Detroit Water and Sewerage Department

Wastewater Master Plan
Executive Summary

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CDM Camp Dresser & McKee

October 2003

DWSD Project CS-1314 Plan Project Team: Camp Dresser & McKee ● CH2M HILL ● PR Networks, Inc. ● Hinshon Environmental Consulting ● **Ralph Tyler Companies** ● Spalding DeDecker Associates, Inc. ● SIGMA Associates, Inc. ● Tetra Tech MPS, Inc. ● Tucker, Young, Jackson, Tull, Inc. ● Wade-Trim, Inc.

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Regional Sewer Service Today

Serving the People and Economy of Southeast Michigan. The Detroit Water and Sewer Department's regional wastewater system has supported the growth of Southeast Michigan for over 130 years. In 2003, the regional system serves the City of Detroit and 76 customer communities which include 3 million people. Since 1950, the regional sewer service area has almost doubled in size. Approximately 1.8 million people are employed by businesses connected to the regional sewer system.

The regional system conveys and treats wastewater for a metropolitan economy that the Detroit Regional Chamber of Commerce estimates as $500 billion per year. Over 2,500 persons are employed by DWSD, and its first and second tier customers to operate and maintain the treatment facilities pumping stations, combined sewer overflow control facilities, and over 14,200 miles of publicly-owned sewers. Also, the regional wastewater system protects the water supply for the city of Detroit and 126 communities in Southeast Michigan – approximately one half of the population of the state.

Largest Treatment Plant in the World. The Detroit wastewater treatment plant processed an average annual flow of 656 million gallons per day in 2002. Wet weather flows will exceed 1,700 million gallons per day during heavy rain events, after the current expansion program at the plant is complete. Detroit's wastewater treatment plant is among the top ten in the world as measured by average daily flow. The existing plant was built in 1940, and expanded three times since. When construction is completed on the current expansion, it will have the largest peak hour flow capacity of any plant in the world. The wastewater treatment plant is operated in compliance with federal and state requirements for pollution control, and it discharges treated wastewater to the Detroit River.

Regional Sewer Service for the Next 50 Years

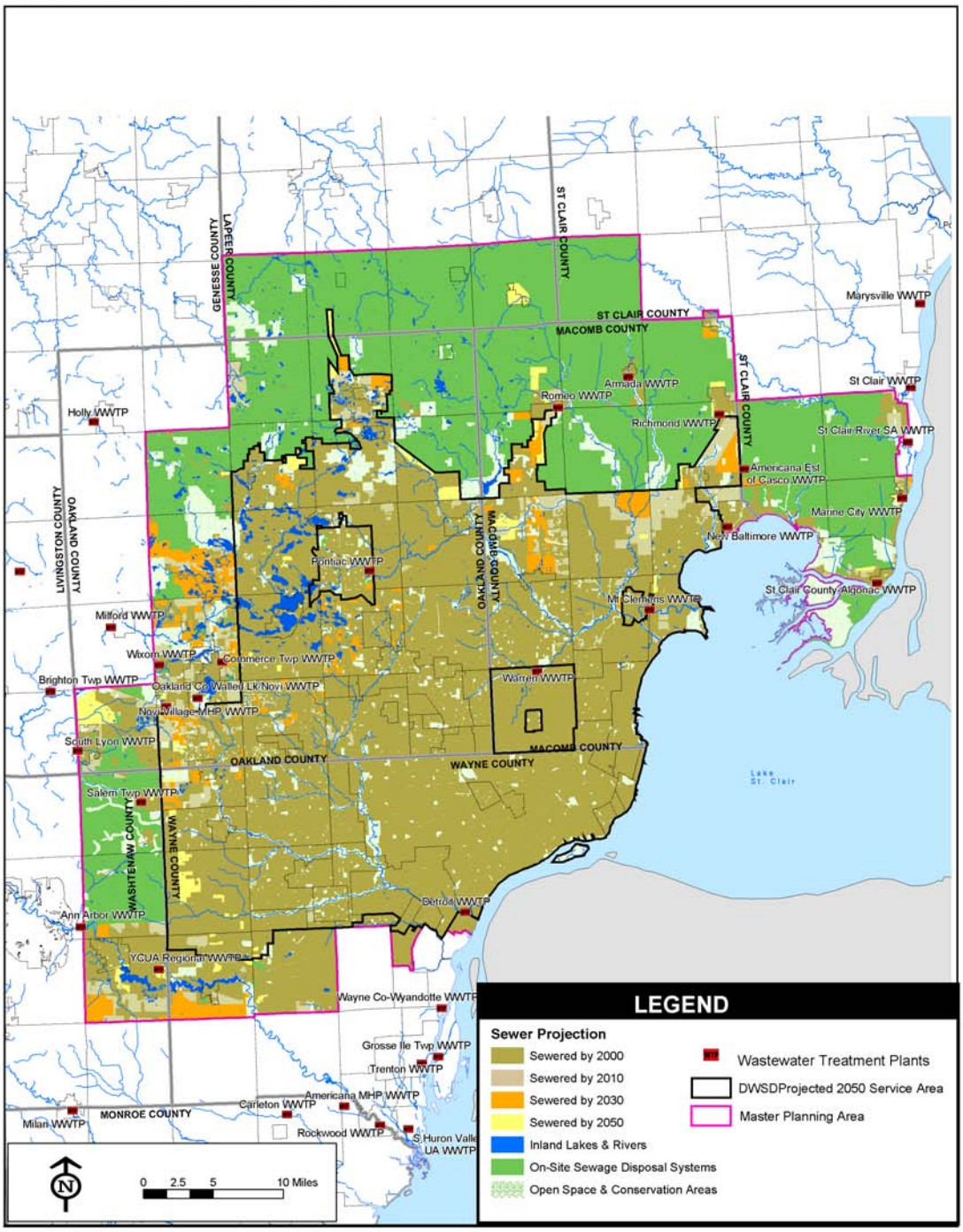
Population Growth and System Expansion. The next 50 years is anticipated to see continued growth of the DWSD regional system, along with growth of the other major wastewater treatment providers. The planning area established for this study included 124 communities. Based on projections made by the Southeast Michigan Council of Governments (SEMCOG), the population in these communities is expected to grow from 3.8 million in 2000 to 4.3 million in 2050. Employment is expected to grow from 2.2 million to 2.5 million. The Regional Transportation Plan for the SEMCOG area includes $24 billion for transportation improvements from 2000 to 2025, and new house construction will exceed 300,000 housing units.

The service area of the regional system is expected to grow by about 100 square miles — the equivalent of almost three townships — by 2050. Detroit's regional sewer system is expected to serve approximately 3.2 million persons in 2050, an increase of about 215,000 persons compared to the present. Figure 1 shows the projected sewer service area in the years 2010, 2030, and 2050.

Each new square mile of typical residential development will include approximately 20 to 30 new miles of public sewer pipeline at a cost of $20 to $25 million, plus an equal length of privately owned service connections from the homes to the sewers at a cost of $3 to $5 million. These costs are typically part of the cost of development and are paid by homeowners as a part of the price of a new home.

Development and Infrastructure for Healthy Watersheds. The planning area for this study is approximately based on the boundaries of the three major watersheds – the Rouge, the Clinton, and the Lake St. Clair/Detroit River. The regional wastewater system currently serves 80 percent of the population in this planning area. The other 20 percent of

Figure 1: Projected Sewer Growth to 2050 in the Planning Area



the population — approximately 650,000 people — is served by 36 smaller wastewater treatment plants and by on-site sewage disposal systems. By the year 2050, it is expected that the regional system will serve about 75 percent of the planning area population, while the rest of the population will be served by other wastewater treatment providers, decentralized wastewater systems, or on-site sewage disposal systems.

Watershed planning done by others indicates a desire to maintain rural, less developed areas in a number of headwater communities. Also, in several communities, there are land use controls and policies to rely on on-site sewage disposal systems, rather than sewers. This Master Plan provides a process for cost-effectively balancing the growth of the regional system with the environmental concerns of communities that favor decentralized wastewater systems or individual on-site disposal systems.

Customer Needs and Regulatory Requirements

The Detroit Water and Sewerage Department (DWSD) has prepared this Master Plan to guide the growth, rehabilitation, and upgrade of the regional system to the year 2050. A similar plan for regional water service for the City and 126 suburban communities will be completed in June 2004.

Prior to this Master Plan, the DWSD had identified needs for control of combined sewer overflows (CSO) and for its wastewater treatment plant. The DWSD now has major construction projects underway for CSO control and for the upgrade and expansion of the wastewater treatment plant. Available results from the CSO program and the wastewater treatment plant program, including projected future costs, have been included in this Master Plan. The Master Plan identifies how the results of these major programs will be used in DWSD's overall 50-year strategy.

DWSD met with a series of groups representing its internal divisions plus retail customers, wholesale customers, and regional stakeholders during the development of the plan. Based on this input, DWSD has identified the following major customer service needs to the year 2050:

- Help customer communities control their sanitary sewer overflows (SSOs).
- Optimize the use of existing facilities to control SSOs through the regional conveyance system and by using the capacity of CSO treatment facilities.
- Eliminate capacity constraints and adjust contract limits with the DWSD collection system through new wastewater service contracts, so that there is a consistent level of service to all customers.
- Expand efforts for rehabilitation of infrastructure to maintain and extend the useful life of the system.
- Perform and promote cost-effective reductions of dry weather inflow/infiltration (DWI/I).
- Provide wastewater service to a projected 215,000 new residents in communities now under contract to the DWSD.
- Provide the option of wastewater service to potential new customers outside of the current contract area.
- Increase operational efficiency through a coordinated regional operational plan, new technology, and continuing performance improvements within the workforce.
- Meet current and future regulatory requirements and become prepared to address emerging regulatory requirements.

What Was Learned

A complete set of findings and conclusions is presented in Volume 7, Section 3 of the Master Plan. Key conclusions are presented below.

Capacity is Available for Projected Growth. The Detroit wastewater treatment plant has capacity for anticipated growth within the current contract service area of the regional system. There is no need to build another wastewater treatment plan for the regional system. There is also capacity available for expansion of the system beyond the current contract service area. More capacity can be made available if flow and capacity management efforts (described below) are successful in removing non-sewage flows. With successful flow and capacity management efforts, the existing regional system can accommodate flows from approximately 200,000 more homes, in addition to the population served today.

Contract Capacity Must be Managed. DWSD is in the process of creating new standardized contracts for its wastewater customers. It is recommended that the new contracts have uniform technical standard for assigning contract capacities. The proposed uniform technical standard would provide for dry weather flows for each decade to 2050, plus allowable wet weather flows up to the 10-year 1-hour design storm (about 1.9 inches per hour of rainfall. Beyond this standard, each community would be responsible for managing its excess wet weather flows.

This Master Plan recommends that DWSD and its wholesale customers review the sewer rate structure and develop a plan to allocate costs on both contract capacity plus metered flow. Today, wholesale customers and retail customers pay only for the flows that they deliver to DWSD. However, DWSD must build and maintain its infrastructure to be able to convey peak flows from the customers that may only occur for a few hours or days per year. A rate structure that allocates costs to both peak capacity and metered flow could provide a benchmark for customers to determine the cost-effectiveness of flow reduction measures in their systems.

Non-Sewage Flows Can be Reduced. Today, over 40 percent of dry weather flows at the treatment plant are non-sewage flows. An older combined sewer system like that of Detroit is expected to have 30 percent or more non-sewage flow. However, some customers and areas of the city have non-sewage flows that exceed the total annual rainfall. Thus, there are large sources of leakage from rivers or from the public water systems that are entering the sewer system.

This Master Plan recommends a reduction in dry weather non-sewage flow where removals are cost-effective. Reductions can be achieved through footing drain disconnections, reductions in flows from leaking water mains that enter the sewers, removal of storm water from separated systems, and removal of river inflows from the combined sewer system. These dry weather reductions will yield even greater reductions of flow during times of wet weather. Several communities in the planning area are already proceeding with such flow reduction measures. On a unit basis, any non-sewage flow of 1 gallon per day that can be removed for $5 or less should be removed. The unit cost of new facilities to provide satisfactory treatment of 1 gallon per day of flow would be at least $6.

Rehabilitation Efforts Need to Increase. DWSD now cleans and inspects 20 to 30 miles of pipe per year in response to customer complaints and service requests. DWSD has many older large brick sewers that are in good condition, as well as many smaller clay lateral sewers that need substantial rehabilitation work. Approximately 90 percent of the sewers in the City of Detroit are older than 50 years. Half of the sewers connected to the wastewater treatment plant are private service connections extending from homes and businesses to the public sewers. These private service connections can be

significant sources of non-sewage flow, sedimentation, and root intrusion. Ordinances for inspection of older service connections at the time of sale of the property are recommended for the City of Detroit and all of its wholesale customers.

On-Site Sewage Disposal Systems. There is an interest in several communities to maintain on-site sewage disposal systems in the future, rather than build sewers. This Master Plan recommends that additional facilities for septage receiving and disposal be constructed to keep pace with the expected increase in regular inspection and pumping of on-site sewage disposal systems. Population projections show that some townships in Oakland and Macomb may experience growth which could exceed the capacity of the soils and lot sizes for on-site sewage disposal. Progress with on-site sewage disposal systems in these townships should be reviewed each decade to determine if sewers or decentralized wastewater treatment systems will be needed in the future.

Dewatering of Flows from CSO Control Facilities. Existing and proposed combined sewer overflow control facilities to be completed by DWSD and several of its customer communities, will store approximately 950 million gallons of CSO. After a storm event, the stored CSO will need to be dewatered and treated within 24 to 72 hours. DWSD is working with its customer communities to develop a regional operations plan that includes operational strategies for dewatering and treating the stored CSO flow and optimization of the system.

Revenue Requirements. An analysis of revenue requirements for wastewater work shows that planned expenditures over the next 5 to 7 years are significantly higher than the needs forecasted beyond that time. The next 5 to 7 years include major expenditures for CSO controls and treatment plant upgrades. This Master Plan has, for the first time, provided DWSD with a long-term forecast of expenditures and revenue requirements. DWSD, its customers and MDEQ should review the long-term forecast and determine what opportunities exist for adjusting capital improvement schedules to meet water quality improvement goal while managing sewer rate increases.

Sanitary Sewer Overflows. SSO's occur in 17 of DWSD's wholesale customers. From July 2000 to June 2002, there were 83 events and 41 million gallons reported. Of the 41 million gallons of SSOs, about 26 million gallons were reported from July 10, 2000 through July 10, 2001. The other 15 million gallons were reported the following year. This plan looked at alternatives for removing excessive wet weather flows from local sewer systems, local storage of SSO, and conveying SSOs to the regional system for treatment. A regional approach has been identified that provides cost savings to customer communities and slightly increases the annual volume of treated CSO discharged.

Shared Responsibility for Success. There is a shared responsibility among DWSD, its wholesale customers, property owners, and regulatory agencies for successful implementation of this Master Plan. This shared responsibility is best understood in terms of the ownership of pipelines connected to the wastewater treatment plant. There are approximately 28,500 miles of pipe connected to the treatment plant. 15 percent is owned by DWSD, 35 percent by its customer communities, and 50 percent is on private property connecting individual homes and buildings to the public sewer system. Shared responsibility can also be understood in terms of the role of DWSD, its wholesale customers, and the Michigan Department of Environmental Quality for Act 451 permit approvals.

Detroit cannot implement the Master Plan alone, neither can its wholesale customers proceed with individual solutions as cost-effective as those provided by a regional approach.

What We Need To Do

The desired outcomes of this Master Plan can be expressed in simple, environmental and public health protection and operational terms:

- **Clean Rivers and Beaches**: The proposals of this Master Plan provide continued measurable progress to improve the quality of receiving waters and beaches.
- **Healthy Watersheds**: The proposals of this Master Plan include new procedures for coordinating sewer service extensions with local zoning and land use plans and improvements to septage management facilities.
- **Dry Basements**: The proposed SSO solutions will reduce basement flooding.
- **Smaller Rate Increases**: The recommended flow management strategy and proactive asset management and rehabilitation efforts result in future sewer rate increases that are at or near the projected rate of inflation.
- **Excellence in Innovation and Operational Efficiency**: Detroit and its wholesale customers that are served by combined sewers are already recognized as a leader in combined sewer overflow controls. This Master Plan outlines technology and human resources initiatives to extend this recognition for dry weather wastewater service and system rehabilitation.

Volume 7 Section 4 of this Master Plan provides detailed recommendations under seven major capital improvement and management programs for three planning intervals over the next 50-years to meet these desired outcomes. The planning intervals are:

Early Period: 2004 to 2015

Middle Period: 2016 to 2030

Late Period: 2031 to 2050

Recommendations are more specific for the earlier period. This Master Plan should be updated every ten years to incorporate new information such as census updates, and to learn from and improve on the results of the preceding times.

In the next 10 years, DWSD is expected to spend over $3.5 billion in work on its combined sewer controls, wastewater treatment plant and new programs recommended under this Master Plan. There will be over $200 million spent within the City of Detroit on sewer rehabilitation and improvements. Customer communities are expected to spend up to $800 million on programs of their own for SSO control, flow management and system extensions.

In addition to DWSD's wastewater treatment and combined sewer overflow programs now underway, this Master Plan recommends three new areas of concentration:

- Expanded Rehabilitation Efforts
- Managing Capacity and Flows
- Increasing Operational Efficiency

Rehabilitation. DWSD inspects and rehabilitates its pipes on a continuing basis. Operation and maintenance programs are in place to deal with urgent problems on a day-to-day basis. Rehabilitation projects that are complaint-based should be transformed into proactive efforts driven by accurate data from condition assessment activities. Uniform criteria should be used for prioritizing the rehabilitation efforts. This Master Plan recommends that DWSD begin to accelerate its inspection program to achieve a rate of approximately 70 miles per year by the year 2010.

The Master Plan also recommends increased use of new technology to inspect and track of the condition of sewers and equipment to minimize the cost of replacement and rehabilitation. DWSD should expand its current systems for asset management to assure that future expenditures for system rehabilitation are minimized, while maintaining the reliability and level of service. Ongoing rehabilitation costs in the future are estimated to be about $300

million per year, or about $90 per year for each person served.

Managing Flows and Capacity. The regional wastewater treatment plant serves an area of over 900 square miles. About 25 percent of the service area has combined sewers that carry wastewater and storm water, the remaining 75 percent of the service area has separate sanitary sewers, and storm water is carried in other pipes. DWSD proposes to leverage a number of its efforts involving wastewater flows, dry weather infiltration/inflow reduction, and assistance to customers with SSO issues into a program for capacity management. Growth predictions show that the potential for future flow increases from new customers are relatively small compared to the opportunities for DWSD to manage flows and capacity to allow for new growth without building extensive new treatment facilities and new conveyance systems.

This Master Plan has identified a number of system bottlenecks where capacity is limited. The timing and cost of these improvements has been prioritized over the planning period.

Operational Efficiency. Water and sewer rates are a universal concern. With this Master Plan the DWSD has a guide to help plan its future expenditures and manage rate increases. In the last two years, DWSD has made a number of changes in its organization and policies that have resulted in cost savings and improved efficiency for all customers. The Master Plan recommends continuing efforts for efficiency, cost-saving measures to deal with new regulations and requirements, and increasing the involvement of customers in major decisions.

DWSD will continue to improve on – and demonstrate to its customers – its progress on improving operational efficiency. DWSD has projected its wastewater revenue requirements and the sewer rate impacts of the 50-year Master Plan recommendations. These projections show that it is possible for DWSD to manage sewer rate increases through careful attention to its rehabilitation efforts, determining the most cost-effective way to perform each of its programs, completing the regional operations plan, and by expanding its initiatives in human resources.

Tools for Implementation

The major tools to begin to implement this Master Plan over the next 24 months are listed below.

Adoption of the Plan. This Master Plan is unique in DWSD's recent history. Such a long-range evaluation of needs has not been performed before. There is no regulatory requirement for a Master Plan, but the plan does impact several regulatory programs. DWSD will work with its Board of Water Commissioners, and its First Tier Partnering Steering Committee to determine how this plan might be adopted and implemented.

New Contracts. The effort now underway by DWSD to update and standardize its sewage disposal agreements with its wholesale customers offers an important legal step which DWSD can use to introduce recommendations of this Master Plan through contracts.

Use of Cooperative Forums. DWSD can use several cooperative forums to advance the goals of this Master Plan: the Southeast Michigan Consortium on Water Quality, DWSD's First Tier Partnering Steering Committee and its associated work groups, Michigan Land Use Task Force and SEMCOG's Wastewater Service Provider's Forum.

Act 451 Permits. Construction permits (Act 451 permits) are extremely important in managing additions and improvements to the system. MDEQ, DWSD, and DWSD's customers all have a role. They also require coordination with the watershed management plans for the Rouge River, and the plan now being prepared for the Clinton River.

DWSD Internal Reorganization. The current reorganization effort at DWSD and new efforts to

reduce costs and improve performance measurement are consistent with the long-term human resources planning and performance benchmarking recommendations of this Master Plan.

Regional 5-Year and 10-Year CIP. In recent years, DWSD has increasingly involved its wholesale customers in review of its annual capital improvement program. This Master Plan recommends a next step to coordinate a long term regional CIP with other customers, transportation agencies, and city departments in 5-year and 10-year forecasts. This type of regional CIP coordination effort will improve the ability to plan for funding requirements through the State Revolving Loan Fund program and other funding sources.

Organization of the Report

The Master Plan report is presented in 8 volumes, including a CD with 67 technical memoranda. One of these technical memoranda titled *Comments and Responses on the Draft Master Plan* provides a listing of all comments received on the draft report and responses to those comments.

Executive Summary

Volume 1. Planning Criteria

Volume 2. Flow Management and Critical Facilities

Volume 3. Wastewater Service Alternatives

Volume 4. Capital Improvement Program

Volume 5. Customer Service and Technical Support

Volume 6. Control of Sanitary Sewer Overflows

Volume 7. Implementation

Volume 8. Table of Contents and Glossary

The CD version of the Master Plan provides all report graphics and maps in color.

Communities Served by DWSD in Each County

Genesee County		
Community	**Water**	**Sewer**
Burton	x	
Clayton Township	x	
Clio	x	
Davison Township	x	
Flint	x	
Flint Township	x	
Flushing	x	
Flushing Township	x	
Gains Township	x	
Genesee Township	x	
Grand Blanc Township	x	
Montrose	x	
Montrose Township	x	
Mt. Morris	x	
Mt. Morris Township	x	
Mundy Township	x	
Richfield Township	x	
Swartz Township	x	
Vienna Township	x	
Lapeer County		
Almont	x	
Imlay	x	
Lapeer	x	
Mayfield Township	x	
Macomb County		
Center Line	x	x
Chesterfield Township	x	x
Clinton Township	x	x
Eastpointe	x	x
Fraser	x	x
Harrison Township	x	x

Lenox Township	x	x
Macomb Township	x	x
New Haven Village	x	x
Romeo Village	x	
Roseville	x	x
Shelby Township	x	x
St. Clair Shores	x	x
Sterling Heights	x	x
Utica	x	x
Warren	x	
Washington Township	x	x
Monroe County		
Ash Township	x	
Berlin Township	x	
Carleton Village	x	
Estral Beach	x	
Rockwood	x	
South Rockwood Village	x	
Oakland County		
Auburn Hills	x	x
Berkley	x	x
Beverly Hills Village	x	x
Bingham Farms Village	x	x
Birmingham	x	x
Bloomfield Hills	x	x
Bloomfield Township	x	x
Clarkston		x
Clawson	x	x
Commerce Township	x	
Farmington	x	x
Farmington Hills	x	x
Ferndale	x	x
Franklin		x
Hazel Park	x	x
Huntington Woods	x	x
Independence Township		x
Keego Harbor	x	x
Lake Orion Township	x	x
Lathrup Village	x	x

Madison Heights	x	x
Novi	x	x
Orchard Lake Village		x
Oakland Township		x
Oak Park	x	x
Orion Village	x	x
Oxford		x
Oxford Township		x
Pleasant Ridge	x	x
Pontiac	x	
Rochester		x
Rochester Hills	x	x
Royal Oak	x	x
Royal Oak Charter Township	x	x
Southfield	x	x
Sylvan Lake	x	
Troy	x	x
W. Bloomfield Township	x	x
Walled Lake	x	
Waterford Township		x
Wixom	x	
St. Clair County		
Burtchville Township	x	
Greenwood	x	
Washtenaw County		
Augusta Township	x	
Pittsfield Township	x	
Superior Township	x	
York Township	x	
Ypsilanti	x	
Ypsilanti Township	x	
Wayne County		
Allen Park	x	x
Belleville	x	
Brownstown Township	x	
Canton Township	x	x
Dearborn	x	x
Dearborn Heights	x	x
Ecorse	x	

Flat Rock	X	
Garden City	X	X
Gibraltor	X	
Grosse Ile Township	X	
Grosse Pointe		X
Grosse Point Farms		X
Gross Pointe Park	X	X
Gross Pointe Shores Village	X	X
Grosse Pointe Woods	X	X
Hamtramck	X	X
Harper Woods	X	X
Highland Park		X
Huron Township	X	
Inkster	X	X
Lincoln Park	X	
Livonia	X	X
Melvindale	X	X
Northville	X	X
Northville Township	X	X
Plymouth	X	X
Plymouth Township	X	X
Redford Township	X	X
River Rouge	X	
Riverview	X	
Romulus	X	X
Southgate	X	
Sumpter Township	X	
Taylor	X	
Trenton	X	
Van Buren Township	X	X
Wayne	X	X
Westland	X	X
Woodhaven	X	

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Wastewater Master Plan
Volume 1

Planning Criteria

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Wastewater Master Plan
Volume 1

Planning Criteria

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Contents

Technical Memoranda*

The Following Technical Memoranda were used in the preparation of *Planning Criteria*, Volume 1 of the Detroit Water and Sewerage Department's Wastewater Master Plan.

- *Planning Area*
- *Review of Sewerage Studies in Wayne County*
- *Review of Sewerage Studies in Macomb and Oakland Counties*
- *Prior DWSD Studies - Macomb, Oakland, and Wayne Counties*
- *Description of Sewer Service Districts*
- *Evaluation of Other WWTPs in DWSD Planning Area*
- *Review of Wastewater Quality and Industrial Pretreatment*
- *Evaluation of Collection System Design Standards*
- *Flow Projections from Significant Industrial Users*
- *Suburban CSO Basins in the DWSD Service Area*
- *Dewatering of Stored Wet Weather Flows*
- *Septage Transport and Disposal to the Detroit Wastewater System*
- *Projects in the Planning Area*
- *Review of DWSD Practices and Policies*
- *Review of Federal, State and Local Regulations*
- *Review of Emerging Regulatory Issues*
- *Review of Regulatory Issues for New Wastewater Discharge*
- *Evaluation of the Greater Detroit Regional Sewer System Model for Wastewater Master Planning*
- *Recommended Standard Provisions for Wholesale Contracts*
- *Wastewater Generation*
- *Year 2050 Population and Employment Projections*

*Technical Memoranda are available on the CD that accompanies this report

Executive Summary

This is Volume 1 — the *Report on Planning Criteria* — of the Detroit Water and Sewerage Department (DWSD) *Wastewater Master Plan* which is the plan for wastewater collection and treatment for the next 50 years. This Master Plan addresses expected future wastewater flows from population growth and economic development. It addresses needs for rehabilitation, replacement and extension of sewers and expansion of wastewater treatment facilities, and it addresses improvements to wholesale and retail customer service. The goal of the plan is to maintain cost-effective and environmentally sound wastewater service to the greater metropolitan Detroit area.

The Wastewater Master Plan began in August 2000. The planning effort has been performed with the participation of DWSD's wholesale customers, other city departments, and in consultation with project teams and agencies involved in other related planning, design and construction efforts. Results of the planning effort were communicated through work group and committee meetings, technical issue reports and a series of reports.

Planning Area

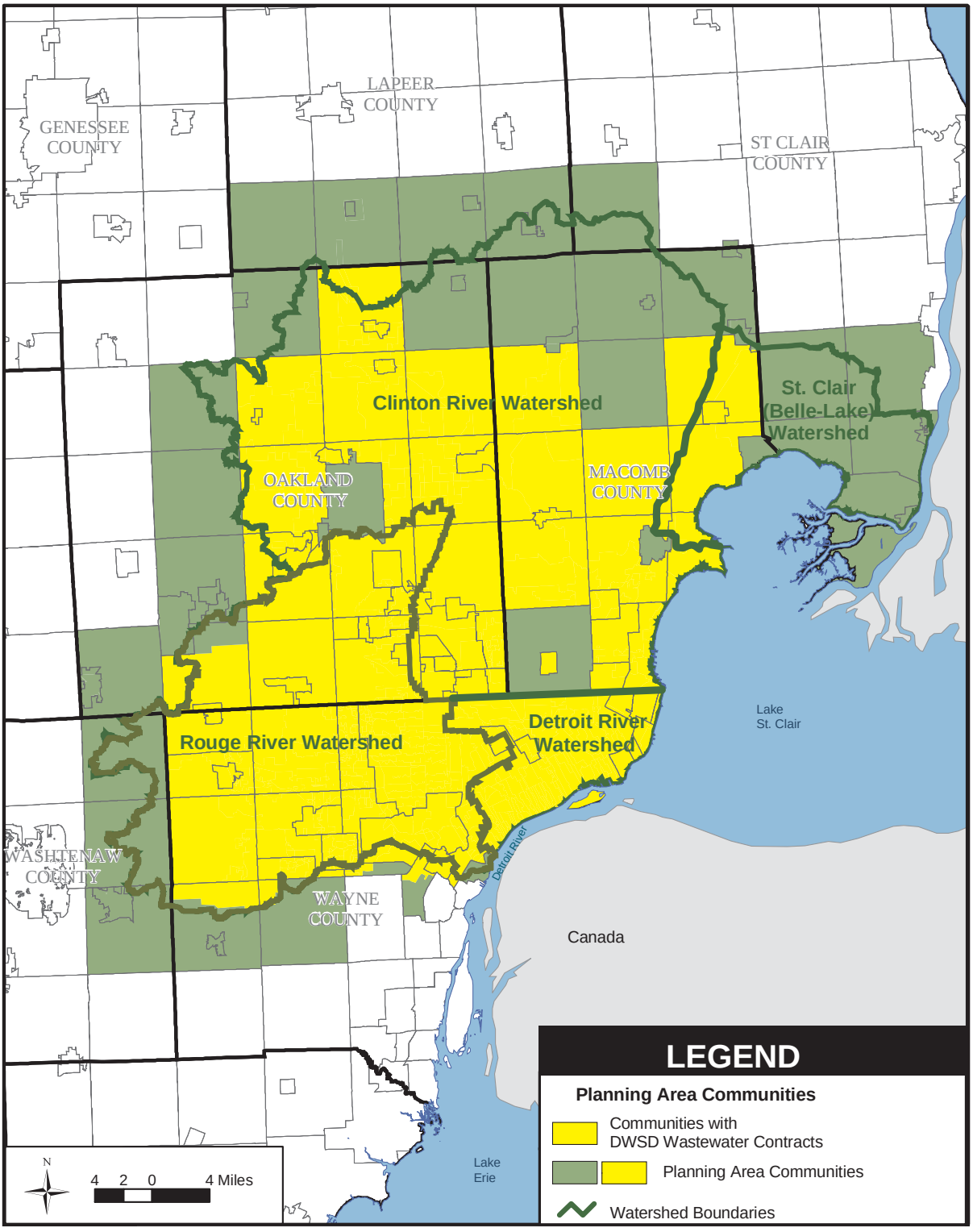
The Wastewater Master Plan was performed within the broader context of the water resource environment of Southeast Michigan. The 208 Water Quality Management Plan (SEMCOG, October 1999) establishes goals for management of Southeast Michigan's water resources, and provides guiding principles for wastewater planning. These principles include:

- Encourage the full use of existing infrastructure before building new facilities.
- Be guided by local governments in determining the wastewater infrastructure needs of individual communities.
- Consider local and regional sustainable development goals.
- Promote collaboration among local governments and the state.
- Use only water quality management strategies that are technically, environmentally, economically, politically and socially feasible.
- Integrate area-wide water quality planning with other planning efforts, including emerging local, regional, state and federal policies and programs geared toward sustainable development.
- Encourage public participation in the planning process.
- Provide sufficient sanitary sewage treatment facilities to ensure protection of public health and the environment and support achievement of designated uses and the sustainability of our environmental resources.

The planning area for the 50-year study is based on a watershed management approach. The current customer base is located in an 904 square-mile area within three watersheds – Rouge River, Clinton River, and the adjoining parts of the Lake St. Clair and Detroit River watersheds. See Figure 1. The planning area for the Master Plan considers the entire area of these three watersheds, plus the total area of any township or municipality that falls within these watersheds. As a result, there are 124 communities in the planning area (see Table 2.1 in Chapter 2).

Within the planning area and adjacent to it, there are currently 36 other wastewater treatment providers (22 major providers). All treatment providers in the watershed have a stake in protecting the water quality of the Rouge, Clinton and Detroit rivers, and Lake St. Clair. DWSD already has formal or informal agreements with a number of these other providers for sludge treatment and septage management. These wastewater treatment providers cooperate on issues of financial and regulatory interest. DWSD invites these 22 treat-

Figure 1: DWSD Wastewater Master Plan Planning Area



ment providers to discussions over the study period of the Wastewater Master Plan to explore cost-effective wastewater collection and treatment solutions and to collaborate on issues of common interest.

The watershed approach to the planning area provides a framework for dealing with the issue of growth of the regional system and concerns about urban sprawl. For example, communities in the planning area that favor the use of on-site disposal systems have been identified. (See Chapter 5). The Wastewater Master Plan considered the positive results of county-based programs for enhanced inspection and maintenance of such systems plus other practices that will continue to allow on-site systems to operate in an environmentally sound manner into the future.

Existing Wastewater Facilities

The DWSD has one wastewater treatment plant located at 9300 West Jefferson in Detroit. Construction is underway at the plant to provide 1,700 million gallons per day of permitted primary treatment capacity and 930 million gallons per day of permitted secondary treatment capacity. When this construction is completed in 2006, Detroit's wastewater treatment plant will be the largest in the world as measured by primary treatment capacity.

The wastewater plant has been upgraded and expanded several times since the original construction was completed in 1940. There are four principle regional interceptors: Detroit River Interceptor, Oakwood Interceptor, Northwest Interceptor and North Interceptor-East Arm. These interceptors were built in the 1930s, except for the North Interceptor-East Arm, which was built in the 1970s. There are 14 DWSD-owned pumping stations, 65 flow meters, 10 internal system meters. There are approximately 3,800 miles of sewer in the city of Detroit and an estimated 8,770 miles in the suburban communities served by Detroit. There are an estimated 1.5 million service connection points to homes and businesses (estimated to be 559 miles in length.) There are currently 23 CSO control facilities and wet weather flow equalization tanks. Over 87 percent of the sewers in Detroit (by length) were constructed more than 50 years ago, and over 17 percent were constructed more than a hundred years ago according to DWSD maps and engineering records.

Most of the City of Detroit has a combined sewer system. However, there is one area on the far east side that was built with 49 miles of separate sewers. Also, reconstruction of the system in the last 50 years has resulted in the construction of a number of sanitary sewers and separate storm drains that are recombined downstream of the redevelopment projects.

Outside of Detroit, the 8,770 miles of customer community sewers include 970 miles of combined sewers and 7,800 miles separate sanitary sewers.

A subsequent phase of this study analyzing the condition of existing facilities, and condition information is summarized in Volume 2, the *Report on Critical Facilities and Flow Management.*

Population Projections

The 2000 population of Detroit and the portions of the 76 existing contract customer communities in the DWSD contract area was 3.2 million. By 2050, the population is expected to grow to about 3.4 million. The 2000 population of the whole planning area was 3.8 million. By 2050, the population is expected to grow to about 4.3 million.

Employment is expected to grow from 1.8 million to about 2.0 million in the existing service area, and from 2.2 million to about 2.5 million in the planning area. These are projections by SEMCOG using the official Census Bureau figures for 2000.

A Geographic Information System (GIS) tool has been developed to analyze population, employment and flows from traffic analysis zones, which are demographic units generally the same as census tracks. This GIS tool provides the ability to

analyze "what if" scenarios for future population and flow projections.

The existing wastewater treatment plant was designed to handle the sanitary sewage in dry weather from a population of 4 million. The combined capacities of the other 22 major wastewater treatment providers provides capacity for approximately another 600,000 persons. Population projections for communities that propose to remain unsewered in 2050 exceed 337,000.

Flow Projections

The DWSD plant receives several types of dry and wet weather flow that can be measured or estimated in the following categories:

- Residential flows
- Commercial, institutional, light industrial
- Major industrial flows (called Significant Industrial Users, or SIUs)
- Water treatment plant discharges
- Hauled wastes
- CSO storage dewatering
- Dry weather infiltration and inflow
- Storm water flows from combined sewers
- Rainfall derived I/I from sanitary sewers

Residential wastewater flows in the existing service area average about 77 gallons per person per day, or 200 gallons per household per day. These values compare well with studies elsewhere in the country that show residential wastewater flows of 60 to 80 gallons per capita per day. In the future, residential per capita flows are expected to remain constant or decrease to about 70 gpcd as water-conserving plumbing fixtures become more widespread.

Commercial, institutional and light industrial flows were analyzed for a variety of businesses, including shopping centers, office buildings, hospitals, schools and colleges. While each business is unique, flows can be estimated with an average of around 50 gallons per employee per day (gped).

Major industrial flows are expected to decline from the current 45 million gallons per day to fewer than 35 million gallons per day in 2050 as industries minimize waste generation and as service industries continue to supplant manufacturing in employment.

Three water treatment plants operated by DWSD discharge backwash water and water treatment sludges that average about 9 million gallons per day.

Hauled wastes include septage, sludge from other treatment plants, and wastes from marinas and recreational vehicles. Septage flows are expected to increase from about 15 million gallons per year to up to 40 million gallons per year due to new ordinances in some counties that mandate inspections of septic systems and/or pumping at the time of sale of homes. New and improved facilities, licensing and inspection are required to assure that disposal sites are economically sited for septage haulers and that septage is properly managed. Preliminary recommendations for new septage receiving facilities have been identified. Annual volumes of sludge trucked from other treatment facilities have been decreasing as more plants use mobile dewatering equipment instead of trucking wastewater to DWSD. Mobile dewatering equipment allows processing of wastewater on-site. The resultant sludge is brought to landfills while the water is discharged back to the plant. About 437,000 gallons per year are currently received by DWSD. Flows from recreational vehicle dump sites and marinas can enter the collections system from direct sewer connections or be carried by the septage haulers and are included in the septage totals cited above.

Thirteen CSO storage facilities have been built in the service area, and additional facilities are proposed. In total, there will be about 950 million gallons of stored CSO or other wet weather flows by

2012. The DWSD Long Term CSO Control Plan recommended that the stored flows be dewatered and treated at the wastewater plant. Further analyses conducted for the Wastewater Master Plan confirm that dewatering of these facilities cannot be accomplished within the desired 24- to 72-hour time frame if only the 930 mgd capacity limitation for secondary treatment is utilized.

The DWSD has been approached by other treatment providers in the planning area about the feasibility of an emergency connection to the DWSD system in the event that the other provider encounters a capacity problem. Such agreements are common between municipal providers in other parts of the country, but there are no formal agreements as yet with DWSD, nor are any anticipated.

Calculated dry weather I/I currently exceeds 30 percent of the total flow arriving at the WWTP (exclusive of WWTP recycle flows). There is substantial opportunity for reducing I/I to free up existing capacity for new growth. The DWSD has a project (CS-1374, scheduled to be completed in October 2004) to identify and remove sources of infiltration and inflow from its collection system.

Residential footing drains are a common feature of homes in metropolitan Detroit. Footing drains can yield high rates of dry weather and wet weather inflow. Downspouts, both residential and commercial also are sources of wet weather inflow. Footing drain and downspout flows also contribute to basement flooding problems.

In wet weather, the DWSD regional system will reach capacity in most pipes during a storm with a return frequency of about one month. Such a storm provides about 0.5 inches per hour of rain, and this will yield 0.25 inches of runoff. Much of the trunk and interceptor system was designed to carry 0.25 inches per hour.

With the completion of the DWSD Long Term CSO Plan, there will be substantial wet weather capacity in the expanded WWTP and the satellite CSO facilities to meet water quality standards for treating CSO flows – in most cases to at least the 1-year storm.

The existing Detroit WWTP has capacity to handle all of the dry weather flow from the projected growth in the existing service area and in much of the planning area over the next 50 years, if infiltration/inflow is managed and reduced. The cost-effectiveness and feasibility of I/I reduction is investigated in Volume 6 of this Master Plan.

Projects in the Planning Area

There are numerous projects underway by DWSD and its wholesale customers, transportation agencies, and private developers that will add new flows to the system; rehabilitate, upgrade and extend pipelines and pumping and treatment facilities; and alter the alignment of sewers over the next 50 years. Discussions were held with other City of Detroit departments regarding their individual planning efforts and new initiatives in the city.

A detailed knowledge of projects in the city and in the planning area is useful in developing the 50-year capital improvement program. Projects on the 50-year timeline can be scheduled to optimize the relationship between new wastewater projects performed by the DWSD and projects built by other agencies.

Maps of some major projects now underway or anticipated in the planning area are shown in Chapter 6.

Policy, Practice and Contracts

The DWSD established a System Expansion Policy in 1998 that is based on the principal of "growth pays for growth."

The DWSD makes decisions to accept new requests for capacity through a three-step process that includes:

- Independent engineering confirmation of the

projected flows being requested by the wholesale customer;

- Analysis of the transport and treatment capacity of the system to accept the new flows; and
- Negotiations with the wholesale customer regarding connection costs and rates for transport and treatment.

A number of areas of policy and practice were reviewed as part of the planning criteria phase of the Wastewater Master plan. These include: engineering standards, rate setting, industrial wastewater pretreatment, and common use facilities.

With respect to engineering standards, the design standard of "0.4 cfs per 1,000 persons" has been used by the DWSD since the 1930s. It is an empirical relationship that provides an estimate of peak hour flows rates and infiltration/inflow for the purpose of determining the quantity of flow to be intercepted for wastewater treatment. For combined sewer areas, a design standard of 0.5 cfs per 1,000 persons has been used for the sizing of interceptors.

The "0.4 cfs per 1,000 persons" standard is generally consistent with Ten-States Standards and the ASCE/WEF Manual of Practice for designing interceptors. It is intended to be applied for tributary areas with populations greater than 20,000.

Since the 1980s, with the advent of computer models and more sophisticated flow monitoring techniques, the new approach to the analysis and design of combined sewer systems is to measure rates of infiltration and inflow, and to use computer models to simulate conditions for specific design storms, such as a 10-year frequency, 1-hour duration storm.

The city's wastewater service contracts were reviewed from the perspective of changes that may be required to support the Wastewater Master Plan. Many of the current contracts for wastewater service were originally developed over 50 years ago, and there are a great variety of terms and conditions that are unique to particular customers. The lack of uniformity presents a challenge to master planning, particularly:

- Different lengths of term of service
- Different types of flow limits (some reference 0.4 cfs/1,000 persons without quantifying a maximum flow rate)
- Ownership, access authority and maintenance responsibilities for specific facilities
- Enforcement of penalty provisions, where these exist
- Different billing intervals

The Wastewater Master Plan will be best supported by contracts that have standard provisions with specific flow limits and terms of service. A discussion of contract terms with wholesale customers is underway through the existing structure of partnering and work groups.

Current and Emerging Regulations

Current and emerging regulations have been reviewed with respect to how they will or may effect effluent limitations, siting for any new WWTP discharges, and other factors affecting DWSD into the future.

Pending SSO regulations are likely to have the most immediate impact on planning decisions. Other current and emerging regulations continue the trend to more stringent water pollution controls.

1. Introduction

1.1 Purpose of the Master Plan

The City of Detroit has provided wastewater collection, treatment and disposal services to the city for over 150 years and to surrounding communities for over 100 years. The regional system of interceptors and the wastewater treatment plant were put into operation beginning in 1940. In the past 60 years, the system has been upgraded and expanded to serve new areas and to provide storage and treatment of combined sewer overflows while meeting increasingly stringent regulations.

Detroit provides these regional wastewater services through its Water and Sewerage Department (DWSD). DWSD has evolved from predecessor agencies dealing with water supply, drainage and sewage treatment and collection.

In 2001, DWSD is in the process of completing over $1.5 billion of new construction to further upgrade and improve the reliability and extend the useful life of the existing wastewater collection and treatment facilities.

On the water side, approximately $900 million of work is underway. These major projects will be completed by 2007. Concurrent with this Wastewater Master Plan, the city is developing a comprehensive Water System Master Plan with a similar 50-year planning and capital project horizon.

The purpose of this Wastewater Master Plan is to look beyond the current projects and provide guidance on the next 50 years of extensions and improvements to the regional collection and treatment system. This Master Plan has been developed to be consistent with the goals of the regional 208 water quality management plan as laid out in the most recent update of October 1999 by the Southeast Michigan Council of Governments (SEMCOG). SEMCOG is the "designated management agency" for Southeast Michigan. This means that Congress has appointed SEMCOG as the agency to deal with regulatory issues of the Clean Water Act of 1977 for this part of the state.

The Wastewater Master Plan considers current water quality problems, such as sanitary sewer overflows and the integration of proposed CSO control with new wastewater facilities. This master plan also considers the future needs of the City of Detroit and the future needs of the city's suburban customers for cost-effective wastewater service and water quality improvement.

1.2 Purpose of Planning Criteria Report

This Volume 1: *Planning Criteria* has been developed to describe the fundamental elements of the 50-year Master Plan— a comprehensive effort to plan for wastewater collection and treatment improvements for the next 50 years. These fundamental elements include forecasts of population and growth, projections and characterization of flows, analyses of contracts and policy, and description of how the system of today functions.

Throughout the text of this *Planning Criteria*, references are provided to a series of technical memoranda that provide additional detail on the planning issues. Technical memoranda used to create this report are listed in the table of contents and are available on the CD that accompanies this Master Plan.

2. Planning Area

2.1 208 Regional Water Quality Management Plan

The Clean Water Act of 1977 formed the basis for regulating pollutants discharged into United States waters. The Act mandated the establishment of area-wide water quality management plans with the goal of establishing a national anti-pollution control framework.

In Southeast Michigan, SEMCOG is the "designated management agency" for the preparation of the area-wide water quality management plan, known as the Water Quality Management Plan for Southeast Michigan (the 208 Plan). This means that Congress has appointed SEMCOG as the agency to deal with regulatory issues of the Clean Water Act of 1977 for this part of the state. Originally adopted in 1978, the Plan has been regularly amended and revised as conditions have warranted. The most recent revision was published in October 1999.

The 208 Plan focuses on restoration and upkeep of surface waters for designated purposes such as aquatic life, wildlife support, agriculture and industrial uses and municipal water supply. As such, concerns for adequate wastewater treatment are integral to the plan both as a matter of public health and as a matter of environmental quality. Such issues as aging infrastructure, uneven sewerage growth and regulatory updates are primary.

Other subjects addressed in the 208 Plan that are directly related to wastewater treatment include atmospheric depositions, erosion and sediment, pollution from storm water runoff and protection of habitat and wetlands.

The 208 Plan establishes guiding principles for wastewater planning in the seven-county Detroit metropolitan area. These include:

- Encourage the use of existing infrastructure. Inventory existing and planned systems with the goal of determining current capacity and cost-effective correction.
- Consider the adequacy of the sewage transport systems and the ability of the publicly owned treatment works (POTW) receiving the wastewater to provide adequate treatment before new connections are built in areas where treatment capacity is nearing its limits.
- Be guided by local governments in determining the wastewater infrastructure needs of individual communities.
- Consider local and regional sustainable development goals and policies when new capacity must be provided to meet current and future needs. Sustainable development is a strategy by which communities seek economic development approaches that also benefit the local environment and quality of life.
- Promote collaboration among local governments and the state.
- Use only water quality management strategies that are technically, environmentally, economically, politically and socially feasible.
- Integrate area-wide water quality planning with other planning efforts, including emerging local, regional, state and federal policies and programs geared toward sustainable development.
- Encourage public participation in the planning process so that area-wide water quality management programs reflect the concerns, priorities and values of the region's stakeholders.
- Effectively eliminate negative effects on the quality of the environment.
- Increase the awareness levels of citizens, technicians and elected officials on water quality problems and the value of developing collaborative approaches.

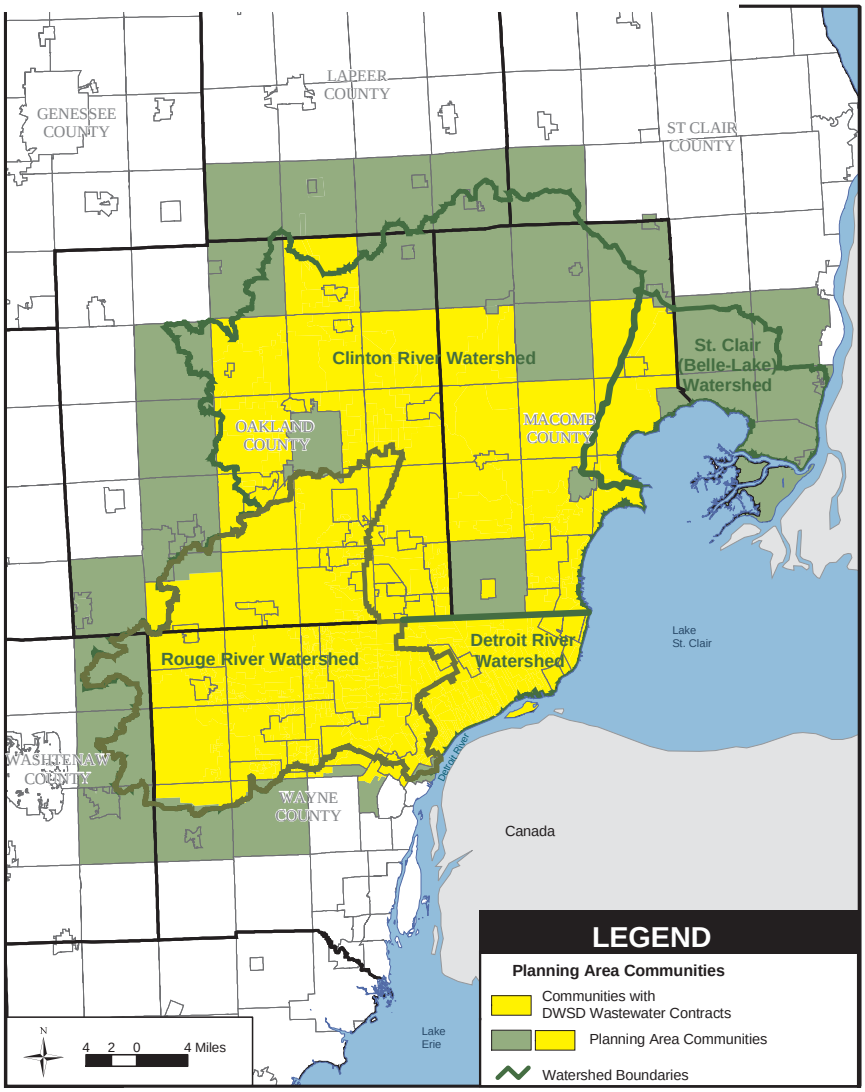
2.2 Watershed Approach to Planning Area

The planning area for the 50-year study is based on a watershed management approach. The cur-

rent customer base is located in a 904 square mile area within three watersheds - Rouge River, Clinton River, and the adjoining parts of the Lake St. Clair and Detroit River watersheds. See Figure 2.1. Based on input from wholesale customers, the planning area for the Master Plan was extended beyond the watershed boundary to include the entire area of any township or municipality that falls within the watershed boundary. As a result, the planning area consists of 124 communities in six counties: Wayne, Macomb, Oakland, Washtenaw, Lapeer, and St. Clair. See Table 2.1 for a list of the communities.

Within or near the planning area, there are currently 22 other major wastewater treatment providers and 14 minor ones. Table 2.2 summarizes the treatment systems of these other providers. Figure 2.2 shows the location of other treatment facilities in and around the planning area. Information is being collected on the current service areas of those facilities. More complete informa-

Figure 2.1: DWSD Wastewater Master Planning Area



tion is provided in the technical memorandum entitled: *"Wastewater Treatment Facilities in the Planning Area."*

All treatment providers in the watershed have a common interest in protecting the water quality of the Rouge, Clinton and Detroit rivers, and Lake St. Clair. DWSD already has formal or informal agreements with a number of providers for sludge treatment and septage management, and providers cooperate on issues of financial and regulatory interest. The DWSD has invited these 22 treatment providers to in depth discussions during this master planning study to explore areas of mutual concern and collaboration.

