Chapter 9: Sanitary Sewer Plan

Background

The Sanitary Sewer Plan evaluates the adequacy of the existing sanitary sewer system, projects sanitary sewer flows from future development, and recommends future improvements to accommodate future flows. This plan is used by both the City locally and the Metropolitan Council regionally for long-term planning of sanitary sewer infrastructure.

In 1984, the City of Savage prepared a Comprehensive Sanitary Sewer Plan describing the expansion of the municipal sewer system to serve the ultimate development of the City. In 2004, the City submitted an updated sewer plan that was found to meet the Metropolitan Council's Tier II requirements. Most recently, in 2009, the City submitted another update to the sewer plan that was also found to meet the Metropolitan Council's requirements.

The initial sanitary sewer trunk for the City was constructed in the 1970s and was sized to accommodate the urbanization of that portion of the City lying generally east of CSAH 27 (Dakota Avenue). The trunk system has since expanded to serve most of the City, with the exception of the far southwest corner. Figure 9-1 illustrates the existing service area, and Figure 9-2 illustrates the locations of City sanitary sewers and lift stations and Metropolitan Council Environmental Services (MCES) interceptor sewers.

Currently, the City has approximately 134 miles of sanitary sewer lines providing services to households and businesses. Trunk sewers and lift stations collect the wastewater and deliver it to the MCES interceptor sewers. The primary MCES interceptor sewer serving the City of Savage is the Savage Interceptor. The smaller Southeast Sanitary District flows into Burnsville and into the Southwest Interceptor. These two MCES Interceptors flow north and eastward, where they connect with the MSB 7030 Interceptor, which delivers the waste to the MCES Seneca Wastewater Treatment Plant in Eagan. A small portion of the City, identified as the Southwest Sanitary District, flows into the Prior Lake Interceptor and ultimately to the MCES Blue Lake Wastewater Treatment Plant in Shakopee.

EXISTING SANITARY SEWER SYSTEM

Sanitary Sewer Service Area

Except for the far southwestern portion of the city, all of Savage has access to public sanitary sewer. The trunk sanitary sewer system is planned to be expanded to provide service to the unserved areas. Because the entire City is located within the Metropolitan Urban Service Area (MUSA), MCES will provide regional collection and treatment for all future development within the city.

The City sanitary sewer system has been divided into four (4) main districts and thirty-eight (38) sub-districts to assist with flow allocations and capacity analysis. The existing districts and sub-districts are shown in Figure 9-1.

Intercommunity Flows

The City has several intercommunity sanitary sewer flows with neighboring communities. These service areas are summarized in Table 9-1 below.

Table 9-1. Intercommunity Flows

Neighboring Community	Flow INTO Savage	Flow OUT OF Savage
Burnsville	30 homes (Rose Bluff)	N/A
Prior Lake	N/A	120 homes, 1 business (Cates Lake, Country Court)

Gravity Sewers

The system's gravity sewers include 8-inch through 36-inch diameter pipe. Much of the system is polyvinyl chloride (PVC) pipe, although other pipe materials include reinforced concrete (RCP), vitrified clay (VCP), ductile iron (DIP), and centrifugally cast fiberglass-reinforced polymer mortar (CCFRPM). The trunk gravity sewers are shown in Figure 9-2.

Figure 9-1: Existing Sanitary Sewer Districts

Existing Wastewater Flows

The MCES measures wastewater flows within the City of Savage utilizing flow meters. Meters M405 and M406 measure the majority of the flow generated in the City. M405 measures the wastewater flow generated in the Southeast district, and M406 measures the wastewater flow generated in both the West and East districts. Historical flow data from these meters is shown in Tables 9-2 and 9-3.

The total average daily flow generated in Savage from 2013-2017 was approximately 2.16 million gallons per day (MGD). This total is slightly greater than the sum of the average daily flows below because the wastewater from sub-districts SW-1 and SW-2 flows unmetered into the City of Prior Lake.

