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PUBLIC NOTICE OF A COMMITTEE MEETING OF THE COMMON COUNCIL OF THE CITY OF WATERLOO

Pursuant to Section 19.84 Wisconsin Statutes, notice is hereby given to the public and to the news media, that the following meeting will be held:

COMMITTEE: FINANCE, INSURANCE & PERSONNEL COMMITTEE

DATE: Thursday, August 15, 2013 **TIME:** 6:30 p.m.

LOCATION: Council Chamber of the Municipal Building
136 N. Monroe Street

to consider the following:

1. CALL TO ORDER AND ROLL CALL
2. APPROVAL OF PREVIOUSLY UNAPPROVED MEETING MINUTES
3. CITIZEN INPUT
4. UNFINISHED BUSINESS
5. NEW BUSINESS
   a. Payroll For July, 2013 - $58,364.28 ***
   b. Pay Vouchers – July 19, 2013 through August 15, 2013 ***
   c. Treasurer's Report & Budget Reports For July 2013
   d. Sanitary Sewer Inflow & Infiltration Study
   e. Recommending To Council A Library Board Recommendation To Permit Sick Leave To Be Used To Acquire Health Insurance For A Retiring Employee Having Served Less Thank Fifteen Years -- Cecilia Wiltzius
   f. Snap Fitness Corporate Plan
6. FUTURE AGENDA ITEMS AND ANNOUNCEMENTS
7. ADJOURN

Mo Hansen
Clerk/Treasurer

[* See Council Packet]**

Committee Members: Springer, Quimby and Cotting

Posted, Emailed & Distributed: August 9, 2013

PLEASE NOTE: It is possible that members of and possibly a quorum of members of other governmental bodies of the municipality may be in attendance at the above meeting(s) to gather information. No action will be taken by any governmental body other than that specifically noticed. Also, upon reasonable notice, efforts will be made to accommodate the needs of disabled individuals through appropriate aids and services. For additional information or to request such services please contact the clerk's office at the above location.

Waterloo - Sanitary Sewer
Inflow/Infiltration Projects
Ranking by Groups

Group	Location	Sewer Repair Replacement Costs	GROUP Sewer Repair Replacement Costs	Infiltration Rate(gpd/in/mi)	GROUP Infiltration Rate(gpd/in/mi)	Rank	I/I Contribution (gpd)	Notes
1	STH 89 / East Madison Street	$200,322	$373,338	111,734	232,395	1	122,400	Grouped because of proximity.
1	Railroad Avenue	$116,850		66,040			66,040	
1	Pierce Street	$56,166		54,621			54,621	
2	Adams Street Railroad Crossing	$28,540	$101,010	86,561	181,099	2	70,560	Grouped because of ability to batch together for slip-line repair
2	Jackson Street Railroad Crossing	$46,490		65,295			65,295	
2	Jefferson Street Railroad Crossing	$25,980		29,243			29,243	
3	Mill Street (upstream /southern segment, MH 11 to MH 6	$99,730	$546,602	72,182	119,171	3	12,637	Grouped because of proximity.
3	Cleveland Street	$164,554		34,352			34,352	
3	Mill Street (downstream/northern segment, MH 6- WWTP)	$282,318		12,637			12,637	
4	West Madison Street	$34,529	$34,529	48,154	48,154	4	48,154	Incorporated into DOT 2017 Reconstruct
5	OTHER: Sealing Manhole Covers [qty. 20@ $500 per]	$10,000	$10,000			5		Coordination required between Dennis and DPW
	TOTALS	**$1,065,479**	**$1,065,479**	**580,819**	**580,819**		**515,939**	

Town & County estimates:
With implementation of the above a favorable outcome would be a 50% reduction in the I/I Contribution (gpd)
from these sources to the treatment plant [roughly an improvement from 515,393 gpd to 257,696 gpd.

I. Executive Summary

Waterloo Water and Light has requested an investigation of sanitary sewer system in the City of Waterloo. The City of Waterloo has had continual issues with inflow and infiltration (I/I). I/I is clear water which enters the sanitary system and is transported to the wastewater treatment plant.

Waterloo conveys wastewater to the treatment plant using a network of pipes and pumping stations. The City of Waterloo has many areas of old clay pipe which are susceptible to cracking, and therefore, are a large source of I/I.