Table 2.1: This is an alphabetical listing of municipalities in the DWSD 50-year Master Plan planning area:

A
Addison Township
Algonac
Allen Park
Almont Township
Almont Village
Armada
Armada Township
Auburn Hills

B
Belleville
Berkley
Berlin Township
Beverly Hills
Bingham Farms
Birmingham
Bloomfield Township
Bloomfield Hills
Brandon Township
Bruce Township

C
Canton Township
Casco Township
Center Line
Chesterfield
China Township
Clarkston
Clawson
Clay
Clinton Township
Commerce Township
Cottrellville Township

D
Dearborn
Dearborn Heights
Detroit
Dryden
Dryden Township

E
Eastpointe

F
Farmington
Farmington Hills
Ferndale
Franklin

G
Garden City
Grosse Pointe
Grosse Pointe Farms
Grosse Pointe Park
Grosse Pointe Shores
Grosse Pointe Woods

H
Hadley Township
Hamtramck
Harper Woods
Harrison Township
Hazel Park
Highland Park
Huntington Woods

I
Independence Township
Inkster
Ira Township

K
Keego Harbor

L
Lake Angelus
Lake Orion
Lathrup Village
Lenox
Leonard
Livonia
Lyon Township

M
Macomb Township
Madison Heights
Marine City
Melvindale
Memphis
Metamora
Metamora Township
Mt. Clemens

N
New Baltimore
New Haven
Northville
Northville Township
Novi

O
Oak Park
Oakland Township
Orchard Lake Village
Orion Township
Ortonville
Oxford
Oxford Township

P
Pleasant Ridge
Plymouth
Plymouth Township
Pontiac

R
Ray Township
Redford Township
Richmond
Richmond Township
River Rouge
Rochester
Rochester Hills
Romeo
Romulus
Roseville
Royal Oak
Royal Oak Township

S
Salem Township
Shelby Township
South Lyon
Southfield
Springfield Township
St. Clair Shores
Sterling Heights
Superior Township
Sylvan Lake

T
Troy

U
Utica

V
Van Buren Township

W
Walled Lake
Warren
Washington Township
Waterford Township
Wayne
West Bloomfield
Westland
White Lake Township
Wixom
Wolverine Lake

Y
Ypsilanti
Ypsilanti Township

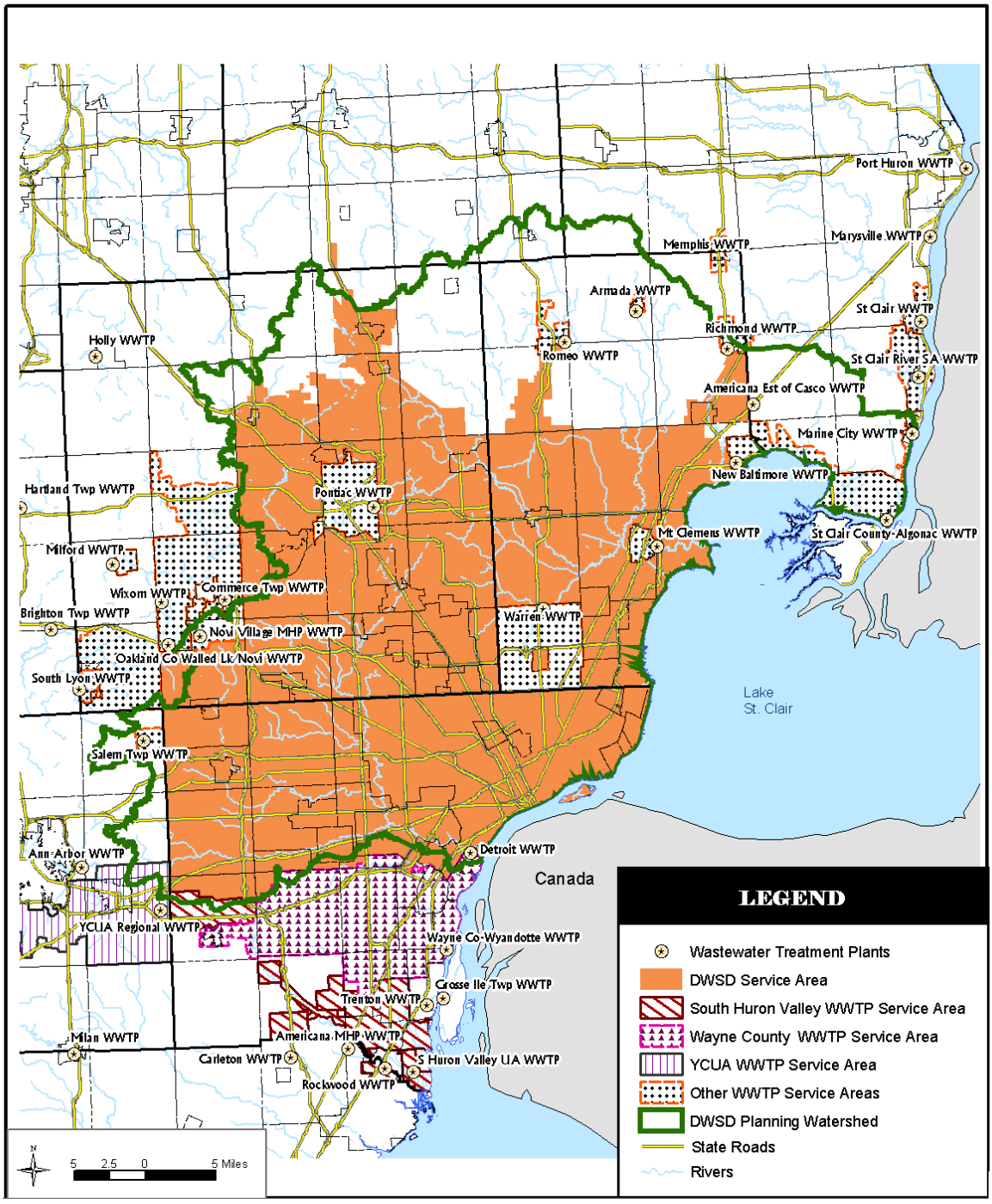
Table 2.2: Characteristics of Other Major Wastewater Treatment Plants in Planning Area

Name of Facility	Design Capacity MGD	Average Daily Flow 2000 (MGD)	Equivalent Residents Served*	Type of System	Sludge Disposal Method**
Macomb County					
Armada WWTP	0.35	0.16	1,548	Separate	LA
Mount Clemens WWTP	6	3.83	18,700	30% Combined	LA
New Baltimore WWTP	1.75	0.97	6,000	Separate	DB
Richmond WWTP	0.9	0.6	4,300	Separate	DB\LA
Romeo WWTP	1.6	0.87	6,850	10% Combined	LA
Warren WWTP	36	23.18	144,864	Separate	INC
Oakland County					
Commerce Township WWTP	3	0.86	49,563	Separate	LA
Holly Village WWTP	1.2	0.92	6,715	Separate	LA
Milford Village WWTP	1.04	0.65	5,500	Separate	DB\LA
Pontiac City WWTP	25.5	12.36	76,000	Separate	INC
South Lyon City WWTP	1.5	1	9,555	N/A	DB\LA
Walled Lake/Novi WWTP	3.5	2.42	9,500	N/A	DWSD/LA
Wixom City WWTP	2.87	2.17	9,500	N/A	LA
St. Clair County					
Algonac WWTP	2.7	1.88	14,000	Separate	LA
Americana Estates of Casco WWTP	0.12	0.12	1,500	Separate	LA
Marine City WWTP	1	0.8	6,200	Separate	LA
Memphis WWSL	0.15	0.15	1,240	N/A	LA
St. Clair Sanitary Authority WWTP	2.2	0.53	3,447	N/A	LA
Washtenaw County					
Ann Arbor WWTP	29.5	18.7	128,000	Separate	LF/INC/LA
Salem Township WWTP	0.05	013	600	N/A	LF/INC
YCUA WWTP	28.9	21.5	227,000	N/A	LA
Wayne County					
Wyandotte WWTP	125.00*	50.4	350,000	N/A	LF

*Resident data from NPDES permit applications

**LA=Land Application; DB=Drying Beds; DB\LA=Drying Beds to Land Application; INC=Incinerator; DWSD=Detroit Water and Sewerage Department; LF=Landfill

Figure 2.2: Current Wastewater Treatment Plants Service Areas



3 Existing Facilities

3.1 Historical Perspective

Metropolitan Detroit is the eighth largest Consolidated Metropolitan Statistical Area (CMSA) in the United States. By the start of the 20th Century the city was emerging as an industrial center. Untreated sewage on both sides of the Detroit River had become a serious pollution problem for Detroit's water supply and for downstream communities.

The 1909 the Boundary Waters Treaty established the International Joint Commission largely to deal with this issue. By 1910, there were 633 miles of sewers in Detroit discharging untreated sewage into the river. The Fairview Sewer, built in 1913, diverted much of the wastewater downstream of the Belle Isle water intake.

As the auto industry came into its own in the early part of the century, both rural American and foreign workers flocked to the city seeking employment and exacerbating the sewerage problem. In 1930, in response to continuing overflows of the Fairview sewer, relief sewers were constructed on east and west Jefferson Avenue. In 1935, construction was started on the existing wastewater treatment plant (WWTP) where the Rouge River flows into the Detroit River. Also during this period, the Detroit River Interceptor (DRI), running from the Fairview Station to downtown, was constructed.

As the Depression deepened, work on the WWTP was halted. Federal public works programs reinvigorated the project, however, and it became operational in 1940 with the completion of the Oakwood-Northwest Interceptor and the DRI.

World War II ushered in another influx of workers as the "arsenal of democracy" geared up to fill the demand for military vehicles. In the 1950s, the population expanded to suburban areas, sparked by the creation of the interstate highway system and a change in Federal Housing Authority loan policies that encouraged the move to outlying areas. These migrations again taxed the sewerage system and in 1954, the treatment plant was expanded.

In the late 1950s a $33 million program to improve treatment and increase the size of the service area began. Further upgrades in the early 1970s were undertaken to increase removal of solids, and minimize phosphorus discharge and bacterial pollution.

In compliance with the Federal Water Pollution Control Act of 1972, treatment facilities were upgraded to include cryogenic oxygen plants, aeration tanks, clarifiers and additional sludge handling capacity. As continued suburban expansion occurred in the 1980s and 90s, the DWSD activated Pump Station 2 and the North Interceptor-East Arm to increase transport and permitted treatment capacity to its present level of 1,600 mgd primary capacity and 930 mgd secondary. Work is currently underway by DWSD to upgrade and expand the permitted treatment capacity o 1,700 mgd primary capacity and 930 mgd secondary.

3.2 Sewer Service Areas

The Detroit Water and Sewerage Department's service area is comprised of 29 sewer districts. These districts represent areas within the City of Detroit and other municipalities that generally have hydraulic independence during dry weather conditions.

These districts and communities are as follows (See Figure 3.1 and Figure 3.2):

Detroit - Nine sewer districts: Rouge River, Hubbell, Southfield, Baby Creek, Conner Creek, Oakwood, Central, Fox Creek, and East Jefferson.

Wayne County - Two large sewer districts: North Huron Valley-Rouge Valley and Northeast Wayne County; the municipalities of Highland Park,

Hamtramck, Dearborn, Allen Park, Melvindale, Grosse Pointe, Grosse Pointe Farms and Grosse Pointe Park; and three small contract areas in Redford Township and Dearborn Heights.

Oakland County - Four sewer districts: Evergreen-Farmington, Clinton-Oakland and Southeast Oakland and the City of Farmington.

Macomb County - Three sewer districts: Southeast Macomb, Macomb, and the City of Center Line.

The tables in the back of this chapter list CSO facilities, equalization basins, meters and DWSD pumping stations

Figure 3.1: Detroit Sewage Districts

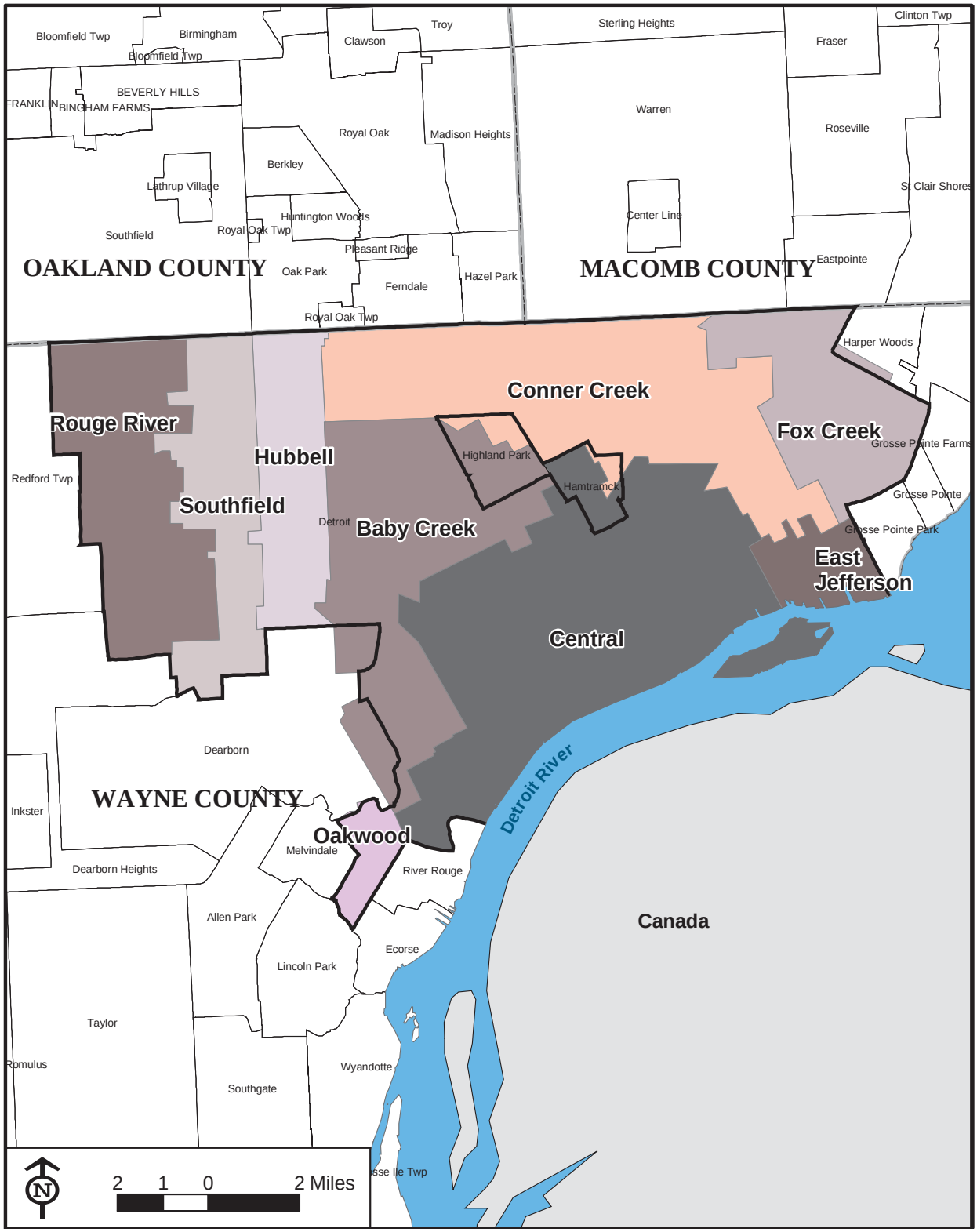
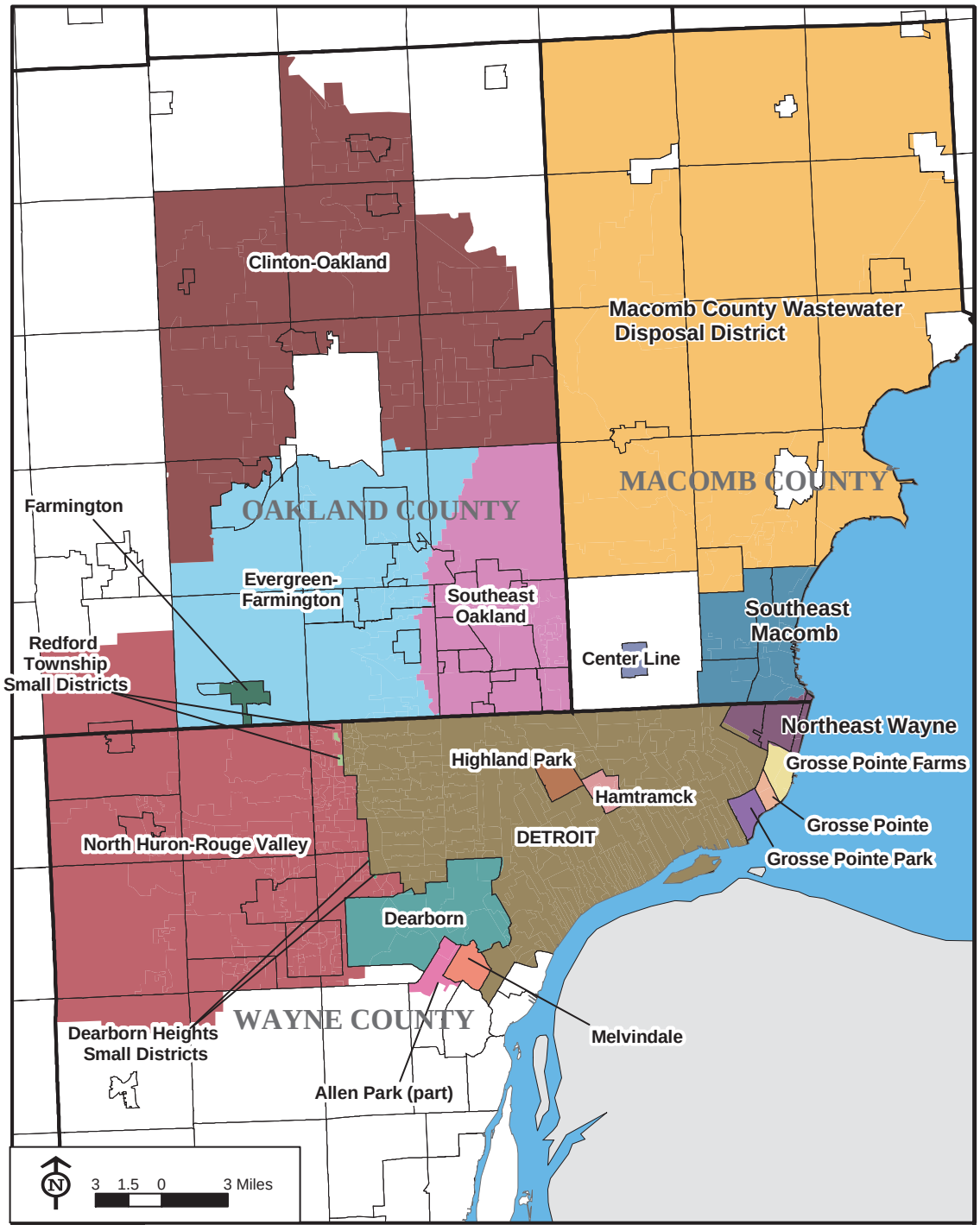


Figure 3.2: Suburban Sewage Districts



3.3 Rouge River Sewer District

3.3.1 General Description & History

The Rouge River Sewer District is in western Detroit. It was one of the areas incorporated into Detroit in the 1920s in the city's final expansion to its present limits. The trunk sewers were built in the 1920s and 1930s.

The Rouge River Sewer District lies in the valley of the main branch of the Rouge River. The valley runs from north to south almost at the district's western boundary.

The river valley is a floodplain that extends on both sides of the main river channel and is lined by shallow bluffs overlooking the valley. The surface contours of the area slope gently from the northeast to the southwest, falling approximately 55 feet in seven miles for an average slope of approximately 0.15 percent, a flat gradient.

The land use in the district is mainly residential single-family housing and secondarily open space, mostly municipal parkland, public and private golf courses and a cemetery. There are some areas of commercial and industrial activity along the I-96 corridor as it passes through the district. The district area is 10,780 acres.

3.3.2 Physical Characteristics

The Northwest Interceptor, the only interceptor in the district, is located close to the east side of the Rouge flood plain. Other sewers are trunk and lateral sewers.

Brennan Pools Pumping Station, located in Rouge Park has a total capacity of 4 cfs (2.6 mgd), with two 900-gpm pumps that operate intermittently as required.

The Puritan Sanitary Pumping Station was recently decommissioned. Dry weather flow is now pumped through two 1,100 gpm sanitary pumps at the Puritan-Fenkell Detention Basin.

Two dewatering pump stations are located at the two CSO facilities in the district, Puritan-Fenkell and Seven Mile detention basins.

Warren-Pierson Control Regulator can limit flow downstream of the regulator to the safe hydraulic capacity of the Northwest Interceptor. There are four inverted siphons from the sewers on the west side of the river, under the Rouge River to the Northwest Interceptor. They are small-diameter sewers that carry the dry weather flow to the Northwest Interceptor.

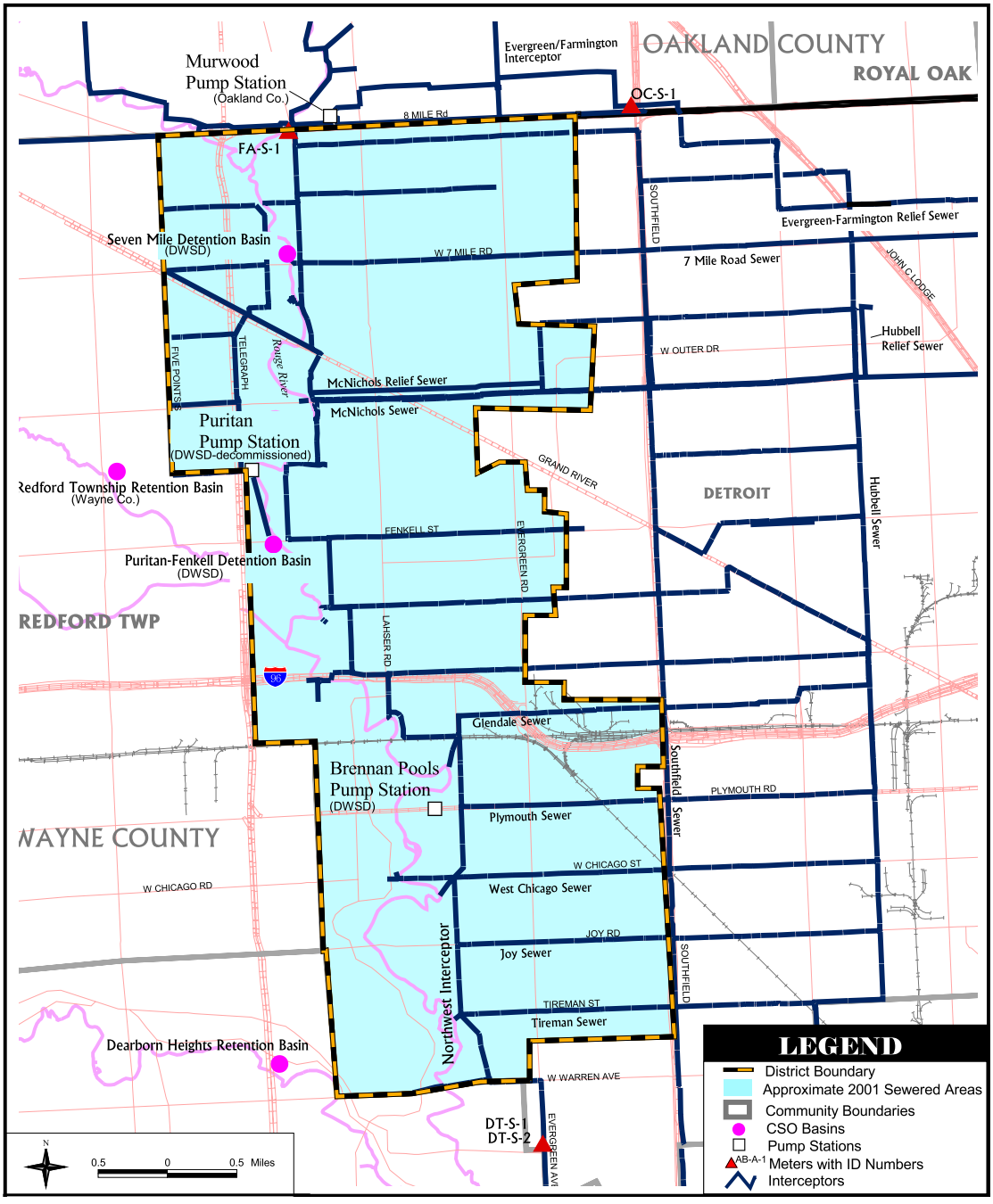
There are 21 outfalls from the district's sewers to the Rouge River divided nearly equally on the east and west sides of the river. The flows from these outfalls are generally considered combined sewer overflows. In addition, the district contains 25 backwater gates and 23 dams. CSO treatment facilities and in-system storage devices are installed to reduce CSO discharges. Seven in-system devices (double leaf in-system storage slide gates and associated equipment) were completed in 1998.

There are two CSO Basins in the district:

Seven Mile Detention Basin: This basin is located on the east side of Shiawassee, north of Seven Mile, on the west side of the Rouge River. Completed in 1999, its treatment performance is currently being evaluated. It is designed to capture and treat CSOs from part of 1,029 acres formerly draining to the Puritan Sanitary Pumping Station. Its storage capacity is 2.2 mg, and it can provide treatment for up to 656 cfs of flow. The basin was designed for 1-year, 1-hour duration storm (1-inch) with 30-minutes detention. The facility contains two catinary-type bar screens and a sodium hypochlorite feed system. During dry weather, there is no flow routed to the Seven Mile Road Basin. During wet weather, the control gate at Seven Mile and Shiawassee regulates the flow to the Seven Mile Basin

Puritan-Fenkell Detention Basin and Pumping Station: This facility is within Eliza Howell Park

Rouge River Sewer District



east of Telegraph south of Fenkell and west of the Rouge River. Completed in 1999, the facility is currently in the demonstration/evaluation phase. It captures the remainder of the CSOs from the area draining to the Puritan Station and provides storage for 2.8 mg of CSO and treatment for up to 845 cfs of flow. The Puritan Fenkell Basin was designed for 1-year, 1-hour duration storm (1-inch) with 20 minutes detention. The facility contains two sanitary pumps rated at 1,100 gpm each. There are three dewatering pumps each rated at 4,500 gpm.

3.4 Southfield Sewer District

3.4.1 General Description & History

Like the Rouge Sewer District, the Southfield Sewer District is one of the areas incorporated into Detroit between 1920 and 1926 in the city's final expansion to its present limits. The trunk sewers were built in the 1920s and 1930s. The surface contours of the area slope gently from the northeast to the southwest. The land falls approximately 60 feet in 11 miles (58,000 feet). This is an average slope of approximately 0.10 percent, a flat gradient. The land use in the area is mostly residential, primarily single-family housing. The storm drainage for the road network is divided between the Detroit combined sewer system and a separate MDOT system for I-96, which discharges directly to the Rouge River. The district covers an area of 7,710 acres.

3.4.2 Physical Characteristics

The construction of the sewer system in the Southfield Sewer District (when it was the eastern part of the Northwestern District) began in the 1920s. The major sewer in the area is the Southfield Sewer, located under the Southfield Freeway from Eight Mile Road to Ford Road where it joins the Hubbell Sewer at the Asbury Park right-of-way. The Southfield Sewer is a concrete cylinder varying in diameter from 6′-9″ to 12′-6″. It has no remote control facilities, but has several relief connections running in an east-west direction for routing of excess combined flows to outfalls on the east side of the Rouge River. Major relief sewers for transporting excess flow west from the Southfield sewer are McNichols Relief (15′-0″); Glendale (13′-0″); Plymouth (8′-3″ to 10′-6″); and Tireman (8′-3″ to 10′ -6″).

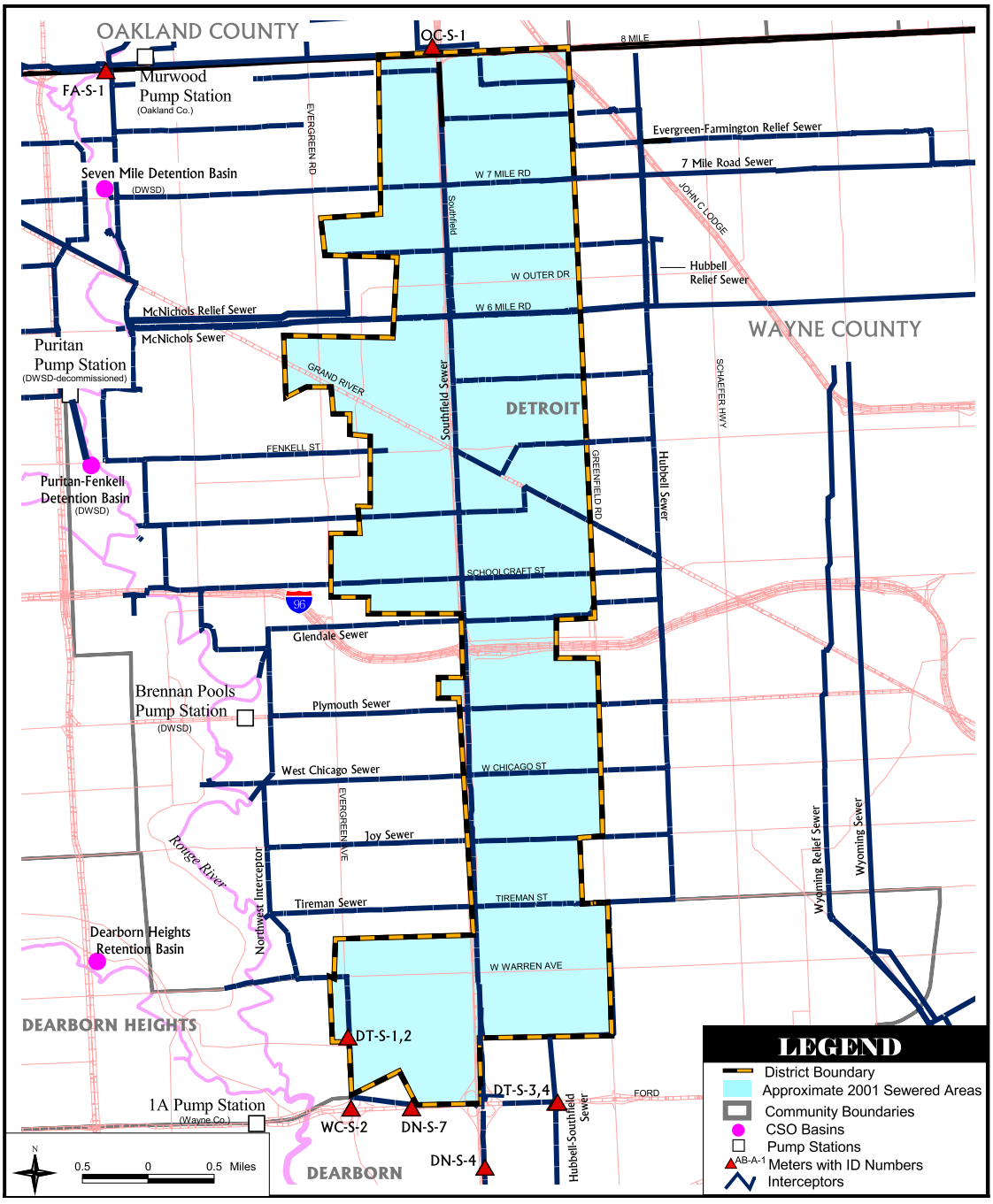
Southfield Sewer transports flow south into the Hubbell-Southfield Combined Sewer at Ford Road. The Hubbell-Southfield Sewer extends from Ford Road south to the Rouge River. At the discharge of this sewer is another CSO control basin. Just upstream from this basin are remotely controlled gates that provide additional in-system storage. Discharges from the district to the NWI are controlled through a regulator gate at Michigan Avenue and through the Hubbell-Southfield CSO Control Basin. The upper portion of the Hubbell-Southfield Combined Sewer, from Ford Road to Michigan Avenue, is a 13′-4″ x 14′-3″ concrete double box. At Michigan Avenue the combined sewer changes to a 14′-6″ x 12′-0″ concrete double box.

The drainage from the Evergreen-Farmington Sewer District in Oakland County originally went to the Southfield Sewer. Since the construction of the Evergreen-Farmington relief sewer, this flow has been redirected to the Conner Creek Sewer District.

There are two relief sewers that serve the district. The Glendale Relief Sewer and the Six Mile (McNichols) Relief Sewer both divert flow from the Hubbell and the Southfield Districts to the Rouge River. There is one outfall directly from the district's sewers to the Rouge River.

Hubbell-Southfield Control Regulator controls the flow from the Hubbell Sewer into the Northwest Interceptor and the Hubbell-Southfield CSO Basin. The regulator at Michigan has two remotely controlled 30″x 60″ sluice gates, which allow diversion of flow to the Oakwood-Northwest Interceptor. The 14′-6″ x 12′-0″ double box contains

Southfield Sewer District



two automatically controlled inflatable dams installed directly upstream from the backwater gates. The outfall has a reverse slope, allowing dewatering of stored sewage through the regulator to the Oakwood-Northwest Interceptor. During dry weather, the flow is diverted to the NWI. During wet weather, the regulator will be set to divert a maximum of 86 cfs to the NWI. Remaining flow is captured behind an inflatable dam up to an elevation of 100 feet.

Hubbell-Southfield CSO Basin was completed in 1999 just upstream of the outfall from the Hubbell Sewer to the Rouge River. This facility provides storage for 22 mg of CSOs and treatment for up to 3,200 cfs of flow. Flows enter the basin through the influent bar screens to the influent channel. There are six catenary-type bar screens in the facility. The discharges are disinfected. Currently there is outflow from the basin to the Rouge River only when the design capacity of the basin is exceeded. The basin dewaters to the Northwest Interceptor through four dewatering pumps each rated at 5,300 gpm.

3.5 Hubbell Sewer District

3.5.1 General Description & History

The Hubbell Sewer District is bounded on the north by Eight Mile Road, on the west by the Southfield Sewer District and on the south by Dearborn. To the east lie the Conner Creek and Baby Creek districts. The district covers an area of 6,490 acres.

This area was incorporated into the City of Detroit between 1920 and 1926 and its development was similar to the Rouge and Southfield districts. The trunk sewers were built in the 1920s and 1930s.

The Hubbell Sewer District has no dominant physical characteristic. Hubbell Avenue is the main north-south street. The Hubbell Sewer was constructed in the Hubbell Avenue right-of-way in 1927. The road is located on the western side of a shallow spur of slightly higher ground that extends out from the ridge that parallels the Detroit River and meets the river at Detroit's downtown area.

The surface contours of the area slope gently from the northeast to the southwest. The land falls approximately 55 feet in 6.5 miles (34,000 feet). This is an average slope of approximately 0.16 percent, a flat gradient.

The land use in the area is mostly residential, primarily single-family housing. There are also some small areas of commercial and industrial activity along the I-96 corridor as it passes through the district. Most of the freeway drainage systems discharge to the combined system. The exception is portions of the Jeffries Freeway (I-96) that go through the Hubbell, Southfield and Rouge River districts.

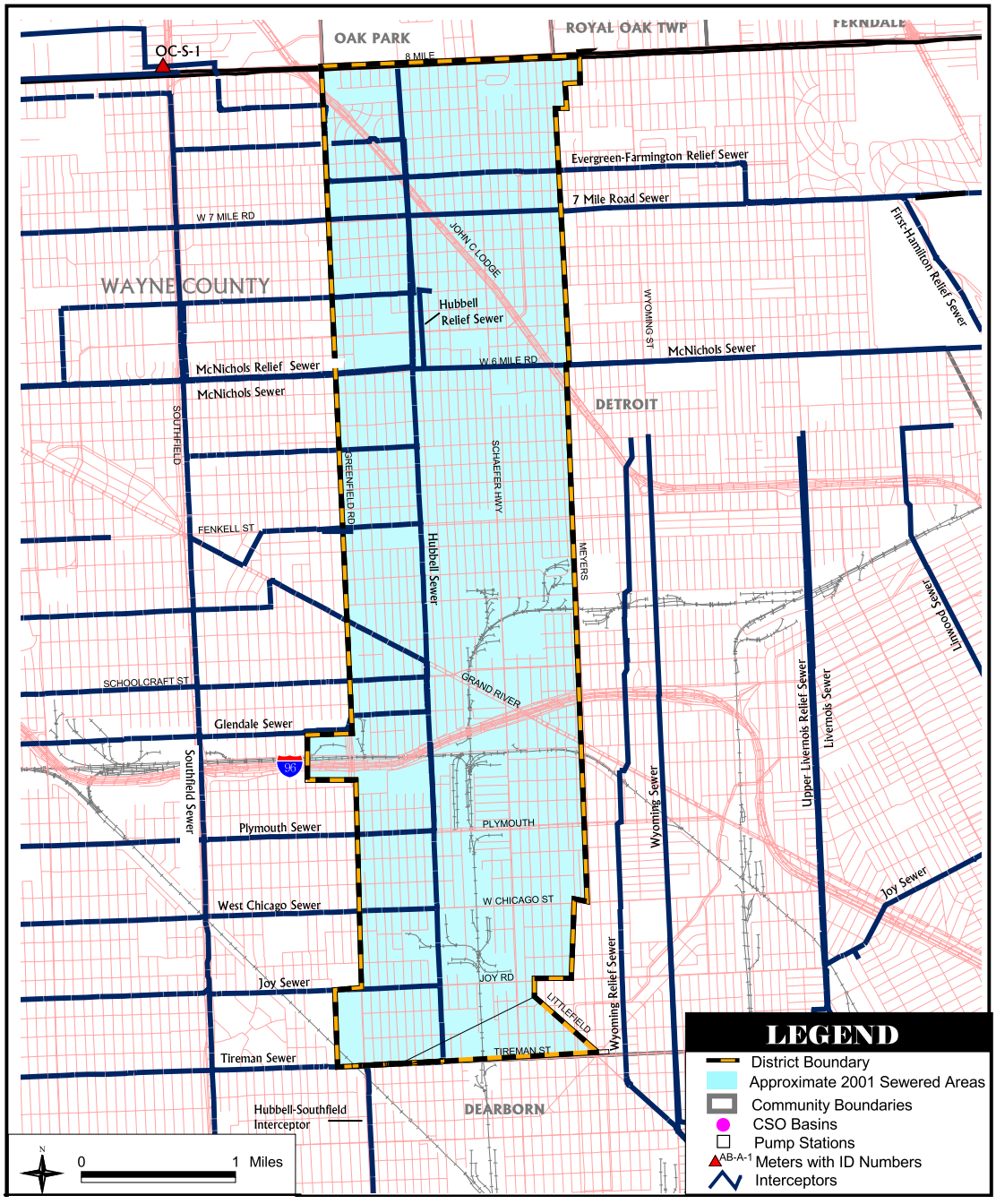
3.5.2 Physical Characteristics

The district drains ultimately to the Northwest Interceptor. The major sewer in the district is the Hubbell Sewer, which is located in the Hubbell Avenue right-of-way from Hessell Street to Tireman Avenue where it turns west along Tireman and enters the Southfield Sewer District. The remaining sewers are trunk and lateral sewers, which generally run east to west along the major streets.

Hubbell Sewer is a concrete cylinder that extends south, from Eight Mile Road to Paul Road, varying in size from 8'-3" to 14'-3". At Paul Road, the Hubbell Sewer changes to a 12'-0" x 14'-3" double box that extends south to Ford Road, where it joins the Southfield Sewer and continues south as the Hubbell-Southfield Sewer. The Hubbell Sewer has no remotely controlled facilities, but has high level relief conduits to transport excess flow in a westerly direction to the Southfield Sewer and Rouge River outfalls.

Various relief sewers were constructed in the dis-

Hubbell Sewer District



trict to relieve the Hubbell Sewer. These sewers include: the McNichols Relief Sewer (11'-3"), which runs from just east of Hubbell Avenue to the Rouge River at Six Mile Road; the Hubbell Relief Sewer, which runs along Hubbell Avenue from Curtis to McNichols and takes flow from the Curtis Sewer to the McNichols Relief Sewer; and the Glendale Relief Sewer (11'-3"), which takes flow from the Hubbell sewer to the Rouge River, and is connected to the Hubbell Sewer by high-level relief sewers directly south of Schoolcraft Road.

There are no outfalls from the district's sewers directly to the Rouge River. Any overflows to the rivers occur after flow has entered the Southfield District. There are no major regulators, CSO basins, or pump stations in the district. However, the flow from this district is discharged through the Hubbell-Southfield Interceptor, regulator, and CSO basin in the Southfield Sewer District.

3.6 Oakwood Sewer District

3.6.1 General Description & History

The Oakwood Sewer District lies on the south side of the Rouge River. It was annexed to Detroit in 1922. It borders River Rouge, Ecorse and Melvindale and ends at West Outer Drive at the Detroit boundary with Lincoln Park.

The surface contours of the area slope very gently from the southwest to the northeast. The land falls approximately 15 feet in 2.5 miles (12,500 feet). This is an average slope of approximately 0.12 percent, a flat gradient.

The major physical features dominating the Oakwood District are the Rouge River and the Fisher Freeway (I-75). The freeway cuts through the district along the long axis. Because of the relatively small size of district, the freeway constitutes a major portion of the district. However, while it makes a significant impact on storm flows due to its relatively large impervious area, it does not contribute to the dry weather flow. This sewer district is the smallest in Detroit, covering an area of 1,520 acres. The land use in the area is mostly residential, single-family housing, with a large industrial corridor between Oakwood Boulevard and I-75, and around the Rouge River.

3.6.2 Physical Characteristics

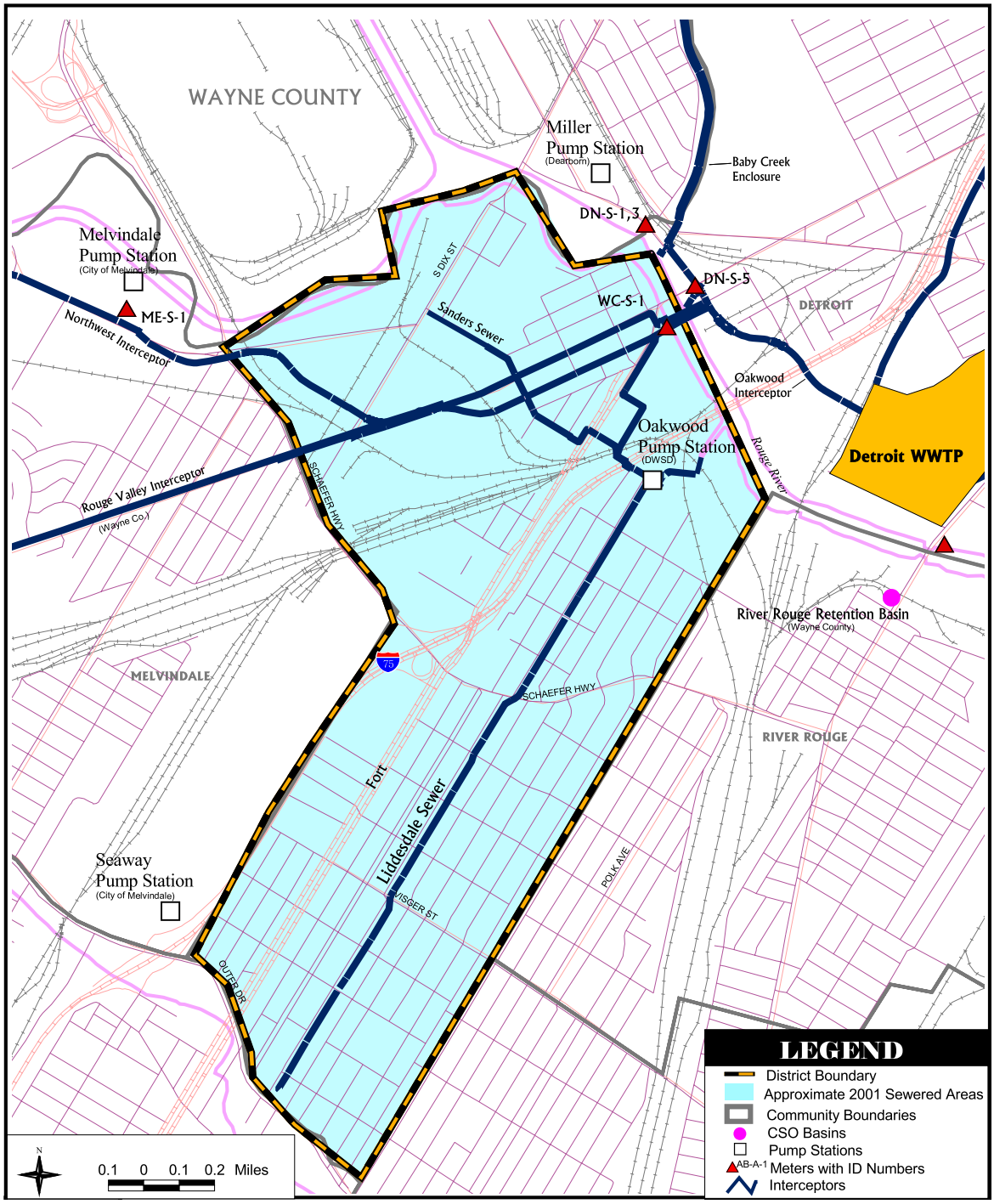
The Oakwood District drains to the Northwest Interceptor, which runs along the north edge of the district and then crosses the river to join the Oakwood Interceptor on the east side of the Rouge River.

The Oakwood District is drained by two trunk sewers, the Liddesdale Sewer and the Sanders Sewer, which transport flow to Oakwood Pumping Station. The Liddesdale Sewer begins at Gleason Road as a 5'-6" diameter concrete cylinder and runs in a northeasterly direction, increasing to a 10'-0" diameter cylinder at Oakwood Pumping Station. The Liddesdale Sewer has no remotely controlled facilities.

Sewers on Schaefer Highway drain to the Liddesdale Sewer. The Sanders Sewer is a 6'-9" diameter sewer that runs in a southerly direction, to the 10'-0" diameter cylinder at the Oakwood Pumping Station. Oakwood Pumping Station lifts flow into the Oakwood-Northwest Interceptor at Fort Street west of the Rouge River. Excess combined flows are discharged to the Rouge River. There are a number of smaller sewers on Sanders Street, Mellon Street, and West Fort Street that drain the area north and west of the Fisher Freeway to the Oakwood Pumping Station.

Oakwood Pumping Station is located at 12330 Sanders Avenue, about a mile and a half northwest of the Detroit Wastewater Treatment Plant. During dry weather, flow into the station is primarily domestic and industrial wastewater. This wastewater is pumped by two 20.1 cfs (13 mgd) sanitary pumps through a 36-inch force main to

Oakwood Sewer District



the Oakwood Interceptor, which flows to the WWTP. One sanitary pump normally will maintain a low level in the wet well.

During heavy rains when the storage capacity is exceeded, the six storm water pumps can discharge combined sewage to the O'Brien Drain to avoid flooding. Two of these six pumps are rated at 106 cfs (68.5 mgd), two are rated at 41.5 cfs (63.3 mgd), and two are rated at 40.2 cfs (26 mgd). The O'Brien Drain transports these flows to the Rouge River. Due to the industrial character of the district, the potential exists for accumulation of waste oil in the wet well. An oil skimmer at the station helps with this problem. Removed skimmed oil is stored in an underground waste oil storage tank.

Oakwood Pumping Station and flooding problems in the Oakwood District have been evaluated under PC-719. Renovations for the pumping station (replacement and reconditioning of pumps) and additional improvements are currently under design, with a projected completion date of 2004. An additional recent contract has provided an emergency diesel generator to provide power during outages.

There are three outfalls in the district along the Rouge River, and four backwater gates.

3.7 Baby Creek Sewer District

3.7.1 General Description & History

Baby Creek Sewer District covers the north central part of the Detroit. Most of Highland Park is in this district. The surface contours of the area slope gently from the north to the south. The land falls approximately 80 feet in eight miles (40,000 feet). This is an average slope of approximately 0.20 percent, a flat gradient. The trunk sewers were built in the 1920s and 1930s. The area of the district is 11,760 acres.

3.7.2 Physical Characteristics

Baby Creek District drains primarily into the Baby Creek Enclosure, which either sends flow to the Oakwood Interceptor through a remotely controlled regulator or discharges flow through an outfall to the Rouge River. The First-Hamilton Relief Sewer also lies partly within the district and carries part of the flow under high flow conditions to the North Interceptor-East Arm. There is a high level relief connection from the Edison Sewer, an 11'-6" diameter concrete cylinder, to the First-Hamilton Sewer at the intersection of Edison Street and First-Hamilton Avenue.

Some major sewers in the Baby Creek District are:

Baby Creek Enclosure (14'-6" x 17'-6") extends approximately three miles from Kirkwood Road south to the Rouge River.

Lonyo Sewer (14'-0" x 14'-6") begins at Kirkwood Road and connects into the Baby Creek Enclosure at Dix Road.

Elmer Ternes Sewer (14'-0" x 14'-6") parallels the Lonyo Sewer.

Wyoming Sewer a (5'3" diameter to 11'-6") cylinder runs from Puritan to Warren where it joins the Weatherby sewer.

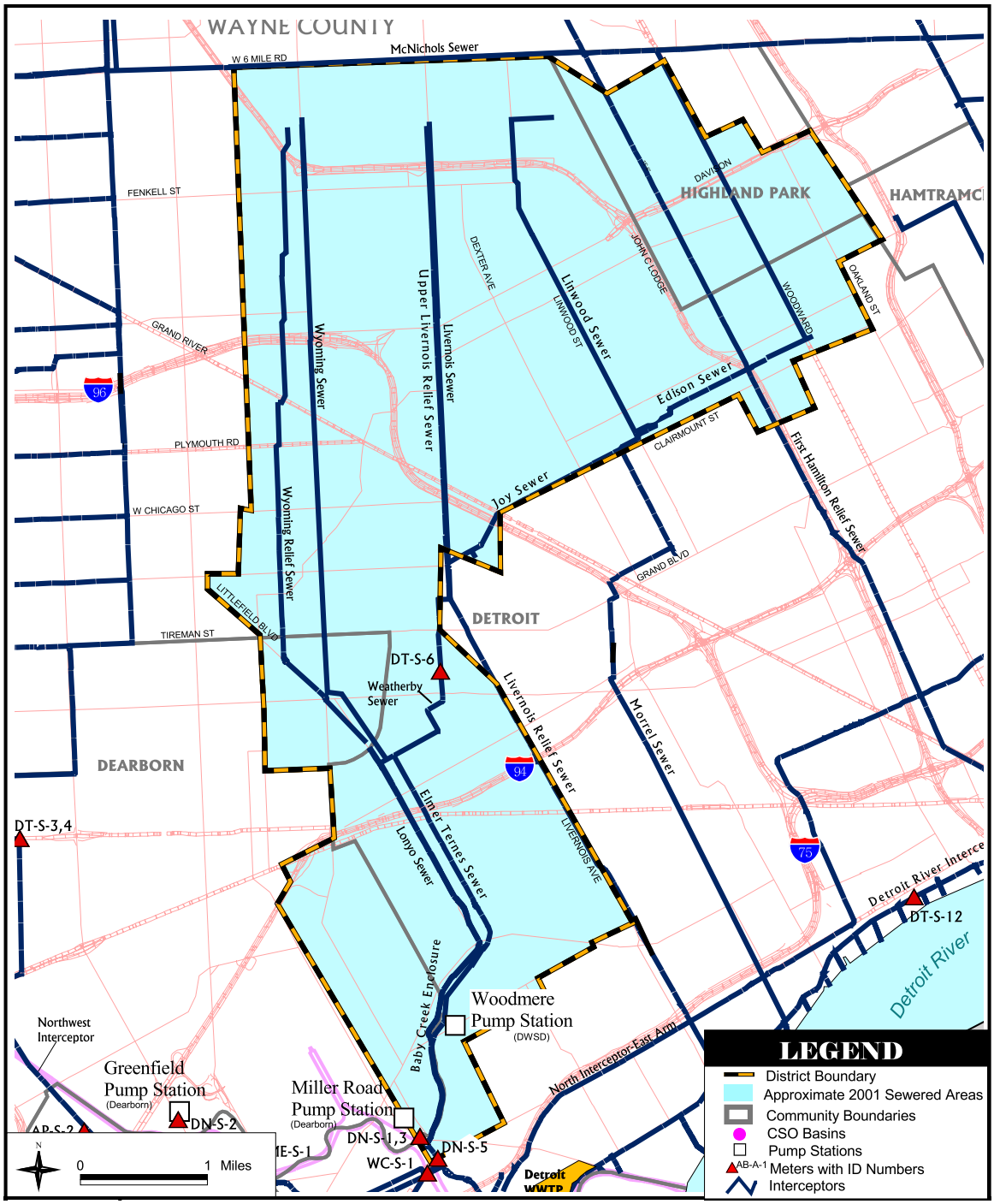
Wyoming Relief Sewer (7'-0" to 15'-0") is a concrete cylinder connecting into the Lonyo sewer, south of the Weatherby Sewer through relief port type connections.

Weatherby Sewer (17'-9" x 13'-5") transports dry weather and some storm flows from the junction structure of the Livernois, Upper Livernois Relief and Joy sewers at Joy Road to the Lonyo Sewer at the intersection of Lonyo Road and Kirkwood Road.

Joy and Edison Sewer (also called **Weatherby Arm**) 17'-9" x 13'-5" transports dry weather and some storm flows from the junction structure of the Livernois, Upper Livernois Relief and Joy sewers at Joy Road to the Lonyo Sewer at Lonyo Road and Kirkwood Road.

Livernois Sewer (5'-0" to 9'-0") is a concrete cyl-

Baby Creek Sewer District



inder running primarily north-south, transporting combined flows from Puritan Road to Joy Road.

Upper Livernois Relief Sewer (6′-0″ to 11′-6″) is a concrete cylinder running parallel with the Livernois Sewer.

Linwood Sewer (9′6″) follows Linwood Street at a 0.12 percent slope**.**

Livernois Relief Sewer (19′-6″) extends from Joy Road to Jefferson Avenue.

First–Hamilton Relief Sewer (4′-0″ to 15′-6″) transports flow from the Evergreen-Farmington District to the North-Interceptor -East Arm and the Detroit River Interceptor.

Woodmere Pumping Station is located in George Patton Park between Dix Avenue and Vernor. The station pumps mostly storm flows but also discharges some sanitary flows to the Baby Creek Enclosure. There are three storm pumps each rated at 256 cfs (165.5 mgd), and two sanitary pumps each rated at 8 cfs (5.2 mgd).

Baby Creek CSO Control Facility CSO outfall will be constructed in June 2003. The structure will be 350 feet by 100 feet by 30 feet and will be located at Patton Park, mostly below grade. The facility will control and treat discharges up to 1,500 cfs from the Baby Creek Outfall.

There are two backwater gates and one outfall in the district.

3.8 Conner Creek Sewer District

3.8.1 General Description & History

This sewer district is located on the north-central boundary of Detroit. Some of Highland Park and part of Hamtramck are in this district. The surface contours of the area slope gently from the northwest to the southeast. The land falls approximately 55 feet in 12 miles (60,000 feet). This is an average slope of approximately 0.09 percent, a very flat gradient. Major suburban flows enter the district from the north: the Evergreen-Farmington Sewer District flow and the Southeast Oakland Sewer District flow. Both are carried to the North Interceptor East Arm by relief sewers. The district covers an area of 17,360 acres, making it the city's second largest sewer district.

3.8.2 Physical Characteristics

The major sewers in the district are:

Conner Creek Sewer (Enclosure) varies from an 8′-0″ diameter sewer to an 18′-6″ x 21′-9″ concrete triple box outfall. The district primarily drains into this sewer, which also transports flow from Center Line. It flows in a general north-south direction and discharges through the Conner Creek Control Regulator into the DRI or, during wet weather events, through the Conner Creek Outfall to the Detroit River. The Conner Creek CSO Facility (currently under construction) will treat the discharges from the Conner Creek system.

Seven Mile Sewer (11′-6″ diameter) follows Seven Mile from Conner Creek Sewer to the Rouge River.

