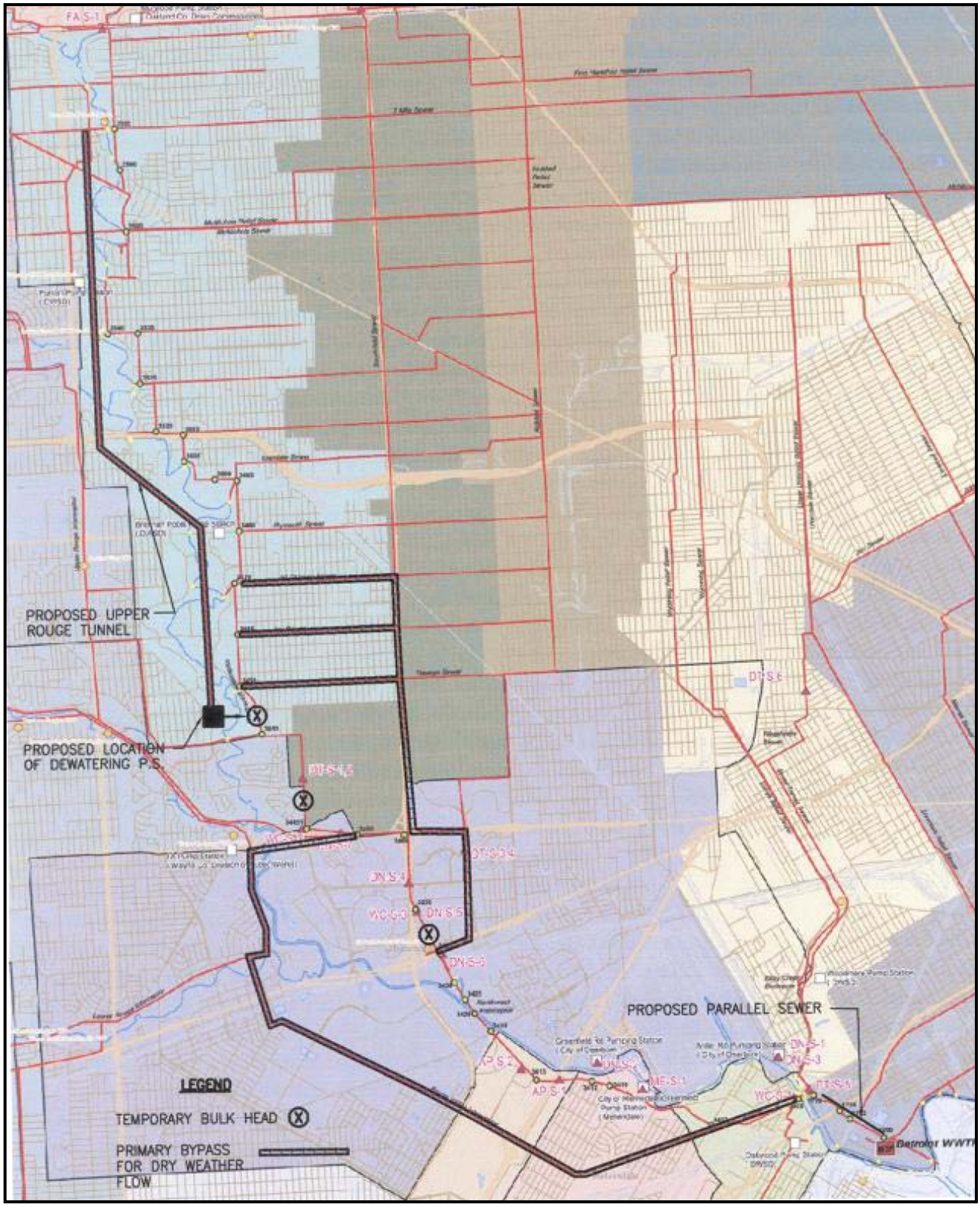


Figure 9. Primary by Pass for the NWI Dry Weather Flow

