

**Detroit Water and Sewerage Department**

**Wastewater Master Plan**

**Volume 8**

# **Table of Contents and Glossary**

**CDM** Camp Dresser & McKee

**October 2003**

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# Table of Contents

The Wastewater Master Plan consists of seven volumes dealing with different aspects of the Master Plan plus an eighth volume containing a global table of contents, a glossary of terms, a list of acronyms and a CD containing the technical memoranda upon which the Master Plan was built.

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- ◆ *Review of Sewerage Studies in Macomb and Oakland Counties*
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- ◆ *Review of Detroit Wastewater Treatment Plant*
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- ◆ *Expanded Treatment Facilities within the City of Detroit*
- ◆ *Technical Feasibility of Satellite Treatment*
- ◆ *Technical Feasibility of a Wet Weather Flow Treatment Facility*
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- ◆ *Long Term Solids Disposal Alternatives for Detroit Wastewater Treatment Plant*
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## Technical Memoranda

The Following Technical Memoranda were used in the preparation of *Evaluation of Regional SSO Controls*, Volume 6 of the Detroit Water and Sewerage Department's Wastewater Master Plan.

- ◆ *Review of Footing Drain Disconnection Projects*
- ◆ *Local Alternatives for SSO Control*
- ◆ *Summary of Footing Drain Flow Studies*
- ◆ *SSO Modeling and Calibration for SSO Case Studies*
- ◆ *Regional SSO Control Analyses-Capacity Constraints in the System*
- ◆ *Field Data Collection and Water Quality Issues for SSO Control*

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## Technical Memorandum

The Following Technical Memorandum was used in the preparation of *Implementation, Volume 7* of the Detroit Water and Sewerage Department's Wastewater Master Plan.

♦ *Comment and Responses*

# Glossary of Terms

The following technical terms are commonly used in this Wastewater Master Plan:

**Antecedent moisture:** The degree of wetness of the soil at the beginning of a runoff period, frequently expressed as an index determined by summation of weighted daily rainfalls for a period preceding the runoff in question. A high antecedent moisture condition (soil is wet before a rain event) can significantly increase the wet weather response of a sewer as the soil is already saturated, leaving no room for storage. Depending on soil types and system conditions, typically, the first 0.2 to 1 inch of rainfall goes into soil storage if antecedent moisture conditions are low (soil is dry before a rain event). When the antecedent soils conditions are high (due to a previous rain event or snowmelt) the effective rain could be 0.2 to 1 inch higher.

**Branch sewer:** A sewer that receives wastewater from a relatively small area and discharges into a main sewer serving more than one branch-sewer area.

**City of Detroit District:** Nine sewer districts (Rouge River, Hubbell, Southfield, Oakwood, Baby Creek, Conner Creek, Central, Fox Creek, and East Jefferson).

**Combined sewer:** A sewer that carries both wastewater and storm water flows. Combined sewers are found primarily in older, urban systems in the northeast and upper Midwest of the United States. Combined sewer systems were built up until the 1950s. Normally, a combined sewer's entire flow goes to a waste treatment plant, but during a heavy storm, the volume of water may be so great as to cause overflows of untreated mixtures of storm water and sewage into receiving waters. Storm-water runoff may also carry toxic chemicals from industrial areas or streets into the sewer system.

**Commingle:** To combine sanitary sewer flows with combined sewer flows and treating the mix as combined sewage for treatment purposes.

**Connecting sewers:** Pipes that connect more than one lateral sewer to a trunk sewer. A pipe that connects one region of lateral sewers to another, or one region of lateral sewers to a trunk sewer. These pipes are generally 24' to 48" diameter in size and are considered as intermediate transports to the trunk sewer system.

**Contract area:** All or part of a township, city, etc. - that has an agreement with a WWTP provider. The contract area is best defined by the WWTP provider. May contain unsewered areas and areas never to be sewerred. For example, the DWSD contract area is defined by DWSD management. In some cases, a contract area may have the same sewer service area as a sewer district; in other cases, contract areas may not correspond to sewer district boundaries or may only cover part of a sewer district.

