Wet Weather Pollution Information Kit

A guide to understanding why storms trigger pollution and what is being done to correct the problem

Prepared by the Detroit Water and Sewerage Department and its First Tier Wholesale Customers

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Wet weather pollution is a complex problem – there are no easy, quick-fix solutions. Combined sewer overflows, sanitary sewer overflows and polluted storm water runoff occur for a multitude of reasons that many times are site specific. Understanding a particular wet weather pollution problem and the approach being taken to address it can be challenging.

The Detroit Water and Sewerage Department (DWSD), in conjunction with its first tier customers, has created this information kit to serve as a resource for wet weather pollution control projects. Significant progress has been made in this area as demonstrated through the numerous projects highlighted in the kit. Many communities outside the DWSD service area are also addressing these same issues.

Southeast Michigan communities have spent hundreds of millions of dollars addressing wet weather pollution problems. Some communities have been fortunate enough to secure federal funding that was available through the Rouge River National Wet Weather Demonstration Program or a low-interest state loan. Many others have had to use local funds and user fees to finance their projects, depleting existing funds needed for other infrastructure maintenance. Funding will continue to be a struggle as communities undertake additional projects needed for long-term wet weather solutions.

The year 2002 has been declared the "Year of Clean Water" as the nation celebrates the 30th anniversary of the enactment of the Clean Water Act. We encourage you to promote the progress being made – wet weather pollution is declining through the efforts of municipal and county government and local watershed groups. We hope this kit serves as a useful resource when a primer in a specific technical area is needed. There are numerous sources of additional information available on the Internet listed throughout the kit.

Sincerely,

George Ellenwood

George Ellenwood
Public Affairs Manager

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Executive Summary

Sewer system design has changed significantly during the last century. Initially, sewers were a substitute for open drains. Enclosed pipes were then designed to transport both wastewater and storm water. Pollution impacts of untreated overflows became evident and separate storm and sanitary sewers were constructed. Today's sanitary sewers are designed to prevent storm water from getting into them but we are still addressing issues from the past.

Storms can trigger pollution to our waterways in several different ways. Combined sewer overflows (CSOs) occur when older sewer pipes designed to carry wastewater and storm water overflow into rivers and streams during storms. Sanitary sewer overflows (SSOs) occur when storm water overloads sanitary sewers through inflow and infiltration; excess flows are released into a river or lake to prevent basement flooding. Storm water also picks up pollutants as it runs off impervious areas and pollutes waterways when it is discharged, untreated.

Southeast Michigan communities and counties have spent hundreds of millions of dollars planning, designing, constructing and operating wet weather pollution control facilities to address these problems. There are many successful projects to celebrate that have decreased the amount of pollutants entering our waterways. But, work still needs to be done. Additional funding is needed to continue implementing long-term wet weather pollution control programs. Capital costs for these pollution control programs will continue to significantly impact sewer service rates.

The frequency of CSO has decreased in southeast Michigan during the last decade as communities have focused on controlling this pollution source.

- Southeast Michigan communities are at the forefront of CSO control. Ten CSO control basins have been constructed and numerous sewer rehabilitation programs undertaken. Data from these projects are being used by many communities throughout the country that are just beginning to control their CSOs.
- The state of Michigan has provided the highest level of funding for CSO projects of any state through the State Revolving Fund (SRF) from 1992 to 2000. The Rouge River National Wet Weather Demonstration Project, the largest federally funded wet weather project, has funded portions of many projects. Local communities have also matched millions of dollars and are repaying bonds and low interest loans.
- Nearly 90 miles of the Rouge River are free of the adverse impacts of CSO; this is a 51% reduction in CSO impacted river miles in the past six years.

Communities in southeast Michigan are working together to develop regional approaches to address SSO problems and share data.

- The Detroit Water and Sewerage Department is working with its customer communities to develop a solution for controlling their SSOs as part of Detroit's wastewater master plan. Detroit does not experience SSO but can help communities control SSO through capacity management in the sewer system.

- Oakland County is working with 15 communities in the Evergreen-Farmington Sewer District to undertake an SSO Demonstration Program.
- Clinton Township and other communities are undertaking pilot programs to test the effectiveness of disconnecting footing drains from homes in preventing SSOs.

Storm water runoff, a leading cause of water pollution, is being addressed.

- Communities are working together and using the watershed planning process to address storm water pollution. Rouge Watershed communities are ahead of the curve in this area; they have been operating under a voluntary permit since 1999 for storm water requirements that don't go into effect until 2003.
- Citizens are involved in the solution. Public education programs are being used to inform homeowners how their actions impact storm drains and the watershed.
- Illicit Discharge Elimination Plans are being developed to identify and remove illicit sanitary sewer connections to storm sewers and waterways.
- Storm water ordinances are being expanded to incorporate storm water control techniques to improve the quality of storm water discharges.

Wet weather pollution regulations are evolving.

- The focus of regulation has expanded during the last 30 years from highly visible sources of pollution like wastewater, to intermittent pollutant sources like CSO and SSO, to hard-to-see sources like storm water runoff.
- The EPA is expected to publish draft SSO regulations within the next six months and the final rules in 2005. The MDEQ is currently addressing SSO control on a case-by-case basis. MDEQ is expected to publish Supplemental Guidance to its SSO Control Strategy later this year or early next year.
- New regulations are going into effect that require communities to undertake programs to control storm water pollution. In southeast Michigan, over 170 communities must apply for a Phase II Storm Water Permit by March 10, 2003.

More funding is needed to address wet weather pollution problems.

- The Great Lakes Water Quality Bond that passed in the November 5, 2002 general election, gave the State of Michigan permission to issue bonds to generate $1 billion over ten years to finance municipal sewage treatment works and storm water projects. This bond almost doubles the amount of money available annually through the SRF. It also provides low-interest loans for improvements on private property like footing drain disconnection programs to address SSOs that are not eligible under current programs.
- In a March 2001 study, SEMCOG estimated that a $29 to $52 billion investment ("out-of-pocket" cost), or nearly $1 billion per year is needed by 2030 to maintain and improve southeast Michigan's sewer infrastructure. Wet weather pollution control needs were estimated to be 14% of this, or $4 to $7 billion.

History of Sewer Systems

Not all sewer systems are created equally. Older sewer systems can be more challenging to operate because they carry more flows during wet weather. Until the 1950s, it was common to build a single pipe, called a combined sewer, to collect sewage and storm drainage from streets and buildings. The sewer was designed to overflow to the river during storms (combined sewer overflow - CSO). This economical method worked well in dry weather but created pollution problems. To address this, communities started requiring construction of separate sanitary and storm sewer systems for new developments.

Initially, communities connected footing drains into the sanitary system because it did not require pumping to the storm sewers that were at a higher elevation. Footing drains collect water from around a home and prevent it from leaking into the basement. They also provide a route for storm water to get into the sanitary sewer system generating greater flows during wet weather.

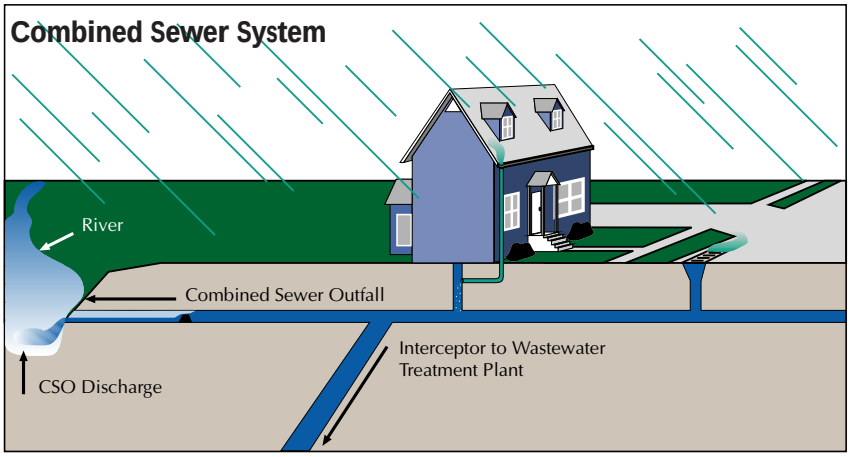
In 1973, the National Building Code was changed to prohibit connecting footing drains to a sanitary sewer. Footing drains continued to be connected in some areas until the early 1980s when these ordinances were strictly enforced. It is believed that most homes built after 1982 do not have connected footing drains.

Many communities began addressing their CSO problems during the late 1970s and early 1980s. Some constructed basins to treat wet weather flows before discharging them and others constructed new storm sewers and used the existing combined sewers to carry sanitary sewage. The majority of communities that separated their sewers did not disconnect residential footing drains because it was not cost-effective and required significant work on private property. Some communities ended up with very wet sanitary systems and constructed basins to hold excess flows until the storm passed and capacity became available.

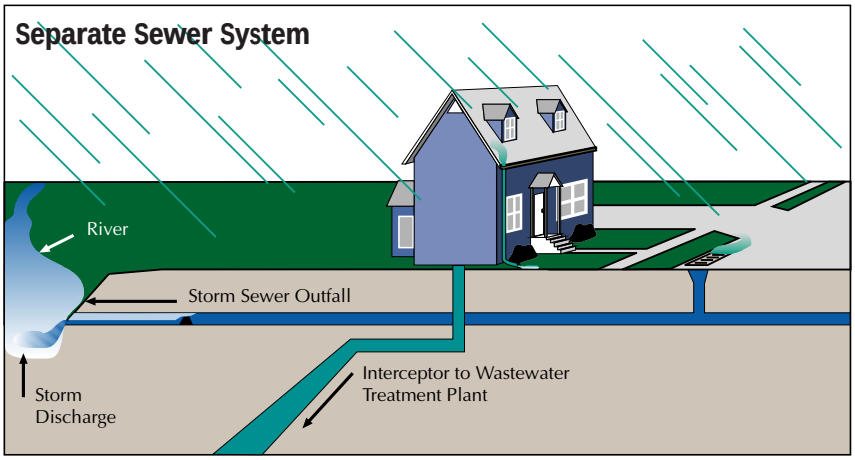
Sewer system design has evolved from single sewer pipes that collect sewage and rain water during the first half of the last century to separated sanitary and storm sewers. Storm water that gets into combined sewers and older sanitary sewers creates wet weather pollution and basement flooding problems.

Wet sanitary systems with connected footing drains can become overloaded and back up into basements or require illegal discharges into waterways to prevent basement flooding (sanitary sewer overflows – SSO). Currently, there are isolated locations within the Detroit system that experience these problems.

Sump pumps used to pick up footing drain flow in separated storm sewer systems can also create pollution problems. Sump pumps are often illegally connected back into sanitary sewers by homeowners instead of discharging to the yard or storm sewer.



Combined sewer systems transport both wastewater and storm water in the same pipe.



Separate sewer systems use separate pipes to collect wastewater and storm water.

Detroit Sewer System

The Detroit Water and Sewerage Department (DWSD) owns and operates one of the largest wastewater systems in the world. The system serves approximately three million residents in 78 communities in southeast Michigan.

The system dates back to 1836 when the first combined sewer was constructed to drain directly into the Detroit River. Called the Grand Sewer, it enclosed Savoyard Creek from Cadillac Square to the Detroit River near Third Street. A portion of this sewer is still in service today.

By 1910, 439 miles of the lateral sewer system and 194 miles of trunk sewer had been constructed to serve the City of Detroit. In 1916, the City of Highland Park became the first community to contract with Detroit for wastewater disposal services. Over the next 55 years, other communities entered into service agreements.

The system eventually grew to include a network of sewers, diversion and control devices, pumping stations and the wastewater treatment plant (WWTP). Completed in 1940, Detroit's WWTP provided primary wastewater treatment to an average flow of 420 million gallons per day (mgd). Numerous improvements have been undertaken since that time to ramp the plant up to its current secondary treatment capacity of 830 mgd and 1,520 mgd primary capacity. Pumping stations collect and transfer wastewater to major interceptors for conveyance to the WWTP. There are 3,500 miles of major sewer lines in the system includ-

ing 700 miles of 48-inch diameter pipe or larger.

The entire sewer system within the City of Detroit is a combined sewer system. A mixture of combined sewers and separate sanitary and storm sewers can be found throughout the suburban communities served by the system. Based on land area, 35% of the DWSD sewer service area is a combined system. Approximately 20% of the DWSD sewered service area is separated with connected footing drains.

Detroit owns the network of large sewer pipes that transport sewage from the suburbs to the Detroit WWTP. Counties and the suburban communities own and maintain the sewers that connect into Detroit's main interceptors. The counties and communities contract with the City of Detroit to discharge their sewage into Detroit interceptors for conveyance to the WWTP.

According to a 2001 report on sewer infrastructure needs prepared by SEMCOG, there were approximately 15,800 miles of sewer in Wayne, Oakland and Macomb Counties as of 2000. Growth projections for the three-county area require an additional 2,700 miles of sewer by 2030 bringing the total to 18,500 miles.

Synopsis

Sewer system design has changed significantly during the last century. From initially being a substitute for open drains, today's sanitary sewers are designed to prevent storm water from getting into them. Many communities in southeast Michigan are addressing problems resulting from excessive wet weather flows.

Additional Resources

Investing in Southeast Michigan's Quality of Life: Sewer Infrastructure Needs, 2001, Southeast Michigan Council of Governments.

Watersheds

A watershed is the area of land that drains into a particular river system. Watersheds come in all shapes and sizes and can vary from millions of square miles, like the land that drains into the Gulf of Mexico, to an acre or two that drains into a pond. Michigan has 65 major watersheds and five are located in southeast Michigan: Clinton, Rouge, Huron, Raisin, and Ecorse Creek. Many of these watersheds cross municipal and county borders.

Every watershed is unique, but they all collect pollutants. As water drains to the lowest point in a watershed, it picks up tiny particles of soil, oil, road salt, animal manure, excess fertilizers, pesticides, and other pollutants.

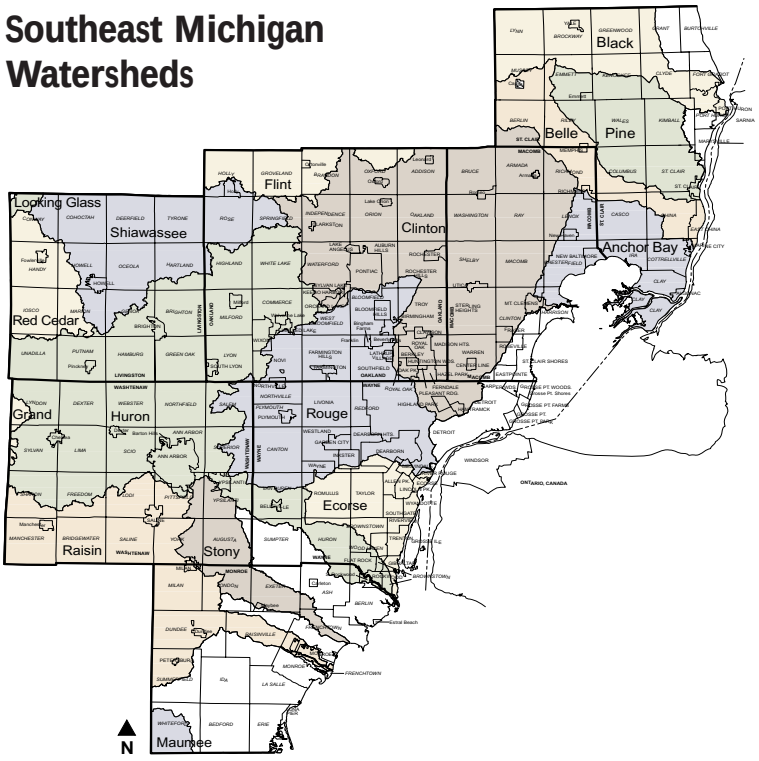
Sources of pollution in a watershed can be divided into two categories: point and non-point sources. Point sources are discharges from stationary locations such as wastewater treatment plants (WWTPs), storm sewer outlets and factories. Point sources are regulated by the Michigan Department of Environmental Quality (MDEQ). Non-point sources are pollutants that cannot always be traced to an exact point of entry. Non-point sources are more diffuse and include storm water runoff from overland flow and agriculture.

In southeast Michigan, point source discharges come from:

- Industrial facilities that pretreat their wastewater to remove pollutants used in manufacturing processes
- Wastewater treatment plants that remove approximately 90% of pollutants from wastewater before discharging the effluent to receiving streams
- Combined sewer overflows (CSOs) that contain bacteria, suspended solids, organic materials, nutrients and other pollutants
- Storm sewers that discharge runoff from roads and residential property polluted with fertilizers, oil, grease, sediments, floatables (paper, cigarette butts) and other contaminants
- Sanitary sewer overflows (SSOs) that occur due to sewer system design or operational problems (frequently during wet weather)

Watersheds are impacted by point and non-point sources of pollution.

Southeast Michigan Watersheds



Source: Watershed Boundaries, Michigan Department of Environmental Quality.

that contain bacteria, suspended solids, organic materials, nutrients and other pollutants.

Non-point sources of discharge that can pollute watersheds include:

- Runoff from agricultural lands, fertilizer and pesticide use
- Runoff from land that goes directly into rivers and streams through an open drainage system
- Drainage from landfill leachate
- Drainage from failed septic systems
- Illicit sanitary sewer connections to storm sewers that allow sanitary sewage to be discharged into waterways without proper treatment
- Stream bank erosion
- Acid rain/air deposition
- Used motor oil, antifreeze or other pollutants dumped down storm drains

Safeguarding our watersheds from point and non-point sources of pollution is important to protect public health and our drinking water supplies. Watershed protection and management requires a regional approach to address pollution sources throughout a watershed.

Many public and private organizations are joining forces to focus on problems within a watershed. They are looking at how water and land uses impact the flow of water, sediment and pollutants through the watershed. They are using watershed management as a tool to balance the goals and uses of watershed residents with environmental resources.

Communities in the Rouge River Watershed are using a watershed-based approach for their Voluntary Storm Water Permit (see Storm Water Pollution).

Synopsis

Watersheds are impacted by a variety of activities that take place within their boundaries. Management and protection of a watershed must be coordinated among the public and private organizations within the watershed.