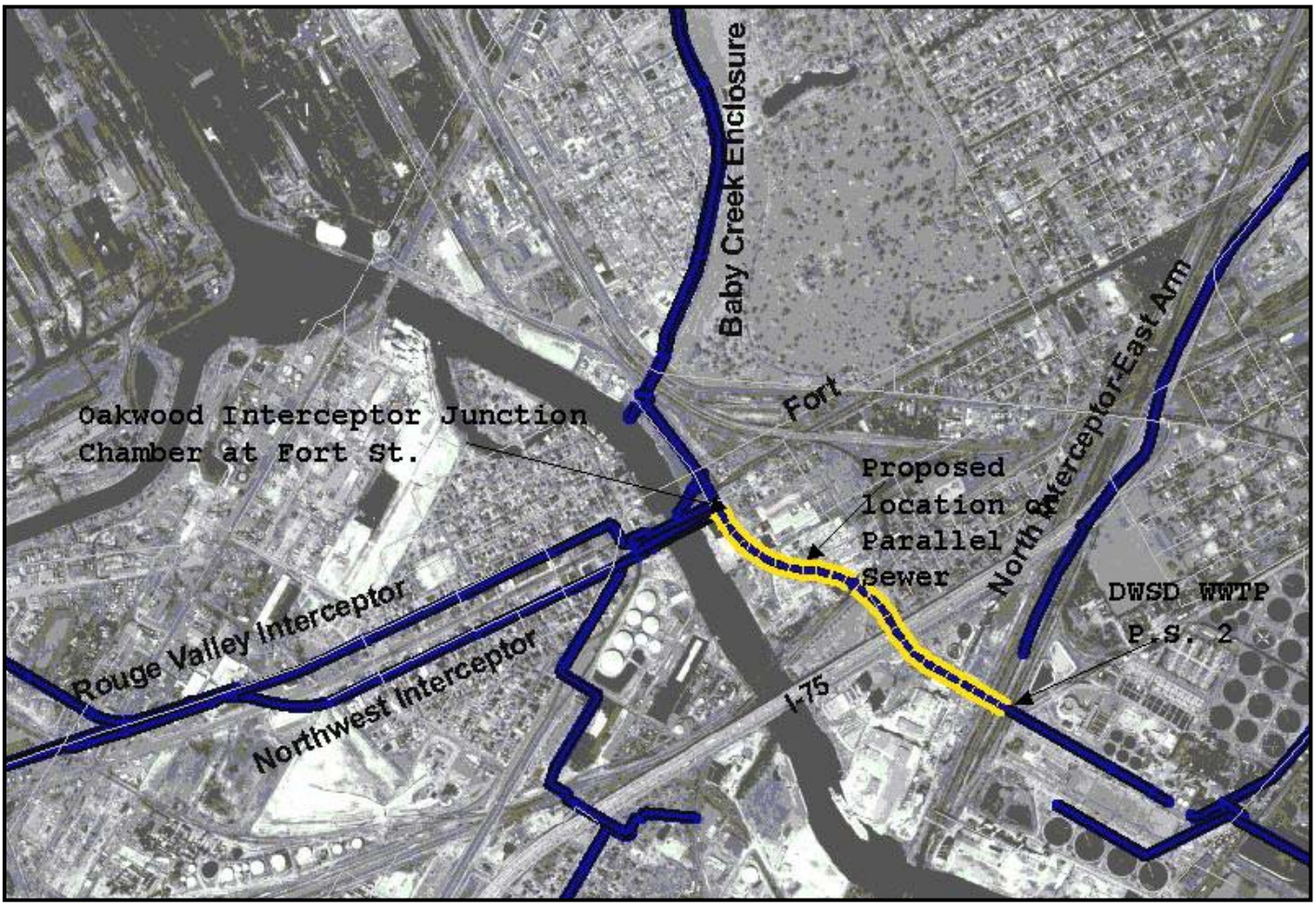


Figure 10. Recommended Parallel Oakwood Interceptor on RR