**Crock:** The clay tile sewer pipe with the smooth glazed surface was commonly referred to a "crock" sewer. It was designed to be placed by spigot into bell on a solid base and when properly backfilled, could withstand sewage flow conditions quite well. One of the weaknesses of crock sewer is that it is brittle and when service connections were made,

or construction was done nearby, or when cleaning machinery passed through, it would crack or chip or sometimes a piece of the pipe wall would break out.

**CSO (combined sewer overflow):** A discharge from a combined sewer system that occurs in response to rainfall and/or snowmelt because the carrying capacity of the sewer system is exceeded. These discharges do not receive all treatment that is available and utilized under ordinary dry weather conditions (normally during dry weather conditions the wastewater is transported to a wastewater treatment facility where it receives appropriate treatment prior to discharge). Both the combined sewer overflow structure and the discharge from the structure are referred to as CSOs.

**Cured-in-place pipe:** CIPP is a flexible cured-in-place pipe used for rehabilitation of pipes and is suitable for a number of different uses and installations. It is available in a full range of pipe diameters and wall thickness.

**Decanting:** The drawing off (of a liquid) without disturbing the sediment or the lower liquid layers. Should rain events occur closely together and the Detroit Wastewater Treatment Plant is unable to accept all flow, decanting at CSO basins provides an operational option. It enables the top layer of captured flow to be released into the waters of the state after disinfection, regaining storage volume for treatment of flow from subsequent rain events.

**Dewatering:** The process of draining and/or pumping water from wastewater equalization/storage facilities back into the main sewer lines when there is enough capacity to handle the stored volume. This typically occurs after wet weather flows from a rain or snowmelt event subsides.

**Discharge (also Overflow):** Any direct or indirect discharge of any waste, waste effluent, wastewater, pollutant, or any combination thereof into any of the waters of the state or upon the ground. Collection system professionals typically use the term “discharge” to describe the location a flow enters into a pipe that delivers flow to a treatment facility.

**Displacement:** Sanitary flows taking capacity in a combined system such that an increase in combined sewer overflows occurs, but allowing the sanitary flows to be delivered to publicly owned treatment works. This is also called “preferential treatment.”

**Downspout:** In plumbing, the water conductor from the roof to the storm drain or other means of disposal.

**Dry combined:** A combined sewer system with some of the storm sources redirected to a storm sewer system including street drainage, but still having other storm sources such as residential footing drain connections.

**Dry weather flow:** Combination of domestic, industrial and commercial wastes found in sanitary sewers during dry weather not affected by recent or current rain. Base flow is also sometimes used interchangeably with dry weather flow. However, base flow more typically is used to describe dry weather runoff to natural systems such as streams and rivers.

**Excellent sewer condition:** Pipe is clean, fully functional, structurally sound, properly aligned, service connections intact, and no evidence of corrosion or cracking.

**Excessive I/I:** The amount of infiltration and inflow over the design capacity or 275 gpcd. The amount of infiltration or inflow that can be economically eliminated from a sewer system, as determined in a cost-effective analysis that compares the costs for correcting the infiltration or inflow conditions to the total costs for transportation and treatment of the infiltration or inflow.

**Extreme event:** The EPA does not define "extreme event" but states the following: The existing Clean Water Act prohibition of sanitary sewer overflows that discharge to surface waters is clarified to provide communities with limited protection from enforcement in cases where overflows are caused by factors beyond their reasonable control or severe natural conditions (such as hurricanes, tornados, widespread flooding, earthquakes, tsunamis, and other similar natural conditions), provided there are no feasible alternatives. The MDEQ considers the 25-year, 24-hour storm as an extreme event for the State of Michigan.

**Flow blending:** The practice of routing some portion of peak wet weather influent around biological treatment units within a wastewater treatment plant and then mixing this flow with the effluent from biological units prior to discharge.

**Force main:** A pressure pipe joining the pump discharge at a water or wastewater pumping station with a point of gravity flow.

**Good sewer condition:** Pipe is free of obstacles and noticeably clean but may show occasional signs of slight cracking. No open joints are evident and most sections are properly aligned. Service connections are reasonably intact, and little or no evidence of corrosion appears. These pipes may have 75 percent of their functional life remaining.