Combined Sewer Overflows

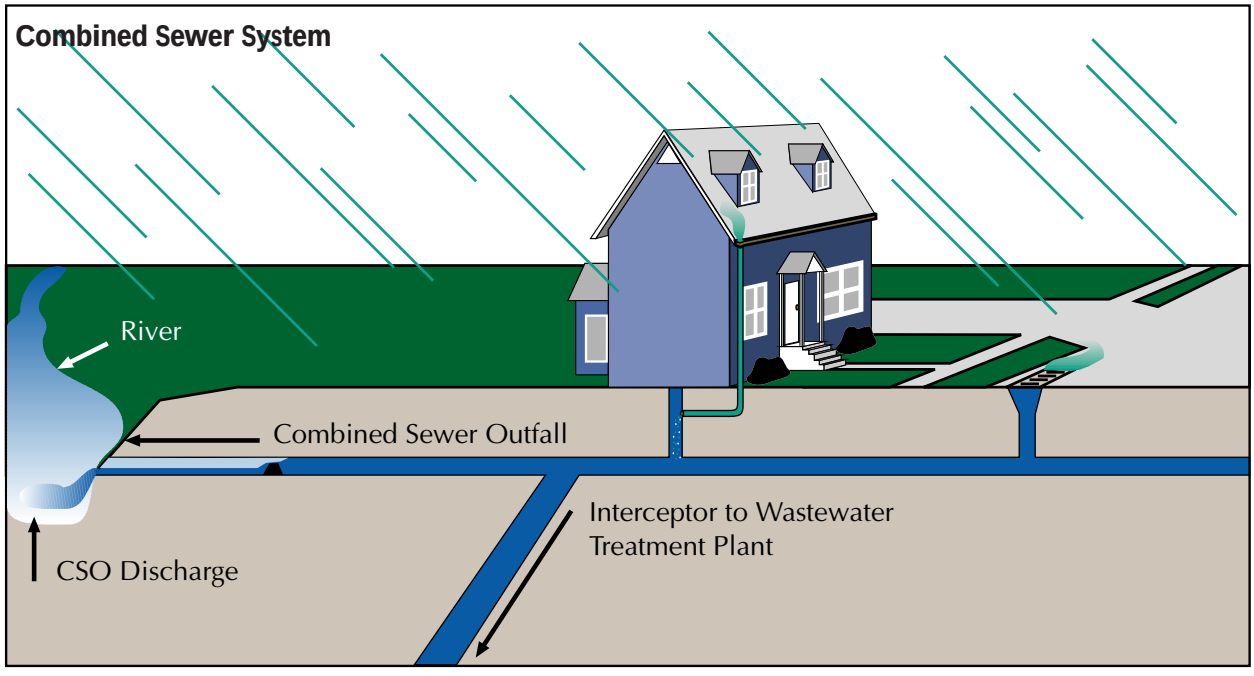
Combined sewers are remnants of our country's early infrastructure. They use a single pipe to carry wastewater from homes and businesses, and storm water that runs off streets and roofs. During dry weather all the wastewater is sent to the treatment plant. During wet weather the sewers overflow and excess wastewater that can't be sent to the treatment plant is discharged directly to a nearby stream.

These untreated overflows include human waste and other pollutants that pose a risk to human health, threaten aquatic species and damage waterways. Combined sewer overflows (CSOs) have resulted in beach closings and aesthetic problems. CSOs can contain high levels of suspended solids, biochemical oxygen demand (BOD), oil and grease, floatables, toxic pollutants, pathogenic microorganisms and other pollutants.

The frequency of combined sewer overflows has decreased in southeast Michigan during the last decade as communities have focused on controlling this pollution source.

Prevalence of CSO

Combined sewer systems serve roughly 900 communities with about 40 million people in 32 states. Most of these communities are located in the Northeast and Great Lakes Regions, particularly in Pennsylvania, Indiana, Ohio, Illinois, Michigan, New York, West Virginia and Maine. In Michigan, 52 communities have combined sewer systems including 26 in the Detroit Water and Sewerage Department's (DWSD) wastewater service area. Construction of combined sewer systems was prevalent until the 1950s when the pollution



issues surrounding increased flows became evident.

The frequency of CSOs has decreased in southeast Michigan during the last decade as communities have focused on controlling this source of water pollution. For example, in 1992, there were 168 CSO discharge locations in the Rouge River Watershed. Today, only a fraction of overflow points have not been addressed; approaches to address remaining points will be developed by 2005. According to a 2001 SEMCOG survey, approximately $2.1 to $2.9 billion is needed to control remaining CSOs in Wayne, Oakland and Macomb counties.

Michigan has been at the forefront of CSO control. Michigan is one of four states that began implementing CSO control programs before issuance of a national policy in 1994.

Regulatory Oversight

CSOs are regulated through the National Pollutant Discharge Elimination System (NPDES) permit program that is administered by the MDEQ and overseen by the EPA. NPDES permits are issued for CSO outfalls.

The MDEQ has adopted more stringent standards for CSO discharges than the national policy. MDEQ allows no untreated CSO discharges while the EPA allows four untreated CSO discharges per year.

The MDEQ oversees 52 community CSO permits for 297 CSO outfalls as part of the NPDES permit program. (Nationwide, there are 859 CSO permits regulating 9,471 outfalls.) Forty-eight of these 52 permitted communities have submitted long term control plans (LTCPs) that have been approved by the state. LTCPs outline a program to eliminate overflows through sewer separation or construction of facilities that provide "adequate treatment" based on MDEQ design-storm requirements. Communities can propose alternative treatment levels similar to EPA's demonstration approach. Under these guidelines, the community tests the completed facility to demonstrate that it is achieving required treatment levels.

Correcting the Problem

Five strategies are being used to control CSO in LTCPs throughout the country:

- rain water control
- in-system storage
- wastewater treatment plant (WWTP) improvements/expansion
- end-of-pipe treatment
- sewer separation

Rain water control methods limit and control the amount of rain water that gets into the sewer system. These are the least expensive methods for controlling CSO. In-system storage involves storing wastewater in existing sewer pipes during storms and then sending it to the WWTP after the storm subsides. WWTP improvements/expansion involves upgrading or expanding the treatment capacity of the WWTP so it can treat more flows during storms. End-of-pipe treatment requires construction of large facilities to store and treat the combined sewage, preventing it from entering the river. These facilities include basins, tunnels, and WWTPs. Sewer separation involves construction of new storm sewers and converting old combined sewers into sanitary sewers.

Significant area CSO control projects are highlighted in the Section on Exemplary Wet Weather Pollution Control Projects. Many Michigan communities are ahead of the curve

in plan development. Detroit and communities involved in the Rouge River National Wet Weather Demonstration Project (RRNWWDP) are well into the implementation phase of their CSO control programs. Some large communities like Pittsburgh and Cleveland are just beginning or are in the process of completing their plans.

Synopsis

Initial wet weather pollution control regulations and efforts have focused on combined sewer overflows. Significant progress has been made in this area through the development of LTCPs and construction of CSO control facilities. Michigan communities have been at the forefront of CSO control implementing projects before many other states.

Additional Resources

Investing in Southeast Michigan's Quality of Life: Sewer Infrastructure Needs, April 2001, Southeast Michigan Council Of Governments.

Report to Congress on Implementation and Enforcement of the Combined Sewer Overflow Control Policy, December 2001.

Wastewater Management - Controlling and Abating Combined Sewer Overflows, August 26, 2002, EPA Office of Inspector General Evaluation Report.

Rouge River National Wet Weather Demonstration Project, www.rougeriver.com.

Sanitary Sewer Overflows

Sanitary sewers are designed to convey domestic and industrial waste from residential, commercial and industrial areas. A sanitary sewer overflow (SSO) occurs when flows from a sanitary sewer are released into a stream, river or lake. The causes, frequency, and environmental impacts of SSO differ from event to event. Every sewer system is unique and a variety of factors influence how the sewer system will operate under normal conditions and during heavy rainstorms.

SSOs occur throughout the United States and can be caused by a variety of factors including:

- high wet weather flows due to inflow/ infiltration (I/I)
- undersized sewer pipes that cannot carry all of the sewage or peak wet weather flow
- sewer pipe breaks, blockages and failures
- constraints in delivering contract flow capacities to the interceptor or lack of adequate capacity
- temporary operation and maintenance problems, including equipment and power failure

The Environmental Protection Agency (EPA) estimates that there are at least 40,000 SSO events in the US each year. Footing drain connections are considered to be a leading cause of excessive sanitary sewer inflow generating SSOs in southeast Michigan. In a recent study of 17 southeast Michigan communities reporting SSOs, 100% of the communities had footing drains connected to their sanitary sewers and 83% feel they are limited by contract capacity.

Excessive wet weather flows from connected footing drains are thought to be a major contributor to SSO in southeast Michigan.

The magnitude and extent of metro Detroit's SSO problem became apparent in the late 1990s when several wetter-than-normal years were encountered along with a string of large storm events. Because several major combined sewer overflow (CSO) control projects were operating and improving water quality, smaller pollution sources like SSO became more visible. In May 2000, the Michigan Department of Environmental Quality (MDEQ) issued an SSO Control Strategy.

SSO events, like CSO events, must be reported to the MDEQ within 24 hours. For the reporting period July 2000 to June 2001, approximately 39 million gallons (MG) of SSO were reported to be discharged from 41 SSO points from suburban communities tributary to the Detroit sewer system during 121 events. (The City of Detroit is served by combined sewer systems and does not have SSOs.) The causes of these SSOs included excessive wet weather flows, physical capacity constraints of the collection systems, contractual limits governing discharge of flows from communities to the regional interceptor and treatment system, and emergency operation and maintenance situations.

Footing drains are believed to be responsible for much of the 39 MG of SSO. Prior studies had estimated peak household footing drain

Annual Volume of Discharges in SE Michigan

Treated wastewater	253,000 MG	94.0%
Untreated CSO	13,800 MG	5.3%
Treated CSO	1,800 MG	0.7%
Total SSO	39 MG	0.01%

flows of 6 gallons per minute (gpm) over an hour period, and about 1,000 gallons per day for a maximum daily flow. However, newer studies underway indicate peak flows are much higher. Initial data has shown peak flows of 22 gpm can be produced from individual homes during a large storm. These peak flows with a sudden rush of storm water take up excess capacity in the sewer pipe and create problems.

Studies have also been undertaken on SSO pollutant concentrations in the Detroit area. Results have revealed that SSO pollutant concentrations are similar or slightly below those found in untreated CSOs.

Regulatory Oversight

Discharging untreated or partially treated sewage from sanitary sewer systems is illegal. Policies surrounding SSO are still being developed; the EPA is expected to publish final regulations in 2005. The regulations are expected to include a provision requiring permits for all sanitary sewer systems and Capacity Management and Operations Maintenance (CMOM) requirements.

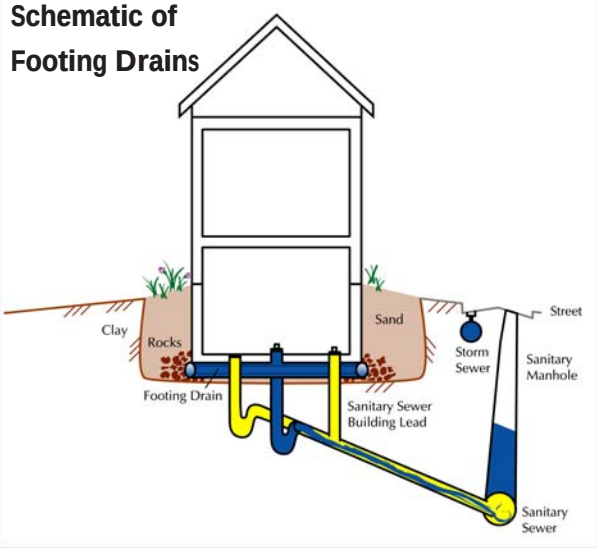
The MDEQ is developing guidance to supplement their SSO Control Strategy through an SSO Advisory Committee composed of MDEQ staff and representatives from local and regional governments. Reporting requirements for SSOs and short-term control measures that communities can implement during the next 36 months have been identified. The committee is also addressing the design criteria and performance standards of sanitary sewer systems, commingling of SSOs and CSOs, treatment of SSOs and compliance schedule expectations. The MDEQ Director will review the committee's recommendations to guide implementation of MDEQ's SSO Control Strategy. An option to allow communities to require disconnection of footing drains at the time a home is sold is being considered as part of the strategy.

Correcting the Problem

The Detroit Water and Sewerage Department (DWSD) is working with its customer communities to develop a solution for controlling their SSOs as part of DWSD's effort to develop a 50-year wastewater master plan. The DWSD SSO Work Group is developing a plan for SSO control that addresses:

- frequency and volume of SSO in the DWSD wastewater service area
- level of SSO reduction that can be achieved through interim measures like footing drain disconnection and I/I reduction
- feasibility and cost of installing more facilities to store SSOs until there is capacity in the interceptor system
- feasibility and cost of satellite treatment.

Schematic of Footing Drains



Six case study communities are evaluating various abatement alternatives. One case study community, Clinton Township, has reduced SSO volumes from 2 million gallons per year to less than 300,000 gallons per year using interim actions such as inflow/infiltration reduction and new operational strategies. Other communities have maximized in-system storage to reduce SSO volumes and are performing pilot projects for footing drain removal, water quality monitoring and system inspections.

Other regional alternatives are being developed to address SSO and capacity issues. Wayne County conducted a study within the North Huron Valley/Rouge Valley District that serves 15 communities. The 2000 study identified and analyzed four design criteria that could be used to develop regional solutions.

Oakland County completed a study in 1999 for the Evergreen-Farmington District that serves 15 communities. The study recommended that local communities take measures to reduce wet weather inflow through manhole inspection and rehabilitation, sump pump disconnection and pilot programs for footing drain disconnection. The study also identified the need for up to eight retention basins to further reduce peak flow rates to the interceptor sewer system.

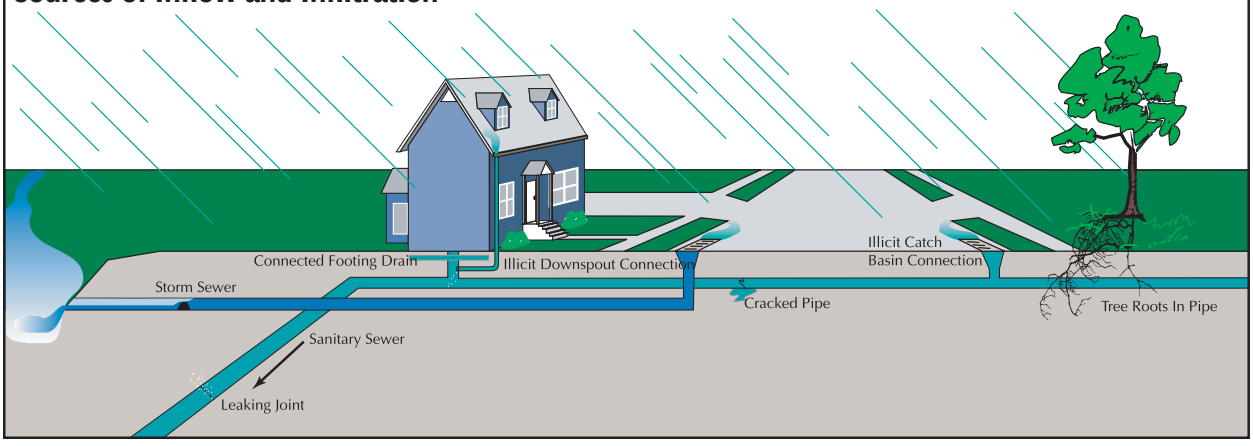
Synopsis

Sanitary sewer overflows are a pollution source that southeast Michigan communities are actively addressing through pilot projects and regional approaches. The volume of SSOs is relatively small compared to treated and untreated CSOs. The reasons SSOs occur differ from event to event. System-specific solutions must be developed for each community.

Additional Resources

Interim Report on SSO Characterization, DWSD Wastewater Master Plan, December 31, 2001.

Sources of Inflow and Infiltration



Storm Water Pollution

Storm water runoff is a leading cause of pollution for nearly 40% of US waterways according to an EPA survey. Polluted runoff is discharged into waterways through land runoff and storm sewer systems. Storm sewers are designed to convey rainfall and snowmelt runoff directly to a stream, river, lake or wetland.

Storm water is transported to storm sewers through catch basins on the street, and footing and roof drains connected to storm sewers. Many urban areas have enclosed or buried storm sewer pipes. Rural areas and some urban areas have open drainage systems that consist of ditches along the roadway to collect storm water. Both open and enclosed drainage systems typically discharge their storm water to a lake or stream without treatment.

During rainfall and snowmelt events, storm water runs off impervious areas such as paved streets, parking lots, sidewalks and building roofs picking up pollutants as it travels toward the storm sewer. The greater the impervious area, the greater the volume of runoff.

Storm Water Pollutants

- fertilizers and pesticides from lawns and gardens
- gasoline, oil, salt and chemicals from roads and paved surfaces
- sediment from construction sites
- bacteria from animal waste
- paper, metal and other debris
- airborne pollutants
- sewage from sanitary sewers illicitly connected to storm sewers
- overflow from failed septic tanks

Storm water that picks up pollutants as it runs off impervious areas is a leading cause of water pollution in our country.

The length of the storm impacts the amount of pollutants in the runoff. Pollutants from the early stages of storm runoff have a higher concentration than the end of the storm when most pollutants have been washed away.

Our rivers and streams are polluted by storm water runoff on a regular basis. Small storms generate polluted runoff and southeast Michigan averages 111 days of precipitation every year.

Regulatory Oversight

Storm water discharges are regulated through the National Pollutant Discharge Elimination System (NPDES) Storm Water Program of the Clean Water Act. The two-phase program addresses non-agricultural sources of storm water discharges that adversely affect our nation's water quality. The first phase required medium and large municipalities (population greater than 100,000) to apply for an NPDES permit for their storm water discharges and develop a program to limit pollution through Best Management Practices (BMPs) by October 1, 1994. The second phase requires urbanized areas (population greater than 50,000) to apply for a permit by March 10, 2003.

Many southeast Michigan communities are ahead of the curve on storm water management. Fifty-three communities, counties and agencies in the Rouge Watershed have been

operating under a voluntary permit since 1999. In addition, Macomb County and the City of St. Clair Shores have coverage under the watershed-based general permit option and are beginning the watershed planning process. The permit requires development of a Watershed Management Plan, Illicit Discharge Elimination Plan, Public Education Plan, Storm Water Pollution Prevention Initiative and a Monitoring and Reporting Plan.

Correcting the Problem

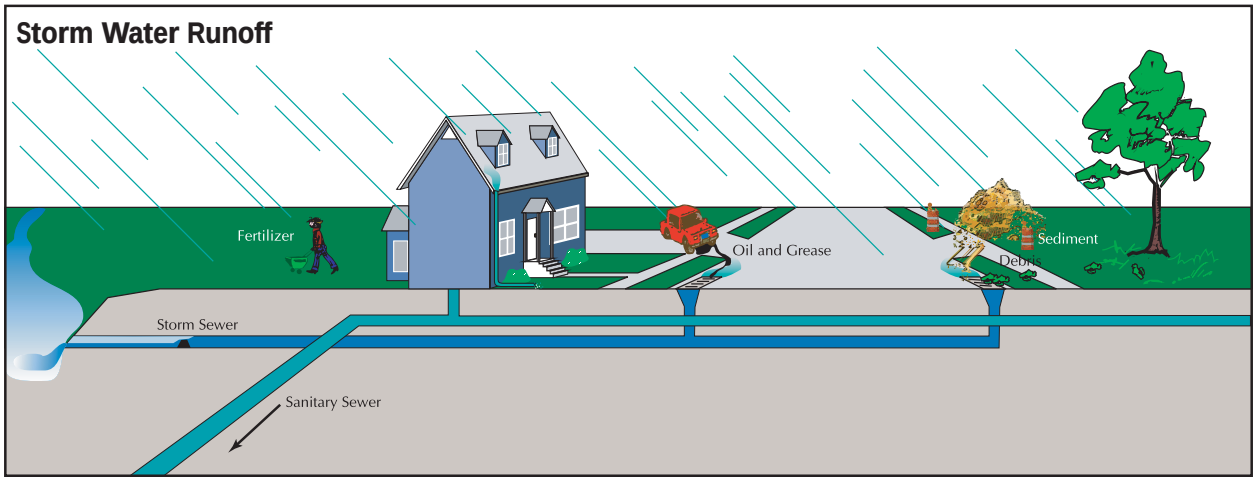
Storm water pollution control is being approached in several different ways. In most cases, storm water discharges do not have to be treated. Instead, BMPs are used to limit the amount of pollutants on pervious and impervious areas. BMPs include regular street sweeping, catch basin cleaning, soil conservation practices and preventing sediment runoff at construction sites. Public education is also being used to inform homeowners about how their actions impact storm drains and the watershed. Homeowners can help limit storm water pollution through proper fertilizing techniques, washing their cars on pervious areas, and not dumping household waste or used motor oil down their storm drains.