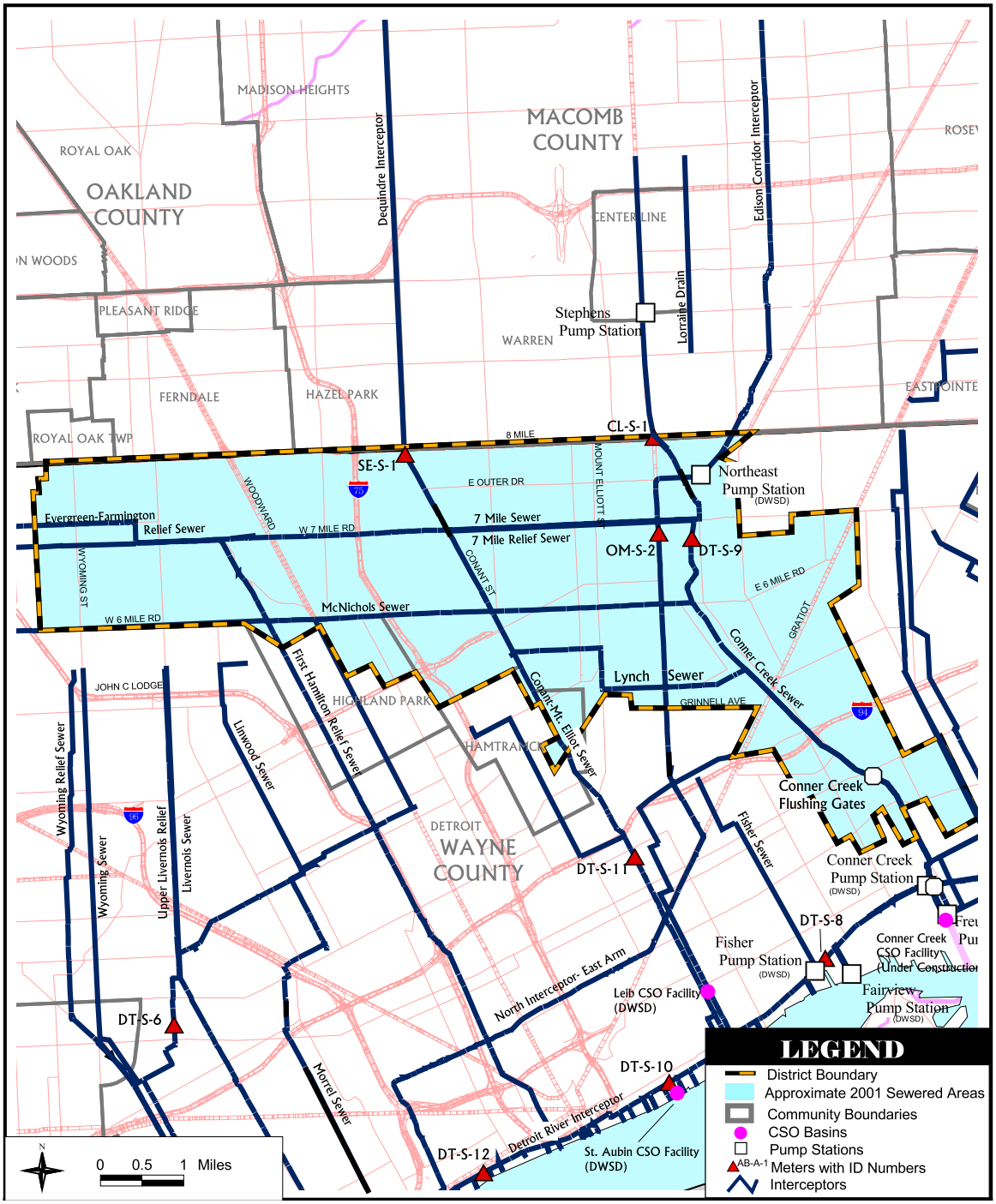
Seven Mile Relief Sewer (13′-0″ to 9′0″) runs in an east-west direction between Conner Creek Sewer and Conant-Mt. Elliott Relief Sewer.

Conant-Mt. Elliott Relief Sewer (9′-0″ to 16′-3″) receives metered suburban flows from the Dequindre Interceptor which enters the sewer by gravity at Emery Road. The flows are then enter the North Interceptor-East Arm. During wet weather, the excess wet weather flows are conveyed through four remotely controlled Leib regulators to the DRI or and are discharged through an outfall to the Detroit River.

First–Hamilton Relief Sewer (4′ to 15′-6″) transports flow from the Evergreen-Farmington District to North-Interceptor-East Arm and Detroit River Interceptor.

North Interceptor – East Arm, (12′-0″-17′-6″) one of the three major DWSD Interceptors, the 86,800-foot reinforced concrete sewer has a capacity range of 341-454 cfs.

Conner Creek Sewer District



McNichols (Six Mile) Sewer (5′-6″ to 10′-6″) combined sewer runs from Griggs Street to Conner Creek Sewer.

Lynch Road Sewer, (4-0″- 11′6″) a combined sewer, is a concrete cylinder providing routing for dry weather flow from Conner Creek sewer to the Conant-Mt. Elliott Sewer.

The East Warren and Conner Creek districts contain two remotely controlled facilities, the **Connor Creek Flushing Gates** at Warren and the **Conner Creek Control Regulator** (control gates) south of East Jefferson. The flushing gates consist of three 10′-0″ x 7′-0″ roller gates. The control regulator has a 48-inch knife gate of sufficient capacity to allow normal dry weather flow into the Detroit River Interceptor and two additional 60″ x 72″ sluice gates for remotely controlled operation.

The Northeast Pump Station lifts flows from the Edison Corridor Interceptor (Macomb County and the Clinton-Oakland districts) to the North Interceptor-East Arm. It currently includes three pumps: two sanitary pumps rated at 150 cfs (97 mgd) each, and one sanitary pump rated at 100.6 cfs (65 mgd). Work is currently underway to add an additional 150 cfs (97 mgd) pump to the station to increase its reliability and to reduce maintenance related to solids buildup in the station wet well. This third pump is scheduled to be installed by 2004. The pumping station can be expanded to include three additional pumps.

3.9 Central Sewer District

3.9.1 General Description & History

This sewer district lies at the center of Detroit and includes the area of the original city settlement. Its most important physical feature is the Detroit River. The construction of the sewer system in the district began in the mid-1800s. All of the major sewers in the district run to the Detroit River, where they originally discharged directly to the river.

The surface contours of the area slope gently from the northwest to the southeast. The land falls approximately 36 feet in 8.5 miles (43,000 feet). This is an average slope of approximately 0.08 percent, a very flat gradient. The area of the district is 22,490 acres, making it the largest in the city.

3.9.2 Physical Characteristics

The Central Sewer District receives flows from all of the other districts. The Detroit River Interceptor and the North Interceptor East Arm are the major interceptors in the district. The other major sewers transporting suburban flow through the district are the First-Hamilton Relief Sewer and the Conant-Mt. Elliot Sewer. Both are connected to the North Interceptor-East Arm and the Detroit River Interceptor, but can overflow during wet weather events to outfalls along the Detroit River. A large number of north-south trunk sewers discharge to the DRI. Some discharge wet weather flows directly to the Detroit River. Some important trunk sewers not shown on the map include the Central, Clark, Third Street, Brush and Joseph Campau sewers.

Some major regulator structures in the district are:

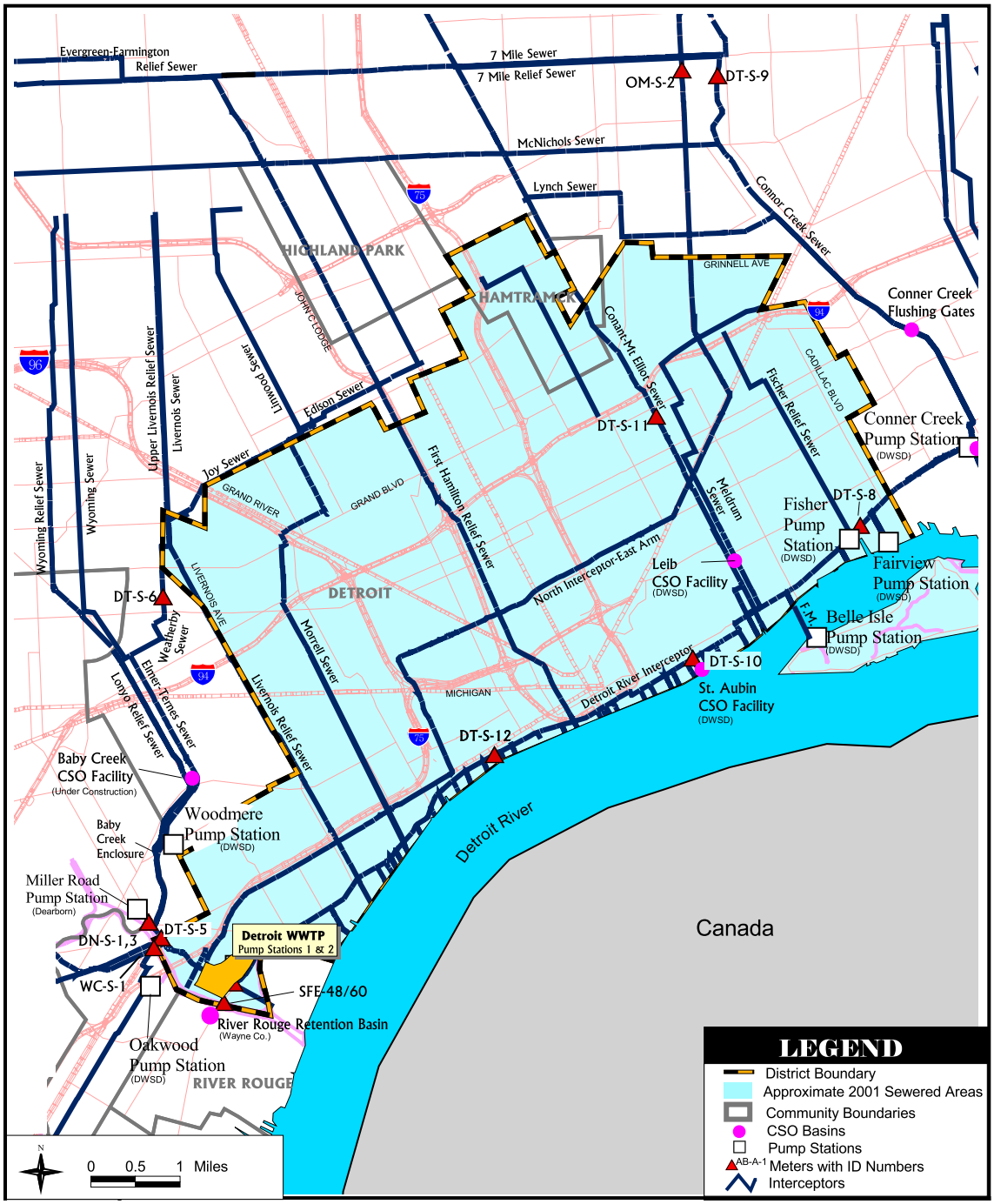
Dearborn Regulator, located at Dearborn Street and West Jefferson; **Livernois Regulator,** located at Dragoon and West Jefferson; **Leib Regulator,** located at Leib and E. Jefferson; **McClellan-Cadillac Regulator** approximately 2,000 feet downstream of the Fairview Pumping Station; **Warren Control Gate; Joy Control Gate** at Joy Road and Warren; **fabridam** (remotely controlled) in the Livernois Relief Sewer; **First-Hamilton Regulator** (remotely controlled along the DRI).

The Central Sewer District has a large proportion of the outfalls, backwater gates, regulators, and dams in the DWSD service area. There are 49 outfalls from the district's sewers to the Detroit River, 24 backwater gates, 40 regulators, eight other regulators and 31 dams.

There are five major pump stations:

Detroit Wastewater Treatment Plant has two large

Central Sewer District



pump stations at the plant. The older **PS-1** is currently capable of pumping up to 2,234 cfs (1,444 million gallons per day). The newer **PS-2** provides an additional 1,423 (920 mgd) of capacity.

Fairview Sanitary Pump Station, constructed in 1910, is a lift station for the Detroit River Interceptor located near East Jefferson. In 1974 its capacity was increased to 336 mgd. It contains three sanitary pumps each rated at 150 cfs (97 mgd), one sanitary pump rated at 75.8 cfs (49 mgd), and a dewatering pump rated at 1.5 cfs (1 mgd).

Fischer Pumping Station, located in Erma Henderson Park, contains two sanitary pumps rated at 10.5 cfs (6.8 mgd) each. Wastewater is pumped from the Fischer Relief Sewer into the Detroit River Interceptor. During dry weather, it is able to handle all incoming flow through the relief sewer. During storm conditions, when the DRI flow level is too high and cannot accept additional flow, the pump is shut down, resulting in overflows.

Belle Isle Pump Station consists of seven packaged pumping stations and a main pumping station. The packaged stations primarily pump sewage to the main station. At the main station two sanitary pumps rated at 18.6 cfs (12 mgd) each move wastewater across the Detroit River to the Detroit River Interceptor (DRI) through a 12-inch force main. When excessive storm flow is received at the main pumping station, two storm pumps rated at 15.8 cfs (10.2 mgd) each are used to pump the excess flow to a storage tank, where it is held until flow decreases. If the storage tank capacity is exceeded, the overflow goes directly to the Detroit River.

Two pilot CSO facilities are currently under construction in the district, the Leib and St. Aubin screening and disinfection facilities. These facilities will screen and disinfect up to 2,000 cfs (Leib) and 250 cfs (St. Aubin) of wet weather flows before discharging to the DRI or the Detroit River. Testing is scheduled to begin after construction. An additional CSO basin is planned for Belle Isle.

3.10 Fox Creek Sewer District

3.10.1 General Description & History

This sewer district is located on the eastern boundary of Detroit. The surface contours of the area generally slope from northwest to south and southeast. The land surface falls approximately 50 feet in seven miles (37,000 feet). This is an average slope of approximately 0.14 percent, a flat gradient. Land use is a mixture of residential and commercial. The area of the district is 8,420 acres.

3.10.2 Physical Characteristics

The district sewer system is laid out at right angles to the Fox Creek Enclosure, the outlet the system originally drained to. Although most sewers in the district ar combined, there is a 2.4 square-mile area of separated sewers. Sanitary flow is conveyed by gravity to the DRI, while the storm water flow from this area is drained through the deeper combined sewers to the Jefferson Avenue East Relief Sewer. Relief sewers were completed after these major sewers were constructed.

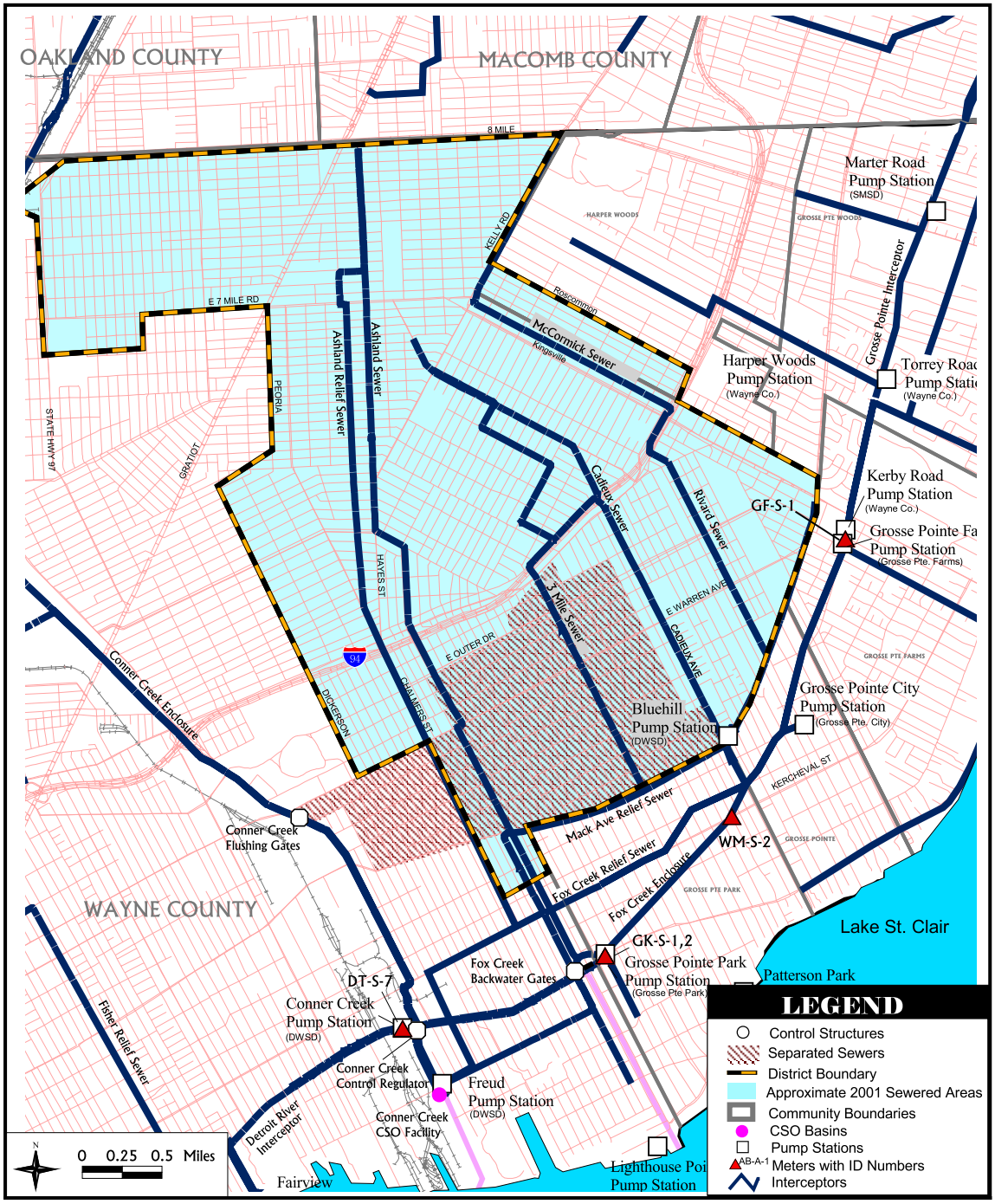
The Fox Creek district drains sanitary and storm flow into the East Jefferson District through the Mack Avenue Relief Sewer, Fox Creek Relief Sewer, and Fox Creek Enclosure.

Mack Avenue Relief Sewer (8′-6″ to 16′-0″ diameter)begins at the Bluehill Pumping Station, extends to Manistique and turns south following Manistique to the Jefferson Avenue East relief sewer.

Fox Creek Relief Sewer (10′-6″ to 14′-6″) located in Grosse Pointe Park, also begins at the Bluehill Pumping Station. Flow is transported down the 16′-0″ Manistique Sewer to the Jefferson Avenue East Relief Sewer.

Fox Creek Enclosure (11′-7″ x 15′-0″ to 16′-0″), located in Grosse Pointe Park, begins at Grosse Pointe Farms pumping station at Kerby Road and directs flows into the Fox Creek backwater gate structure where it continues either into the

Fox Creek Sewer District



Jefferson Avenue East Relief Sewer or to Fox Creek open channel.

Excess combined flows from Mack Avenue, Mack Avenue and Fox Creek relief sewers are routed to the Conner Creek Pumping Station and to the Freud Pumping Station.

Combined sewers, such as Ashland, Bedford, Three Mile Road, Cadieux and Rivard sewers, transport flow from within the Fox Creek District to the major sewers listed here.

Fox Creek Backwater Gate structure transfers flow from the Fox Creek Enclosure into the Jefferson Avenue East Relief Sewer. It is located in the East Jefferson District, but handles flows from the Fox Creek District. Excess combined flow may also be routed through this structure to the Fox Creek open channel. The structure contains three manually operated sluice gates, which are used for flushing the Fox Creek open channel into the Jefferson Avenue East Relief Sewer.

Bluehill Pump Station is the only DWSD-owned station in the district that pumps flows generated there. It is located at 17145 Mack, between Cadieux and Moross. There are two separate stations: a sanitary pumping station serving a 3.7 square-mile area north of the station for dry weather flows and a storm water pumping station for wet weather flows. The station contains two sanitary pumps rated at 10 cfs (6.5 mgd) each and three storm pumps rated at 390 cfs (252 mgd). The station receives combined wastewater flow into its sanitary and storm water pumping station wet wells through the 11'-9" diameter Rivard Sewer. During dry weather flow periods, flow is pumped to the 10'-6" diameter Fox Creek Relief Sewer. During storm weather, combined wastewater is pumped by three storm pumps through a control chamber into the Fox Creek Relief Sewer. Under high storm flow conditions, a control chamber diverts excess flow into the Mack Avenue Relief Sewer. A fourth storm pump will be added and electrical improvements will be made by 2003.

3.11 East Jefferson Sewer District

3.11.1 General Description & History

The East Jefferson Sewer District is located downstream of the Conner Creek and the Fox Creek sewer districts. The Detroit River lies at the south limit of the district and is the point of discharge for the CSOs from the district. The surface contours of the area slope gently from the northwest to the southeast. The land falls approximately 10 feet in one mile (5,000 feet) for an average slope of approximately 0.20 percent, a flat gradient. The East Jefferson Sewer District is the second-smallest district in Detroit at 2,810 acres.

3.11.2 Physical Characteristics

Several major trunk sewers and relief sewers transport combined flows from the Fox Creek District and surrounding suburbs, primarily to the Jefferson Avenue East Relief Sewer. Dry weather and excess combined flows flow through the DRI west along Jefferson Avenue from the easterly city limits of Grosse Pointe Park.

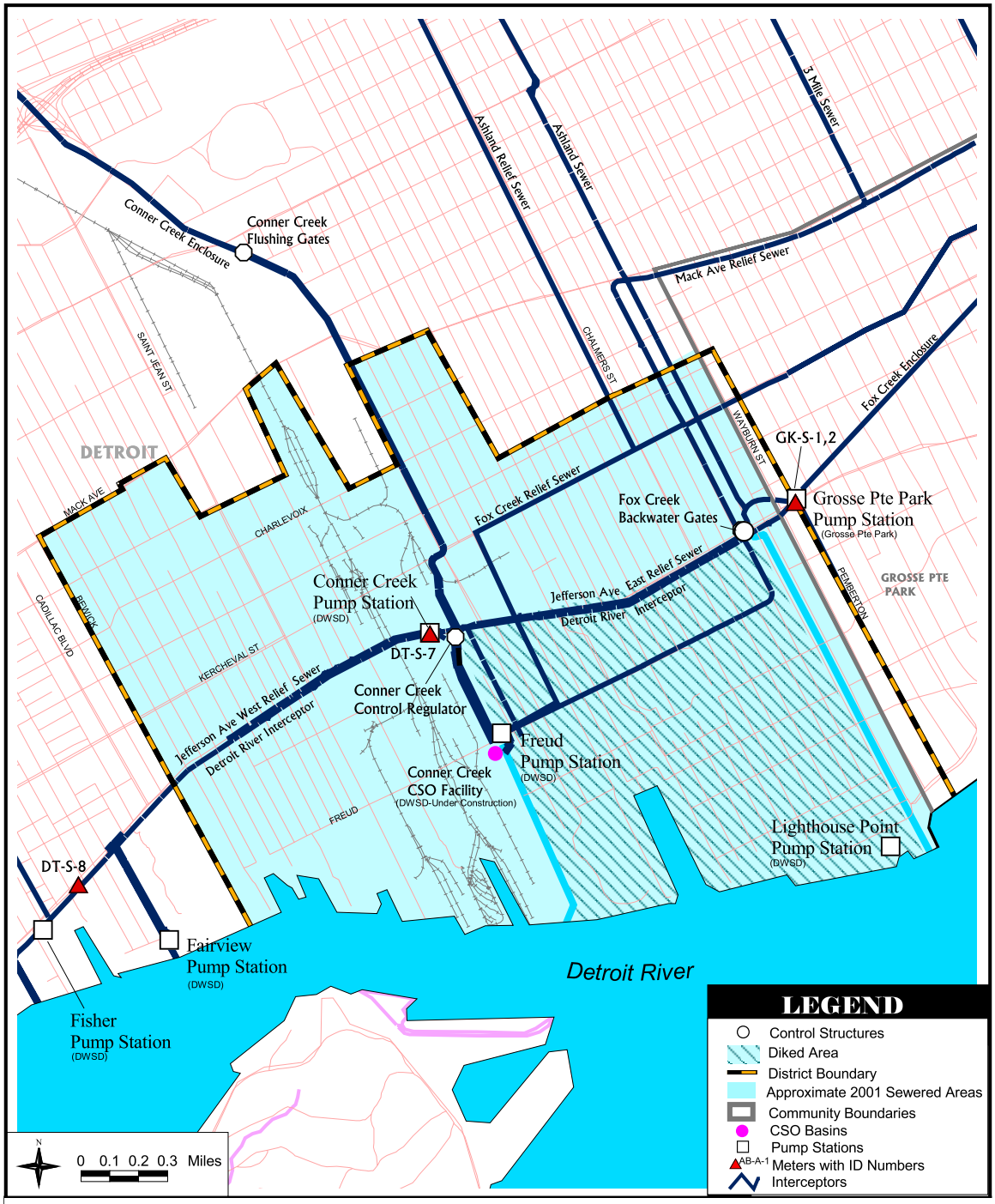
The East Jefferson District also receives dry weather flow and combined flow from the Conner Creek District. Flow is transported from the Conner Creek Enclosure by gravity to the DRI through a 7'-0" diameter cylinder. Excess combined sewage overflows through the Conner Creek backwater gate structure to the Detroit River through the Conner Creek open channel.

The district includes a diked area on the east side of Detroit of several hundred acres where the ground level is lower than the water level in the Detroit River.

The district contains three pump stations:

Conner Creek Pumping Station is located at 12244 East Jefferson at Clairpointe. It receives both sanitary and storm flows from two 14-foot diameter sewers, the Jefferson Avenue East and West relief sewers. During dry weather conditions,

East Jefferson Sewer District



sanitary flow is pumped to the Detroit River Interceptor (DRI). This large pumping station contains eight storm pumps each rated at 492 cfs (318 mgd), two sanitary pumps each rated at 110 cfs (71.1 mgd), one sanitary pump rated at 75 cfs (48.5 mgd) and one sanitary pump rated at 60.3 cfs (39 mgd).

During storm conditions, flows that cannot be pumped into the DRI are discharged to the Conner Creek open channel, which discharges to the Detroit River. The station is currently being renovated.

Freud Pumping Station is located at 12300 Freud, between Tennessee and Clairpointe, south of Jefferson. It has eight storm pumps each rated at 449 cfs (290.2 mgd), one sanitary pump rated at 35.1 cfs (22.7 mgd) and one sanitary pump rated at 20.1 cfs (13 mgd).

The Freud station receives wastewater flow through the 16-foot diameter Fox Creek and Ashland relief sewers.

Because the Freud Pumping Station is primarily a storm pumping station, very little dry weather flow is received. During storm flows, the sanitary pumps are not operated. At high wet well levels, storm water pumps currently discharge directly to the Conner Creek channel. When the Conner Creek Pump Station capacity is exceeded, storm water overflows into the Fox Creek and Ashland relief sewers that discharge to the Freud Pumping Station.

Lighthouse Point Pumping Station is located at Lighthouse Point Recreation Center, 14490 Riverside Drive. This submersible pump station includes two pumps, each rated at 450 gpm.

Two outfalls in the district are associated with the Conner Creek and Fox Creek pumping stations. Four backwater gates are in the district. The **Conner Creek Control Regulator** in the district is described on Page 3-14.

Conner Creek CSO Basin began construction in 2001. The basin will collect CSOs from the Conner Creek Pump Station, Freud Pump Station, and Conner Creek Backwater Gates. The basis of design recommended that the basin be located at the head of Conner Creek. This pilot facility will test the effectiveness of treatment through bar screens to remove floatables and sodium hypochlorite disinfection with a five-minute contact time. The capacity of the basin is 30 MG, based on the 10-year-one hour storm peak flow of 13,262 cfs. There will be four compartments in the facility, with the ability to decant. The basin dewaters to the DRI and will be controlled by the level in the DRI.

Construction of the **Connor Creek CSO Basin** began in 2001. The basin will collect CSOs from the Conner Creek and Freud pumping stations and Conner Creek Backwater Gate. Capacity of the basin is 30 MG, based on the 10 year-one hour storm peak flow of 13,262 cfs.

3.12 City of Highland Park

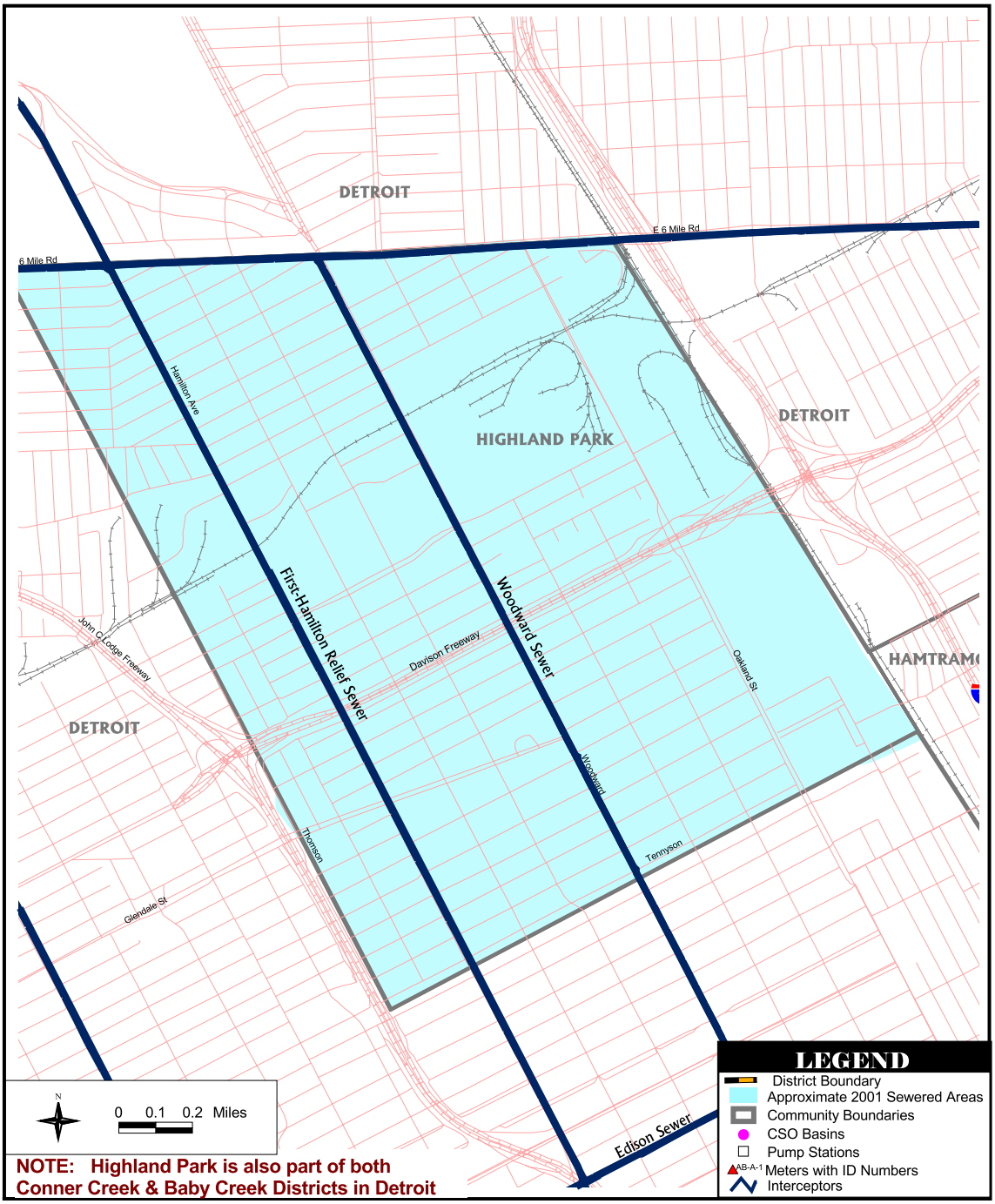
3.12.1 General Description & History

The City of Highland Park lies to the north of downtown Detroit along Woodward Avenue. It is bounded by Tuxedo and Tennyson streets on the south and McNichols Road on the north.

The city covers an area of 1,894 acres (2.96 square miles). Land use in the city is 49 percent residential; 26 percent commercial, institutional, and office; 11 percent industrial; and 14 percent is transportation, utilities, recreation, and other uses. The housing stock was largely built in the 1920s, with many large brick art-and-crafts style houses originally built by auto company foremen.

Highland Park's sewer system was constructed beginning in the 1890s as an outlet became available in the Detroit system. Highland Park was incorporated in 1917 and was originally on the edge of Detroit. It was surrounded by Detroit when Detroit annexed the area up to Eight Mile Road in

City of Highland Park



the mid-1920s. The municipality made an agreement with Detroit to discharge sewage into Detroit's sewer system in 1898. A new agreement, signed in 1940 when the WWTP was constructed, provided for the community to pay for the treatment of its wastewater as well as conveyance. Contractual agreements between Highland Park and DWSD allow the city to discharge up to a 10-year peak flow.

Highland Park was heavily industrialized for many decades, with both Ford and Chrysler automobile plants located there. Ford closed its Highland Park plant in 1971, and Chrysler left the city in 1996. More recently, despite some new commercial and residential developments, the city's industrial base has continued to decline. The city's financial problems, resulted in the appointment of a state emergency financial director in 2001.

The Highland Park sewer system is so interconnected with the Detroit system that it is effectively an integral part of that system, with portions of the city falling within the Baby Creek and Conner Creek sewer districts.

3.12.2 Physical Characteristics

The sewer system in Highland Park is between 50 and 80 years old. The entire system is combined and is reported to be adequate to handle storm flows. The city's sewers are interconnected with the City of Detroit sewers, so none of Highland Park's discharges are metered separately.

Inspection of the system conducted for the *1982 City of Highland Park SSES Study* showed that there was excessive infiltration in some areas of the city. Many manholes showed signs of deterioration. Numerous sewers contained appreciable sediment deposits.

Major interceptors and trunk sewers in Highland Park include the McNichols Sewer, the Woodward Sewer, and the First-Hamilton Relief Sewer. The First-Hamilton Relief Sewer was designed to include wet weather capacity for Highland Park.

These sewers are more fully described in the sections on the Connor Creek and Baby Creek districts earlier in this chapter.

There are no pump stations, control structures, CSO outfalls or CSO basins in Highland Park.

3.13 City of Hamtramck

3.13.1 General Description & History

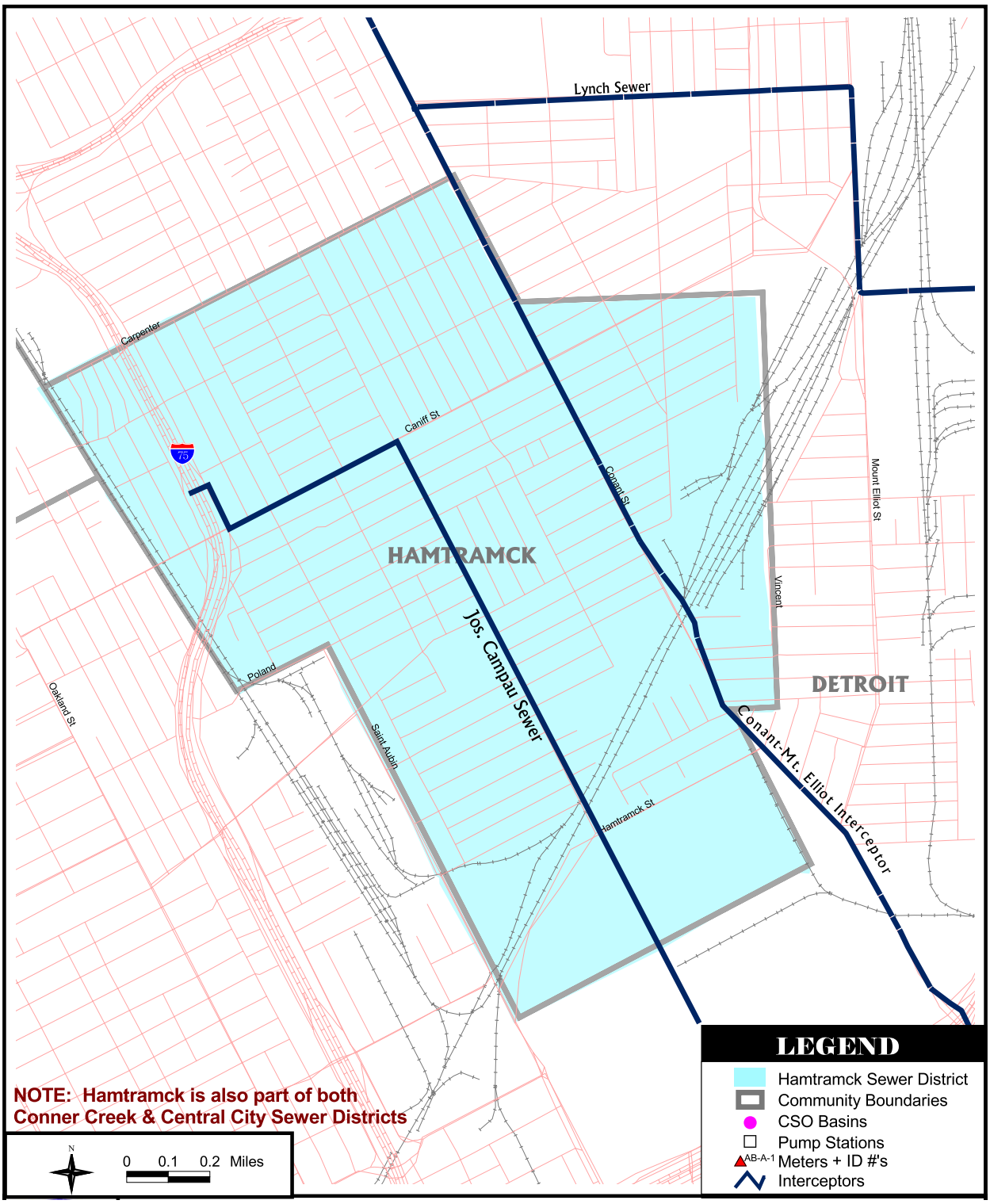
The City of Hamtramck lies to the north of downtown Detroit between Carpenter (north boundary) and Newton (south boundary). The western boundary is Lumpkin and the Grand Trunk Western railway and the eastern is Conant and Vincent. Most of Hamtramck lies in the Central Sewer District.

The city covers an area of 1,337 acres (2.09 square miles). Land use in the city is 53 percent residential; 16 percent commercial, institutional, and office; 19 percent industrial; and 12 percent transportation, utilities, recreation, and other uses. The housing stock is largely wooden single-family homes, built in the 1920s by Polish and German immigrants.

The City of Hamtramck was incorporated in 1922. It was originally on the edge of Detroit but was surrounded when Detroit annexed up to Eight Mile Road in the mid-1920s. Hamtramck was formerly a center of industry and had a peak population of approximately 90,000 in 1930. Since then, industrial activity and population have declined. The Dodge Main Plant, which at one time employed 25,000 people, closed in 1980. The city is currently undergoing financial problems and the State of Michigan has appointed a financial controller to attempt to resolve these problems. Commercial activity in the city has increased in recent years.

Hamtramck's sewer system was constructed in the 1920s as an outlet became available in the De-

City of Hamtramck



troit system. The Hamtramck sewer system is so interconnected with the Detroit system that it is an integral part of that system.

Hamtramck originally made an agreement with Detroit to discharge sewage into Detroit's system in 1928. This agreement included capital and operating charges for past use of Detroit sewers, but the agreement may have expired in 1963. The current agreement came into force in 1942. A contract for indefinite service was signed in August 1941, and states that the charge for sewer service will be based on the water consumption, at the rate of $0.2162 per thousand cubic feet of water delivered. A 1989 settlement requires Hamtramck to pay back arrearages for these sewer service payments.

The contracts between Hamtramck and DWSD allow for acceptance of peak flows up to 1,244.5 cfs. A total conveyance capacity of 337.5 cfs was purchased by Hamtramck, with an additional 907 cfs for a 10-year storm provided in the design of the Conant-Mt. Elliott relief sewer.

3.13.2 Physical Characteristics

The entire system is combined and is reported to be adequate to convey the sanitary flows from the city but not adequate to carry the flow from a 10-year storm or greater. The sewer system is interconnected with the Detroit system and there are no meters installed to measure flow.

Main sewers in the city are the Joseph Campau Sewer and the Conant-Mt. Elliott Relief Sewer. The relief sewer was designed to provide wet weather capacity for Hamtramck.

These sewers are more fully described in earlier sections on the Central and Connor Creek districts.

There are no pump stations, control structures, CSO outfalls or CSO basins in Hamtramck.

3.14 North Huron Valley-Rouge Valley Sewer District

3.14.1 General Description & History

The North Huron Valley-Rouge Valley (NHV-RV) Sewer District serves most of western Wayne County and a small portion of Oakland County. Except for the Oakland County portion, the district is administered by the Wayne County Department of the Environment. The district also currently accepts wastewater from the Western Townships Utility Authority (WTUA). The first agreement between DWSD and Wayne County to serve the communities within the NHV-RV district was signed in 1953. It was amended in 1955, twice in 1961, in 1983, 1984, and 1988. The district covers 274 square miles, an estimated 55 percent of which is sewered. The peak flow allowed for discharge from NHV-RV sewers into the Detroit sewer system is 245.6 mgd (380 cfs).

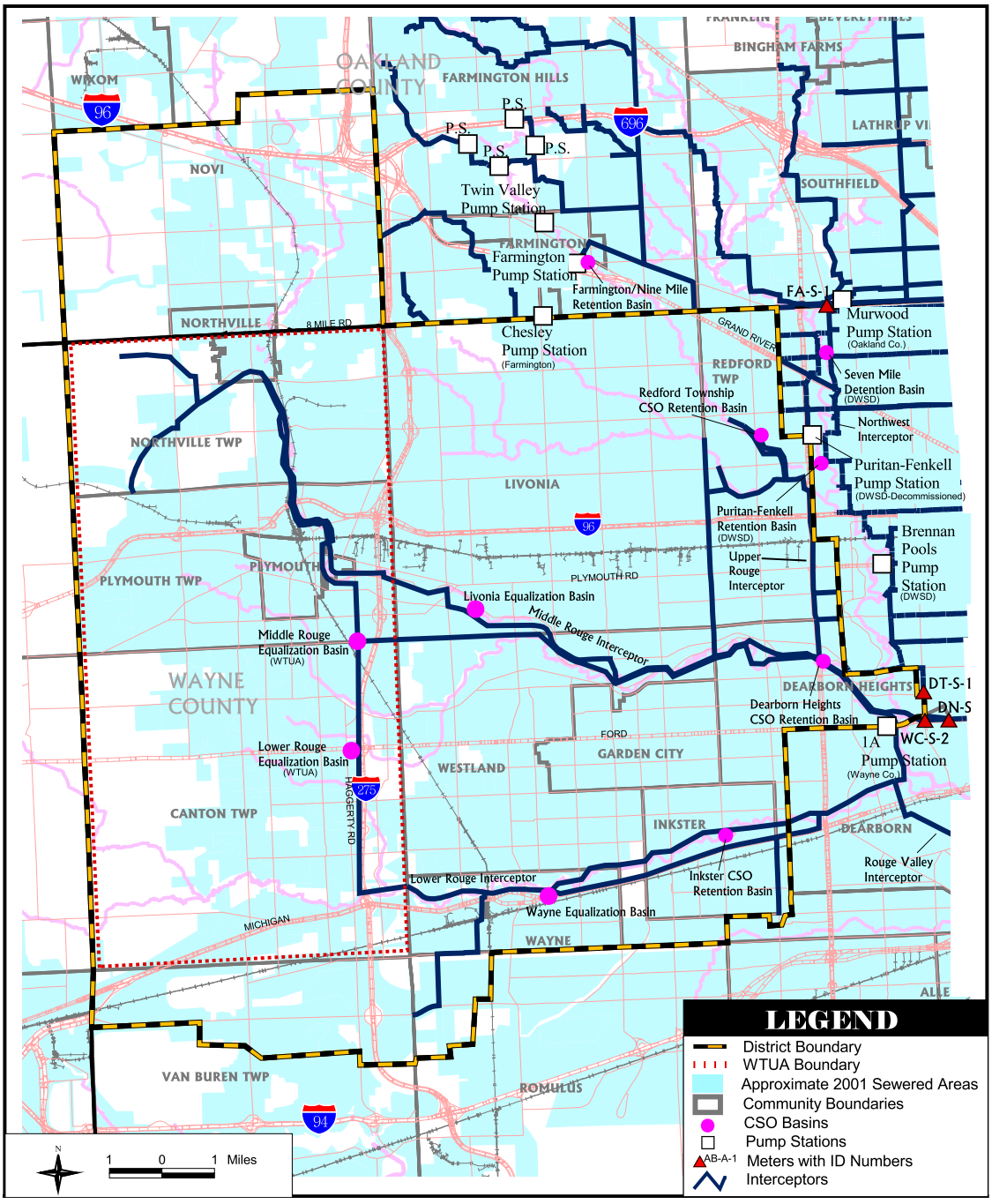
3.14.2 Physical Characteristics

Combined sewer areas in the district are primarily limited to the eastern portion of the district in the oldest communities such as Garden City, Inkster and Livonia. Even in these cities, most of the sewers are separated. The Middle Rouge subdistrict is served by the Upper Rouge and Middle Rouge interceptors, which combine with Detroit's Evergreen Sewer at Ford Road. The Lower Rouge subdistrict is served by an interceptor system that parallels the lower branches of the Rouge River. This interceptor system crosses under the Rouge River at Fort Street and discharges into the Oakwood section of the Northwest Interceptor.

There are numerous overflow points to the Rouge River. DWSD is currently evaluating various CSO facility alternatives for overflows occurring along the Rouge River from Pembroke to the West Warren Siphon outfalls.

A high-level weir is located between the Rouge

North Huron Valley-Rouge Valley Sewer District



Valley Interceptor and the Northwest Interceptor. Junction chambers are located at the intersection of the Middle and Lower Rouge Valley interceptors.

Lift Station 1A, operated by Wayne County, has the capacity to pump from the Middle Rouge Interceptor to the Northwest Interceptor under surcharged conditions. The capacity of the pump station is 250 cfs (164 mgd).

There are several CSO and wet weather flow basins in the district:

Redford Township CSO Retention Basin is located in Redford Township at the intersection of Lola Drive and Puritan Avenue. The facility contains a two-compartment basin of 1.7 million gallons, three catenary-type bar screens, two swirl concentrators, and sodium hypochlorite disinfection sized to treat 180 cfs with a retention time of 20 minutes. The pump station capacity is 16,200 gpm. Overflow from the basin enters the upper Rouge River.

Inkster CSO Retention Basin is owned by the City of Inkster and located on Inkster Road north of Michigan Avenue. The basin serves an area of 833 acres, has a volume of 3.0 MG and was sized based on the 1-year 1-hour design storm with a peak flow of 500 cfs and 20 minutes of detention. It has six constant speed pumps at 45,000 gpm at 30 feet TDH.

Dearborn Heights CSO Retention Basin is owned by Dearborn Heights and is located within the Middle Rouge Parkway. It has eliminated four CSO outfalls. The basin serves an area of 340 acres with volume of 2.7 MG. It was sized for the 10-year 1-hour design storm with a peak flow of 500 cfs and 30 minutes of detention. The basin has six vertical mixed flow pumps each having a pump capacity of 45,000 gpm at 28 feet TDH.

Wayne Equalization Basin, located in Wayne, has a volume of 2.3 MG. It serves an area of 2,849 acres.

Livonia Equalization Basin, located in Livonia, has a volume of 2.2 mg and was sized for the 10-year 6-hour storm. It serves an area of 11,678 acres.

In addition, there are two basins in the district operated by the Western Townships Utilities Authority. The influent is pumped and effluent flows by gravity.

Middle Rouge Equalization Basin: Volume 7.8 MG.

Lower Rouge Equalization Basin: Volume 5.5 MG.

There are 48 regulators in the district nearly all of which are associated with outfalls along the Rouge River and its branches.

3.15 Northeast Wayne County Sewer District

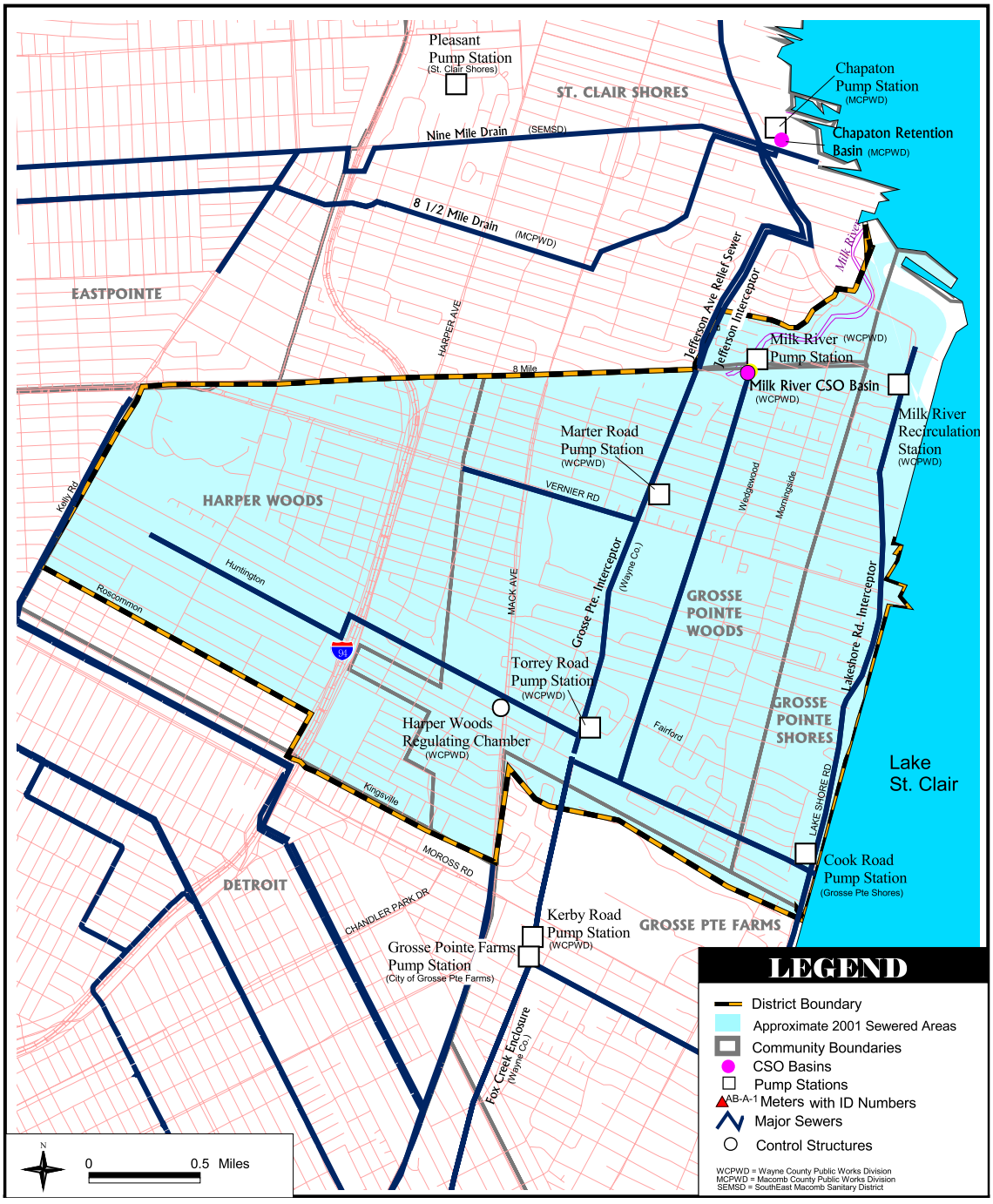
3.15.1 General Description & History

The Northeast Wayne County Sewer District (NEWCSD) consists of the communities of Harper Woods, Grosse Pointe Woods and Grosse Pointe Shores. The district covers all of these communities except a portion of Harper Woods between Roscommon Street and the Detroit boundary. The Milk River Drainage District, located in the NEWCSD, was formed by Harper Woods and Grosse Pointe Woods, communities discharging to the Milk River. The Wayne County Department of Environment, Public Works Division (WCPWD) operates the facilities in both districts from offices located at the Milk River facility. The Northeast Wayne County Drainage Board and the Milk River Drainage Board are the decision-making entities that administer each district.

The district covers 7.63 square miles. Land use is more than three-quarters residential.

Wayne County entered into an agreement with DWSD in 1944 to discharge its wastewater into

Northeast Wayne County Sewer District



Detroit's sewer system. The agreement was subsequently amended in 1957 and 1961. NEWCSD has a peak discharge of 82.1 MGD (127 cfs) to the Detroit sewer system. This maximum discharge includes the flow from the upstream Southeast Macomb Sanitary District, which has a contract with Wayne County Department of Public Works for sewage disposal service.

3.15.2 Physical Characteristics

Grosse Pointe Shores is the oldest community in the district and has both combined and separated sewers. Most of its sewers were constructed between 1949 and 1975, with the largest proportion constructed in the 1950s. Grosse Pointe Woods has combined sewers, as much of the system was constructed before 1929. Harper Woods has separated sewers. A portion of Harper Woods is part of the Detroit system.

The Grosse Pointe Woods and Harper Woods sewer systems discharge to the WCGP Interceptor through the Milk River System. Formed in the 1950s with the construction of the Milk River Pumping Station, the Milk River System is operated by the Milk River Drainage Board and includes the pumping station, a retention basin, and a recirculating pump station at the end of the Milk River on Lake Shore Drive. Overflows from the basin discharge to the Milk River.

Marter Road Booster Station boosts the flow into the WCGP Interceptor during wet weather to the maximum allowed by the DWSD contract. This pump station has three pumps each rated at 36 mgd (55 cfs).

Milk River Pumping Station contains three pumps rated at 5,000 gpm (7.2 mgd, 11 cfs). During dry weather, it collects and lifts dry weather flows for discharge to the WCGP Interceptor. During storms, the pumping station discharges flow in excess of 22 cfs to the 18.5 MG **Milk River Retention Basin**. The **Milk River Recirculation Station** contains two pumps rated at 10,000 gpm (14.4 mgd, 22 cfs).

Torrey Road Pumping Station, operated by Grosse Pointe Woods, pumps sanitary flows from Grosse Pointe Woods to the Milk River Retention Basin. It has two pumps rated at 2,600 gpm (3.7 mgd, 5.7 cfs) and one pump rated at 20,000 gpm (28.8 mgd, 43.9 cfs).

Cook Road Pumping Station operated by Grosse Pointe Shores, has two sanitary and two storm pumps that pump flow from Grosse Pointe Shores to the WCGP Interceptor. Maximum installed capacity is controlled at 2 mgd (3 cfs) to meet contract limitations. There are four outfalls from the Lake Shore Interceptor to Lake St. Clair that overflow when the pumping capacity of the Cook Road Pumping Station is exceeded.

Kerby Road Pumping Station, 127 cfs capacity, is the major discharge point for NEWCSD. The station, located in Grosse Pointe Farms, contains five pumps each rated at 14,200 gpm (20.4 mgd, 31 cfs).

The entire flow from the NEWCSD and the Southeast Macomb Sanitary District, as well as additional flow from Grosse Pointe Farms is lifted to the Fox Creek Enclosure by the Kerby Road Pumping Station. The flow from the Fox Creek Enclosure enters the DWSD Freud Pumping Station and Detroit River Interceptor.