**Groundwater:** Subsurface water occupying the saturation zone from which wells and springs are fed. In a strict sense the term applies only to water below the water table. Also called phreatic (q.v.) water, perlotic water.

**Highway drainage system:** Major freeways, such as I-696, I-96, and I-94 have a separate drainage system designed by Michigan Department of Transportation, commonly called the "MDOT system." This system is designed to drain to the major rivers directly, so the flows from these freeways are not considered to contribute directly to the wastewater treatment plant load. However, the contribution of these areas to combined sewer flows is unknown.

**Independent customers:** There are some customers outside of the city boundaries that contract directly with DWSD for service.

**Infiltration:** The water entering a sewer system and/or service connections from the ground, through such means as, but not limited to, defective pipes, pipe joints, connections, or manhole wells. Infiltration does not include, and is distinguished from, inflow.

**Inflatable dam:** A balloon-like rubber dam inflated by air, used to store flow in the sewer pipe or control flow through interceptors or outfalls.

**Inflow:** The water discharged into a sewer system, including service connections, from such sources as, but not limited to, roof leaders, cellar drains, yards and area drains, foundation drains, cooling water discharges, drains from springs and swampy areas, manhole covers, cross connections from storm and combined sewers, catch basins, storm water, surface runoff, street wash waters, or drainage. Inflow does not include, and is distinguished from, infiltration.

**Initial abstraction:** The amount of rainfall for which little or no wet weather response is observed. Capacity of soil to sorb rainfall as soil infiltration begins prevents a wet weather response due to that portion of the rainfall being sorbed by the soil. This can impact both inflow and infiltration components of the response. A portion of the initial abstraction can be due to surface depression storage as well as the sorption by the soil.

**Interceptor sewer:** A large-diameter, deep sewer that “intercepts” dry flow and a portion of wet weather flow from a number of trunk sewers and transports the flow to the WWTP. There are three interceptor sewers serving the City of Detroit and its First-Tier customers: the Detroit River Interceptor (DRI), the North Interceptor - East Arm (NI-EA) and the Oakwood North West Interceptor (ONWI).

**Lateral sewer:** A sewer that collects flows from home and business service connections and transports the flow into a trunk sewer. There are over 2,400 miles of lateral sewers throughout the collection system for the City of Detroit.

**Main sewer:** In larger systems, the principal sewer to which branch sewers and submains are tributary; also called a trunk sewer. In small systems, a sewer to which one or more branch sewers are tributary. In plumbing, the public sewer to which the service connector or building sewer is connected.

**Metered area:** A collection of subareas whose summed flow is to a common meter(s). Metered areas extend upstream only so far as the next meters(s) if applicable, i.e., upstream metered area (generally referred to as an incremental meter area in those cases).

**Model tributary area:** A collection of all subareas.

**Needs investigation sewer condition:** Structural cracks appear in two of every three sections of pipe. Some cracks and joints are noticeably allowing exfiltration and infiltration. These pipes need to be placed on an annual watch and replacement/repair will need to be implemented in 10 to 20 years. An occasional obstruction may be reducing the pipe's capacity by 20 to 30 percent, or, pipe is more than 50 percent obstructed. Occasional pieces of pipe may be missing. Corrosion is so severe that the core of the pipe wall is visible. Collapse is inevitable and attempting to perform maintenance cleaning could further impede the ability to restore service flow. Repair/replacement needs to be planned immediately.

**Outfall:** The sewer pipe where a combined sewer discharges into a lake or river. Detroit has 32 outfalls on the Rouge River and 46 outfalls on the Detroit River. Combined sew-



age is discharged through these outfalls during heavy rains to prevent backups in residential basements and on streets. Each outfall is listed in the NPDES discharge permit issued to the City of Detroit.

**Parshall flume:** A calibrated device for measuring the flow of liquid in an open conduit. It consists essentially of a contracting length, a throat, and an expanding length. At the throat is a stillover which the flow passes at a critical depth. The upper and low heads are each measured at a definite distance from the sill and the measurements used to calculate the flow through the flume.

**Planning area (community based) :** Entire area of any township or municipality that lies, all or in-part, within the wastewater master planning area as outlined by the Rouge River, Clinton River and the adjoining parts of the Lake St. Clair and Detroit River watersheds.