Communities are also implementing Illicit Discharge Elimination Plans (IDEP) to identify illicit sanitary sewer connections to storm sewers or waterways. Wayne County has implemented a program since 1997. The program includes a hotline (888.223.2363) for reporting illicit connections or waste dumping into storm drains. Other communities are developing IDEPs as part of their Phase II permit requirements.

On-site storm water management requirements are another method to reduce the rate of storm water runoff in the municipal storm sewer system. Most communities are requiring new developments to build storm water retention facilities to manage all the runoff from the development. Storm water ordinances, traditionally developed to define the levels of storm water control from a quantity standpoint, have also been expanded in recent years to incorporate control techniques to improve the quality of storm water discharges.

Synopsis

Storm water collects pollutants as it runs off impervious surfaces during the first part of a storm. Polluted storm water is discharged into our waterways and can adversely impact aquatic life of rivers, streams and lakes. New regulations are requiring communities to undertake programs to reduce the amount of pollutants in the runoff path of storm water.



Wastewater and Wet Weather Pollution Regulations

The Clean Water Act (CWA), the regulatory teeth for our nation's waterways, has extended its focus to include new pollution sources over the years. As the largest pollution sources have been reduced, additional and less prominent sources are being targeted. Regulated discharges have grown beyond wastewater treatment plants and industry to include wet weather pollution from combined sewer overflows and storm water.

While the CWA protects our nation's waters and has supremacy, state regulations laid the foundation for water pollution control efforts. The State of Michigan adopted the Stream Control Commission Act of 1929 to monitor and protect waterways. This Act was later amended into the Water Resources Commission Act and consolidated into the Michigan Environmental Code. These state laws were the primary vehicles for regulating water quality until 1972 when most state regulatory requirements were folded into the CWA.

The CWA became the first federal clean water law in 1948. The Act provided funds for state and local government to address water pollution problems but did not establish federal goals or guidelines. Enforcement was limited and required state consent. Amendments were made in the 1950s and '60s but lacked efficient enforcement procedures.

Frustration at the lack of progress mounted as water pollution took center stage with events like the burning of the Cuyahoga River in Cleveland, Ohio, the loss of Lake Erie's fish

Clean Water Regulatory/Legal Events

2005	EPA expected to publish final SSO regulations
2003	MDEQ expected to publish SSO Control Strategy Supplemental Guidance. Phase II Permit applications due for urban areas.
2002	Michigan law restricts governmental immunity for sewer backups to sewer defects and establishes process for homeowners to seek compensation
2000	Wet Weather Water Quality Act Amendment to CWA unifies CSO Program by incorporating the 1994 National CSO Policy into the law. MDEQ issues SSO Control Strategy.
1999	Phase II Storm Water Regulations expanded to include urban areas with smaller populations
1998	Michigan Court of Appeals rule municipalities are liable for sewer backups in CS&P vs. City of Midland
1994	EPA issues National CSO Policy. Phase I Permit applications due for medium and large municipalities. MDEQ publishes its CSO Control Manual.
1990	Phase I Storm Water Regulations issued
1989	EPA issues National CSO Control Strategy as first federal effort to regulate CSO
1987	CWA Amendments required phased control of storm water discharges
1980	Montgomery vs. Costle rules CSOs are exempt from CWA secondary standards
1976	NPDES Program goes into effect. MDEQ begins administering state NPDES program.
1972	CWA Amendments establish NPDES Program and federal grant program for municipal WWTPs
1956 - 1970	Federal amendments passed that lacked efficient enforcement procedures
1949	Michigan legislature toughens water pollution law and creates the Water Resource Commission
1948	First federal clean water law
1929	State of Michigan adopts the Stream Control Commission Act

populations and beach closings throughout the country. In 1972, amendments provided the statutory basis for a national permitting program and the structure to regulate pollutant discharges into waterways.

The 1972 CWA Amendment required states to adopt water quality standards that are approved by the Environmental Protection Agency (EPA). It also required the EPA to develop and implement the National Pollutant Discharge Elimination System (NPDES) Permit Program. The EPA was given the authority to set effluent limits on an industry-wide basis and on a water quality basis to ensure protection of the receiving water. The CWA required pollutant dischargers to obtain an NPDES permit or their discharges would be considered illegal. The EPA was also given the ability to authorize state governments to administer the NPDES Permit Program, while retaining oversight responsibility. The Michigan Department of Environmental Quality (MDEQ) has administered the state's NPDES permit program since the national program went into effect in 1976.

The 1972 amendment also increased federal spending to help publicly-owned wastewater treatment plants meet new secondary treatment standards requiring the removal of at least 85% of harmful pollutants in raw wastewater. A federal grant program was established and replenished from 1974 to 1994 to provide $96 billion for new construction and upgrades of municipal wastewater treatment plants.

Combined Sewer Overflows

With continuous discharges from wastewater treatment plants and industry improving under the NPDES program, attention turned to intermittent discharges such as combined sewer overflows (CSOs). CSOs are exempt from CWA secondary treatment standards based on a 1980 Federal District Court Ruling (Montgomery Environmental Coalition v. Costle, 646 F2d 568 (DC Circ 1980)).

The first federal effort to regulate CSOs came in 1989 when the EPA issued a National Combined Sewer Overflow Control Strategy that recommended all CSOs be identified and characterized by their status of compliance with NPDES requirements. The strategy set forth three objectives: to ensure CSOs only occur during wet weather, to bring all CSO discharge points into compliance with the CWA, and to minimize negative impacts of CSO. The strategy also charged states to develop permitting strategies to reduce, eliminate and control CSOs. Since secondary treatment standards did not apply, states established treatment requirements on a case-by-case basis as part of the NPDES permit.

Process to Update EPA Regulations

Proposed rule published in Federal Register

▼ Comment Period

EPA develops and publishes final regulation in Federal Register

▼

Final regulation published in Code of Federal rules at end of year

EPA publishes strategies and policies that are interpreted and implemented by EPA regions and states but are not binding like laws and regulations. Strategies and policies (like the 1994 National CSO Policy) are sometimes incorporated into CWA Amendments to become part of the law.

Michigan responded to the charge; it is one of four states that began implementing a CSO control program before a national policy was issued in 1994.

The national policy requires capturing 85% of the average annual CSO volume and providing a minimum of primary treatment and disinfection. Michigan's requirements exceed this policy. Michigan's state administrative rules require that all discharges containing sewage of human origin be disinfected.

In order to make the CSO Policy law and improve implementation, Congress amended the CWA in December 2000. Referred to as the Wet Weather Quality Act, the amendments incorporated the national CSO Policy as a statutory requirement and required states to issue CSO NPDES Permits that are consistent with national policy. Periodic reviews of water quality standards were also required to ensure that long term CSO control plans are consistent and attainable. The amendments also authorized a CSO capital improvement projects grant fund; however, Congress has never appropriated money to it.

1994 EPA CSO Control Policy Principles

1. Clear levels of control to meet health and environmental objectives.
2. Flexibility to consider the site-specific nature of CSOs and find the most cost-effective way to control them.
3. Phased implementation of CSO controls to accommodate a community's financial capability.
4. Review and revision of water quality standards during the development of CSO control plans to reflect the site-specific wet weather impacts of CSOs.

Storm Water

About the same time CSOs were targeted, separate storm water discharges emerged as another culprit of pollution. The 1987 CWA Amendments added a requirement for phased control of storm water discharges, resulting in the Phase I Storm Water Regulations being issued in November 1990. The Phase I Program required large Municipal Separate Storm Sewer Systems (MS4s) serving a population of 100,000 or more to apply for a permit by October 1, 1994.

In December of 1999, the Phase II regulation expanded the storm water permit program to require operators of MS4s within the regulated urbanized areas to obtain an NPDES Permit for their point source storm water discharges. MS4s outside of urbanized areas can also be required to apply for a permit based on potential water quality impacts of their discharges. Phase II Permit applications must be submitted to the MDEQ by March 10, 2003.

In southeast Michigan, over 170 communities must apply for a Phase II Permit. Communities within the same watershed can work together to develop a single watershed storm water management plan and obtain a Watershed Permit. Communities also have the option of addressing everything on their own through an Individual Permit. Both approaches require development of an Illicit Discharge Elimination Plan (IDEP), Public Education Plan (PEP) and identification of storm water discharge points or outfalls.

Sanitary Sewer Overflows

Regulation of SSOs is still evolving. The EPA is expected to publish draft regulations for comment within the next six months and the rules will probably be finalized in 2005. The MDEQ

is also in the process of developing guidelines for implementing their SSO Control Strategy. MDEQ is currently addressing SSO control on a case-by-case basis by negotiating Administrative Consent Orders (ACOs) that establish the corrective measures to be undertaken and the compliance schedule for completing the work. Many communities in Michigan are moving ahead with SSO control projects such as construction of retention basins or removal of residential footing drains that may be connected to the sanitary sewers.

Basement Flooding Liability Legislation

On January 2, 2002, a bill was signed into law (PA222) that revised liability standards from municipalities where sewer backups occur and established a process for affected persons to seek compensation for such events. In order to seek compensation, the claimant must prove: a sewage disposal system defect existed, a particular government agency was responsible for the defect, and the defect was 50% or more the cause of any property damage or physical injuries. Basement backups attributable to homeowner problems such as blocked service leads are not the liability of the municipal sewer system owner/operator. Homeowners are also restricted to collecting economic damages only.

PA222 also establishes notice provisions to provide municipalities with better and more timely information and provides property owners with specific procedures to follow in seeking compensation for sewage disposal system events. PA222 is an attempt to provide greater certainty than the unlimited exposure to potential liability for sewer backups that resulted from a 1998 Michigan Court of Appeals decision in CS&P v. City of Midland. Michigan courts will determine if it actually results in a more definitive standard.

Synopsis

The focus of regulation has expanded during the last 30 years from highly visible sources of pollution to intermittent pollutant sources and hard-to-see sources like impervious urban areas. The Clean Water Act Amendments of 1972 established our current permitting system for discharges into our nation's waterways. Since that time, point source discharges from wastewater treatment plants have been cleaned up tremendously. Efforts have turned to intermittent wet weather discharges like combined sewer overflows and non-point sources like storm water runoff. Regulation of SSOs is still evolving.

Additional Resources

Investing in Southeast Michigan's Quality of Life: Sewer Infrastructure Needs, April 2001, Southeast Michigan Council Of Government.

Report to Congress on Implementation and Enforcement of the Combined Sewer Overflow Control Policy, December 2001.

EPA Office of Wastewater Management website, www.epa.gov/owm/ includes information about wet weather regulations.

www.rougeriver.com includes examples for storm water permit regulations.

MDEQ website, www.michigan.gov/deq/ contains information about state wet weather regulations (go to water section, then surface water section).

Wet Weather Pollution Control Spending

Considerable progress has been made in controlling wet weather pollution in southeast Michigan during the past decade. Ten CSO control basins have been constructed, numerous sewer rehabilitation programs have been undertaken to limit wet weather inflow and infiltration, and numerous projects are under design and construction to further limit pollutants from reaching our waterways. Wet weather pollution is a complex problem that requires a long-term solution. We are experiencing benefits of cleaner water through a reduced number of wet weather overflows in southeast Michigan.

Southeast Michigan communities' spending for CSO, SSO and storm water management is significant. Calculating the entire dollar amount is difficult. However, looking at the expenditures of counties and some of the key communities in the DWSD service area provides insight into the importance that is being placed on this issue. Since 1992, Detroit has spent $18 million on the development and implementation of its Long Term CSO Control Plan and $260 million on the design and construction of CSO facilities exclusive of the Upper Rouge Tunnel. An additional $300 million will be spent implementing the Long Term Control Plan through the year 2005. These capital costs are a major contributor to the double-digit rate escalations that are expected to occur over the next few years.

Wayne County and the Rouge River communities are spending nearly $531 million on the Rouge River National Wet Weather Demonstration Project (RRNWWDP). Local funds are providing over $186 million for program projects.

Michigan leads the nation in using the highest amount of SRF loans and federal grant money to control CSO.

Macomb County and their local communities have spent $65 million on the Lake St. Clair Clean Water Initiative.

Oakland County and their local communities have spent $78 million on three CSO basins as part of the RRNWWDP. Current projects underway include the $144 million improvements to the George W. Kuhn Drainage District and planning for the Evergreen-Farmington Sanitary Sewer Overflow Control Project with estimates from $20 to $180 million depending on the approach taken.

Michigan a Leader in CSO Spending

Michigan got a head start on CSO control. Of the 32 states with CSO, it is one of four states that began implementing a CSO control program prior to the 1994 national policy requiring it to do so. The other three states were Illinois, Iowa and Vermont.

This jump start has allowed Michigan to provide the highest level of funding for CSO projects of any state through the State Revolving Fund (SRF), a low-interest loan program administered by states and funded by the federal government and states. A total of $529 million has been loaned to local communities

from 1988 to 2000 for CSO projects. This represents 25% of the CSO project loans throughout the country ($2.07 billion). Illinois and New York are the only comparable states, providing $466 million and $326 million in loans respectively in the same timeframe.

Michigan has also benefitted greatly from federal spending for CSO. From 1992 to 2000, Congress appropriated over $600 million to 32 communities with combined sewer systems. Due to the efforts of US Congressman John Dingell, the RRNWWDP received $338 million. A significant portion of this money has been spent on CSO control, therefore, the RRNWWDP received over one-third of the total funds earmarked by Congress for CSO control during that time. Newark, New Jersey, received the second highest level of funding at $44.3 million. The RRNWWDP has received an additional $7 million in grant funding since 2000, bring the total federal funding up to $345 million.

Limited Funding on the Horizon

While federal assistance has helped propel the region to its leadership position in CSO control, there are not enough funds available to undertake remaining projects. Local governments are being forced to shoulder significantly more of the capital expenditure than in the past. Rising operations and maintenance costs are also pinching available funds.

In a March 2001 study, SEMCOG estimated that a $14 to $26 billion investment is needed by 2030 to maintain and improve southeast Michigan's sewer infrastructure. After accounting for inflation, interest and borrowing on capital improvements, "out-of-pocket" costs range from $29 to $52 billion. This equals nearly $1 billion per year on the low end.

SEMCOG's breakdown of needed sewer service dollars is as follows:
42% new sewer service
22% operation and maintenance
16% sewer rehabilitation
12% CSO control
6% WWTP
2% SSO remediation

Fourteen percent or $4 to $7 billion of these projected costs are directly related to wet weather pollution.

Even for the lower cost estimates, needs in southeast Michigan alone exceed loan funding available from the entire state. If the federal and state government would commit to contributing $135 million per year to a low-interest loan program, available revenues to support sewer infrastructure would more than double to about $400 million per year. (The Great Lakes Water Quality Bond proposes $1 billion over ten years or around $100 million per year in addition to the existing SRF.) For comparison, state and federal funding for transportation infrastructure in southeast Michigan is approximately $700 million annually.

Wet weather pollution control and other sewer service projects are competing with other infrastructure needs. SEMCOG estimated transportation infrastructure needs to be $17 billion for the same timeframe.

Synopsis

Southeast Michigan communities and counties have spent hundreds of millions of dollars planning, designing, constructing and operating wet weather pollution control facilities. Michigan has been fortunate to receive federal grant money in a time of limited funding and to have appropriated the highest level of low

interest loans for CSO control. Additional funding is needed to continue implementing long-term wet weather pollution control programs. Capital costs for pollution control projects will continue to impact sewer service rates.

Additional Resources

Investing in Southeast Michigan Quality of Life: Sewer Infrastructure Needs, April 2001, Southeast Michigan Council of Governments.

Report to Congress on Implementation and Enforcement of the Combined Sewer Overflow Control Policy, December 2001.

Great Lakes Water Quality Bond

The Great Lakes Water Quality Bond that passed in the November 5, 2002 general election gave the State of Michigan permission to issue bonds to generate $1 billion over ten years to finance municipal sewage treatment works and storm water projects. The bond almost doubles the amount of money available annually through the State Revolving Fund (SRF).

The Great Lakes Water Quality Bond will help improve and protect the water quality of our lakes and streams and assist in meeting the sewage treatment needs important to maintaining our economic vitality.

The bond placed three bills in motion that:

- created a new revolving fund
- provided a new source of money
- limited how the new money and fund are organized and used
- changed the existing SRF point scoring and planning process.

A new revolving fund, called the Strategic Water Quality Initiatives Fund (SWQIF), was created to provide low-interest loans for improvements on private property that will benefit area water quality. These types of projects have not been eligible for funding in the past. Municipalities can apply for loans for two types of projects:

- Improvements to reduce or eliminate the amount of groundwater or storm water entering sanitary or combined sewer leads including service lead rehabilitation and footing drain disconnection

The Great Lakes Water Quality Bond provides additional wastewater project funding for the State Revolving Fund. It also creates a new fund for projects that reduce storm water entering sanitary and combined sewers, and upgrades or replacement of failing septic systems.

- Upgrades or replacements of failing on-site systems that are adversely affecting public health or the environment, or both.

Municipalities that apply and receive SWQIF money serve as the loan recipient and funnel the money to the private property owner to pay for the improvements. The loan may be repaid by the municipality from its sewer revenues or, if the municipality chooses, some or all of the money to repay the loan may be collected from the property owner.

The bills provide a new source of money for the SRF through the state's ability to borrow up to $1 billion by issuing general obligation bonds. The bonds are repaid from the state general fund.

The use and allocation of new SRF and SWQIF money is limited. Ninety percent of the new money will be used for SRF and 10% for SWQIF. Every year, at least 2% of all SRF funds must be allocated, to the extent needed, for non-point source projects.

Three separate priority lists will be created for eligible projects: sewage treatment/storm water projects, non-point source projects and SWQIF.

Many of the sewage treatment/storm water projects likely funded in southeast Michigan will focus on eliminating sewer overflows. The funds will not be used to extend sewers to currently unsewered portions of southeast Michigan, unless there is a demonstrated public health threat from failing septic systems.