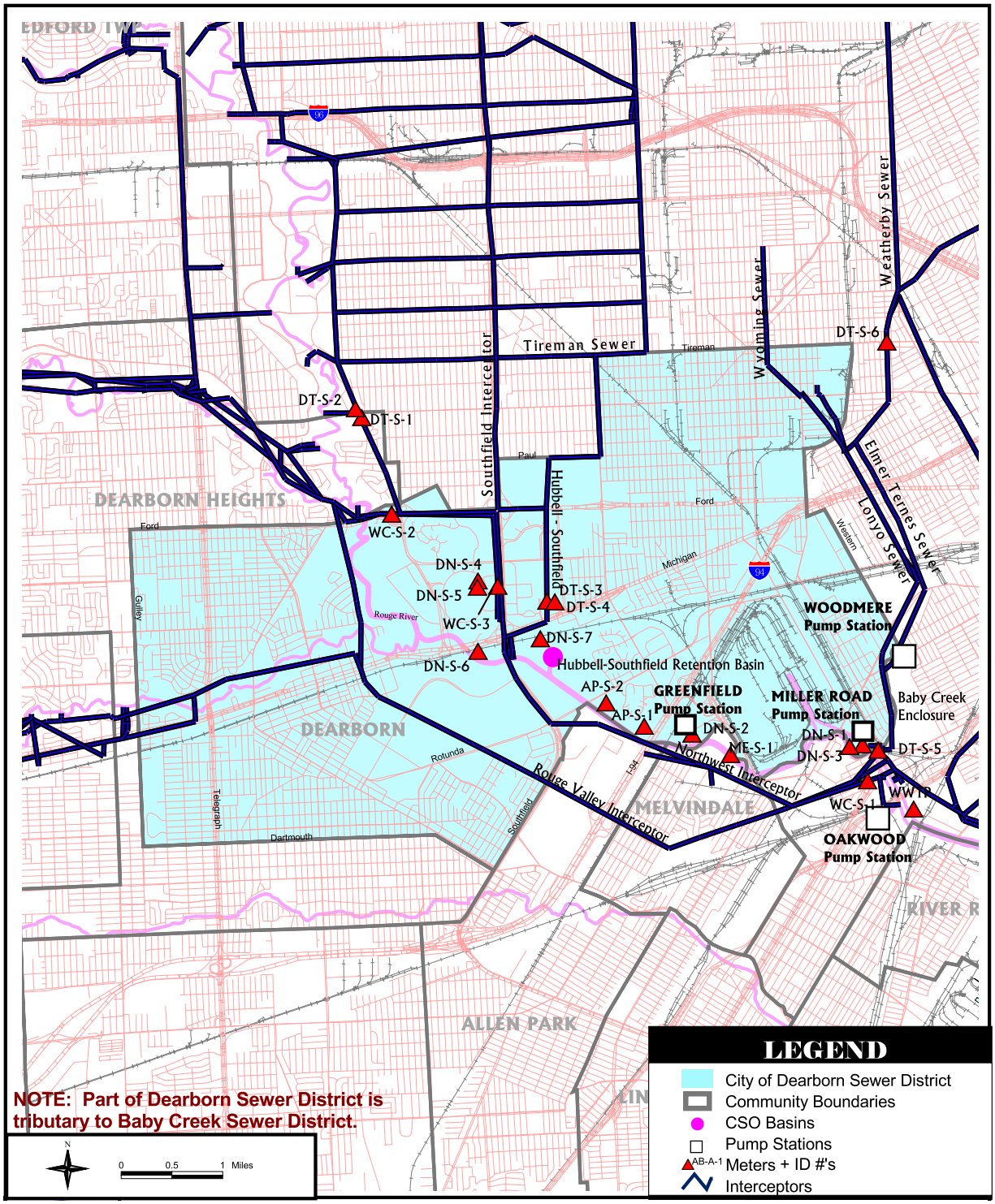
3.16 City of Dearborn

3.16.1 General Description & History

Dearborn is directly south and west of the City of Detroit and is also located at the terminus of the Wayne County interceptor system. It is therefore the location of many important facilities in both systems. To the west of the city is the North Huron Valley - Rouge Valley Sewage Disposal District. To the south are the Cities of Allen Park, Melvindale, Taylor and Romulus.

The city is traversed by the Rouge River and the Lower Rouge River, which lie in the floors of shallow valleys. The ground slopes generally from

City of Dearborn



northwest to southeast, although the topography is very flat, the result of a glacial lake plain formation.

Of the 15,615 acres in the city, approximately 30 percent of land use is residential, 10 percent is commercial, 16 percent industrial, 12 percent institutional, and the remaining 32 percent public right-of-ways, flood-control facilities, and vacant land. The large component of non-residential land use is due to the location of major companies and institutions such as Ford Motor Company, Greenfield Village, Henry Ford Community College, and the University of Michigan-Dearborn campus. The city's major roads include I-94, Michigan Avenue, Ford Road, Telegraph Road, and the Southfield Freeway.

Agreements for sewage flow were reached between Detroit and Dearborn in 1957, 1960 and 1961. Through these agreements, 64.6 mgd (100 cfs) represents the 1998 peak flow allowed for discharge from the Dearborn sewers into the Detroit sewer system. Billing for the City of Dearborn is divided into separate charges for Dearborn East, Dearborn East (storm), Dearborn West, and Dearborn Northeast.

3.16.2 Physical Characteristics

Dearborn's collection system has a total of 456 miles of sewer, most of it constructed before 1940. The existing sewer system is mostly combined - 12,325 acres of combined sewer area and 934 acres of separated sewer area.

There are five sewer districts in the city: East Dearborn, West Dearborn, Northwest Interceptor District, Hubbell Creek District, and Baby Creek District. The last two have traditionally been considered as part of their bordering districts in Detroit.

About 1,500 acres of Dearborn in the northeastern part of the city are in the drainage area of the Baby Creek District, and are unmetered. In addition, some storm flows are unmetered and enter the Detroit combined system. The rest of Dearborn's sewage is metered at two points associated with the two pump stations in the city. These meters are located at the intersection of Miller Road and Dearborn Avenue and at the intersection of Greenfield Avenue and Butler Street.

As of 1980 there were 21 combined sewer overflows, including overflows at diversion chambers overflows at overflow manholes and emergency overflows at the pumping stations. Eighteen diversion structures regulate flow of wastewater into the interceptor system.

To address overflows to the Rouge River, construction of a storage tunnel is being pursued. The original plan for the Dearborn Tunnel consisted of two phases. The final design for Phase I of the tunnel was completed in 1994 and construction on the tunnel began in 1995. This initial design of the Dearborn Tunnel consisted of an approximately 31,000-ft long 18-ft diameter tunnel totaling 65 MG of storage volume. Due to heavy groundwater inflows encountered during construction of the Phase I tunnel, construction was halted. Since the halt of construction, Dearborn has re-evaluated CSO facility alternatives and considered constructing a joint tunnel with Detroit. In 2003, the city decided to construct a separate Dearborn tunnel instead of the joint tunnel.

DWSD-owned wastewater facilities located partially or wholly in Dearborn include the **Hubbell-Southfield CSO Basin** (see Section 3.4), the **Baby Creek CSO Basin** to be constructed (see Section 3.7) and several meters.

There are two pump stations in Dearborn that discharge part of the city's sewage to the DWSD system. These pump stations were converted from wastewater plants that were formerly located at these sites.

Greenfield Road Pumping Station has five submersible pumps, with a total station capacity of 68

cfs (44 mgd).

Miller Road Pumping Station has one pump, providing a firm capacity of 20 cfs (13 mgd).

DWSD-owned facilities in Dearborn include the **Hubbell-Southfield CSO Basin**, the **Baby Creek CSO Basin** and several metering facilities.

3.17 City of Allen Park Sewer System

3.17.1 General Description & History

Allen Park was incorporated in 1957 and covers an area of 4,524 acres or 7.1 square miles. Of this, approximately 1,696 acres, or 2.6 square miles, are served by the Detroit Water and Sewerage Department. Allen Park is bounded on the north and west by Dearborn and Dearborn Heights, on the east by Melvindale and Lincoln Park, and on the south by Taylor and Southgate (24).

The northern third of Allen Park is served by DWSD. It is primarily an industrial area with about 1,000 single-family residences and 500 multi-family units. The southern two-thirds of the city is served by the Wyandotte Wastewater Treatment Plant through a contract with the Wayne County Department of Public Works.

Land use in the city is 51 percent residential, 17 percent commercial, institutional, and office, 11 percent industrial and extractive, and the remaining 21 percent transportation, recreation, and other uses (SEMCOG, 1995). The housing stock was predominantly built during the 1950s and 1960s.

There are three industrial parks in Allen Park. Large industrial companies in the area include Frito-Lay, Inc., Ford Motor Company, and Heublien, Inc. Major roads through Allen Park include the Southfield Freeway, I-94 (Ford Freeway), and Oakwood Boulevard.

Three agreements for sewage disposal were established between Detroit and Allen Park in April 1955, July and August 1959 and June 1974. The peak flow allowed for discharge from Allen Park sewers into the Detroit sewer system is 0.4 cfs per 1,000 persons based on population and the "Industrial Hydraulic Equivalent." The current accepted discharge limit is 7.1 cfs. Occasional excess wet weather flows in the system have resulted in backups from the DWSD connection and basement flooding in some sections of Allen Park. City officials have been meeting regularly with DWSD and MDEQ since February 2001 to discuss the availability of additional capacity. The city has spent over $73 million in recent years to improve its sanitary sewer system and reduce infiltration and inflow.

3.17.2 Physical Characteristics

The sewer system in Allen Park is separated, but footing drains and downspouts are connected to the sanitary system in many areas. The city has undertaken a program to require disconnection of downspouts and footing drain removal during renovations.

Flow from the Allen Park sewer system is discharged into the Northwest Interceptor through two connection points, AP-S-1 and AP-S-2. Flows at AP-S-1 are measured using an Accusonic meter installed in November 2001. This connection has an overflow relief outfall to the Rouge River that was included in the system design and remains in place today.

There are three pump stations upstream of the APS-1 outlet: **Outer Drive and I-94**, **Lawrence Avenue**, and **Watson Avenue**. The pump station at Outer Drive and I-94 lifts flows for gravity discharge into the Northwest Interceptor at APS-1. The pump station has two pumps, each at 3.6 mgd (5.6 cfs). Recent inspections indicate that an internal flap gate is rusted shut, and it is not likely that recent wet weather events have produced SSOs to

the Rouge River through this pathway. During heavy rain events, however, to prevent basement flooding, the city has to pump excess sewage to the North Branch of Ecorse Creek using portable equipment.

The flows at APS-2 are measured by a recently installed 10-inch magnetic flowmeter. There is no provision for an overflow at this location.

Allen Park is evaluating alternatives that will minimize basement flooding and sanitary sewer overflows that the district has experienced over the last three decades.

3.18 City of Melvindale

3.18.1 General Description & History

Melvindale was incorporated in 1932. It is bordered on the east by Detroit, on the west by Allen Park on the north by Dearborn, and on the south by Allen Park and Lincoln Park. Several manufacturing facilities are located in the city.

The area of the city is 1,728 acres. Land use in the city is 37 percent residential, 17 percent commercial, institutional, and office, 18 percent industrial, 16 percent transportation, communication, and utility and the remaining 12 percent recreation, open land, and other uses. The housing stock is primarily bungalows and ranches built in the 1920s to 1960s. A large number of residences were constructed in the early 1940s.

Major roads in the area include I-94, I-75, Greenfield Road, and Oakwood Boulevard. The Rouge River runs near the northern border of the city, and the Ecorse River runs along its southern border.

The first agreement for Detroit to accept Melvindale's sanitary flow was established in 1955. This agreement was amended in 1965 and 1969. A final agreement in 1977, allows a maximum flow of 0.5 cfs per 1,000 population, based on the most recent census. Sanitary plus infiltration/inflow to the sanitary system are accepted as long as this limit is not exceeded. Melvindale must meter all flows which must be pumped into the Northwest Interceptor in Greenfield Road west of Wall Street. The rental charge for the Marathon Oil Company sewer line was increased.

3.18.2 Physical Characteristics

Construction began on the sewer system in Melvindale in 1929 as a separated system with residential footing drains connected. The original system discharged directly to the Rouge River, but was eventually connected to the DWSD Northwest Interceptor through the Melvindale Pump Station. This connection included an emergency river bypass for surcharged conditions.

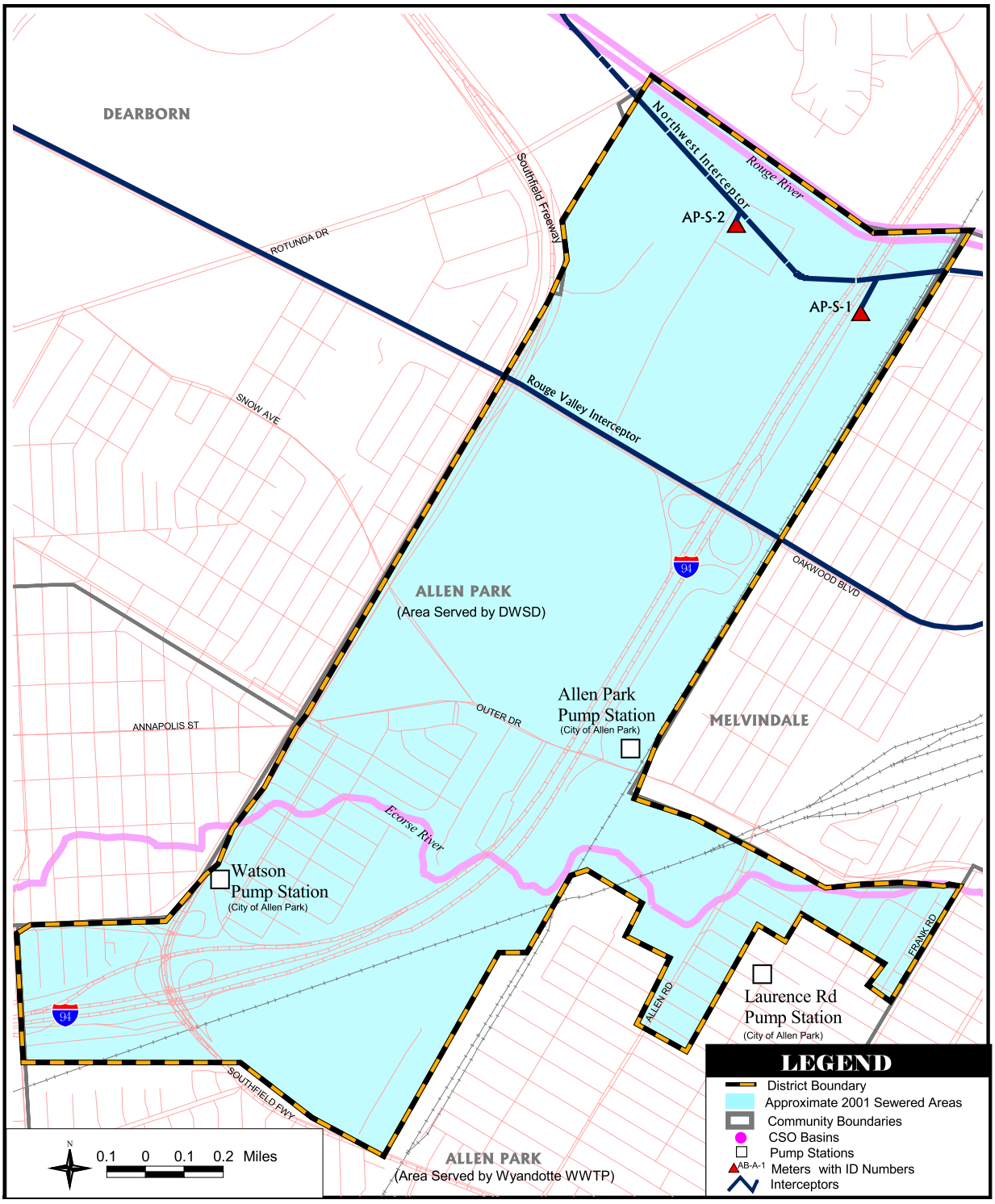
The original Melvindale Pump Station was located along the banks of the Rouge River near Greenfield Avenue and Wall Street. In 1966, the deteriorating pump station was replaced. The new pump station was located a few hundred feet away. As there was potential damage to the aging interceptor, Melvindale was required to use the existing tap into the Northwest Interceptor. This required a 16-inch force main from the new pump station up to the original pump station location. The original emergency bypass to the Rouge River is still available for surcharged conditions.

Melvindale Pump Station has two 4,000 gpm pumps and one 2,000 gpm pump. Sanitary flow is pumped into the Northwest Interceptor through a 16-inch connection at Greenfield Road, 400 feet west of Wall Street. There is a 14-inch magmeter originally installed in 1983 at this location to measure flow to DWSD.

Seaway Lift Station, located at 19140 Seaway, is also owned and operated by Melvindale. This lift station has two small pumps with unknown capacities.

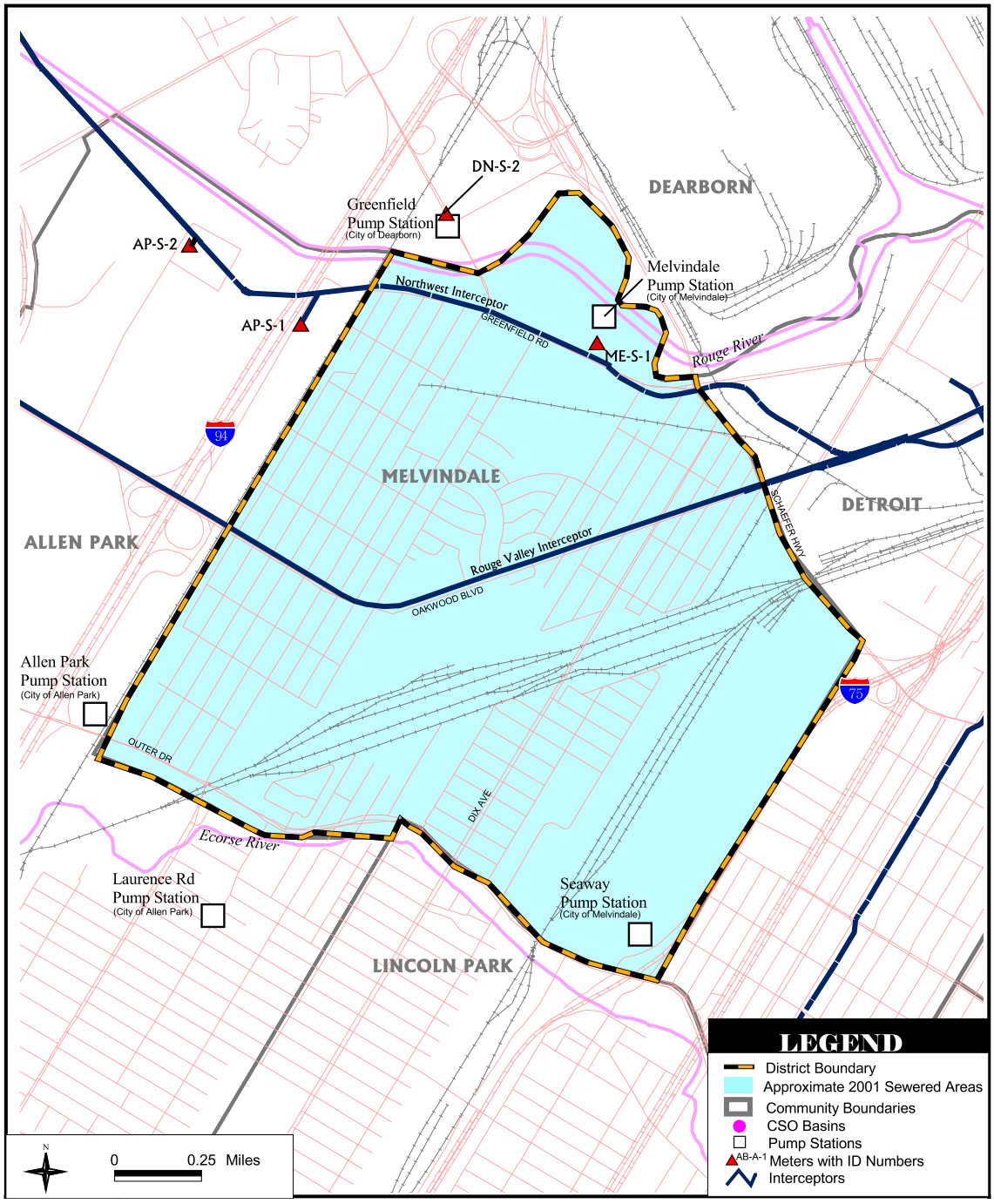
Under wet weather conditions, the new pump station is operated at about 15 cfs and is able to force

City of Allen Park



flows into the Northwest Interceptor. During three rain events over the last five years, Melvindale has opened the emergency bypass to the Rouge River in order to reduce basement backups occurring during upstream surcharging. By opening the bypass, the pumps were able to operate at about 18 cfs. Two SSO overflows have been reported to MDEQ in the last two years, but one of these overflows was due to a maintenance issue.

City of Melvindale



3.19 City of Grosse Pointe

3.19.1 General Description & History

The City of Grosse Pointe was incorporated in 1934 and covers 845 acres (1.32 square miles). The sewer service area is approximately 691 acres. Grosse Pointe is bounded on the east and west by Grosse Pointe Farms and Grosse Pointe Park, respectively. To the north of the city is Detroit and to the south is Lake St. Clair.

Grosse Pointe is a fully developed residential community with virtually no industry. Land use in the city is 86 percent residential (less than 1 percent multi-family housing), 12 percent commercial, institutional, and office, and the remaining 2 percent is cultural, recreation, and other uses.

Main streets are East Jefferson Avenue and Kercheval Street. There are no highways through the city.

The agreements between Detroit and all Grosse Pointe communities for sewage flow and treatment were established in 1938 and 1940. The agreements were amended in 1941. Based on the agreements, DWSD treats sanitary flow from Grosse Pointe communities entering the Detroit system from the Fox Creek Enclosure. Grosse Pointe sewers are allowed a peak flow of 543 mgd (840 cfs) for discharge into the Detroit system.

3.19.2 Physical Characteristics

The sewers in Grosse Pointe were mostly constructed prior to 1965, with a large portion constructed between 1930 and 1950. There are approximately 244,000 feet of sewers ranging in size from six-inch diameter to 63-inch by 98-inch arch pipe. The smaller sewers (less than 18-inch diameter) are mostly vitrified clay pipe, while the larger sewers are predominantly reinforced concrete pipe. Infiltration and inflow in the system are affected by levels in Lake St. Clair.

Grosse Pointe's sewer system is about 70 percent separated and 30 percent combined. The area north of Waterloo (one block north of Kercheval) has combined sewers. However, only a few blocks are true combined sewers, and the rest of the system in this area consists of separate storm and sanitary sewers which discharge to a common interceptor. The sanitary and storm flows from this area enter the Grosse Pointe Neff Road Pumping Station via this interceptor and are pumped to DWSD's Fox Creek Enclosure.

The area south of Waterloo has separated sewers with storm sewers discharging to Lake St. Clair through twelve storm outfalls. Sanitary sewers flow to the north and discharge into the main interceptor taking flows to the Grosse Pointe Neff Road Pumping Station.

Grosse Pointe Neff Road Pumping Station contains two small sanitary pumps and four large storm pumps with a total discharge capacity of 294 cfs. The pumping station discharges flows into the Fox Creek Enclosure.

3.20 City of Grosse Pointe Farms

3.20.1 General Description & History

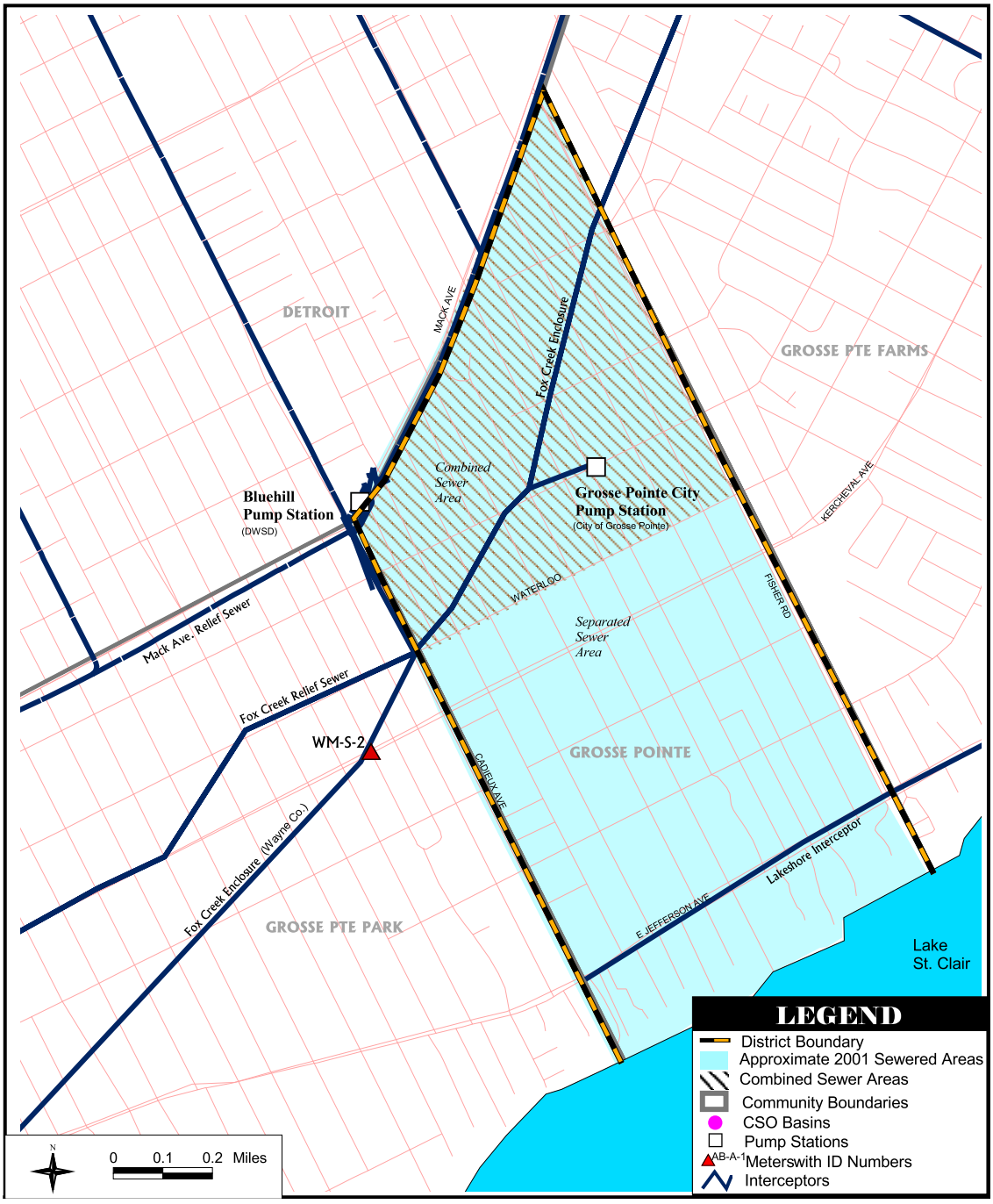
Grosse Pointe Farms is an established residential community incorporated in 1949, with an official area of 2,041 acres (3.19 square miles). The sewered area is 1,429 acres (2.2 square miles). The community is fully developed and has no significant industry.

Grosse Pointe Farms is bounded on the north by Detroit, on the south by Lake St. Clair, on the east by the North East Wayne County Sewer District and on the west by Grosse Pointe.

Land use in the city is 75 percent residential, 9 percent commercial, institutional, and office, 1 percent transportation, communication, and utility, and the remaining 15 percent is cultural, recreation, and other uses.

Main streets in the district are Lake Shore Road,

City of Grosse Pointe



Kercheval Avenue, and Moross Road. There are no highways through the city.

The topography of the area is fairly level, except for a low plateau rising about 25 feet from the shore in the southeastern section of the city. The underlying soils are mostly clay and sandy clay with seams of sand or gravel. These seams are especially common between Grosse Pointe Boulevard and the lake.

The agreement between the Detroit and the Grosse Pointe Farms area for sewage flow was reached in 1938 and amended in 1941. The agreement for sewage treatment was established in 1941, followed by amendments in 1943 and 1947. Dry weather flow from Grosse Pointe Farms and storm flow from a portion of the city discharges into the Fox Creek Enclosure at the Grosse Pointe Farms Kerby Road Pumping Station. The contract agreements with Detroit provide for transport and treatment of all flows entering Detroit through the Fox Creek Enclosure. The peak flow allowed for discharge from Grosse Pointe Farms sewers into the Detroit sewer system is 358 mgd (553.8 cfs). This is equivalent to the current pumping station capacity.

3.20.2 Physical Characteristics

The sewer system in Grosse Pointe Farms was originally a totally combined system divided into two distinct areas, the Lake Area and the Fox Creek Area. The Lake Area is mostly east of Ridge Road. The Lake Area drains to an interceptor in Lake Shore Drive. An interceptor in Kerby Road conveys wastewater from the Lake Shore interceptor to the Grosse Pointe Farms Pumping Station. In the past, during wet weather events the combined sewage from the Lake Area overflowed through a number of outfalls to Lake St. Clair. The city separated 800 acres of combined sewered area, a project that was completed by the end of 2002. Most of the area to be separated is in the Lake Area, south of Ridge Road and east of the Country Club of Detroit.

The Fox Creek area lies to the west of Ridge Road. All of the wastewater from this area discharges to the Grosse Pointe Pumping Station and does not overflow to the lake.

Grosse Pointe Farms (Kerby Road) Pumping Station at 305 Chalfonte, contains eight pumps, and has a capacity of 554 cfs. The pumps vary in size from two 2,000 gpm sanitary pumps to two large 75,000 gpm storm pumps. Flow entering the wet well is pumped into the Fox Creek Enclosure. The flow into Detroit's sewer system is not metered, but is estimated with pumping records.

Kerby Road Pumping Station at 315 Chalfonte, located in Grosse Pointe Farms and operated by Wayne County, transfers flows from the Northeast Wayne County Sewer District and the Southeast Macomb Sewer District to the Detroit system. The station contains five pumps each rated at 14,200 gpm (20.4 mgd, 31 cfs).

3.21 City of Grosse Pointe Park

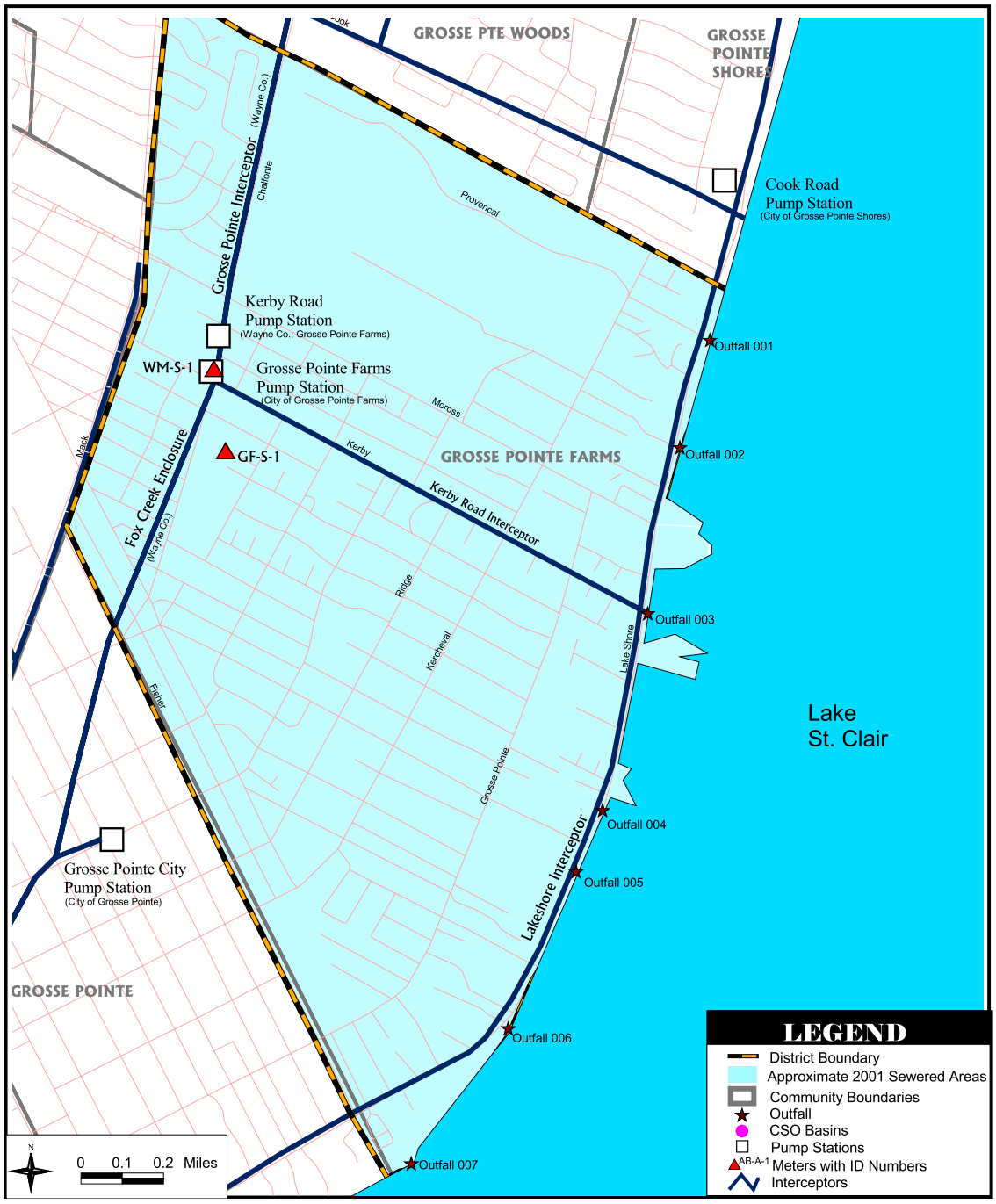
3.21.1 General Description & History

Grosse Pointe Park, like the other Grosse Pointe communities, is primarily a residential community. Grosse Pointe Park developed rapidly in the 1920s and 1930s as a suburban residential area close to Detroit, but was not incorporated as a city until 1950. By 1970, the peak population was reached, and it has declined since then.

The city covers 1,734 acres (2.71 square miles) and is bordered on the north and west by Detroit, on the south by Lake St. Clair and on the east by Grosse Pointe.

Grosse Pointe Park is a residential area with no significant industry. Land use is 92 percent residential (less than 1 percent multi-family housing), 4 percent commercial, institutional, and office, and the remaining 2 percent cultural, recreation, and other uses.

City of Grosse Pointe Farms



Topography is flat to gently rolling, with ground slopes ranging from 0 percent to 2 percent, but typically 0.1 percent to 0.3 percent. Main streets are East Jefferson and Kercheval. There are no highways through the city.

The agreement between the cities of Detroit and Grosse Pointe Park was established in 1938 for acceptance of sewage flow and amended in September 1940 for sewage treatment. These agreements provide for the transportation and treatment of combined sewage flows up to 54.3 mgd (84 cfs) to the Detroit River Interceptor.

3.21.2 Physical Characteristics

Grosse Pointe Park until recently had a combined sewer system, consisting of high-level lateral and interceptor sewers and low-level relief interceptors. In general, the laterals run in a north-south direction. Sewers south of Jefferson Avenue drain north to the interceptor that follows this road. Sewers between Jefferson and Mack drain south to Jefferson. The entire system drains to the Grosse Point Park Pumping Station on Jefferson at Maryland Avenue.

Two interceptors in Jefferson Avenue transport sewage from the laterals westward to the pumping station. One is a high-level sewer and the other low-level, with numerous interconnections. The shallower interceptor is a continuation of the Detroit River Interceptor (DRI), but the interceptor is bulkheaded by a permanently-closed backwater gate at Wayburn Avenue, to force flow to the pumping station. A 16-inch force main and 48-inch sewer connect the pumping station to the DRI beyond the bulkhead. Although the DWSD's Fox Creek Enclosure crosses the city, it is not part of the city's sewer system. The city sewers cross under the enclosure by means of inverted siphons.

The total length of sewers in the city is estimated at 49 miles. The high-level interceptors were constructed between 1912 and 1926, while the deep relief interceptors were constructed between 1938 and 1956. Many of these interceptors are of elliptical brick construction.

When the sewer system in Grosse Pointe Park was combined, the storm pumps would discharge excess flows to the Fox Creek Channel and eventually the Detroit River. These flows often ended up overflowing the channel and entering the property of residents in Creekside, a neighborhood in Detroit bordering Grosse Pointe Park. As a result of legal action taken by residents of this neighborhood, the sewer system in the city was separated and a storm water pump station was constructed in Patterson Park.

Patterson Park Storm Water Pumping Station eliminated overflows to Fox Creek in 2000. There are seven pumps in the station: one storm pump rated at 1.44 mgd (0.93 cfs); two storm pumps each rated at 32.40 mgd (21 cfs) and four storm pumps each rated at 86.40 mgd (55.8 cfs).

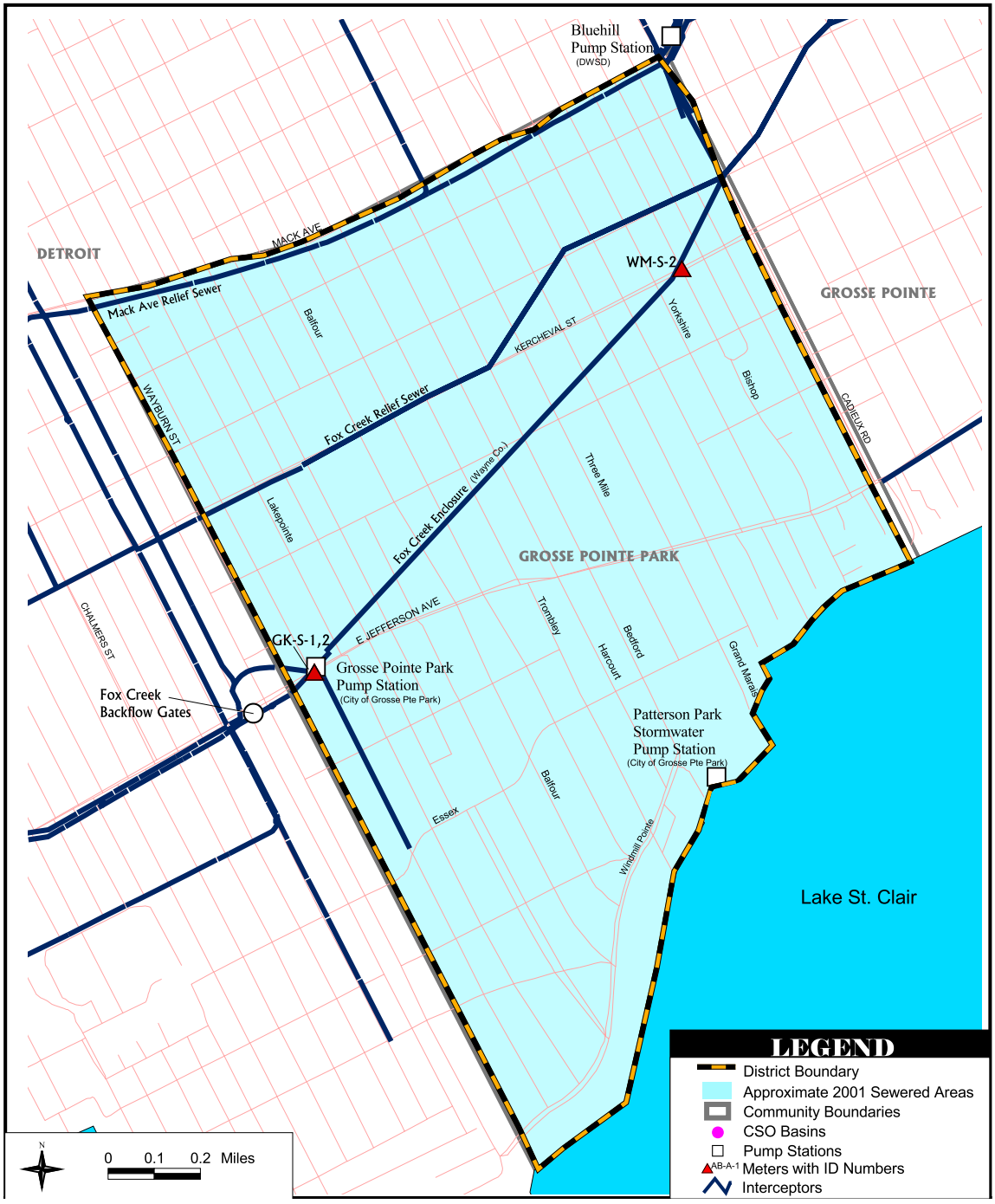
Grosse Pointe Park Pumping Station collects wastewater flows and pumps them to the DWSD system. The pump station was originally constructed in 1939, and expanded in 1961. There are eight pumps in the station: three sanitary pumps each rated at 2 mgd (3 cfs); three storm pumps each rated at 23 mgd (35.5 cfs) and two storm pumps each rated at 97.2 mgd (150 cfs). The three sanitary pumps and two smaller storm pumps discharge to the DRI. Before the sewer separation, the two large storm pumps discharged through the Alter Road Outlet Conduit to the Fox Creek Canal.

3.22 Other Small Wayne County Districts

3.22.1 General Description

There are a few small areas in Wayne County that have separate service contracts with DWSD and are considered separate contractual districts, even though they are part of larger areas. These are located in Dearborn Heights, Redford Township,

City of Grosse Pointe Park



and Harper Woods.

Wayne County Area #3 (Wayne County School District No. 2): This 49-acre area within Dearborn Heights has a 1998 estimated population equivalent (used for flow estimation) of 257. Sewers are combined. The original 1950 contract between Wayne County Board of Road Commissioner and DWSD provided for the connection by Dearborn Township of a 6″ sewer from the premises of School District No. 2 to Detroit's Warren Avenue sewer. The property was located on the east side of Ann Arbor Trail approximately 500 feet south of Warren Avenue. This area is now part of Dearborn Heights.

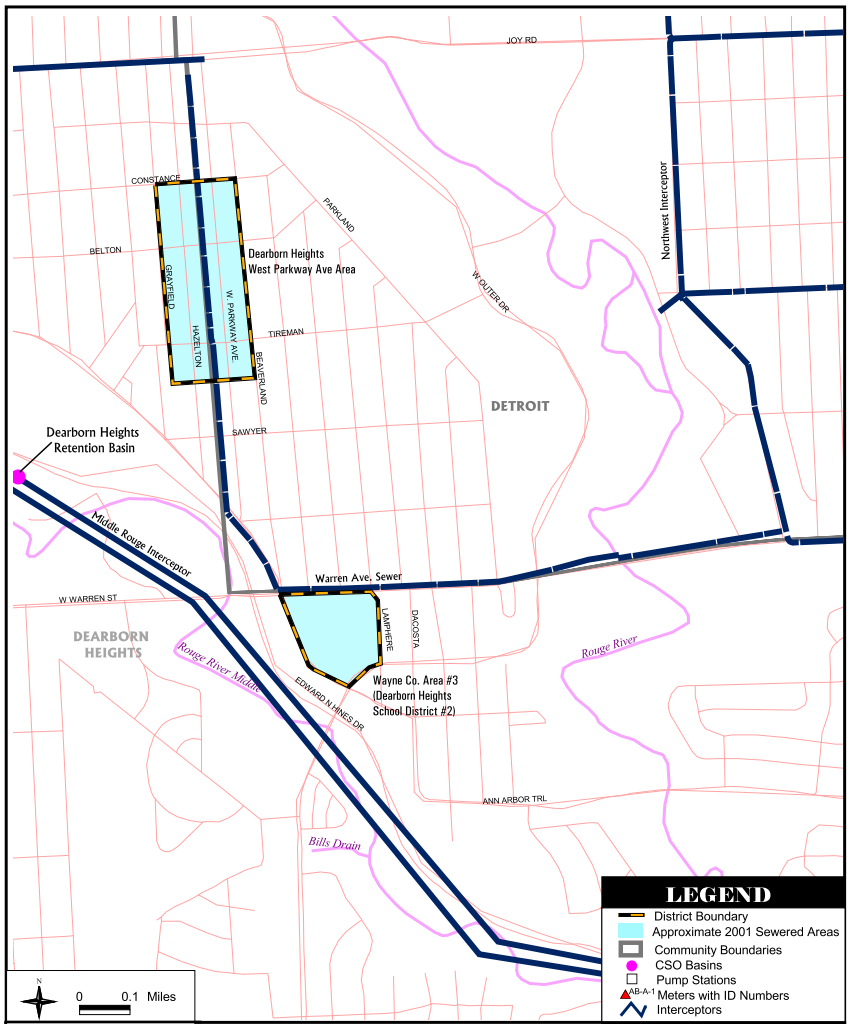
Other Dearborn Heights Contracts: In addition to the above area, a 1995 list of contracts from DWSD includes two other contracts with Dearborn Heights: A 1949 sewer use agreement for West Parkway Avenue, and a 1950 disposal agreement for the Warren Avenue Sewer. There is also a 1966 sewer use agreement between DWSD and Dearborn Heights for dry weather discharges to the Warren Avenue Sewer.

Wayne County Area #6 (Redford District 6): This 80-acre area in Redford Township has an estimated 1998 population equivalent of 900. Sewers in this area are combined. The original contract between the Wayne County Board of Road Commissioners and DWSD was signed in 1951. In the agreement, Redford Township was to construct a connecting 30″ sewer to the 6′-3″ Six Mile Road sewer.

Redford Township - 7 Mile and Grand River Area: There is another 47-acre section of Redford Township that has an estimated 1998 equivalent population of 841. The sewers in this area are combined. The contract for service to this area was signed between Detroit and Redford Township in 1935 for a connection to the sewer at Seven Mile and Grand River Avenue.

Section of Harper Woods between Roscommon and Kings-

Dearborn Heights Small Contract Areas



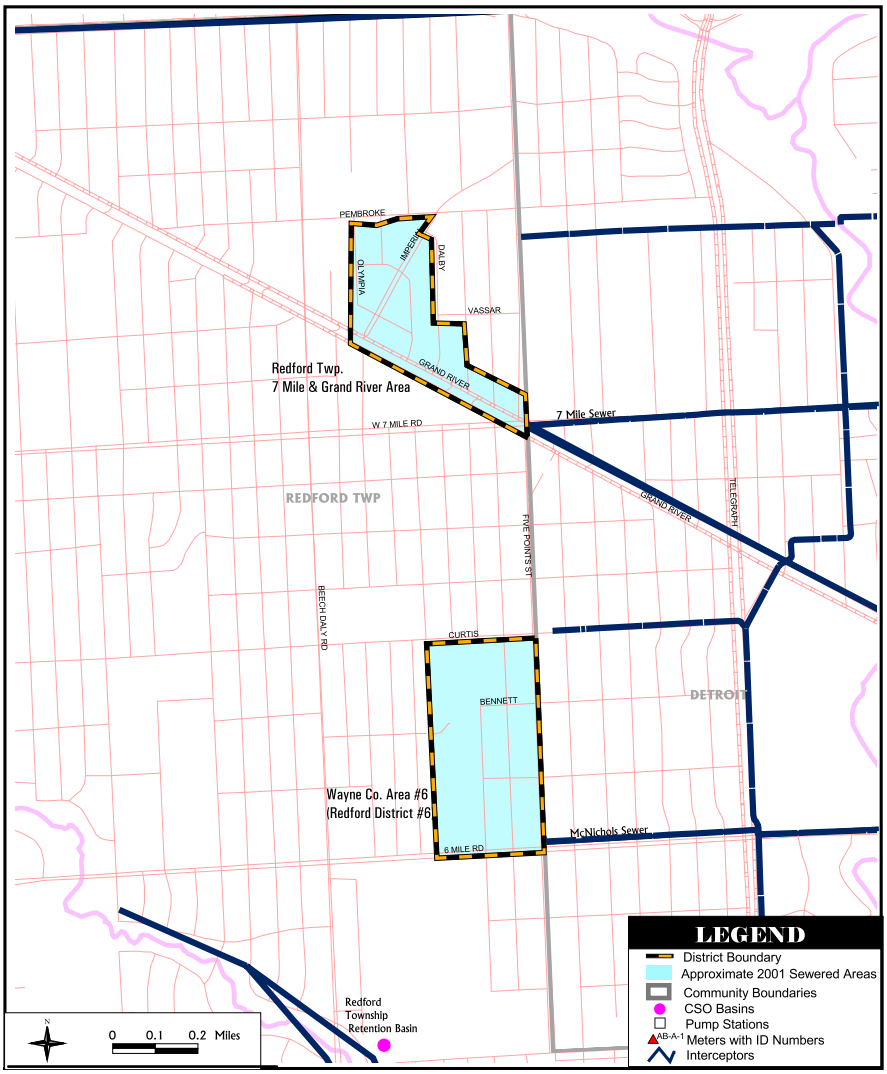
ville Roads: This 195-acre section of Harper Woods drains to the Detroit system and is not included in the Northeast Wayne County Sewer District. This area has an estimated population of 1,703 and has mostly combined sewers. The 1958 agreement between DWSD and Harper Woods replaces an earlier agreement with Gratiot Township for sewer service. See map of Northeast Wayne County Sewer District on Page 3-31.

3.22.2 Physical Characteristics

Separate and combined sewer areas are described above. These areas do not have any other significant infrastructure features such as interceptors, CSO basins, or other structures.

The flows from these areas are not metered, as most contracts contain an initial lump sum and/or annual lump sum charge for service. The Harper Woods contract, however, bases payment on water usage.

Redford Township Small Contract Areas



3.23 Evergreen-Farmington Sewage Disposal District

3.23.1 General Description & History

The Evergreen-Farmington Sewage Disposal District (EFSDD) is directly north of Detroit in Oakland County. The system serves 130 square miles in the communities of Bingham Farms, Bloomfield Hills, Bloomfield Township, Farmington Hills, Keego Harbor, Lathrup Village, Franklin Village, Auburn Hills, Orchard Lake Village and parts of Beverly Hills, Birmingham, Farmington, Southfield, Troy, West Bloomfield, and Sylvan Lake. The office of the Oakland County Drain Commissioner operates the EFSDD sewer system. The EFSDD originally consisted of the Evergreen and Farmington subdistricts.

Land use in the district is primarily residential with some commercial, office facilities and light industrial. The western part on the district, particularly the northwest, is still undergoing development. The area slopes generally to the southwest and varies in elevation from 1,000 feet to 640 feet.

The first agreement between Detroit and Oakland County for EFSDD sewage flow and treatment was established in 1958 and amended in 1963 and 1984. Peak flow allowed for discharge from EFSDD sewers into the Detroit sewer system is 109.9 mgd (170 cfs).

3.23.2 Physical Characteristics

There are approximately 913 miles of sewers in the district ranging in size from 8" to 78". About 203 miles are trunk sewers and interceptors; about 710 miles are local sewers. Dry weather flow from EFSDD is conveyed by interceptors extending south from the Farmington and Evergreen subdistricts to the East-West Interceptor on Eight Mile Road. The East-West Interceptor is connected by the Evergreen–Farmington Relief Sewer to the First-Hamilton Relief Sewer in Detroit. Originally the EFSDD discharged to the Southfield Sewer in Detroit. However, this outlet was limited in capacity and there were frequent overflows to the Rouge River. In 1984, the Evergreen-Farmington Relief Sewer was constructed between the First-Hamilton Sewer and the North Interceptor/East Arm to transport dry as well as wet weather flows to the Detroit Wastewater Treatment Plant. There is one regulator structure at the connection of the Evergreen-Farmington system to the Southfield Sewer. It is normally closed, but it can be operated to divert flows to the Southfield Sewer if needed for maintenance or other reasons.

Most of the EFSDD sewer system has separated sewers with a small portion of combined sewers in Birmingham and parts of Bloomfield Hills. Some areas of the district with separated sewers have footing drains connected to the sanitary sewers.

The areas with combined sewers discharge to new CSO control basins. Basins in the district are:

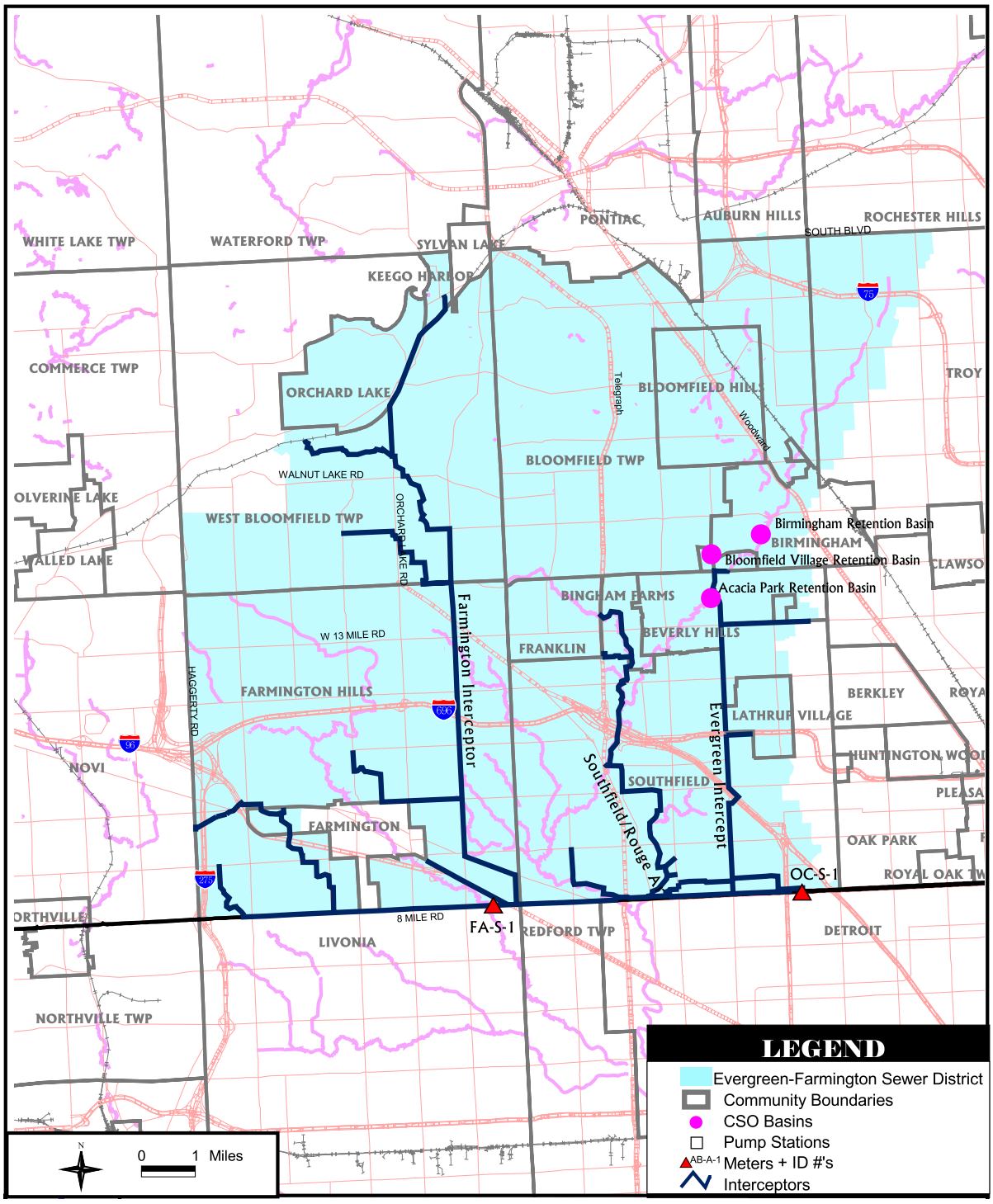
Birmingham Retention Basin and Tunnel is located east of Shirley Drive and north of Lincoln Avenue in Linden Park. The basin has a volume of 5.5 MG and treats a peak flow of 330 cfs. The basin serves an area of 1185 acres. Operation of the Birmingham Basin began in December 1997.

