Wayne County Rouge Valley Sewage Disposal System

Service Agreement Renewals

Allocation of Wastewater Capacity

Revision: April 26, 2012

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Foreword

In 2008, Wayne County began making preparations to negotiate two related service agreements for the Rouge Valley Sewage Disposal System (RVSDS): a new service agreement between Wayne County and the City of Detroit for disposal of wastewater from the RVSDS, and a new service agreement between Wayne County and RVSDS customers for wastewater transport and disposal.

In March of 2009, Wayne County met with RVSDS customers to propose an action plan for negotiating a new service agreement for the RVSDS. The action plan was to include completion of technical analyses in support of the new service agreement and legal negotiations for the terms and conditions of the new service agreement, concurrently.

The technical analyses were to be such that:

- Consistent and high quality data sources would be used to characterize customer communities; and
- A technically sound and equitable method for allocating capacity would be developed and used to determine new contractual capacities.

During the period March 2009 through November 2011, Wayne County completed the technical analyses to support a new service agreement. These analyses are summarized in three related reports:

1. District Characteristics;
2. Allocation of Wastewater Capacity; and
3. District Wastewater Transport Capacity.

Wayne County and RVSDS customers met numerous times during this period to review data, assumptions, and methodologies used in the technical analyses. RVSDS customers were also provided multiple drafts of each document for review and comment.

The capacity allocations that were developed in this set of reports are technically sound and represent fair allocations, based on the then-best available data to Wayne County. Currently, Wayne County and some RVSDS customers have Amended Consent Orders (ACOs) with the Michigan Department of Environmental Quality (MDEQ) that require the study, design and implementation of improvements to reduce sanitary sewer overflow (SSO) discharges. The

capacity allocations that were developed in this set of reports are not intended to solely resolve an ACO or the future occurrence of SSOs by Wayne County or its customers.

Concurrently during the technical review period, Wayne County undertook negotiations with legal representatives of RVSDS customers and the City of Detroit, for a new service agreement for wastewater transport and disposal, respectively. Legal negotiations remain ongoing at this time.

Also, a Short-Term Corrective Action Plan (STCAP) that included pipe lining, pipe grouting, manhole repairs, comfort station work, and a new siphon downstream of Lift Station 1A (LS1A) was being implemented to reduce interceptor system inflow and infiltration (I/I) and improve the transport capacity of the interceptor system.

Monitoring of the STCAP improvements is to be done from July 1, 2012 to June 30, 2013. After the STCAP improvements are evaluated, a Long-Term Corrective Action Plan (LTCAP) is understood to be needed under the ACOs. These LTCAP improvements may include community sewer and interceptor system improvements which may result in recommendations for contractual modifications of flow rates and peak wet weather flow rates.

Currently, further work on developing the technical basis for allocating capacity amongst RVSDS customers has been held in abeyance. It is anticipated that technical analysis will resume when the STCAP improvements are completed and evaluated, the LTCAP analysis is underway, and as agreed to by Wayne County and the RVSDS customers.

This document, titled “Allocation of Wastewater Capacity,” reflects technical comments from RVSDS customers through November 2011. This document will be finalized, and amended as necessary, as available data is updated and improvements to the RVSDS are completed.

1. EXECUTIVE SUMMARY

This document presents a summary of Wayne County's technical analysis performed for the allocation of the available wastewater capacity among the customer communities of the Rouge Valley Sewage Disposal System (RVSDS). The goal of this effort is to implement a capacity allocation methodology that is equitable and technically sound. The wastewater allocations must fit within the contracted outlet capacity of the RVSDS to the city of Detroit. The new wastewater allocations are not intended to completely solve the sanitary sewer overflow (SSO) problems of the communities.

The following changes have occurred since 1988, the last time capacity allocations were updated in the RVSDS service area ("the District"):

- New combined sewer overflow (CSO) and sanitary sewer overflow (SSO) regulations have been promulgated.
- Sewer separation projects have been undertaken for combined sewer areas in Garden City, Livonia, Plymouth and Plymouth Township. Regulator gates have been removed in the respective regulator chambers.
- Combined sewer overflow (CSO) retention treatment basins have been built in Dearborn Heights, Inkster and Redford Township.
- Equalization basins for sanitary sewer areas have been built in the Cities of Livonia and Wayne.
- The Western Township Utility Authority (WTUA) was formed and collects and equalizes wastewater from Canton, Northville and Plymouth Townships. The WTUA communities discharge about 36% of the community wastewater volume to the RVSDS. The remainder is discharged to the Ypsilanti Community Utility Authority (YCUA) facility.
- DWSD has implemented CSO control projects including retention treatment basins and an expansion of the primary treatment capacity at the Detroit Wastewater Treatment Plant (DWWTP). These projects allow DWSD to better control the peak wet weather wet well levels at the DWWTP and the associated backwater in the Northwest Interceptor.
- Lift Station 1A was built at the Middle Rouge interceptor outlets to the DWSD Northwest Interceptor with a peak pumping rate of about 250 cfs.
- Wayne County has installed and is operating flow meters on the interceptor system.
- DWSD replaced the billing flow meters (WCS1, WCS2 and WCS3) for the District and the maintenance and quality control of the billing meters has greatly improved.

The following five options were evaluated for allocating capacity of the RVSDS to transport wastewater to DWSD for treatment.

- Option 1 – 1988 Allocation Methodology
- Option 2 – City of Detroit Methodology
- Option 3 – Per-Acre Methodology
- Option 4 – Flow Based Methodology, and
- Option 5 – Blended Factor Methodology

Option 5, the Blended Factor Method, was selected as the most equitable and technically sound option for the District. This method utilizes the available district characteristics data collected from consistent and high quality data sources. These data are presented in the companion document "District Characteristics" produced as part of Wayne County's technical analysis for allocation of the available wastewater capacity among the customer communities of the District.

The contractual capacities between Wayne County and the customer communities were last amended in 1988 with a total of 378.81 cfs of sustained capacity allocated to the customer communities and 87.74 cfs allocated on an intermittent peak wet weather basis. The 87.74 cfs of wet weather capacity is about 23% greater than the sustained capacity of 378.81cfs. The Michigan Department of Environmental Quality (MDEQ) accepted the allocation of the 466.55 cfs total for the District.

Wastewater from the District is treated at the DWWTP. A verbal agreement has been reached with the City of Detroit to use the 1984 contract capacity of 444.5 cfs. The total outlet capacity of the three existing City of Detroit connections was evaluated. Under free flowing gravity conditions, the District can discharge up to 377 cfs to the DWSD interceptors. With pumping at Lift Station 1A, the outlet capacity increases to about 450 cfs.

The new service agreement with District communities will be based on a maximum of 546.74 cfs available wastewater capacity for the District. This capacity is about 23% greater than the proposed contractual capacity with DWSD and allows for spatial variability of rainfall/snowmelt and attenuation of peak flow rates in the interceptor system.

The allocation tables presented in the memorandum demonstrate the current and future wastewater flow needs for the customer communities. The total flow rate for the District using the Blended Factor Method with wet weather determined using the physical parameters is 596.45 cfs. A 10% reduction in wet weather inflow will be necessary to meet the current 546.74 cfs total allocation capacity.

2. SUMMARY OF ALTERNATIVES CONSIDERED FOR ALLOCATING CAPACITY

Five options for allocating wastewater capacity within RVSDS were evaluated as listed below:

- Option 1 – 1988 Allocation Methodology
- Option 2 – City of Detroit Methodology
- Option 3 – Per-Acre Methodology
- Option 4 – Flow Based Methodology, and
- Option 5 – Blended Factor Methodology

Data and analysis used in each of the allocation methodologies is presented below.

a) Option 1 – 1988 Allocation Methodology

This option was used as the preliminary basis for allocating community contract capacities in 1988, when the allocations were last amended. Capacity was allocated for sanitary wastewater, dry weather ground water infiltration and wet weather infiltration and inflow based on community flow metering data. Wet weather infiltration and inflow capacity was allocated on a uniform basis using a methodology developed by the MDEQ. Final community capacities were negotiated, and included factors such as:

- Some communities declined to increase their contractual capacity and declined to participate in an interceptor relief project.
- Some communities conducted Sanitary Sewer Evaluation Study (SSES) work to reduce wet weather infiltration/inflow rates.

A comprehensive flow metering program was conducted from 1981 to 1987 on the community connections to estimate existing wastewater flow rates. The flow rates estimated in the Rouge Valley system from a Facility Plan Amendment report in 1987 are summarized below in Table 1. More detailed tables from the report are given in Appendix B.

Table 1

Flow Rate Summary from 1987 Facility Plan Amendment Report

Component	1987 Flow Rates (cfs)
Sanitary Wastewater from Sewered Areas	138.08
Sanitary Wastewater from Unsewered Areas	9.54
Ground Water Infiltration	122.41
Wet Weather Inflow	330.45
Total	600.48

The contributions from domestic (residential), commercial and industrial connections were estimated to sum to 138.08 cfs. The flow rate from unsewered but developed areas that someday could be connected was estimated to be 9.54 cfs. Groundwater inflow (GWI) into the community sewers and in the Wayne County interceptor system was estimated to be 122.41 cfs. Peak wet weather inflows were estimated to be 330.45 cfs. The total wastewater flow rate was estimated to be 600.48 cfs and the existing outlet capacity at the time with DWSD was 324.5 cfs.

In 1987, the RVSDS interceptor system capacity also was evaluated. The community connections were numbered and mapped. The service areas of the community connections also were characterized (number of manholes, length of sewer system, etc.). This information was used as the initial basis for the GDRSS model of the RVSDS interceptor system.

About 8,600 acres of combined sewer area existed in the service area in 1987. The flow rates from these areas into the interceptor system were regulated and the regulator settings were subsequently adjusted to be about 3.25 times the average dry weather flow rate. In the 1990's, separate sewers were installed in about 4,100 acres of combined sewer area primarily in Garden City, Northville Township, Livonia and Plymouth. The mechanical regulator gates were removed on these connections but regulator chambers with the old regulator gate openings still exist. In some cases, the outfalls to the river were bulk headed; in others, they were left opened to provide emergency relief. About 4,500 acres of combined sewer area remains in Dearborn Heights, Inkster and Redford Township.

Population and wastewater flow rate projections were made for year 2025. These flow rates were compared to existing capacities in 1987 and the existing transport capacities of the interceptor system. The wastewater flow rates were subdivided into the categories shown in Table 2.

Table 2

Estimated Year 2025 Wastewater Flow Rates from 1987 Facility Plan Amendment Report

Component	2025 Wastewater Flow Rates (cfs)
Base Wastewater	203.78
Groundwater Infiltration	139.76
Wet Weather Inflow	282.97
Design Flow Rate	621.51

It was apparent that the estimated peak flow rates for year 2025 exceeded the transport capacity of the interceptor system and the outlet capacity with DWSD. Wayne County and the communities developed an approach to resolve these issues. GWI was evaluated as not being cost-effective to remove. Some communities with high wet weather inflow rates implemented SSES programs to reduce their inflow rates.