Lift stations are used to pump wastewater from areas that cannot be serviced by gravity sewer. Waterloo operates six lift stations. Five of the lift stations are connected to the Utility's radio based SCADA system. These lift stations record pump run to times, which can then be used to calculate flow through the lift station. Problem areas found through lift station run to time analysis include the Streator lift station drainage area and the Portland lift station drainage area.

Problems occur when the I/I in a treatment system becomes so great that the hydraulic capacity of the wastewater treatment plant is compromised. The Waterloo wastewater treatment plant has an average hydraulic design capacity of 0.458 MGD, a maximum daily flow of 1.21 MGD, and a peak hydraulic design capacity of 2.34 MGD.

I/I can be quantified based on water use records and season evaluations of influent flow to the wastewater treatment plant. Wastewater influent flows can be divided into base flow, which is based on residential, commercial, and industrial water use, dry weather infiltration, which is the average wastewater influent flow during January, February, November, and December of each year, wet weather infiltration, which is the maximum weekly average influent flow, and inflow, which is the maximum daily flow in the treatment plant. The Waterloo wastewater treatment plant experiences a base flow of 0.253 MGD, a dry weather infiltration of 0.222 MGD, a wet weather infiltration of 0.669 MGD, and an inflow of 1.284 MGD.

Lift station runtime analysis, nighttime flow monitoring, and smoke testing were utilized to locate and quantify areas of significant I/I. Lift station analysis was used to isolate drainage areas that may have increases in flow during wet weather events. Nighttime flow monitoring was used to further isolate areas where significant I/I is being contributed. Smoke testing was used to located potential areas of inflow that may not be specifically located by lift station analysis or nighttime flow monitoring.

Areas of concern identified in the analyses described above include:

- State Highway 89/East Madison Street sanitary sewer
- Sanitary sewer railroad crossings at Adams, Jefferson, and Jackson Streets
- Mill and Cleveland Streets' sanitary sewer
- Railroad Avenue sanitary sewer
- Pierce Street sanitary sewer
- West Madison Street sanitary sewer
- The abandoned meat processing facility located in the industrial park near Industrial Drive
- 740 Railroad Avenue
- The Portland Sanitary District

These areas were found to contribute as much as 650,000 gallons per day of clearwater flow and should be addressed to minimize impact upon the City's wastewater treatment plant and future discharge limits that will be imposed by the Wisconsin Department of Natural Resources.

II. Introduction

The City of Waterloo's sanitary sewer system collects and conveys wastewater from residencies, commercial and industrial establishments, and public buildings and institutions to the wastewater treatment facilities. The wastewater discharged by users to the collection system also carries a portion of clear water, called inflow and infiltration (I/I). Infiltration is groundwater which enters the collection system, generally underground, through defective pipes or joints, defective connections, or manhole walls. Infiltration is usually more of a steady flow which varies throughout the year dependent on the season, level of soil saturation, groundwater levels, and physical integrity of the collection system. Inflow is defined as clear water which directly enters the collection system, which may include roof drains, area surface drains, manhole covers, cross connections or overflows between storm sewers and sanitary sewers, sump pumps, or other direct flow sources. The volume of inflow entering the collection system at any time is highly variable, but is generally proportional to the magnitude of any precipitation or snowmelt event.

I/I flow quantities create an additional demand on all facilities involved in wastewater collection and treatment. I/I occupies a portion of the hydraulic capacity of the collection system. When I/I entry to the collection system is greatest, detrimental conditions such as flooding and backups into buildings could occur when sewers are over capacity, potentially causing property damage and personal health risks. During extreme conditions, overflows from manholes and bypasses may allow sewage to overflow onto the ground or into rivers and drainage ways. There is an additional economic cost to pump, convey, and treat the extra volume of water if not kept under control. So, it is desirable to minimize inflow and infiltration into the collection system to the extent that is cost effective.