Acacia Park Retention Treatment Basin, completed in 1997, is located within the Douglas-Evans Nature Preserve, north of Ronsdale Drive, west of Evergreen Road. The basin is owned by the Village of Beverly Hills, has a volume of 4.0 MG and treats a peak flow of 290 cfs. The basin serves an area of 816 acres.

Bloomfield Village Retention Treatment Basin, completed in 1997, is located on Lincoln Hills Golf Course, has a volume of 10 MG, is sized for a peak flow of 700 cfs and serves an area of 2,325 acres.

Lathrup Village Equalization Basin, located at Evergreen and I-696, is owned by Lathrup Village and began operating in 1992. It is a sanitary reten-

Evergreen-Farmington Sewer District



tion tank and therefore has not eliminated any CSO outfalls. It has a volume of 3.0 MG, is sized for the 25-year 24-hour design storm with a peak flow of 18 cfs (the influent pumping rate) and serves an area of 950 acres.

The Murwood Street Pumping Station is located on Eight Mile in Southfield and pumps flow to DWSD's First-Hamilton Relief Sewer via the Evergreen-Farmington Relief Sewer. Other pumping stations in the district are the **Morris Lake Arm Relief, Walnut Lake #1, Walnut Lake #2, Walnut Lake #3 and Farmington Hills.**

There are three overflow structures from the EFSDD to the Evans Ditch, which drains to the Rouge River.

3.24 Southeast Oakland County Sewage Disposal District

3.24.1 General Description & History

The Southeast Oakland County Sewage Disposal District (SOCSDD) is directly north of Detroit in Oakland County. The district is approximately 41,960 acres and serves the cites of Berkley, Clawson, Ferndale, Hazel Park, Huntington Woods, Madison Heights, Oak Park, Pleasant Ridge, Royal Oak and Royal Oak Township. It also serves parts of the cities of Birmingham, Southfield, Beverly Hills and Troy. The Oakland County Drain Commissioner administers the district.

Land use is primarily medium- to high-density single dwellings and commercial and light industrial.

The original agreement between Detroit and Oakland County for SOCSDD sewage flow and treatment was established in November 1962 and amended the next month. The maximum rate and peak flow allowed for discharge into Detroit's sewer system is 168 mgd (260 cfs).

3.24.2 Physical Characteristics

There are approximately 136 miles of sewer in the SOCSDD service area, ranging in size from eight inches to 15 feet. Combined sewers serve about 60 percent of the service area.

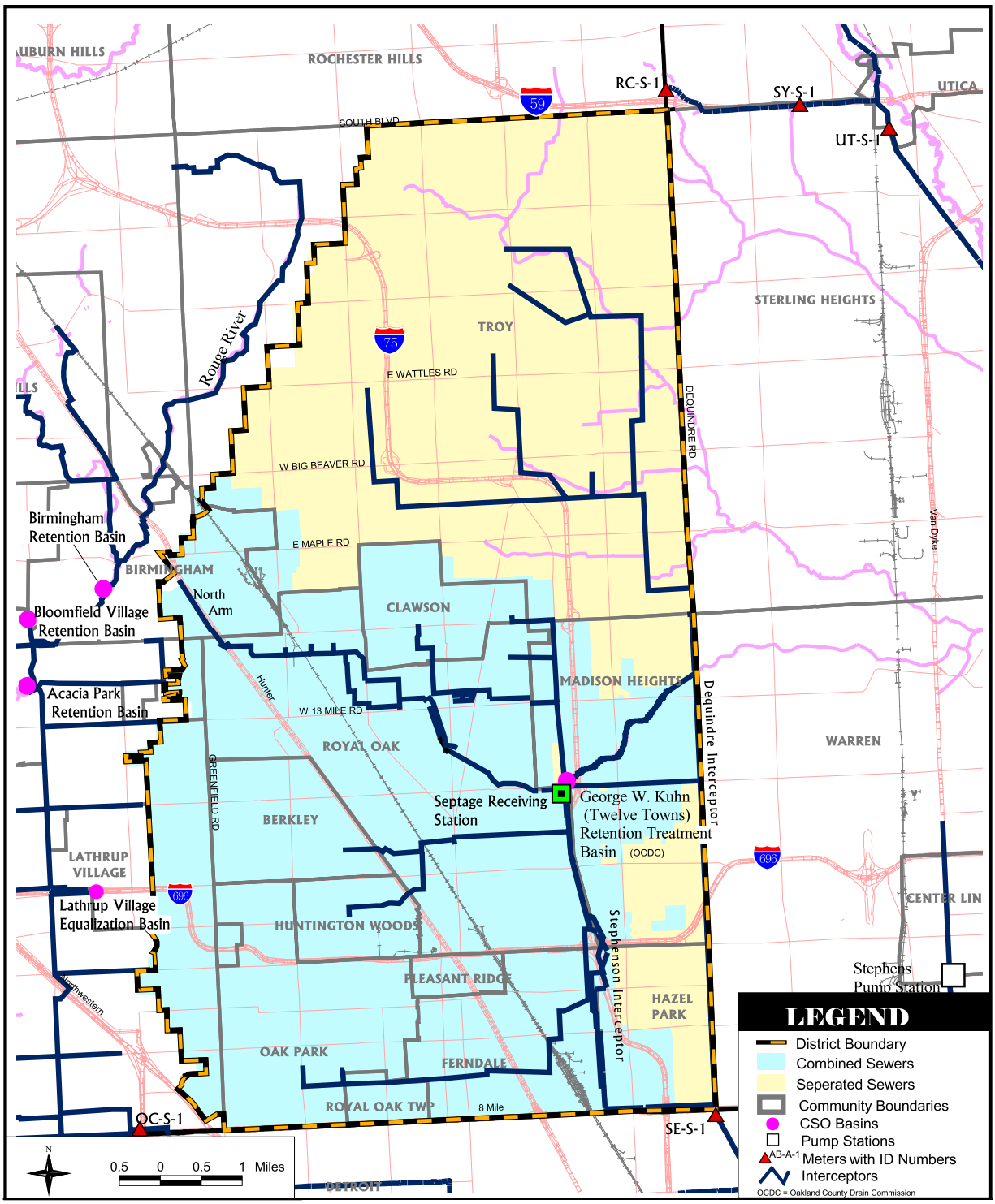
The SOCSDD discharges through the Dequindre Interceptor to the Conant-Mt. Elliott Relief Sewer for transport via the North Interceptor-East Arm and Detroit River Interceptor to the Detroit Wastewater Treatment Plant. Flows to DWSE are measured through a 66-inch magnetic flow meter located at the intersection of Dequindre and Conant.

Flows to the Dequindre Interceptor are from the following drainage areas:

- The Twelve Towns Drainage District which drains facilities approximately 24,000 acres upstream of and including the inlet weir to the George H. Kuhn Retention Treatment Facility.
- George W. Kuhn Drainage District, which is downstream of the existing inlet weir to the to the George H. Kuhn Retention Treatment Facility, including the existing facility and the new intermediate weir structure. The district also includes the Hazel Park 10-Mile Sewer, the Madison Heights parallel storm sewers, and the Madison Heights CSO reroute.
- Separated sewer areas in Troy, Hazel Park and Madison Heights.

The original combined sewer portion of the SOCSDD originally discharged to a branch of the Red Run Drain that ultimately drains to the Clinton River. This was known as the Twelve Towns Drain, because portions of twelve municipalities discharged their combined sewage to it. Interceptor sewers were constructed later to carry the dry weather flow to the sewer system. The system can still overflow to the Red Run Drain under wet weather conditions. In 1973, the Twelve Towns Retention Treatment Facility was constructed to eliminate additional CSO discharges. Now re-

Southeast Oakland County Sewer District



named the **George W. Kuhn Retention Treatment Facility,** it has a volume of 62 MG, but has 32 MG of in-system storage upstream of the inlet weir. Modifications now underway include a volume increase of 126 MG, including an additional 33 MG of in-system storage upstream of the existing inlet structure. The peak flow will be 6,700 cfs and the detention time will be 31 minutes. A new dewatering pump station, additional weir modifications, new sodium hypochlorite storage building and disinfection system, automatic flushing system, and a new fine-screening system will be added. Two to four additional CSO outfalls will be eliminated. The construction is scheduled to be completed by 2005.

A septage receiving station at 29132 Stephenson Highway is described in Section 5.5. The North Arm Relief Drain construction in Birmingham and Royal Oak, was also recently completed with the goal of reducing basement flooding.

3.25 Clinton-Oakland Sewage Disposal District

3.25.1 General Description & History

The Clinton-Oakland Sewage Disposal District covers a large section of northwest Oakland County. The district is operated by the office of the Oakland County Drain Commissioner and serves the cities of Auburn Hills, Clarkston, Rochester and Rochester Hills, the villages of Lake Orion and Oxford and the townships of Independence, Oakland, Orion, Oxford, Waterford and West Bloomfield. The district does not include Pontiac which is served by the county-operated Pontiac Wastewater Treatment Plant.

The COSDD covers the largest area of any district in the DWSD system. The estimated total area is 146,430 acres (229 square miles) with a total of 119,813 acres considered the tributary sewered area.

The Clinton-Oakland District includes many of the "outer ring" suburbs in Oakland County that are still being developed. Construction is generally newer and less dense than in the Southeast Oakland and Evergreen-Farmington districts, with some areas still served by septic systems or other facilities.

A sewage disposal and treatment agreement for the COSDD was established between Detroit and Oakland County in 1968. The agreement was amended in 1973. The peak discharge rate is based on population in the district (0.4 cfs per 1,000 population). Peak flow allowed for discharge from the COSDD sewers into the Detroit sewer system is 63 mgd (97.5 cfs). The projected peak flow for 2020 is 113 cfs. The sewer system in the district will remain sanitary per agreement with DWSD.

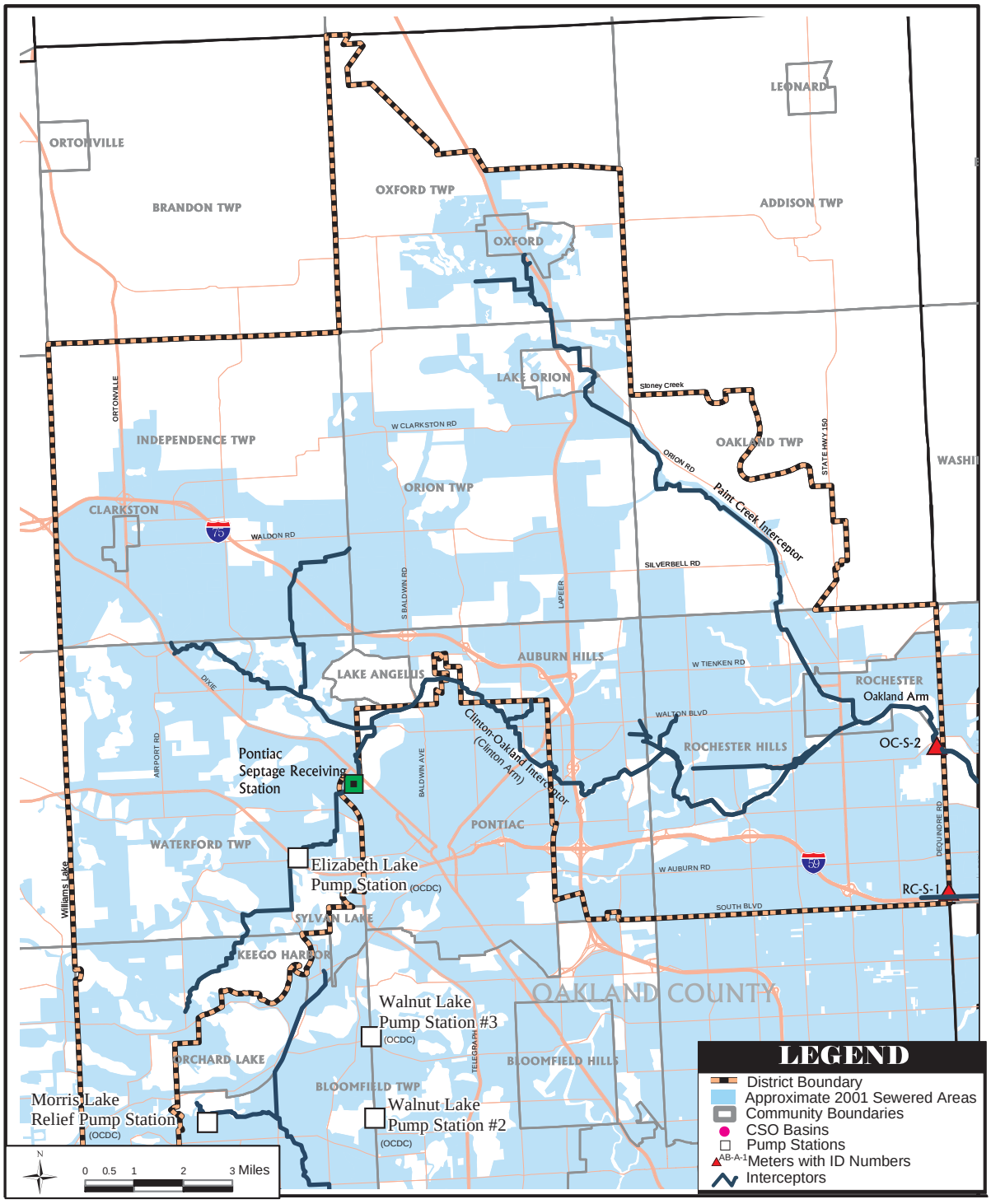
3.25.2 Physical Characteristics

The sewers in this district receive sanitary flows only, as all sewers are separated. The estimated total length of interceptors is 57 miles and the length of community sewers is an estimated 888 miles. There are also 4,289 feet of force main (10- to 66-inch diameter) from the Elizabeth Lake Pumping Station.

Most areas discharge to the two major interceptors in the COSDD, the Paint Creek Arm and the Clinton Arm. They join just prior to entering the Oakland Arm of the Oakland-Macomb Corridor Interceptor. Near Avon and Dequindre Roads there is 5′ 6″ diameter connection, and a Parshall flume with a capacity of 162 cfs to measure flows. Flows through these interceptors enter the Edison Corridor Interceptor and eventually end up at the Northeast Pump Station where they are pumped to the North Interceptor-East Arm.

A third interceptor, known as the Avon Arm, serves a smaller area of the district. This interceptor connects to the Oakland Arm Interceptor of the Oakland-Macomb interceptor system at Dequindre near South Boulevard. The connection at this point is through a 30″ pipeline. An 18-inch Parshall flume with a capacity of 24 cfs measures the flow.

Clinton-Oakland Sewer District



A small portion of the district, 5,100 acres in southeast Rochester Hills, flows to Southeast Oakland County Sewage Disposal District interceptors.

Elizabeth Lake Pumping Station, the largest pumping station operated by Oakland County, is located in Waterford at the south portion of the Clinton Arm. All of the flow from this interceptor goes through this pump station. Its tributary sewered area in Bloomfield Township and a large portion of Waterford Township is estimated at 10,100 acres. The station has a maximum allowable capacity of 19.7 mgd (30 cfs). There are five centrifugal pumps in the station. The 1994 *Clinton-Oakland SDD Analysis Report* lists 101 pumping stations in the district, with an estimated total capacity of 190 cfs, located as follows: Auburn Hills (1); Rochester Hills (1); Lake Orion (16); Independence Township/Clarkston Village (9); Orion Township (14); Oxford Township (7); Waterford Township (50) and West Bloomfield Township (3).

Oakland County Septage Receiving Station was opened in Pontiac in March 2002 to process septage from surrounding communities.

3.26 City of Farmington Sewer District

3.26.1 General Description & History

The City of Farmington was settled in 1824, incorporated as a village in 1867, and then as a city in 1926. About three-quarters of Farmington is directly connected to the Detroit sewer system, with the rest served by the Evergreen-Farmington Sanitary District.

The area of the city is 1,424 acres. The community is primarily residential and commercial with no significant industrial discharges. Land use in the city is 66 percent residential (single and multi-family), 21 percent commercial, institutional, and office, 4 percent industrial, and the remaining 9 percent transportation, utilities, recreation, and other uses.

Major roads through the city are Grand River Avenue, Eight Mile, Nine Mile, and Ten Mile roads. There are no freeways through the city.

A sewage flow and treatment agreement was first established between Detroit and Farmington in 1956. The sewage flow agreement was amended in 1958. Farmington has a peak flow allowance of 3.9 mgd (6 cfs) into the Detroit sewer system.

3.26.2 Physical Characteristics

The sewer system in Farmington originally consisted of approximately 60 percent separated and 40 percent combined sewers. In the early 1990s, a sewer separation project was completed that converted the combined portion into a completely separated system. A retention basin and pump station were completed in 1993.

Farmington Nine-Mile Retention Basin is a 3.2 million gallon sewage retention basin within the city. The retention basin treats flows through settling, skimming, and disinfection. During wet weather events, the retention basin discharges to the Rouge River. Separation of the sewers and construction of the retention basin eliminated 10 CSO discharges to the Rouge River.

There are three pumping stations in the city:

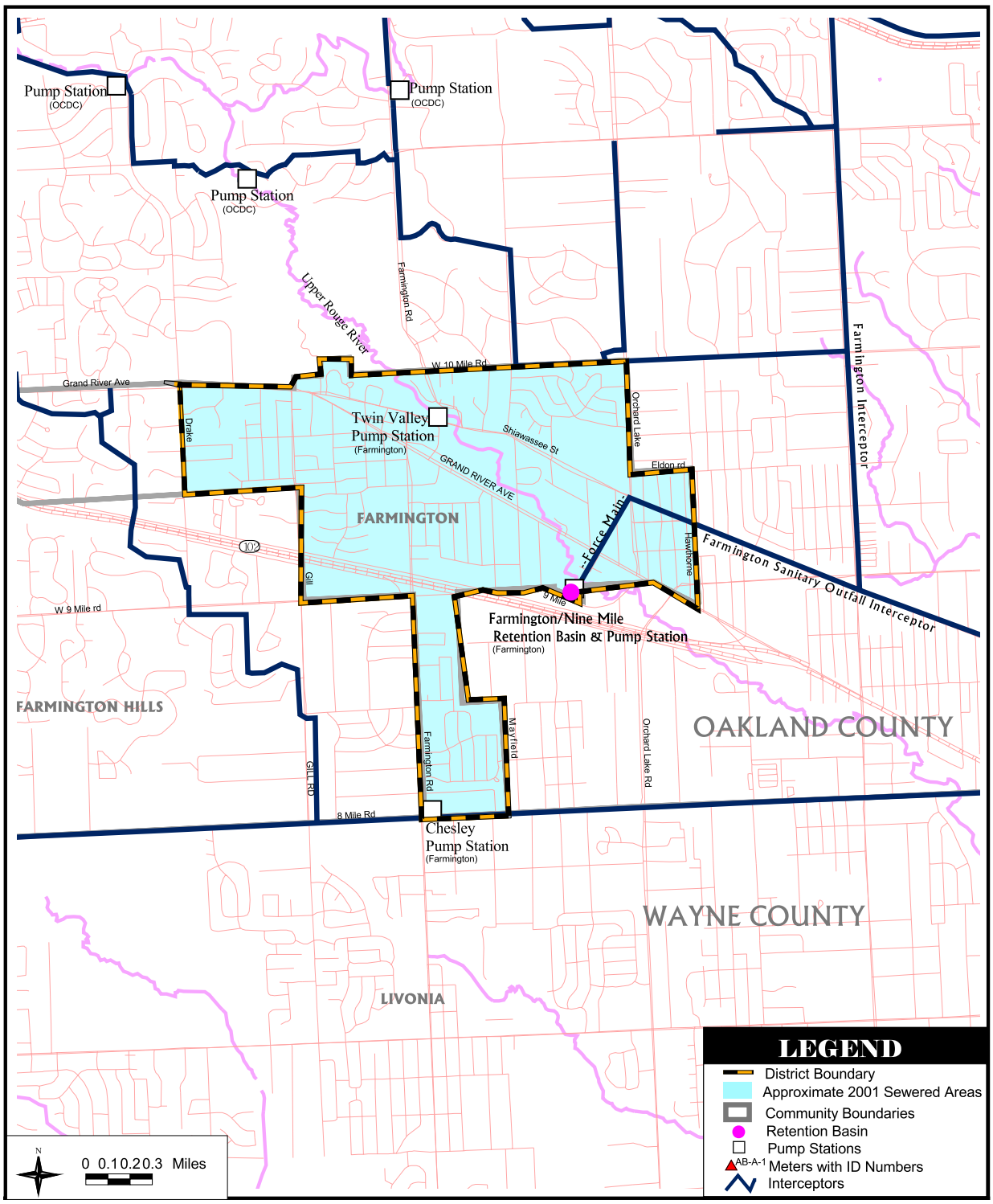
Nine Mile Road Pumping Station: Located at the retention basin, it has three 1,600 gpm pumps with a firm capacity of 3,200 gpm. This pumping station discharges through a force main to the Farmington Sanitary Outfall Interceptor.

Twin Valley Pumping Station: There are two 100-gpm pumps in this station.

Chesley Pumping Station: There are two 800 gpm pumps in this station.

Farmington Sanitary Outfall Interceptor, four miles long, starts northeast of the retention basin

City of Farmington



and follows Shiawassee Street to the southeast until it joins the Detroit system at Eight Mile Road.

The flow from the City of Farmington sewer system is metered as it discharges to the Northwest Interceptor at the intersection of Berg Road and Hessel Avenue near Eight Mile Road.

3.27 City of Center Line Sewer District

3.27.1 General Description & History

Center Line has an area of 1.7 square miles and is surrounded by the City of Warren (an area not served by the Detroit Water and Sewerage Department). Center Line is bordered by 11 Mile Road/I-696 on the north, Stephens Street on the south, Lorraine on the east, and a railroad (Conrail) on the west.

Center Line was incorporated as a village in 1925 and as a city in 1936. The city is primarily residential with significant industrial and commercial land use. Land use in the city is 52 percent residential, 22 percent commercial, institutional, and office, 20 percent industrial, and the remaining 6 percent transportation, utilities, recreation and other uses,

Agreements for sewage flow and treatment between Detroit and Center Line were established in 1960 and amended later that year the Center Line sewers are allowed a peak flow discharge of 6.5 cfs (4.2 mgd) to the Detroit sewer system.

3.27.2 Physical Characteristics

Center Line has 133,000 linear feet of sanitary sewer (83,000 linear feet of which was constructed prior to 1950) and 120,000 linear feet of storm sewer. The sewer system in Center Line was separated in the 1970s. Footing drains are connected to the sanitary sewers, but downspout disconnection has been enforced. In 1998, a $10 million bond issue was passed to further sewer infrastructure repairs.

The sanitary trunk sewers in Center Line discharge to a 48-inch diameter interceptor under Van Dyke Avenue that typically flows only one-quarter full. The sewage flows to the Stephens Pumping Station. From there it is discharged to a 24-inch sewer that passes through Warren along Van Dyke Avenue. The connection with the DWSD sewer system is just south of Eight Mile Road and east of Savage Street on Conner Avenue.

There are three primary storm sewers in Center Line:

Lorrain Drain is an 11-foot diameter sewer that passes along the eastern city limits of Center Line and discharges to Bear Creek immediately north of 13 Mile Road. This sewer drains the area in Center Line south of 10 Mile Road.

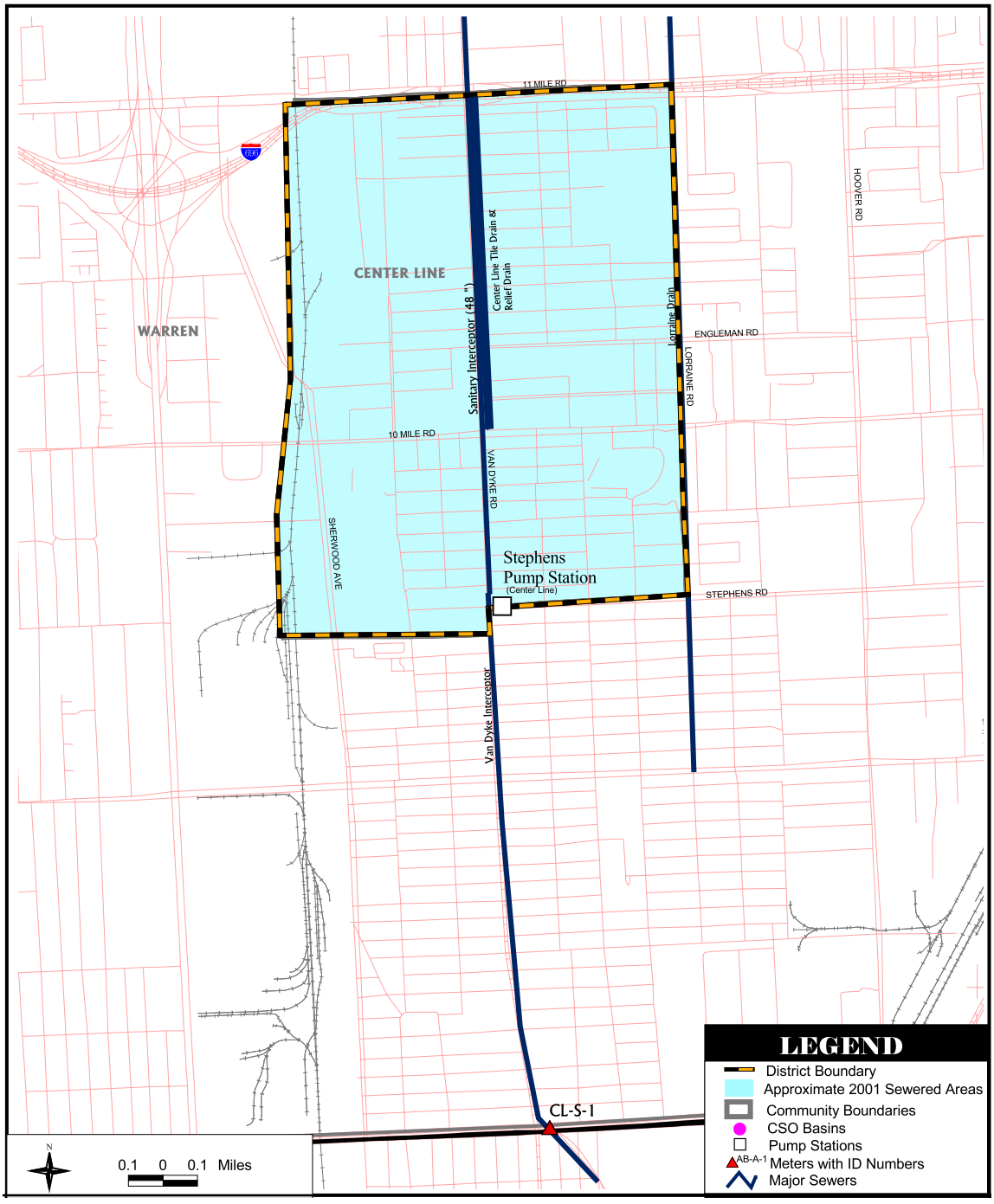
Center Line Tile Drain is a 24-inch diameter sewer located in Van Dyke Road that flows into the Center Line Relief Drain at the intersection of Van Dyke and the I-696 service drive.

Center Line Relief Drain varies in size from 54-inch diameter at 10 Mile Road to 84-inch diameter at the northern city limits.

Stephens Pumping Station, located at the intersection of Stephens and Van Dyke, consists of three pumps with capacities of 800-gpm, 1,900-gpm, and 2,700-gpm at 40-feet TDH. In addition, there is a 5,400-gpm pump powered by a diesel generator that is utilized in the event of a power failure. The station went through a two-phase investigation and rehabilitation program as the result of the 1998 infrastructure bond issue.

The sewage exits the Stephens Pump Station in an 80-foot long, 30-inch diameter pipe. Under dry weather conditions, the sewage continues south along Van Dyke in a 24-inch diameter pipe en route to the Detroit Wastewater Treatment Plant. However, during wet weather conditions, sewage can overflow a weir and discharge into a 36-inch diameter pipe. This pipe empties into a 78-inch

City of Center Line



diameter storm sewer pipe. The 78-inch diameter pipe empties into the Lorraine Drain, an 11-foot diameter storm drain which discharges into Bear Creek. Bear Creek in turn discharges into the Clinton River and from there discharges to Lake St. Clair. The city is currently addressing sewer overflows into the Lorraine Drain.

In October 2000, high bacterial levels were found in Bear Creek. An investigation revealed that a bulkhead to route flows to DWSD was supposed to be constructed during the sewer separation work, but was never completed. For 30 years, sewage was running into Bear Creek instead of flowing into the DWSD system. This construction error has been corrected, but sewer overflows continue to be a problem and are being investigated.

3.28 Southeast Macomb Sanitary District

3.28.1 General Description & History

The Southeast Macomb Sanitary District (SMSD), formerly called the South Macomb Sanitary District, serves the cities of Eastpointe, Roseville and St. Clair Shores. It is a customer of the Northeast Wayne County Sanitary District (NWCSD), which is administered by the Wayne County Department of Environment, Public Works Division (WCPWD). Ownership and operation of wastewater facilities in the district are complex, involving agreements and operating arrangements among the district, the city governments, the Macomb County Public Works Commission (MCPWC) and the Wayne County PWD. The service area of SMSD is approximately 24 square miles and is primarily residential.

The SMSD is allowed to discharge up to 102 cfs to the Northeast Wayne County Sewer District. The NWCSD currently has an agreement with DWSD to transport and treat 82.1 MGD (127 cfs) of wastewater. This represents the total flow coming from both SMSD and NWCSD.

3.28.2 Physical Characteristics

The wastewater from the SMSD is conveyed to the Jefferson Interceptor through nine major sewers operated by SMSD, Macomb County, St. Clair Shores and Roseville.

The Jefferson Interceptor empties into the Grosse Pointe Interceptor through the **Marter Road Pumping Station,** operated by Wayne County at the intersection of Marter and Eight Mile Roads. The outlet capacity for the SMSD is 75 cfs by gravity and about 102 cfs by pumping through Marter Road Pumping Station. Flow to DWSD from the Northeast Wayne County District is measured through a 42-inch magmeter in front of Kerby Road Pump Station at Kerby and Chalfonte.

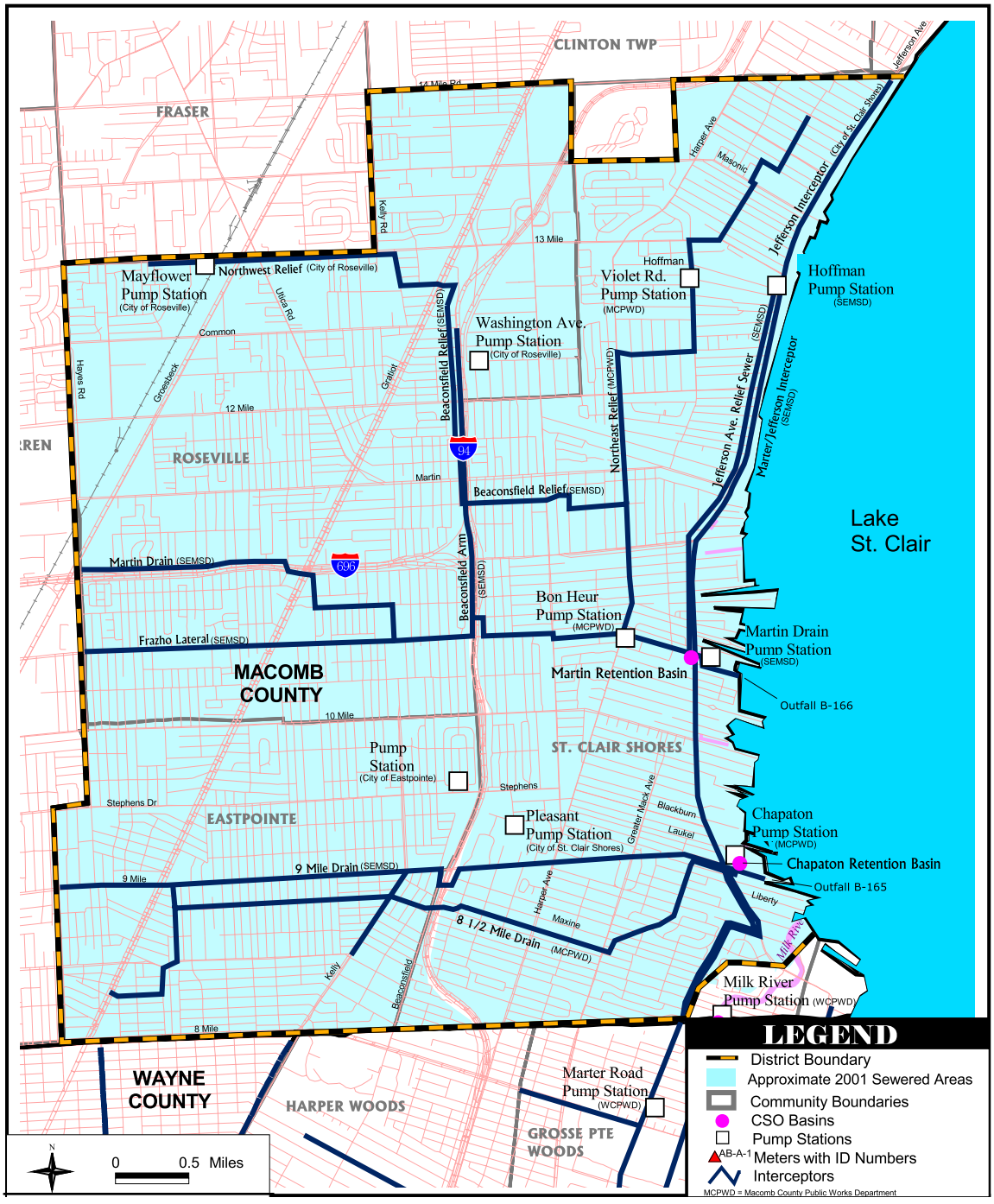
The Wayne County Grosse Pointe Interceptor outlet to the Fox Creek Enclosure may be closed during storms to protect the downstream communities. During wet weather, flows from the SMSD system enter the Chapaton and Martin retention and treatment basins operated by the Macomb County Public Works Commission. Both basins were constructed in 1969 and provide primary treatment and disinfection of effluent before discharging to Lake St. Clair. When basin capacities are exceeded, combined sewage overflows into the lake.

Chapaton Retention Basin at 9 Mile and Jefferson, has a storage capacity of 28 MG. This basin serves the area tributary to the 8½ and 9 Mile drains and can also accept sanitary flows from the Jefferson Interceptor.

Chapaton Pump Station, located near the basin, and also operated by the Macomb County PWC, pumps flows from the 8½ and 9 Mile drainage area into the Jefferson Interceptor and the Chapaton Retention Basin. There are four gates in the Chapaton system.

Martin Retention Basin (8.6 MG) is located at 10½ Mile and Jefferson, has a storage capacity of 8.6

Southeast Macomb Sanitary Sewer District



MG and serves the area tributary to the Martin Drain.

Martin Drain Pump Station, located near the basin, and operated by the Southeast Macomb Sanitary District, was constructed in 1991 to pump combined sewage overflows from the Martin Retention Basin into Lake St. Clair. There are two gates in the system.

Hoffman Pump Station is also operated by the district. It is located on the Jefferson Interceptor in St. Clair Shores, and is currently undergoing renovation.

There are four overflow pumping stations that are manually operated by St. Clair Shores to relieve backups in the system: **Masonic Boulevard, Hoffman Street, Lake Boulevard,** and **12 Mile Road Emergency** overflow pump stations**.** Roseville operates the **Mayflower** and **Washington Avenue** pump stations. Eastpointe operates the **Pleasant** and **Eastpointe-N.E. Relief** pump stations**.** The Michigan Department of Transportation operates the **I-94 Stormwater Pump Station** in Eastpointe**.**

The Macomb County Public Works Commission operates the **Bon Heur Pump Station**, in St. Clair Shores, and the **Violet Pump Station**, in Roseville.

The Southeast Macomb Sewer District recently began a $65 million construction program, including sewer system improvements, to be completed in 2003. Part of this program will be the construction of a four-foot relief sewer paralleling the Jefferson Interceptor. This new sewer will route some excess flows to DWSD, rather than to Lake St. Clair.

3.29 Macomb County Wastewater Disposal District

3.29.1 General Description & History

The Macomb County Wastewater Disposal District (MCWWDD) encompasses most of Macomb County and is operated by the Macomb County Public Works Office. The original contract with DWSD provided service to the cities of Fraser, Sterling Heights and Utica, and the townships of Chesterfield, Clinton, Harrison, Macomb and Shelby. Subsequently, the agreement was expanded to include Washington and Lenox townships and the Village of New Haven.

The area covered by the MCWWDD was primarily rural until the 1960s. The southern part of this area is now heavily developed. The northern part is still partly rural but is developing rapidly.

The original agreement for sewage disposal and treatment between Detroit and Macomb County was established in 1967. Maximum flows in the agreement were based on population (0.4 cfs per 1,000 population). Macomb County sewers have an estimated peak flow of 94 mgd (146 cfs) for discharge into the Detroit sewer system.

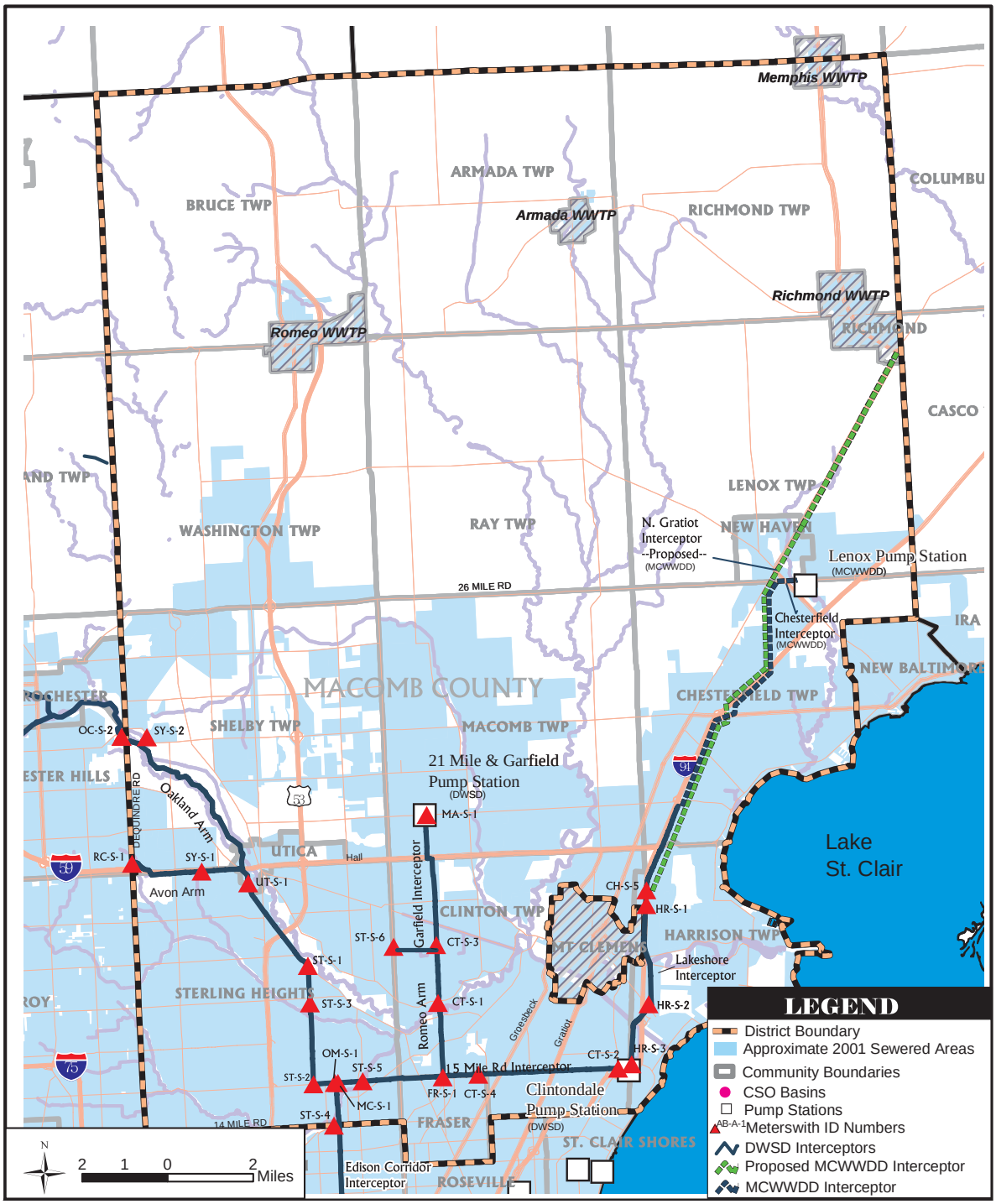
3.29.2 Physical Characteristics

DWSD constructed and maintains the major interceptors in Macomb County with the exception of the Chesterfield Interceptor. These were built under an agreement that Macomb County would reimburse DWSD for construction, operation and maintenance.

The west branch of the MSD interceptor system, known as the Oakland Arm, meets with the east branch, known as the Romeo Arm, forming the Edison Corridor Interceptor. This 12′ 9″ diameter interceptor extends from 15 Mile Road to the **Northeast Sewage Pumping Station** which is located in Detroit, but serves Macomb County and the Clinton-Oakland Sewer District in Oakland County. All flow from the MCWWDD is directed through this pumping station. Additional information on this pump station can be found in the section on the Conner Creek District.

The Oakland Arm runs from the intersection of 15 Mile Road and Dodge Park to Utica Road and then along Utica Road to Hall Road (M-59). At M-59, the Oakland Arm branches northwest and

Macomb County Wastewater Disposal District



west. The northwest branch is still called the Oakland Arm. The western branch is called the Avon Arm. The Romeo Arm follows 15 Mile Road east to Garfield Road, then north along Garfield to 21 Mile Road. At the corner of 15 Mile and Garfield, the 15 Mile Interceptor directs flows east to the Clintondale Pump Station. The Lakeshore Interceptor extends generally north from the Clintondale Pump Station to 21 Mile Road, where the Chesterfield Interceptor joins the Lakeshore Interceptor.

The replacement of the Romeo Arm Interim Interceptor (force main) with a 10-foot gravity interceptor (Garfield Interceptor) in Macomb Township is underway. The Garfield Pump Station and force main will be abandoned. A proposed North Gratiot Interceptor would follow Gratiot from 21 Mile to 31 Mile roads and serve New Haven and Chesterfield and New Haven townships. Other gravity interceptors (Utica, Chesterfield/Macomb, Armada, Richmond, and Memphis arms) are proposed to serve the growing population in Macomb County.

There are three pump stations in the district:

Clintondale Pump Station, in Clinton Township is operated by DWSD. It receives flow from the Chesterfield and Lakeshore interceptors, and pumps it to the 15 Mile Road Interceptor. There are three pumps in the station, each rated at 40 cfs. Evaluation of this pump station for renovation is currently underway.

Garfield Pumping Station at 21 Mile and Garfield roads was abandoned when the new Garfield Interceptor was completed.

Lenox Pump Station, owned and operated by MCWWDD, is located on 26 Mile Road near New Haven. It discharges to the 2.6 cfs capacity Chesterfiled Interceptor. Maximum pump capacity is about 0.78 cfs.

The Macomb County sewer system is nearly all separated. However, sanitary sewer overflows are a problem. Recently, Clinton Township was fined by the Michigan Department of Environmental Quality for discharging 230 million gallons of sewage into the Clinton River since 1981 through nine illegal pumps. Construction of a relief sewer has been proposed to take additional flows from this area to DWSD.

Tables 3.1, 3.2 and 3.3
Table 3.1 is a list of CSO facilities and equalization basins in the service area. Table 3.2 lists meters in the DWSD Service Area by community, number, type and maintenance responsibility. Table 3.3 lists DWSD pumping stations, their functions and their capacities.

Table 3.1:CSO Facilities and Equalization Basins in DWSD Service Area

CSO Basin	Operating Authority	Storage Volume (MG)	Treatment Capacity (cfs)	Pumped or Gravity
Detroit CSO Facilities				
Seven Mile Basin	DWSD	2.2		Gravity
Puritan-Fenkell Basin	DWSD	2.8		Gravity
Hubbell-Southfield Basin	DWSD	22		Gravity
Baby Creek Pilot Treatment Facility *	DWSD	--		Gravity
Conner Creek Pilot Treatment Facility**	DWSD	30	13,262	Gravity
St. Aubin Pilot Treatment Facility (completed)	DWSD		250	Gravity
Leib Pilot Treatment Facility (completed)	DWSD		2,000	Gravity
Suburban CSO Basins				
Acacia Park	Oakland Co. Drain Commissioner	4		Gravity
Birmingham	Oakland Co. Drain Commissioner	5.5		Gravity
Bloomfield Village	Oakland Co. Drain Commissioner	10		Gravity
George W. Kuhn (Twelve Towns)	Oakland Co. Drain Commissioner	62		Gravity
Redford Township	Wayne Co. Dept. of Environment	1.7		Pumped
Inkster	Wayne Co. Dept. of Environment	3		Pumped
Dearborn Heights	Wayne Co. Dept. of Environment	2.7		Pumped
Milk River	Inter-County Drainage Board (Wayne-Macomb Counties)	19		Pumped
Martin	South Macomb Sanitary District	8.6		Gravity
Chapaton	South Macomb Sanitary District	28		Pumped
Suburban Equalization Basins				
Livonia	City of Livonia, Wayne Co.	2.2		Pumped
Wayne	City of Wayne, Wayne Co.	2.3		Pumped
Lathrup Village	City of Lathrup, Oakland Co.	3		Pumped
Farmington	City of Farmington, Oakland Co.	3.2		Pumped
Middle Rouge	Western Townships Utility Authority (Northville, Plymouth Canton Townships, Plymouth)	7.8		Pumped
Lower Rouge	Western Townships Utility Authority (Canton Township)	5.5		Pumped
Totals		**225.5**	**15,512**	

*Under Design
** Under Construction

Table 3.2: Meters in the DWSD System

City/District Served	Meter Number	Meter Type	Maintenance
Allen Park	AP-S-1	Transit Time	DWSD
Allen Park	AP-S-2	Transit Time	DWSD
Chesterfield	CH-S-5	Flume	DWSD
Center Line	CL-S-1	Magmeter	DWSD
Clinton Township	CT-S-1	Flume	DWSD
Clinton Township	CT-S-2	Flume	DWSD
Clinton Township	CT-S-3	Flume	DWSD
Clinton Township	CT-S-4	Flume	DWSD
Dearborn: East	DN-S-1	Flume	Dearborn
Dearborn: West	DN-S-2	Magmeter	Dearborn
Dearborn: East	DN-S-3	Weir	Dearborn
Dearborn: North Central	DN-S-4	Magmeter	Dearborn
Dearborn: North Central	DN-S-5	Magmeter	Dearborn
Dearborn: North Central	DN-S-6	Flume	Dearborn
Dearborn: North Central	DN-S-7	Flume	Dearborn
Rouge River*	DT-S-1_2	Transit Time	GDRSS
Central City*	DT-S-10	Transit Time	GDRSS
Central City/Conner Creek*	DT-S-11	Transit Time	GDRSS
Central City*	DT-S-12	Transit Time	GDRSS
Hubbell/Southfield*	DT-S-3_4	Transit Time	GDRSS
Baby Creek*	DT-S-5	Transit Time	GDRSS
Baby Creek*	DT-S-6	Transit Time	GDRSS
Conner Creek*	DT-S-7	Transit Time	GDRSS
East Side/G.P. Park/ Milk River*	DT-S-8	Transit Time	GDRSS
Conner Creek*	DT-S-9	Transit Time	GDRSS
Farmington	FA-S-1	Flume	DWSD
Fraser	FR-S-1	Flume	DWSD
Grosse Pointe Park	GK-S-1	Flume	DWSD
Grosse Pointe Park	GK-S-2	Venturi	DWSD
Harrison Township	HR-S-1	Flume	DWSD
Harrison Township	HR-S-2	Flume	DWSD
Harrison Township	HR-S-3	Flume	DWSD
Macomb Township	MA-S-1	Magmeter	DWSD
Macomb	MC-S-1	Transit Time	GDRSS
Melvindale	ME-S-1	Ultrasonic	DWSD
Evergreen-Farmington	OC-S-1	Ultrasonic	DWSD
Clinton-Oakland	OC-S-2	Flume	DWSD
Clinton-Oakland/ Macomb*	OM-S-1	Transit Time	GDRSS
Clinton-Oakland/ Macomb*	OM-S-2	Transit Time	GDRSS
Rochester Hills	RC-S-1	Flume	DWSD
Southeast Oakland	SE-S-1	Magmeter	Oakland Co
Sterling Heights	ST-S-1	Flume	DWSD
Sterling Heights	ST-S-2	Flume	DWSD
Sterling Heights	ST-S-3	Flume	DWSD
Sterling Heights	ST-S-4	Flume	DWSD
Sterling Heights	ST-S-5	Flume	DWSD
Sterling Heights	ST-S-6	Flume	DWSD
Shelby Township	SY-S-1	Flume	DWSD
Shelby Township	SY-S-2	Ultrasonic	DWSD
Utica	UT-S-1	Flume	DWSD
Wayne County Rouge Valley	WC-S-1	Transit Time	Wayne Co
Wayne County Rouge Valley	WC-S-2	Ultrasonic	Wayne Co
Wayne County Rouge Valley	WC-S-3	Ultrasonic	Wayne Co
NE Wayne County	WM-S-1	Magmeter	Wayne Co
Grosse Pointe/ G.P. Farms*	WM-S-2	Transit Time	GDRSS
Central City/ Oakwood*	WWTP	Various**	DWSD

*Not a billing meter
**8 Pumps/7 Magmeters/1 Transit Time

Table 3.3: DWSD Pumping Stations

Name	Location	Function	Sanitary Capacity (MGD)		Storm Capacity (MGD)		No. of Pumps
			Design	Maximum Installed	Design	Maximum Installed	
Belle Isle	Sunset Drive, Belle Isle, Detroit	Sanitary	2	4	10.2	20.4	4
Bluehill	17145 Mack, Detroit	Sanitary/ Storm	6.5	13	504	756	5
Clintondale	3475 Union Lake Road, Mt. Clemens	Sanitary	52	78	--	--	3
Conner	12244 E. Jefferson, Detroit	Sanitary/ Storm	158.4	229.5	2226	2544	12
Fairview	202 Parkview, Detroit	Sanitary	242.3	339.36	--	--	4
Fischer	8650 E. Jefferson, Detroit	Sanitary	6.8	13.6	—	—	2
Freud	12300 Freud, Detroit	Sanitary/ Storm	13	35.6	2031	2322	10
Garfield	16650 21 Mile Road, Mt. Clemens	Sanitary - eliminated	11.8	17.7	--	--	3
Lighthouse Point	Harbor Island, Detroit	Sanitary	0.65	1.3	--	--	2
Northeast	11000 E. Eight Mile, Detroit	Sanitary	162	258.4	--	--	3
Oakwood	12330 Sanders, Detroit	Sanitary/ Storm	13	26	246.9	315.4	8
WWTP- Pump Station 1	9300 W. Jefferson, Detroit	Combined	1036	1222	1225	1444	8
WWTP - Pump Station 2a	9300 W. Jefferson, Detroit	Combined	749	856	805	920	7
Woodmere	9300 W. Vernor, Detroit	Sanitary/ Storm	5.2	10	331	497	5

Source: DWSD-owned pump station information from *Asset Audit Report*, 12/19/01 and *Needs Assessment Study, Revision 2 for the Detroit Water Treatment Plant*, 11/15/01, Detroit Wastewater Partners

4. Population Projections

4.1 Historical Perspective

The current DWSD service area is made up of large sections of three southeastern Michigan counties – Macomb, Oakland and Wayne. Each county experienced dramatic gains in population in the 20th Century due to industrialization and economic development centered on the automobile industry. Wayne, Oakland and Macomb are, in that order, the three most populous counties in the state with a combined population of over 4,000,000 people.

In 1900, Wayne had 10 times as many residents as Macomb and eight times as many as Oakland. That population ratio continued to grow through the 1920 census when, with over 1,100,000 residents – triple that of 1900 – Wayne was substantially larger than its neighbors to the north and northeast. By 1920, Oakland had doubled its 1900 population to 90,000 while Macomb's numbers had grown only 5,000 since the beginning of the century to 38,000.

That trend began to change in the 1920s. On a percentage basis, both Macomb and Oakland began to grow faster than Wayne. Still, by 1950, Wayne County had nearly 2.5 million residents compared to just under 400,000 for Oakland and half that number for Macomb. From 1950 to 1970, however, Macomb County more than tripled its population, moving from 184,000 residents to 626,000. At the same time Oakland grew at nearly as impressive a rate, going from 396,000 in 1950 to 908,000 in 1970. Meanwhile Wayne's population remained relatively stable, changing from 2,435,000 to 2,670,000 during that period.

Starting in 1980, when it recorded a 12 percent decrease from 1970, Wayne County has lost residents. Most losses have come from the City of Detroit, which officially fell below the million-resident mark in 2000 for the first time since 1920. Oakland and Macomb, meanwhile, have recorded steady growth since 1980. In the last decade of the century, Macomb's population grew at a rate of 9.9 percent while Oakland's grew at a 10.2 percent rate. Wayne County lost 2.4 percent of its population during this period. The U.S. as a whole grew at a rate of 12 percent in that decade.

In 2000, Oakland County had more than half as many residents as Wayne, while Macomb was well over one-third of Wayne's population. Still, with over 2 million residents, Wayne County remains the population leader in Michigan.

4.2 Population, Employment and Household Projections

Population, household and employment estimates are integral to wastewater management planning. Water usage rises as populations rise. The more water used, the greater the volume of wastewater that needs to be treated. The growth of human populations results in increased pollution of the water supply as land cover and land uses change. These changes include construction impacts, diffused impervious surfaces, the shrinking of wetlands, and increased sewage flows.