Garden City had combined sewers in 1987 and the flow rates from Garden City into the interceptor system were regulated to about 3.25 times the average dry weather flow rate. Garden City declined to increase their capacity in the interceptor system. The remaining communities chose to increase their contract capacities and paid for the required interceptor system improvements.

Wayne County negotiated an increase in the outlet capacity with DWSD for a new Middle Rouge interceptor connection. This increase was possible because the discharge from the Evergreen-Farmington Sewage Disposal System into the Northwest Interceptor was diverted to another DWSD sewer freeing up some capacity in the Northwest Interceptor (NWI). Wayne County recognized that significant attenuation of peak flow rates occurs in the RVSDS interceptor system. Therefore, the sum of the community capacities was more than the outlet capacity with DWSD. A total of 466.55 cfs of intermittent peak wet weather capacity was allocated to the communities.

It is interesting to note that the current average of the sanitary wastewater flow rate is about 72 cfs and the sanitary wastewater flow rate for 1987 was estimated to be about 138.08 cfs. In 1987, the peak GWI rate was estimated to be 122.41 cfs. Under current conditions, this flow rate is about 110 cfs. Why so different? Outlet meter data was not available in 1987 and the meter data by each community exceeded the system capacity.

b) Option 2 – City of Detroit Methodology

This option was used in the 1961 RVSDS service agreement and is still used today in some sewerage systems tributary to the DWSD. This is a simple method, based only on population:

- 0.4 cfs/1000 persons for communities with sanitary sewers; or
- 0.5 cfs/1000 persons for communities with combined sewers.

An increase of only 0.1 cfs per 1000 residents for combined sewer communities was considered adequate when combined sewer overflow and sanitary overflows were permitted. These rates equate to about 258.4 or 323 gpd per resident, respectively. These rates allow for the peak sanitary flow rate plus provide an allowance for GWI through footing drains, pipe joints and manholes joints, and some wet weather inflow.

In addition to these residential capacity rates, allowances have been made by DWSD for commercial, industrial and institutional capacities in the communities. Employment has been related to an equivalent population. Allowances for institutions and industrial process wastewater also were made and added to the residential capacities.

The main advantage of this method is its simplicity. However if this method were utilized, a relatively uniform allocation of capacity among the customer communities would occur based primarily on residential population. Communities with older housing units would have nearly the same capacity rate as communities with newer housing units.

c) Option 3 – Per-Acre Methodology

Capacity allocations may be provided on a per-acre basis by land use category. Wastewater generation factors are required for each land use category. Textbook values of these factors vary widely. Sufficient flow metering data does not exist for the District to estimate per-acre factors by land use category. Also, a consensus on future land use for the District would need to be established, and obtaining such consensus for future land use has proven to be a difficult issue in the past.

d) Option 4 – Flow Based Methodology

Capacity may be allocated based on a statistical analysis of wastewater flow metering data. This option is probably the most accurate method of allocating system capacity, as it would be based on actual community flow rates and needs. However, extensive high quality flow metering data does not currently exist for the numerous (over 100) community connections. Therefore, implementing this option would require a large metering project. In addition, future flow rates would also have to be estimated based on some other method.

e) Option 5 – Blended Factor Methodology

This method is similar to but more detailed than the approach taken in 1988. Capacity is allocated for sanitary wastewater, dry weather ground water infiltration and wet weather infiltration and inflow. In addition, allocations are made for employment, significant industrial user (SIU) and institutional flow rates. Flow metering data can be used to develop wastewater generation factors for some wastewater categories. Housing age may be used as a substitute for sewer system age and considered when allocating capacity. This option best uses the available data and considers actual needs for the RVSDS and District.

Table 3 provides a comparison of allocation options. Wayne County will utilize Option 5, the Blended Factor methodology, to allocate RVSDS wastewater capacity among District customers. This methodology is the fairest, fits the complexity of the RVSDS and requires the least amount of new information from the communities.

Table 3

Comparison of Allocation Options

Option	Description	Advantages	Disadvantages
1	1988 Method	• Community familiarity	• Does not utilize all available data • Assumptions not consistent for all communities • Extensive flow metering program needed
2	City of Detroit Method	• Simple	• Does not utilize all available data • Not tailored to actual community wastewater needs
3	Per-Acre Method	• Simple	• Does not utilize all available data • Not tailored to actual community wastewater needs • Requires future land use and flow factors
4	Flow-Based Method	• Very accurate and detailed	• Extensive flow metering program needed
5	Blended Method	• Uses all available data • Technically sound • Fairest allocation method	• Some additional community data requested

3. BLENDED FACTOR METHODOLOGY

This capacity allocation methodology utilizes a blend of wastewater generation factors coupled with system data analysis. The Blended Factor Method subdivides community wastewater flows into the following five flow factors:

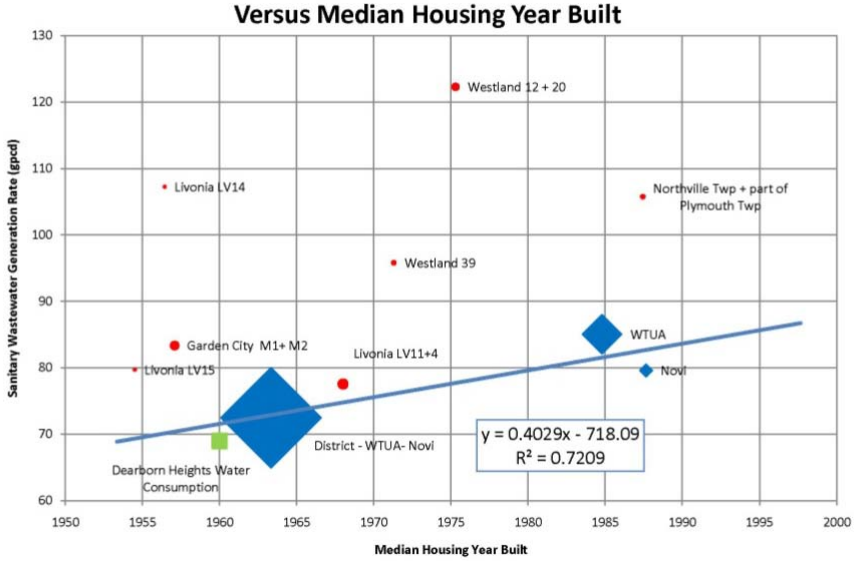
- Factor 1 - Sanitary wastewater from residents and employment;
- Factor 2 - Ground water infiltration in dry weather;
- Factor 3 - Institutional flow rates;
- Factor 4 - Industrial flow rates (from SIUs); and
- Factor 5 - Wet weather inflow.

Data and analysis used to develop each of these factors is summarized below and in the companion document "District Characteristics" produced as part of Wayne County's technical analysis for the allocation of the available wastewater capacity among the customer communities of the RVSDS.

a) Factor 1 – Sanitary Wastewater Generation Rate

A sanitary wastewater generation rate relationship for the District was determined using the dry weather flow rate and median housing year built data. Data from high quality DWSD outlet meters and other dye-dilution tested meters were used to develop the following relationship shown in Figure 1. Available flow meter data were evaluated and detailed in the District Characteristics Memorandum.

Figure 1
Sanitary Wastewater Generation Rate
Versus Median Housing Year Built



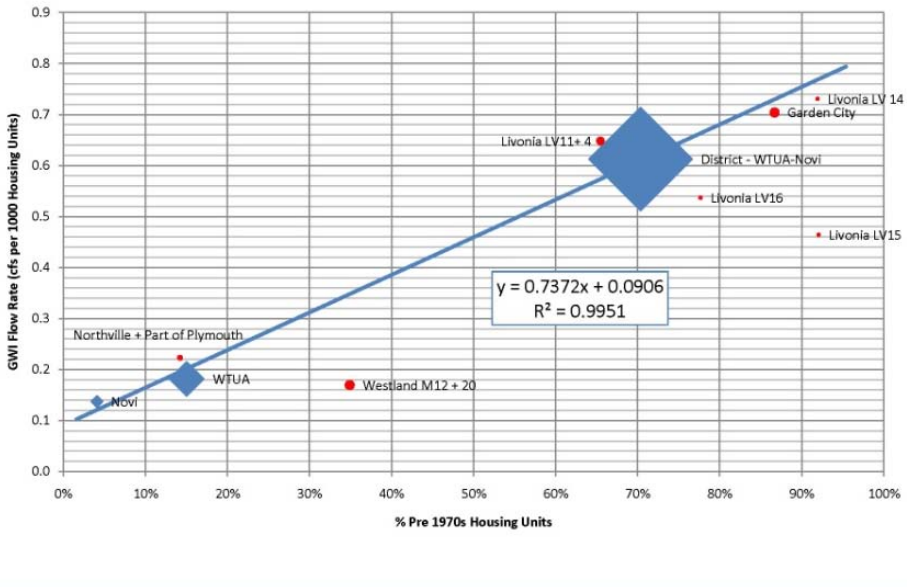
The average sanitary wastewater generation rate for the community is multiplied by 1.4 to determine the peak hour flow rate. This peaking factor was derived from the BG1 meter data for the City of Novi.

b) Factor 2 – Dry Weather Ground Water Infiltration

The rate of GWI into the RVSDS that occurs during peak dry weather conditions was estimated by subtracting the minimum daily dry weather flow rate recorded for the RVSDS in the driest part of summer/fall from the maximum daily dry weather flow rate in the spring. The GWI rates are not expected to be uniform across the District and are expected to be significantly higher for communities with older sewer systems and housing units. GWI was correlated to the number of housing units and the percentage of pre-1970 housing units.

Figure 2 plots the GWI rate per 1,000 housing units versus the percentage of pre-1970 housing units. A trend line was fit to the three highest quality data points.

Figure 2
Dry Weather Ground Water Infiltration Rate



c) Factor 3 – Institutional Flow Rates

Institutional flow rates are a small fraction of the community wastewater generation. There are several overlapping components to Institutional flow rates. Residents in some institutions such as correctional facilities are counted by the U.S. Census in the residential population.

Some institutions such as hospitals are already counted in the SIU data. Employment also is separately counted. Therefore, it is important to review the community provided information carefully to generate an equitable allocation.

Institutional flow rate can be estimated on a facility or per-acre basis for hospitals (by number of beds), universities, schools, colleges or other facilities with transient populations not otherwise counted.

An example of institutional flow rates for a community is given by the City of Novi who provided a comprehensive analysis of their institutional flow needs. Table 4 provides a summary of Novi's analysis, which is based on calculating a residential equivalent unit (REU) for each institution. The Unit Factor Chart and complete listing of institutions is included as Appendix C for reference.