This I/I report is being prepared as an update to the City of Waterloo and the Waterloo Utilities as to the current status of the sanitary sewer collection system. The purpose of this report is to provide a summary of the data and findings observed during this study. This report contains the following major items:

- Provide a description of the existing system and documents the conditions that are known to exist based on discussions with maintenance staff
- Flow conditions and capacity experienced at plant
- Evaluation of lift station run data
- Summary and evaluation of data collected from nighttime flow monitoring
- Summary and evaluation of smoke testing data
- Evaluate repairs to the Mill and Cleveland Streets sanitary sewer drainage area
- Provide a summary of data, areas of concern, relative severity of the I/I, and cost effectiveness of repair

The proposals establishing scope of work for the I/I study can be found in Appendix A.

III. Collection and Treatment System

The City of Waterloo sanitary sewer system consists of a network of underground sewage conveyance pipelines and pumping facilities responsible for transporting (mostly by gravity) all of the wastewater produced within the City and regional areas to the treatment plant. The existing treatment plant, located next to the Maunesha River and Fireman's Park, provides advanced treatment of the wastewater to permitted standards before discharge to the Maunesha River. A map of Waterloo's sanitary sewage collection system facilities, which includes the service area breakout, is provided in Appendix B.

1. Sanitary Sewer System

   The sanitary sewer system in Waterloo is composed of clay pipe, slip lined clay pipe, and PVC pipe. Clay pipe commonly has problems with infiltration due to its susceptibility to cracking and collapse with age. Slip lining is sometimes used to remedy these problems, however is not an ideal solution. Manholes are installed between lengths of pipe to provide access for maintenance and cleaning. Waterloo has manholes made of brick, strong sealed brick, block, and precast concrete. Manholes can also be a significant source of infiltration, especially when made of brick or block where water can seep through the joints as mortar loosens with age. All manholes can prove to be a significant source of inflow when stormwater entry occurs through the top casting or adjustment rings.

   A good indicator of the condition of the sanitary sewer system is maintenance and sewer backup records. The map in Appendix B shows sewer maintenance and a list of sewer maintenance can be found in Appendix C. Areas which require regular maintenance include:

   - Lum Street
   - Dickenson Street
   - Edison Street
   - Pierce Street
   - Polk Street

2. Lift Stations

   Lift (or pumping) stations provide service to areas which cannot be serviced by gravity and the stations lift the wastewater to discharge at higher elevations so that flow can continue by gravity. Waterloo Water and Light currently maintains six lift stations which are listed in Table 3-1:

Table 3-1
Summary of Sewage Lift Stations

Lift Station	Location	Design Pumping Capacity (gpm)
West Madison (LS 1)	West Madison Street	350
Treyburn (LS 2)	Lexington Way	150
Streator Lane (LS 3)	Streator Lane	110
Portland SD (LS 4)	Portland Road	200
Fireman's Park	Fireman's Park	Single pump design
DeYoung (LS 5)	McKay Way	200

With the exception of the Fireman Park location, all the lift station locations are of the duplex submersible pump station design type and are connected to the Utilities radio based SCADA control system. The Fireman Park location is equipped with a single pump design and is seasonally used to serve the park concession and restroom facilities. There are no records of equipment run time or starts available for the Fireman Park station location.

The De Young station is the most recent addition to the collection system lift stations. Based on the new construction completed in 2008 and the limited connected users at this time, there was no further evaluation of this collection area.

3. Treatment Plant

Wastewater Treatment Plant Hydraulic Design

The wastewater treatment plant continuously measures and records the wastewater and clear water influent flow received from the sanitary sewer collection system. The plant is designed with hydraulic and treatment unit process design capacities that are selected to best promote the intended treatment of influent sanitary sewer waste flow. Although the influent waste strength also plays an important role in these considerations of capacity, the plant hydraulic capacity indicates what rates of flow though the plant can be provided with favorable plant treatment performance. The existing plant hydraulic design capacities are summarized in Table 3-2 as follows:

Table 3-2
WWTP Hydraulic Design Conditions

Hydraulic Design Parameter	Flow Rate (MGD)	Flow Rate (gpm)
Average Daily Flow	0.458	318
Maximum Daily Flow	1.212	871
Peak Daily Flow	2.34	1,621

Flow records presented in the following sections generally indicate that the treatment plant is approaching or operating beyond the intended hydraulic design conditions and would benefit from reductions of clear water flow. The following sections detail the standard methods used to identify and evaluate the portion of clear water flow estimated present within the sanitary sewer waste stream.

