Chapter 4

Challenges in the Rouge River Watershed

Introduction

This chapter elaborates on the primary storm water challenges and pollutants in the Rouge River Watershed. Sources of these pollutants with their respective causes are also discussed.

Pathogens, flow rate and volume, total phosphorus and total suspended solids have been identified as the primary pollutants or stressors that affect Rouge River water quality and watershed conditions. Discussion about pathogens is focused on the bacterial indicators of fecal coliform and *E. coli*.

Significant efforts and local government investments have provided tremendous success in reducing levels of bacteria in the Rouge River through control and elimination of combined sewer overflows (CSOs) and sanitary sewer overflows (SSOs) across the watershed. As the levels of bacteria have significantly declined, the communities and counties have further recognized the impacts of other pollutants and stressors. While continuing to reduce bacteria levels in the river is a primary objective, the other pollutants listed above have a more refined role in this watershed plan update. This watershed plan focuses attention and efforts on a "gray-to-green" infrastructure conversion across the watershed with a coordinated public education campaign to enhance awareness on this important topic.

Until the CSOs and SSOs were controlled, all other sources of pollution were hidden behind this larger source. Thus, the first and largest challenge to improving the water quality of the Rouge River was eliminating raw sewage from entering the river from CSOs. A significant success was the construction of ten (10) CSO retention basins and numerous sewer separation projects through the combined efforts of local communities, Wayne and Oakland counties and through funding from the Rouge River National Wet Weather Demonstration Project (Rouge Project)(Catalfio et al., 2006).

At the same time, many storm water projects have been undertaken across the watershed to address other pollutants, sediment and nutrients. Other stressors were also addressed, such as excess flow in the river and its tributaries combined with the replacement of natural areas or green infrastructure with impervious surfaces, or grey infrastructure.

While much attention continues to be focused on eliminating pathogens to the river, another priority is to reduce the volume of storm water runoff entering the streams and the river. This excess volume of water causes significant changes in the stream hydrology which has further effects on natural features and biological conditions. The stream hydrology was described in detail for each of the subwatersheds and is further explained in this chapter.

Challenges is an overarching term encompassing the pollutants and stressors that directly impact water quality; the sources of these pollutants and stressors, and the causes that must be addressed in order to reduce the impact of the pollutants on water quality conditions.

Dearborn CSO

Designated Uses of the Rouge River:

- *Agriculture*
- *Industrial Water Supply*
- *Navigation*
- *Warm Water Fisheries*
- *Other Indigenous Aquatic Life & Wildlife*
- *Partial Body Recreation*
- *Full Body Recreation*
- *Coldwater Fisheries (Johnson Creek)*

Designated Uses, Desired Uses and Beneficial Use Impairments

Desired Uses in the Watershed

As described in Chapter 3, there are eight (8) designated uses specific to the Rouge River. While the designated uses specify state standards and outline protection for specific ways in which the river and its tributaries may be used, watershed stakeholders commonly express support for a river that is valuable for other uses, called desired uses. Desired uses include restoring and/or protecting all of the applicable designated uses. The desired uses presented below are in addition to the designated uses.

To establish the priorities of the watershed plan, ARC members completed a brief survey prioritizing desired uses across the watershed. These survey results were then compiled into a preliminary list and categorized as either impaired or threatened. Table 4-1 summarizes the identified desired uses and lists them by SWAG priority, with 1 being highest priority and 5 being the lowest priority.

Table 4-1: Subwatershed Desired Use Priority

	Main 1-2	Main 3-4	M1	L1	M3	L2	Upper
Flood Control	1	1	1	1	1	1	1
Ecosystem Protection & Enhancement	2	3	2	2	2	2	3
Recreational Opportunities & Aesthetics	3	5	4	4	3	3	5
Coordination of Planning & Development	4	2	3	3	5	5	4
Open Space/Greenway Preservation	5	4	5	5	4	4	2

Desired Uses of the Rouge River :

1) *Flood Control*
2) *Ecosystem Protection & Enhancement*
3) *Recreational Opportunities and Aesthetics*
4) *Coordinated Planning & Development*
5) *Open Space Greenway Preservation & Enhancement*

Flood Control (Impaired & Threatened)

Flood control is a primary concern for most communities in the watershed. There is limited hydraulic capacity within the drains, and flooding occurs when large rain events (and /or snow melts) occur. The Federal Emergency Management Agency publishes100-year floodplain maps that identify areas prone to flooding during a 100-year flood event, also referred to as the flood event that has a 1% chance of occurring in any single year. The challenges associated with flooding are exacerbated when natural floodplain areas are converted to impervious surfaces. While filling of floodplain areas can be offset by providing compensatory storage in other areas, this only provides flood protection. This practice affects other stream and river characteristics because oftentimes the river channel becomes narrower and deeper creating more potential for erosion and other long-term impacts.