Table 4

Transient User Calculations: City of Novi Example

EXISTING					
Category	**Total REU**	**Avg pop/REU**	**gpcd**	**gpd**	**cfs**
Restaurants	690	2.3	82.2	130,426.8	0.20
Hotels	824	2.3	82.2	155,762.2	0.24
Major Shopping Areas	1461	2.3	82.2	276,232.7	0.43
Hospital/Medical (non-SIU)	545	2.3	82.2	57,983.8	0.09
Attractions	178	2.3	82.2	33,627.0	0.05
Non-Public Schools/Colleges	79	2.3	82.2	14,947.7	0.02
Industrial (non-SIU)	147	2.3	82.2	27,749.1	0.04
TOTAL	**3923**				1.08
PLANNED/FUTURE					
Category	**Total REU**	**Avg pop/REU**	**gpcd**	**gpd**	**cfs**
Restaurants	167	2.3	82.2	31,573.0	0.05
Hotels	183	2.3	82.2	34,598.0	0.05
Major Shopping Areas/non SIU	641	2.3	82.2	121,187.5	0.19
TOTAL	**991**				0.29

It was suggested that the highest non-residential water user data be provided and used for determining this component. However, a usable relationship could not be derived from the variety of water use data submitted. Additional data will be necessary to allocate institutional flows for all communities.

Historically, there was 14.59 cfs of Institutional flow in the 1961 Agreement. Most of these institutions were decommissioned. Maybury State Park has retained its 0.58 cfs of capacity allocation which has been assigned to Northville Township.

The other Wayne County Institutional flows such as the Northville State Hospital and Eloise in Westland will be allocated to the communities based on land use and community requested institutional flow requirements.

d) Factor 4 – Significant Industrial Users (SIUs)

Industrial wastewater from SIUs is generated by industrial processes, not employees. Data for peak SIU flow rates have been obtained from the Industrial Pretreatment Program (IPP) for DWSD. Flow rate allocations made for these industries are shown in Table 5. SIU flow rates for the year 2035 are estimated to be the same as the current SIU flow rates in the analysis presented in this report.

Table 5

Permitted Average Daily SIU Flow Rate by Community

Community	2009 Average Daily SIU Flow Rate (cfs)	2035 Average Daily SIU Flow Rate (cfs)
Canton Township	0.15	0.08
Dearborn Heights	0.04	0.00
Garden City	0.01	0.01
Inkster	0.20	0.17
Livonia	2.21	2.36
Northville	0.00	0.01
Northville Township	0.01	0.11
Novi	0.32	0.08
Plymouth	0.05	0.05
Plymouth Township	0.41	0.31
Redford Township	0.15	0.09
Romulus	0.52	0.70
Van Buren Township	0.02	0.04
Wayne	2.01	3.19
Westland	0.15	0.13
Total	6.26	7.33

e) Factor 5 – Wet Weather Inflow

Wet weather inflow was distributed among the communities on a uniform basis in 1988. The uniform basis was provided by the Michigan Department of Natural Resources (MDNR) (now the MDEQ) and provided allocations for manhole defects, pipe joints, and footing drains. A similar approach is being taken again for the community capacities.

The resulting sanitary wastewater plus GWI flow rate needs to be sustainable and cannot exceed the outlet capacity with DWSD. A portion of the wet weather inflow rate can be sustainable – up to the outlet capacity with DWSD; the rest of the wet weather inflow capacity is intermittent.

Two methods for estimating wet weather inflow were examined in this analysis as follows:

1: Wet weather inflow rates from previous studies

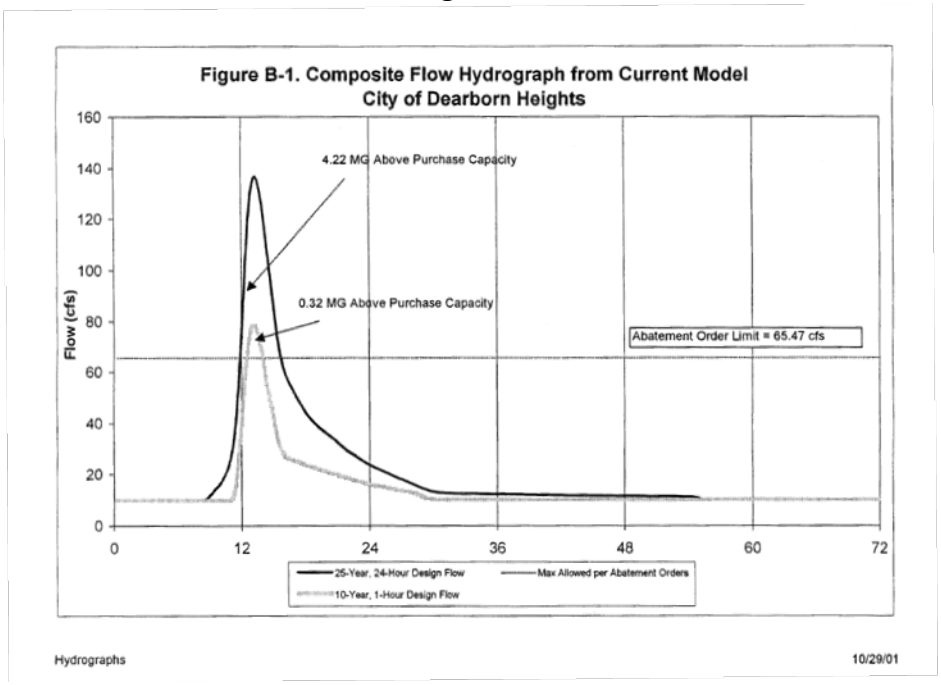
2: Wet weather inflow rates estimated from physical characteristics of District and community sewer systems.

Data and analysis utilized in these methods are summarized below.

i. Method 1: Wet Weather Inflow Rates from Previous Studies

In Method 1, the design hydrographs for each non-WTUA communities shown in the 2001 report titled "North Huron Valley/Rouge Valley – Regional SSO Alternative Evaluation" was examined. The 10-year, 1-hour design storm peak wet weather inflow rate was chosen because it is the community accepted standard for SSO control. The dry weather flow rate and the peak flow rate were scaled off figures in this report. In the example figure shown below for Dearborn Heights, the dry weather flow rate is about 10.9 cfs. The peak flow rate for the 10-year, 1-hour design storm is about 78.5. So the 10-year, 1-hour design storm wet weather inflow rate is 78.5 – 10.9 = 67.6 cfs. The 10-year, 1-hour design storm wet weather inflow rates for the WTUA communities (Plymouth, Canton and Northville Townships) were provided from a 2002 Project Performance Certification report.

Figure 3



The trial allocation for year 2009 using the Blended Factor Method and Method 1 for wet weather inflow is presented in Table 6. WTUA communities are assumed to be 36% in the District for all allocation tables.

Table 6

Year 2009 Waste Water Flow Rates

Method 1 - Wet Weather Inflow Rates from Previous Studies

Trial Capacity Allocation Using the Blended Factor Methodology

A	B	C	D	E	F	G	H	I	J	K	L	M
Customer	Year 2009 Population	Year 2010 Employment	Year 2009 Median Housing Year Built	Factor #1 Peak Hour Sanitary Wastewater (cfs)	Year 2009 Total Housing Units in District	Year 2009 Percentage of Housing Units Built Pre-1970	Factor #2 Peak Dry Weather Ground Water Infiltration	Factor #3 Institutional /Other Wastewater (cfs)	Factor #4 Year 2009 SIU Flow Rate (cfs)	Factor # 5 Wet Weather Inflow Rate (cfs)	Total Flow Rate (cfs)	Capacity from 1988 Agreement (cfs)
Canton Township (2)	30,482	8,035	1986	5.64	12,428	8.4%	1.89	0.00	0.03	18.2	25.71	14.37
Dearborn Heights (1)	35,933	7,291	1960	5.73	15,744	84.1%	11.19	0.00	0.00	67.6	84.52	65.47
Garden City	27,664	8,405	1957	4.41	11,843	86.7%	8.64	0.00	0.01	64.2	77.28	24.40
Inkster	29,237	5,322	1961	4.67	12,396	76.5%	8.11	0.00	0.17	29.6	42.56	26.66
Livonia	95,269	98,090	1966	17.61	39,763	66.1%	22.99	0.00	2.36	71.1	114.06	106.52
Northville	6,232	4,242	1964	1.09	2,843	49.2%	1.29	0.00	0.01	9.9	12.33	7.61
Northville Township (2)	9,667	2,558	1987	1.80	4,250	14.4%	0.84	0.58	0.04	2.8	6.07	5.51
Novi (1)	43,963	31,840	1988	8.73	18,446	8.8%	2.86	1.08	0.08	8.8	21.59	20.48
Plymouth	8,676	9,329	1958	1.55	4,862	72.5%	3.04	0.00	0.05	8.1	12.74	4.80
Plymouth Township (2)	9,648	8,462	1977	1.86	4,193	35.4%	1.47	0.00	0.11	7.4	10.87	10.22
Redford Township (1)	47,380	15,088	1954	7.46	20,142	93.1%	15.64	0.00	0.09	32.0	55.19	52.89
Romulus (1)	2,460	2,462	1996	0.53	946	13.1%	0.18	0.00	0.70	1.8	3.15	3.60
Van Buren Township (1)	5,895	7,559	1984	1.24	2,628	22.8%	0.68	0.00	0.04	3.6	5.55	5.00
Wayne	18,054	16,070	1960	3.17	7,822	73.1%	4.93	0.00	3.19	22.9	34.21	27.92
Westland	82,281	26,383	1969	14.05	39,093	55.6%	19.57	0.00	0.13	62.5	96.21	80.04
Wayne County							3.18	0.00			3.18	11.06
WCAA (Dry Weather Only)								1.55			1.55	0.00
Total for District	452,841	251,135	1971	79.53	197,398	51.8%	106.52	3.21	7.01	410.51	606.77	466.55
Total for WTUA	49,797	19,054	1985	9.29	20,870	15.0%	4.20	0.58	0.18	28.40	42.65	30.10
											(E+H+I+J+K)	

Notes:

1) Information is given for the part of the community within the District.
2) WTUA community characteristics have been multiplied by 0.36
3) Sanitary Wastewater Capacity = (B + 0.15 x C) x (0.4029 x D -718.09)/1,000,000 x 1.547 x 1.4 (Peak Hour)
4) Dry Weather Ground Water Infiltration Capacity = (0.7372 x G + 0.0906) x (F /1000)
5) Wet Weather Capacity = 10Y-1H from SSO Report or for WTUA 10Y-1H from 2002 PPC Report x 40%
6) Wayne County Interceptor GWI = 3.18 cfs
7) SIU = Significant Industrial Users (Source:DWSD SIU list with permitted daily flow rate data, December 2009.)
8) Capacity from 1988 Agreement has been updated with transfers to Northville Township and Plymouth Township in 2005