Gateway Master Plan

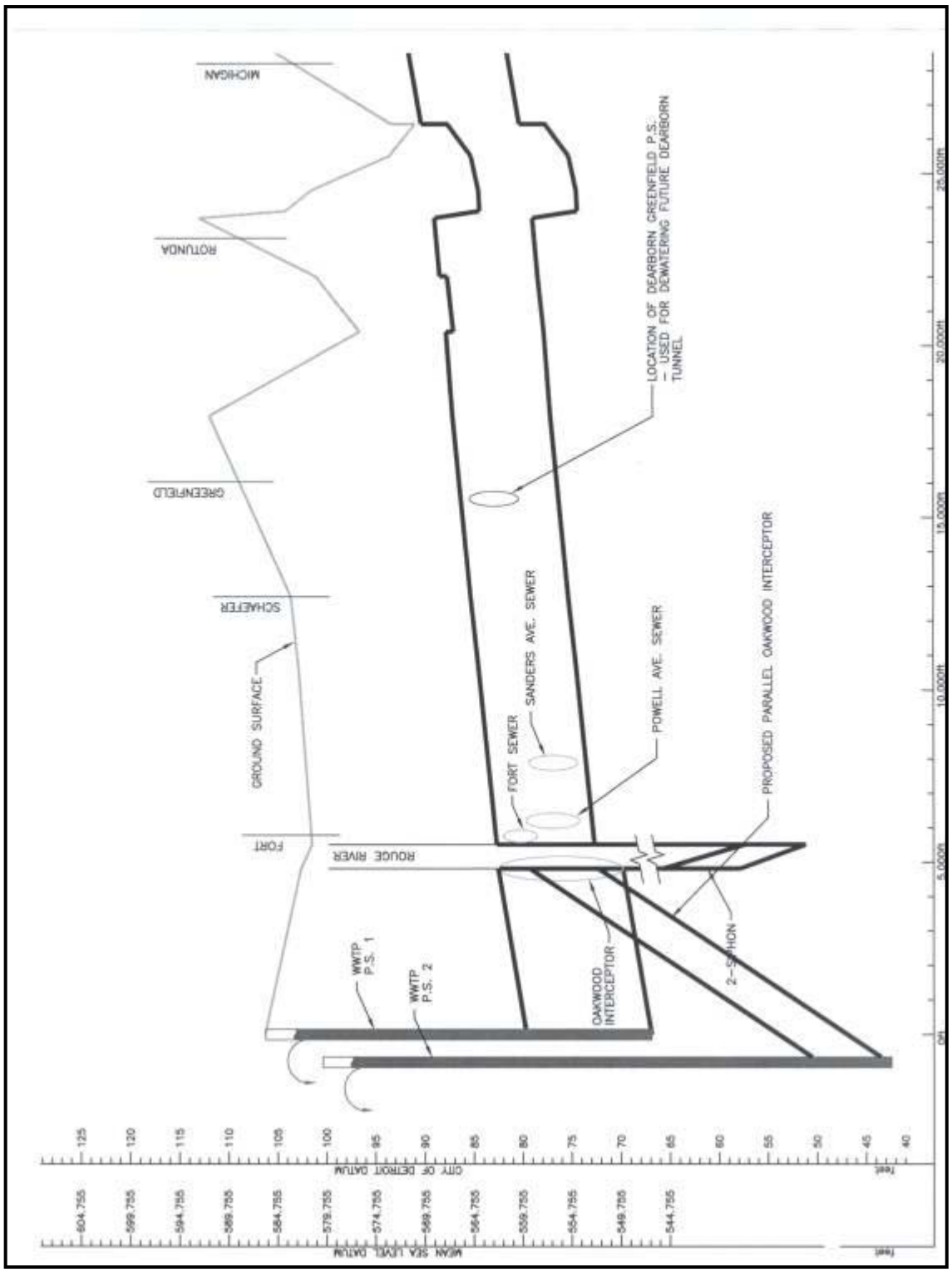
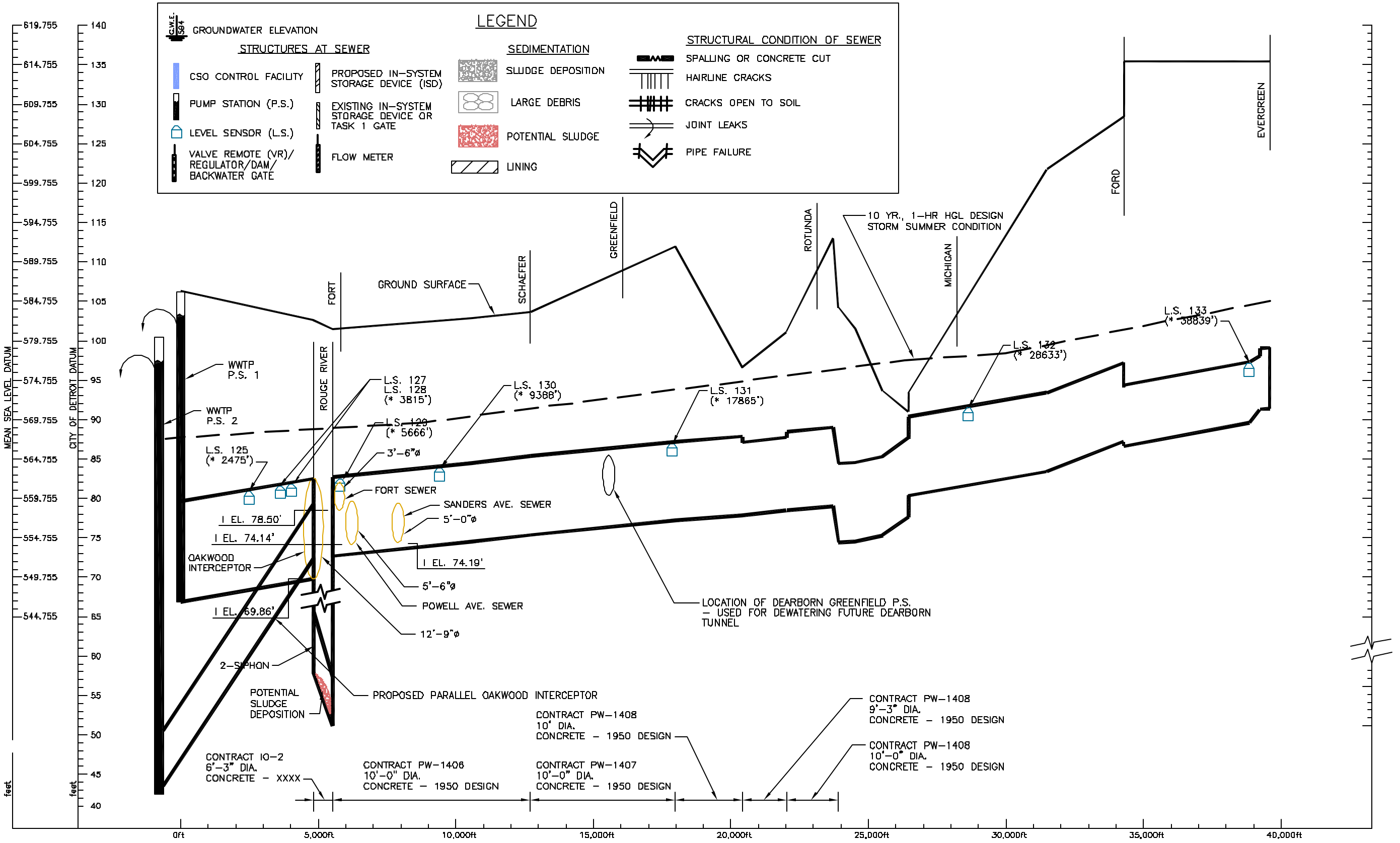