Ecosystem Protection & Enhancement (Threatened)

ARC members defined this use to include the combined categories of natural features, including riparian corridors, wetlands and woodlands, threatened and

endangered species, and habitat opportunities. Although this category is often affected by variable stressors, the overriding impacts are similar and inter-related.

City of Dearborn

Recreational Opportunities & Aesthetics (Impaired)

An overarching goal of the ongoing restoration activities is to make the river and its tributaries more appealing for recreational purposes to residents and visitors of the watershed. The visual aesthetics have a direct effect on these recreational opportunities. ARC members believe that the streams, riparian corridors and other green infrastructure throughout the watershed provide aesthetic beauty, and want to encourage people to utilize these areas for recreation. In addition, they want to illustrate that green infrastructure like parks, greenways and streams can increase the value of homes and neighborhoods. Increased use of local waterways and riparian corridors also helps raise citizens' level of awareness and concern for watershed issues.

Coordinated Planning & Development (Impaired)

The ARC wants to promote and achieve the environmental and economic benefits of coordinated planning and development within the Rouge River Watershed. Often times numerous governmental entities review and issue permits for a single development. Differences in objectives for a project exist between agencies and even between municipal departments. The watershed plan provides a mechanism to encourage consistency and coordination throughout the process.

Pollutant/Stressors are specific identifying factors that are known to degrade conditions in the streams and river. While pollutants are often referred to as phosphorus, sediment, toxics, metals, etc., stressors include more broad factors such as flow variability/volume and rate, natural features impacts and habitat degradation.

Open Space/Greenway Preservation and Enhancement (Threatened)

Greenways are linear open spaces, including habitats and trails that link parks, nature preserves, cultural features or historic sites for recreational and conservation purposes, according to the Community Foundation's GreenWay Initiative. Greenways can link people to their community and communities to each other. Open space is important for a variety of reasons, including habitat, increased potential for storm water infiltration, pollution prevention, aesthetics, and recreational opportunities. Development, which adds impervious surfaces to the landscape, is one of the greatest threats to the watershed. Preserving existing open space and greenways could be a critical factor in the health of the river in the future.

Pollutant sources are where the pollutants or stressors originate. Some sources may be specific sites, while other sources are generalized to include overarching issues across the watershed. Reducing or eliminating sources will reduce the impacts from pollutants and stressors which will ultimately work towards protecting designated uses.

Beneficial Use Impairments (BUIs)

In addition to the designated and desired uses described above, the Rouge Remedial Action Plan (RAP) identifies the beneficial uses that are impaired in the Rouge River Area of Concern (AOC), also representative of the entire Rouge River Watershed. The Great Lakes Water Quality Agreement describes the need for restoring and protecting 14 beneficial uses in Areas of Concern. An impaired beneficial use means a change in the chemical, physical or biological integrity of the Great Lakes system sufficient to cause any of the following (USEPA, 2008):

- **Restrictions on fish and wildlife consumption**
- Tainting of fish and wildlife flavor
- **Degradation of fish and wildlife populations**
- **Fish tumors or other deformities**
- Bird or animal deformities or reproduction problems

- **Degradation of benthos**
- **Restrictions on dredging activities**
- **Eutrophication or undesirable algae**
- Restrictions on drinking water consumption, or taste and odor problems
- **Beach closings**
- **Degradation of aesthetics**
- Added costs to agriculture or industry
- Degradation of phytoplankton and zooplankton populations
- **Loss of fish and wildlife habitat**

Of the 14 potential beneficial uses for any AOC, the nine (9) uses in **bold** above have been identified as impaired in the Rouge River AOC.

Restoration of beneficial uses is an important aspect of the overall watershed restoration process, however, the regulatory mechanisms that direct the watershed implementation programs, including the development of this watershed management plan and the RAP programs for AOCs are different. It is for this reason that the RAP and the watershed plan are distinct documents,; however, components of the documents may include similar recommendations and projects that work towards the watershed plan goals and removal of the beneficial use impairments. In many instances, the types of restoration projects and ultimate achievements are complementary.