The quantity of the wastewater produced depends not only on the number of residents, but also on the activities of those residents. These activities are dynamic and greatly influenced by mitigating factors including lifestyle, age and marital status. Thus household demographics play a part in projecting wastewater needs.

As has been the case in Southeast Michigan, population nearly always increases in areas with growing sources of employment, also bringing industrial and commercial impacts. The nature of the industrial and commercial usage is also vital. Different industries bring with them different associated water-usage demands.

Thus projections of populations, employment and

households need to go in lockstep with projections of wastewater planning. The Southeast Michigan Council of Governments (SEMCOG) based its population and employment projections for the Master Plan planning area on the 2000 U.S. Census.

4.2.1 Definition of Terms:

Population: Residents of a community, either in housing units or group settings, such as college dormitories, nursing homes, correctional facilities, etc.

Households: The total number of occupied housing units. Households are broken down into those with and without children and each of those categories is divided into quartiles by income.

Employment: The number of full- and part-time jobs including those held by the self-employed. Employment is broken down into eight classes: Agriculture and natural resources; manufacturing; transportation; communication and utilities; wholesale trade; retail trade; financial, insurance and real estate; services; and public administration.

Communities: Localities that are defined specifically by the U.S. Census Bureau except for those parts of townships that are surrounded by a city or village. Such "islands" are counted with the surrounding city or village.

Regional Development Forecast (RDF): Prepared by the Southeast Michigan Council of Governments, the RDF provides projections of people, households and jobs for a seven-county area and the cities and municipalities within that area in five-year increments.

4.2.2 Methodology 2000-2020

Projections for the DWSD service area were obtained by using well-established computer modeling based on data garnered from the U.S. Census, the Michigan Employment Security Commission and other sources. SEMCOG's Regional Development Forecast (RDF) began by developing Regional Forecast Totals. These totals relate to the seven-county area that comprises the SEMCOG region and are derived from data compiled by the University of Michigan's Institute of Labor and Industrial Relations.

Household and economic interactions within the region were determined by using a second well-established population modeling system. This model divides the larger region into districts called Minor Civilian Divisions (MCD).

Finally the districts were further broken down into Traffic Analysis Zones (TAZ). Zone forecasts were then added up to make the projections for each community within the DSWD planning zone and the community projections were further added to obtain county and watershed numbers.

4.2.3 Methodology 2020-2050

Projecting the population, employment and household trends through 2050 was accomplished by computer analysis of the 2020 numbers.

The general rules used to arrive at the new numbers were:

1) If an area was projected to lose population from 2010 to 2020, that loss was continued, but at a statistically valid lesser rate.

2) If an area was projected to gain population from 2010 to 2020, that rate of gain was continued, but only until vacant housing capacity was exhausted.

3) Once vacant housing capacity was exhausted in areas of growing population, growth rate was capped at 2 percent every five years.

Certain modifications of these general rules were applied to generate more accurate numbers at the smaller (district and zone) levels.

4.3 2050 Population and Employment Projections

The Southeast Michigan Council of Governments (SEMCOG) provided its population and employment projections for the Master Plan planning area based on the 2000 U.S. Census (See Tables 4.3 4.4 and 4.5 at the end of this chapter.).

The following section describes the SEMCOG projections.

4.3.1 Population Projections

Communities in counties in the DWSD Master Plan planning area will all show marked increases in population through 2050 with the exception of Wayne County, which will remain essentially unchanged.

Macomb will show the greatest growth, moving from 788,000 residents in 2000 to just over a million by the half-century mark. Most of the growth will reflect the trend of movement from the City of Detroit and its nearby suburbs to outlying areas, primarily townships on the northern fringes of the counties.

Total population in the planning area will increase by (11 percent) by 2050 to about 4.3 million residents. Figure 4.1 shows areas that are projected to grow in population by 3,000 people from 2000 to 2050.

Macomb County will grow steadily over the next 50 years, adding 35,000-50,000 residents each decade. Older suburbs like Roseville, Warren, East Pointe and Mt. Clemens will record steady or slightly declining population numbers. Extensive growth will be seen in the central and northern parts of the county with Bruce, Chesterfield, Lenox, Richmond and Shelby townships all showing significant gains in residency.

Oakland County will undergo steady population growth over the next five decades, reflecting a general trend of older suburbs losing a small percentage of residents with outlying areas growing quickly.

County seat Pontiac will grow slowly and steadily, but other older suburbs, such as Hazel Park, Birmingham, Ferndale, Oak Park and Madison Heights will all lose residents.

Outlying townships such as Addison, Brandon, Holly, Oakland, Oxford and Springfield will undergo significant growth while Lyon Township will increase nearly fivefold, from 11,797 to 55,125. The City of Novi will gain the most residents, nearly doubling the 47,583 population of 2000.

Wayne County's population will remain fairly steady over the next 50 years with declines in Detroit and several nearby suburbs being offset by gains in outlying areas.

Detroit will lose about 100,000 residents by 2050 and established suburbs like Livonia, Westland, Garden City and Lincoln Park will also decline in population. An interesting exception to this rule is the "island" suburb of Hamtramck, which is expected to have a 25 percent population increase.

Gaining residents will be the outlying townships of Brownstown, Huron and Sumpter, which will double or nearly double in size. Although not showing the percentage growth of those townships, Canton Township will gain the most residents, nearly 35,000.

Populations of the seven **Lapeer County** communities in the in the Master Planning area will double in size over the next 50 years with Dryden and Metamora townships showing the most significant growth. **St. Clair County** municipalities in the Master Planning area will all grow over the next five decades by an aggregate total of about 2,000 residents per decade. Ira Township will grow the most, going from just under 7,000 people to well over 10,000. The four **Washtenaw County** communities in the Master Planning area will un-

dergo strong population growth with the exception of the City of Ypsilanti, whose population numbers will remain flat.

4.3.2 Employment Projections

Employment in the planning area will increase by 18 percent by 2050, a faster growth rate than population. Every county will show increases in employment, with Oakland gaining the most jobs – more than 100,000 – and passing Wayne as the planning area leader in employment by 2010.

As a trend, jobs in manufacturing will fall in virtually every part of the planning area. A 16 percent decline will drop the number of jobs in this sector to just over 400,000. The most marked increases will be in the services area, where jobs will increase 30 percent to 1,377,000 – well over a third of the jobs in the planning area.

Macomb County employment will rise or stay flat in every sector except manufacturing, which will decline by some 18 percent. Services jobs will increase from 136,000 to over 200,000 in the next 50 years.

In the next decade, **Oakland County** will supplant Wayne as Southeast Michigan's employment leader. Marked losses in manufacturing will be offset by gains in retail trade and services. Overall employment will increase by nearly 25 percent.

Wayne County will also add jobs, but at a slower rate than Oakland and Macomb. It will also see steep declines in the manufacturing sector while agriculture jobs will nearly triple to 19,129.

Planning area communities in **St. Clair** and **Lapeer** counties will follow the general trends of Wayne, Oakland and Macomb while those communities in **Washtenaw County** will show job gains in every sector, including manufacturing.

Breakdowns on populations and employment by communities in the planning area are shown in Tables 4.3, and 4.5 at the end of this section.

Figure 4.1: Projected Growth by Traffic Analysis Zone

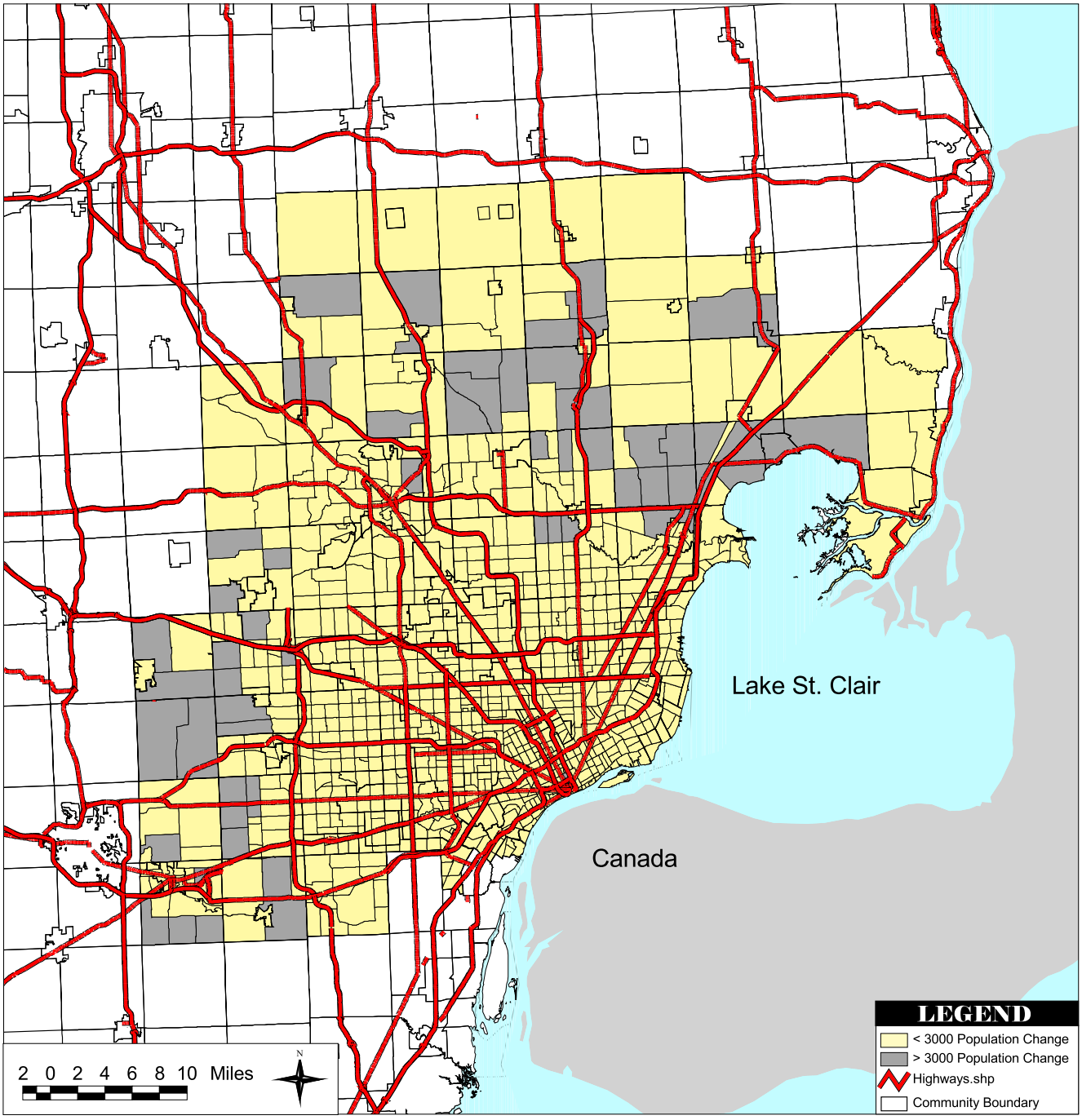
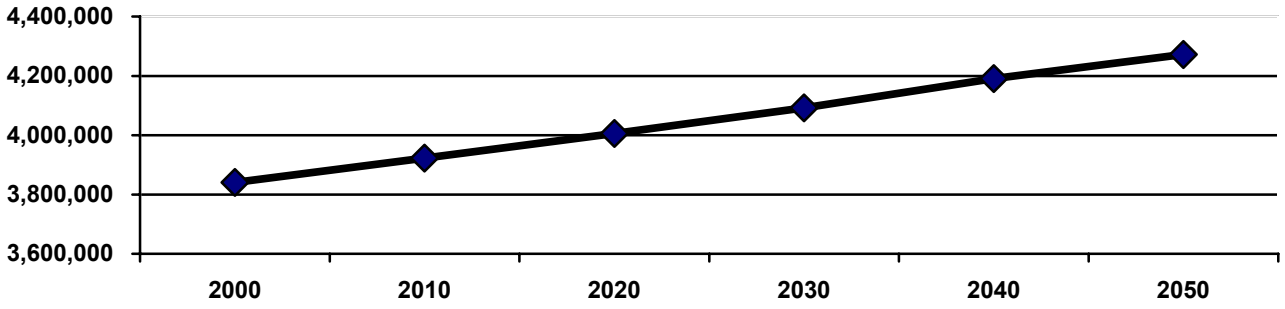
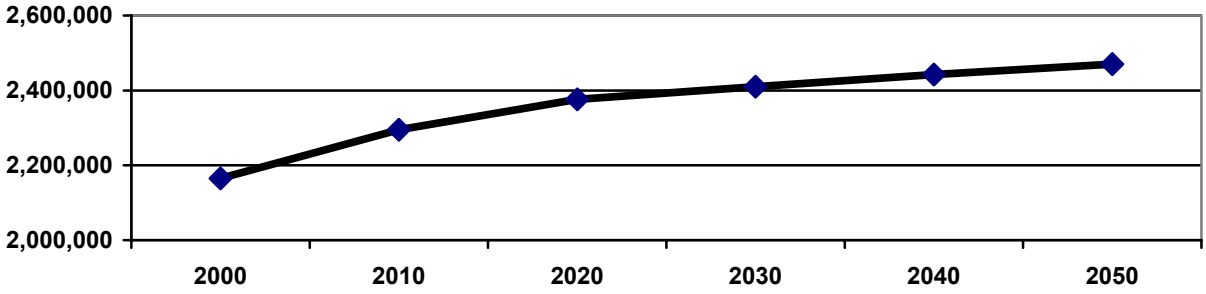


Table 4.1: Year 2000 and Projected Populations of Communities in the Planning Area (by County)



	2000	2010	2020	2030	2040	2050
Lapeer	21,310	23,860	29,293	33,771	38,250	42,727
Macomb	788,149	836,000	882,395	930,423	970,487	1,006,080
Oakland	1,137,342	1,190,142	1,230,356	1,261,879	1,296,042	1,324,210
St. Clair	41,439	44,385	48,754	51,696	54,219	56,352
Washtenaw	87,846	100,852	111,929	121,807	129,566	135,895
Wayne	1,764,854	1,727,594	1,703,218	1,692,622	1,702,680	1,706,621
Totals	**3,840,940**	**3,922,833**	**4,005,945**	**4,092,198**	**4,191,244**	**4,271,885**

Table 4.2: Year 2000 and Projected Employment of Communities in the Planning Area (by County)



	2000	2010	2020	2030	2040	2050
Macomb	381,864	405,730	423,600	433,303	442,133	449,756
Oakland	887,957	976,954	1,026,806	1,043,529	1,059,650	1,072,755
St. Clair	11,253	13,275	15,038	16,735	18,262	19,552
Washtenaw	42,597	48,408	50,905	53,382	55,621	57,204
Wayne	841,361	850,669	859,912	863,380	866,966	871,082
Totals	**2,165,032**	**2,295,036**	**2,376,261**	**2,410,329**	**2,442,632**	**2,470,349**

Table 4.3: Population Projections by County

Table 4.3.1: Lapeer County
Year 2000 and Projected Populations for Lapeer County Communities Located in the Planning Area

	2000	2010	2020	2030	2040	2050
ALMONT TWP	3,694	4,258	5,585	6,658	7,731	8,804
ALMONT VILLAGE	2,897	2,940	3,365	3,663	3,960	4,258
DRYDEN	632	626	619	619	619	619
DRYDEN TWP	4,438	5,007	6,582	7,821	9,061	10,300
HADLEY TWP	4,266	5,002	5,376	5,870	6,365	6,859
METAMORA	433	444	433	430	426	422
METAMORA TWP	4,950	5,583	7,333	8,710	10,088	11,465
TOTALS	**21,310**	**23,860**	**29,293**	**33,771**	**38,250**	**42,727**

Table 4.3.2: Macomb County
Year 2000 and Projected Populations for Macomb County Communities Located in the Planning Area

	2000	2010	2020	2030	2040	2050
ARMADA	1,551	1,527	1,617	1,692	1,766	1,846
ARMADA TWP	3,695	4,329	5,292	6,198	6,925	7,580
BRUCE TWP	6,395	7,878	9,909	12,362	15,224	17,792
CENTER LINE	8,531	8,172	8,052	8,105	8,286	8,518
CHESTERFIELD TWP	37,405	46,272	53,085	62,150	69,519	77,073
CLINTON TWP	95,629	98,668	103,679	108,040	112,697	116,822
EASTPOINTE	34,077	32,852	32,165	31,007	30,862	30,740
FRASER	15,297	14,813	14,882	15,708	16,294	16,862
GROSSE PTE SHORES*	80	71	77	84	89	93
HARRISON TWP	24,461	25,473	25,578	24,881	24,931	24,970
LENOX TWP	5,365	6,471	7,560	8,559	9,245	9,837
MACOMB TWP	50,478	74,250	94,313	111,246	116,759	121,429
MEMPHIS*	807	810	766	751	769	787
MT CLEMENS	17,331	16,247	15,788	15,763	16,630	17,624
NEW BALTIMORE	7,405	11,212	13,011	13,598	14,063	14,441
NEW HAVEN	3,071	3,296	3,559	3,921	4,239	4,516
RAY TWP	3,744	4,330	5,293	6,055	6,616	7,102
RICHMOND	4,880	5,536	6,446	7,326	7,900	8,394
RICHMOND TWP	3,429	4,184	5,117	6,352	7,354	8,327
ROMEO	3,721	4,270	4,524	4,712	4,843	4,973
ROSEVILLE	48,129	45,645	43,921	42,549	43,101	43,624
SHELBY TWP	65,165	73,676	83,435	92,697	97,255	101,195
ST. CLAIR SHORES	63,096	59,679	57,261	55,009	55,365	55,802
STERLING HEIGHTS	124,471	126,381	124,630	124,932	126,865	128,730
UTICA	4,571	5,416	5,283	5,192	5,393	5,577
WARREN	138,247	132,601	129,973	128,347	130,149	132,007
WASHINGTON TWP	17,118	21,941	27,179	33,187	37,348	39,419
TOTALS	**788,149**	**836,000**	**882,395**	**930,423**	**970,487**	**1,006,080**

*Entire community is not in Macomb County. Numbers are for part of community in Macomb County only.

Table 4.3.3: Oakland County
Year 2000 and Projected Populations for Oakland County Communities Located in the Planning Area

	2000	2010	2020	2030	2040	2,050
ADDISON TWP	6,107	7,091	7,973	9,440	10,690	11,570
AUBURN HILLS	19,837	20,634	20,981	21,006	21,178	21,345
BERKLEY	15,531	14,632	14,012	13,552	13,570	13,585
BEVERLY HILLS	10,442	10,138	10,170	10,353	10,500	10,662
BINGHAM FARMS	1,030	1,014	987	967	970	973
BIRMINGHAM	19,370	18,457	17,881	17,800	17,858	17,896
BLOOMFIELD HILLS	3,940	3,810	3,705	3,710	3,840	4,005
BLOOMFIELD TWP	42,944	41,214	40,239	39,178	39,379	39,617
BRANDON TWP	13,230	15,176	16,924	18,509	19,667	20,680
CLARKSTON	971	944	927	957	966	975
CLAWSON	12,732	11,905	11,201	10,654	10,744	10,868
COMMERCE TWP	30,349	33,818	37,435	41,019	43,105	44,895
FARMINGTON	10,423	10,155	10,147	10,317	10,353	10,385
FARMINGTON HILLS	82,111	80,391	79,111	76,817	77,269	77,820
FERNDALE	22,105	20,532	19,142	17,880	17,949	18,032
FRANKLIN	2,958	2,879	2,823	2,793	2,799	2,804
HAZEL PARK	18,963	17,826	16,861	15,860	15,750	15,662
HUNTINGTON WOODS	6,076	5,823	5,642	5,595	5,610	5,622
INDEPENDENCE TWP	32,572	37,305	38,343	38,103	38,753	39,320
KEEGO HARBOR	2,769	2,829	2,815	2,805	2,813	2,819
LAKE ANGELUS	326	305	282	264	268	271
LAKE ORION	2,664	2,521	2,640	2,916	3,144	3,377
LATHRUP VILLAGE	4,236	4,042	3,930	3,863	3,872	3,880
LEONARD	332	316	336	332	338	342
LYON TWP	11,797	27,386	39,539	51,212	53,337	55,125
MADISON HEIGHTS	31,101	29,449	27,816	26,564	26,672	26,814
NORTHVILLE*	3,352	3,240	3,159	3,156	3,165	3,173
NOVI	47,583	59,468	69,165	77,396	85,722	91,263
OAK PARK	29,793	28,125	26,784	25,634	25,520	25,426
OAKLAND TWP	13,071	17,467	21,662	26,083	28,729	30,884
ORCHARD LAKE	2,215	2,164	2,196	2,216	2,225	2,233
ORION TWP	30,799	34,793	38,275	40,949	42,354	43,559
ORTONVILLE	1,535	1,606	1,696	1,830	1,901	1,960
OXFORD	3,540	3,581	3,562	3,546	3,568	3,586
OXFORD TWP	12,485	17,553	21,842	25,884	27,300	28,387
PLEASANT RIDGE	2,594	2,484	2,419	2,375	2,383	2,389
PONTIAC	66,347	71,769	74,454	75,542	77,286	78,792

ROCHESTER	10,502	11,006	11,003	11,126	11,146	11,165
ROCHESTER HILLS	68,790	70,339	72,536	72,584	74,053	75,444
ROYAL OAK	60,137	57,136	54,855	52,231	52,067	52,009
ROYAL OAK TWP	5,446	5,235	5,299	5,399	5,350	5,308
SOUTH LYON	9,299	11,467	11,576	11,659	11,860	12,023
SOUTHFIELD	78,296	75,811	74,075	73,397	74,274	75,251
SPRINGFIELD TWP	13,338	15,527	17,888	20,326	22,263	23,708
SYLVAN LAKE	1,725	1,612	1,574	1,523	1,526	1,528
TROY	80,959	79,110	78,424	77,046	77,869	78,561
WALLED LAKE	6,713	7,090	7,162	6,992	6,992	6,992
WATERFORD TWP	73,150	72,594	72,603	72,863	74,505	75,968
W. BLOOMFIELD TWP	64,860	65,367	66,515	66,985	68,388	69,783
WHITE LAKE TWP	28,219	33,260	34,395	34,312	34,780	35,171
WIXOM	13,263	17,583	21,367	24,484	25,536	26,408
WOLVERINE LAKE	4,415	4,163	4,008	3,875	3,886	3,895
TOTALS	1,137,342	1,190,142	1,230,356	1,261,879	1,296,042	1,324,210

***Entire community is not in Oakland County. Numbers are for part of community in Oakland County only.**

Table 4.3.4: St. Clair County
Year 2000 and Projected Populations for St. Clair County Communities Located in the Planning Area

	2000	2010	2020	2030	2040	2050
ALGONAC	4,613	4,952	5,551	5,733	5,948	6,126
BERLIN TWP	3,162	3,731	4,392	4,831	5,179	5,480
CASCO TWP	4,748	4,836	5,128	5,302	5,563	5,788
CHINA TWP	3,340	3,683	4,082	4,200	4,395	4,560
CLAY TWP	9,822	10,510	11,432	11,982	12,376	12,685
COTTRELLVILLE TWP	3,575	3,820	4,172	4,540	4,870	5,161
IRA TWP	6,966	7,598	8,604	9,430	9,946	10,390
MARINE CITY	4,891	4,878	5,030	5,323	5,587	5,807
MEMPHIS*	322	377	363	355	355	355
TOTALS	41,439	44,385	48,754	51,696	54,219	56,352

*Entire community is not in St. Clair County. Numbers are for part of community in St. Clair County only.

Table 4.3.5: Washtenaw County
Year 2000 and Projected Populations for Washtenaw County Communities Located in the Planning Area

	2000	2010	2020	2030	2040	2050
SALEM TWP	5,562	7,787	9,940	11,388	12,570	13,678
SUPERIOR TWP	10,740	13,121	15,958	18,173	20,195	22,149
YPSILANTI	22,340	23,307	22,908	22,110	22,051	22,108
YPSILANTI TWP	49,204	56,637	63,123	70,136	74,750	77,960
TOTALS	**87,846**	**100,852**	**111,929**	**121,807**	**129,566**	**135,895**

Table 4.3.6: Wayne County
Year 2000 and Projected Populations for Wayne County Communities Located in the Planning Area

	2,000	2,010	2,020	2,030	2,040	2,050
ALLEN PARK	29,479	27,814	26,345	25,039	25,077	25,224
BELLEVILLE	4,002	4,189	4,266	4,285	4,331	4,368
CANTON TWP	76,366	94,888	105,027	106,583	109,110	111,271
DEARBORN	97,775	101,320	104,510	106,128	106,965	107,708
DEARBORN HEIGHTS	58,264	55,977	54,102	54,712	55,368	56,097
DETROIT	951,270	908,977	879,064	865,618	858,570	845,930
GARDEN CITY	30,047	28,087	26,175	24,508	24,367	24,261
GROSSE POINTE	5,670	5,434	5,360	5,294	5,310	5,324
GROSSE PTE SHORES*	2,743	2,716	2,714	2,706	2,725	2,740
GROSSE PTE FARMS	9,764	9,200	8,934	8,684	8,692	8,699
GROSSE PTE PARK	12,443	11,783	11,472	11,199	11,212	11,224
GROSSE PTE WOODS	17,080	16,313	16,055	15,899	16,036	16,175
HAMTRAMCK	22,976	24,022	25,841	27,900	28,327	28,752
HARPER WOODS	14,254	13,739	14,136	14,990	15,228	15,484
HIGHLAND PARK	16,746	12,554	10,877	11,392	12,237	13,119
INKSTER	30,115	28,903	27,189	26,203	26,265	26,351
LIVONIA	100,545	96,589	94,048	92,941	95,272	97,701
MELVINDALE	10,639	10,158	9,760	9,733	9,833	9,917
NORTHVILLE*	3,107	3,059	3,055	3,081	3,121	3,167
NORTHVILLE TWP	21,036	24,157	27,024	29,558	31,524	33,243
PLYMOUTH	8,987	8,771	8,764	8,884	9,073	9,298
PLYMOUTH TWP	27,833	29,864	32,175	33,714	35,071	36,213
REDFORD TWP	51,622	49,315	48,180	46,850	46,901	47,040
RIVER ROUGE	9,905	8,247	6,992	6,178	6,001	5,869
ROMULUS	22,979	23,438	23,859	24,725	26,124	27,349
VAN BUREN TWP	23,554	25,151	27,280	29,556	32,735	35,741
WAYNE	19,051	17,958	16,802	16,541	16,994	17,491
WESTLAND	86,602	84,971	83,212	79,721	80,211	80,865
TOTALS	1,764,854	1,727,594	1,703,218	1,692,622	1,702,680	1,706,621

*Entire community is not in Wayne County. Numbers are for part of community in Wayne County only.

Table 4.4: Employment Projections by Job Sector

Table 4.4.1: Macomb County
Year 2000 and projected employment for Macomb County

	2000	2010	2020	2030	2040	2050
Agriculture	4,168	4,210	4,663	5,207	5,719	6,274
Manufacturing	110,465	105,297	104,234	97,640	95,211	90,251
Transportation, Utilities, Communications	10,930	12,334	13,152	14,107	14,815	15,560
Wholesale Trade	16,823	19,261	20,760	21,700	22,286	22,918
Retail Trade	70,727	71,065	72,453	71,953	70,341	68,926
Finance, Insurance, Real Estate	21,217	23,082	24,830	27,125	29,215	31,530
Services	135,948	158,343	171,047	182,522	191,116	200,462
Public Administration	11,586	12,138	12,461	13,049	13,430	13,836
Totals	**381,864**	**405,730**	**423,600**	**433,303**	**442,133**	**449,757**

Table 4.4.2: Oakland County
Year 2000 and projected employment for Oakland County

	2000	2010	2020	2030	2040	2050
Agriculture	9,565	9,375	10,294	11,625	13,009	14,495
Manufacturing	131,353	127,769	129,211	119,175	115,135	107,777
Transportation, Utilities, Communications	32,793	35,396	36,429	37,723	38,571	39,321
Wholesale Trade	62,864	68,919	71,804	71,940	71,307	70,550
Retail Trade	150,971	165,159	178,940	184,394	188,428	192,408
Finance, Insurance, Real Estate	98,237	99,236	101,290	104,053	106,249	108,388
Services	407,625	484,032	517,149	535,892	550,394	564,698
Public Administration	16,955	20,069	21,507	22,597	23,650	24,715
Totals	**910,363**	**1,009,955**	**1,066,624**	**1,087,399**	**1,106,743**	**1,122,352**

Table 4.4.3: St. Clair County
Year 2000 and projected employment for St. Clair County

	2000	2010	2020	2030	2040	2050
Agriculture	2,207	1,808	1,687	1,620	1,524	1,418
Manufacturing	13,093	11,983	11,860	11,255	11,106	10,537
Transportation, Utilities, Communications	4,860	5,364	5,774	6,148	6,389	6,569
Wholesale Trade	2,379	3,103	3,677	4,126	4,523	4,907
Retail Trade	13,261	14,065	15,291	16,213	16,830	17,313
Finance, Insurance, Real Estate	3,645	3,862	4,290	4,905	5,518	6,150
Services	22,691	27,847	31,208	34,288	36,878	39,292
Public Administration	2,380	2,483	2,611	2,723	2,780	2,809
Totals	**64,516**	**70,515**	**76,398**	**81,278**	**85,548**	**88,995**

Table 4.4.4: Washtenaw County
Year 2000 and projected employment for Washtenaw County

	2000	2010	2020	2030	2040	2050
Agriculture	4,549	4,377	4,751	5,074	5,324	5,554
Manufacturing	34,517	41,032	44,292	44,308	46,142	46,495
Transportation, Utilities, Communications	8,916	9,745	10,411	11,068	11,555	12,012
Wholesale Trade	6,618	8,181	9,172	9,903	10,527	11,156
Retail Trade	38,888	42,628	47,211	49,573	51,324	53,024
Finance, Insurance, Real Estate	10,729	12,366	13,163	14,319	15,460	16,662
Services	119,998	134,283	140,323	144,626	146,738	148,503
Public Administration	7,960	9,508	10,418	11,098	11,687	12,267
Totals	**232,175**	**262,120**	**279,741**	**289,969**	**298,757**	**305,673**

Table 4.4.5: Wayne County
Year 2000 and projected employment for Wayne County

	2000	2010	2020	2030	2040	2050
Agriculture	6,503	8,162	10,318	12,788	15,642	19,129
Manufacturing	178,053	167,422	167,695	157,524	154,764	147,941
Transportation, Utilities, Communications	77,960	76,118	76,857	78,933	79,765	80,681
Wholesale Trade	51,616	57,801	61,276	63,215	64,319	65,582
Retail Trade	170,906	174,011	181,196	182,550	181,707	181,439
Finance, Insurance, Real Estate	63,419	65,072	68,577	74,473	80,060	86,318
Services	371,900	403,539	410,205	417,623	420,257	424,146
Public Administration	50,174	49,304	48,756	48,809	48,314	47,917
Totals	**970,531**	**1,001,429**	**1,024,880**	**1,035,915**	**1,044,828**	**1,053,153**

Table 4.5: Employment Projections by Community

Table 4.5.1:
Year 2000 and Projected Employment for Macomb County Communities Located in the Planning Area

	2000	2010	2020	2030	2040	2050
ARMADA	1,148	1,406	1,674	1,955	2,108	2,226
ARMADA TWP	631	1,085	1,507	1,839	2,104	2,326
BRUCE TWP	2,362	2,848	3,528	4,213	4,982	5,689
CENTER LINE	9,415	9,023	8,665	8,454	8,308	8,207
CHESTERFIELD TWP	11,625	13,144	14,486	14,660	14,807	14,917
CLINTON TWP	36,449	40,270	42,907	43,774	44,580	45,214
EASTPOINTE	10,523	10,424	10,656	10,875	11,048	11,176
FRASER	14,348	14,687	14,991	15,251	15,466	15,628
GROSSE POINTE SHORES*	89	94	87	85	83	82
HARRISON TWP	7,908	8,898	9,546	9,910	10,182	10,388
LENOX TWP	1,008	1,364	1,900	2,458	3,018	3,520
MACOMB TWP	3,150	5,427	7,588	9,678	11,729	13,476
MEMPHIS*	470	474	520	521	521	521
MT CLEMENS	28,097	27,924	27,890	28,209	28,415	28,560
NEW BALTIMORE	3,670	4,300	4,932	5,352	5,700	5,967
NEW HAVEN	980	1,439	1,693	1,891	2,057	2,186
RAY TWP	846	1,087	1,259	1,434	1,590	1,715
RICHMOND	2,664	3,258	3,753	4,225	4,555	4,811
RICHMOND TWP	967	1,129	1,340	1,520	1,679	1,806
ROMEO	4,424	5,374	6,115	6,675	7,141	7,499
ROSEVILLE	22,865	21,960	20,618	19,100	18,131	17,513
SHELBY TWP	16,783	20,314	23,690	26,392	28,462	30,056
ST. CLAIR SHORES	21,569	21,786	21,587	21,239	21,002	20,841
STERLING HEIGHTS	68,008	71,662	73,879	74,772	75,623	76,378
UTICA	6,765	6,830	7,218	7,577	7,884	8,118
WARREN	101,187	103,762	104,023	101,985	100,508	99,501
WASHINGTON TWP	3,913	5,761	7,548	9,259	10,450	11,435

*Entire community is not in Macomb County. Numbers are for part of community in Macomb County only.

Table 4.5.2:
Year 2000 and Projected Employment for St. Clair County Communities Located in the Planning Area

	2000	2010	2020	2030	2040	2050
ALGONAC	1,162	1,249	1,317	1,371	1,419	1,456
BERLIN TWP	1,594	2,035	2,594	3,225	3,802	4,298
CASCO TWP	253	355	557	772	1,007	1,236
CHINA TWP	1,393	1,568	1,750	2,000	2,233	2,423
CLAY TWP	1,391	1,562	1,688	1,806	1,907	1,987
COTTRELLVILLE TWP	697	836	878	877	875	874
IRA TWP	1,874	2,397	2,747	3,101	3,370	3,579
MARINE CITY	2,677	3,049	3,269	3,335	3,392	3,435
MEMPHIS*	212	224	238	248	257	264

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Table 4.5.3:
Year 2000 and Projected Employment for Oakland County Communities Located in the Planning Area

	2000	2010	2020	2030	2040	2050
ADDISON TWP	1,233	1,803	2,151	2,517	2,857	3,135
AUBURN HILLS	54,253	65,848	75,541	77,684	79,163	80,231
BERKLEY	7,014	7,273	7,561	7,863	8,105	8,284
BEVERLY HILLS	2,949	3,230	3,493	3,740	3,954	4,118
BINGHAM FARMS	6,994	7,506	7,825	8,063	8,273	8,431
BIRMINGHAM	22,802	22,572	22,226	22,163	22,083	22,022
BLOOMFIELD HILLS	15,687	19,212	20,900	21,822	22,680	23,335
BLOOMFIELD TWP	24,943	28,486	31,280	33,161	34,776	36,009
BRANDON TWP	1,891	2,499	3,191	3,838	4,436	4,932
CLARKSTON	3,329	3,731	4,116	4,427	4,697	4,905
CLAWSON	6,404	6,756	6,904	6,875	6,860	6,850
COMMERCE TWP	10,745	12,508	13,829	14,731	15,478	16,051
FARMINGTON	8,127	7,863	7,718	7,498	7,355	7,257
FARMINGTON HILLS	78,835	84,279	86,021	85,005	84,381	83,965
FERNDALE	11,312	11,558	11,404	11,173	11,055	10,986
FRANKLIN	2,911	2,903	2,987	3,089	3,180	3,248
HAZEL PARK	4,883	4,615	4,389	4,099	3,940	3,836
HUNTINGTON WOODS	1,954	2,204	2,376	2,544	2,688	2,798
INDEPENDENCE TWP	7,725	9,964	10,792	10,990	11,108	11,191
KEEGO HARBOR	1,426	1,521	1,634	1,720	1,794	1,849
LAKE ANGELUS	52	64	69	74	78	82
LAKE ORION	1,715	1,916	1,996	2,075	2,138	2,184
LATHRUP VILLAGE	3,873	4,122	4,132	4,034	3,962	3,912
LEONARD	121	141	157	163	168	171
LYON TWP	3,104	7,261	9,738	11,414	12,980	14,296
MADISON HEIGHTS	28,848	28,641	28,033	27,538	27,121	26,825
NORTHVILLE*	1,476	1,719	2,024	2,376	2,562	2,705
NOVI	34,984	43,060	47,967	50,607	52,835	54,525
OAK PARK	12,003	11,153	10,363	9,527	8,977	8,618
OAKLAND TWP	1,756	3,096	4,360	5,665	6,607	7,232
ORCHARD LAKE	1,232	1,305	1,402	1,472	1,531	1,576
ORION TWP	9,057	13,285	15,730	17,232	18,555	19,623
ORTONVILLE	654	916	1,103	1,313	1,416	1,495
OXFORD	1,650	1,889	2,169	2,446	2,637	2,785
OXFORD TWP	3,571	5,060	5,932	6,634	7,218	7,650
PLEASANT RIDGE	953	1,063	1,150	1,210	1,261	1,300
PONTIAC	63,070	73,510	77,088	76,787	76,800	76,908
ROCHESTER	17,448	18,541	18,782	18,277	17,953	17,735
ROCHESTER HILLS	29,439	33,022	35,900	37,460	38,787	39,784
ROYAL OAK	42,252	43,555	44,090	43,583	43,329	43,167
ROYAL OAK TWP	3,937	4,106	3,938	3,755	3,637	3,559
SOUTH LYON	2,868	3,512	4,153	4,781	5,155	5,444
SOUTHFIELD	128,407	132,846	131,047	126,524	123,550	121,523
SPRINGFIELD TWP	2,685	4,146	5,535	6,805	7,904	8,809
SYLVAN LAKE	1,144	1,193	1,231	1,238	1,246	1,252
TROY	135,977	140,763	143,966	144,882	146,020	146,940

Table 4.5.3 (continued):
Year 2000 and Projected Employment for Oakland County Communities Located in the Planning Area

	2000	2010	2020	2030	2040	2050
WALLED LAKE	7,770	7,725	7,626	7,192	6,898	6,699
WATERFORD TWP	32,366	34,715	36,766	38,149	39,364	40,278
WEST BLOOMFIELD TWP	21,706	26,084	29,318	31,843	34,040	35,740
WHITE LAKE TWP	4,986	6,698	7,310	7,522	7,670	7,777
WIXOM	12,924	14,963	16,823	17,380	17,817	18,155
WOLVERINE LAKE	512	553	570	569	571	573

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Table 4.5.2:
Year 2000 and Projected Employment for Wayne County Communities Located in the Planning Area

	2000	2010	2020	2030	2040	2050
ALLEN PARK	15,718	15,454	14,892	14,221	13,548	13,075
BELLEVILLE	3,989	4,442	4,868	5,129	5,327	5,472
CANTON TWP	26,841	38,521	46,192	51,398	54,830	57,482
DEARBORN	108,418	111,986	113,499	114,686	115,502	116,132
DEARBORN HEIGHTS	15,817	13,766	12,901	12,359	11,993	11,752
DETROIT	345,424	320,382	309,544	304,795	301,499	299,753
GARDEN CITY	11,437	11,619	11,477	11,375	11,294	11,237
GROSSE POINTE	7,026	7,199	7,132	7,089	7,060	7,040
GROSSE POINTE FARMS	6,475	6,613	6,616	6,626	6,637	6,645
GROSSE POINTE PARK	2,864	2,929	2,923	2,915	2,909	2,904
GROSSE POINTE SHORES*	482	490	484	495	501	506
GROSSE POINTE WOODS	5,438	5,642	5,799	6,392	6,892	7,278
HAMTRAMCK	5,890	5,471	5,350	5,173	5,066	4,993
HARPER WOODS	5,035	4,153	3,732	3,438	3,244	3,116
HIGHLAND PARK	7,616	7,537	7,011	6,491	6,147	5,922
INKSTER	5,788	5,298	4,858	4,318	3,959	3,725
LIVONIA	105,019	111,908	114,081	112,831	112,273	112,026
MELVINDALE	3,326	3,070	2,845	2,794	2,765	2,745
NORTHVILLE*	4,433	4,485	4,793	5,021	5,217	5,365
NORTHVILLE TWP	6,908	8,378	8,953	9,241	9,488	9,676
PLYMOUTH	8,237	7,982	8,631	8,623	8,634	8,643
PLYMOUTH TWP	24,569	28,761	31,954	32,571	33,083	33,488
REDFORD TWP	18,676	18,101	17,540	16,596	15,966	15,554
RIVER ROUGE	2,653	2,521	2,781	2,985	3,154	3,287
ROMULUS	39,038	44,292	47,732	50,128	52,236	53,875
VAN BUREN TWP	10,611	13,254	15,609	17,379	18,818	19,951
WAYNE	16,564	17,391	17,520	17,339	17,214	17,141
WESTLAND	27,069	29,024	30,195	30,972	31,710	32,299

*Entire community is not in Wayne County. Numbers are for part of community in Wayne County only.

Table 4.5.4:
Year 2000 and Projected Employment for Washtenaw County Communities Located in the Planning Area

	2000	2010	2020	2030	2040	2050
SALEM TWP	1,166	4,601	6,114	7,524	8,802	9,557
SUPERIOR TWP	5,483	6,194	6,329	6,323	6,344	6,363
YPSILANTI	17,716	17,416	17,309	17,247	17,227	17,224
YPSILANTI TWP	18,232	20,197	21,153	22,288	23,248	24,060

5. Flows

5.1 General

The DWSD Wastewater Treatment Plant receives flows that can be measured or estimated in the following categories:

- Residential flows
- Commercial, institutional and light industrial flows
- Major industrial flows (called Significant Industrial Users, or SIUs)
- Hauled wastes from septic tank systems and other treatment plants
- Water treatment plant backwash and sludge discharges
- Flows dewatered from CSO and wet weather flow equalization basins
- Dry weather infiltration and inflow (I/I)
- Rainfall derived I/I from separate or separated sewers
- Storm water flows from combined sewers
- Flows recycled in the wastewater treatment process
- Potential future agreements with other providers to accept emergency flows. There are no agreements at this time.

This chapter discusses proposed planning criteria for the first seven categories of flows. Rainfall-derived I/I, storm water flows in the DWSD system, and treatment plant recycle flows are documented in previous reports related to the Greater Detroit Regional Sewer System Model (see references). These wet weather and recycle flows are examined in more detail in Volume 2 of this Master Plan: *Critical Facilities and Flow Management.* Analysis of these flows is documented in Volume 6: *Evaluation of Regional SSO Controls.*

As noted in Chapter 2, there are other wastewater treatment providers within the planning area. Some of these providers have discussed with DWSD future contract agreements with the DWSD that would allow for the diversion of flow from the provider to the DWSD in emergency conditions. The ability of the regional system to accept these new flows are presented in Volume 2 of this Master Plan: *Critical Facilities and Flow Management.*

5.2 Residential Wastewater Generation

The Master Plan proposes to use a value of 77 gallons per capita per day for residential wastewater flows as the present and future planning area-wide average. Residential wastewater flows could decrease to 70 gpd if further water conservation practices are adopted .

The ongoing Comprehensive Water Master Plan being prepared by the DWSD is examining water supply and treatment needs for the next 50 years. That study is using a residential water use rate of 135 gpcd. That residential flow is much higher than the wastewater flow, because water systems are sized to deliver flows to communities for summer conditions when the use of swimming pools, car washing and residential lawn watering takes place. The Comprehensive Water Master Plan examined residential water use records in the summer months to develop the 135 gpcd figure.

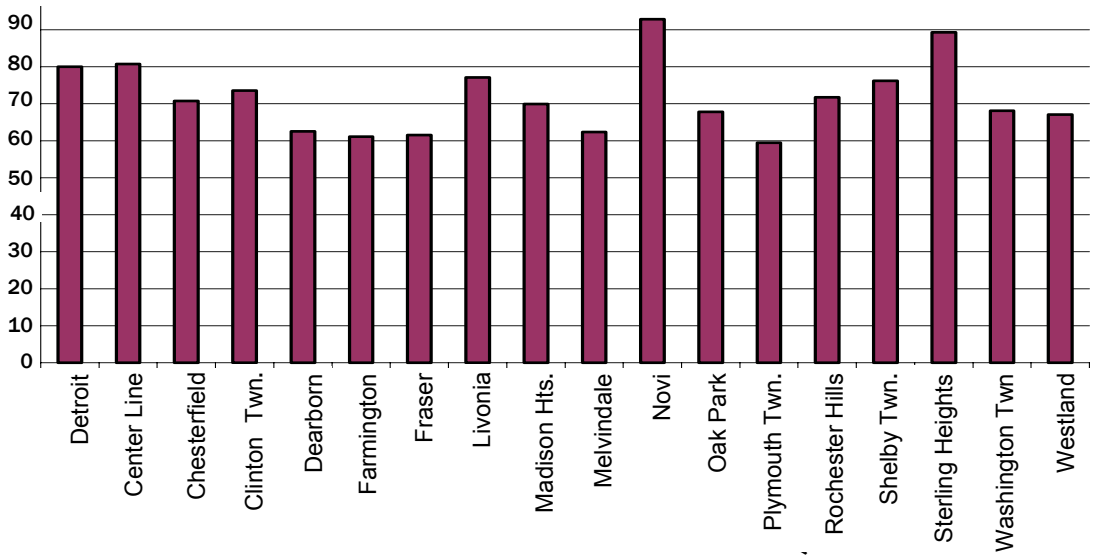
To determine a per capita residential water usage, 66 communities supplied information on billing for 20-30 random residential accounts for three consecutive winter quarters starting in 1998-99.

This survey was subsequently expanded to include 66 communities. See the technical memorandum *Wastewater Generation*. Results from the survey of 17 communities are presented here.For each community, a statistical analysis was performed. Any value greater than two standard deviations from the norm was not considered part of the average. Detroit was added to the study using a residential water use value of 80 gallons/

Table 5.1: Winter Season Water Consumption

Community	Number of Accounts Reviewed	Average Consumption (gal/household/day)	Average Consumption (gal/person/day)
Detroit	N/A	214.04	80.00
Center Line	20	166.90	80.75
Chesterfield	32	141.47	70.73
Clinton Township	20	180.22	73.53
Dearborn	20	158.01	62.58
Farmington	30	129.24	61.14
Fraser	20	152.31	61.50
Livonia	22	197.96	77.12
Madison Heights	6,175	162.93	69.91
Melvindale	20	141.77	62.40
Novi	20	235.66	92.83
Oak Park	4,411	192.64	67.85
Plymouth Township	30	151.45	59.48
Rochester Hills	24	191.34	71.71
Shelby Township	20	203.11	76.18
Sterling Heights	30	239.59	89.25
Washington Township.	19	188.22	68.06
Westland	24	159.98	67.06

Household Weighted Residential Consumption (gal/person/day)



person/day based on previous studies by the Greater Detroit Regional Sewer System (GDRSS) project. Population per household was extrapolated using SEMCOG data on population and number of households for each community.

The residential water usage value when communities are weighted by number of households is 76.60 gallons/person/day. See Table 5.1, which illustrates the information provided by the 17 communities and Detroit, weighted by number of households.

An American Water Works Association Research Foundation 1999 study found that the mean indoor per capita use of 12 national study sites was 69.3-gpcd. (Table 5.2) . Similarly, the U.S. Geological Survey's *Estimated Use of Water in the United States in 1995* cited a figure of 73 gpcd for the Great Lakes Region.

The study also found that across all sites 42 percent of the annual water usage was for indoor usage and 58 percent annual water usage was for indoor usage.

Table 5.2: Residential Water Use

Study Site	Mean Daily Indoor Use (gpcd)
Waterloo/Cambridge, Ontario, Canada	70.6
Seattle, Wash.	57.1
Tampa, Fla.	65.8
Lompoc, Calif.	65.8
Eugene, Ore.	83.5
Boulder, Colo.	64.7
San Diego, Calif.	58.3
Denver, Colo.	69.3
Phoenix, Ariz.	77.6
Scottsdale/Tempe, Ariz.	81.4
Walnut Valley WD, Calif.	67.8
Las Virgenes MWD, Calif.	69.6
Mean of Study Sites	**69.3**

Table 5.3: Indoor Water Use Per Capita Per Day in 1999 & 1984

Activity	AWWRF 1999	HUD 1984
Washing Machines	21.7%	22%
Showers	16.8%	21%
Baths	1.7%	9%
Toilets	26.7%	28%
Leakage	13.7%	5%
Faucets	15.7%	12%
Dishwasher	1.4%	3%
Other Domestic	2.2%	N/A

This mix varied according to climate conditions. In addition, the foundation identified household water usage. Table 5.3 shows those findings and compares them with a similar 1984 Department of Housing and Urban Development study.

Since 1984, there have been changes in plumbing codes – primarily in toilet and showerhead capacities – and an increased public awareness of how to conserve water usage in the household. Also, the cost of treatment of wastewater continues to increase to meet stringent water pollution control requirements. As public education continues in the use of water-conserving devices in the household and the cost of wastewater treatment increases, it is expected that the downward trend in household water consumption will continue.

The use of a value of 77 gpcd for greater Detroit is 6-12 percent less than the 85 gpcd previously developed by the GDRSS project.

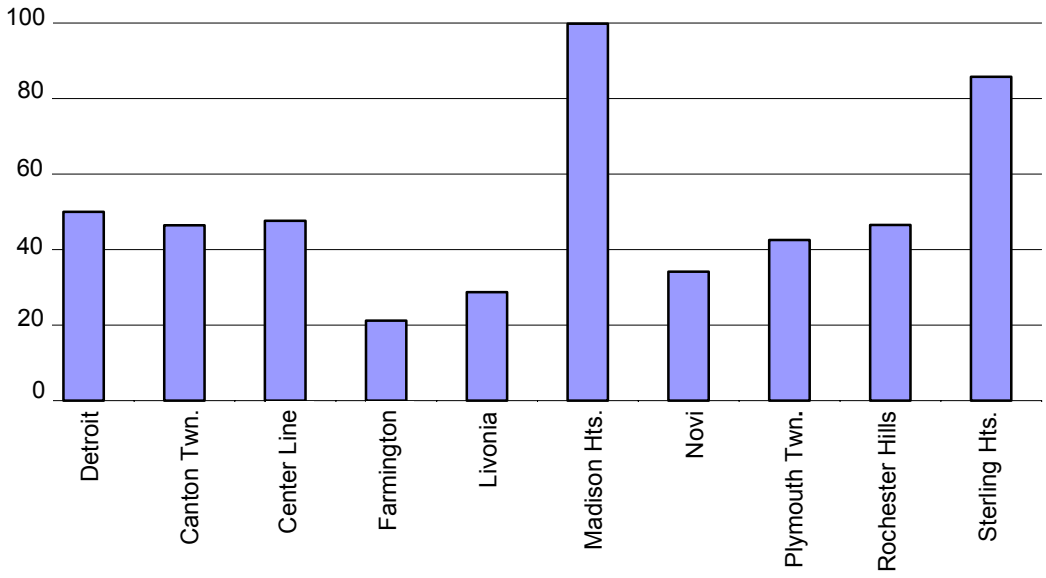
5.3 Commercial/Industrial Use

Several communities contributed information about commercial/industrial wastewater generation. Determining values for this generation was

Table 5.4: Commercial/Industrial Water Use by Community

Community	Average Daily Consumption (gallons/day)	Employment Population	Gallons/Employee/ Day
Detroit	18,443,950	368,879	50
Canton	979,800	21,091	46.46
Center Line	476,249	10,000	47.62
Farmington	173,058	8,155	21.22
Livonia	3,086,753	107,438	28.73
Madison Heights	2,789,304	27,939	99.84
Novi	985,397	28,822	34.19
Plymouth Township	1,008,590	23,726	42.51
Rochester Hills	1,319,805	28,343	46.57
Sterling Heights	5,851,785	68,200	85.8
Totals	**35,114,690**	**692,593**	**50.7**

Employee-Weighted Average Consumption (gallons/employee/day)



accomplished by measuring winter quarter water usage. Existing Greater Detroit Regional Sewer System (GDRSS) CS-1249 estimates of these unit flows were reviewed. Also, additional commercial/industrial water usage information was collected and evaluated from several communities. Recommended unit flows for commercial/ industrial wastewater generation were calculated.

The GDRSS estimate of commercial and industrial water usage was 50 gallons per employee per day (gped). To confirm this estimate, 10 communities provided commercial/industrial billing records for three winter quarters.

SEMCOG provided data on the employment population for each community, and the average per employee commercial/industrial consumption was calculated from that data.

When each community receives equal weight, the commercial/industrial water usage value is 65 gallons/employee/day. When communities are weighted by employment population, the figure is 50.7 gped. No spatial trends could be discerned.

The commercial/industrial water use data, weighted by employment population, is plotted under Table 5.4.

5.4 Significant Industrial Users

There were 403 Significant Industrial Users (SIUs) in the Detroit Water and Sewerage Department (DWSD) service area. A Significant Industrial Users is any user of the POTW which:

- Has an average discharge flow of 25,000 gallons per day or more of process wastewater excluding sanitary, boiler blowdown, and noncontact cooling water; or
- Has discharges subject to the national categorical pretreatment standards; or
- Requires pretreatment to comply with specific pollutant limitations ; or
- Has in its discharge toxic pollutants that are in concentrations and volumes which are subject to regulation under this division as determined by the department; or
- Is required to obtain a permit for the treatment, storage or disposal of hazardous waste pursuant to regulations and may or does contribute or allow waste or wastewater into the POTW including, but not limited to leachate or runoff; or
- Is found by the City of Detroit to have a reasonable potential for adverse effect, either singly or in combination with other contributing industries, on the POTW operation, the quality of sludge, the POTW's effluent quality, or air emissions generated by the POTW.

5.4.1 Methodology

A survey was conducted of methods used to forecast future industrial and commercial wastewater flows and loadings in various master/facilities plans. The survey focused primarily on plans for cities similar in size to Detroit. The plans included in the survey were for Boston; Clayton County, Georgia; Cleveland; Dallas; Gwinnett County, Georgia; Los Angeles; Milwaukee; Minneapolis; Pittsburgh; Seattle; Singapore; Stamford, Connecticut; Unified Sewerage Authority, Oregon; and two smaller Canadian cities. The methods varied greatly and ranged from ignoring industrial and commercial flows and loadings altogether to obtaining detailed data from each industry.

In general, the larger the municipality and the longer the Master Plan time frame period, the less detailed the industrial and commercial forecasting data used. Large municipalities tend to have more industry than smaller municipalities and also serve a much larger domestic population. Population growth and the impact of such growth on sewer overflows were generally the main focus for large municipal master plans.