IV. Inflow and Infiltration Quantification

Water Use Records

The City of Waterloo water use records are used to establish an approximate value for a base flow to the wastewater treatment facility. The base flow generally reflects the water that is served to the user estimated to flow to the sanitary sewer. These base flows are evaluated for the years 2006 through 2009 and are based on water use billing records summarized in Table 4-1.

Table 4-1
Wastewater Base Flows (Residential, Commercial, Industrial, and Public Water Use)

Year	Estimated Population	Total Daily Water Consumption* (gpd)	Total Per Capita Use (gpcd)	Residential / Commercial Use (gpd)	Per Capita Residential / Commercial Use (gpcd)
2006	3,417	264,512	77.4	218,070	63.8
2007	3,470	258,665	74.5	220,825	63.6
2008	3,523	253,876	72.1	214,998	61.0
2009	3,569	236,119	66.2	205,142	57.5
Average	3,495	253,293	72.5	214,759	61.5

**Includes residential, commercial, public, and industrial.*

The historical values outlined in Table 4-1 are very typical values on water use for the size community and region of the country. The industrial use metered (included within the total water use) accounts for approximately 15% of the total water use. The base waste water flow rate is estimated to be 70 gallons per capita per day (gpcd) for continued flow evaluation.

Daily Infiltration Quantities

Infiltration is separated into dry weather and wet weather infiltration. Dry weather infiltration shall be defined as total wastewater flow observed at the treatment facility during period of minimum precipitation and snow melt minus the base flow. Wet weather infiltration is the total observed wastewater flow during periods of high ground water or saturated soil conditions with minimal concurrent precipitation minus the base flow. Typically, wet weather infiltration is evaluated over a 7 to 14 day time period to minimize the influence of rainfall or drainage (inflow) which may occur during to the evaluation period.

Dry weather infiltration is typically considered to occur during the months of January, February, November, and December each year. An average of these months is calculated for each year and Appendix E presents the supporting data. Based on the range of these values, an average of these annual conditions from 2006 to 2009 were used to estimate the dry weather flow (DWF) condition. The DWF condition is estimated to be 437,000 gpd.

Wet weather infiltration can be estimated by further evaluating the maximum weekly average flow conditions that occur each year. The maximum annual weekly average condition is calculated for each year and Appendix E presents the supporting data. The maximum seven day average flow of 2.324 MGD is found (in June, 2008). The Year 2008 event is considered to be an extreme wet flow condition when a total of 10 inches of rainfall occurred during that week of record. The remaining maximum weekly flow averages are more repeatable at lower levels. Based on this range, an average of annual conditions from 2006 to 2009, excluding Year 2008, were used to estimate the wet weather flow (WWF) condition. The WWF condition is estimated to be 884,000 gpd.

The estimated DWF and WWF flow conditions are used to further evaluate and compare against the EPA per capita day standards established for reasonable levels of infiltration. This comparison relies on the DWF and WWF conditions presented as the portion of flow found to be greater than the base flow as further detailed in Section 3.3.2.4. Both the dry and wet weather flow determinations are made in the following Table 4-2.

Table 4-2
Infiltration Determination

2006 to 2009 Data		
Dry Weather Infiltration (DWF)	=	DWF to Base Flow
	=	437,000 gpd – 214,759 gpd
	=	222,241 gpd
Per Capita Rate (DWF)	=	222,241 gpd ÷ 3,495 = 63.6 gpcd
	=	Use 70 gpcd
2005 to 2009 Data		
Wet Weather Infiltration (WWF)	=	Max Weekly Flow to Base Flow
	=	884,000 – 214,759 gpd
	=	669,241 gpd
Per Capita Rate	=	669,241 gpd ÷ 3,495 = 191.5 gpcd
	=	Use 200 gpcd

Daily Inflow Quantities

The maximum daily flow (MDF) on record will be evaluated to determine the maximum daily inflow conditions. To account for the infiltration flow present, the inflow portion of daily flow shall be maximum daily flow less the wet weather daily flow (WWF). The maximum daily flow on record for Years 2006 through 2009 was 3,523,700 gallons (June 9, 2008) which previously was considered an extreme weather event. The average of all years evaluated (2,168,000 gpd) would appear to be more representative of the expected conditions. So, by subtracting the WWF (884,000 gpd) from this flow, the inflow component of 1,284,000 gpd inflow is estimated. Using the average population of 3,495 persons of the time period, a per capita inflow rate of 367.0 gpcd is then calculated.