WTUA Community	Total Flow Rate(cfs)	
	36% in District	100% in District
Canton Township	25.71	71.42
Northville Township	6.07	16.87
Plymouth Township	10.87	30.19
Total	42.65	118.48

ii. Method 2: Wet Weather Inflow Rates – Based on Physical Parameters

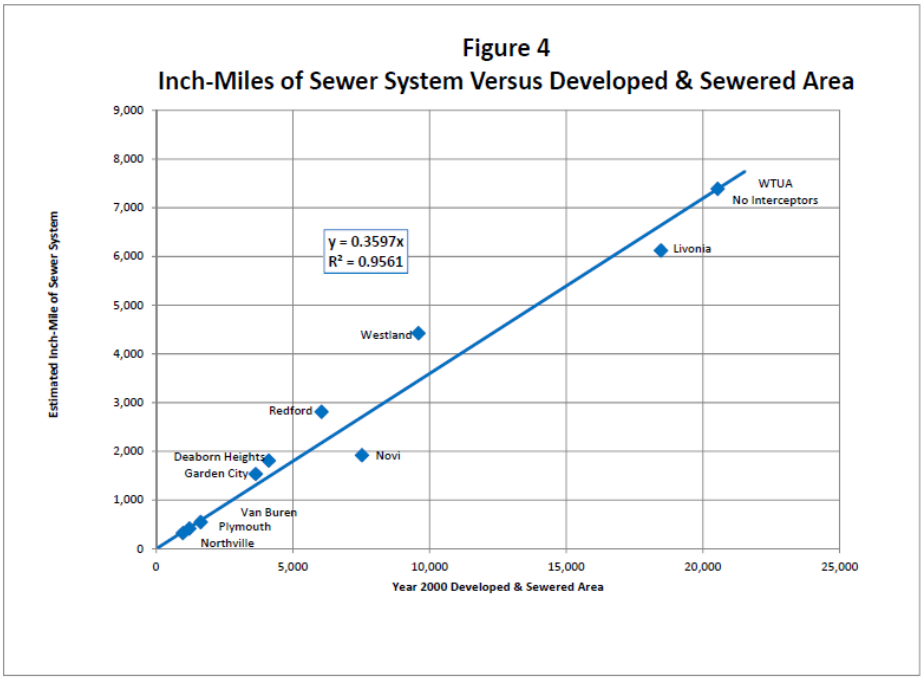
The second method of estimating the wet weather inflow rate is based on the physical characteristics of the community sewer systems and the WTUA and Wayne County interceptor system.

a. Footing Drain Connections

A wet weather inflow rate of 1.25 gpm was provided for each pre-1970 housing unit to account for footing drainage. This value is a suggested design value. Actual footing drainage rates may be significantly greater. Dearborn Heights provided a study that estimated an average wet weather inflow rate of 1.89 gpm for footing drainage. This value was used for the Dearborn Heights pre-1970 housing units.

b. Inch–Miles of Sewer

The inch-miles of the community sewers, WTUA interceptors and of the Wayne County interceptors were estimated and presented in the memorandum titled "District Characteristics". Most of the communities provided these data or a GIS coverage that was used to develop the inch-miles data. Figure 4 is the plot of the inch-miles versus developed and sewered area for each community.



The following relationship was used for communities unable to provide inch-miles data:

Estimated Inch–Miles of Sewer = 0.3597 x Developed and Sewered Area

The percentage of pre-1970's housing units for each community was used to estimate the percentage of the community sewer system built using older and more leaky construction practices.

Wet weather inflow rates per inch-mile of sewer are commonly used to evaluate cost-effectiveness of wet weather infiltration/inflow removal projects. Wet weather inflow rates that are commonly used are:

- 2,000 gallons per day for pre-1970's sewer systems, and
- 500 gallons per day for post-1970's sewer systems

For future conditions, an estimate of inch-miles of sewer was also required. It was assumed the inch-miles of pre-1970 sewer did not change. The SEMCOG future population estimates were divided by the district average of 2.3 persons per household to estimate the number of new housing units. The acreage of new developed land was determined using the number of new housing units divided by the housing density for each community. Finally, the previously shown relationship was applied to estimate the future inch-miles of sewer for each community.

Table 7 shows the inch-miles of sewer for each community for current and future conditions. Table 8 and Table 9 are the trial allocation for Year 2009 and Year 2035 Blended Factor Method with Method 2 for Factor #5 (wet weather inflow).

Table 7

Inch–Miles of Sewer by Community for Year 2010 and Year 2035

Customer	Year 2009 % Pre 1970 Housing Units	Year 2009 % Served by Public Sewer	Year 2000 Developed Area in District (acres)	Year 2000 Developed Area on public sewer (acres)	Year 2035 Developed Area (acres)	Total Area in District (acres)	2010 Inch-Miles	Estimated 2035 Inch-Miles	2009 & 2035 Pre 1970 Inch-Miles	2009 Post 1970 Inch-Miles	2035 Post 1970 Inch-Miles
Canton Township (1)	8.4%	96.5%	10,809	10,434	12,808	23,102	4,517	5,544	560	3,957	4,985
Dearborn Heights	84.1%	99.9%	4,117	4,114	4,117	5,293	1,811	1,812	1,523	288	289
Garden City	86.7%	99.7%	3,647	3,637	3,647	3,751	1,536	1,540	1,331	205	209
Inkster	76.5%	99.3%	3,116	3,095	3,116	4,001	1,113	1,121	852	262	269
Livonia	66.1%	99.3%	18,599	18,462	18,693	22,929	6,122	6,199	4,049	2,073	2,149
Northville	49.2%	96.3%	1,011	973	1,048	1,318	323	348	159	164	189
Northville Township (1)	14.4%	92.1%	4,390	4,043	5,922	10,596	1,191	1,744	84	1,107	1,660
Novi	8.8%	93.1%	8,083	7,523	10,727	16,616	1,922	2,741	169	1,754	2,572
Plymouth	72.5%	100.0%	1,211	1,211	1,211	1,417	417	417	302	115	115
Plymouth Township (1)	35.4%	95.9%	6,305	6,046	7,012	10,242	1,682	1,950	515	1,167	1,435
Redford Township	93.1%	99.4%	6,078	6,042	6,078	7,054	2,813	2,830	2,618	195	212
Romulus	13.1%	96.5%	753	727	868	1,712	261	312	34	227	278
Van Buren Township	22.8%	97.5%	1,667	1,624	2,587	8,001	549	874	125	424	749
Wayne	73.1%	99.7%	2,832	2,824	2,832	3,852	1,016	1,019	743	273	276
Westland	55.6%	99.3%	9,656	9,588	10,192	13,085	4,427	4,706	2,463	1,964	2,243
District Total	51.8%	97.2%	82,273	79,968	90,856	132,968	29,700	33,743	15,528	14,172	17,629
District Total - WTUA- Novi	70.3%	98.5%	52,656	51,841	65,115	131,552	28,472	35,762	14,917	13,554	17,012
District Interceptors							5,281	5,281	4,332	949	949
WTUA Interceptors							811	811	308	503	503

(1) WTUA Community

Table 8

Year 2009 Wastewater Flow Rates

Method 2 - Wet Weather Inflow Rates Based on Physical Parameters

Trial Capacity Allocation Using the Blended Factor Methodology

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
Customer	Year 2009 Population	Year 2010 Employment	Year 2009 Median Housing Year Built	Factor #1 Peak Hour Sanitary Wastewater (cfs)	Year 2009 Total Housing Units in District	Year 2009 Percentage of Housing Units Built Pre-1970	Factor # 2 Peak Dry Weather Ground Water Infiltration	Factor #3 Institutional/ Other Wastewater (cfs)	Factor #4 Year 2009 SIU Flow Rate (cfs)	Estimated Pre 1970 Inch-Miles of Sewer System	Estimated Inch-Miles of Sewer System	Footing Drainage Rate (cfs)	Pre-1970's Pipe and Manhole Inflow Rate (cfs)	Post-1970's Pipe and Manhole Inflow Rate (cfs)	Factor #5 Wet Weather Inflow Rate (cfs)	Total Flow Rate (cfs)
Canton Township (2)	30,482	8,035	1986	5.64	12,428	8.4%	1.89	0.00	0.03	201	1,626	2.90	0.62	1.10	4.63	12.19
Dearborn Heights (1) (13)	35,933	7,291	1960	5.73	15,744	84.1%	11.19	0.00	0.00	1,523	1,811	47.07	4.71	0.22	52.00	68.92
Garden City	27,664	8,405	1957	4.41	11,843	86.7%	8.64	0.00	0.01	1,331	1,536	28.59	4.12	0.16	32.87	45.93
Inkster	29,237	5,322	1961	4.67	12,396	76.5%	8.11	0.00	0.17	852	1,113	26.41	2.63	0.20	29.25	42.21
Livonia	95,269	98,090	1966	17.61	39,763	66.1%	22.99	0.00	2.36	4,049	6,122	73.25	12.53	1.60	87.39	130.35
Northville	6,232	4,242	1964	1.09	2,843	49.2%	1.29	0.00	0.01	159	323	3.90	0.49	0.13	4.52	6.91
Northville Township (2)	9,667	2,558	1987	1.80	4,250	14.4%	0.84	0.58	0.04	30	429	1.70	0.09	0.31	2.11	5.36
Novi (1)	43,963	31,840	1988	8.73	18,446	8.8%	2.86	1.08	0.08	169	1,922	4.51	0.52	1.36	6.38	19.14
Plymouth	8,676	9,329	1958	1.55	4,862	72.5%	3.04	0.00	0.05	302	417	9.82	0.94	0.09	10.84	15.48
Plymouth Township (2)	9,648	8,462	1977	1.86	4,193	35.4%	1.47	0.00	0.11	185	605	4.13	0.57	0.32	5.03	8.47
Redford Township (1)	47,380	15,088	1954	7.46	20,142	93.1%	15.64	0.00	0.09	2,618	2,813	47.20	8.10	0.15	55.45	78.65
Romulus (1)	2,460	2,462	1996	0.53	946	13.1%	0.18	0.00	0.70	34	261	0.35	0.11	0.18	0.63	2.03
Van Buren Township (1)	5,895	7,559	1984	1.24	2,628	22.8%	0.68	0.00	0.04	125	549	1.67	0.39	0.33	2.38	4.34
Wayne	18,054	16,070	1960	3.17	7,822	73.1%	4.93	0.00	3.19	743	1,016	15.93	2.30	0.21	18.44	29.73
Westland	82,281	26,383	1969	14.05	39,093	55.6%	19.57	0.00	0.13	2,463	4,427	60.57	7.62	1.52	69.71	103.46
Wayne County							3.18	0.00		4,332	5,281	0.00	13.40	0.73	14.14	17.32
WTUA Interceptors										111	292		0.34	0.14	0.48	0.48
WCAA (Dry Weather Only)								1.55								1.55
Total for District	452,841	251,135	1971	79.53	197,398	52%	106.52	3.21	7.01	19,229	30,544	328.01	59.50	8.75	396.25	592.52
Total for WTUA	49,797	19,054	1985	9.29	20,870	15%	4.20	0.58	0.18	528	2,952	8.74	1.63	1.87	12.25	26.50
																(E+H+I+J+P)