Environmental Stressors and Pollutants of Concern

Pollutant causes are described as the reason why the source and pollutants/stressors exist. They further direct management strategies necessary to address the pollutant contributions from the identified

The ARC Technical Committee developed the priority list of pollutants, sources and causes across the watershed (Table 4-2). ARC members' first priority is to eliminate pathogens in the river. Water volume and rate were identified as the second priority, sediment as the third priority and finally, nutrients as the fourth priority. It is important to recognize that addressing water volume and rate through green infrastructure/low impact development (LID) practices[1] will have a positive effect on all environmental stressors/pollutants of concern. Therefore, green infrastructure/LID practices are recognized as high priority activities for achieving Rouge River Watershed restoration and protection goals.

Table 4-2 assisted the communities to identify and prioritize which pollutant(s) should be addressed first and which BMPs should be used. The table lists the priority pollutants, potential sources and causes of these pollutants, suspected geographic extent of impact, and BMPs. This table helped guide decision-making with regard to collaborative watershed solutions.

[1] Green infrastructure (GI) is an approach to storm water management that uses natural systems (or engineered systems that mimic natural processes) to enhance environmental quality. In general, GI techniques use soils and vegetation to infiltrate, evapotranspire, and/or recycle stormwater runoff. Low impact development is synonymous with green infrastructure practices (Odefey 2012).

Table 4-2: Summary of the Priority Pollutants, Potential Sources and Causes, Geographic Extent of Impact and Best Management Practices

Pollutant	Potential Sources		Potential Causes	Extent of Impact	Best Management Practices
Pathogens (*E. coli* and Fecal Coliform indicators)	Combined Sewer Overflows (CSOs)		• Insufficient sewer capacity. • Loss of green infrastructure via urban development.	Communities w/Combined Sewers: • Beverly Hills • Bloomfield • Birmingham • Dearborn • Dearborn Heights • Detroit • Highland Park • Inkster • Redford Township • River Rouge	• Wet Weather Storage • Downspout Disconnection • Inflow and Infiltration Management • Bioretention/Rain Gardens • Capture & Reuse (Rain Barrels/Cisterns) • Constructed Wetlands/Retention • Green Roofs • Grow Zones • Pervious Pavement • Storm Water Retrofit Practices • Tree Planting • Vegetated/Bio Swales • Ordinance Updates
	Illicit Connections/Discharges	Failing Septic Systems (OSDS)	• Historical lack of septic system maintenance, education, inspection and correction. • Undetected or uncorrected illicit discharges.	All communities with septic systems[1]	• OSDS Ordinance Updates (Oakland County) • Intensive Sampling • Dye Testing • Funding Mechanisms for System Replacement or Sewer Tap-in to aid homeowners
		Sanitary Sewer Overflows (SSOs)	• Insufficient sewer capacity.	All communities with SSOs[2]	• Downspout Disconnection • Inflow and Infiltration Management
		Cross-Connections	• Undetected or uncorrected illicit discharges. • Inadequate construction inspection for new and existing sanitary sewer connections.	Watershed Wide	• Intensive Sampling • Dye Testing • Sewer Inspections • Improved Tap-in Inspection and Plan Review Procedures

[1] As indentified in Table 2-6.
[2] As identified in Chapter 2.

Pollutant	Potential Sources		Potential Causes	Extent of Impact	Best Management Practices
Pathogens (*E. coli* and Fecal Coliform indicators)	Contaminated Storm Water Runoff	Pet Waste/Urban Animal Waste	• Little knowledge of the importance of pet waste /urban animal waste management. • Loss of green infrastructure via urban development.	Watershed-Wide	• Animal Waste Management • Non-Point Source Education • Bioretention/Rain Gardens • Capture & Reuse (Rain Barrels/Cisterns) • Constructed Wetlands/Retention • Green Roofs • Grow Zones • Pervious Pavement • Storm Water Retrofit Practices • Tree Planting • Vegetated/Bio Swales • Ordinance Updates
		Agricultural Animal Waste	• Poor manure management. • Lack of Buffer Strips	Lower 1 Subwatershed (Superior and Salem townships) Middle 1 Subwatershed (Salem Township)	• Manure Management Education • Increase Buffer Zone along waterways. • Education on Good Housekeeping Procedures
		Re-suspended Sediment	• Unsatisfactory infrastructure maintenance. • Eroding streambanks from excessive wet weather flows.	Watershed-Wide	• Municipal Good Housekeeping Practices and Programs • Bioretention/Rain Gardens • Capture & Reuse (Rain Barrels/Cisterns) • Constructed Wetlands/Retention • Green Roofs • Grow Zones • Pervious Pavement • Storm Water Retrofit Practices • Tree Planting • Vegetated/Bio Swales • Ordinance Updates
	Wastewater Treatment Plants (Ypsilanti Community Utility Authority (YCUA), Walled Lake, Commerce and Salem townships)		N/A		