Synopsis

The Great Lakes Water Quality Bond nearly doubled the amount of state loan money available to municipalities to finance CSO, SSO, wastewater and storm water projects. It also provides a new funding source to undertake improvements on private property that will help improve area water quality.

Additional Resources

November Bond Proposal from MDEQ web site under Clean Water Revolving Fund area, www.michigan.gov/deq.

SB 4625 (PA 396, 2002), SB 5892 (PA 397, 2002), SB 5893 (PA 398, 2002) at www.michiganlegislature.org.

Exemplary Wet Weather Pollution Control Projects

Communities throughout southeast Michigan have spent hundreds of million of dollars controlling CSO, SSO and storm water runoff. A representative list of projects is shown below and highlighted on the following pages. We encourage you to contact the person listed for additional information to learn more about the project and other projects underway in their community.

Combined Sewer Overflow Control Projects

- Detroit Long Term CSO Control Plan
- Hubbell-Southfield CSO Basin
- Conner Creek CSO Control Facility
- Maheras Park Fish Habitat Mitigation
- Rouge River National Wet Weather Demonstration Project
- Four Wayne County CSO Basins
- Three Oakland County CSO Basins
- George W. Kuhn Drain Improvements (Formerly Twelve Towns Drain)
- Exploring a Joint CSO Tunnel for Detroit and Dearborn

Sanitary Sewer Overflow Control Projects

- Clinton Township Footing Drain Disconnection Pilot Program
- Evergreen-Farmington SSO Control Demonstration Program

Storm Water Management Projects

- Ford Rouge Complex
- Rouge Oxbow Restoration Project at Henry Ford Museum and Greenfield Village
- Wayne County Storm Water Ordinance
- Watershed Planning in Oakland County

Detroit Long Term CSO Control Plan

Detroit's Long Term Combined Sewer Overflow (CSO) Control Plan (LTCP) was developed during a three-year process that involved over 300 DWSD staff and a team of 11 consultants. The award-winning Plan addresses annual discharges of 20 billion gallons of CSO through 78 outfalls on the Detroit and Rouge Rivers. It also embraces a demonstrative approach resulting in a reduction of $2-3 billion from original cost estimates to control CSOs based on the Michigan Department of Environmental Quality's (MDEQ) presumptive approach for adequate treatment. As required by DWSD's NPDES Permit, the Plan was submitted to the MDEQ in June of 1996.

The Detroit and Rouge Rivers have markedly different impacts from CSO discharges. The Plan reflects the results of an extensive evaluation of both the collection system and wastewater treatment plant's ability to transport and treat wet weather flow. A system rating, operational plan, finance plan, rehabilitation plan and public involvement activities were also undertaken.

The $1.07 billion Plan identifies four major strategies to reduce overflows: rain water control, in-system storage, wastewater treatment plant (WWTP) expansion and end-of-pipe treatment. Rain water control methods limit the amount of rain water that can get into the sewer system. A rain water control pilot project was undertaken in four neighborhoods to determine the effectiveness of downspout disconnection, cisterns, restricted catch basin covers and tree planting. In-system storage maximizes the use of existing storage space inside sewer pipes during a storm. Six CSO

Detroit's LTCP helps protect and improve water quality of the Detroit River.

facilities were modified and rehabilitated to provide additional storage capacity. Based on a WWTP stress test, it was determined that the plant's primary treatment capacity could be increased with the addition of two primary clarifiers and an influent pump. End-of-pipe treatment includes construction of large facilities to store and treat the combined sewage, preventing it from entering the rivers. The LTCP includes four basins, three screening and disinfection facilities and a 7.5-mile storage tunnel.

Over 90 CSO control measures were identified and grouped to reflect the strategy they supported. Control measures were evaluated through a three-step screening process and consolidated into ten alternatives that were used to formulate a final Preferred Alternative. The final ten alternatives were created based on lessons learned, viable solutions, work group findings and criteria for alternative development. The Preferred Alternative reflects a demonstration approach to CSO control and the differences in treatment needs for discharges to the Detroit and Rouge Rivers. The Plan was accepted by the MDEQ and elements are included in the current DWSD NPDES Permit.

1995 Plan

2001 Plan Update

The LTCP bolstered relationships and developed team bonds. Internal relationships within DWSD grew through work group activities where common interests and priorities were identified, ideas exchanged, and technologies evaluated. DWSD's working relationship with the MDEQ evolved beyond a forced relationship into sharing ideas and understanding one another's viewpoints. Relationships with first tier wholesale customers progressed from animosity to finding common interests and goals to work toward.

In June 1999, after nearly two years of meetings, decision makers from key first tier customers and DWSD reached consensus on a cost allocation methodology for the LTCP as well as two other rate issues that had been in litigation since 1992. In August 2000, new rates went into effect and for the first time since April 1992, there were no CSO rate matters pending in Federal Court.

During the past six years, DWSD has been implementing and evaluating these strategies providing valuable information to the CSO control community. A LTCP Update, submitted to the MDEQ in December 2001, reaffirmed the assumptions and direction of the program further establishing DWSD as a regional and national CSO control leader.

Beyond cost savings, the benefits of the LTCP have been far reaching throughout the DWSD organization and its customers:

- Positioned DWSD as a leader in CSO control in southeast Michigan
- Developed fair and equitable CSO cost allocations between Detroit and its customers
- Strengthened relationships within DWSD, with MDEQ and surburban wholesale customers
- Demonstrated environmental stewardship

Detroit's LTCP helps protect the public health of four million people living in the City and surrounding communities by controlling CSOs. Benefits to downstream communities include improved water quality. Improvements have already been realized in areas near the three operational CSO basins. These basins are capturing and storing or treating combined sewage that would have previously overflowed untreated into the Rouge River. Operation of other basins along the Rouge have been coordinated to ensure that flows are released back into the system when capacity is available. This coordinated effort protects against the unnecessary releases of pollutants into the Rouge and Detroit Rivers.

For further information, contact George Ellenwood, DWSD Public Affairs Manager, at 313.964.9460.

Detroit CSO Long Term Control Plan Components

Facility/Location	Type of Facility	Estimated Completion
Hubbell-Southfield Basin Rouge River	Screening, settling and disinfection 22 million gallon (MG) storage capacity	Operational Performance evaluation completed

Seven Mile Basin Rouge River	Screening, settling and disinfection 2.2 MG storage capacity	Operational Performance evaluation completed

Puritan-Fenkell Basin Rouge River	Screening, settling and disinfection 2.8 MG storage capacity	Operational Performance evaluation completed

St. Aubin Facility Detroit River	Screening and disinfection 160 million gallons per day (mgd) flow through capacity	Operational 2002 Performance evaluation to begin when operational

Lieb Facility Detroit River	Screening and disinfection 1,000 MGD flow through capacity	Operational 2002 Performance evaluation to begin when operational

Conner Creek Basin Detroit River	Screening, settling and disinfection 30 MG storage capacity	Operational January 2005
Two Primary Clarifiers Detroit WWTP	360 mgd primary treatment capacity	Operational March 2003

Baby Creek Facility Rouge River	Screening and disinfection 3,300 mgd flow through capacity	Operational August 2005

In-system Storage Detroit and Rouge Rivers	Storage for 83 MG	Operational July 2005
Tunnel Rouge River	Storage for 120 MG	Feasibility evaluation for joint tunnel with Dearborn - March 2003
Downspout Disconnection City of Detroit	Residential downspout disconnection	Implementation strategy being developed

Hubbell-Southfield CSO Basin

The Hubbell-Southfield CSO Basin was constructed by the City of Detroit as part of their Long Term CSO Control Plan. The $49 million basin is one of nine basins partially funded by the Rouge River National Wet Weather Demonstration Project (RRNWWDP). This nationally-recognized program, established to clean up the Rouge River, is comparing the treatment effectiveness of basins with different features. The Hubbell-Southfield Basin features a dual-purpose shunt channel and decant abilities to improve treatment performance and can be operated in three distinct modes.

Built to treat the largest combined sewer outfall on the Rouge River, Hubbell-Southfield is one of the largest CSO basins in Michigan. However, even with a capacity of 22 million gallons, it represents the smallest design storm capture of the nine RRNWWDP detention basins. The site was not large enough to build the facility to either the Michigan Department of Environmental Quality (MDEQ) presumptive requirements (complete capture of the 1-year, 1-hour storm and screening, settling and 30 minutes of disinfection contact time for the 10-year, 1-hour storm) or the less stringent RRNWWDP criteria (screening and 20-minute detention for a 1-year, 1-hour storm). Special design considerations were included to satisfy the MDEQ that sufficient treatment would occur.

Jeff Garland Photography

Located adjacent to the TPC Golf Course, the Hubbell-Southfield Basin (building shown in background) is a quiet neighbor that is preventing wet weather pollution.

Surrounded by a championship golf course, wetlands and the Rouge River, the 300-foot wide by 1,200-foot long basin is the maximum size that could be built in the allowable area. It provides approximately 18-minute detention for the 1-year, 1-hour storm including settling, skimming and disinfection. It has two compartments capable of accepting flows up to 3,200 cubic feet per second (cfs) that are screened and distributed through the two compartments by gravity.

Because the basin was constructed within the CSO outfall channel to the Rouge River, the shunt was originally built to maintain CSO flow to the river during the construction period. Once the basin was complete, the shunt channel became an integral part of basin operations. It protects the basin from "blowing out" when capacity is maximized and can be used to shunt inflow around the two basin compartments to prevent negative treatment. Negative treatment occurs when flow through the basin suspends previously settled solids and causes the effluent to be more polluted than the influent.

The shunt channel allows the facility to be operated in three distinct modes. The first is traditional flow-through where CSO is initially directed into compartment 1 and then through compartment 2 prior to Rouge River discharge. A second operational scenario allows the

initial, first flush CSO volume to be completely captured in compartment 1 with any additional combined sewage volume flow-through treated in compartment 2 before being discharged into the Rouge River. The third approach uses both compartments as complete capture basins and any additional flow is screened, disinfected and shunted through the facility to the Rouge River. This operational flexibility allows DWSD to best suit the level and type of treatment to the storm event being experienced.

Another innovation tested in the basin design is its decant abilities. Under normal conditions, basin contents are discharged into the interceptor for treatment at the Detroit Wastewater Treatment Plant. Should a second rain event occur within 24 to 48 hours after the first, and the sewer system cannot accept the stored flow, decanting will provide for the top layer of captured flow to be released into the Rouge River. This will happen after disinfection and significant settling time is achieved to allow for treatment of flow from subsequent rain events.

Studies conducted at the Hubbell-Southfield and other RRNWWDP basins have demonstrated that treatment can be enhanced in smaller-sized facilities. From January 2000 through August 2001, the basin treated 2.9 billion gallons of CSO. The analysis of nearly 3,000 samples during that time revealed that basins sized smaller than ones designed to the MDEQ's presumptive criteria can easily achieve CSO Control Program Phase II public health goals. These basins, used in the first flush capture mode, also appear to address Phase III water quality goals. Regulatory agencies can use this information to support and approve smaller, more cost-effective basin requirements for CSO treatment in other locations.

Hubbell-Southfield Basin

The Hubbell-Southfield CSO Basin has been recognized for engineering excellence by the American Consulting Engineers Council of Michigan, the Michigan Society of Professional Engineers and the Southeastern Michigan Branch of the American Society of Civil Engineers.

The project was funded through three sources: federal grant, state loan and local funds. Through the efforts of Congressman John Dingell, the Rouge River National Wet Weather Demonstration Project was established to provide grant funding for both design and construction for this and other facilities. Approximately 95% of the design and 55% of construction costs was funded by this federal grant. A low interest State Revolving Loan was also provided through the MDEQ for the construction engineering and administration costs. Local share bonds through the City of Detroit financed the balance of the project.

For further information, contact George Ellenwood, DWSD Public Affairs Manager, at 313.964.9460.

Conner Creek CSO Control Facility

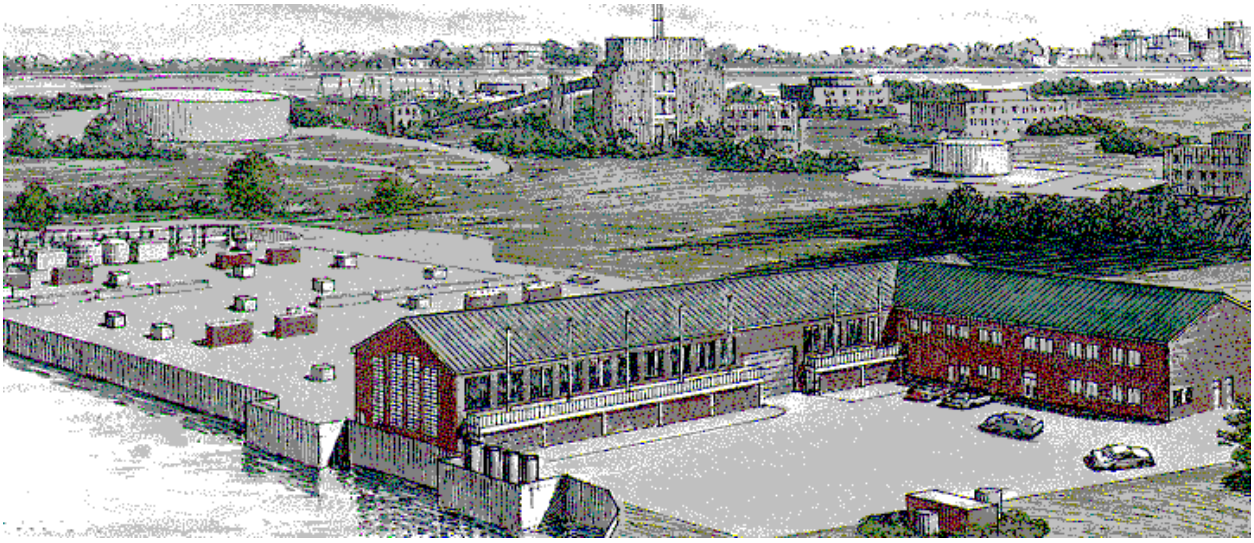
The Conner Creek CSO Control Facility is being constructed as part of DWSD's Long Term CSO Control Plan. The basin will provide settling, skimming, and disinfection for the Conner Creek sewer and the Conner Creek and Freud Pumping Stations that combine to form Michigan's single largest CSO.

The basin is a pilot project to demonstrate the effectiveness of high-rate disinfection with five minutes of contact time to disinfect the 10-year, 1-hour storm peak flow of 13,262 cubic feet per second (cfs) from the three outfalls. A demonstrative approach was used because the cost to meet the MDEQ's presumptive level of control (10-year design storm with 30 minutes of detention) was prohibitive and the receiving stream has a very high flow rate of 200 to 250 billion gallons per day. The high-rate screening and disinfection system screens raw sewage debris and kills bacteria at a cost savings of roughly $450 million when compared to the presumptive level of control.

The project started construction in March 2001 and is scheduled for completion by December 31, 2004. When completed, it will treat a peak flow rate of 8,700 million gallons per day (mgd).

The basin is located at the head of Conner Creek to allow gravity conveyance of flow through the basin. The location also provides a buffer between the basin and the residential neighborhood to the east. The basin is divided into four rectangular reinforced concrete compartments (57.5 feet wide, 30 feet deep, and 550 feet long) capable of storing 30 million gallons.

Flow will enter the basin through two influent channels at the Conner and Freud Outfalls and be directed through three of ten screening and chemical mixing channels. As flow increases, more channels are used. After the flow is screened, it passes through a diffuser and one or more of the six sodium hypochlorite mixers



When completed, the Conner Creek CSO Control Facility will treat Michigan's single largest CSO.

where it is disinfected. Chemical dosing of sodium hypochlorite will be controlled through ten, 197-gallons per minute (gpm) constant speed magnetic drive pumps that draw from four 95,000-gallon, rubber-lined steel storage tanks.

After screening and disinfection, the flow is distributed to the four retention basin compartments. For most storm events, the retention basin will completely fill and then overflow the treated effluent to Conner Creek. Any floatables not removed by the bar screens will be captured by a scum baffle further downstream.

When the CSO event is over, the basin will be dewatered to the Detroit River Interceptor (DRI). The total volume of storage is 62 million gallons, 30 million gallons in the retention basin and 32 million gallons in the upstream structures. This total volume will be dewatered to the DRI in a 48-hour period. The rate of dewatering will be controlled based on the level in the DRI.

A system of 50 flushing gates located throughout the basin will be used to clean the facility after each CSO event. Submersible chopper pumps will be used to pump the flushed solids to the DRI.

Construction of the Conner Creek Facility is scheduled for completion by the end of 2004.

The Conner Creek Basin is being built at a cost of $187 million. A $2.3 million fish habitat mitigation project in nearby Maheras Park is also being undertaken as part of the project.

For further information, contact George Ellenwood, DWSD Public Affairs Manager, at 313.964.9460.

Maheras Park Fish Habitat Mitigation

As a companion project to the Conner Creek CSO Control Facility, DWSD is undertaking a $2.3 million fish habitat mitigation project in Maheras Park, a 53-acre public park on the Detroit River, east of Conner Creek. This project replaces surface water area lost in Conner Creek as a result of the basin. This project is expected to be completed ahead of its December 31, 2004, deadline.

Maheras Park is the largest of the four Detroit parks upstream of Conner Creek and is a designated City of Detroit Historic District. The 8.5-acre project at the south end of the park will provide a much needed fish habitat along this highly developed stretch of the Detroit River. Originally open space, this prime park area previously provided few recreational activities. The fish habitat development was supported by the community and approved by the Historic District Commission.

Over 50,000 cubic feet of soil are being excavated to create the pond. An island, surrounded by an inlet and outlet to the Detroit River, is being created to allow water and fish to circulate through the pond. Fish habitats will be sculpted from the pond through a deep-water hole and shallow shelves along the banks. The shelves will be planted with wetland plants and underwater shelters constructed from excavated tree root masses to provide fish breeding and resting places lacking along the Detroit River shoreline.

Stone block riprap, boulder riprap, and wild-

The Maheras Park Fish Habitat mitigates surface waters lost in Conner Creek and provides fish breeding and resting places along the Detroit River.

flower plantings will be incorporated into the area surrounding the pond. Placed in a stair-way fashion, stone block riprap creates a flat surface that allows fishing access at the water's edge. An overlook is planned near the deep-water fish habitat. This area will be five feet above the design waterline to provide barrier-free fishing access to the pond.

A perimeter sidewalk will link the overlook, island, fishing access points, and interpretive signage. The overlook will be furnished with benches and a 30-foot diameter picnic shelter with picnic tables. The sidewalk will lead visitors around the pond to the bridges that bring pedestrians onto the island. Backless benches are planned for visitors to relax and enjoy views of the park, river and downtown skyline.

Grass planting on the island will remain un-mowed as a natural prairie. Many deciduous and fast-growing trees will be added around the pond area to provide visitors with shade. Interpretive signage is planned for various locations within the Fish Habitat Mitigation area to explain the intent of the pond, the ecology of the wetland planting and fish habitat, and the freighters travelling on the Detroit River.