Figure 11. Profile of the Recommended Parallel Oakwood Interceptor

Table 2. Engineer's Opinion of Probable Capital Cost

No.	Item Description	Quantity	Unit	Unit Amount	Total Cost
	Lined Tunnel with 84'' pipe,	4,000	LF	$2,000.00	$8,000,000.00
	Access MH 0-8' deep	4	EA	$11,000.00	$44,000.00
	Addl. Depth of MH over 8'	50	VF	$1,000.00	$50,000.00
	Junction Chamber at Pump Station No.2 DWWTP	1	LS	$200,000.00	$200,000.00
	Junction Chamber at Oakwood Interceptor at Flora/Reisner St.	1	LS	$400,000.00	$400,000.00
	Oakwood Redundant Interceptor				**$8,694,000.00**
	Reline Sewer (10'-0'' diameter equivalent)	17,400	LF	$1,000.00	$17,400,000.00
	Replace Sewer (10'-0'' diameter equivalent)	8,700	LF	$2,500.00	$21,750,000.00
	Reline or Replacement of Sewer				**$39,150,000.00**
	Allowance for Temporary Diversion Structures				**$2,000,000.00**
Subtotal					$49,844,000.00
	Contractor Overhead & Profit (25%)				$ 12,461,000
	Total Construction				$ 62,305,000
	Contingency (30%)				$ 18,691,500
	Engineering, Legal, Administrative, Management (20%)				$ 12,461,000
	Total Project Cost				$ 93,457,500



NOTE:

1. * APPROX. DISTANCE
2. PROFILE IS ONLY FOR PLANNING PURPOSES.