Pollutant	Potential Sources	Potential Causes	Extent of Impact	Best Management Practices
Water Volume and Rate	High percentage of impervious surfaces (Gray Infrastructure) and lack of natural features (Green Infrastructure).	• Historic lack of awareness/education. • Deficiency in tracking the percentage of impervious areas across the watershed. • Loss of green infrastructure via urban development. • Historic and ongoing lack of storm water management. • Inconsistent application of integration and follow through in local/county master plans and ordinances.	Watershed-Wide	• Bioretention/Rain Gardens • Capture & Reuse (Rain Barrels/Cisterns) • Constructed Wetlands/Retention • Green Roofs and Grow Zones • Pervious Pavement • Storm Water Retrofit Practices • Tree Planting • Vegetated/Bio Swales • Storm Water Retrofit Analysis • Ordinance Updates • Buffer Strips • Tilling Practices
	Floodplain/riparian corridor modifications and loss of capacity	• Historic lack of awareness/education. • Loss of green infrastructure via urban development. • Historic and ongoing lack of storm water management. • Historic development in floodplain and riparian corridor areas without consistent procedures. • Inconsistent application of integration and follow through in local/county master plans and ordinances.	Walled Lake Branch Tonquish Creek Evans Ditch	• Bioretention/Rain Gardens • Capture & Reuse (Rain Barrels/Cisterns) • Constructed Wetlands/Retention • Green Roofs and Grow Zones • Pervious Pavement • Storm Water Retrofit Practices • Tree Planting • Vegetated/Bio Swales • Stream Repair & Protection Practices • Storm Water Retrofit Analysis • Ordinance Updates • Financial Programs • Institutional Relationships • Riparian & Upland Management

Pollutant	Potential Sources	Potential Causes	Extent of Impact	Best Management Practices
Sediment	High percentage of impervious surfaces (Gray Infrastructure) and lack of natural features (Green Infrastructure). a. Construction sites	• Loss of green infrastructure via urban development. • Lack of a viable soil erosion & sedimentation control program. • Absence of effective education regarding riparian corridor management and storm water BMP maintenance.	Areas of Development or Redevelopment	• Municipal Good Housekeeping Practices and Programs • Ordinance Updates • Non-Point Source Education
	High percentage of impervious surfaces (Gray Infrastructure) and lack of natural features (Green Infrastructure). b. Streambanks	• Loss of green infrastructure via urban development. • High wet weather flows. • Absence of effective education regarding riparian corridor management and storm water BMP maintenance.	Walled Lake Branch Tonquish Creek Evans Ditch	• Stream Repair & Protection Practices • Bioretention/Rain Gardens • Capture & Reuse (Rain Barrels/Cisterns) • Constructed Wetlands/Retention • Green Roofs and Grow Zones • Pervious Pavement • Storm Water Retrofit Practices • Tree Planting • Vegetated/Bio Swales • Ordinance Updates • Non-Point Source Education • Financial Programs
	High percentage of impervious surfaces (Gray Infrastructure) and lack of natural features (Green Infrastructure). c. Roads, Highways, Bridges and Related Infrastructure	• Loss of green infrastructure via urban development. • Insufficient storm water infrastructure maintenance.	Watershed- Wide	• Municipal Good Housekeeping Practices and Programs • Grow Zones • Pervious Pavement • Storm Water Retrofit Practices • Tree Planting • Vegetated/Bio Swales • Ordinance Updates • Financial Programs