Infiltration and Inflow Evaluation

The infiltration and inflow rates established above will be evaluated to determine if they are excessive per the criteria established in the EPA manual "I/I Analysis and Project Certification". These criteria are summarized as follows:

Maximum Per Capita Flow (w/infiltration)		= 130 gpcd
Maximum Per Capita Peak Daily Flow (w/inflow)		= 275 gpcd
Existing Per Capita Flows (2005 to 2009)		
Base Wastewater Flow + Wet Weather Infiltration		= 70 + 200
		= 270 gpcd
Above + Inflow	= 270 + 367	= 637 gpcd

Based on comparison with EPA criteria, both infiltration and inflow appear to be problems in the collection system. The State of Wisconsin makes independent determination of acceptability, although the EPA guidelines are considered sound baseline for consideration, and thus could approve this condition as acceptable. However, the magnitude of the apparent issue is such that further analysis was completed to determine areas and scope of the specific issues in order to evaluate if rehabilitation or repair is economically viable at this time.

Unavoidable Infiltration and Inflow

A certain amount of I/I is unavoidable, even in new construction. 200 gallons per day per inch mile (gpd/in*mi) (an inch mile is defined as the length of pipe in miles multiplied by the diameter of the pipe) is used as a standard for allowable infiltration for construction of new sanitary sewers. Based upon the size of Waterloo's collection system, Waterloo has 31,500 gpd of unavoidable I/I.

V. Collection System Evaluation

A. Lift Station Evaluation

Each of the lift stations connected to the control system have the respective pump run times and starts automatically recorded on a daily basis. In addition, the respective local control systems continuously estimate a daily flow rate discharged from each respective station based on the monitoring of wet well levels and operating time of each pumping cycle. When these records are compared against rainfall and wet weather events, there can be useful indications of lift station collection areas that are significantly affected by infiltration and inflow. This data was used to further investigate and isolate areas of high I/I in the sanitary sewer system.

The duplex type pump station design intends that a single pump unit provide for the pumping capacity needed as indicated in Table 3-1. If there is flow to the station beyond pumping capacity of a single pump unit, the second pump unit then automatically activates and runs until such time the station pumps down and service can resume with a single pump unit alone, or all station pumps are shut off. The records of sustained time periods when both pump units are activated can indicate there is a problem at the station or there are times when there is more flow to the station than anticipated by design. When these time periods correlate closely to rainfall events, this would further suggests the additional flow to the station relates to increased infiltration and inflow flow that exceed the station peak pumping design.

A summary of the station both pumps on condition run time are presented in Appendix D. Evaluation of the both pumps running condition is summarized as follows:

- In 2007 and 2008 at the West Madison station, there are extended time periods when both pumps were required to operate. Modifications to this station and discharge force main were completed in 2008 and the need for both pumps to operate has been corrected. Subsequently, there is no pronounced impact of rainfall events on this station.
- The Treyburn station has not been impacted by rainfall conditions.
- The Streator station had some corrective work completed in 2008 and has not been impacted by rainfall conditions.
- The Portland SD station appears to be impacted by rainfall conditions. This is seen with rainfall events periodically.

Whereas run time conditions recorded can simply indicate a problem at the station, the estimated daily flow from each station can also be used to further clarify the flow conditions that occur during rainfall events. Under these

circumstances, there may be an increase of flow to the station that a single pump unit can handle. A summary of the station flow weekly average flow conditions and total rainfall are presented in Appendix D. Evaluation of these flow conditions is summarized as follows:

- In 2008 at the West Madison station, the Briess Malting Company had connected and increased flow to the station. Comparison of the daily flow totals at the connected industries (Van Holten and Briess) would suggest the station estimates of flow were reported lower than occurred. The evaluation of changes in flow attributed to rainfall events does not indicate any impact.
- The Treyburn Station has not been impacted by rainfall conditions. However, recent increases of flow to the station, since April of 2010 warrant additional checking of the collection area. There appears to be a 5,000 gallons per day (gpd) increase since April of 2010. Additional review of data from 2012 and 2013 confirm that the Treyburn Lift Station is not greatly impacted by rain events. The minor magnitude of flow increase in 2010 prohibits effective flow monitoring during nighttime hours. This area should be targeted for televising to locate potential issues.
- The Streator station appears to be impacted by rainfall conditions. Periodic increases of 5,000 to 10,000 gpd can be observed during increases of rainfall. Additional review of data from 2012 and 2013 confirms the impact of wet weather on the Streator Lift Station. Nighttime flow monitoring and smoke testing were unable to identify any sources of I/I. This area should be monitored for potential sump pump connections. Repair or replacement of sanitary sewer should be performed if any major utility projects are undertaken.
- The Portland Sanitary District Lift Station appears to be heavily impacted by wet weather events. Data from 2008 through 2010 indicates from increases between 15,000 and 20,000 (approximately 100% increase) gallons per day. More recent data from spring of 2013 shows that flows from the Portland Sanitary District increased from nearly 15,000 gallons per day to nearly 140,000 gallons per day, an increase of almost 1,000%. Because the Portland Sanitary District is a separate entity of the Waterloo Utilities, they are charged based upon wastewater flow to the Waterloo WWTP. High flow events, such as what occurred in 2013, result in excessive wastewater changes. The Portland Sanitary District should evaluate their clearwater issues to alleviate I/I issues for the City as well as reduce unnecessary changes due to high flows.

Based on the evaluation of run time and flow conditions record by the control system, it is apparent that the Treyburn, Streator and Portland SD lift station collection areas should be evaluated further for inflow and infiltration observed during rainfall events.

B. Nighttime Flow Monitoring

Spot flow monitoring during the nighttime hours was utilized in an attempt to determine areas of relatively high I/I and to eliminate areas from future I/I investigation. Nighttime flow monitoring is used to quantify the clean water entering the system because residential and industrial usage is greatly reduced during nighttime hours. Monitoring was performed through the night and early morning hours of July 23 to 24, 2010, July 27 to 28, 2010, and April 10 to 11, 2013. These were periods following large rain events. The average daily flow at the treatment plant during this monitoring was 1.426 million gpd, 0.812 million gpd, and 1.155 million gpd, respectively. The actual flow over the monitoring periods, which was during the nighttime (12 a.m. to 5 a.m.), were 824 gallons per minute (1.186 million gpd), 450 gallons per minute (0.648 million gpd), and 844 gallons per minute (1.215 million gpd), respectively.

The flow in selected manholes throughout the City was measured using an ISCO Model 2150 Area Velocity Flow Module and Sensor. A portable laptop computer provided real to time indication of depth and velocity of flow used to calculate the flow rate.

The data collected during the nighttime flow monitoring were divided into large drainage basins. Flow balances were created to quantify the water entering the sanitary sewer system for discrete areas within each drainage basin. Summaries of the data collected during the nighttime flow monitoring sessions are described below.

<u>July, 2010 Findings</u>

1. Industrial Park and Portland Sanitary District

   Another separate section of sanitary sewer drains directly into the wastewater treatment plant, collecting the Industrial Park and the discharge from the Portland Sanitary District lift station. This sanitary sewer is newer near the Industrial Drive area, however is known to have low spots along Commercial Avenue. The sewer passes through a commercial building area, agriculture use land and under a drainage ditch before entering the wastewater treatment plant.

   Flow monitoring was performed during the July 23 to 24 monitoring period. A flow rate of 63 to 67 gallons per minute was measured at the wastewater treatment plant manhole coming from the Industrial Park. The manhole itself leaked at a rate estimated between 5 and 10 gallons per minute. A flow rate of 16 gallons per minute was measured at the end of Industrial Lane in the Industrial Park. The Portland Sanitary District lift station flows increased by approximately 100% during the monitoring period. Because of this increase in flow during this monitoring period, excessive pumping from the lift station may have skewed the

measurements at the wastewater treatment plant as compared with the manhole on Industrial Drive.

Flow balances revealed an increase of 47 to 51 gallons per minute between the manhole at the wastewater treatment plant and Manhole 70 on Industrial Lane, although this may have been skewed by the Portland Lift Station.