For further information, contact George Ellenwood, DWSD Public Affairs Manager, at 313.964.9460.

Rouge River National Wet Weather Demonstration Project

The Rouge River in southeast Michigan has been polluted for decades. The Rouge River National Wet Weather Demonstration Project (RRNWWDP) is a $531 million program established to clean up the Rouge River. It is the largest, federally-funded wet weather program in the nation.

The RRNWWDP serves as a laboratory for national policy for a watershed approach to wet weather water quality management. It considers all pollution sources, implements innovative pollution controls, and focuses on coordinating local efforts with the ultimate goal of restoring a polluted resource. Benefits of a watershed approach include faster environmental improvements and reduced costs. Communities are working together to develop solutions and take ownership of the issues. This encourages local accountability, political support and innovative solutions.

A major portion of the RRNWWDP focuses on combined sewer overflow (CSO) control. Approximately 25% of the Rouge River Watershed is currently served by combined sewers, and CSOs are a significant pollution source. A CSO Control Program is being implemented in three phases as established through NPDES permits:

- Phase I: Elimination of raw sewage and protection of public health for approximately 40% of the combined sewer area
- Phase II: Public health protection for the remaining combined sewer area
- Phase III: Meet water quality standards in the Rouge River

The Rouge River

As part of the CSO Control Program, six communities have separated their sewers and eight communities have built ten retention treatment basins. The basin facilities have met strict criteria established by the Michigan Department of Environmental Quality (MDEQ) and through a demonstration approach, it has been determined that basins sized smaller than ones designed to the MDEQ's presumptive criteria can effectively eliminate raw sewage and protect public health.

Other major accomplishments of the RRNWWDP include addressing storm water through subwatershed management plans and pollution prevention plans. Major public education and involvement efforts continue to increase awareness and maintain focus on local priorities. New initiatives are underway to restore streambanks and habitat and to redevelop and revitalize areas along the River.

Nearly 90 miles of the Rouge River are now CSO-free; this is a 51% reduction in CSO impacted river miles over the past six years. Phase I CSO projects and other Rouge projects are restoring the natural beauty and ecological health of the river. Significant improvements to

The Rouge River

water quality have already been documented. The mean Dissolved Oxygen (DO) in the lower Rouge was 4.5 milligrams per liter (mg/l) in 1994 with an increase to almost 7.0 mg/l in 2001. The percent of DO readings that violated the State water quality standard of 5 mg/l dropped from 61% in 1994 to less than 4% in 2001. Similar improvements occurred at all stations in the watershed with most stations meeting the standard 100% of the time. These results are for the entire year, during wet and dry periods.

Health of the ecosystem is also improving. Results of the 4th Annual Friends of the Rouge Frog and Toad Survey indicated a greater number of green frogs and northern leopard frogs heard during the 2001 survey than in the previous year. Six species were found in a man-made wetland that was constructed as part of the project to demonstrate wetland habitat improvements in an urban area.

Detailed information on the project including a clearinghouse of project documents can be found at www.rougeriver.com.

For further information, contact Josephine Powell, Deputy Director at the Wayne County Department of Environment, at 313.224.2658.

Four Wayne County CSO Basins

As part of the Rouge River National Wet Weather Demonstration Project, four combined sewer overflow (CSO) demonstration basins were constructed by the Wayne County Department of Environment and local communities. The four basins capture previously bypassed combined sewage and turn it back into the interceptor when possible, or treat it prior to releasing it to the Rouge River. All four facilities enhance public health and welfare by eliminating raw sewage discharges to the river.

The demonstration portion of the project required minor differences in the basins so that during the monitoring phase of the project, the most effective method for treating the combined sewage could be determined and applied at other combined sewer outfalls. The design differences in the facilities include size of storm capable of complete capture, use of swirl concentration, and first flush capture.

Design of the basins was also very sensitive to the needs and desires of the closely located residents in these highly developed environments. Adjustments included burying the storage facility, use of odor and noise control, and incorporating architectural amenities to external portions of above ground control buildings.

Jeff Garland Photography

The Redford CSO Basin tested the effectiveness of the swirl concentrator.

The City of Inkster chose to use a segmented basin with a first flush compartment to store the first million gallons (MG) of flow. Its total treatment capacity of 3.1 MG is divided into 1.1 MG for the first flush and 2.0 MG for the basin. The project designers recognized an optional use for the first flush compartment that may have significant water quality benefits. The basin can be operated both ways and benefits of each have been evaluated. With a pumping capacity of 500 million gallons per day (mgd), the Inkster basin retains 35 to 40 overflow events each year and provides primary treatment and disinfection for an additional 8 to 10 overflows.

In addition to the obvious benefit of water pollution control, the Inkster facility also provides a recreation area with basketball courts, a playground, and a restroom. When site conditions precluded burying the Inkster basin in the stretch of Lower Rouge Parkway, the top of the basin was designed for public access. The existing site, through public parkland, did not include any amenities and was a source of community frustration due to illicit activities that occurred in the secluded spot.

Redford Township selected the swirl concentrator in series with their 2.0 MG basin to determine if the use of a concentrator can make a smaller basin as effective as a larger basin. To derive as much information as possible, alternate modes of operation were designed into the system allowing several combinations of

Jeff Garland Photography

The Dearborn Heights Basin, located along the Middle Rouge, cleaned up a landfill site and eliminated four CSO outfalls.

the basin and concentrator to be analyzed at minimal cost. With a pumping capacity of 190 mgd, the Redford basin retains 30 to 35 overflow events each year and provides primary treatment and disinfection for an additional 9 to 10 overflows.

The City of Dearborn Heights' 2.7 MG basin eliminated raw sewage contamination of the Middle Rouge River from four CSOs and provided state approved closure of a landfill including an exposure barrier so the site could be safely used for recreation. The basin has a pumping capacity of 500 mgd. The 13-acre basin site selected had served as a landfill from 1936 to 1944. Due to the site's history, this project was challenging. Two opposing activities had to be integrated: closing a landfill and digging a 50,000 cubic yard opening to build a basin. Several innovative construction techniques were used to minimize environmental exposure to landfill contaminants.

The River Rouge Basin was designed for the 10-year, 1-hour storm event with 30 minutes of detention time. The 5.2 MG basin has two compartments that operate in series with the lower compartment filling first to capture the first flush of the storm. Presettled wastewater that has been transferred and stored in the upper channel is used to flush the lower chamber.

All basins were funded through three sources: federal grant, state loan and local funds. Through the efforts of Congressman John Dingell, the Rouge River National Wet Weather Demonstration Project was established to provide grant funding for both design and construction of these and other facilities. Approximately 95% of the design and 55% of construction costs were funded by this federal grant. A low interest State Revolving Loan was also provided through the MDEQ for the construction engineering and administration costs. Local share bonds through the communities financed the balance of the projects. Due to the assistance of both federal and state funds, this amount equated to less than 35% of the total basin costs.

For further information, contact Josephine Powell, Deputy Director at the Wayne County Department of Environment, at 313.224.2658.

Three Oakland County CSO Basins

As part of the Rouge River National Wet Weather Demonstration Project, three CSO demonstration basins were constructed by the Oakland County Drain Commissioner. The basins have eliminated 46 outfalls and demonstrated that basins designed for smaller storms can meet water quality requirements. During their five years of operation, the basins have reduced CSO and helped improve water quality in the Rouge River.

Together, the three basins are capable of storing over 24 million gallons (MG) of sewage during a rain event. Each basin can hold the combined sewage flows generated during the 1-year/1-hour storm for 30 minutes. Captured flow is returned to the interceptor if possible or treated prior to discharge to the Rouge River. Treatment provided includes skimming, settling, screening and disinfection.

The Acacia Park CSO Retention Basin is located in the Village of Beverly Hills. Constructed below ground, the two-compartment basin can store 4 MG of combined sewage. It has a unique flushing system that uses industrial water and flushing troughs to flush the basin floor after it is dewatered. The flushing system also cleans the screens that effluent is discharged through. The facility was designed to blend into the surrounding area at the Douglas-Evans Nature Preserve. The control building resembles a stable and a “Relic Prairie” meadow was established as part of the project.

The Bloomfield Village CSO Retention Basin was designed as an amenity to the Lincoln Hills Golf Course where it resides. Residents of

Acacia CSO Basin

Bloomfield CSO Basin

Birmingham CSO Basin

Birmingham, Bloomfield and Bloomfield Hills were involved in basin siting, planning and design. The control building is shared by golfers and county workers.

The Birmingham CSO Retention Basin eliminated 44 CSO outfalls and is capable of storing

5.5 MG of combined sewage. It uses the same type of flushing system as the Acacia Park basin. The control building design resembles a gristmill to complement nearby Linden Park along the Rouge River.

All three basins were funded with a combination of federal grants, state loan and local funds. The projects were completed at a cost of $78 million with 90% of the design cost and 55% of the construction cost funded by the Rouge River National Wet Weather Demonstration Project grant money established through the efforts of Congressmen John Dingell and Joseph Knollenberg.

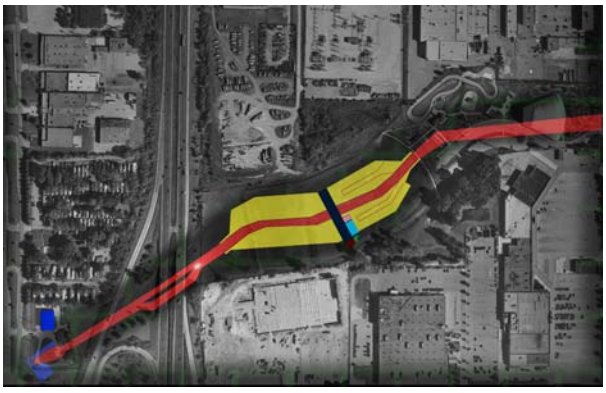
For additional information, contact Philip Sanzica, PE, Chief Engineer with the Oakland County Drain Commissioner at 248.858.0958.

George W. Kuhn Drain Improvements (Twelve Towns)

The Retention Treatment Facility (RTF) for the George W. Kuhn Drainage District of the Southeastern Oakland County Sewage Disposal System discharges treated combined sewer overflow (CSO) to the Red Run Drain through a National Pollutant Discharge Elimination System (NPDES) Permit. The George W. Kuhn Drainage District was formerly known as the Twelve Towns Drainage District. Due to water quality concerns, RTF improvements are required as part of their NPDES Permit to reduce the number of CSOs and meet the Michigan Department of Environmental Quality's criteria.

The Drainage District is a combined sewer system designed to serve all or parts of 14 communities and encompasses a drainage area of approximately 24,500 acres. The existing facility consists of a 2.5-mile tunnel capable of retaining and disinfecting 90 million gallons (MG) of combined sewage. An expansion was designed to add compartments on either side of the tunnel to provide 30 MG additional storage capacity. The basin compartments are approximately 15 feet below grade.

Because the system hydraulics placed severe limitations on both the basin layout and equipment selection, extensive hydraulic modeling was performed. The screening system and facility layout were designed with a high-flow relief gate system to minimize hydraulic losses. A vertical, self-cleaning, 6 mm fine-screen system was selected to remove and transport materials from the flow to the interceptor sewer. Emergency shunt gates pass flows through a shunt channel equipped with two-inch coarse screens.



The GWK Drain Improvements will add 30 MG of storage as shown in the yellow area.

A new dewatering pump station and force main will discharge to the interceptor to increase storage and enable the system to maintain delivery of the 260 cubic feet per second (cfs) contract capacity to the downstream interceptor. The existing weir wall will be lowered and extended to eliminate the bypass gate. An automatic full-coverage, spray nozzle flushing system, combined with an aggressively sloped floor and flushing troughs, conveys the settled solids to the dewatering pump station. A new disinfection system will use diffusers to disinfect the initial flows and high-energy mixers will provide rapid mixing disinfection of all flows above a set flow depth.

Soil conditions, existing utilities, site limitations and the need to transport flows through the existing facility during construction were challenges that influenced facility layout. Because the site is bordered by a freeway, roadway, and commercial/industrial properties, and is located under a main electrical power line, construction access is permitted from only one side of the structure. Existing sewer lines were integrated with new construction to provide uninterrupted flows.

The need to transport flows through the existing facility during construction required a thorough evaluation of construction sequencing to minimize contractor risk, provide efficient construction, and minimize owner cost. The recommended construction sequence included diversion of flows during construction, phased construction, time limitations, and risk management recommendations.

An extensive structural analysis of the existing RTF structure using state-of-the-art computer modeling techniques was performed to ensure adequacy for pre-construction, construction and post-construction loadings. The structural effects of the new basin compartments created the need for final grade restrictions and modification to the existing structure to accommodate in-service loadings. Finite element analysis of the existing structure indicated that no additional loadings could be carried by the RTF; the new basin compartments were designed so new construction would not compromise the structural integrity of the existing RTF. Differential settlement and integration with the existing structure were important design considerations. The structural geometry was designed to accommodate dump truck and service equipment access and maneuverability.

Three-dimensional design and animation tools were used to visualize spatial layout requirements of the expansion that increased the size of the facility from 90 to 120 MG. The animation was used to anticipate interferences prior to construction and to help the owner and communities visualize the final design.

For further information, contact Philip Sanzica, PE, Chief Engineer with the Oakland County Drain Commissioner at 248.858.0958.

George W. Kuhn Drain CSO Basin Screening Room Model

Dewatering Pump Station Model

Exploring a Joint CSO Tunnel for Detroit and Dearborn

The Cities of Detroit and Dearborn are conducting a feasibility study to determine if capital and operations/maintenance cost savings can be achieved by joining forces and constructing a single tunnel to control CSO from both Cities. Each City has already undertaken their own planning and preliminary design efforts for storage tunnels to capture their respective CSO. The planned Detroit tunnel is a 22.5-foot diameter, 7.5-mile long deep rock tunnel; the proposed Dearborn tunnel is an 18-foot diameter, 5.7-mile long soft ground tunnel. The two tunnels are located within 1.7 miles of each other. Both tunnels are to be dewatered into the Detroit sewer system for treatment at the wastewater treatment plant.

The concept of connecting the two tunnels to create a single, larger tunnel grew from discussions between Dearborn and Detroit. It became apparent that a more environmentally-beneficial solution might be achieved if a single, larger tunnel was constructed. The joint tunnel would reduce the total volume of overflow to the Rouge River from both communities and reduce the average number of overflows from two to three events per year to less than one. The cities met with the MDEQ and received positive feedback about further exploring the concept.

The feasibility study is evaluating the technical, institutional, financial and legal issues surrounding the concept of connecting the Dearborn and Detroit tunnels. The initial part of the study is looking at administrative issues of how to coordinate the joint project including:

- how to handle capital costs
- operation and maintenance responsibilities
- using and allocating costs for the tunnel
- administering permit from MDEQ
- availability of loans from the State Revolving Fund (SRF)
- addressing potential requirements and costs for future retrofitting.

The technical issues that will be addressed in the feasibility study include:

- subsurface ground conditions to connect the tunnel
- availability of land to construct the tunnel connection
- hydraulic analysis for operating and sharing tunnel volume and surge control
- dewatering and flushing the tunnel
- impact on river water quality as determined by reducing frequency of discharge.

The study will take 19 months to complete and cost $1.6 million. The costs are being shared equally by the cities of Dearborn and Detroit. If connecting the tunnels is determined feasible, the final design would be completed in 2007.

For further information, contact George Ellenwood, DWSD Public Affairs Manager, at 313.964.9460, or Kurt Giberson, City of Dearborn Director of Public Works at 313.943.2075.

Clinton Township Footing Drain Disconnection Pilot Program

Clinton Township is undertaking a program to determine how effective footing drain disconnection will be in preventing storm water from overloading sanitary sewers during wet weather. The program will measure the amount of rain water that can be diverted from footing drains to storm sewers, and determine if a Township-wide program could cost-effectively address sanitary sewer overflows that pollute the Clinton River and Lake St. Clair.

Clinton Township was fined $250,000 two years ago for discharging 230 million gallons of sewage from nine pumps into the Clinton River over a 20-year period. The discharges were necessary to prevent sewage backups in basements from sewer pipes overloaded with storm water. In addition to the fine, the Michigan Department of Environmental Quality (MDEQ) ordered the Township to undertake a program to disconnect the pumps and prevent future sanitary sewer overflows. The program included a footing drain disconnection pilot program and other measures:

- Rehabilitating 900 manholes to prevent rain water and groundwater infiltration at a cost of $1.3 million
- Lining 108,000 feet of residential sewers to prevent infiltration at a cost of $4.2 million
- Stiffening penalties for residents who do not extend their downspouts at least five feet from their home through a $500 fine
- Eliminated two pumps as a result of system improvements

The $104,000 footing drain pilot program is the first pollution control measure to include construction on private property. Through the project, 25 homeowners near Groesbeck and 16 1/2 Mile Roads are having sump pumps installed in their basements that will pump storm water from their footing drains to new storm sewers installed in their backyards. The area was selected for the study because it experiences flooding during large storms.

The Township is paying for the work and homeowners are responsible for maintaining sump pumps inside their homes. Meters were installed to measure the amount of storm water pumped from each home and the amount of sewage and storm water in the sanitary sewer. This data will help the Township determine if wet weather flows in the sanitary sewer can be reduced to a low enough level that the emergency pumps would not have to be turned on.

The footing drain program is currently one year ahead of schedule. Mother Nature is the only obstacle; the dry summer has prevented data collection. If the program is effective, the Township will consider disconnecting footing drains in its six other districts.

For additional information, contact Mary Bednar, Clinton Township Engineer, at 586.286.9387.

Evergreen-Farmington SSO Control Demonstration Program

The Oakland County Drain Office is working with 15 communities in the Evergreen-Farmington Sewage Disposal System to demonstrate that Clean Water Act goals can be met through a program with substantially lower costs than required by the conventional Michigan Department of Environmental Quality (MDEQ) approach. The program will evaluate all aspects of SSO treatment, infiltration/inflow reduction, and system capacity expansion. Projects that cost-effectively reduce the largest pollution load will be undertaken first. Larger, more expensive improvements to expand capacity will only be undertaken if communities aren't successful in drying out their system and additional storage capacity is needed.

A total of 16 projects are proposed in five areas over a 15-year period:

- system flow management
- SSO treatment demonstration
- infiltration/inflow (I/I) reduction
- system capacity expansion
- system monitoring and reporting

Projects will be undertaken in the first three areas simultaneously.

System flow management projects will increase capacity through several different measures:

- Construction of a connector sewer between the Farmington and Evergreen Interceptors to allow up to 14 cfs of wet sanitary flow to be transferred to the Evergreen Interceptor. The Walnut No. 1 Pumping Station will be rehabilitated or replaced.
- Removal of four sewer siphons in West Bloomfield Township that can accumulate grease and reduce capacity. This will also reduce upstream basement flooding.
- Modification of regulators at the Birmingham, Bloomfield Village and Acacia Park CSO Basins to reduce flows from the basins by 14 cfs and free up capacity in the Evergreen Interceptor for the connector sewer.
- Construction of relief sewers for the Middlebelt Interceptor if additional capacity is still needed.