Pollutant	Potential Sources	Potential Causes	Extent of Impact	Best Management Practices
Sediment	Urban/Rural Storm Water Runoff	• Loss of green infrastructure via urban development. • Insufficient storm water infrastructure maintenance. • Absence of effective education regarding riparian corridor management and storm water BMP maintenance.	Watershed-Wide	• Bioretention/Rain Gardens • Capture & Reuse (Rain Barrels/Cisterns) • Constructed Wetlands/Retention • Green Roofs and Grow Zones • Pervious Pavement • Storm Water Retrofit Practices • Tree Planting • Vegetated/Bio Swales • Ordinance Updates • Non-Point Source Education • Financial Programs • Institutional Relationships • Buffer Strips • Tilling Practices

Pollutant	Potential Sources	Potential Causes	Extent of Impact	Best Management Practices
Nutrients	High percentage of impervious surfaces (Gray Infrastructure) and lack of natural features (Green Infrastructure).	• Loss of green infrastructure via urban development.	Watershed-Wide	• Bioretention/Rain Gardens • Capture & Reuse (Rain Barrels/Cisterns) • Constructed Wetlands/Retention • Green Roofs and Grow Zones • Pervious Pavement • Storm Water Retrofit Practices • Tree Planting • Vegetated/Bio Swales • Storm Water Retrofit Analysis • Ordinance Updates
	Urban/Rural Storm Water	• Loss of green infrastructure via urban development. • Historic lack of education about proper fertilization and soil testing practices for property owners and property managers. • Insufficient storm water infrastructure maintenance.	Watershed-Wide	• Bioretention/Rain Gardens • Capture & Reuse (Rain Barrels/Cisterns) • Constructed Wetlands/Retention • Green Roofs and Grow Zones • Pervious Pavement • Storm Water Retrofit Practices • Tree Planting • Vegetated/Bio Swales • Ordinance Updates • Non-Point Source Education • Financial Programs • Institutional Relationships • Manure Management
	Wastewater Treatment Plants	N/A		
	Failing Septic Systems	• Historical lack of septic system maintenance, education, inspection and correction. • Undetected or uncorrected illicit discharges.	Communities with Septic Systems*	• OSDS Maintenance Ordinance (Oakland County) • Intensive Sampling/Dye Testing • Funding Mechanisms for System Replacement or Sewer Tap-in to aid homeowners
	Roads/Highways/Bridges and Related Infrastructure	• Loss of green infrastructure via urban development. • Insufficient storm water infrastructure maintenance.	Watershed-Wide	• Municipal Good Housekeeping Practices and Programs • Grow Zones • Pervious Pavement • Storm Water Retrofit Practices • Tree Planting • Vegetated/Bio Swales • Ordinance Updates • Financial Programs
	Nuisance Waterfowl/Urban Animal Waste	• Lack of education regarding pet waste/urban animal waste management.	Lakes, ponds & impoundments Watershed-Wide	• Non-Point Source Education • Grow Zones

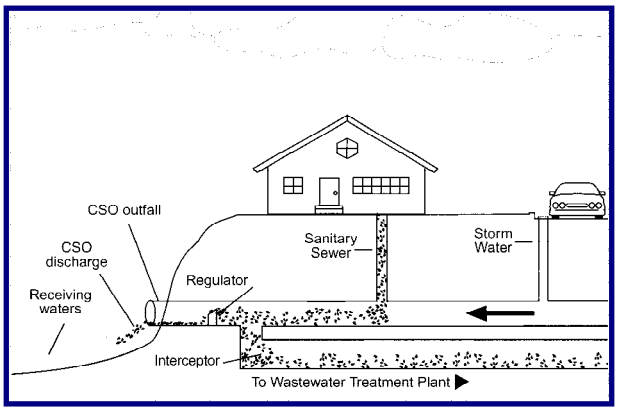
*As indentified in Table 2-6.

Sources of Identified Pollutants and Environmental Stressors

Sources of the priority pollutants and environmental stressors are further described below. In addition, those causes directly related to the sources of pollutants and stressors are also highlighted**.** It is important to recognize that many of the causes and sources have similar and overlapping characteristics and have been more narrowly defined in this plan revision as compared to the original watershed management plans. Extensive restoration achievements combined with this knowledge and experience has enabled the ARC members to define the focus of future restoration priorities more succinctly.