**Pump or pumping station:** A structure containing pumps and associated piping, valves, and other mechanical and electrical equipment for pumping wastewater. Also called a lift station when it is used to lift wastewater from a low point to a higher pipe so that it can be transported by gravity.

**PVC:** Polyvinyl chloride material which is durable and yet light-weight to handle. This material is joined by a glue-bonding process making it the most water-tight pipe material available for sewers today. This material is smooth and offers good transfer of the waste water flow.

**Rain dependent infiltration/inflow (RDII) :** Rain Dependent Infiltration/Inflow is the fraction of rainfall that enters the collection system due to precipitation in excess of the initial abstraction. It is described as the ratio of the inflow that enters a sanitary sewer system during a precipitation event to the total precipitation minus initial abstraction for the selected rainfall event. Generally used to represent wet weather response in separate sewer systems.

**Receiving waters:** The surface waters of the state into which an effluent is or may be discharged.

**Regulator:** Flow control device that restricts flow from trunk sewers into interceptors or rivers based on the wastewater level. A sluice gate is a regulating device.

**Reinforced concrete:** Formed concrete pipe with steel reinforcing material embedded in its walls. This product is very strong and is commonly used for large diameter pipes.

**Relief sewer:** (a) A sewer built to carry the flows in excess of the capacity of an existing sewer; (b) A sewer intended to carry a portion of the flow from a district in which the existing sewers are of insufficient capacity, and thus prevent hydraulic overloading of the latter.

**Return frequency:** The reciprocal of the annual probability of exceedance of a specific flow value (also known as recurrence interval (q.v.)). In statistical analysis of hydrologic data, with observations equally spaced in time and the interval between two successive

observations as unit of time, the reciprocal of one minus the probability of a value equal to or less than a certain value; or, the mean number of such time units necessary in order to obtain once a value equal to or greater than a certain value. For example, when the interval between observations is a year, a return period of 100 years (a frequency of 1/100) means that on the average in the long run, an event of this magnitude or greater is expected to occur not more often than once in 100 years.

**Sanitary sewer:** A sewer that carries liquid and waterborne wastes from residences, commercial buildings, industrial plants, and institutions together with minor quantities of ground, storm and surface water that are not admitted intentionally.

**Separate sewer system:** A dual pipe or drainage system with sanitary sewers for wastewater flows and storm sewers or drains for storm water flows.

**Septage planning area:** Communities within a 15-mile radius of existing or proposed DWSD septage receiving stations that plan on relying, totally or in part, on the use of on-site sewage disposal systems (OSDS) to meet their wastewater needs.

**Service connection:** A pipe that carries the wastewater flow from a customer's facility to a point where it is joined to the public sewer system. This joining may be in the form of a manufactured plumbing piece (such as a "Y" or a "T"), or a custom-made opening in the public sewer main where the customer's pipe penetrates the lateral sewer.

**Sewage backup:** Any time flows are restricted downstream, causing levels to rise in the sewer. Sewage backup originates from hydraulic restrictions, obstructions, sewer or pump station failures, and similar conditions that occur within the public sewer system. Sewage backup may also occur due to conditions existing within the private service lead or exclusively on private property such as root intrusion into service leads, plugging resulting from attempts to flush large solids.

**Sewer district:** A sewer service area whose boundaries are established by a legal, political, or rate-making authority. Five examples of sewer district types are: 1) sewer drainage areas defined as the city developed, now considered as districts mainly for rate-making, planning, and maintenance purposes (i.e., City of Detroit sewer districts); 2) an operating authority formed by agreement between several jurisdictions to build and maintain sewer system components (i.e., Southeast Macomb Sanitary District); 3) sewer service areas originally defined as a drainage area, with separate rate structures, covering several cities, but operated by a county (i.e., Evergreen-Farmington Sewer District under Oakland County); 4) district similar to (3) above, but covering communities in two counties (i.e., Northeast Wayne County Sanitary District); and 5) cities with their own sewer system that they maintain (i.e. Center Line)

**Sewer drainage areas:** defined as the city developed, with no formal legal boundaries (example: City of Detroit sewer districts). In some cases, these districts have slightly different sewerage rates.