Notes:

1) Information is given for the part of the community within the District.
2) WTUA community characteristics have been multiplied by 0.36
3) Sanitary Wastewater Capacity = (B + 0.15 x C) x (0.4029 x D -718.09)/1,000,000 x 1.547 x 1.4 (Peak Hour)
4) Dry Weather Ground Water Infiltration Capacity = (0.7372 x G + 0.0906) x F /1000
5) Footing Drainage Rate = 1.25 gpm per 1970s Housing Unit
6) Inch-Miles = community provided data or 0.3383 x acre of developed land served by public sewer
7) Pipe & Manhole Inflow = (% Pre-1970s x 2000) gpm/inch-mile
8) Pipe & Manhole Inflow = (% Post-1970s x 500) gpm/inch-mile
9) Wayne County Interceptor GWI = 3.18 cfs
10) Inch - Mile of Wayne County Interceptor was taken from as-built plans.
11) SIU = Significant Industrial Users (Source:DWSD SIU list with permitted daily flow rate data, December 2009.)
12) Capacity from 1988 Agreement has been updated with transfers to Northville Township and Plymouth Township in 2005
13) Dearborn Heights footing drain connections were reduced to 11,177 homes and the metered footing drain rate of 1.89 gpm per connection was applied.

WTUA Community	Total Flow Rate(cfs)	
	36% in District	100% in District
Canton Township	12.19	33.85
Northville Township	5.36	14.89
Plymouth Township	8.47	23.53
Total	26.02	72.28

Table 9

Year 2035 Wastewater Flow Rates

Method 2 - Wet Weather Inflow Rates Based on Physical Parameters

Trial Capacity Allocation Using the Blended Factor Methodology

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
Customer	Year 2035 Population	Year 2035 Employment	Year 2035 Median Housing Year Built	Factor #1 Peak Hour Sanitary Wastewater (cfs)	Year 2035 Total Housing Units in District	Year 2035 Percentage of Housing Units Built Pre-1970	Factor # 2 Peak Dry Weather Ground Water Infiltration	Factor #3 Institutional/ Other Wastewater (cfs)	Factor #4 Year 2009 SIU Flow Rate (cfs)	Estimated Pre-1970 Inch-Miles of Sewer System	2035 Estimated Inch-Mile of Sewer System	Footing Drainage Rate (cfs)	Pre-1970's Pipe and Manhole Inflow Rate (cfs)	Post-1970's Pipe and Manhole Inflow Rate (cfs)	Factor #5 Wet Weather Inflow Rate (cfs)	Total Flow Rate (cfs)
Canton Township (2)	35,565	9,573	1991	6.74	14,320	7.3%	2.07	0.00	0.03	201	1,996	2.90	0.62	1.39	4.91	13.74
Dearborn Heights (1) (13)	34,109	7,589	1960	5.45	15,744	84.1%	11.19	0.00	0.00	1,523	1,812	47.07	4.71	0.22	52.01	68.65
Garden City	25,546	8,114	1957	4.08	11,843	86.7%	8.64	0.00	0.01	1,331	1,540	28.59	4.12	0.16	32.87	45.60
Inkster	25,633	6,181	1961	4.13	12,396	76.5%	8.11	0.00	0.17	852	1,121	26.41	2.63	0.21	29.25	41.67
Livonia	95,779	97,807	1966	17.71	39,959	65.8%	23.01	0.00	2.36	4,049	6,199	73.25	12.53	1.66	87.45	130.53
Northville	6,470	4,316	1966	1.14	2,946	47.5%	1.30	0.00	0.01	159	348	3.90	0.49	0.15	4.54	6.99
Northville Township (2)	12,309	2,692	1994	2.35	5,315	11.5%	0.93	0.58	0.04	30	628	1.70	0.09	0.46	2.26	6.17
Novi (1)	56,415	41,710	1995	11.62	23,251	7.0%	3.30	1.38	0.08	169	2,741	4.51	0.52	1.99	7.02	23.40
Plymouth	9,181	9,353	1962	1.66	5,117	68.9%	3.06	0.00	0.05	302	417	9.82	0.94	0.09	10.84	15.61
Plymouth Township (2)	10,769	8,100	1981	2.08	4,636	32.0%	1.51	0.00	0.11	185	702	4.13	0.57	0.40	5.11	8.81
Redford Township (1)	44,553	16,015	1954	7.06	20,142	93.1%	15.64	0.00	0.09	2,618	2,830	52.21	8.10	0.16	60.48	83.27
Romulus (1)	2,740	2,676	1999	0.59	1,072	11.6%	0.19	0.97	0.70	34	312	0.35	0.11	0.21	0.67	3.12
Van Buren Township (1)	8,216	7,592	1995	1.74	3,727	16.1%	0.78	0.00	0.04	125	874	1.67	0.39	0.58	2.63	5.19
Wayne	17,214	15,739	1960	3.03	7,822	73.1%	4.93	0.00	3.19	743	1,019	15.93	2.30	0.21	18.45	29.60
Westland	87,088	28,002	1972	15.08	41,187	52.8%	19.76	0.00	0.13	2,463	4,706	60.57	7.62	1.74	69.93	104.90
Wayne County							3.18	0.00		4,332	5,281		13.40	0.73	14.14	17.32
WTUA Interceptors										111	292		0.34	0.14	0.48	0.48
WCAA (Dry Weather Only)								1.55								1.55
Total for District	471,587	265,459	1974	84.47	209,476	48.1%	107.61	4.48	7.01	19,229	32,817	333.02	59.50	10.51	403.03	606.59
Total for WTUA	58,644	20,366	1990	11.17	24,270	12.9%	4.51	0.58	0.18	528	3,618	8.74	1.63	2.39	12.76	29.20
																(E+H+I+J+P)

Notes:

1) Information is given for the part of the community within the District.
2) WTUA community characteristics have been multiplied by 0.36
3) Sanitary Wastewater Capacity = (B + 0.15 x C) x (0.4029 x D -718.09)/1,000,000 x 1.547 x 1.4 (Peak Hour)
4) Dry Weather Ground Water Infiltration Capacity = (0.7372 x G + 0.0906) x F /1000
5) Footing Drainage Rate = 1.25 gpm per 1970s Housing Unit
6) Inch-Miles = community provided data or 0.3383 x acre of developed land served by public sewer
7) Pipe & Manhole Inflow = (% Pre-1970s x 2000) gpm/inch-mile
8) Pipe & Manhole Inflow = (% Post-1970s x 500) gpm/inch-mile
9) Wayne County Interceptor GWI = 3.18 cfs
10) Inch - Mile of Wayne County Interceptor was taken from as-built plans.
11) SIU = Significant Industrial Users (Source:DWSD SIU list with permitted daily flow rate data, December 2009.)
12) Capacity from 1988 Agreement has been updated with transfers to Northville Township and Plymouth Township in 2005
13) Dearborn Heights footing drain connections were reduced to 11,177 homes and the metered footing drain rate of 1.89 gpm per connection was applied.

WTUA Community	Total Flow Rate(cfs)	
	36% in District	100% in District
Canton Township	13.74	38.17
Northville Township	6.17	17.13
Plymouth Township	8.81	24.48
Total	28.72	79.78

Table 10 is a comparison of wet weather inflow rates for Method 1 versus Method 2 for Year 2009 conditions. Method 1 provides a total wet weather inflow rate of 410.51 cfs for the District. Method 2 provides a total wet weather inflow rate of 396.25 cfs.

Table 10

Year 2009: Comparison of Wet Weather Inflow Estimation Methods

Customer	Capacity from 1988 Agreement (cfs)	Method 1		Method 2	
		Wet Weather Inflow Rates from SSO Reports (cfs)	Total Flow Rate (cfs)	Wet Weather Inflow Rates Based on Physical Parameters (cfs)	Total Flow Rate (cfs)
Canton Township (1)	14.37	18.2	25.71	4.63	12.19
Dearborn Heights	65.47	67.6	84.52	52.00	68.92
Garden City	24.40	64.2	77.28	32.87	45.93
Inkster	26.66	29.6	42.56	29.25	42.21
Livonia	106.52	71.1	114.06	87.39	130.35
Northville	7.61	9.9	12.33	4.52	6.91
Northville Township (1)	5.51	2.8	6.07	2.11	5.36
Novi	20.48	8.8	21.59	6.38	19.14
Plymouth	4.80	8.1	12.74	10.84	15.48
Plymouth Township (1)	10.22	7.4	10.87	5.03	8.47
Redford Township	52.89	32.0	55.19	55.45	78.65
Romulus	3.60	1.8	3.15	0.63	2.03
Van Buren Township	5.00	3.6	5.55	2.38	4.34
Wayne	27.92	22.9	34.21	18.44	29.73
Westland	80.04	62.5	96.21	69.71	103.46
Wayne County	11.06	0.0	3.18	14.14	17.32
WTUA Interceptors	0.00	0.0	0.00	0.48	0.48
WCAA (Dry Weather Only)	0.00	0.0	1.55	0.00	1.55
Total for District	466.55	410.51	606.77	396.25	592.52
Total for WTUA	30.10	28.40	42.65	12.25	26.50

(1) WTUA community characteristics have been multiplied by 0.36

Both methods provide similar total flow rates and are greater than the available wastewater capacity of 546.74 cfs that may be allocated to the communities. Method 2 was chosen for the capacity allocations presented in this analysis because it uses consistent data sources and sound engineering practices and may be projected better into the future.

Table 11 is a comparison of existing and future condition allocations using Method 2 for the wet weather inflow rates. The governing flow rate is the larger of the Year 2009 or Year 2035 total flow rates.