Combined Sewer Overflows (CSO)

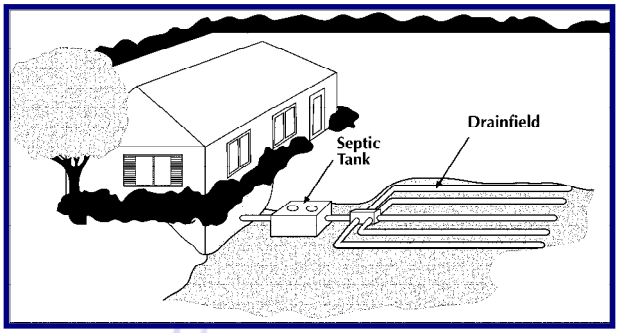
Combined sewers are sewer systems designed to carry sewage and storm water in the same pipe. After heavy rainfall or snowmelt events, the wastewater volume is often more than the sewer system or treatment plant can handle resulting in excess wastewater, known as a combined sewer overflow, being discharged directly into rivers, lakes and coastal areas. The CSO not only contains storm water but also untreated human waste and industrial waste, toxic materials, and floating debris. This *insufficient sewer capacity* is a primary reason for the existence of combined sewer overflows while *lack of funding* is an ongoing challenge to their correction.



Illicit Connections/Discharges

On-site Sewage Disposal Systems (OSDS)

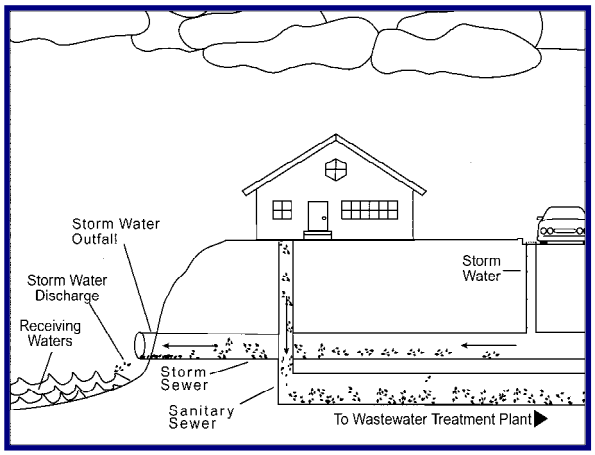
On-site Sewage Disposal Systems, also known as septic systems, are generally private systems used for sewage disposal from residential homes. Historically, businesses and industry could utilize OSDS, however, most of these have been eliminated. Private systems for residential areas are generally comprised of an earth drain field or engineered mound/elevated field that treats the sanitary waste by allowing naturally-occurring bacteria to decompose the sewage as is flows through the system. OSDS, when designed, constructed and maintained properly are not considered a source of pathogens to the river; however, these systems are not designed to operate in perpetuity. When these systems exceed their natural design expectancy or are not constructed or maintained properly, they are considered a potential significant source of pathogens to the river.



While CSOs and SSOs discharge during wet weather events, failing septic systems can discharge continuously. A typical house can discharge in excess of 50,000 gallons per year of wastewater which can be a significant source of *E. coli* to the river. The observed failure rates for these systems have been between 25%-40% percent based on studies conducted in the Rouge River Watershed and across Michigan.

Historical lack of septic system maintenance, education, inspection and correction is cited as the primary cause for the pollution issues connected to failing OSDS. In addition, *lack of funding* is also identified as a reason that private owners of these systems do not voluntarily initiate correction. Finally, failing OSDS are difficult to pinpoint and have the potential to be undetected illicit discharges.

Sanitary Sewer Overflows (SSOs)



Sanitary sewer overflows are also considered to be illicit connections/discharges. When properly designed, operated, and maintained, sanitary sewer systems collect and transport all of the sewage that flows into them to a publicly-owned treatment works (POTW). However, occasional, unintentional discharges of raw sewage from municipal sanitary sewers occur in almost every system due a variety of issues, including infiltration and inflow (I&I); undersized sewer pipes or *insufficient sewer capacity*; broken, cracked or blocked pipes and equipment failures due to *unsatisfactory infrastructure maintenance*; sewer service connections due to inadequate construction inspection for new and existing sanitary sewer connections, and long-term system and infrastructure deterioration.

The untreated sewage from these SSOs can contaminate our waterways, causing serious water quality problems. They can also cause sewage to backup into basements, causing property damage and threatening public health.

Illicit Connections

Illicit connections are another type of illicit discharge. Illicit connections occur when a sanitary sewer pipe is connected to a separate storm sewer system that ultimately discharges to a ditch, stream, wetland, river or other area. These illicit connections are often difficult to locate in areas with extensive storm sewer systems.