**Sewer pipe:** A pipe that carries wastewater or storm water. Sewers can be classified into three levels: interceptors, trunk and lateral.

**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 the wastewater treatment plant and storm sewer flow is discharged directly to a drain or river, without treatment.

**Sewered area:** The actual area that currently has sewer pipes in the ground. Sewered areas are best defined by the owners of the sewers, that is the communities through their existing sewer maps or, in the absence of data directly from the communities, by the SEMCOG sewer area maps.

**Shunting:** A shunt channel protects a CSO basin by directing flows in excess of a basin treatment capacity around the basin. This avoids the potential for negative treatment that can occur if flow through the basin suspends previously settled solids and causes the effluent to be more polluted than the influent. Though the shunted flows do not receive any sedimentation, they are skimmed, screened, and disinfected prior to overflow.

**Siphon:** A closed conduit which utilizes atmospheric pressure to increase the flow through a conduit. A portion of the siphon lies above the hydraulic grade line, resulting in pressure less than atmospheric and requiring a vacuum within the conduit to start flow.

**SSO (sanitary sewer overflow):** An overflow, spill, release, or diversion of wastewater from a sanitary sewer system. SSOs do not include combined sewer overflows (CSOs) or other discharges from the combined portions of a combined sewer system. SSOs include: (a) Overflows or releases of wastewater that reach waters of the United States; (b) Overflows or releases of wastewater that do not reach waters of the U.S.; (c) Wastewater backups into buildings that are caused by blockages or flow conditions in a sanitary sewer other than a building lateral. Wastewater backups into buildings caused by a blockage or other malfunction of a building lateral that is privately owned are not SSOs. SSOs are discharges of raw or inadequately treated sewage from municipal separate sanitary sewer systems, which are designed to carry domestic sanitary sewage but not storm water. These overflows may also contain industrial wastewater that is present in the sewer system. When an SSO occurs, raw sewage may be released into basements, city streets, properties, rivers, and streams.

**Storm sewer:** A system of pipes (separate from sanitary sewers) that carries storm water runoff and other surface wash waters from buildings and land surfaces.

**Subarea:** A designated subunit or sub-sewershed area of a wastewater collection system representing the smallest delineated drainage area. These subareas are the smallest resolution used in the sewer models. A subarea is equivalent to a subbasin.

**Submain sewer:** A sewer into which the wastewater from two or more lateral sewers is discharged and which subsequently discharges into a main, a trunk, or other collector.

**Surface waters of the state:** All of the following, but does not include drainage ways and ponds used solely for wastewater conveyance, treatment, or control: (a) The Great Lakes and their connecting waters. (b) All inland lakes. (c) Rivers (d) Streams. (e) Impoundments. (f) Open drains. (g) Other surface bodies of water within the confines of the state.

**Trunk sewer:** A sewer that receives flow from lateral sewers or many tributary branches and sends the flow to an interceptor. These sewers serve a large territory, and generally only have a few connections, if any, to buildings or streets.

**Waters of the state:** All waters within the jurisdiction of the state including all of the following:  
(a) Ground waters. (b) Lakes. (c) Rivers. (d) Streams. (e) All other watercourses and waters.  
(f) The Great Lakes bordering the state.

**Wet sanitary sewer:** A sanitary sewer that hydraulically responds to wet weather like a combined system due to the amount of storm water entering the system. This is typically the result of having residential footing drains connected to the sanitary system that can contribute up to 90 percent of total wet weather flows. However, unlike a “dry combined system”, they can also be the result of any source of I/I other than intended direct storm connections, that is significant enough to cause a wet weather response similar to a combined system (eg. Infiltration in joints and cracks)

**Wet weather flow:** Wet weather flow includes dry weather flow and any sources of inflow and infiltration directly impacted by precipitation and/or snow melt. Wet weather impacts may extend well beyond a specific event. However, wet weather impacts do not include long-term changes to groundwater elevation and the infiltration accompanying these changes.