Industrial growth is much more difficult to fore-

Table 5.5: SIU Number and Flow Among Different Industry Groups (millions of gallons per day)

	MFG	TCU	Wholesale	Services	Total
SIUs	289	28	16	70	403
Flow	35.6	2.6	0.6	6.0	44.9

MFG: Manufacturing; TCU: Transportation, Communications & Utilities

cast than population growth. Existing industries are constantly changing manufacturing processes, and often such changes result in less wastewater discharged and/or lower strength wastewaters. Industries are realizing significant cost savings by both reducing the volume of wastewater generated by manufacturing processes and recycling or by better pretreatment of existing wastewater streams. Also, new industrial facilities are generating less wastewater than older facilities in the same industry due to improved manufacturing processes.

The following steps were followed in projecting future flows and loading for this Master Plan:

- Identify SIUs
- Group SIUs based on type of business
- Group SIUs based on geographical location
- Identify current SIU employment numbers
- Identify current SIU flows
- Identify current SIU loadings
- Project future SIU employment numbers
- Project future SIU flows
- Project future SIU loadings

5.4.2 Characteristics of Current SIUs

As of April 2001, there were 403 SIUs in the DWSD sewer service area. Almost all SIUs can be categorized into four groups:

- Manufacturing
- Services
- Transportation, communication and utilities (TCU)
- Wholesale trade

These 403 SIUs discharge about 45 million gallons per day (mgd) flow. It is estimated that the remaining 12,042 non-SIUs discharge another 50 mgd.

Table 5.5 summarizes the make-up of the current SIUs and flows by industry group.

The manufacturing sector is the largest source of SIUs and SIU flows. About 72 percent (289 of 403) of the current SIUs are manufacturers. They discharge about 80 percent (35.6 mgd) of the total SIU flow (44.9 mgd). The services sector is the sec-

Table 5.6: SIU Usage by Industry and District: Gallons per Employee per Day

	MFG	TCU	WHOLESALE	SERVICES	AVERAGE GPED BY DISTRICT
Clinton-Oakland	137	4,540	0	145	148
Dearborn	213	314	289	93	194
Detroit	537	4,920	271	106	355
Evergreen-Farmington	122	0	4,640	142	190
Macomb	195	250	111	159	197
NE Wayne	374	0	0	100	163
SE Oakland	600	1,210	914	69.5	168
Western Wayne	171	2,440	1,733	149	186
Total by Industry	294	1,240	732	99	243

MFG: Manufacturing; TCU: Transportation, Communications & Utilities

Table 5.7: Top 20 Flow Dischargers

Facility Name	Employees	Flow, gpd	Sector	City
IPMC, Acquisition L.L.C.	180	4,475,444	MFG	Detroit
Ford - Rouge Complex	10,000	2,290,000	MFG	Dearborn
Amer. Axle & Manufacturing. Inc.-Forge Plant	1,064	1,706,847	MFG	Detroit
DaimlerChrysler-Detroit Axle Plant	1,900	1,382,374	MFG	Detroit
Marathon Ashland Petroleum LLC	280	1,355,536	MFG	Detroit
GMC-Detroit/Hamtramck Assembly Center	4,500	1,066,200	MFG	Detroit
GMC-Orion Assembly Plant	4,000	1,054,118	MFG	Lake Orion
DaimlerChrysler-Warren Truck Assembly	4,000	982,000	MFG	Warren
Ford - Wayne Assembly Plant	8,000	960,000	MFG	Wayne
DaimlerChrysler-McGraw Glass Plant	1,200	952,082	MFG	Detroit
DaimlerChrysler-Sterling Heights Assembly	2,800	899,300	MFG	Sterling Heights
Detroit Ed. Co.-Warren Plant	50	803,889	TCU	Detroit
National Steel Corp., Great Lakes	1,200	797,849	MFG	River Rouge
Visteon Corporation –Sterling Plant	4,050	766,800	MFG	Sterling Heights
DaimlerChrysler-Jefferson N. Assembly	5,276	688,414	MFG	Detroit
DaimlerChrysler-Technology Center	12,500	672,000	MFG	Auburn Hills
William Beaumont Hospital	9,500	628,181	Services	Royal Oak
LTV Steel-Tubular Products Division	99	624,858	MFG	Ferndale
Visteon Corporation –Utica Plant	2,800	620,000	MFG	Shelby Twn
Frito-Lay	350	617,517	MFG	Allen Park

MFG: Manufacturing; TCU: Transportation, Communications & Utilities

ond largest, accounting for about 17 percent of SIUs with 14 percent of the flow.

Table 5.6 summarizes the gallons per employee per day (gped) by industry and by district. Detroit has the highest gped among eight districts at 355 gallons/employee/day. The TCU sector has the highest gped among four industry groups.

5.4.3 Top SIU Dischargers

The largest SIUs play a significant role in determining the SIU flow and loading make-ups. Table 5.7 lists the top 5 percent (20 out of 403) SIU flow dischargers. All top SIUs are manufacturers, except two (one TCU and one service). Thirteen of the 20 top SIUs are auto manufacturers or suppliers. The regional distribution, however, is less concentrated. Seven top SIUs are in Detroit and the remaining 13 are spread among 12 different communities.

These top 20 dischargers employ 40 percent of the 403 SIUs' workforce and discharge over 52 percent (23.3 mgd) of the total SIU flow (44.9 mgd).

5.4.4 Projecting Future SIU Flows and Pollutant Loadings

Over 97 percent of the SIUs have pretreatment, which is typically settling, pH neutralization, and oil/water separation.

There are 12,042 non-SIUs, all with very limited information. Discharges may not be significant or continuous.

The trend of industrial consolidation and reduction of manufacturing activity is also evident. There were about 450 SIUs in 1994 and in 2000 the total was about 400. The total SIU flow trend has been flat to slightly downward as well.

The trend is that the (unit) industrial discharge will be smaller in volume and weaker in strength. Multiple driving forces including more stringent regulations, self-interest and better awareness of environmental issues, and cost-cutting benefits are driving the reductions. The industrial users will reuse more process water, and improve manufacturing processes to reduce waste flow and load. Conservation and pollution prevention make business sense as well. For example, from 1983 to 1987, the total metal loading to the wastewater treatment plant dropped from four tons to one ton per year.

The industrial pretreatment program (IPP) will also initiate education for non-SIUs. As a result of this program, the DWSD may see reduction in flow and loadings from non-SIUs as well.

5.4.5 Projected Future SIU Flows

Table 5.8 presents projected SIU flows among different industry groups by decade. The current total SIU flow is 45 mgd. It will stay at this level until 2010; then the total SIU flow will decrease gradually to 35 mgd by 2050. The manufacturing sector will see the largest decrease, from 35.6 mgd in 2000 to 24.6 mgd in 2050.

Table 5.8: Projected Flows by Industry (millions of gallons per day)

	MFG	TCU	Wholesale	Services	Total
2000	35.6	2.6	0.55	5.9	**44.9**
2010	34.8	2.9	0.61	6.4	**44.9**
2020	31.5	2.8	0.60	6.6	**41.5**
2030	29.2	2.8	0.60	6.8	**39.5**
2040	26.9	2.8	0.59	7.0	**37.3**
2050	24.6	2.7	0.58	7.1	**34.9**

MFG: Manufacturing; TCU: Transportation, Communications & Utilities

Table 5.9 shows flow projection results by sewer district and by decade. Detroit is the region that will see the largest net flow reduction, from 23.6 mgd in 2000 to 17 mgd in 2050; the Clinton-Oakland district will see the largest net flow increase, from 3.0 mgd in 2000 to 4.8 mgd in 2050.

5.4.6 Conclusions

- The current SIU list consists of 403 SIUs. Over 70 percent (or 289) of the SIUs are in the manufacturing sector.
- The current SIU flow in the DWSD service area

Table 5.9: Projected SIU Flows by Sewer District (millions of gallons per day)

Flow	Clinton-Oakland	Dearborn	Detroit	Evergreen-Farmington	Macomb	NE Wayne	SE Oakland	Western Wayne	Total
2000	3.0	3.4	23.6	0.54	5.2	0.41	3.5	4.9	**45**
2010	3.6	3.0	22.7	0.59	5.4	0.41	3.2	4.9	**45**
2020	3.8	2.7	21	0.59	5.1	0.39	2.8	4.6	**42**
2030	4.2	2.35	19.6	0.60	5.0	0.37	2.4	4.3	**39**
2040	4.5	2.0	18.2	0.59	4.8	0.36	2.0	4.0	**37**
2050	4.8	1.7	17	0.57	4.6	0.35	1.6	3.7	**35**

is about 45 mgd, about 79 percent of which is from the manufacturing sector.

• Among the eight DWSD sewer districts, Detroit is home to the largest number of SIUs (153 or 38 percent), followed by Western Wayne (with 81 SIUs, or 20 percent).

• SIUs in Detroit discharge about 23.6 mgd, or 53 percent of the total SIU flows.

• The future SIU flow is projected to decrease, from 45 mgd in 2000 to 35 mgd in 2050. The decrease of manufacturing SIU flows is the most significant factor.

• Detroit will see the largest net SIU flow reduction between 2000 and 2050, from 24 mgd to 17 mgd. The Southeast Oakland district will see the largest percentage SIU flow decrease of over 50 percent (from 3.5 mgd to 1.6 mgd). The Clinton-Oakland district will see the largest percentage increase of SIU flow at nearly 60 percent (from 3.0 to 4.8 mgd).

• The projected loadings for all pollutants will decrease between 2000 and 2050.

5.5 Septage and Hauled Flows

Domestic septage is either liquid or solid material removed primarily from septic tanks. Cesspools, portable toilets, aerobic treatment units, holding tanks, marinas and recreational vehicles also contribute septage to varying degrees.

The septage service planning area includes the DWSD sewer planning area, all of Macomb and Oakland counties and portions of Lapeer, Wayne and St. Clair counties. In 2000, there were an estimated 133,600 on-site sewage disposal systems in the area.

Figure 5.1 is a map of the septage service planning area. This area includes all of the watershed basin planning area and the adjacent communities that will continue to use OSDS in the future.

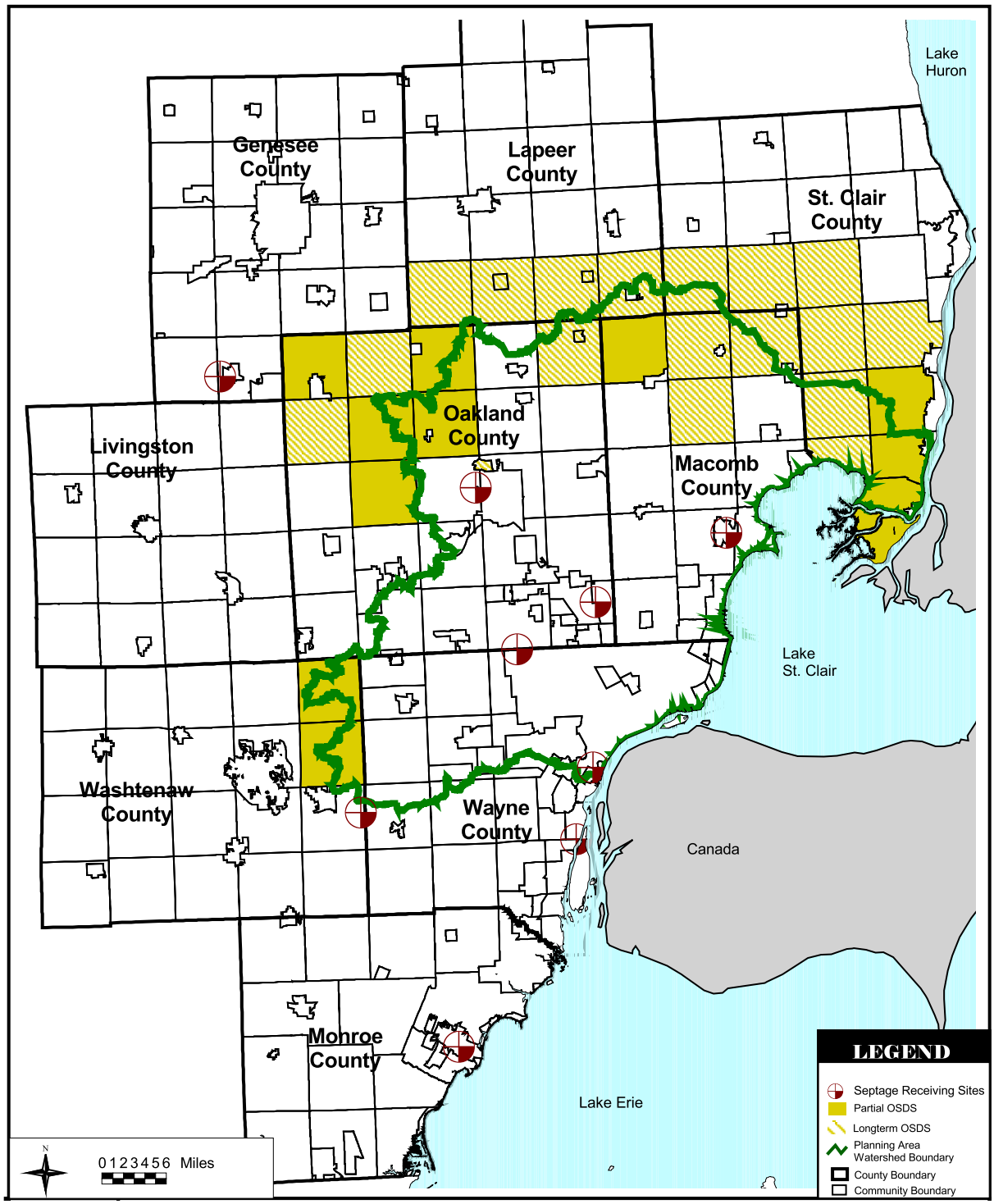
5.5.1 Regulatory Issues

Treatment and disposal of septage are regulated by the U.S. Code of Federal Regulations (40 CFR) Part 503. The Office of the Inspector General released an *"Audit Report of Biosolids Management and Enforcement"* in March 2000 indicating that, "EPA has not taken necessary steps to reasonably ensure compliance with Part 503 requirements." The audit report goes on to say that EPA Clean Water Act enforcement priorities are CSOs, SSOs, animal feeding operations and storm water regulations. Biosolids and septage disposal are not priorities as they are not thought to be as great an environmental risk. However, recent enforcement has been stricter and as land disposal of septage becomes more difficult and expensive, more septage will go to Publicly Owned Treatment Works (POTWs).

Michigan's law regarding the transportation and disposal of septage is currently under review to comply with EPA regulations. Proposed changes would toughen standards for land application. The new law would require:

- Reducing pathogens for land application;
- Reducing vector attraction for land application;
- Testing soil for phosphorous;
- Screening of septage if land applied;
- Requiring use of a septage receiving facility if one is within 25 miles of septage generation;
- Limiting annual application of septage to land;
- Restricting application of septage to frozen or snow-covered ground;
- Requiring a written plan if septage is applied in winter;
- Requiring quarterly reports to MDEQ on land application and complaints;
- Requiring descriptions of how pathogen requirement and vector attraction reduction standards

Figure 5.1: Septage Service Planning Area



are to be met;

- Requiring land application sites to be inspected at least quarterly;
- Increasing fees significantly to pay for inspections and oversight and
- Creating an option for domestic septage receiving facilities to treat or store septage.

Septage concentrates bacteria and chemicals and has an unpleasant odor. Disposal of septage on land increases the potential for groundwater contamination. It exposes wildlife, pets, insect vectors and humans to hazardous material, unpleasant odors and pollution from runoff during precipitation and snow melt. The runoff can contaminate surface water. Increasing land values make it difficult to afford land disposal sites. In addition, land disposal of septage is viewed as a community detriment.

As of May 2001 there were 34 septage servicers permitted by DWSD to dispose of septage and portable toilet waste into the Detroit system.

5.5.2 Septage

Septage is generated when a septic tank is pumped as part of routine maintenance and when portable toilets and recreational vehicle tanks are emptied. The regulation of on-site sewage systems is controlled by local health departments and the MDEQ. In 1990, there were an estimated 1.2 million on-site sewage disposal systems (OSDS) in Michigan serving over 30 percent of homes. MDEQ reports that more than half of building permits issued for new single-family homes are for those served by an OSDS.

Proper maintenance of an OSDS requires periodic removal of solids that accumulate in the septic tank. Solids removal is primarily designed to protect the disposal field from plugging and prevent biological growth from blocking the soil structure. The inspection of OSDS as part of a property transfer often includes pumping the septic tank. In 2000, DWSD estimated that 15,000,000 gallons of septage (12 percent of the state estimate) was deposited in the Detroit system.

DWSD provides for the disposal of septage for facilities within the DWSD sewer service area and for facilities outside the sewer service area. There are four septage disposal sites in the DWSD sewer service area, three in Oakland County and one at the DWSD wastewater treatment plant. DWSD requires that haulers provide analytical testing of their septage twice a year. In addition DWSD also collects samples from haulers' trucks on an unannounced basis.

About 3,400 OSDS permits are issued each year in the septage service planning area to serve new buildings. A number of communities have growth policies that endorse continued use of on-site sewage disposal systems for all or parts of their communities, as indicated in their 208 plan. Those communities are shown in Figure 5.1.

Wayne County

Wayne County requires inspection of on-site sewage disposal systems and pumping of septic tanks when property is transferred. About 200 permits per year are issued for the portion of Wayne County outside of Detroit. Most new growth in the county is expected to occur along with extension of sanitary sewers.

Detroit

Detroit is sewered virtually in its entirety, although small pockets may still be using OSDS. There are 331 addresses in Detroit that are water-only accounts (they do not receive sewage bills.) Records indicate that 154 of these are receiving sewage disposal from adjoining communities. Another review identified addresses that have had final billing and no longer receive water. Eight addresses could not be identified. At least 27 of the remaining 101 have had permits for on-site

Table 5:10: Septage Receiving Stations in the DWSD Service Area

Plant	Hours	Fees
Detroit Wastewater Treatment Plant 9300 W. Jefferson, Detroit	24 hours/day, all year	$.02/gal
Oakland County 22440 Eight Mile Road, Southfield	8 a.m.-4 p.m., Mon.-Fri., Sat. 9- 4 p.m.	$.028-$.048/ gal
Oakland County 1155 Cesar Chavez, Pontiac	24 hours/day, all year.	$.028-$.048/ gal
S.E. Oakland County 29132 Stephenson, Madison Heights	7:30 a.m.- 3:30 p.m. Mon.-Fri.	$.028-$.048/ gal
Ypsilanti Community Utilities Authority 2777 State, Ypsilanti	8 a.m. - 4 p.m. Mon.-Fri.	$.04/gal

sewage disposal systems. Sewers were available to 84 of the 101 addresses, but there is no connection record. Sewers are not available to 23.

Macomb County

In Macomb County, problems with on-site sewage disposal system maintenance practices have been cited as contributing to the closing of beaches along Lake St. Clair. Much of the growth that is expected in the county will rely on new sanitary sewers. There is no land application of septage in Macomb County. Septage is accepted at the Mt. Clemens Wastewater Treatment Plant. Macomb County has passed an ordinance requiring inspection of on-site sewage disposal systems at time of sale.

Lapeer County

All septage is currently land-applied. The population of the southern communities is expected to double by 2050. Most of this population will be served by OSDS.

Livingston County

Up to 10 million gallons of septage is land applied annually.

Oakland County

Oakland has about 80,000 OSDS and issues up to 3,000 permits annually, but has no land disposal of septage. The western and northern portions of the county will increase about 50 percent from 47,000 to 70,000 by 2050 – all served by OSDS. Oakland County does not require inspections at time of sale.

St. Clair County

Soils and water table limitations make St. Clair unsuitable for land disposal of septage, although there is one land disposal site in the county. It has 25,000 OSDS and about 16,000 OSDS are in the Wastewater Master Plan study area. Most septage is trucked to nearby counties. An area of rapid growth, these communities are in need of a disposal site for septage.

Washtenaw County

Sewage haulers in Washtenaw County do not use the DWSD system. The haulers use the Ypsilanti Community Utility Authority plant, other POTWs and land application.

5.5.3 Receiving Stations in Southeast Michigan

Septage can be disposed of in Southeast Michigan for 2 cents to nearly 7 cents per gallon. Table 5.10 lists addresses and hours of receiving stations in the service area. Figure 5.1 shows existing receiving stations. Nationally, the "median cost of disposal (tipping fee) typically ranges from 3 to 6 cents per gallon," according to a 1998 National Small Flows Clearinghouse report. DWSD charges 2 cents per gallon.

Disposal fees are typically determined by weighing trucks when empty and again when full. A truck will check in, fill out forms or deposit prepurchased tokens, dump its load through hoses into a manhole, wash its hoses and exit.

Security concerns include problems such as manholes that are left open on weekends, use of counterfeit tokens and inadequate or broken video surveillance cameras. Other concerns include odors, cleanliness of the stations, proximity to residential and commercial facilities, convenience and access to water to wash the site and equipment. Not every receiving station has washing facilities.

DWSD charges less than other state disposal plants. Since DWSD charges for septage disposal are the lowest in the state and below the national median, it is recommended that DWSD review charges for transport and treatment as a basis for any change to current charges. Peak purchase months for DWSD tokens are May and June. January is the slowest month for purchases.

There are several variables that affect the amount of septage pumped by haulers and taken to disposal sites tributary to the DWSD wastewater treatment plant. These factors include:

- Cost of disposal
- Hours of operation of disposal sites
- Distance and time to transport septage
- Number of existing on-site sewage systems
- Age of the on-site systems
- Operational problems with on-site systems
- Time of the year
- Availability of land disposal sites
- Regulatory requirements
- Frequency of pumping individual septic tanks
- Frequency of home sales

5.5.4 Projections on Septage

To project the future amount of septage that will be generated, the population projections for communities that will rely on on-site systems in Wayne, Oakland, Macomb, St. Clair and Lapeer counties were extracted from the SEMCOG projections for 2000 to 2050. Figure 5.2 shows how the population increases would impact septage quantities. A septage service area was developed based on the distance a hauler would have to travel to dispose of septage. Areas in St. Clair and Lapeer counties that are outside the DWSD sewer study area were included since these could be served by new septage disposal stations and are likely to need septage disposal as land disposal becomes more difficult. Lapeer and St. Clair counties are expected to increase the total number of OSDS, while Oakland, Macomb and Wayne are expected to have fewer.

5.5.5 Current Usage

In 2000, DWSD reported that it received approximately 15 million gallons of septage. This figure includes more than 600,000 gallons of waste from portable toilet servicers. (Some haulers pump both septic tanks and portable toilets.)

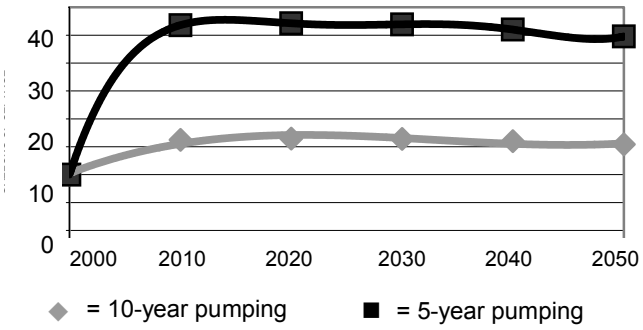
Average monthly flow of septage for 1996-97 was 1.12 MG. For 2000-01 it increased to 1.6 MG. Extrapolating the maximum monthly flow of May and June 2000, the 2.6 MG of septage would be about 0.01 percent of the total wastewater flow to the Detroit plant.

5.5.6 Potential Future Septage Receiving Station Locations

DWSD, septage haulers and local health departments have requested that additional septage receiving stations be located in the areas nearer to where septic tanks are located. This would also reduce the demand for land disposal of septage.

Macomb County published a report of septage management practices in June 2000. The report suggests creation of septage disposal locations in New Baltimore and in the following townships: Chesterfield, Clinton, Lennox, Macomb, Shelby and Washington. It also suggests improving the present dump station in Mt. Clemens, which it characterized as underutilized. The Mt. Clemens POTW is the only septage disposal site in Macomb County. Among other wastewater treat-

Figure 5.2: Septage Disposal Projections (millions of gallons)



ment plants in Macomb County, the cities of Romeo, Armada, Richmond and Memphis all reported that a holding basin would likely be needed if septage is accepted.

Wayne County septage haulers requested a disposal facility in the Plymouth-Northville area, at Henry Ruff DPW and near the Detroit Metro Airport. There are many on-site sewage disposal systems south of the airport. The Wyandotte Wastewater Treatment Plant stopped receiving septage due to construction at the plant. When it begins to receive septage again, it would serve the area south of Detroit Metro Airport.

Three areas are recommended for consideration for new septage receiving stations (See Figure 5.3):

- Near the Macomb County/St. Clair County line (New Baltimore)
- Northwestern Oakland County
- The Plymouth/Northville area in Wayne County

Criteria to consider when siting a septage receiving station include:

- Odor containment or isolation
- Adequate capacity in the sewer line to transport septage so that solids are not a problem
- Truck traffic routing and safety
- Easy and efficient access by haulers
- Capacity to queue trucks so waiting lines are not a hazard
- Local zoning
- Year-round availability

5.5.7 Ancillary Issues

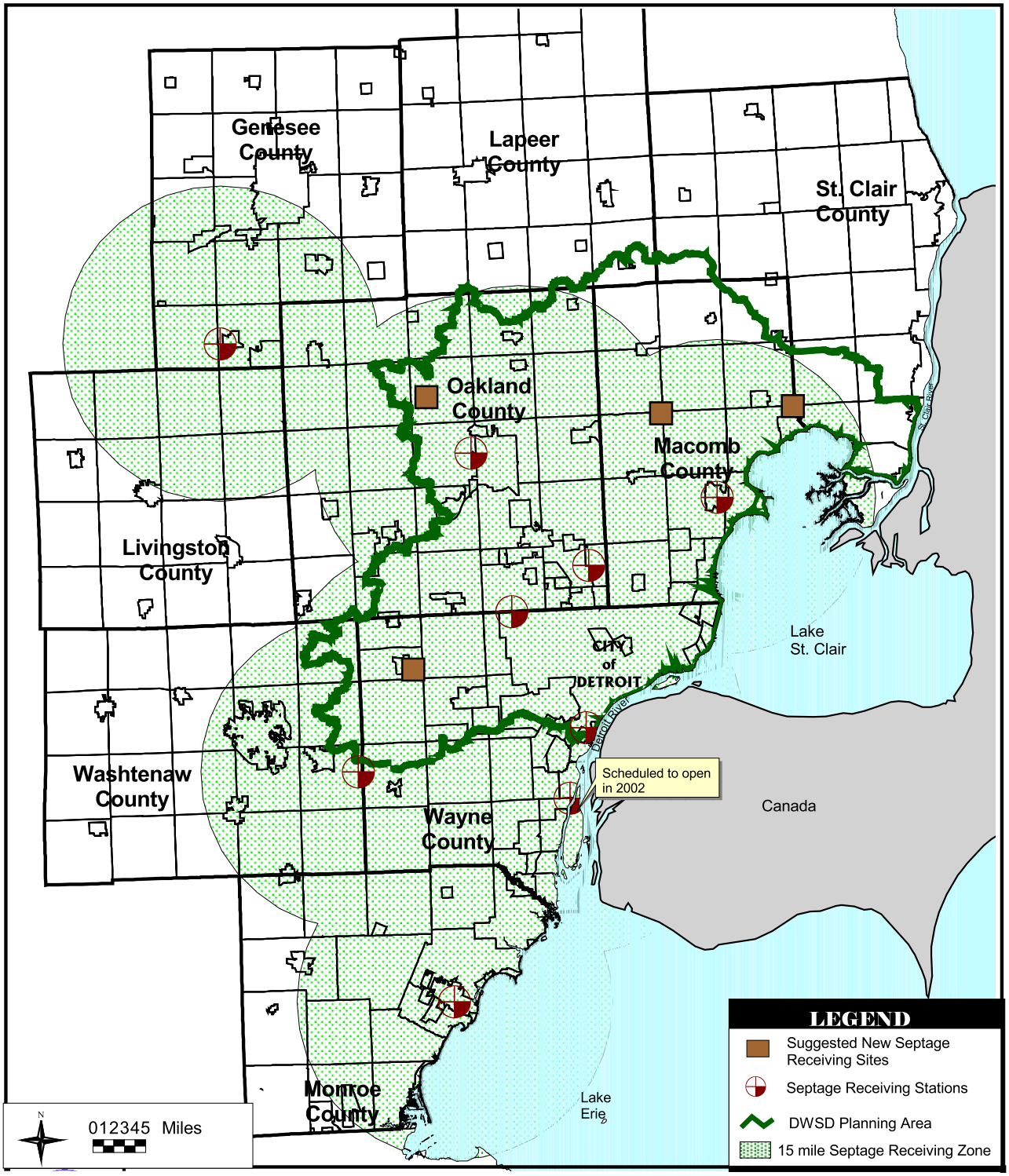
The 15 million gallons per year of septage reported as discharged to the DWSD system in 2000 is likely underestimated. At least one hauler had more loads dumped than tokens purchased and there was possible unauthorized use of the septage receiving station on Eight Mile Road.

- Septage adds 4 percent or less CBOD to the treatment plant during the months of highest discharge of septage. During other months the impact would be less. Suspended solids, ammonia nitrogen and phosphorous are lower percentages of the wastewater flow. See Table 5.11.
- Contact with the haulers indicate that they are interested in providing safe and sanitary disposal of septage, want to make a profit and support whatever can be done to improve the efficiency of hauling and disposing of septage. A mail survey of septage haulers supported additional septage receiving stations in northern Macomb County, southeast Wayne County and western Oakland County. Haulers also suggested better monitoring at receiving stations and asked for input in the design of any new

Table 5.11: Maximum Monthly Septage Contributions to DWSD Sewage Treatment Plant

Parameter	mg/l	DWSD Pounds	Septage Pounds	%
Suspended Solids	34,100	30,764,000	738,377	2.4
CBOD	31,900	15,671,000	690,740	4.4
NH3-N	97	197,000	21,000	1.1
Phosphorous	210	492,780	4,547	0.9
Mercury	0.23	(No data)	4.98	---

Figure 5.3: Recommended New Septage Receiving Stations



septage receiving stations.

- DWSD also receives sludge from Oakland County wastewater treatment plants. In 2000, 437,500 gallons of sludge was discharged into the DWSD system from 15 facilities.
- Chesterfield Township in Macomb County also has approval to discharge sediment dewatering wastewater into the DWSD system. In 2001, 250,000 gallons were authorized.

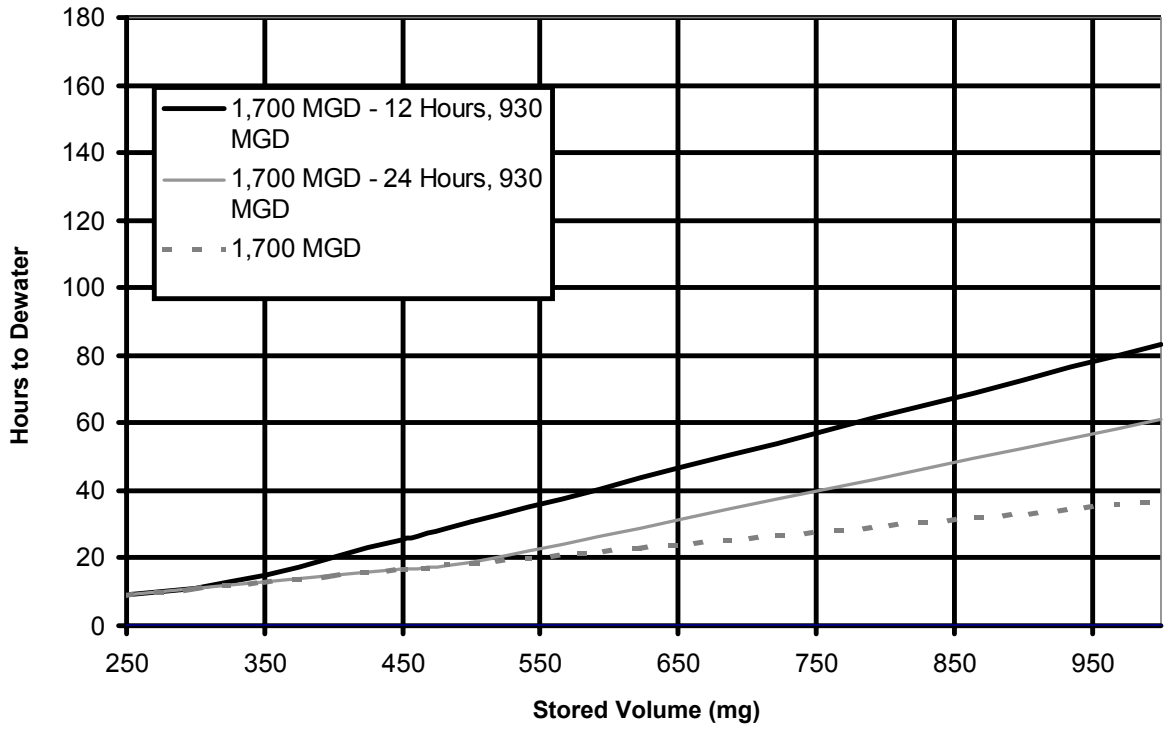
5.6 Flows From CSO Basin Dewatering

An inventory of existing CSO and equalization basins is provided in Chapter 3. There is currently about 150 million gallons of CSO and other wet weather flows are stored. With proposed future phase CSO controls, the volume of CSO and other wet weather flows and associated solids to be stored will be approximately 950 million gallons. Future controls for sanitary sewer overflows could push this total higher. Provisions for the future stored flows and the captured solids are major factors in treatment capacity planning.

Dewatering protocols for the future array of storage basins are being developed under the ongoing work of the Long Term CSO Control Program. For the purpose of the Wastewater Master Plan, an analysis was performed to establish a general understanding of the impact of the flows on treatment plant capacity.

This analysis is based on approximately five years of historical wastewater treatment plant flow data.

Figure 5.4: Hours to Dewater Various Storage Volumes and Dewatering Rates



Results for various dewatering protocols are presented in detail in the technical memorandum *Dewatering of Stored Wet Weather Flows.*

Figure 5.4 shows a summary of the analysis from the technical memorandum. The figure shows the 90 percent "likelihood" of having available capacity at the treatment plant following a major wet weather event. These scenarios shown on the figure are:

1) Dewater stored volume within the 1,700 mgd planned primary capacity for 12 hours, followed by a 930 mgd secondary capacity rate.

2) Dewater stored volume within the 1,700 mgd planned primary capacity for 24 hours, followed by a 930 mgd secondary capacity rate.

3) Dewater stored volume within the 1,700 mgd planned primary capacity (bypass secondary treatment).

The analysis indicates that the planned 950 million gallons cannot be dewatered within the 930 mgd secondary treatment capacity within 72 hours – the time period typically used as a design period for dewatering to assure that the storage facility would be ready for the next storm event and that stored flows would not become septic before dewatering.

Further analyses were conducted by the Wastewater Treatment Plant Improvement Work Group and the Regional Operational Plan Work Group. Similar conclusions were reached regarding the ability of the system to dewater stored flows within three days using only a 930 mgd secondary capacity rate.

5.7 Calculated Dry Weather Infiltration/Inflow

A preliminary estimate of dry weather infiltration and inflow can be calculated using a flow balance approach. The Greater Detroit Regional Sewer System Project provided data for the period November 1997 through October 1999 for a flow balance. The flow balance used metering data as the basis for total flow from any incremental area within the collection system. The downstream and upstream meters define an incremental area. Once these total flows were available, estimates were made of the individual components of the flow. These components are summarized in the following equation and represent sanitary flow sources such as residential and commercial industrial, and extraneous flow such as dry weather inflow and infiltration.

$$Q_{total} = Q_p + Q_{siu} + Q_e + Q_w + Q_{dwi/i}$$

Where, Q_p is the residential population (by place of residence).

Q_{siu} is the significant industrial users

Q_e is the employed population (by place of employment).

Q_w is the water treatment plant filter backwash.

$Q_{DWI/I}$ is the dry weather inflow/infiltration.

Changes made to the original GDRSS estimates of dry weather inflow and infiltration (DWI/I) include the following:

- 77 gpcd was used instead of the 85 gpcd for the residential population unit flow
- Updated significant industrial user (SIU) flow estimates
- Updated SIU employed population estimates

The GDRSS estimate of 85 gpcd was based on gross billing records primarily from water use information. The Wastewater Master Plan value of 77 gpcd included all relevant GDRSS information and added additional detail from 66 communities.

The SIU flows and employment values that had originally been used by GDRSS were based on data determined in 1997. The SIU employment values were incomplete for all but the largest flow contributors. The Wastewater Master Plan SIU

values are based on 2000 information. Because of the more complete employment values and because it was observed that the SIU flows are dropping over time, it was decided that the 2000 dataset was more accurate.

Table 5.12 shows result estimates of calculated dry weather infiltration/inflow (DWI/I) for the existing service area. Additional analysis of DWI/I is provided in Section 3.4 of Volume 3: *Wastewater Service Alternatives.*

5.8 Summary of Existing Flows

Table 5.13 shows a summary of average daily flow by community (GPCPD) based on GDRSS monitoring data from November 1997 to October 1999. Additional review and analysis of these flows are provided in the technical memorandum *Flow Needs for DWSD Customers through 2050* on the CD that accompanies this Master Plan.

Table 5.12: First-Tier Customer Information

First Tier Customer	Type	Total Area (acres)	Combined (acres)	Separate (acres)	Metered DWF	DWI/I (mgd)	DWI/I (inches)
Allen Park	Sanitary	1,716	0	1,716	1.7	0.28	2.20
Center Line	Sanitary	1,031	0	1,031	1.2	0.06	0.76
City of Detroit	Combined	82,555	82,555	0	296	185	30.15
Clinton-Oakland	Sanitary	75,822	0	75,822	31.3	3.2	0.56
Dearborn	Mixed	14,823	10,000	4,823	22.1	6.6	5.95
Dearborn Heights Dist 2	Sanitary	17	17	0	0.07	0.04	31.82
Evergreen-Farmington	Mixed	62,681	3,850	58,831	43	7.4	1.58
Farmington	Sanitary	1,376	0	1,376	1.4	0.41	4.02
Grosse Pointe	Mixed	684	271	413	1.7	0.92	18.05
Grosse Pointe Farms	Mixed	1,384	1,337	48	2.9	1.9	18.05
Grosse Pointe Park	Sanitary	1,283	0	1,283	1.4	0.34	3.54
Hamtramck	Combined	1,347	1,347	0	5.0	2.9	28.57
Harper Woods	Storm	188	188	0	0.84	0.70	50.03
Highland Park	Combined	1,870	1,870	0	3.4	1.7	12.12
Macomb	Sanitary	84,248	0	84,248	51	12	1.97
Melvindale	Sanitary	1,757	0	1,757	1.6	0.36	2.75
N.E. Wayne	Mixed	20,410	8,106	12,304	25	7.6	5.03
North Huron/Rouge Val	Mixed	98,063	6,155	91,908	68	10	1.40
Redford Township	Combined	49	49	0	0.08	0.05	13.64
S.E. Oakland	Sanitary	42,146	22,997	19,149	47	8.6	2.76
Wayne Co Area 6	Combined	81	81	0	0.16	0.08	13.64
Totals		493,529	138,822	354,707	605	251*	6.83

*Total includes 9 mgd of wastewater treatment plant washwater. Actual DWI/I is 242 mgd.

Table 5.13: November 1997 to October 1999 Average Daily Flow by Community*

Community	Flow (gpd)	SIU Flow (gpd)	Population	Per-capita Flow (gpcpd)
ALLEN PARK	4,879,072	722,503	8,082	514
AUBURN HILLS	4,623,004	817,135	20,298	187
BERKLEY	1,866,265	0	16,807	111
BEVERLY HILLS	1,275,190	0	10,482	122
BINGHAM FARMS	580,140	0	1,026	565
BIRMINGHAM	3,006,973	0	20,022	150
BLOOMFIELD HILLS	1,400,753	0	4,449	315
BLOOMFIELD TWP	6,413,134	0	44,255	145
CANTON TWP	7,866,152	97,163	75,458	103
CENTER LINE	1,185,388	9,700	8,303	142
CHESTERFIELD TWP	3,918,448	97,900	36,345	105
CLARKSTON	275,899	0	1,029	268
CLAWSON	1,684,066	99,777	13,761	115
CLINTON TWP	10,239,968	185,357	93,436	108
DEARBORN	30,400,636	8,374,907	91,931	184
DEARBORN HEIGHTS	4,000,662	25,400	34,270	116
DETROIT	231,875,754	24,609,221	951,285	218
EASTPOINTE	3,690,774	30,460	32,008	114
FARMINGTON	1,343,860	6,251	10,036	133
FARMINGTON HILLS	12,234,738	373,161	82,043	145
FERNDALE	3,474,928	737,092	24,719	111
FRANKLIN	491,911	0	2,894	170
FRASER	2,082,068	30,089	14,807	139
GARDEN CITY	3,501,576	4,865	29,535	118
GROSSE POINTE	1,924,802	105,000	5,186	351
GROSSE PTE SHORES	366,671	0	2,773	132
GROSSE PTE FARMS	3,402,803	90,000	9,320	355
GROSSE PTE PARK	3,252,290	0	11,708	278
GROSSE PTE WOODS	1,963,120	0	16,225	121
HAMTRAMCK	5,477,760	2,098,364	16,966	199
HARPER WOODS	1,949,475	0	13,564	144
HARRISON TWP	3,300,615	425,113	25,064	115
HAZEL PARK	2,221,547	218,647	19,631	102
HIGHLAND PARK	2,986,296	78,240	17,074	170
HUNTINGTON WOODS	704,726	814	6,311	112
INDEPENDENCE TWP	3,896,974	0	33,693	116
INKSTER	3,051,663	132,270	27,757	105
KEEGO HARBOR	341,706	0	2,856	120

***Numbers reflect only the portions of communities served by DWSD**

Flow calculation based on meter data (11/97 - 10/99), SIU flows from 11/97 to 10/99 and estimated 2000 population

Community	Flow (gpd)	SIU Flow (gpd)	Population	Per-capita Flow (gpcpd)
LAKE ORION	376,656	0	3,084	122
LATHRUP VILLAGE	607,821	0	4,312	141
LENOX TWP	492,109	0	5,424	91
LIVONIA	17,001,309	1,431,046	97,321	160
MACOMB TWP	4,614,690	46,300	52,301	87
MADISON HEIGHTS	4,804,994	287,809	32,111	141
MELVINDALE	1,419,374	257,290	10,095	115
NEW HAVEN	323,680	0	2,776	117
NORTHVILLE	948,153	700	6,325	150
NORTHVILLE TWP	2,357,485	8,000	21,568	109
NOVI	5,342,646	209,582	35,335	145
OAK PARK	3,386,193	3,352	29,911	113
OAKLAND TWP	1,610,957	0	13,351	121
ORCHARD LAKE	396,169	0	2,454	161
ORION TWP	4,780,881	1,169,094	31,299	115
OXFORD	426,470	8,600	3,420	122
OXFORD TWP	1,372,098	0	13,970	98
PLEASANT RIDGE	351,793	58,452	2,723	108
PLYMOUTH	1,323,492	34,301	8,773	147
PLYMOUTH TWP	4,433,475	262,482	27,259	153
REDFORD TWP	6,017,406	94,819	49,733	119
ROCHESTER	2,533,010	806,198	9,987	173
ROCHESTER HILLS	8,596,888	124,500	71,071	119
ROMULUS	714,918	338,360	3,105	121
ROSEVILLE	6,351,360	166,925	48,296	128
ROYAL OAK	8,248,168	819,781	64,731	115
ROYAL OAK TWP	578,413	0	4,841	119
SHELBY TWP	7,392,421	691,015	63,880	105
SOUTHFIELD	13,684,405	223,801	76,307	176
ST. CLAIR SHORES	7,309,399	20,400	61,973	118
STERLING HEIGHTS	16,562,761	2,987,690	120,793	112
TROY	15,842,420	342,511	82,676	187
UTICA	914,102	137,000	4,744	164
VAN BUREN TWP	1,616,276	13,490	11,961	134
WASHINGTON TWP	1,741,798	0	18,778	93
WATERFORD TWP	9,311,358	28,735	76,049	122
WAYNE	3,636,296	1,299,599	18,872	124
W. BLOOMFIELD TWP	7,574,345	0	65,507	116
WESTLAND	9,465,156	96,048	85,216	110

Flow calculation based on meter data (11/97 - 10/99), SIU flows from 11/97 to 10/99 and estimated 2000 population

6. Projects in the Planning Area

6.1 Introduction

The development of a Wastewater Master Plan requires not only a thorough understanding of the current collection system and its condition, but also a review of efforts currently underway to upgrade, rehabilitate or expand environment, transportation, housing and commercial facilities in the planning area. This chapter presents a compilation of projects proposed or underway in the planning area to be considered in development of the DWSD Wastewater Master Planning effort.

Beyond those projects being undertaken by DWSD to study, design, and construct improvements to the system, three other categories of projects merit consideration as the planning effort moves forward:

- Suburban system projects that have been identified by customer communities to improve, upgrade or modify facilities tributary to the DWSD collection system;
- Major developments and transportation projects that have the potential to change capacity requirements or affect the location of either existing or planned facilities; and
- Roadway widening and improvement projects that can supplement population projection information to identify areas where service expansion may be required and that should be considered when planning for sewer construction along similar routes. The projects identified in this report will be updated and appended throughout the development of the Wastewater Master Plan as new information is collected.

6.2 Approach

Various sources of information were used to compile the lists of ongoing projects. DWSD contract records provided the most comprehensive listing of ongoing work being performed within the DWSD system. This list has been continually updated as the planning effort has moved forward and as other projects have been undertaken by the department. Suburban project information was gathered through contact with first-tier customers and through reviews of plans generated by suburban communities. Information on area transportation projects was primarily obtained from SEMCOG, which serves as the clearinghouse for transportation funding in Southeast Michigan. SEMCOG's 2025 Regional Transportation Plan for Southeast Michigan Project List was reviewed and edited to identify transportation projects included in this chapter. Finally, area planning departments were contacted and media reports were reviewed to identify specific major development projects that are being planned or are underway in the planning area.

Once a project or group of projects was identified, certain general information was collected. The information for each project included the agency leading the effort, the project's location, and its current status (planning, design or construction). Additionally, each project was categorized as to how it would impact the collection system. The categories used are:

- Adds flows
- Rehabilitates existing facilities
- Reconfigures the collection system
- Expands the service area and
- Enhances operation or improves service

Finally, an estimate of the timeframe when the project would be completed and a determination of the system components that would be affected were made.

6.3 DWSD Projects

Thirty-five DWSD projects have been currently identified that need consideration in formulating the Wastewater Master Plan. These range from various CSO facilities being designed and constructed to operations and rates studies. Many of these will have a direct impact on the planning process, since they are reconfiguring existing facilities. Others, such as CSO facilities, need to be considered in determining the quantities of flow that will be generated during rainfall events and during dewatering periods following each event. The projects are listed in Table 6.1 at the end of this chapter. Figure 6.1 shows their locations. All significant 2000-2005 CIP projects are included.

6.4 Suburban System Projects

Only major projects that would affect DWSD system capacities or operations were considered. Local community renewal and replacement projects and sewer extension projects with flows that could be established through population increases were not specifically identified. The table focuses on significant CSO facility construction projects that will potentially increase system flows during and following rain events and SSO projects that are likely to alter flows if excess infiltration and inflow are eliminated. Table 6.2 at the end of this chapter lists the major suburban projects identified to be considered in formulating the Wastewater Master Plan. Figure 6.2 shows their locations.

6.5 Major Developments and Transportation Projects

Sewage collection systems are affected by developmental activities that generate flows; such projects may require reconfiguring existing or future infrastructure. Commercial/industrial projects of sufficient size to affect sanitary flow can be identified for shorter forecasting periods but are not easily identifiable for long-range planning purposes. Seventeen major development and transportation projects that will be considered in formulating the Wastewater Master Plan have been identified. Additional projects will be identified over the remaining term of the Master Plan. Table 6.3 at the end of this chapter lists the major development and transportation projects. Figure 6.2 shows their locations.

6.6 Roadway Widening and Improvement Projects

Throughout the planning period, improvements to the urban infrastructure will continue to be made. Historically, utility planners and designers have done only a fair job of coordinating surface and subsurface infrastructure improvements. The SEMCOG 25-year Transportation Plan identifies numerous roadway widening and improvement projects that are planned within the wastewater planning area. Figure 6.3 shows planned roadway widening or reconstruction locations.

6.7 Use of Project Lists

These projects and their anticipated timing were considered as recommendations were developed for proposed wastewater facility upgrade or extension within the Wastewater Master Plan. The lists also serve as a basis for customer communities to develop plans to address their internal wastewater infrastructure in coordination with the Master Plan capital improvement program schedule.

Table 6.1: Ongoing DWSD Projects

Contract	Project Name	Location	Category	Stage
CS1357	Water and Sewage Rates Study	DWSD Service Area	Improve Service	Study
CS1267	Management Information System-Wastewater Operations Group	DWSD Service Area	Improve Service	Study
CS1278	Comprehensive Water Master Plan	DWSD Service Area	Add Flow	Study
PC736	Northeast Sewage Pump Station Improvements	Macomb Co. Sewage Districts	Improve Service	Pre-Construction
CS1363	Belle Isle Pump Station Improvements	Detroit: Belle Isle	Improve Service	Construction
CS1281	Long-Term CSO (Partial) Control Plan Phase II	DWSD Service Area Wide	Add Flow	Planning
CS1281	Suburban Capacity Requests	Clinton Township	Expand Area	Planning
CS1281	Upper Rouge CSO Tunnel	Detroit	Add Flow	Study
PC739 CS1284	Connor Creek CSO Facility	Detroit: Connor Creek at Detroit River	Add Flow	Construction
PC731	St. Aubin CSO Pilot Facility	Detroit: St. Aubin at Detroit River	Add Flow	Complete
PC732	Leib CSO Pilot Facility	Detroit: Leib at Detroit River	Add Flow	Complete
PC748	Baby Creek CSO Facility	Detroit: Baby Creek sewer to outfall at Rouge River	Add Flow	Construction
PC719	Oakwood Pump Station Modifications	Detroit	Improve Service	Construction
CS1329	In-System Storage Devices	DWSD Service Area	Add Flow	Construction
CS1284 PC739	Conner Creek and Fox Creek Stations Rehabilitation	Detroit	Improve Service	Construction
PC695	Regulators/Remote Flow Control Structures and Dam Rehabilitation	DWSD Service Area	Rehab Facilities	Construction
PC713	Department-Wide Instrumentation, Control, and Computer Systems Program II	DWSD Service Area	Improve Service	Construction
PC744	Wastewater System Asset Audit Task of Program Management for DWWTP Rehabilitation, Upgrade	Detroit	Rehab Facilities; Improve Service	Planning
	Clintondale Pump Station Forcemain Capacity (Clintondale P.S. Improvements)	Macomb County Sewage Districts	Add Flow	Design
PC687	Master Sewer Meters, Clinton Township	Clinton Township	Improve Service	Construction
PC685	Bluehill Pump Station Addition	Detroit	Add Flow	Construction
CS1240	Lateral Sewer Replacement-Palmer Woods	Detroit	Improve Service	Design
PCi45	Romeo Arm Interceptor in Garfield Road	Macomb County	Expand Area	Construction
CS1330	Environmental Regulation Compliance	Detroit	Improve Service	Study
CS1336	Public Involvement with CSO Planning	Detroit	Improve Service	Study
CS1344	Inspect/Rehab Existing Outfalls	Detroit: Detroit, Rouge rivers	Rehab Facilities	Construction
	Helen Jefferson In-Place Rehabilitation	Detroit	Rehab Facilities	
PC709	Detroit River Outfall No. 2 Oversight	SW Detroit (WWTP)	Improve Service	Construction
PC694	Hubbell-Southfield CSO Basin	Detroit	Add Flow	Monitoring
	Fox Creek Improvements	Detroit	Rehab Facilities	Construction

Table 6.2: Suburban System Ongoing Projects

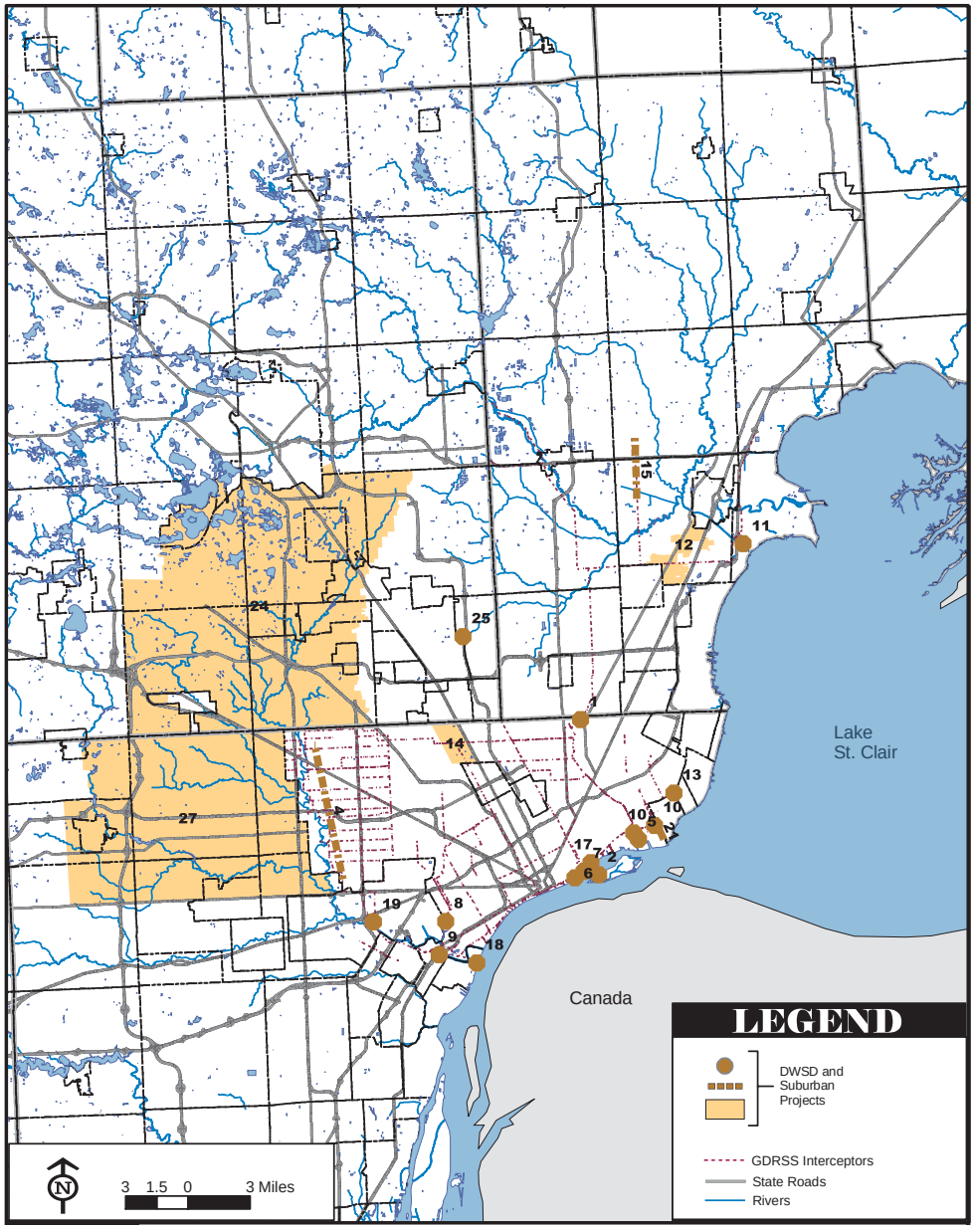
Project Name	Location	Category	Current Stage
Evergreen Farmington SSO	SE Oakland County	Reduce Flows	Planning and Design
Kuhn Drain (Twelve Towns) CSO Basin	Twelve Towns Area	Add Flow	Design
North Gratiot Interceptor	Macomb County	Add Flow	Planning
Middle Rouge SSO	Wayne County	Reduce Flows	Planning
Phase II CSO Facilities	Wayne County	Add Flow	Planning

Table 6.3: Major Developments and Transportation Projects

Project Name	Location	Category	Current Stage
Metro Airport Expansion	Romulus	Reconfigure	Construction
Pinnacle Aeropark	Romulus	Reconfigure	Planning; Design
Compuware HQ	Campus Martius	Reconfigure, Add Flows	Completed
Campus Martius Reconstruction	Woodward & Michigan	Reconfigure	Construction
Ambassador Bridge Gateway	I-75 at Ambassador Bridge	Reconfigure	Design
Ambassador Bridge Second Span	Detroit River at Ambassador Bridge	Reconfigure	Study
Rouge Gateway Project	Along Rouge River from Michigan Ave to Detroit River	Reconfigure	Planning; Design
People Mover Extension	Downtown Detroit		Study
Light Rail -- Woodward	Downtown to 8 Mile	Reconfigure	Study
Detroit Intermodal Rail Terminal	SW Detroit	Add Flows	Planning
Cruise Ship Dock	Detroit River	Add Flows	Planning
Ford Field	I-75 & Brush	Reconfigure	Completed
Fairgrounds Redevelopment	Woodward and 8 Mile	Add Flows	Planning
I-375 Extension	Woodward to Atwater	Reconfigure	Planning
I-94 Widening and Reconstruction	M-10 to Eight Mile Road	Reconfigure	Planning
I-96 Interchange Reconstruction	Beck to Wixom Roads	Reconfigure	Planning
Telegraph Road Extension	Dixie to Walton	Reconfigure	Planning

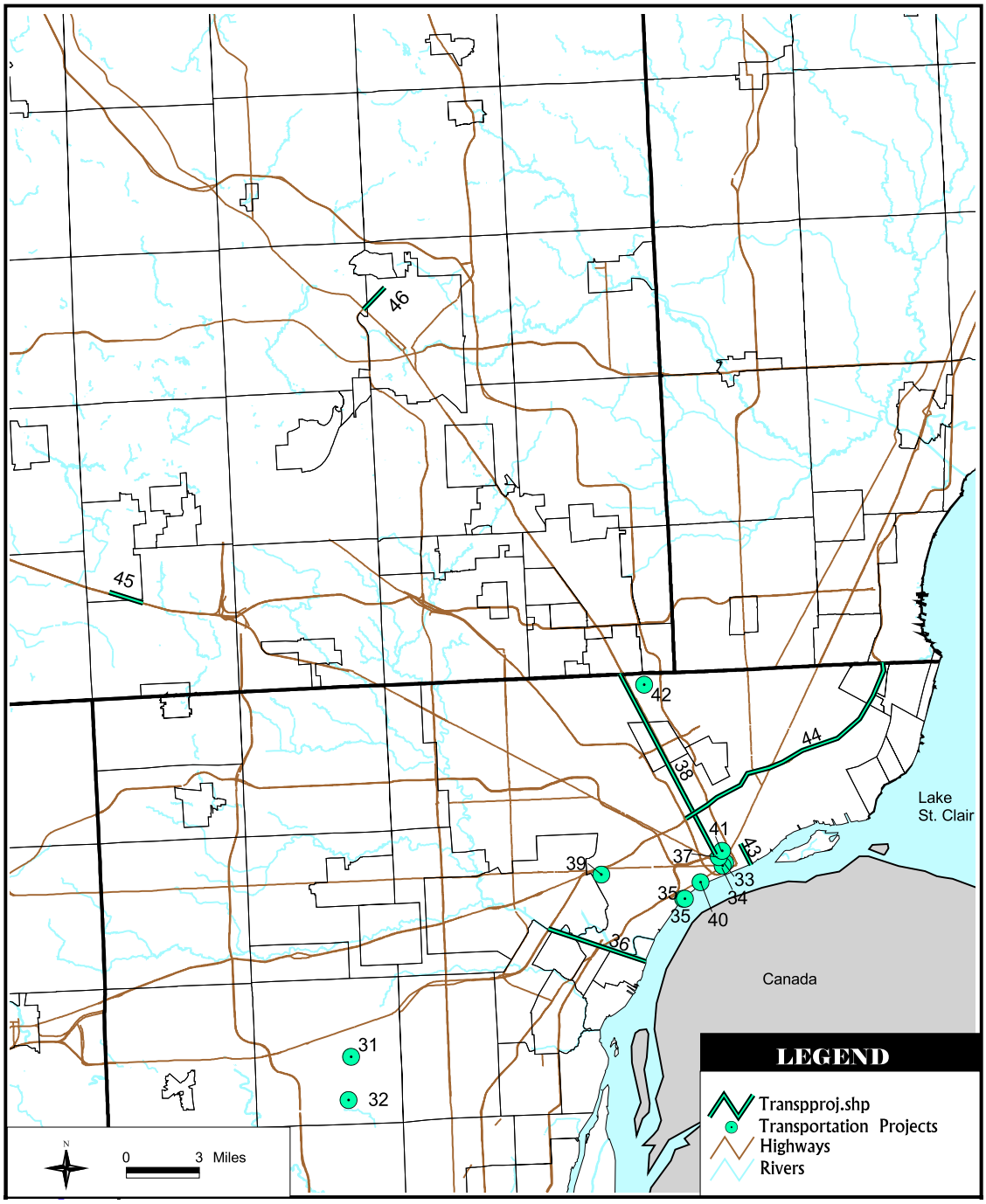
The *Review of Projects in the Planning Area* technical memorandum which accompanies this report lists additional road widening and improvement projects that are planned or currently underway in the Study Area.