Table 11

RVSDS Wastewater Capacity Allocation for Existing and Future Conditions

Customer	Capacity from 1988 Agreement (cfs)	Year 2009 Total Flow Rate (cfs)	Year 2035 Total Flow Rate (cfs)	Governing Total Flow Rate (cfs)	Capacity Allocation Total Flow Rate with 10.87% Reduction in GWI and Wet Weather Inflow (cfs)
Canton Township (1)	14.37	12.19	13.74	13.74	12.98
Dearborn Heights	65.47	68.92	68.65	68.92	62.05
Garden City	24.40	45.93	45.60	45.93	41.42
Inkster	26.66	42.21	41.67	42.21	38.14
Livonia	106.52	130.35	130.53	130.53	118.52
Northville	7.61	6.91	6.99	6.99	6.35
Northville Township (1)	5.51	5.36	6.17	6.17	5.82
Novi	20.48	19.14	23.40	23.40	22.27
Plymouth	4.80	15.48	15.61	15.61	14.10
Plymouth Township (1)	10.22	8.47	8.81	8.81	8.09
Redford Township	52.89	78.65	83.27	78.65	70.92
Romulus	3.60	2.03	3.12	3.12	3.02
Van Buren Township	5.00	4.34	5.19	5.19	4.82
Wayne	27.92	29.73	29.60	29.73	27.19
Westland	80.04	103.46	104.90	104.90	95.15
Wayne County	11.06	17.32	17.32	17.32	15.44
WTUA Interceptors	0.00	0.48	0.48	0.48	0.43
WCAA (Dry Weather Only)	0.00	1.55	1.55	1.55	1.55
Total for District	466.55	592.52	606.59	603.24	548.29
Total for WTUA	30.10	26.50	29.20	29.20	27.33

(1) WTUA community characteristics have been multiplied by 0.36

The capacity allocated to each community was then determined by reducing the dry weather GWI and wet weather inflow rate components of the governing total flow rate to meet the available RVSDS wastewater capacity of 546.74 cfs. There were no reductions to sanitary wastewater, SIU or Institutional flow rates.

4. REVIEW OF COMBINED SEWER AREAS

It was requested that the capacity for areas served by combined sewers be reviewed. The previously used Wayne County standard for combined area regulator capacity is 3.25 multiplied by the average dry weather flow rate. Dearborn Heights provided existing regulator capacity data. Table 12 is a comparison of the existing Dearborn Heights regulator settings and the Year 2009 capacity allocations using Method 2 for wet weather inflow rates.

Table 12

Combined Sewer Area Allocation Comparison: Dearborn Heights Example

	1996 PPC Report Wet Weather Flow Rate (cfs)	Year 2009 Method 2 Flow Rate (cfs)
Separated Sewer	52.82	41.58
Combined Sewer	12.64	17.20
Total Developed	65.46	58.78
Capacity from 1988 Agreement	65.47	

Based on this example from Dearborn Heights, the Blended Factor methodology being utilized for allocation of RVSDS capacity provides significantly more capacity than 3.25 times the average dry weather flow rate for the combined sewer areas. Therefore, all areas served by combined sewers will be treated the same in this analysis as separate sewer areas.

5. ALLOCATION OF RVSDS WASTEWATER CAPACITY

Contractual capacities that were negotiated (but not finalized) for the proposed service agreement between Wayne County and the customer communities are presented in Table 13. The capacity allocations from the 1988 amendment to the Service Agreement are also shown for comparison. The negotiated capacity allocations are based on the technical analysis presented in this report and the requests of the customer communities. No community wanted a reduction in capacity, even if the analysis showed reductions would be fair. Some communities wanted to keep their 1988 capacity allocation for the time being even though the analysis indicated that more capacity could be fairly allocated. These communities wanted to consider the results of the STCAP flow monitoring program and the LTCAP study before agreeing to additional capacity.

Table 13		
2011 RVSDS Wastewater Capacity Allocation – Based on Technical Analysis		
Customer	**Capacity from 1988 Agreement (cfs)**	**Proposed Capacity Allocation (cfs)**
Canton Township (1)	14.37	14.37
Dearborn Heights	65.47	65.47
Garden City	24.40	46.00
Inkster	26.66	31.55
Livonia	106.52	106.52
Northville	7.61	11.00
Northville Township (1)	5.51	5.506
Novi	20.48	24.00
Plymouth	4.80	12.00
Plymouth Township (1)	10.22	10.224
Redford Township	52.89	52.89
Romulus	3.60	3.66
Van Buren Township	5.00	5.00
Wayne	27.92	27.92
Westland	80.04	98.00
Wayne County	11.06	15.00
WTUA Interceptors	0.00	0.00
WCAA (Dry Weather Only)	0.00	1.55
Total for District	466.55	530.66
Total for WTUA	30.10	30.10

(1) WTUA community characteristics have been multiplied by 0.36

Allocations of the RVSDS wastewater capacity for each community from Table 13 will be compared to the transport capacity of relevant segments of the RVSDS, summarized in a separate report titled “District Wastewater Transport Capacity.”

Appendix A

1988 Service Agreement Tables

EXHIBIT B

EXISTING SUSTAINED INTERCEPTOR CAPACITY OF
JOINT NORTH HURON VALLEY - ROUGE VALLEY COMMUNITIES
IN EXISTING ROUGE VALLEY SEWAGE DISPOSAL SYSTEM

Joint NHV/RV Community	Existing Sustained Capacity (cfs)
Novi	4.00
Northville	3.60
Northville Township	2.60
Plymouth	4.80
Plymouth Township	9.60
Canton Township	14.37
Van Buren Township	3.20
Livonia	77.94
Redford Township	39.00
Westland	62.90
Inkster	19.47
Garden City	24.40
Dearborn Heights	24.23
Wayne	16.20
Romulus	3.60
Wayne County Institutions	11.41
Wayne County	3.18
Total	324.50 cfs

Notes:

Sustained capacity is the community's peak right-to-deliver discharge rate on a long-term, continuous basis at any time.

11/20/87

EXHIBIT C

MAXIMUM ALLOWABLE RATES OF DELIVERY OF YEAR 2025 PEAK WASTEWATER FLOWS
NORTH HURON VALLEY - ROUGE VALLEY WASTEWATER CONTROL SYSTEM

JOINT NHV-RV COMMUNITY	EXISTING SUSTAINED CAPACITY (cfs)	ADDITIONAL SUSTAINED CAPACITY (cfs)	ADDITIONAL WET WEATHER CAPACITY (cfs)	TOTAL ADDITIONAL CAPACITY (cfs)	TOTAL COMMUNITY CAPACITY (cfs)
Novi	4.00	15.40	1.08	16.48	20.48
Northville	3.60	1.10	2.91	4.01	7.61
Northville Twp.	2.60	0.00	0.00	0.00	2.60
Plymouth	4.80	0.00	0.00	0.00	4.80
Plymouth Twp.	9.60	0.00	0.00	0.00	9.60
Canton Twp.	14.37	0.00	0.00	0.00	14.37
Van Buren Twp.	3.20	1.65	0.15	1.80	5.00
Livonia	77.94	7.82	20.76	28.58	106.52
Redford Twp.	39.00	7.19	6.70	13.89	52.89
Westland	62.90	4.69	12.45	17.14	80.04
Inkster	19.47	1.97	5.22	7.19	26.66
Garden City	24.40	0.00	0.00	0.00	24.40
Dearborn Hgts.	24.23	11.28	29.96	41.24	65.47
Wayne	16.20	3.21	8.51	11.72	27.92
Romulus	3.60	0.00	0.00	0.00	3.60
Institutions	11.41	0.00	0.00	0.00	11.41
Wayne County	3.18	0.00	0.00	0.00	3.18
TOTALS	324.50	54.31	87.74	142.05	466.55

Appendix B

1987 Facility Plan Amendment Report Tables

TABLE 7
NORTH HURON VALLEY/ROUGE VALLEY
WASTEWATER CONTROL SYSTEM
EXISTING FLOWS

	SEWERED (DCI) (CFS)	UNSEWERED EQUIVALENT FLOW (CFS)	INFILTRATION (CFS)	INFLOW (CFS)	TOTAL FLOW (CFS)
Canton Township	18.34	0.69	5.80	21.30	46.13
Dearborn Heights	7.78	0.03	6.51	71.53	85.85
Garden City	4.47	0.03	5.32	16.58	26.40
Inkster	5.29	0.03	2.38	21.67	29.37
Livonia	21.61	0.34	16.00	86.86	124.81
Northville, City	1.76	0.22	0.45	4.94	7.37
Northville Township	3.25	1.39	0.61	2.38	7.63
Novi, North	1.62	1.54	0.28	0.00	3.44
Novi, South	4.62	2.32	4.58	1.50	13.02
Plymouth, City	2.23	0.04	--	1.53	3.80
Plymouth Township	7.23	1.70	3.57	6.37	18.87
Redford Township	18.00	0.06	27.64	14.82	60.52
Romulus	2.42	--	0.08	1.36	3.86
Van Buren Township	3.00	--	0.00	0.20	3.20
Wayne	8.01	0.01	2.46	22.37	32.85
Westland	9.10	0.57	23.31	39.14	72.12
Wixom	4.76	0.57	0.20	0.00	5.53
Institutions	11.41	0.00	0.00	0.00	11.41
Wayne County Interceptors	3.18	0.00	0.00	0.00	3.18
RV	--	--	22.91	15.45	38.36
NHV	--	--	0.31	2.45	2.76
TOTALS	138.08	9.54	122.41	330.45	600.48

Note: Infiltration for the City of Plymouth is included in the Inflow Component.

TABLE 12

2025 PEAK WASTEWATER FLOWS
NORTH HURON VALLEY/ROUGE VALLEY
WASTEWATER CONTROL SYSTEM

COMMUNITY	BASE FLOW (CFS)	INFILTRATION (CFS)	INFLOW (CFS)	DESIGN FLOW (CFS)	EXISTING CAPACITY (CFS)	DESIGN CAPACITY (CFS)
Canton Township	32.90	5.80	21.30	60.00	14.37	14.37
Dearborn Heights	6.73	6.51	54.55	67.79	24.23	67.79
Garden City	3.87	5.32	13.37	22.56	24.40	24.40
Inkster	4.80	2.38	19.21	26.39	19.47	26.39
Livonia	25.21	16.00	70.26	111.47	77.94	111.47
Northville, City	1.99	0.49	4.94	7.42	3.60	7.42
Northville Township	11.35	1.79	2.22	15.36	2.60	2.60
Novi	14.14	4.86	1.50	20.50	4.00	20.50
Plymouth, City	2.71	--	2.09	4.80	4.80	4.80
Plymouth Township	20.76	4.62	6.37	31.75	9.60	9.60
Redford Township	15.94	27.64	13.30	56.88	39.00	56.88
Romulus	2.62	0.09	1.58	4.29	3.60	4.29
Van Buren Township	4.80	0.00	0.12	4.92	3.20	4.92
Wayne	9.54	2.46	22.37	34.37	16.20	34.37
Westland	31.83	30.93	31.89	94.65	62.90	94.65
Institutions[1]	11.41	0.00	0.00	11.41	11.41	11.41
Wayne County Interceptors	3.18	0.00	0.00	3.18	3.18	3.18
RV	--	25.46	15.45	40.91	--	40.91
NHV	--	0.41	2.45	2.86	--	2.86
TOTAL	203.78	139.76	282.97	621.51	324.50	542.81

1. Institution flows are comprised of the following sources:

Michigan State Hospital	2.20 cfs
Michigan State Park	0.58 cfs
Plymouth State Home and Training School	0.68 cfs
Detroit House of Corrections	1.60 cfs
Wayne County Training School	0.35 cfs
Wayne County General Hospital	6.00 cfs