# Acronyms

The following acronyms are commonly used in this Wastewater Master Plan:

<b>ACO:</b> Administrative Consent Order	<b>GASB:</b> Governmental Accounting Standards Board
<b>ASCE:</b> American Society of Civil Engineers	<b>GDRSS:</b> Greater Detroit Regional Sewer System
<b>BFP:</b> Belt filter press	<b>GIS:</b> Geographical Information Systems
<b>BMP:</b> Best management practices	<b>GLWQA:</b> Great Lakes Water Quality Agreement
<b>CAP:</b> Corrective action program	<b>gpcd:</b> Gallons per capita per day
<b>CBOD:</b> Carbonaceous biochemical oxygen demand	<b>HGL:</b> Hydraulic grade line
<b>BOD:</b> Biochemical oxygen demand	<b>HRIS:</b> Human resources information system
<b>CCP:</b> Concrete cylinder pipe	<b>I/I:</b> Inflow and infiltration
<b>cfs:</b> Cubic feet per second	<b>IPP:</b> Industrial pretreatment program
<b>CIP:</b> Capital Improvement program	<b>ISO:</b> Industrial Standards Organization
<b>CIPP:</b> Cured in-place pipe	<b>ISSD:</b> In-system storage device
<b>CMOM:</b> Capacity, management, operations and maintenance	<b>IWC:</b> Industrial waste control
<b>CS:</b> Combined system	<b>MDEQ:</b> Michigan Department of Environmental Quality
<b>CSO:</b> Combined sewer overflow	<b>mg:</b> Millions of gallons
<b>DRI:</b> Detroit River Interceptor	<b>mgd:</b> Millions of gallons per day
<b>dtpd:</b> Dry tons per day	<b>MWEA:</b> Michigan Water Environment Association
<b>DWF:</b> Dry weather flow	<b>NI-EA:</b> North Interceptor – East Arm
<b>DWI/I:</b> Dry weather inflow and infiltration	<b>NIEA:</b> Northwest Interceptor East Arm
<b>DWSD:</b> Detroit Water and Sewerage Department	<b>NPDES:</b> National Pollutant Discharge Elimination System
<b>EMS:</b> Environmental management system	<b>NSF:</b> National Sanitation Foundation
<b>EPA:</b> United States Environmental Protection Agency	<b>NWI:</b> Northwest Interceptor
<b>ESRI:</b> Environmental Systems Research Institute	<b>O&amp;M:</b> Operations and maintenance
<b>EXTRAN:</b> Extended transport	<b>ONWI:</b> Oakwood Northwest Interceptor
<b>FD:</b> Footing drain	<b>OSDS:</b> On-site sewage disposal system

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<b>POTW:</b> Publicly owned treatment works	<b>WWMP:</b> Wastewater Master Plan
<b>PPC:</b> Project performance certification	<b>WWTP:</b> Wastewater treatment plant
<b>PVC:</b> Polyvinyl chloride pipe	<b>YCUA:</b> Ypsilanti Community Utility Authority
<b>RCP:</b> Reinforced concrete pipe	
<b>RDF:</b> Regional development forecast	
<b>RDII:</b> Rain-dependent inflow and infiltration	
<b>SCADA:</b> Supervisory control and data acquisition	
<b>SEMCOG:</b> Southeast Michigan Council of Governments	
<b>SEP:</b> Supplemental environmental project	
<b>SIU:</b> Significant industrial user	
<b>SS:</b> Sanitary system	
<b>SSES:</b> Sewer system evaluation survey	
<b>SSO:</b> Sanitary sewer overflow	
<b>SWMM:</b> Storm Water Management Model	
<b>SWQD:</b> Surface Water Quality Division of the Michigan Department of Environmental Quality	
<b>TAZ:</b> Traffic analysis zone	
<b>TDML:</b> Total daily maximum load	
<b>TDS:</b> Total dissolved solids	
<b>TSS:</b> Total suspended solids	
<b>TWWPR:</b> Theoretical wastewater production rate	
<b>VCP:</b> Vitrified clay pipe	
<b>VSS:</b> Volatile suspended solids	
<b>WET:</b> Whole effluent toxicity	
<b>WIMPROP:</b> Wastewater Treatment Plant Improvements and Regional Operation Plan	
<b>WOTS:</b> Work order tracking system	
<b>WTUA:</b> Western Township Utilities Authority	
<b>WWF:</b> Wet weather flow	