Figure 6.1: Current DWSD and Suburban Wastewater Projects



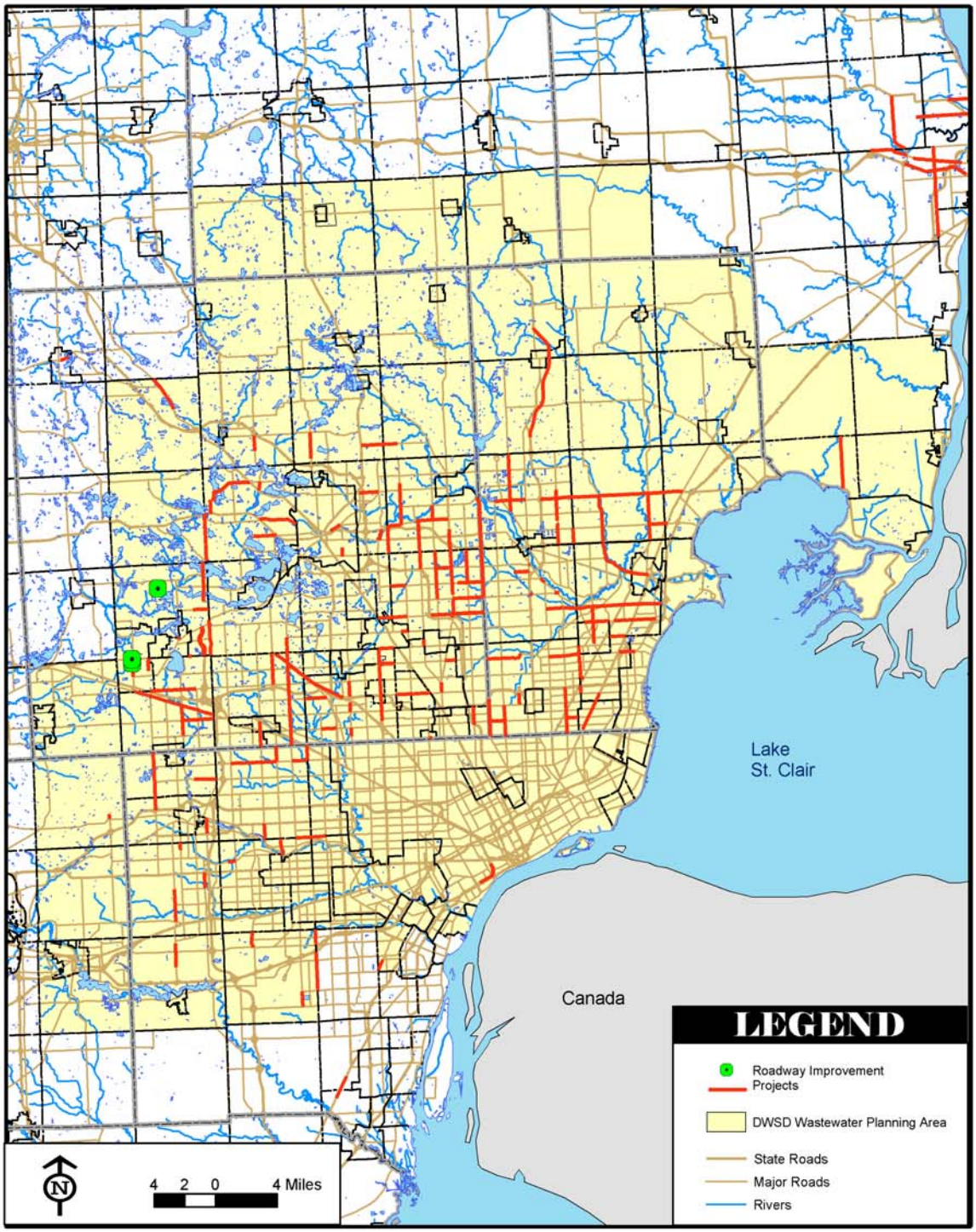
MAP KEY: 1) Northeast Sewage Pump Station Improvements, **2)** Belle Isle Pump Station Improvements, **3)** (Reserved), **4)** Upper Rouge CSO Control Facility**, 5)** Connor Creek CSO Facility, **6)** St. Aubin CSO Pilot Facility, **7)** Leib CSO Pilot Facility, **8)** Baby Creek CSO Facility, **9)** Oakwood Pump Station Modifications, **10)** Conner Creek and Fox Creek Stations Rehabilitation, **11)** Clintondale Pump Station Forcemain Capacity, **12)** Master Sewer Metering, Clinton Twp., **13)** Bluehill Pump Station Addition, **14)** Lateral Sewer Replacement-Palmer Woods, **15)** Romeo Arm Interceptor in Garfield Road, **16)** Inspect/Rehab Existing Outfalls (various locations throughout city), **17)** Helen Jefferson in-place rehabilitation, **18)** Detroit River Outfall No. 2 Oversight, **19)** Hubbell-Southfield CSO Basin, **20)** Fox Creek Improvements, **21)** Evergreen Farmington SSO, **22)** Kuhn Drain (Twelve Towns) CSO Basin, **23)** Middle Rouge SSO

Figure 6.2: Transportation and Development Projects



MAP KEY: 31) Metro Airport Expansion, **32)** Pinnacle Aeropark, **33)** Compuware HQ, **34)** Campus Martius reconstruction, **35)** Ambassador Bridge Gateway, **35)** Ambassador Bridge Second Span, **36)** Rouge Gateway Project, **37)** People Mover Extension, **38)** Light Rail--Woodward Detroit, **39)** Intermodal Rail Terminal, **40)** Cruise Ship Dock, **41)** Ford Field, **42)** Fairgrounds Redevelopment, **43)** I-375 Extension, **44)** I-94 Widening and Reconstruction, **45)** I-96 Interchange Reconstruction, **46)** Telegraph Rd. Extension

Figure 6.3: Future Road Widening and Improvement Projects



7. Policies, Practices and Contracts

7.1 General

The Detroit Water and Sewerage Department has developed policies and practices related to the design, construction, operation, and financing of the regional wastewater collection and treatment system.

The following aspects of these standards were reviewed for the Wastewater Master Plan:

- 7.2 Design standards
- 7.3 Operational responsibilities
- 7.4 Capacity allocation
- 7.5 Wastewater service contracting
- 7.6 System expansion

7.2 Design Process and Standards

The Water Systems Design Group and the Wastewater Design Group – both part of DWSD's Engineering Services Division – are responsible for the design of sewers, force mains and sewage pump stations. Consulting engineers are often hired to perform projects under the direction of the Division.

The Water Systems Design Group designs large and small pipelines, (including the sewers and force mains) for both water and wastewater services. The group is made up of the Planning, Major Pipeline Design, Urban Systems Design, and Suburban Systems Design sections.

Water Systems Group

Planning Section

The Planning Section establishes the hydraulic design of sewers and pumping stations. For major sewers such as the interceptors and large trunk sewers, the Planning Section prepares a Basic Requirements Report (BRR). The BRR documents current and projected population and wastewater flows, future maximum design flow, and diameter and slope of the pipes. The large interceptors and trunk sewer projects are usually executed as capital projects funded under the DWSD Capital Improvement Program (CIP). The last large sewer planning was performed in the mid-1980s.

Major Pipeline Section

The Major Pipeline Design Section is responsible for the structural and materials components of the design. This section handles sewer interceptors and water transmission mains. The Major Pipeline section also controls pipe material type, pipe joints, anchorages, footings, and layout and is in charge of producing contract documents for the construction of large water and sewer projects. Redevelopers are directed to modify existing systems to meet their needs.

Urban Systems Design Section

This section designs smaller sewers (typically smaller than 36-inches to 48-inches in diameter) within Detroit. Since most of the city is already part of the DWSD collection system, new lateral sewers are designed if there is a significant change in the land use pattern or if residents complain about basement flooding that may be caused by undersized existing sewers. Redevelopers are directed to modify the existing system to meet this need.

Suburban Systems Design Section

This section reviews the design of water and wastewater pipes in subdivisions and developments of suburban communities that are DWSD customers. The designs are reviewed to avoid construction conflicts with existing DWSD-owned facilities and to verify that the pipe materials used are consistent with DWSD specifications and to assure minimum pipe size standards are met. The

design of the meter and point of connection to the DWSD system is checked to verify that the pipe size is adequate and that the type of connection is consistent with DWSD specifications. The suburban community is responsible for the design.

Wastewater Systems Group

The Wastewater Design group is responsible for the design of wastewater treatment and collection facilities, including sewage pumping stations that are DWSD-owned and operated.

The General Superintendent of Engineering requests construction of new sewage pumping stations or modification of existing stations based on projected future sewage flows by the Planning Section of the Water Systems Design group. The Water Supply Operations division, which operates and maintains the sewage pumping stations, also generates such requests.

The Wastewater Design Group is given the flow and head requirements for new pumping stations. For existing pumping stations, extra pumping capacity or pump replacement may be needed. The Wastewater Design Group creates contract documents for new or modified pumping stations based on flow and head requirements.

General guidelines for the hydraulic design of sewage pumping stations include recommendations:

- To comply with the Ten States Standards for wastewater facilities design
- To comply with requirements of environmental regulatory agencies (in this case MDEQ)
- To provide a spare pump with a capacity equal to that of the largest pump
- To provide space for the addition of one or two pumps for future expansion
- To provide a larger pump than required
- To increase the use of variable frequency drives
- To add a smaller pump at existing pumping stations for average flow conditions, instead of using larger pumps (designed for maximum flow conditions)

Design and Design Oversight Services

The Engineering Services Division's *Engineering Guidance Manual* and *DWSD Standard Specification Set* guides engineers on various tasks and projects. The standard specification set provides a reference for use in contract drawings on projects performed by DWSD. The following subsection provides a review of sewer design standards used in Southeast Michigan for reference.

7.2.1 Review of Sewer Design Standards

Southeast Michigan Practice

The sewer design criterion "0.4 cfs per 1,000 persons" has been commonly used throughout the Detroit regional sewer system. The origin of this criterion was reviewed, and it is compared with other standards for sewer design. In 1958, the six-county Supervisors Inter-County Committee requested a National Sanitation Foundation (NSF) study on sewerage and drainage problems in Southeast Michigan. Two resulting reports, released in 1964, reviewed the regional system and provided standards to guide future design. *Sewerage and Drainage Problems and Administrative Affairs* provides a partial history of the design criteria used in Detroit the suburban communities served by the Detroit Water and Sewerage Department collection system. Table 7.1 summarizes conditions and projected flows as understood in 1964.

In general, the existing systems provided 0.4 cfs/1,000 people (259 gpcd) for separate sewer systems and 0.5 cfs/1,000 people (324 gpcd) for combined systems according to the report. The value of 0.4 cfs/1,000 people assumed that the collection system would not have high infiltration/

Table 7.1: Historic Design Criteria for Existing Systems in 1964			Population	cfs	gpcd
Wayne County Service District:					
Rouge Valley	Combined/Sanitary	0.45 cfs/1,000	720,350	324	291
Northeast Wayne District	Combined/Sanitary	0.50 cfs/1,000	255,000	127.5	232
Grosse Pointe Shores	Combined	0.40 cfs/1,000	5,000	20	2,585
Oakland County Service District:					
Evergreen-Farmington	Combined/Sanitary	0.44 cfs/1,000	398,693	176	285
Southeast Oakland	Combined/Sanitary	0.41 cfs/1,000	681,300	278	264
Clinton-Oakland	Sanitary	n/a	n/a	n/a	n/a
Grosse Pointe Farms	Combined/Sanitary	4.0 cfs/1,000	20,000	80	2,585
Grosse Pointe Park	Combined/Sanitary	4.65 cfs/1,000	18,000	84	3,016
Detroit	Combined	0.50 cfs/1,000	4,000,000	2,000	324

cfs: cubic feet per second gpcd: gallons per capita per day

inflow and would not have connected footing drains. The 0.4 cfs/1,000 rate for suburban communities with separate systems has been institutionalized in several of the DWSD wastewater service agreements, the major exceptions being communities along Lake St. Clair. These communities have a much higher design capacity, (as much as 10 times as high – 4.0 cfs/1,000) in part to minimize storm/combined flow into Lake St. Clair and to avoid adversely affecting the raw water intake by Detroit at Belle Isle.

Ten States Standards

The *Ten States Standards for Wastewater Facilities* is a guide to designing and planning new wastewater collection systems and treatment facilities. It was prepared by a committee originally consisting of representatives from 10 Midwestern states, including Michigan. The document is commonly referred to as the Ten State Standards and its goal is establishing a degree of uniformity of practice among these states and Ontario.

The manual states that sewer capacity should be designed for the estimated ultimate tributary population, unless considering parts of the system that can be readily increased in capacity. Consideration should be given to the maximum anticipated capacity of institutions, industrial parks, etc. as well.

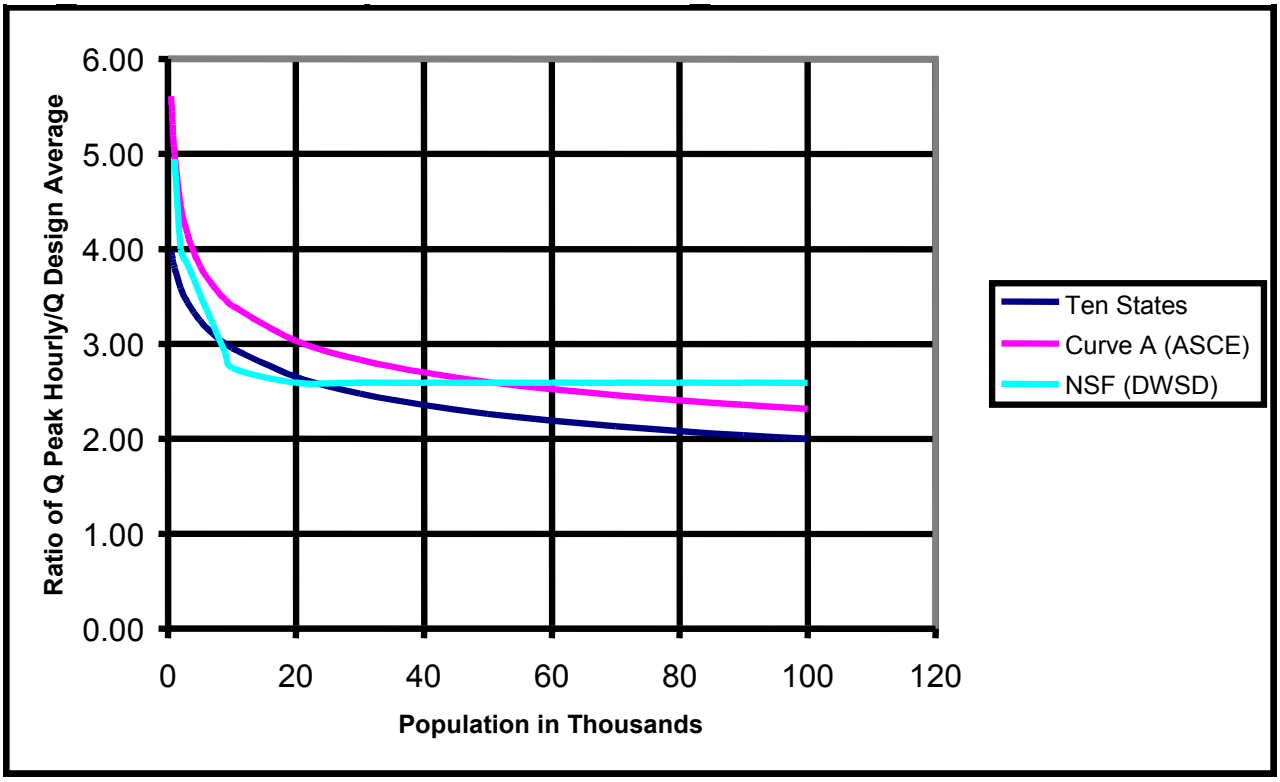
In determining the required capacities of sanitary sewers the following factors should be considered:

- Maximum hourly domestic sewage flow;
- Additional maximum sewage or waste flow from industrial plants;
- Inflow and groundwater infiltration;
- Topography of the area;
- Location of sewage treatment plant;
- Depth of excavation; and
- Pumping requirements.

In determining the required hydraulic capacity of sewers, the following flows are defined for use in these recommended design standards.

- **Design Average Flow:** The average of the daily volumes to be received for a continuous 12-month period. However, the design average flow for the facilities having critical seasonal high hydraulic loading periods shall be based on the daily average flow during that high seasonal period.
- **Design Maximum Day Flow:** The largest volume of flow to be received during a continuous 24-hour period.
- **Design Peak Hourly Flow:** The largest volume

Figure 7.1: Comparison of Design Standards Ratios



of flow to be received during a one-hour period.

• **Design Peak Instantaneous Flow:** The instantaneous maximum flow rate to be received.

For existing collection systems, the design standards recommend making projections of anticipated flows from actual flow data to the extent possible. The results are to include the probable degree of accuracy of the data used. In addition, consideration is to be given to flow reduction anticipated due to infiltration/inflow reduction or flow increases due to elimination of sewer bypasses and backups.

ASCE Engineering Practice

In 1983 a joint committee of the American Society of Civil Engineers (ASCE) and the Water Environment Federation (WEF) published *Design and Construction of Sanitary and Storm Sewers* a compilation of current practices in this field intended to be used as an aid, but not as a standard for design.

In determining the quantity of sanitary sewage to use in the design of the collection system, the manual recommends the following:

- Determine the design period for which the system is to be built;
- Estimate population for the design period;
- Project tributary area and land usage;
- Determine the average daily per-capita sewage flow;
- Determine the daily minimum, maximum and average flow and the peak 15-minute flow for any 12-month period.

The manual does not specify an average daily per capita flow rate to use; rather, a table of average flows at a number of locations is provided. These flows range from a low of 50 to a high of 209 gal-

lons per capita per day (gpcd), with a median of 100.

Comparison of Design Standards

Various approaches to determining design flows are shown in Figure 7.1. The DWSD's approach and the other standards' are similar in that they all recognize the need to account for variation in average daily flows. The DWSD practice, as recommended in the NSF report, is conservative in that it does not reduce the design flows for populations above 20,000, but holds it constant at the 0.4 cfs (259 gpcd) rate.

Another difference in the approach is that the NFS design chart gives the actual flow to use for a given population versus a ratio of minimum or peak to average daily flow. In order to compare the NSF approach directly with the other standards as was done in Figure 7.1, the flows were converted to a ratio by assuming an average gpcd flow rate of 100 gpcd.

The use of pressure sewers and grinder pumps in collection systems does not significantly change flows that would be predicted from the design standards. Pressure sewers and grinder pumps do provide some minor local attenuation of flow peaks. The design standards apply to larger areas where the net affect of such attenuation is negligible.

Modeling Approaches to Sewer Design

Since the 1980's, with the advent of computer models and more sophisticated flow monitoring techniques, the new approach to the analysis and design of combined sewer systems is to measure rates of infiltration and inflow and to use computer models to simulate conditions for specific design storms, such as a 10-year frequency, 24-hour duration storm, or the 25-year frequency, 1-hour duration storm.

Summary

The historical basis of design of 0.4 cfs per 1,000 people is an empirical approach for gravity sewers. New sewer technologies, such as pressure sewers and vacuum sewers do not necessarily have the same hydraulic response as the older gravity-flow systems on which the 0.4 cfs/1,000 rate was based.

The 0.4 cfs/1,000 rate was intended as a design standard, not as a contractual basis. It also assumes that the system is designed, constructed, and maintained well and has minimal extraneous inflows and infiltration.

7.3 Operational Responsibilities

7.3.1 Capital Improvement Program (CIP) Development

The Engineering Services' Wastewater Facility Design Group is in charge of identifying CIP projects at the Wastewater Treatment Plant and sewage pumping stations and for developing contract documents for bidding and executing these projects. Input is received from operations staff. The Major Pipeline Design group is in charge of identifying CIP projects in the conveyance system and preparing contract documents. The CSO Design group is in charge of identifying CIP projects for the collection system to comply with permits, rules and regulations related to CSOs, and contract development. The Wastewater Construction group schedules and executes construction projects at the Wastewater Treatment Plant. Construction projects outside the Wastewater Treatment Plant are managed either by the Field Engineering Group or the Wastewater Construction Group.

Each year, the WWTP, the Water Supply Operations Division and the Mechanical Maintenance Division generate a list of projects to be included on the CIP list.

Other engineering groups develop and forward similar CIP lists and all lists are ultimately submitted the CIP Executive Committee. The committee designates annual projects and prioritizes them

based on the available finding.

PC-744, was created to expedite CIP projects at the Wastewater Treatment Plant. PC-744 has identified about 35 projects to be completed over five years and it will also develop manuals, procedures and training operations.

7.3.2 Rate-Setting Procedures

DWSD's Financial Services and Financial Planning divisions are in charge of the rate-setting process for all customers.

Wholesale rates are established annually. Rates are based on projected operation and maintenance costs for the primary collection system (main interceptors and sewage pumping stations) and treatment system (wastewater treatment plant), and any capital costs incurred on this "backbone" infrastructure. In 1989, DWSD started a "look back" program, which provides for a rate adjustment at the end of each year based on actual flows and costs. Overcharged customers are reimbursed; undercharged customers have costs added to the following year's bill.

Customer input opportunity is available prior to and during the annual process of the rates being established and presented to the Board of Water Commissioners and then the Detroit City Council for approval.

7.3.3 WWTP Plant Operation and Maintenance

The Wastewater Treatment Division operates and maintains the wastewater treatment plant and the CSO retention basins. A workgroup made up of DWSD staff, suburban customer representatives and consultants reviews issues relating to WWTP improvements and regional operational plans.

The CSO Operations group is responsible for the operation of the three existing CSO retention basins. The group is expected to grow as additional CSO retention basins come into operation.

Studies and designs are currently underway on continuous sludge withdrawal and on-site residuals treatment at the DWSD's Water Treatment Plant. These improvements would eliminate solids discharge into the collection system when sedimentation basins are dewatered.

7.3.4 Operation and Maintenance of the Conveyance System

The Water Supply Operations Division also operates sewers, sewage pumping stations and the water transmission system.

The Systems Control Center, which is part of the Water Supply Operations Division, monitors and controls flow in the collection system and water system. The Facilities Management Division maintains facilities.

7.3.5 Industrial Waste Control

The Industrial Waste Control (IWC) Division monitors more than 13,000 large and small industrial and commercial customers in Wayne, Oakland and Macomb counties. It issues permits to industrial users, and enforces requirements of the Industrial Pretreatment Program (IPP) of the Clean Water Act. The staff of about 100 monitors about 400 "significant" users on a regular basis. IWC also surveys customers every three years and relies on customers for updates on changes in usage, flows, or discharge strengths. In addition to wholesale rates, IWC customers pay a charge to offset the additional costs of treatment and to support IWC's regulatory activities and face surcharges based on the pollutant levels of their discharges.

7.3.6 Office of Program Management Assistance

The Office of Program Management Assistance (OPMA) provides support to both the water and wastewater systems. It maintains records for DWSD and the reports sent to regulatory agen-

cies, and disseminates environmental and legislative reports within DWSD. OPMA also handles hazardous waste management at DWSD facilities and conducts risk management plans and air quality studies at those facilities.

7.4 Capacity Allocation

The DWSD wastewater system includes the wastewater conveyance system and the treatment system. The conveyance system includes the four main interceptors (DRI, Oakwood, Northwest and NI-EA) and lift stations. The treatment system includes the wastewater treatment plant (WWTP) and the outfalls that discharge the WWTP effluent into the Detroit River and the Rouge River.

7.4.1 Conveyance System

The DWSD makes decisions to accept new requests for capacity through a three-step process that includes:

- Independent engineering confirmation of the projected flows being requested by the wholesale customer;
- Analysis of the transport and treatment capacity of the system to accept the new flows; and
- Negotiations with the wholesale customer regarding connection costs and rates for transport and treatment.

Currently, DWSD reviews customer applications for new or expanded service only at the point of connection to the DWSD collection system. The capacity and type of connection are reviewed based on the requested flow. DWSD does not evaluate the design within the customer's service area to avoid liability for design flaws. However, DWSD will require customers to conform to DWSD's minimum standards for design and construction.

Customer applications for new or expanded services undergo an internal evaluation process. The evaluation process includes a technical feasibility study by the Engineering Services Division and a rate evaluation by the Financial Services and Financial Planning divisions. The technical evaluation only includes a capacity and connection-type evaluation at the point of connection to the DWSD collection system. Construction costs for new major infrastructure that may be needed within the customer service area (such as meters and connection points) will be paid to DWSD either through an upfront payment, a monthly surcharge rate designed to amortize the cost over a fixed time period, or a combination of the two.

The DWSD service area includes combined sewer systems as well as separated sewer systems. Detroit and several suburban communities have combined sewer systems. Some of the separated sewer systems have been classified as "wet" sanitary systems due to significant inflows.

The main interceptors within the Wayne-Oakland-Macomb area were designed for future population projections for the three counties using a design flow parameter of approximately 0.4 cfs per 1,000 capita. For a few existing "wet" systems, higher values of 0.5 to 0.6 cfs per 1,000 capita were used.

The Greater Detroit Regional Sewer System (GDRSS) model was developed through a cooperative effort between DWSD, Dearborn and Wayne, Oakland and Macomb counties to predict the hydraulics and flows in the collection and transport system. The GDRSS model has been widely used to estimate flows in the DWSD collection system under dry weather and wet weather scenarios. The GDRSS model was updated to the Wastewater Master Plan model Version 1.0 and is useful in predicting the hydraulic profile at various locations in the collection system at different flows. It has been used for system-wide flow balances and analysis of some customer requests for

additional information.

7.4.2 Treatment System

In 1996, DWSD published the *Long Term CSO Control Plan* study. In addition to the plan, the study evaluated individual process capacities and the overall treatment capacity at the wastewater treatment plant. It reported:

- Maximum flow capacity of 2,500 mgd in the transport system;
- In-system storage capacity of 130 million gallons;
- Firm pumping capacity of 1,646 mgd for raw sewage for the two pumping stations at the WWTP;
- Primary clarifier raw water capacity (excluding recycle flow) of 1,520 mgd;
- Secondary clarifier capacity of 930 mgd (including recycle);
- Solids handling capacity of 552 dry tons per day;
- Total outfall capacity of 1,800 mgd.

The study recognized that the primary clarifier capacity was the limiting factor in treating wet weather flows. Hence, two new clarifiers are being built to increase permitted primary treatment capacity by approximately 180 mgd. Other ongoing construction projects include new chlorination and dechlorination facilities, and construction of a second outfall to the Detroit River.

The annual average flow at the Wastewater Treatment Plant, including dry and wet weather flows, was approximately 725 mgd in 2001. However, flows reach as high as 1,500 mgd during extreme wet weather events.

The DWSD *Long Term CSO Plan* (DWSD Contract CS-1281) addressed the issue of building CSO retention basins to store wet weather flows in excess of the primary treatment capacity. Currently, Detroit has three CSO retention basins recently built and in operation (Hubbell-Southfield, Puritan-Fenkell and Seven-Mile). Additional CSO retention basins are either under construction (Conner Creek CSO Pilot Facility, St. Aubin/Leib CSO Pilot Facility) or are being designed. The basins and others in the suburbs are listed in Chapter 3, Table 3.1.

7.5 Wastewater Service Contracting

DWSD contracts with municipalities, public sewage disposal districts or authorities and some individual residential and commercial customers for wastewater services.

The DWSD does provide wastewater service directly to residents of Detroit and to about 200 residential and commercial customers in municipalities that border Detroit. (For example, some properties in Southfield along Eight Mile Road are provided residential sewer service from Detroit). In these cases, DWSD and the respective municipalities have determined that the most cost-effective service for these customers is service directly from Detroit. In addition, several large commercial customers throughout the service area have contracts with DWSD.

In addition to the City of Detroit, DWSD has service contracts with the following customers:

Wayne County: Northeast Wayne County; Wayne County Area #3; Wayne County Area #6; Rouge Valley; Allen Park; Dearborn East; Dearborn Northeast; Dearborn West; Grosse Pointe; Grosse Pointe Farms; Grosse Pointe Park; Hamtramck; Harper Woods; Highland Park; Melvindale and Redford Township.

Oakland County: Clinton-Oakland District; Evergreen-Farmington District; Farmington; Southeast Oakland County District.

Macomb County: Center Line, Macomb County, Northeast Wayne County and Southeast Macomb Sanitary District (via Wayne County).

The city's wastewater service contracts were reviewed from the perspective of changes that may be required to support the Wastewater Master Plan. Many of the current contracts for wastewater service were originally developed over 50 years ago, and there are a great variety of terms and conditions that are unique to particular customers. The lack of uniformity presents a challenge to master planning, particularly:

- Different lengths of term of service
- Different types of flow limits (some reference 0.4 cfs/1,000 persons without quantifiable flow rates)
- Ownership, access authority and maintenance responsibilities for specific facilities
- Enforcement of penalty provisions, where these exist
- Penalty rates are from 30 years ago and lack incentive
- Different billing intervals

The Wastewater Master Plan will be best supported by contracts that have standard provisions with specific flow limits and terms of service. A discussion of contract terms with wholesale customers has been conducted through the existing structure of partnering and work groups.

These work groups have included the Contracts Work Group, the SSO Work Group, and the Wastewater Treatment Plant Improvement Regional Operation Plan (WIMPROP) Work Group. The Contract Work Group and the WIMPROP Work Group are continuing beyond the Master Plan project.

7.6 System Expansion

The DWSD adopted the System Expansion Policy in 1998. The System Expansion Policy calls for charging capital costs to new or existing customers who wish to either extend or expand their water and wastewater services within their communities. Prior to this policy, when customers requested additional or expanded service to the DWSD system, capital costs were distributed among the entire customer base.

7.7 Next Steps

The policies and practices reviewed in this chapter have been further documented and discussed with DWSD and its customers during the remainder of the Master Plan. The needs for further documentation, consistency and staff training in the application of the policies and practices are assessed as part of Volume 5: *Customer Service and Technical Support Program.*

8. Regulatory Issues

Laws, regulations and agreements that affect the Wastewater Master Plan have been adopted on the international, federal, state and local level. Chief among them are the Federal Clean Water Act, Clean Air Act, Safe Drinking Water Act and the Michigan Natural Resources and Environmental Protection Act, a.k.a. the Michigan Environmental Code (MEC) and those agreements reached through the International Joint Commission.

Wastewater service providers face current and more stringent emerging regulatory issues

Emerging

- Proposed Federal Regulations
- Legal Cases
- Proposed State Regulations
- Regulatory Trends

Current

- International Joint Commission
- Federal Regulations
- State Regulations
- Transportation Permits
- Building and Zoning Codes

8.1 Water Quality Standards

The Federal Clean Water Act and the Michigan Environmental Code establish current Water Quality Standards for receiving waters. These standards, which are reviewed every three years, were last amended on several levels in 1999 to comply with EPA's Great Lakes Initiative Water Quality Guidance.

In Michigan, all waters are protected at a minimum for the following designated uses:

- Agricultural
- Navigation
- Industrial water supply
- Public water supply at the point of water intake
- Warm water fishery
- Other indigenous aquatic life and wildlife
- Partial body contact recreation

Certain other bodies of water are protected for additional designated uses, such as cold water fishery and total body contact recreation. In southeast Michigan, the cold water fishery designation applies to the Great Lakes and connecting channels and a few small trout streams. However, most rivers, streams and lakes within the region fall under the less sensitive warm water fishery designation.

Almost all of the surface waters in the region are protected for total body contact year round. In addition, narrative standards dealing with such issues as turbidity, color, oil films, floating solids, foams, settleable solids, suspended solids, deposits, taste- or odor-producing substances, and radioactive substances and numerical criteria for many pollutants, such as pesticides, phosphorus and micro-organisms, have been adopted.

Rule 82 of the Water Quality Standards allows the approval of mixing zones for the dissipation and dilution of a pollutant at the point of discharge so long as there is no biological harm and designated uses are not impaired. However, no more than 25 percent of the receiving water design flow may be used for mixing. The EPA has banned the use of mixing zones for bioaccumulative chemicals throughout the Great Lakes Basin. Michigan is expected to adopt similar regulations.

8.1.1 Water Quality Protection

Rule 98 of the Water Quality Standards requires that, in general, where new or increased pollutants are discharged, current water quality must be maintained, unless a lowering of the quality is necessary for important economic or social development in the area. Where existing water quality exceeds the minimum level prescribed by these standards, specific procedures are laid out for pol-

lutant-loading increases.

In 1978, the United States and Canada entered into a Water Quality Agreement through the International Joint Commission (IJC) to develop programs and activities necessary to protect the integrity of water in the Great Lakes Basin ecosystem. The Agreement established the Great Lakes Water Quality Board and the Great Lakes Science Advisory Board to advise the IJC on water quality and pollution control issues. The IJC, which was established in 1909 to assist governments in finding solutions to problems in boundary waters, has been instrumental in advocating major policy changes even though it has no regulatory authority. Key activities of the IJC have included:

- The establishment of recommended maximum phosphorus contributions to each lake;
- Controls on dredging activities;
- Oversight of commercial shipping operations including vessel discharges;
- Spill prevention and emergency spill response efforts;
- Expanded data collection programs and water quality trend analysis;
- Designation of "Areas Of Concern" where water quality problems have resulted in impairments to beneficial uses;
- The adoption of regulatory strategies to control persistent toxic pollutants; and
- The preparation of Lakewide Management Plans.

The International Joint Commission publishes a biennial report on problems and recommendations. These recommendations are often key considerations in the adoption of state water quality standards and effluent limits for permitted discharges, as well as the enactment of new statutory provisions.

8.1.2 POTW Issues, Permits and Related Topics

The EPA (40 CFR Part 122, and 403) and MDEQ (Part 21 Administrative Rules) set the major requirements for POTWs. Among them are:

Effluent Limits (Water Quality/Technology Based): Under federal and state law, National Pollutant Discharge Elimination System (NPDES) permits are required for all discharges of wastewater to Michigan waters. The permits typically establish effluent limits (concentration and loading) for various pollutants, sampling, reporting and scientific requirements. At a minimum, POTWs must achieve "secondary treatment" effluent quality – physical and biological removal of suspended solids and organic oxygen-consuming material, plus disinfection standards. More restrictive Water Quality Based Effluent Limits standards are sometimes imposed, particularly if the discharge is to a smaller receiving stream.

Toxic Pollutants, Reasonable Potential and WET Testing: Prior to issuing an NPDES permit, MDEQ conducts analyses on the frequency and severity of pollutant concentrations over a period of time to determine a POTW's "reasonable potential" for discharging toxic pollutants in toxic amounts. Whole Effluent Toxicity (WET) testing may be used to determine the threshold at which biological organisms experience adverse impacts when subjected to treated wastewater.

Removal Requirement: Municipal discharges are normally required to remove at least 85 percent of the influent pollutant load for suspended solids and Biochemical Oxygen Demand (BOD). A waiver from this requirement can be sought for wastewater that is diluted by stormwater drainage.

Biosolids Disposal (Incineration, Landfill, Land Application): Wastewater biosolids are typically incinerated, transported to a landfill, or disposed of by land application. Incineration is usually cost-

effective for extremely large facilities and emissions are regulated under the Clean Air Act. By-product ash is typically disposed of in a landfill under Solid Waste Management regulations of Part 115 of the MEC.

Alternatively, some facilities rely on landfills as the primary method of disposal for their biosolids. Municipal sludges, which are transported to landfills for disposal, are either stabilized (typically with lime or other chemical additives) or unstabilized, and then transported by truck to the landfill for disposal.

Regulatory constraints on landfill operations include requirements on the amount of water in sludge, and other typical constraints for issues such as daily cover, leachate collection and treatment, methane gas management, odor prevention, litter control, etc. Some wastewater treatment facilities, particularly in rural areas, utilize land application of biosolids. Such application requires compatibility (i.e., acceptable levels of toxicants and micro-organisms) and appropriate seasonal and dosage constraints. Typically, land application requires 180-day sludge-holding tanks to meet these constraints. Land development concerns sometimes make land application controversial.

Industrial Pretreatment Requirements: Industrial pretreatment of wastewater in municipal sewer systems is regulated to prevent pollution, sewer damage and disruption to POTWs. Industrial facilities are subject to local sewer use ordinances which address federal pretreatment regulations (40 CFR Part 403) on discharges, allowable concentration of pollutants, effluent standards, monitoring and reporting requirements.

Combined Sewer Overflows (CSOs): CSO provisions in NPDES permits typically establish requirements and schedules for a control program to eliminate or adequately treat combined sewage during wet weather events to meet Water Quality Standards and protect public health. These permits also require that all combined sewer overflows be reported to the MDEQ and the public. The Clean Water Act allows case-by-case solutions to be developed to meet state Water Quality Standards. Michigan requires all raw sewage of human origin to be disinfected.

Sanitary Sewer Overflows (SSOs) and Bypasses: The Clean Water Act and the MEC ban discharges of wastewater with less than secondary treatment from a separated sewer system. Such discharges have reporting requirements similar to CSOs. NPDES permits typically authorize bypasses of untreated or partially treated wastewater from the treatment plant or the collection system only under emergency conditions.

As noted in the discussion in Section 8.5 (Emerging Regulatory Issues), MDEQ is currently developing supplemental guidance which discusses the types of corrective measures to be undertaken by communities in response to wet weather-related sanitary sewer overflow problems.

DWSD is supporting its customer communities by advocating the most cost-effective solutions to SSO control, which include increased contract capacity for several communities, displacement of combined sewer flows to CSO control facilities to allow conveyance of SSO to treatment, and strategies to eliminate excessive I/I. Further description of these solutions are provided in Volume 6: *Evaluation of Regional SSO Controls.*

Stormwater Discharges: Federal EPA regulatory controls designate Phase I (population over 100,000) and Phase II (population 10,000-100,000) separated sewer urban municipalities. Phase I municipalities are required to obtain NPDES discharge permits for their stormwater discharges. These permits include requirements to develop stormwater management plans, eliminate illicit discharges and connections, implement public education programs and undertake other pollu-

tion prevention activities. Permits detailing Phase II community requirements must be issued by 2003. Michigan's voluntary stormwater discharge permit program is comparable to the federal Phase II program, and the EPA has indicated that Michigan permits will satisfy the Phase II permit requirements.

Spill Containment and Hazardous Material Management: MDEQ's Part 5 Administrative Rules establish spill containment and storage requirements for hazardous chemicals in quantities above 40,000 gallons. Hazardous material management plans are required for stored bulk hazardous chemicals and materials. OSHA standards in this area are detailed in CFR 1910. EPA requires operator certification training for those working with chlorine gas. Public utilities must also prepare Risk Management Plans under the Chemical Safety Information, Site Security and Fuels Regulatory Relief Act (Public Law 106-40).

Construction Permits: Permits must be obtained from MDEQ pursuant to Part 41 of the MEC (formerly Act 98, P.A. 1913) prior to construction or alteration of any sewer system or treatment facility. The permit application includes a certification from the sewer system owner that sufficient capacity is available in the transport system and at the wastewater plant to convey and treat flows generated by the proposed project. MDEQ issues a permit after reviewing the application and determining that the facilities have been properly designed so as to protect the public health and prevent unlawful pollution.

8.2 Financial Assistance Programs, Funding Issues

Financial assistance programs and constraints on generating revenue are in place at the state and federal level.

State Revolving Fund Loans: State Revolving Fund (SRF) and EPA loans under the Title VI of the Federal Clean Water Act are available for wastewater treatment projects and collection systems at low interest rates. The SRF program (20-year loans at 2.5 percent interest in 2001) averages about $200 million in loans per year. However, discretionary projects for growth and development or other non-mandated functions often rank too low on the MDEQ priority list to receive loan assistance. SRF requirements include preparation of a "Project Plan" identifying the problem, discussing alternative solutions, and describing the proposed new facilities.

In order to increase the funds available through the SRF program, the Michigan legislature authorized a referendum in the November, 2002 election requesting voter ratification of a $1 billion General Obligation bond to provide additional funding for wastewater infrastructure projects. It was approved. The funds available for SRF loans approximately doubled, and allow up to 10 percent of the bond proceeds to be used for improvements on private property, such as septic tanks/tile field renovations and disconnection of footing drains from sanitary sewer systems.

Grant Programs: Federal grant money is sometimes available for specific projects. An example is the Rouge River National Wet Weather Demonstration Project, which financed construction of many CSO control facilities. That federal grant included a requirement for a 45 percent local match. Most grant programs tend to focus on rural and financially disadvantaged areas. However, in December 2000 Congress authorized $1.5 billion for CSO control facilities as part of the Wet Weather Water Quality Act of 2000. Details of this program are not yet finalized and by law the grant program cannot begin unless a minimum funding level for SRF loans is surpassed.

Stormwater Utility Financing: Some areas have generated revenue based on charging for stormwater drainage and runoff. The legality of this type of stormwater utility financing is in question

based on a Michigan Court of Appeals ruling that Lansing's stormwater fees constituted an illegal tax since they were imposed without ballot approval.

Basement Flooding Liability and Claims: A Michigan Courts of Appeals ruling that municipalities are strictly liable for basement flooding and sewer backup damages even though negligence may not exist has led to the passage of Public Act 222 of 2001. This law, which took effect on Jan. 2, 2002, amends Michigan's governmental immunity statute to give municipalities certain protections from lawsuits for sewer backups, but only if provisions of the Act are followed.

8.3 Miscellaneous Environmental Requirements

Various other state and federal regulations are applicable to wastewater treatment.

Soil Erosion and Sedimentation Control: Part 91 of the MEC requires that permits issued by local agencies to require on-site soil erosion control measures such as silt curtains, straw bales, temporary stormwater detention ponds, and prompt reseeding of bare areas to minimize deposition of sediments from runoff during project construction. Enforcement is delegated to local agencies.

Source Water Protection: The Safe Drinking Water Act requires that all pollutant sources that could adversely affect potable water supplies be identified and, where necessary, controlled to protect raw water intakes.

Floodplain Occupation: Part 31 of the MEC prohibits occupation, filling or grading of floodplains, streambeds or stream channels, except as designated through MDEQ permits that regulate activity that would harmfully interfere with the discharge or stage characteristics of the stream.

Wetland Preservation: Part 303 of the MEC restricts draining, filling and developing wetlands larger than five acres. Farming and related agricultural activity is exempted. Creating new wetlands to offset losses is sometimes considered as a last alternative.

Inland Lakes and Streams: Part 301 of the Michigan Environmental Code controls encroachment on lakes and streams including dams, stream crossings, shoreline alterations, and filling and grading activities. MDEQ permits require detailed explanation on protection of water resources when applicable.

Great Lakes Submerged Lands: Permits from both state and federal agencies are required for activities that encroach on or modify Great Lakes shoreline or submerged lands. Regulated activities include shoreline stabilization structures, marinas, docks and alterations to bottom elevation or side slopes. Relevant regulations are Part 325 of the MEC and the Rivers and Harbors Act of 1899.

Farmland Preservation: Owners of farmland and open space may enter into a 10- to 90-year "development rights agreement" which limits property taxes, thus preserving farmland and open space from development and conversion (Part 361, MEC).

Waste Haulers and Septage: Parts 121 and 117 of the MEC and MDEQ's Administrative Rules require those businesses that haul septage and liquid industrial waste to license all vehicles, to comply with standards for transport and disposal of materials, and to submit reports on the quantity, nature and disposal point of wastes.

8.4 Local Requirements

Local and county requirements may affect wastewater treatment plans in southeast Michigan.

Detroit City Charter: The new charter that went into effect in 1997 describes the specific duties of

the Water and Sewerage Department, including supplying water and sewerage and establishing equitable rates. It requires funds paid to the city for these services to be used for payment of expenses incurred in providing the services. It requires that no property necessary for the operation of the department be sold without voter approval. It provides for the adjustment of rates and cites penalties for failure to comply with Charter regulations. The Water and Sewerage Department is required to provide reasonable standards of uninterrupted service and prohibit unjust discrimination on service and rates. Under the Charter, the Water and Sewerage Department is also subject to provisions pertaining to other city departments in areas such as condemnation of property, sale or disposition of property, borrowing for improvements, entering into contracts, etc.

Under the City Charter, eminent domain can be exercised to condemn private or public property located within or outside the city for any public purpose, provided that private property owners are provided just compensation.

Wayne County Stormwater Ordinance: In October 2000, Wayne County adopted an ordinance that establishes stormwater management standards for new development projects in Wayne County including residential, commercial and industrial subdivisions. The ordinance requires adequate stormwater outputs based on an allowable peak flow rate of discharge from the developed area, and protection of downstream water resources through use of detention basins and buffer strips.

Zoning and Site Plan Approvals: Public utility development in an area where conflicts exist with local master plans and zoning requirements may require a petition to rezone the property or a request for a variance or special-use permit.

Building and Safety Permits: Most local governmental units have established procedures and rules governing construction of buildings to meet code and safety requirements. Permits are required from a local building and development department based on applications that describe the specific facilities to be constructed. Periodic inspections during construction are required. A fee is typically charged to recover costs.

Street and Road Permits: Local, county and MDOT permits are typically required for activities that impact roadways including temporary closures, traffic redirection, modification of traffic control devices, and installation of underground utilities within the road right-of-way.

Railroad and Utility Approvals: Activities that impact railroad or public-utility property require formal approval from affected agencies prior to construction. Encroachment on such property or easements requires permission, which is typically issued after detailed plans are approved by the agency.

County Drains: Permits are required from the county drain commissioner for activities that affect a variety of county drain issues including drain crossings, encroachment into the right-of-way, channel modification, drain bank encroachment and activities that alter drainage quantities.

8.5 Emerging Regulatory Issues

The most significant emerging regulatory issue appears to be EPA's Total Maximum Daily Load regulation. This policy could fundamentally change the regulatory approach for siting new facilities. It also could change the process for establishing limits on discharges from existing facilities. The other critical emerging issues are new regulations to control sanitary sewer overflows, and further clarification of MDEQ's definition of "adequate treatment" for combined sewer overflows. Wet weather discharges (both SSOs and CSOs) are problematic in southeast Michigan and changes to the regulatory program for these

sources could be significant. Basement flooding liability and reporting requirements are also of concern. Potential emerging issues are:

Total Maximum Daily Loads (TMDLs): This proposed regulatory initiative would establish maximum allowable pollutant loads to all impaired water bodies, including most of the waterways in Southeast Michigan, for both point and non-point contributors.

Sediment Cleanups: The potential initiative would identify and remedy contaminated sediments in lakes, rivers and harbors and further control of pollutant sources to prevent recontamination.

Septic Tank Regulations: New requirements are anticipated to require more effective oversight and control of septic tank/tile fields. These are likely to increase the frequency of pumping.

Septage Disposal Legislation: It has been proposed that Michigan adopt the federal 503C regulations on land disposal of septage. Compliance with federal regulations would reduce the land application of septage.

"Smart Growth" Initiatives: Consideration is being given to a variety of programs aimed at reducing sprawl onto undeveloped lands with limited infrastructure. Financial incentives and planning-based requirements are being considered.

Sanitary Sewer Overflow Supplemental Guidance: MDEQ has developed supplemental guidance describing corrective measures that need to be undertaken by communities with SSO problems due to excess wet weather. This includes a list of "short term measures" that focuses on the identification and control of sources of infiltration and inflow, as well as longer term corrective projects such as storage facilities, treatment facilities or transport facilities.

8.6 Conclusions

Many state, federal and local regulatory programs have the potential to impact the Wastewater Master Plan as it pertains to both the wastewater treatment and the collection system. Based on growth and development in the service area, additional wastewater treatment capacity will be required as populations expand. The antidegradation requirements of Rule 98 in Michigan's Water Quality Standards mandate that any increased discharge or new discharge must demonstrate the economic and social impacts necessary for additional treatment plant capacity.

Plans for a new wastewater treatment plant would be complicated by regulatory constraints including stringent effluent limits to protect receiving streams (especially small water bodies), compatibility with local zoning ordinances and land-use plans, as well as concerns from property owners. Treatment requirements for a new wastewater plant may be substantially more stringent than the conventional secondary treatment process currently employed by DWSD, especially if the facility cannot be located on a Great Lakes connecting waterway such as the Detroit River, where substantial dilution is available to offset the need for advanced waste treatment processes. Financial assistance from the SRF loan program may be difficult to secure if the primary purpose of the facility is to serve future growth and development. Conventional financing through bond sales may require that the debt be supported by sewer revenues from existing customers.

Extension of sewers to unsewered areas may be constrained by local regulatory requirements including zoning and site plan issues, street and road permits, stream crossings, farmland and open space preservation, and wetland conservation programs. The incremental impacts of an expanded sewer service area on the current system must be addressed including transport and treatment capacities.

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