The remainder of the sanitary sewer system drains to a 21-inch PVC interceptor sewer which follows Hendricks Street. The interceptor sewer collects from Madison Street east of Hendricks Street and Madison Street West of Hendricks Street. For the remainder of this report Eastern Madison Street will refer to the sanitary sewer collection system east of Hendricks Street and Western Madison Street will refer to the sanitary sewer collection system west of Hendricks Street, regardless of street names.

2. Mill Street and Cleveland Street

Mill Street and Cleveland Street sanitary sewer systems drain directly into the wastewater treatment plant, servicing an older neighborhood. The furthest upstream portion of the Mill Street sewer system has been slip lined according records maintained by the City. An inverted siphon is located on Cleveland Street, passing under a drainage ditch.

Flow monitoring was performed early during the July 23 to 24 monitoring period, while the treatment plant flow was near 860 gallons per minute. A flow rate of 94 gallons per minute was measured entering the treatment plant in manhole (Manhole) 4 from this drainage area. Flow was measured at the convergence of Cleveland Street onto Mill Street in Manhole 6, with 20 to 28 gallons per minute from Cleveland Street and 45 gallons per minute upstream from Mill Street. Because of low velocity and possible backflow from Cleveland Street up Mill Street, the Mill Street measurement could be inaccurate. The 24 to 29 gallons per minute rate was measured upstream of the inverted siphon on Cleveland Street in Manhole 8.

Flow balances between each of the manholes revealed an increase of 21 to 29 gallons per minute between Manhole 6 and the wastewater treatment plant, an increase of 45 gallons per minute upstream of Manhole 6 on Mill Street, an increase of 0 to 9 gallons per minute between Manhole 6 and Manhole 8 on Cleveland Street, and an increase of 24 to 29 gallons per minute upstream of Manhole 8 on Cleveland Street.

3. Eastern Madison Street

The Eastern Madison sanitary sewer drains Rood Avenue, eastern Pierce Street, Railroad Avenue, Gregor Street, Grove Street and State Trunk Highway 19 and 87, Hickory Lane, and Maple Drive and associated drainage area (Oak Hill Subdivision). Nighttime flow monitoring was performed in this area during the July 23 to 24, 2010 flow monitoring period. A portion of State Trunk Highway NM and eastern Pierce Street and East Madison Street between Grove Street and Maple Drive have been televised. The Eastern Madison drainage area was further subdivided for nighttime flow monitoring. The divisions included the Oak Hill subdivision, Hickory Lane, Grove Street and State Trunk Highway 89, Railroad Avenue, and Rood Avenue and eastern Pierce Street.

Flow was unable to be measured at the corner of Maple Dr. and Oak Street in Manhole 48, on Grove Street in Manhole 30, and at the corner of Hickory Lane and East Madison Street in Manhole 43. Flow was estimated to be between 5 and 10 gallons per minute at Maple Drive and Grove Street, but was unable to be estimated at Hickory Lane (due to low velocity). A flow rate of 91 to 99 gallons per minute was measured from East Madison Street (including Grove Street, Hickory Lane, and the Oak Hill Subdivision) at the corner of Railroad Avenue and East Madison Street in Manhole 26. Flow was not measured coming from Railroad Avenue at this point because the sanitary sewer dropped into the manhole (flow measurement with the ISCO flow meter will not work in this situation). Flow was measured in Manhole 27 on Railroad Avenue to be 23 gallons per minute. An additional flow entered the manhole through a 4-inch pipe from the trailer park to the west of Railroad Avenue but was not able to be measured.

No flow measurement was able to be obtained from Rood Avenue in Manhole 16 during the flow monitoring period. Rood Avenue is known to have a problem with storm sewer backups which flood the roadway and cover sanitary sewer manholes. The abandoned shoe factory on eastern Pierce Street, which flows into Rood Avenue, is suspect of having roof drains connected to the sanitary sewer system. A flow rate of 152 gallons per minute was measured in Manhole 14 at the corner of Madison Street and Hendricks Street from East Madison Street.

Flow balances revealed an estimated increase in flow of 71 to 89 gallons per minute (assuming 5 to 10 gallon per minute contribution from Grove Street and Maple Drive) between Manhole 26 on East Madison Street and Manhole 48 on Maple Drive, including Hickory Lane. Railroad Avenue was found to contribute 23 gallons per minute upstream of Manhole 27, with a significant (but immeasurable) contribution from the trailer park to the west.