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DETROIT WATER AND SEWERAGE DEPARTMENT
CS-1314 WASTEWATER MASTER PLAN

PROFILE
OAKWOOD - NORTHWEST INTERCEPTOR

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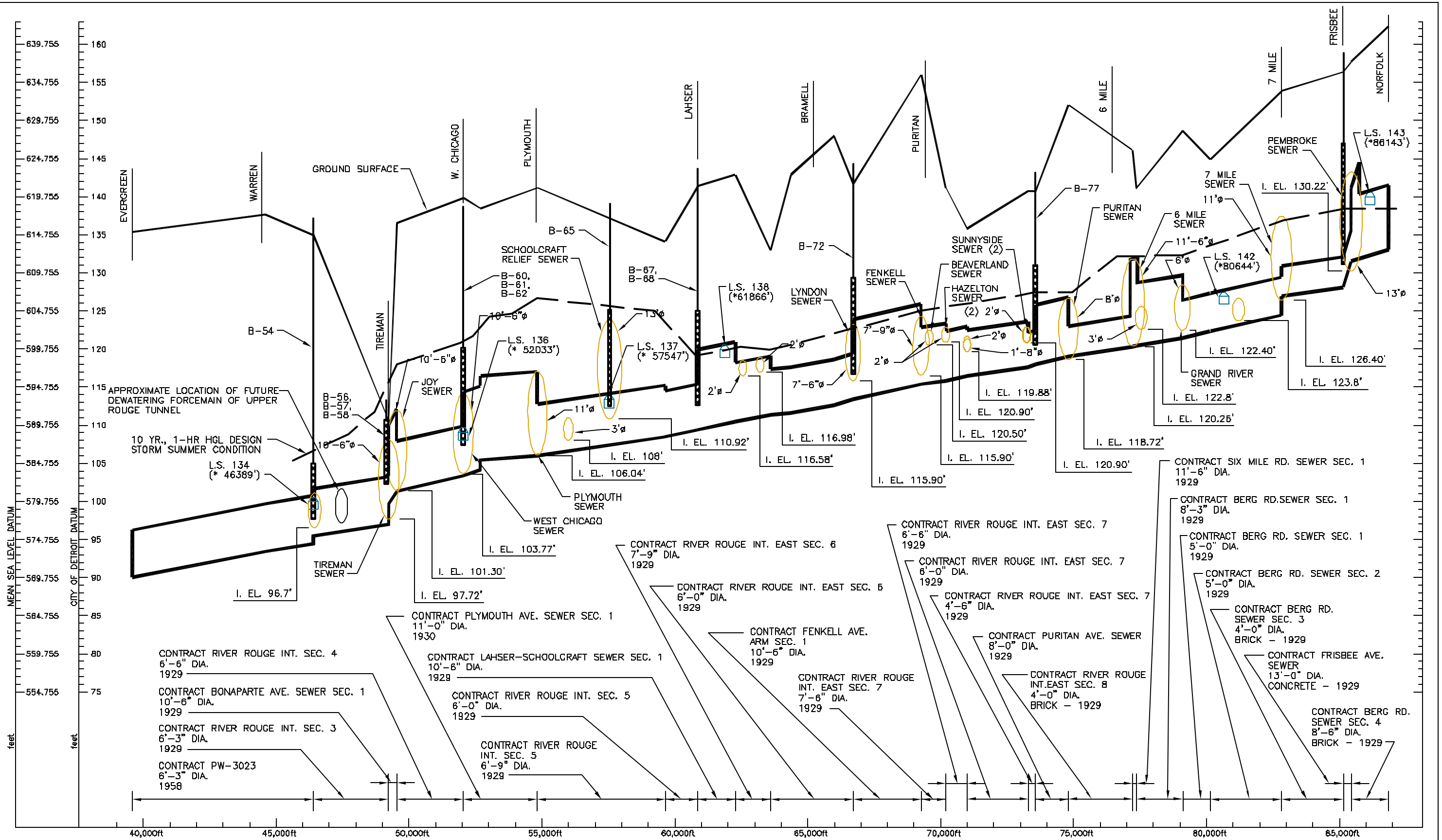

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