SSO treatment demonstration projects will evaluate treatment alternatives through three projects:

- Demonstration and evaluation of primary and secondary treatment processes at the Kendallwood Sanitary Retention Tanks. Primary treatment would be similar to existing CSO basins including screening, skimming, settling and disinfection. Secondary treatment would include processes that can be quickly ramped up during wet weather such as filtration, oxidation, high-rate clarification and fine screening.
- Pre-demonstration SSO sampling at the Walnut No. 1 Pumping Station to quantify pollutant loadings to use as baseline data to evaluate SSO treatment effectiveness. Parameters tested would include bacteria, BOD and solids.
- Treat sanitary sewage at the Bloomfield Village CSO Basin by mixing combined sewage and wet weather sanitary sewage in the basin.

Infiltration/inflow reduction projects will free up additional capacity by reducing wet weather flows that make their way into the sewer through four projects:

- Formalize a footing drain removal demonstration project to quantify effectiveness. The

City of Auburn Hills would be assisted with their project and another community within the system identified to conduct another demonstration project.

- Formalize a sump pump disconnection demonstration project similar to the ones conducted in Beverly Hills and Farmington to quantify the effectiveness of sump disconnection. A community would be identified and assisted in undertaking the demonstration project.
- Evaluate flood prone manholes to identify reconstruction material and techniques that limit I/I and can be used in community manhole rehabilitation programs.
- Study wet weather surges at the Eight Mile Road Interceptor to determine if they are damaging manholes and allowing significant I/I into the sewer system.

Four system capacity expansion projects would be evaluated to provide additional storage capacity if needed:

- Construct a storage tunnel along Inkster Road
- Evaluate the size and location of sanitary retention treatment tanks needed for any remaining SSO locations
- Consider contracting additional wet weather capacity in the Southfield Interceptor from DWSD
- Consider connecting the Eight Mile Road emergency overflow to the proposed DWSD CSO tunnel.

The final project would be to monitor system and community flows and prepare annual reports to member communities and the MDEQ of the progress of I/I reduction and the need for system capacity expansion projects. Annual reporting would begin in year 3 and continue through year 15 of the project.

For additional information contact Jim Porter, Special Projects Engineer with the Oakland County Drain Commissioner at 248.858.0987.

Ford Rouge Complex

The Ford Rouge Center in Dearborn is one of the world's largest and oldest industrial icons. The first vehicle assembled at the Rouge was the Fordson farm tractor in 1920 and the Model A was built at the Rouge from 1927 to 1931. Ford Motor Company is investing $2 billion to redevelop the historic property to lay the groundwork for sustainable manufacturing. Redevelopment plans for the 1917 complex are intended to form the foundation for the company's vision of balancing lean manufacturing with environmental sensitivity. Environmental initiatives include:

Living Roof

At approximately 454,000 square feet, the world's largest living roof on an industrial building will be covered with sedum, a succulent groundcover, and other plants. The roof will reduce storm water runoff by holding an inch of rainfall. The living plants absorb carbon dioxide as part of photosynthesis, so oxygen is emitted and greenhouse gases are reduced. The low-growing, drought resistent perennial groundcover will require no mowing and little other maintenance. The "green" roof will also help cool the new assembly plant on summer days and improve air quality. Ten, giant (115 feet long, 25 feet wide and up to 22 feet high) rooftop window boxes called monitors will flood the plant with daylight and lower energy costs by reducing the need for artificial light.

Miller Road Greening

Plans call for Miller Road to be replaced with a 1.5-mile "green belt" boulevard of trees and flowers. Over 22 acres along the road will be landscaped with trees, shrubs, groundcover and wetlands to support a diverse animal habitat. Many of the plants were chosen for their ability to clean the soil and filter storm water runoff.

Storm Water Runoff Filtering

Storm water will be collected and filtered by the living roof and porous parking lots, and then channeled to planted swales that mimic the cleaning action of natural wetlands by slowing down the flow of storm water runoff and filtering it through sand, gravel and the thick plant roots. This three-day cycle removes most particles from the storm water. Building a natural system like this, rather than a conventional storm water treatment plant, could save Ford millions of dollars if/when Federal and State storm water regulations are enacted.

Ford Rouge Complex

Soil Cleanup

Michigan State University is partnering with Ford Motor Company to develop successful pilot projects that use plants to rid soil of contaminants (phytoremediation). The primary contaminants found at the Coke Oven facility at the Rouge Center are polycyclic aromatic hydrocarbons (PAHs), that are formed by coal processing during production of coke for use in smelting. Many PAHs are water-insoluble

Greenhouse plants

chemicals, which are slow to decompose and therefore persistent in the environment. An experimental field study at the Allen Park Clay Mine was established in 2000 to characterize and optimize the factors required for effective remediation of the Rouge Center soil. Preliminary results after one growing season show most of the plants displayed accelerated PAH degradation to produce harmless breakdown products such as water and carbon dioxide. If successful, pilot plots will be established at various areas of the Ford Rouge Center.

For additional information, contact Don Russell at the Ford Motor Company, Environmental Quality Office, at 313.322.3828.

Sources

Ford Rouge Center Moves Into the 21st Century. Ford Motor Company News Release. November 3, 2000.

Ford Rouge Center, A Living Laboratory Fact Sheet.

Ford Motor Company Michigan State University Rouge Phytoremediation Research Project Summary Brochure.

Rouge Oxbow Restoration Project at Henry Ford Museum and Greenfield Village

Progress is continuing with the restoration of an oxbow of the Rouge River at Henry Ford Museum and Greenfield Village, adjacent to the Lower Branch of the Rouge River in Dearborn, Michigan. This project was funded by grants from the State of Michigan Clean Michigan Initiative (CMI) and the Rouge River National Wet Weather Demonstration Project.

The main objective of the project is to restore valuable fish and wildlife habitat within the Rouge River and to restore functioning riverine wetlands that have been lost due to the channelization of the river in the 1970s. Secondary objectives include improvement of water quality, increased floodplain storage, educational/interpretive opportunities and improved aesthetics.

At its initiation, it was envisioned the project would be completed in three phases:
Phase I – Oxbow Wetland Restoration
Phase II – Combined Sewer Overflow (CSO) Modifications
Phase III – Open Connection to the Rouge

Rouge Oxbow

An existing storm sewer provided river water to the oxbow during Phase I, and a siphon connects the wetlands on both sides of the existing CSO until Phases II and III can be completed. Phase I was completed in the summer of 2002.

The recently completed Phase I improvements restored the oxbow channel and wetlands to simulate riverine wetlands common in southeast Michigan rivers. The restoration provides a 2,200-ft channel that varies in width from 15 to 105 feet and in depths from 3 to 8 feet. The channel is surrounded by 3 acres of submergent and emergent wetland systems (0-3 foot depths) that provide habitat for various wildlife species. The wetlands transition to 10 acres of existing and restored upland woodlands and meadow. Uplands are planted with various tree, shrub, grass and wildflower species. Bioengineering (planted slope stabilization) techniques also provide shrub areas. In spring 2003, native fish species will be introduced to the oxbow wetlands, including bass, channel catfish and bowfin. Various wildlife have already begun to use these habitat areas including macroinvertebrates, amphibians, reptiles, waterfowl and small mammals such as herons, migratory song birds, wood ducks, frogs, turtles, raccoons and coyotes. The island created in the middle of the oxbow will be an interpretive area for many educational and public programs including summer camps, classes, a Native American village that originally occupied the area, and stories of innovative naturalists such as John Burroughs.

For further information, contact Josephine Powell, Deputy Director at the Wayne County Department of Environment, at 313.224.2658.

Source

www.rougeriver.com, Rouge River Project
Website: Rouge Oxbow Restoration Project

Wayne County Storm Water Ordinance

In October 2000, the Wayne County Commission enacted a Storm Water Management Ordinance (No. 2000-652) and Administrative Rules that are administered by the Wayne County Department of Public Services. The purpose of the Ordinance is to prevent pollution from storm water runoff (the excess portion of precipitation that does not infiltrate the ground, but "runs off" and reaches a stream, water body, or storm sewer), and to protect water quality. The Ordinance is written:

- To protect the environment against pollution and other effects from storm water runoff, and to protect the public health and safety
- To provide for the implementation of a storm water management program in Wayne County to manage and prevent flooding, streambank erosion, pollution, and other effects from storm water runoff
- To establish standards and criteria for the design and construction of storm water management systems
- To establish best management practices for the design, construction, maintenance, and operation of storm water management systems
- To provide for the issuance of storm water construction approvals
- To provide for the long-term preservation and maintenance of storm water management systems
- To authorize the inspection of storm water management systems
- To provide for administration, implementation, and enforcement.

The Storm Water Management Ordinance and Administrative Rules apply to construction activities that impact storm water runoff:

- into or around new or existing road rights-of-way within the jurisdiction of the County
- into or around County drains
- in projects that are developed under the Subdivision Control Act
- in projects that are subject to the Mobile Home Commission Act
- into, on, or through property owned by the County
- in new or existing storm sewer systems owned, operated, or controlled by the County
- in, around, or to any watershed or subwatershed that is included in the Certificate of Coverage issued by the MDEQ to the County pursuant to the County Voluntary Storm Water General Permit.

The Ordinance is not intended to invalidate any published rules, regulations, or ordinances enacted by local units of government within Wayne County prior to October 2000. The Ordinance does not prevent any local unit of government from adopting or enacting a storm water management program applicable to activities within its jurisdiction. The County Ordinance does not apply to construction activities subject to a storm water management program enacted by a local unit of government as long as the enacted program imposes equal or more stringent requirements.

Application

Applicants must submit a written application for storm water construction project approval to the Wayne County Permit Office. Information must be submitted for new projects as well as proposed modifications to a storm water management system that has previously re-

ceived a storm water construction approval from the County.

During the application process, applicants must demonstrate that the storm water management system will be maintained in perpetuity. Long-term maintenance for storm water systems must include site monitoring and preventative maintenance activities that may be necessary to ensure the system is functioning as designed; remedial actions necessary to repair, modify or reconstruct the system in the event it does not properly function; notification to the subsequent owners of the limitations/restrictions on the property; and, actions necessary to enforce the terms of restrictive covenants.

Design and Construction

The County encourages the development and use of innovative storm water management system designs and construction techniques as long as they meet the flood control and water quality objectives of the Ordinance. In the design phase, the applicant must consider:

- the public health, safety, welfare, and the environment
- the inconvenience caused by storm water runoff on the subject property
- the long-term impact on storm water runoff on, from, and beyond the property
- the natural drainage pattern of the land
- the impact on the affected watershed(s)
- the effect of complete upstream development on the subject property as determined by applicable master plans and/or storm water plans
- the extent of downstream improvements necessary for proper storm water drainage.

Violations and Enforcement

Whenever possible, the County will attempt to enter into voluntary agreements to resolve Ordinance and permit violations. If a voluntary agreement cannot be reached, the County can issue a written notice of a violation to the person(s) alleged to have caused or contributed to a violation of the Ordinance. This includes a statement of facts upon which the violation is based.

Within 14 days of receipt of a written notice, the alleged violator must submit to the County an explanation of the violation and a plan of correction.

Within 14 days of receipt of the explanation and plan, the County must determine whether the proposed plan resolves or corrects the violation. If it does, then the plan of correction is incorporated into a consent agreement.

If the County determines that there has been a violation of the Ordinance or construction approval, they may issue an administrative compliance order in the following circumstances:

- the County determines that a person has violated a consent agreement entered into with the County; or
- the County has attempted to resolve the violation but no voluntary agreement or consent agreement has been entered into.

Within 28 days of being issued an administrative compliance order, the receiver may appeal the issuance.

The County may issue an administrative order without attempting to voluntarily resolve violations or by consent agreement if the violation constitutes or causes, or will constitute or cause, substantial injury to the public health, safety, welfare, or environment.

Civil fines can be levied against Ordinance or construction approval violators. The County may also bring a civil action in the name of the County to enforce the provisions of the Ordinance and its associated rules. Violators of the Ordinance may also, under certain circumstances, be subject to a misdemeanor punishable by a fine of $500 per violation per day, or imprisonment for up to 90 days, or both.

In general, applicants for storm water construction approval must incorporate the performance and design standards detailed in the rules. The rules also detail the permit application review procedures.

Standards Manual

Wayne County also published a Standards Manual that provides an easy to understand explanation of the Ordinance and Administrative Rules. The Manual also provides substantial guidance material for the design of different storm water management facilities and other useful information.

For further information, contact the Wayne County Permit Office at 734.595.6504. The Ordinance, Rules and Standards Manual are available at the Permit Office in Wayne and at www.wcdoe.org under the storm water section.

Watershed Planning in Oakland County

Oakland County is home to the headwaters of five river systems: the Rouge, Clinton, Huron, Flint and Shiawassee River Watersheds. These watersheds reach out into dozens of communities with urban and rural land uses. Until recently, organized efforts to coordinate watershed planning, public education and Illicit Discharge Elimination Program (IDEPs) were limited to the Rouge River Watershed through the Rouge River National Wet Weather Demonstration Program. Success of these efforts, impending Phase II storm water regulations and the desire to help provide funding mechanisms for storm water projects prompted the Oakland County Drain Commissioner's (OCDC) office to take an active role in developing watershed approaches throughout the county.

Expanding efforts are focusing on the Rouge River Watershed, a largely urban watershed addressing CSO, SSO and non-point source pollution problems. The OCDC has been working closely with communities in the Rouge River Watershed to evaluate opportunities available through Chapter 20 of the Michigan Drain Code to implement projects required by the current storm water permit and impending regulations. Under Chapter 20, a District can be established to undertake storm water and public health water quality improvements. The District is supported by the communities with land area that benefit from the project. OCDC is working with the communities to further refine and develop this Comprehensive Chapter 20 Drainage District Program. The OCDC is also helping establish subwatershed districts within the other watershed areas, starting with the Clinton River Watershed. Some interest groups and activities are already underway in the Red Run, Stony Creek, and Paint Creek that are led in conjunction with the Clinton River Watershed Council. The goal is for OCDC to facilitate the stakeholder groups to work together and share resources to initiate watershed planning, develop IDEPs and implement public education programs to meet Phase II Storm Water requirements. Permit application support is also being provided to different watershed communities throughout the county to help meet the March 2003 deadline.

OCDC has also been involved with the development of the Kent Lake Watershed Plant and other activities with the Huron River Watershed Council. The ongoing programming with the Rouge River Watershed public education committee has already resulted in the coordination of watershed identification signs to increase public awareness, a public education video and discussions about the Rouge Watershed on cable TV. The Drain office has also established contacts with the various County Departments – Health Department, Parks and Recreation Department, and Planning Department to work on programs and efforts

For additional information on watershed planning activities in Oakland County, contact Kathy Fraser, Environmental Planner or Philip Sanzica, PE, Chief Engineer with the Oakland County Drain Commissioner at 248.858.0958.

What Citizens Can Do to Help

There are a variety of things that homeowners can do to protect their watershed. Many communities are in the process of developing or implementing public education programs to educate their citizens on how their actions impact the watershed.

Citizens can prevent pollutants from getting in the path of storm water through:

- healthy lawn and garden practices that limit fertilizer and pesticide use
- effective car care and maintenance practices that prevent oil, grease, heavy metals and soap from becoming part of runoff
- not dumping any chemical or waste down storm drains
- maintaining their septic systems
- cleaning up animal waste in their yard to prevent bacteria from entering storm water runoff
- conserving and using water wisely
- using rain barrels to collect roof runoff and conserve water
- direct roof and other runoff to greenways and other pervious areas to the maximum practical extent

Using Fertilizers and Maintaining Healthy Lawns, Shrubs and Trees

Landscape practices affect the environment, especially streams and rivers. Homeowners often over-fertilize their lawns, apply too much herbicide and spray pesticides as a preventative measure even when pest problems do not exist. It is estimated that homeowners use ten times more pesticide per acre than farmers. The problem with these activities is that excess chemicals run off the property into storm drains and ultimately nearby creeks and streams.

Lawn fertilizers that are washed off by rain increase nutrient levels in waterways and promote algae growth. Algae "blooms" are a problem in rivers because they deplete the dissolved oxygen in the water, which ultimately affects the types and numbers of fish that can survive. Minimizing chemicals also makes good economic sense. You may be able to reduce your landscape maintenance costs by using less chemicals and less water as a result of replacing lawn areas with shrubs and groundcovers that are native to Michigan.

Three steps to a strong soil foundation

1. Have the pH and fertility of your soil tested by MSU Extension. Your soils may not require any fertilizer. Contact the local MSU Extension Office for more information (see "Getting Help"). A small fee is charged for the soil-testing service.
2. Test soil compaction. Compacted soils are unhealthy for plants and can cause rainwater to run off like it does on pavement. To test for soil compaction, try sinking a screwdriver into the ground without pounding. If the screwdriver doesn't penetrate easily, aerate the soil with a hand or mechanical corer.
3. Examine soil texture. Neither very sandy nor heavy clay soils provide a good foundation for lawns or other plantings. To examine soil texture, squeeze a handful of soil into a ball. If the soil falls apart, it's too sandy; if the soil stays in a clump, it has too much clay. Good textured soil will form a ball when squeezed, but can be broken apart with minimal force.

Add compost or other organic matter lightly on top of your lawn and rake in. Over time, repeated "top dressing" will improve soil texture.

Water with care

Heavy soils composed of clay are common in Wayne County and are easily saturated. Overwatering clay soils can cause plants and beneficial insects to drown. Water lightly and frequently, every day if possible. Watering daily for 15-20 minutes during dry weather is usually sufficient. Grass roots are short (often less than four inches long) and can't use excess water. Light, frequent watering also reduces the stress to the grass plant which, in turn, reduces the potential for disease and insect damage. Light watering keeps beneficial microorganisms active on the soil surface.

Watering tips:

- Use drip irrigation or soaker hoses to get water directly to the root zone.
- Capture rain water in a barrel and use it for flowerbeds.
- Adjust timers on automatic sprinkler systems every week or so depending on the weather.
- Maintain irrigation systems to minimize leakage and maintain efficient application patterns.

Use mulch

Shredded leaves, grass clippings, compost and other yard materials can be recycled as mulch. Mulching flower beds, shrubs, newly planted trees, and vegetables helps support plant growth. A couple of inches of mulch retains soil moisture, improves the texture of soil, and helps control weed growth.

Convert lawns to low-maintenance plantings

Reduce the need for fertilizers, herbicides, mowing and watering by replacing turf grass with lower-maintenance plantings. Steep slopes and areas that are wet or shaded may not be suited for growing grass.

Examine your lawn for opportunities to replace it with other plantings. These can range from expanding flowerbeds and other plantings, to using turf only where it's the best plant to fulfill a particular function, such as active recreation.