Appendix C

City of Novi Transient User Calculations

City of Novi Calculations

EXISTING

Category	Total REU	Avg pop/REU	gpcd	gpd	cfs
Restaurants	689.87	2.3	82.2	130426.8	0.201814
Hotels	823.88	2.3	82.2	155762.2	0.241016
Major Shopping Areas	1461.085	2.3	82.2	276232.7	0.427425
Hospital/Medical (non-SIU) (subtract 45,000 gpd SIU)	544.715	2.3	82.2	57983.82	0.08972
Attractions	177.864	2.3	82.2	33626.97	0.052032
Non-Public Schools/Colleges	79.063	2.3	82.2	14947.65	0.023129
Industrial (non-SIU)	146.774	2.3	82.2	27749.09	0.042937
TOTAL	**3923.25**				1.078074

PLANNED/future

Category	Total REU	Avg pop/REU	gpcd	gpd	cfs
Restaurants	167	2.3	82.2	31573.02	0.048854
Hotels	183	2.3	82.2	34597.98	0.053535
Major Shopping Areas/non SIU	641	2.3	82.2	121187.5	0.187518
TOTAL	**991.00**				0.289907

City of Novi Calculations

Shopping Areas	Tap Unit Assignment
Twelve Mile Crossing	365.691
Novi Town Center	283.304
West Oaks I & II	233.437
Twelve Oaks Mall	387
West Market Square	141.322
Novi Promenade:	50.331
	1461.085
Medical Centers	
Henry Ford	34.26
Meadowbrook Medical	38.08
Keystone Medical	14.6
Providence Park Campus	544.715
	631.655
Places of Worship	
Church of the Holy Cross	2.00
Novi United Methodist	1.00
Faith Community Church	3.00
First Baptist Church	1.00
Holy Family Church	5.00
Grace Immanuel Church	1.00
Meadowbrook Congregtion	3.00
First Baptist Church	1.00
First Baptist Church	1.00
St. James Catholic Church	5.00
Oak Pointe Church	14.12
Orchard Hills Baptist	1.60
Laymans Evangelical	2.00
Crosspointe Meadows	1.44
Good Shephard Church	3.00
Brightmoor Tabernacle	15.88
	61.04
Attractions	
Rock Financial Showplace	50.168
Novi Ice Arena	26.696
Lifetime Fitness	76
Total Roller Hockey	9
Total Sports	16
	177.864
Non-Public Schools	
Walsh College	8.752
South University	16.282
Art Institute	11.229
Catholic Central	42.8
	79.063
Major Industrial	
Comau Pico	46
Husky Injection Molding	24.774
Wisne	19
Harada	18
CVS Warehouse	39
	146.774

City of Novi Calculations

Company	REU	Address 1	City	State	ZIP Code	Company Description
Fair Lane Motel	4.00	45700 Grand River	Novi	MI	48374	Hotel
Extended Stay Deluxe #4058	17.00	39640 Orchard Hill Place	Novi	MI	48375	Hotel
TownePlace Suites by Marriott	19.79	42600 W 11 Mile Road	Novi	MI	48375	Hotel
Staybridge Suites	30.00	27000 Providence Parkway	Novi	MI	48374	Hotel
Residence Inn by Marriott	32.28	27477 Cabaret Drive	Novi	MI	48377	Hotel
Country Inn & Suites by Carlson	36.70	21625 Haggerty Road	Novi	MI	48375	Hotel
Holiday Inn Express	39.36	39675 Twelve Mile Road	Novi	MI	48377	Hotel
Hilton Garden Inn	52.56	27355 Cabaret Drive	Novi	MI	48377	Hotel
Extended Stay America # 680	53.18	21555 Haggerty Road	Novi	MI	48375	Hotel
Courtyard by Marriott	55.02	42700 W. Eleven Mile Road	Novi	MI	48375	Hotel
Doubletree Hotel	79.00	42100 Crescent Blvd	Novi	MI	48375	Hotel
Baronette Renaissance, The	87.00	27790 Novi Road	Novi	MI	48377	Hotel
Crowne Plaza Novi	119.00	27000 Sheraton Dr	Novi	MI	48377	Hotel
Sheraton Detroit Novi	199.00	21111 Haggerty Road	Novi	MI	48375	Hotel
HOTELS	**823.88**					
29 Park	MS	43155 Main Street	Novi	MI	48375	Night club
Stuart's of Novi, LLC	0.00	41390 W. Ten Mile Rd.	Novi	MI	48375	Restaurant
Ah Wok Restaurant	1.00	41563 W 10 Mile Rd	Novi	MI	48375	Restaurant
Celiac Specialities	1.00	39799 Grand River Avenue	Novi	MI	48375	Restaurant
Domino's Pizza	1.00	41728 Ten Mile Road	Novi	MI	48375	Restaurant
Dragontown	1.00	21518 Novi Road	Novi	MI	48375	Restaurant
Dunkin Donuts of Novi	1.00	39415 W 10 Mile Road	Novi	MI	48375	Restaurant
Fumi Japanese Restaurant	1.00	24271 Novi Road	Novi	MI	48375	Restaurant
Greek Isles Eatery, Inc.	1.00	39777 Grand River	Novi	MI	48375	Restaurant
Guido's Pizza	1.00	47964 Grand River Avenue	Novi	MI	48374	Restaurant
Happy Sushi	1.00	41766 10 Mile Road	Novi	MI	48375	Restaurant
Jack's Meat Market	1.00	41527 W. Ten Mile Road	Novi	MI	48375	Restaurant
Jimmy John's Gourmet Sandwiches - Beck Road	1.00	31204 Beck Road	Novi	MI	48377	Restaurant
Little Caesars Enterprises, Inc. #57	1.00	41467 W 10 Mile Road	Novi	MI	48375	Restaurant
Marco's Pizza	1.00	21520 Novi Road	Novi	MI	48375	Restaurant
Maria's Italian Bakery	1.00	41706 W 10 Mile Rd	Novi	MI	48375	Restaurant
Pine Land Restaurant	1.00	39723 Grand River Avenue	Novi	MI	48375	Restaurant
Subway Sandwiches & Salads #23720	1.00	21514 Novi Road	Novi	MI	48375	Restaurant
Lakeview Bar & Grill	2.00	43393 13 Mile Rd	Novi	MI	48377	Restaurant
Gatsby's	2.54	45701 Grand River	Novi	MI	48374	Restaurant
Primo's Pizza	3.00	24330 Meadowbrook	Novi	MI	48375	Restaurant
Ole Ole Southwestern Bar and Grille	4.00	1103 East Lake Drive	Novi	MI	48377	Restaurant
Dairy Queen	5.00	41490 Grand River Avenue	Novi	MI	48375	Restaurant
Rio Wraps	5.00	41490 Grand River	Novi	MI	48375	Restaurant
Picasso Café, Inc.	5.48	39915 Grand River Ave	Novi	MI	48375	Restaurant
Boston Market # 1083	5.60	43363 Crescent Blvd	Novi	MI	48375	Restaurant
Burger King #6509	6.00	39601 Grand River	Novi	MI	48375	Restaurant
McDonalds	6.00	42665 W 12 Mile Rd	Novi	MI	48377	Restaurant
McDonalds	6.00	21050 Haggerty Road	Novi	MI	48377	Restaurant
O'Tooles of Novi	6.00	24555 Novi Road	Novi	MI	48375	Restaurant
Taco Bell #3783	6.00	21090 Haggerty Rd	Novi	MI	48375	Restaurant
Wendy's	6.00	26245 Novi Road	Novi	MI	48375	Restaurant
Don's of Traverse City	7.00	48730 Grand River	Novi	MI	48374	Restaurant
Tubby's	7.00	41460 Grand River Avenue	Novi	MI	48375	Restaurant
Pei Wei Asian Diner	7.40	43170 Grand River Avenue	Novi	MI	48375	Restaurant
Potbelly Sandwich Shop	8.40	43350 Grand River Avenue	Novi	MI	48375	Restaurant
Big Boy - Novi Road	9.00	26401 Novi Road	Novi	MI	48375	Restaurant
Mirchi Indian Cuisine	9.00	43317 Grand River Avenue	Novi	MI	48375	Restaurant
Rosewood Fine Foods	9.00	46077 Grand River	Novi	MI	48375	Restaurant
Leo's Bar and Grill, Inc.	10.00	40380 Grand River Avenue	Novi	MI	48375	Restaurant
Steve & Rocky's	10.61	43150 Grand River Ave	Novi	MI	48375	Restaurant
Kim's Gardens	13.00	26150 Novi Road	Novi	MI	48375	Restaurant
Pita Café	13.00	43224 W. 11 Mile Road	Novi	MI	48375	Restaurant
Panera Bread # 667	13.15	25875 Novi Road	Novi	MI	48375	Restaurant
Border Cantina	15.00	21420 Novi Rd	Novi	MI	48375	Restaurant
Moe's on Ten Family Dining	16.00	39455 W. Ten Mile Road	Novi	MI	48375	Restaurant
Gourmet Buffet	16.12	43626 West Oaks Drive	Novi	MI	48377	Restaurant
Carrabba's Italian Grill	16.25	43455 West Oaks Drive	Novi	MI	48377	Restaurant
Applebee's	16.52	47900 Grand River	Novi	MI	48374	Restaurant
Outback Steakhouse	17.00	48020 Grand River Ave	Novi	MI	48374	Restaurant
Library Sports Pub & Grill	18.00	42100 Grand River Ave	Novi	MI	48375	Restaurant
Denny's Restaurant #7672	19.00	27750 Novi Road	Novi	MI	48377	Restaurant
On the Border Mexican Café	19.80	21091 Haggerty Rd	Novi	MI	48375	Restaurant
The Melting Pot	20.00	26425 Novi Road	Novi	MI	48375	Restaurant
Chili's Grill and Bar	21.00	20901 Haggerty Rd.	Novi	MI	48375	Restaurant
Big Boy - 8 Mile & Haggerty Rd	23.00	20800 Haggerty Rd	Novi	MI	48375	Restaurant
Flairs Mediterranean Fusion	23.00	42050 Grand River	Novi	MI	48375	Restaurant
Red Robin of Michigan, Inc.	27.00	43250 Crescent Blvd.	Novi	MI	48375	Restaurant
Famous Dave's	29.00	43350 Crescent Boulevard	Novi	MI	48375	Restaurant
TGI Friday's	29.00	43200 Crescent Blvd	Novi	MI	48375	Restaurant
Ruby Tuesdays #7632	30.00	39581 12 Mile Road	Novi	MI	48375	Restaurant
Red Lobster #389	33.00	27760 Novi Road	Novi	MI	48377	Restaurant
Guernsey Farms Dairy	40.00	21300 Novi Road	Northville	MI	48167	Restaurant
Olive Garden Italian Restaurant #1330,	41.00	43300 Crescent Blvd	Novi	MI	48375	Restaurant
Shiro Restaurant	19.00	43180 W. 9 Mile Road	Novi	MI	48375	Restaurant
RESTAURANTS (not counted elsewhere)	**689.87**					