YCUA Plant

Waste Water Treatment Plants

There are three (3) waste water treatment plants that discharge into the Rouge River Watershed: Ypsilanti Community Utility Authority (YCUA), Walled Lake WWTP, and Commerce WWTP. Each of these treatment plants has a NPDES permit that specifies allowable levels of various parameters in the discharge.

Urban/Rural Storm Water Runoff

Non-point source pollution is the main focus when developing the list of priority environmental stressors and pollutants. Examples of non-point source pollution that impact the Rouge River include storm water runoff from urban and agricultural areas, highways and roads; industrial stockpiles; old solid waste and hazardous waste landfills, and erosion from construction projects.

Storm water is regulated today because it is viewed as a significant source of pollution. During wet weather events, water moves over the surface picking up pollutants such as bacteria, heavy metals, nutrients, oils and grease, pesticides, and soil particles and deposits them in water bodies.

Urban and rural storm water runoff is identified as a source of the priority pollutants in the Rouge River, but other causes are directly connected to this source. They include the high percentage of impervious surfaces and lack of natural features, floodplain/riparian corridor modifications and loss of capacity and re-suspended sediment.

High Percentage of Impervious Surfaces and Lack of Natural Features

One of the most significant sources for the priority pollutants and environmental stressors in the Rouge River is the conversion of existing natural features to impervious surfaces, such as rooftops and pavement. Impervious surfaces serve as a conduit for increased water volume as well as other priority non-point source pollutants, such as sediment and nutrients. As development has increased across the Rouge River Watershed so has the delivery of pollutant loadings and excess storm water runoff to the Rouge River's creeks and streams.

Floodplain in Bloomfield Township

Floodplain/Riparian Corridor Modifications and Loss of Capacity

As previously described, natural floodplain areas are commonly converted to impervious surfaces as development progresses across the landscape. Floodplain areas provide numerous ecological benefits in addition to storm water storage capacity. Enhancement and restoration of these areas not only benefits water quality, but also provides habitat and recreational opportunities that can lead to improved public perception of water quality issues.

Pet Waste/Urban Animal Waste/Nuisance Waterfowl

Pet waste and urban animal waste contains bacteria that may be carried by storm water runoff and discharged into local streams. This bacteria cause an increase in pathogen concentrations, such as *E. coli.* Picking up pet waste from lawns and paved surfaces will work towards reducing bacteria levels in the Rouge River. At the same time, feeding ducks and geese, while a seemingly harmless activity, can cause them to become dependent on humans for food which increases their populations. Waterfowl waste, similar to pet waste, is picked up by storm water and transported to local streams. Lack of education about the impact of pet waste /urban animal waste management on the Rouge River's streams and creeks has been identified as the primary cause for this source of pathogens.

As these environmental stressors and pollutants have been prioritized, it is also important to graphically show the inter-relationship to the designated and desired uses. Table 4-3 identifies which pollutants have an effect on each of the designated and desired uses.

Table 4-3: Potential Pollutant Effect on Designated and Desired Uses

		Pathogens (*E. coli* and Fecal Coliform indicators)	Water Volume & Rate	Sediment	Nutrients
Designated Uses	Agriculture	X	X	X	NA
	Industrial water supply	X	NA	X	X
	Navigation	NA	X	X	NA
	Warmwater fishery	X	X	X	X
	Other indigenous aquatic life and wildlife	X	X	X	X
	Partial body contact recreation	X	X	X	X
	Total body contact recreation between May 1 and October 31	X	X	X	X
	Coldwater Fishery	X	X	X	X
Desired Uses	Flood Control	NA	X	NA	NA
	Ecosystem Protection & Enhancement	X	X	X	X
	Recreational Opportunities & Aesthetics	X	X	X	X
	Coordinated Planning & Development	NA	NA	NA	NA
	Open Space/Greenway Preservation	X	X	X	X

Conclusion

Primary challenges in the watershed are identified by the pollutants and stressors: pathogens, flow rate and volume, sediment and nutrients in the river system. Each of these challenges has associated with it sources and causes, all of which have been addressed through the earlier watershed plans and will continue to be addressed in the future. Controlling these pollutants and stressors is significantly dependent on reductions in storm water volume entering the river and its

tributaries, elimination of CSOs and SSOs, identification and reduction of additional bacterial sources, enhanced public education and improved planning coordination amongst agencies. Controlling the offending pollutants and stressors will also address the Rouge River TMDLs for *E. coli,* biota and dissolved oxygen.