Growing tips

- High mowing keeps lawns thick and healthy, and helps shade out weeds.
- Adjust mowers so that only the top one-third of the grass blade is cut and/or leave grass at least 3" high after cutting. Taller grass helps promote strong root development.
- Use a sharp mower blade. A dull blade will tear the grass and provide an entry port for diseases.
- Keep the mower deck clean by washing the underside of the mower after each use. A clogged deck won't mulch or discharge well.

Recycle clippings

If left on the lawn, clippings provide important moisture and nutrients (clippings can provide up to half the nitrogen needed by your lawn). Since they're about 85% water, clippings quickly break down and don't cause thatch.

If your grass grows vigorously, you may need to periodically collect clippings. If they haven't decomposed before the next mowing, remove clippings and recycle them by using them as mulch or adding them to a compost pile.

Manage thatch

Thatch is the woody remains of grass. Thatch builds up when there aren't enough microorganisms in the soil to break down woody grass remains.

To encourage microorganisms that reduce thatch, keep soil aerated and don't use insecticides. If thatch builds up over one half-inch, aerate the soil and sprinkle compost or sifted topsoil over the lawn instead of fertilizing.

Composting

Compost is decomposed organic material such as lawn clippings and leaves. Consider starting a home compost pile.

Choose the right fertilizer

To help protect water quality, follow these three important steps when choosing a fertilizer:

1. Choose a slow-release fertilizer. Overusing fertilizers can promote excessive lawn growth and create extra waste. Excessive nutrients may move past the root zone and reach rivers and lakes. Threats are greater if "quick release" chemical fertilizers are used. Slow release fertilizers promote steady, uniform growth and protect water quality. These include organic fertilizers, timed-release coated products, and products with water-insoluble nitrogen (marked "WIN"). To be considered slow-release, Michigan

State University specialists suggest that 25% of the nitrogen should be WIN.

2. Choose a fertilizer with little or no phosphorus. It is important to select fertilizers that contain the right amount of nutrients, including nitrogen (N), phosphorus (P), and potassium (K). The amount of phosphorus placed on lawns is a concern because it is a major pollutant within the Rouge River Watershed.

3. Fertilize in the fall, not in the spring. Fall fertilizing promotes deep, healthy root systems, and minimizes weed and disease problems. Spring applications can actually harm lawns by promoting more blade growth than root growth, making the lawn more susceptible to drought.

Fertilizing trees and shrubs

Healthy trees and shrubs do not require annual fertilizing. If woody plants appear unhealthy, it may be due to poor soils, insects, disease or current weather patterns. Fertilizers should be applied only when a tree or shrub is growing poorly and the problem can't be traced to other causes. If trees or shrubs do need fertilizer, apply it when the plants are dormant, in late fall or early spring.

Applying fertilizers, herbicides and pesticides

If you use lawn care chemicals, follow the label directions exactly and keep them off paved areas. Sweep them off the street or sidewalk and put sweepings back on the lawn. Avoid overspraying liquid chemicals.

Getting help

MSU Extension Office for
Wayne County
313.833.3412

MSU Extension Office for Washtenaw County
313.971.0079

Wayne County Dept. of Environment 24-Hour Hotline
888.223.2363

Sources

Charter Township of Redford information sheet: Using Fertilizers and Maintaining Healthy Lawns, Shrubs and Trees

The Community Partners for Clean Streams program (Janis A. Bobrin, Washtenaw County Drain Commissioner) and Southeastern Oakland County Resource Recovery Authority (SOCRRA). Original graphics by David Zinn. Revisions by Canton Township Engineering Services and JJR Incorporated (Fall 1997).

Rouge Repair Kit: A Citizen's Guide to Restore and Protect the Rouge River, Produced by the Rouge River National Wet Weather Demonstration Project, which is funded, in part, by the United States Environmental Protection Agency grant # X995743-02.

Car Care and Maintenance

Washing cars in your driveway can add pollutants to nearby rivers. Wash water that enters storm drains often contains detergents, oil, grease, heavy metals and dirt. Storm drains eventually discharge these substances into a river.

Vehicle fluids dumped down a storm drain or directly into a waterway can cause serious problems. Four quarts of oil, the amount it takes to fill your automobile's engine, can form an eight acre oil slick in a river. Other vehicle fluids such as antifreeze are poisonous to people, fish and wildlife. Many cats and dogs have died from drinking sweet-tasting puddles of antifreeze found on driveways, in ditches or near storm drains.

Washing tips

- Wash your car at a commercial car wash that uses water efficiently and disposes of the wash water properly. If a commercial car wash isn't available near you, then wash your car on the lawn to prevent soapy runoff from entering storm drains or roadside ditches.
- Remove dirt around the wheels first with a wire brush. Collect the soil with a broom and dispose of it in a manner that will keep it out of storm drains.
- Use non-phosphate biodegradable detergents and mild soaps, such as vegetable oil-based soaps.
- Wash one section of the car at a time and rinse it quickly using a pistol grip nozzle with high pressure and low volume, or use water from a bucket instead of a hose to save water.

Recipes for your automobile

Car soap

1/4 cup vegetable oil-based liquid soap
Warm water

Mix ingredients in pail.

Car wax

1 cup linseed oil
4 tbsp. carnauba wax
(available at auto supply stores)
2 tbsp. beeswax
1/2 cup vinegar

Put ingredients in top half of a double-boiler or saucepan. Heat slowly until wax has melted. Stir and pour into a heat-resistant container. After wax has solidified, rub it on the car with a

lint-free cloth. Saturate a corner of a cotton rag with vinegar and polish the wax to a deep shine.

Vinyl cleaner
1/4 cup washing soda
1 cup boiling water (sodium carbonate)

Dissolve washing soda in boiling water. Apply with sponge and wipe off with a damp cloth.

Vehicle fluid and repairing vehicles

Vehicle fluids include any fluid normally used in a vehicle such as engine oil, transmission fluid, power steering fluid, brake fluid, hydraulic fluids and radiator fluid.

Many of these fluids can be hazardous in themselves and may pick up contaminants during use in the vehicle. They can contaminate water supplies and kill fish and other aquatic life even in small quantities.

If you spill:

- Pour kitty litter, sawdust or cornmeal on spills to absorb spilled materials. Sweep up absorbants after a few hours.
- If it's a large spill (over 1 gallon of absorbant), take the material to a household hazardous waste disposal center or event.
- If it's a small spill, place the used absorbants in a strong plastic bag in the trash.

Car maintenance tips

- If you change vehicle fluids, such as motor oil or antifreeze, at home, take the waste fluids to a recycling center (see "Getting help") or an oil change facility. Under no circumstances should any vehicle fluid be poured down any drain, dumped in the trash or poured onto the ground.
- Always use a drip pan under your work and use funnels when transferring fluids.
- Never mix waste oil with gasoline, solvents or other liquids before recycling. These items cannot be recycled if they are "contaminated" by each other.
- Change vehicle fluids in the garage whenever possible or areas where leaks or spills can't flow into a storm drain.
- Inspect vehicles regularly for leaking oil and fluids and make repairs immediately after problems are detected.

Recreational vehicle tips

- Follow the above guidelines.

Getting help

Michigan Department of Environmental Quality, 800.662.9278

Wayne County Environmental Health, 313.326.4920

Sources

Charter Township of Redford information sheet: Car Care and Maintenance

Community Partners for Clean Streams program (Janis A. Bobrin, Washtenaw County Drain Commissioner) and the Rouge River Repair Kit. Original graphics by David Zinn and JJR Incorporated. Revisions by Canton Township Engineering Services and JJR Incorporated (Fall 1997).

Rouge Repair Kit: A Citizen's Guide to Restore and Protect the Rouge River, Produced by the Rouge River National Wet Weather Demonstration Project, which is funded, in part, by the United States Environmental Protection Agency grant # X995743-02.

Maintaining Septic Systems

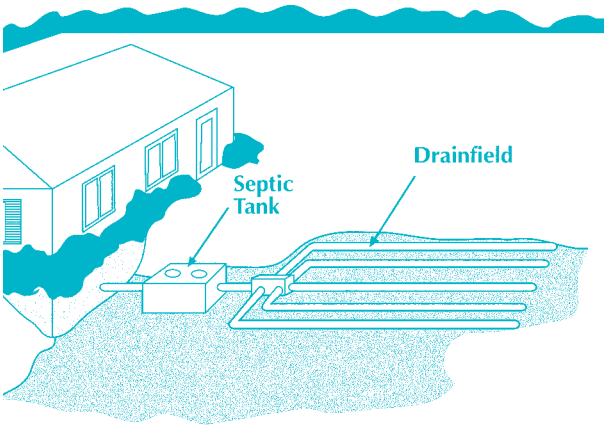
Septic systems are wastewater treatment systems designed to collect untreated household wastes from residences where sanitary sewer systems are not available. They are typically designed to be effective over a 20-year period if properly maintained.

Poorly maintained and failing septic systems can cause serious problems. Sewage from overloaded systems can pond on the ground near the drainfield or back up into buildings. Poorly treated septic liquids can contaminate ditches, creeks and shallow drinking water supplies. Animals and people may become ill from contact with these polluted waters.

In addition to public health concerns, it is costly to repair or replace a failing system.

How a septic system works

A septic system consists of a septic tank and a drainfield. Wastewater flows from the house to the septic tank where natural bacteria begin to break down the solid materials into three layers. Lighter wastes such as oil and grease rise to the top and form a scum layer. Heavier solids settle to the bottom and form a sludge layer. Between them is a center liquid layer of wastewater. The sludge residue in the tank builds up and must be removed to prevent it from entering the drainfield and clogging the system.



The center layer flows slowly from the tank into the drainfield. The drainfield is made up of perforated pipes that equally distribute the wastewater across the gravel-filled drainfield. The liquid then soaks into the soil, which acts as the final filter for treatment of wastewater received from the septic tank or from the house.

Septic system dos and don'ts

Do

- Learn the location of your septic tank and drainfield. Keep a sketch of it with your maintenance record for service visits. Obtain a copy of your septic permit from the Health Department, if possible.
- Connect laundry and kitchen water to the septic tank.
- Divert other sources of water, like roof drains, house footing drains and sump pumps, to lawn areas away from the septic system. Excessive water keeps the soil in the drainfield saturated and prevents adequate treatment of the wastewater.
- Have your septic tank pumped out by a licensed operator every two to three years.
- Have the operator make sure there is a tee or baffle on the outlet of the septic tank. The baffle stops the scum from floating into the drainfield.
- Check with the Health Department if you are having problems. They can assist with operation, maintenance and design questions.

- Take leftover hazardous household chemicals to your approved hazardous waste collection center for disposal.
- Use bleach disinfectants and toilet bowl cleaners sparingly and in accordance with product labels. Preferably use alternative cleaning products.
- Cut the grass over the disposal field. Grass cut around two to three inches increases plant activity called evapotranspiration. This process removes nutrients from the disposal field through the root system and increases evaporation.

Limit water entering your tank:

- Use water-saving faucets, showers and toilets.
- Minimize the amount of water used for bathing and dishwashing.
- Drain appliances one at a time.
- Spread clothes-washing over the entire week and avoid half-loads.
- Check toilets for leaks at least once a year by putting a few drops of food coloring into the toilet tank. If colored water appears in the toilet bowl, you have a leaking toilet.
- Prevent roof, foundation, driveway, basement and water softener discharge from entering the tank or disposal field area.

Don't

- Don't go down into a septic tank. Toxic gases produced by the natural treatment processes can kill humans in minutes. Extreme care should be taken when inspecting a septic tank, even when just looking in the lid opening.
- Don't allow heavy vehicles to drive over, or park on top of, the septic system.
- Don't plant trees or shrubs on, or directly adjacent to, the septic tank or drainfield. Plant roots could damage the system.
- Don't cover the drainfield with a hard surface such as concrete, asphalt, aboveground pools or decks. This area should be covered by grass only.
- Don't repair your septic system without checking with the Health Department to see if you need a permit.
- Don't use a kitchen garbage disposal unit. Heavy use adds large quantities of solids and shortens the life span of the septic system.
- Don't use commercial septic tank additives. These products do not help, but rather harm your system in the long run.
- Don't use your toilet or sink as a trash can. Pouring harsh chemicals and cleansers down the drain can contaminate the groundwater and kill the beneficial bacteria that treat your wastewater.

Do not flush or wash down the drain:

coffee grinds
meat fat
grease or oil
cigarette butts
diapers
personal hygiene items
dental floss
kitty litter
paper towels
disposable

The same goes for hazardous chemicals, such as:

paints
paint thinners
oils
photographic solutions
varnishes
pesticides
gasoline
household cleaning products

These items can overtax or destroy the biological digestion taking place within your system. In addition, hazardous chemicals can contaminate your groundwater.

What to do if your system is failing

Signs that your system is failing:

- Sewage backup in drains or toilets
- Slow flushing toilets, sinks or drains
- Visible liquid on the surface of the ground near the septic system. It may or may not have an odor associated with it.
- Lush, green grass over the drainfield, even during dry weather. Often, this indicates that an excessive amount of liquid from the system is moving up through the soil, instead of downward, as it should.
- Build-up of aquatic weeds or algae in lakes or ponds adjacent to your home. This may indicate that nutrient-rich septic system waste is leaching into the surface water.
- Unpleasant odors around your house
- Gurgling sounds in the sinks and drains

If your system exhibits one or more of the failure indicators, contact your county health official for assistance in assessing the situation. Sometimes the system can be repaired without complete replacement. Sewage contains harmful bacteria so keep pets and children away from the system. Limit water use until repairs can be made. If a new system or repairs are needed, a permit is often required from your local Health Department.

Getting help

Wayne County Department of Environmental Health, 313.326.4920

Sources

Charter Township of Redford information sheet: Maintaining Septic Systems

Rouge RAP Advisory Council On-Site Septic Subcommittee and Rouge Repair Kit. Graphics by JJR Incorporated (Fall 1997).

Rouge Repair Kit: A Citizen's Guide to Restore and Protect the Rouge River, Produced by the Rouge River National Wet Weather Demonstration Project, which is funded, in part, by the United States Environmental Protection Agency grant # X995743-02.

Rain Barrels: A New Spin on an Old Idea

Over 700 gallons of water will run off the average 1,200 square foot roof during a 1-inch rain storm over a 24-hour period. Recognizing this significant flow contribution to combined sewer systems and sewer systems with connected footing drains, some communities are undertaking programs to capture residential roof runoff during rain events. The City of Toronto, Ontario, and the City of Bremerton, Washington, have implemented voluntary programs to use rain barrels in their communities to prevent storm water from getting into the sewer system.

Rain water harvesting systems have been around for centuries. Many cultures including Meso-America, the Middle East and ancient Rome captured rain water and stored it for later use. In the 19th and early 20th centuries, families settling in the United State's high plains used small concrete cisterns to store rain water. Today, all new construction in Bermuda and the US Virgin Islands requires rain water harvesting systems. The state of California offers a tax credit for rain water harvesting systems and financial incentives are offered in cities in Germany and Japan.

Rain barrels offer an inexpensive way for residents to harvest rain water and keep it out of the sewer system. Rain barrels offer homeowners many benefits:

- Clean source of water for your plants. The average size roof will supply about 4,000 gallons of water from April to August.
- Water conservation. Fresh water that would otherwise be lost to runoff can be captured and used.
- Cost savings. There is an opportunity to save money by using less metered water from your home.

A rain barrel can be made from a 55-gallon drum, a brass faucet, louvered screen and hose adapter or purchased from one of several manufacturers. Ready-made rain barrels range from $70 to $150 plus shipping costs. Online sources include:

- www.composter.com
- www.urbangardencenter.com
- sprucecreekrainsaver.com
- www.gardeners.com
- www.rainsaverusa.com

Michigan communities that have promoted the use of rain barrels include Dearborn and the Downriver Community Council.

Sources

"Rainwater Harvesting, An ancient technology – cisterns – is reconsidered" *by Daniel Winterbottom, Landscape Architecture, April 2002*

City of Bremerton, Washington, USA (www.cityofbremerton.com)

City of Toronto, Ontario, Canada (www.city.toronto.on.ca)

Wet Weather Web Resources

www.amsa-cleanwater.org
Association of Metropolitan Sewerage Agencies

AMSA represents the interest of over 300 public agencies and organizations and has conducted CSO studies with its members and worked with other organizations to publish reports including *Communities at Work...The National Response to Combined Sewer Overflows* and *The Cost of Clean.*

www.crwc.org
Clinton River Watershed Council

Information about activities within the Clinton River Watershed. Includes clearinghouse of information on Phase II NPDES Storm Water Permit Requirements established in partnership with SEMCOG at www.crwc.org/projects/phase2/phase2home.html.

www.dwsd.org
Detroit Water and Sewerage Department

Press releases and information about DWSD service area, history of the water and sewerage system and understanding rates.

www.epa.gov
Environmental Protection Agency

Abundance of information on CSO, SSO and storm water pollution including policies and regulation. Area to surf your watershed. Includes EPA's December 2001 *Report to Congress on Implementation and Enforcement of the CSO Control Policy*.

www.michigan.gov/deq
Michigan Department of Environmental Quality

Information on Michigan's NPDES program, CSO and SSO reporting and programs governing water quality in Michigan.

www.rougeriver.com
Rouge River National Wet Weather Demonstration Project (RRNWWDP)

A clearinghouse of information about the RRNWWDP being administered through the Wayne County Department of Environment.

www.semcog.org
Southeast Michigan Council of Governments

SEMCOG has published several reports on the infrastructure needs of southeast Michigan including Investing in *Southeast Michigan's Quality of Life: Sewer Infrastructure Needs* and *Putting Southeast Michigan's Water Quality Plan into Action: Tools for Local Governments.*

www.stormwatercenter.net
The Storm Water Manager's Resource Center

Information for storm water practitioners, local government officials and others that need technical assistance on storm water management issues.

www.wef.org
Water Environment Federation

WEF has been developing and disseminating information on the nature, collection and treatment of domestic and industrial waste since 1928. Their site contains a variety of technical information and a glossary of terms at www.wef.org/OperationsCentral/glossary

www.win-water.org
Water Infrastructure Network

WIN is a broad-based coalition of local elected officials, drinking water and wastewater service providers, state environmental and health administrators, engineers and environmentalists dedicated to preserving and protecting the health, environmental and economic gains that America's drinking water and wastewater infrastructure provides. They have published a variety of reports including *Water Infrastructure Now Recommendations for Clean and Safe Water in the 21st Century* and *Clean & Safe Water for the 21st Century.*

www.yearofcleanwater.org
The Year of Clean Water

A web site commemorating the 30th anniversary (October 18, 2002) of the enactment of major revisions to the Clean Water Act.