Planned and Future Projects with Transient Users

Hotels		
Hilton Homewood	13 Mile at M-5	37
Possible Hotel	Wixom/Grand River	40
Possible Hotel	Novi/96	40
Hyatt at Rock Financial	Grand River at Rock Fin	50
		167
Restaurants		
Legacy Parc outlot	Ten Mile and Wixom	26
Providence restaurants	Beck and Grand River	50
Possible Restaurant	Wixom/Grand River	35
Weiss outlots	Novi and Ten Mile	72
		183
Regional Retail		
Wal-Mart SuperCenter	Town Center and 11 Mil	51
Main Street (retail, medical)		320
Brooktown (retail)	Meadowbrook/Grand Ri	120
Providence Retail	Beck/Grand River	150
		641

City of Novi

Water Unit Factor Chart

(See Notes Following Table)

Usage Type	Unit Factor	Information Source
Auto Dealers	0.300 per 1000 sq. ft.	D
Barber Shops	1.000 per 1000 sq. ft.	A - C
Bars	0.044 per seat	D
Beauty Shops	0.223 per booth	D
Boarding Houses	0.160 per person	A - C
Boarding Schools	0.270 per person	A - C
Bowling Alleys (no bar, or lunch facilities)	0.160 per alley	D
Car Wash:		
a) Manual, Do-It-Yourself	2.500 per stall	D
b) Semi-Automatic (mechanical without conveyor)	12.500 per lane	D
c) Automatic (with conveyor)	33.000 per lane	D
d) Automatic (with recycling water)	8.400 per lane	D
Churches	0.008 per seat	D
Cleaners:		
a) Pick-up Only	0.048 per employee	D
b) With Pressing Facilities	1.250 per press	D
Clinics:		
a) Medical	1.000 per doctor	D
b) Dental	1.400 per dentist	D
Community Buildings	2.000 per building	D
Convalescent and/or Nursing Homes	0.300 per bed	D
Convents	0.200 per person	D
Country Clubs	0.080 per member	A - C
Day Care	0.012 per student	CITY
Drug Stores:		
a) With Fountain Service	0.080 per seat, **plus** **0.140 per 1000 sq. ft.**	D
b) Without Fountain Service	0.140 per 1000 sq. ft.	D

City of Novi

Water Unit Factor Chart

(See Notes Following Table)

Factories (exclusive of excessive industrial use)	0.500	per 1000 sq. ft.	D
Fraternal Organizations (members only)	1.000	per hall	D
Fraternal Organizations (members and rentals)	2.000	per hall	D
Funeral Home (including one residence)	2.200	per funeral home	D
Grocery Stores & Super Markets	0.310	per 1000 sq. ft.	D
Health Clubs:			
a) With Showers and/or Pool	2.300	per 1000 sq. ft.	D
b) Without Showers and/or Pool	0.260	per 1000 sq. ft.	D
Hospitals	1.220	per bed	A - C
Hotels and/or Motels (exclusive of swimming, pools, bars, restaurants, etc.)	0.380	per room	A - C
Laundry (self-serve)	0.540	per washer	D
Office Building	0.400	per 1000 sq. ft.	D
Public Institutes (other than hospitals)	0.320	per employee	A - C
Racquet Clubs	0.820	per court	D
Residences:			
Mobile Home Parks	1.000	per mobile home	CITY
Multiple Family Residence	1.000	per residence	CITY
Single Family Residential	1.000	per dwelling	
Restaurants:			
a) Conventional Type (with or without drinks)	0.130	per seat	A - B
1. Seasonal Out-door Eating	0.130	per seat x 5/12	CITY
2. Banquet Section	0.130	per seat x 25%	CITY
b) Quick Service Franchise Type (**without dishes**, dealing mainly in hamburgers, with or without eating in building. Includes, but not necessarily limited to McDonald's, Burger Chef, Burger King, Red Barn, and Hardees.)	5.600	per restaurant	D
c) All Other Restaurants (Includes, but not limited to, drive-ins, snack bars, carryouts, such as fried chicken, pizzas; could have some eating in building, **all without dishes.**	1.800	per restaurant	D
Rooming Houses (No Meals)	0.130	per person	A - C

City of Novi

Water Unit Factor Chart

(See Notes Following Table)

Schools:			
a) Elementary	0.012	per student	D
b) Junior or Middle School	0.020	per student	D
c) High School	0.038	per student	D
d) Bus Maintenance Facility	0.165	per 1000 sq. ft.	D
Service Station	0.240	per pump	C - D
Store (other than specifically listed)	0.340	per 1000 sq. ft.	CITY
Summer Camps	0.140	per housing unit	D
Swimming Pool (residential excluded)	3.000	per 1000 sq. ft.	D
Theaters (drive-in)	0.012	per car space	D
Theaters (indoor)	0.008	per seat	D
Warehouses	0.100	per 1000 sq. ft.	D

Notes Pursuant to Resolutions Dated April 10, 1991 and June 7, 1999:

1) In the computing of unit factors to be charged to industrial and commercial users, each separately operated business entity in a common building shall have a unit factor as set forth above (unless modified by agreement) but in no instance less than 1.00 tap unit for each separately operated business entity.

2) When the usage requested is not specifically identified under the *"Usage Type"* column, an estimated temporary tap unit assignment will be initially assigned by the City, and the USER will enter into a monitoring agreement (Exhibit A) to determine the actual tap unit assignment.

INFORMATION SOURCE:

A - Cincinnati Report
B - Gordon McDougall Report to Wayne County
C - Manual of Septic Tank Practice Publication No. 526, U.S. Department of Health
D - Oakland County Department of Public Works Studies

CITY OF NOVI

Sewer Unit Factor Chart

(See Notes Following Table)

Usage Type	Unit Factor		Information Source
Auto Dealers	0.300	per 1000 sq. ft.	D
Barber Shops	1.000	per 1000 sq. ft.	A - C
Bars	0.044	per seat	D
Beauty Shops	0.223	per booth	D
Boarding Houses	0.160	per person	A - C
Boarding Schools	0.270	per person	A - C
Bowling Alleys (no bar, or lunch facilities)	0.160	per alley	D
Car Wash:			
a) Manual, Do-It-Yourself	2.500	per stall	D
b) Semi-Automatic (mechanical without conveyor)	12.500	per lane	D
c) Automatic (with conveyor)	33.000	per lane	D
d) Automatic (with recycling water)	8.400	per lane	D
Churches	0.008	per seat	D
Cleaners:			
a) Pick-up Only	0.048	per employee	D
b) With Pressing Facilities	1.250	per press	D
Clinics:			
a) Medical	1.000	per doctor	D
b) Dental	1.400	per dentist	D
Community Buildings	2.000	per building	D
Convalescent and/or Nursing Homes	0.300	per bed	D
Convents	0.200	per person	D
Country Clubs	0.080	per member	A - C
Day Care	0.012	per student	CITY
Drug Stores:			
a) With Fountain Service	0.080	per seat, **plus**	
	0.140	per 1000 sq. ft.	D
b) Without Fountain Service	0.140	per 1000 sq. ft.	D

CITY OF NOVI

Sewer Unit Factor Chart

(See Notes Following Table)

Factories (exclusive of excessive industrial use)	0.500	per 1000 sq. ft.	D
Fraternal Organizations (members only)	1.000	per hall	D
Fraternal Organizations (members and rentals)	2.000	per hall	D
Funeral Home (including one residence)	2.200	per funeral home	D
Grocery Stores & Super Markets	0.310	per 1000 sq. ft.	D
Health Clubs:			
a) With Showers and/or Pool	2.300	per 1000 sq. ft.	D
b) Without Showers and/or Pool	0.260	per 1000 sq. ft.	D
Hospitals	1.220	per bed	A - C
Hotels and/or Motels (exclusive of swimming, pools, bars, restaurants, etc.)	0.380	per room	A - C
Laundry (self-serve)	0.540	per washer	D
Office Building	0.400	per 1000 sq. ft.	D
Public Institutes (other than hospitals)	0.320	per employee	A - C
Racquet Clubs	0.820	per court	D
Residences:			
Mobile Home Parks & Multiple Family Residences:			
a) One Bedroom	0.600	per dwelling unit	CITY
b) Two Bedroom	0.750	per dwelling unit	CITY
c) Three or more Bedrooms	1.000	per dwelling unit	CITY
Single Family Residential	1.000	per dwelling	CITY
Restaurants:			
a) Conventional Type (with or without drinks)	0.130	per seat	A - B
1. Seasonal Out-door Eating	0.130	per seat x 5/12	CITY
2. Banquet Section	0.130	per seat x 25%	CITY
b) Quick Service Franchise Type (**without dishes**, dealing mainly in hamburgers, with or without eating in building. Includes, but not necessarily limited to McDonald's, Burger Chef, Burger King, Red Barn, and Hardees.)	5.600	per restaurant	D
c) All Other Restaurants (Includes, but not limited to, drive-ins, snack bars, carryouts, such as fried chicken, pizzas; could have some eating in building, **all without dishes.**	1.800	per restaurant	D
Rooming Houses (No Meals)	0.130	per person	A - C

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Sewer Unit Factor Chart

(See Notes Following Table)

Schools:			
a) Elementary	0.012	per student	D
b) Junior or Middle School	0.020	per student	D
c) High School	0.038	per student	D
d) Bus Maintenance Facility	0.165	per 1000 sq. ft.	D
Service Station	0.240	per pump	C - D
Store (other than specifically listed)	0.340	per 1000 sq. ft.	CITY
Summer Camps	0.140	per housing unit	D
Swimming Pool (residential excluded)	3.000	per 1000 sq. ft.	D
Theaters (drive-in)	0.012	per car space	D
Theaters (indoor)	0.008	per seat	D
Warehouses	0.100	per 1000 sq. ft.	D

Notes Pursuant to Resolutions Dated April 10, 1991 and June 7, 1999:

1) In the computing of unit factors to be charged to industrial and commercial users, each separately operated business entity in a common building shall have a unit factor as set forth above (unless modified by agreement) but in no instance less than 1.00 tap unit for each separately operated business entity.

2) When the usage requested is not specifically identified under the *"Usage Type"* column, an estimated temporary tap unit assignment will be initially assigned by the City, and the USER will enter into a monitoring agreement (Exhibit A) to determine the actual tap unit assignment.

INFORMATION SOURCE:

A - Cincinnati Report
B - Gordon McDougall Report to Wayne County
C - Manual of Septic Tank Practice Publication No. 526, U.S. Department of Health
D - Oakland County Department of Public Works Studies