Calendar of Environmental Events

April

DWSD Benefit Basketball Game for Friends of Detroit River
Detroit Water and Sewerage Department
Public Affairs, 313.964.9460
www.dwsd.org

Earth Day
www.earthsite.org, www.earthday.net

Rouge Education Project Annual Monitoring Day
Friends of the Rouge River, 313.792.9627
www.therouge.org

Rouge River Interpretative Programs
Wayne County Parks, 734.261.1990
www.waynecounty.com/parks

Spring Bug Hunt
Friends of Detroit River
www.detroitriver.org

May

National Wetlands Month
The Terren Institute
www.terrene.org

National Drinking Water Week
American Water Works Association
www.awwa.org

Nautical Coast Clean Up (Lake St Clair)
The Nautical Mile
www.nauticalmile.org

Oakland County Annual Fishing Contest
Oakland County Parks, 888.OCPARKS
www.co.oakland.mi.us/arc/c_serv/parks/home.html

Rouge Education Project Student Congress
Friends of the Rouge River, 313.792.9627
www.therouge.org

Rouge River Water Quality Festival
Wayne County Department of Environment
www.wcdoe.org/rougeriver

Rouge River Interpretative Programs
Wayne County Parks, 734.261.1990
www.waynecounty.com/parks

June

Clinton River Day by *Friends of the Clinton River*
Clinton River Watershed Council, 248.853.9580
www.crwc.org

Historic View Of The Huron by *Friends of the Huron River*
Huron River Watershed Council, 734.769.5123
comnet.org/hrwc/

Huron River Cleanup by *Friends of the Huron River*
Huron River Watershed Council, 734.769.5123
comnet.org/hrwc

Huron River Tour De Wetland by *Friends of the Huron River*
Huron River Watershed Council, 734.769.5123
comnet.org/hrwc/

River Day – Detroit River Cleanup
Friends of Detroit River
www.detroitriver.org

Rouge Rescue
Friends of the Rouge River, 313.792.9627
www.therouge.org

September

Clinton River Watershed Cleanup by *Friends of the Clinton River*
Clinton River Watershed Council, 248.853.9580
www.crwc.org

National Pollution Prevention Week
www.p2.org

Oakland County Annual Fishing Contest
Oakland County Parks, 888.OCPARKS
www.co.oakland.mi.us/arc/c_serv/parks/home.html

Abbreviations of Terms

BMP	Best Management Practice
BOD	Biological Oxygen Demand
cfs	Cubic feet per second
CSO	Combined Sewer Overflow
CWA	Clean Water Act
DO	Dissolved Oxygen
DRI	Detroit River Interceptor
DWSD	Detroit Water and Sewerage Department
EPA	Environmental Protection Agency
IDEP	Illicit Discharge Elimination Permit
LTCP	Long Term Control Plan
MDEQ	Michigan Department of Environmental Quality
MG	Million gallons
mgd	Million gallons per day
mg/l	Milligrams per liter
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
PEP	Public Education Plan
RRNWWDP	Rouge River National Wet Weather Demonstration Project
SEMCOG	Southeast Michigan Council of Government
SRF	State Revolving Fund
SSO	Sanitary Sewer Overflow
SWQIF	Strategic Water Quality Initiatives Fund
WWTP	Wastewater Treatment Plant

Glossary of Terms

1-year, 1-hour storm - The intensity of a storm that statistically occurs at least once every year is called the 1-year, 24-hour storm. In Michigan, this storm produces 2.2 inches of rain. The 1-year, 1-hour storm is the hour during that storm with the heaviest rainfall. In Michigan, this would equal about 1 inch of rain.

10-year, 1-hour storm - The intensity of a storm that statistically occurs at least once every ten years for a 24-hour period. In Michigan, this storm produces about 3.6 inches of rain in a 24-hour period. The 10-year, 1-hour storm is the hour during that storm with the heaviest rainfall. In Michigan, this would equal about 1.8 inches of rain.

Acid rain - Rain with a pH of less than 5.6 that has mixed with sulfur and nitrogen oxides in the atmosphere as a result of burning fossil fuel. Acid rain can damage buildings, wildlife and aquatic life.

Basin - A concrete tank to capture and treat overflows from a combined sewer system. Basins are typically about 30 feet deep, covered, and buried 3 to 5 feet below grade. The captured flow is returned to the interceptor sewer when there is sufficient capacity to transport it to the WWTP. Basins are equipped with screening and disinfection devices.

Best Management Practice (BMP) - A practice or combination of relatively low cost practices that prevents or controls the discharge of pollutants to receiving waters.

Biochemical Oxygen Demand (BOD) - A laboratory measurement of wastewater that is one of the main indicators of the quantity of pollutants present. BOD measures the amount of oxygen that will be consumed by microorganisms when oxygen in wastewater biologically reacts with organic material in the wastewater. A decrease in BOD indicates that water quality is improving.

Bioengineering - The science that uses living plant materials as a main structural component to control erosion, sedimentation, and flooding. Also referred to as soil bioengineering, it is used for land stabilization and habitat restoration.

Catch basin - A structure designed to remove debris from storm water runoff that is collected from streets. A catch basin includes a small, underground storage area to remove sediment and a cover with 8 to 36 holes to prevent sticks and debris from entering the storm sewer.

Clean Water Act (CWA) - A federal law that dates back to 1948, the 1972 CWA amendments set the basic structure for regulating discharges of pollutants to waters in the United States. The law gave the EPA authority to set effluent standards on an industry basis and continued the requirements to set water quality standards for all contaminants in surface waters. The CWA makes it unlawful to discharge any pollutant into a navigable water unless a NPDES permit is obtained under the Act.

Cistern - An underground tank or pipe to collect storm water runoff from catch basins prior to discharge into sewer systems. Cisterns are used to store and slowly release storm water from residential areas into the combined sewer system until the threat of CSOs has passed.

Collection system - A network of sewer pipes used to collect wastewater and/or storm water and transport it to a wastewater treatment plant or sewer outfall.

Combined sewer - A sewer that carries both wastewater and storm water. During dry weather, all flows are sent to a WWTP. During wet weather, the sewers fill and flows that do not reach a WWTP overflow to nearby streams or rivers. Combined sewers are found primarily in older, urban systems in the northeast and upper Midwest of the United States. Combined sewer systems were the primary type of sewer system constructed prior to the 1950s.

Combined sewer overflow (CSO) - The overflow of a mixture of wastewater and storm water into a river when heavy rainfalls overload a combined sewer. CSOs pose a health and safety hazard.

Commingling - The mixing of flows from two different sources. An example would be discharging sanitary sewer flows into a combined sewer system.

Cubic feet per second (cfs) - A measurement of flow rate. It represents the number of cubic feet of volume passing by a stationary point in one second.

Decanting/Dewatering - The process of draining or removing water from a storage structure like a basin or tunnel after a storm.

Demonstrative approach - An alternative treatment and control approach proposed by a community to meet regulatory requirements for CSO or SSO control. Under this approach, the community tests the completed facility to demonstrate that it is achieving required treatment levels. If it cannot meet requirements, improvements need to be made to achieve the required level of treatment. Demonstrative approaches are undertaken to save money. Detroit used a demonstrative approach to shave $2-3 billion off original cost estimates to control CSOs based on MDEQ's presumptive approach for adequate treatment.

Design storm capture - The size of storm a collection and treatment system has been designed to capture and hold. Design storm sizes are expressed in terms of their frequency of occurrence.

Detention - The temporary storage of storm water runoff to control peak discharge rates and provide gravity settling of pollutants.

Detroit Water and Sewerage Department (DWSD) - A City of Detroit Department that provides water and sewer service for the southeast Michigan area. Sewage service is provided to three million people in 78 communities. DWSD operates and maintains 3,500 miles of sewer that carry rain water and wastewater.

Diffuser -A porous tube or other device that air is forced through and divided into very small bubbles for interaction with organic pollutants found in liquids.

Discharge - Treated and untreated water released from an outfall into a surface water. Discharges classified as intermittent include CSO, SSO and storm water. Continuous discharges include treated effluent from WWTPs.

Disinfection - Disinfection devices are used in CSO basins and screening facilities to kill pathogens in the discharge. Current practice is disinfection by means of chlorination using sodium hypochlorite at a low concentration (similar to laundry bleach).

Dissolved oxygen - The oxygen freely available in water, vital to fish and other aquatic life and for the prevention of odors. Dissolved oxygen (DO) levels are considered the most important indicator of a water body's ability to support desirable aquatic life. An increasing DO means water quality is improving. Secondary and advanced waste treatment are generally designed to ensure adequate DO in waste-receiving waters.

Downspout disconnection - Downspouts are connected into many combined sewer systems increasing the amount of rain water that gets into a system. Downspouts are disconnected at ground level to divert rain water onto lawns where it will filter into the ground. This requires capping the existing outlet pipe, installing a concrete splash pad at the downspout outlet and diverting the flow away from the home or building.

Dry weather flow - Flow in a combined or sanitary sewer that is not influenced by a rain storm or snowmelt.

Effluent - The treated discharge from wastewater treatment and manufacturing plants discharged into a surface or ground water. NPDES permits outline the water quality requirements of effluent.

Enclosed storm drainage system - A system of buried sewer pipes to collect and transport storm water to an outlet on a river, stream or lake. Most urban areas have enclosed storm drainage systems.

EPA - The United States Environmental Protection Agency is the federal regulator responsible for administering the Clean Water Act.

First flush - During the initial part of a storm, rainfall washes accumulated materials (grit, paper, oil, salt, lawn chemicals) off impervious surfaces. This first flush of storm water runoff contains the highest level of pollutants. If the runoff discharges directly to lakes and streams it can cause a shock load. As a minimum, basins are generally capable of capturing the first flush.

First Tier Customers - Wastewater customers that have direct contracts with DWSD. There are 15 First Tier Customers including Wayne, Oakland and Macomb Counties.

Floatables - Materials found in sewers and storage tanks that are lighter than water.

Flushing gates - Devices (gates) in a sewer or tank that can store flow. The flow is then released to flush sediments deposited in sewer and tank sections below the gates.

Footing drain - Drain tiles around a home's foundation that collect water from around the home and prevent it from leaking into the basement.

Footing drain disconnection - The removal of storm water footing drain flow from a combined or sanitary sewer system. This typically requires the installation of a sump pump to direct flows onto a lawn or into a nearby storm sewer system.

Heavy metals - Metals that can be precipitated by hydrogen sulfide in acid solution, including lead, silver, gold, mercury, bismuth, and copper. Heavy metals are considered harmful to humans when ingested.

Hydraulics - The branch of engineering that deals with water or other fluid in motion.

Hydraulic modeling - Development of a computer model to represent the flow of wastewater in a collection system to determine how the system will react under different flow conditions.

Illicit connection - An illegal connection of a sanitary sewer into a storm sewer that allows human waste to go directly into streams and rivers. Illegal connections also include illegal storm water connections to sanitary systems, such as sump pumps that homeowners have connected into the sanitary sewer system instead of discharging into their yard or storm sewer.

Impervious areas - Surfaces that cannot absorb rain water including streets, sidewalks, roofs, parking lots and driveways. The larger the impervious area, the greater the runoff volume.

Infiltration - The absorption of water into the ground, expressed in terms of inches per hour. It is also the penetration of water from the soil into sewer or other pipes through defective joints, connections, or manhole walls.

Inflow - The discharge of storm water into a sanitary sewer system through footing drains, sump pumps, inappropriate catch basin connections, leaking manhole covers or other sources.

Influent - Flows into a treatment facility, storage facility, or sewer system. Influent characteristics, flow rates and volume are used to determine the size and treatment requirements of a facility.

In-system storage - The use of existing sewer pipes and structures to store excess flows during a wet weather event.

Interceptor - A large sewer that collects flow from a number of trunk sewers and transports the flow to the WWTP. These sewers do not connect to homes, buildings or streets. Detroit's system drains to three main interceptors: the Detroit River Interceptor (DRI), the North Interceptor - East Arm (NI-EA) and the Oakwood Northwest Interceptor (ONWI).

Lateral sewer - A sewer that collects flows from homes and businesses for discharge into trunk sewers. There are thousands of lateral sewers throughout the collection system tributary to Detroit.

Long Term Control Plan (LTCP) - A plan that outlines a program to control combined sewer overflows through a variety of ways, such as sewer separation, construction of facilities that treat overflows, storage facilities to store them until they can be sent to a WWTP, etc.

Manhole - A structure designed to provide access to a sewer system for cleaning and other maintenance activities.

Michigan Department of Environmental Quality (MDEQ) - Formerly known as the Michigan Department of Natural Resources, the MDEQ has regulatory oversight and issues all NPDES permits in the state of Michigan.

MDEQ presumptive level of control - For CSO control, this requires complete capture of the 1-year, 1-hour storm and screening, settling and 30 minutes of disinfection contact time for discharge of the 10-year, 1-hour storm.

Million gallons per day (mgd) - A measurement of flow. It represents the number of million gallon increments of volume passing by a stationary point in a 24-hour period.

Mitigation - An activity or project to reduce the impact of a pollutant or replace lost land features such as wetlands and surface water.

National Pollutant Discharge Elimination System (NPDES) - A provision of the Clean Water Act that prohibits discharge of pollutants into waters of the United States unless a special permit is issued by EPA, a state, or, where delegated, a tribal government on an Indian reservation.

Negative treatment - The remixing of settled solids in a basin that creates an effluent that is more polluted than the influent.

Non-point source - Sources of pollution that cannot always be traced to an exact point of entry. Non-point sources of pollution include land runoff that goes directly in the river, illicit sanitary sewer connections to a storm sewer and streambank erosion.

Nutrient - An element or compound such as nitrogen, phosphorus or potassium that is necessary for plant growth. Fertilizers contain nutrients.

Open drainage system - A system of ditches and open channels that collect and transport storm water to an outlet on a river or stream. Open drainage systems are typically found in rural and industrial areas.

Organic material - Material derived from organic or living things.

Outfall - The sewer pipe where a combined sewer or storm sewer discharges into a lake or river.

Overland flow - The flow of storm water across the land surface that ultimately reaches a stream, river or lake.

Oxbow - A loop formed by a horseshoe-shaped bend in a river.

Pervious surfaces - Surfaces that are permeable and absorb storm water. Grass is a pervious surface.

Pilot project - A project conducted on a small scale to demonstrate the effectiveness of an approach, such as to treat wet weather pollution or limit storm water from getting into a collection system.

Point source - Discharges from stationary locations such as WWTPs, storm sewer outlets and factories. Point source discharges include combined sewer outfalls and storm sewer outfalls that are regulated by the MDEQ.

Primary treatment - The first stage of wastewater treatment that removes settleable or floating solids only. Generally, 40% of suspended solids are removed and 30-40% of the BOD is removed in the wastewater.

Pumping station - A structure containing pumps and the associated piping, valves and other mechanical and electrical equipment for pumping wastewater, storm water or combined sewage. Also called a lift station when it is used to lift flows from a low point to a higher pipe so that it can be transported by gravity.

Regulator - A device installed in combined systems to control the amount of flow into the sewer system during periods of wet weather. Excess flows are routed to an outfall.

Relief sewer - Sewers constructed to relieve capacity deficiencies on existing sewer systems.

Sanitary sewer - A sewer that carries wastewater only.

Sanitary sewer overflow (SSO) - The discharge of untreated sanitary sewage into a waterway as a result of operational problems, undersized pipes, heavy inflow and infiltration or sewer pipe breaks, blockages or failures. Excessive inflow from footing drain connections are believed to be responsible for much of the SSO problem in southeast Michigan.

Screening devices - Devices, such as bar screens, used in basins and other screening facilities to remove larger solids and floatables. In the case of basins, the screening devices remove material about ½-inch in diameter and larger.

Scum baffle - A plate that extends below the surface of wastewater in a tank to prevent floating matter from passing through the tank.

Second Tier Customers - Customers within the DWSD system who contract for wastewater disposal from Wayne, Oakland and Macomb Counties. There are 52 Second Tier Customers in the Detroit wastewater system.

Secondary treatment standards - Minimum requirements of the Clean Water Act to remove 85% of the BOD and total suspended solids in wastewater. Secondary treatment normally uses biological treatment processes followed by settling tanks.

Sedimentation - See Settling.

Septic system - A domestic wastewater treatment system that treats household waste through a septic tank and a soil absorption system. Bacteria decomposes the waste, sludge settles to the bottom of the tank, and treated effluent flows out into the ground through drainage pipes. Failing septic systems can contaminate ditches, creeks and shallow drinking water supplies.

Settling - The process of subsidence and deposition of suspended matter carried by water, wastewater, or other liquids. It is usually accomplished by reducing the velocity of the liquid below the point that it can transport the suspended material. Also called sedimentation.

Sewer separation - Replacing a combined sewer with a separate sanitary sewer pipe and a storm sewer pipe. The sanitary sewer pipe flow is transported to a wastewater treatment plant and storm sewer flow is discharged directly to a drain or river, without treatment.

Sewer siphon - An inverted siphon that transports sewer flows under a river or stream, eliminating the need for pumping.

Shunt channel - A channel used to route flows around a storage basin when flow rates result in negative treatment.

Skimming - The removal of floatables from combined or sanitary sewage.

Snowmelt - Runoff created when snow melts and the resulting water enters sewer systems.

Sodium hypochlorite - A water solution of sodium hydroxide and chlorine where sodium hypochlorite is the essential ingredient. It is similar to laundry bleach and is used as a disinfectant in CSO basins.

State Revolving Fund (SRF) - A federal and state program offering low interest loans to municipalities for the construction of publicly-owned water pollution control facilities.

Storm sewer - A system of sewer pipes that carry only storm water runoff from buildings and land surfaces.

Storm water runoff - Water that runs off streets, roofs and land during rain storms, washing pollutants off these surfaces into the sewer system. Typical pollutants of storm water runoff include chlorides, coliform bacteria, heavy metals, nutrients, oil and grease, and suspended solids.

Stream bank erosion - The movement of sediment and soil material from the banks and bottom within a stream or river. The higher the flow, the greater the erosion.

Subwatershed - A drainage area within a watershed.

Suspended solids - Solid organic or inorganic particles physically held in suspension in wastewater by agitation or flow.

Swirl concentrator -A treatment device that uses centrifugal force to remove pollutants from wastewater.

Trunk sewer - A sewer that receives flow from many lateral and other trunk sewers, serving a large territory. Trunk sewers feed into interceptors.

Tunnel - A large, deep, underground pipe used to store and transport wastewater or combined sewage during rain storms. Tunnels typically have higher storage capacities than basins and are capable of transporting flows directly to a wastewater treatment plant or interceptor.

Wastewater Treatment Plant (WWTP) - A facility that treats wastewater, industrial waste and sludge. Detroit's WWTP uses three main processes: primary treatment, secondary treatment and disinfection. More than 90% of all incoming pollutants are removed through treatment. This exceeds the compliance standards set by federal and state regulators.

Watershed - The complete area or region draining into a river, river system, or body of water.

Wet sanitary system - A sanitary sewer system that experiences a higher volume of flow during wet weather due to storm water inflow and infiltration.

Wet weather - Weather that creates precipitation including rain, snow, sleet and hail.

Wet weather pollution - Pollution that occurs as the result of storm water entering a sewer system or running off impervious surfaces. Types of wet weather pollution include CSO, SSO and storm water runoff.

Wetland - An area that periodically has water logged soils or is covered with a shallow layer of water resulting in reduced soil conditions. A wetland area typically supports plant life adapted to wet environments.

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