Table 9-2. M405 Historical Wastewater Flow

Year	Average Daily Flow (MGD)	Peak Flow (MGD)	Peak Factor
2013	0.246	0.612	2.48
2014	0.252	0.703	2.79
2015	0.248	0.613	2.47
2016	0.248	0.606	2.45
2017	0.246	0.623	2.53
5-Year Average	**0.248**	**0.631**	**2.54**

Table 9-3. M406 Historical Wastewater Flow

Year	Average Daily Flow (MGD)	Peak Flow (MGD)	Peak Factor
2013	1.815	5.599	3.09
2014	1.833	5.776	3.15
2015	1.785	5.723	3.21
2016	1.870	6.042	3.23
2017	1.905	4.701	2.47
5-Year Average	**1.841**	**5.568**	**3.03**

Existing Lift Stations

The City sanitary sewer system includes fourteen (14) lift stations. The installation years, pumping capacities, peak hourly flows, and existing residual capacities of each lift station are provided in Table 9-4. The firm pumping capacity, which should equal or exceed the peak hourly sanitary flow, is the capacity of the station with its largest pump out of service. The firm capacity for the lift stations equipped with more than two pumps was calculated using SewerCAD V8i, a sewer modeling software. The location of each lift station is indicated in Figure 9-2.

Table 9-4. Existing Lift Station Summary

Lift Station	Year Built	No. of Pumps	Individual Pump Design Capacity (gpm)	Firm Pumping Capacity (gpm)	Peak Flow (gpm)	Residual Capacity (%)
139th St	1971	2	110	110	4	96
Natchez	1979	2	50	50	17	67
Utica	1979	3	275	350	203	42
Ottawa	1979	2	50	50	10	80
Hwy 13	1984	2	600	600	374	38
Deer Run	1985	2	100	100	9	91
River Bend	1988	3	1,000	1,700	438	74
Steiner	1992	2	720	720	281	61
Bunge	1992	2	150	150	115	23
Cty Rd 42	1993	2	1,000	1,000	264	74
154th St	1996	2	380	380	179	53
Downtown	2000	3	560	850	451	47
Oak Hills	2003	2	400	400	32	92
Big Sky	2017	3	1,040	2,300*	53	98

** Dual forcemains*

Existing Trunk Sewers

A trunk main is a sewer pipe having a diameter greater than eight (8) inches. It is important to ensure that trunk mains are sized properly since they convey large quantities of flow. Trunk mains throughout the City of Savage were identified, and their capacities were analyzed with SewerCAD. The size, capacity, sub-district being served by each trunk main, existing peak hourly flows, and existing residual capacities are listed in Table 9-5. Residual capacities obtained from the SewerCAD model are shown in Figure 9-3.

Table 9-5. Trunk Sewer Summary

Sub-District	Diameter (in)	Capacity (gpm)	Peak Flow (gpm)*	Residual Capacity (%)
W-15	15	1,095	132	88
W-14	33	6,337	259	96
W-13	33	4,434	332	93
W-12	33	4,118	677	84
W-11	15	1,321	220	83
W-10	36	6,746	1,196	82
W-9	18	2,687	210	92
W-8	18	5,536	224	96
W-6	15	9,024	128	99
W-4	12	619	174	72
W-5	36	5,184	2,177	58
E-17	10	609	161	74
E-16	15	2,673	213	92
E-9	12	639	346	46
E-7	18	2,033	493	76
E-5	12	856	576	33
E-8	15	1,381	304	78
E-6	12	1,113	458	59
E-4	10	580	64	89
E-1	36	6,693	3,875	42

**Peak hourly flow in trunk mains includes all wastewater flows collected in upstream sub-districts.*

Figure 9-2: Existing Sanitary Sewer System

Figure 9-3: Existing Residual Capacity

Individual Sewage Treatment Systems

Many homes in Savage are served by individual sewage treatment systems (ISTS), also known as septic systems. As of October 2018, there were a total of 106 active ISTS within the City. Two (2) of these systems have been identified as non-conforming and are planned for repair or abandonment. Scott County administers the regulation and oversight of these systems.

Connection to City utilities is governed by City Code Title 5, Chapter 53, excerpted below. Generally, if a dwelling is located within 200 feet of a new sanitary sewer or water main, the property owner must connect after receiving notification from the City Clerk. If an ISTS was installed or replaced prior to the availability of public sewer service then it may be allowed to continue in operation if the property owner obtains a waiver from the City in accordance with Section 53.02.

> *§ 53.01 SEWER SERVICE CONNECTIONS.*
> *(A) Connection required, notice. When property abuts or has access to any public street or alley and a dwelling on the property is within 200 feet of the proposed construction along which sewer mains have been constructed, the owner of any dwelling or commercial establishment on the property shall connect with the sanitary sewer in accordance with the provisions of this chapter within 90 days after the date of mailing or delivering official notice to do so. The notice shall be given to the owner or occupant in writing by the City Clerk on order of the Council.*

Community Treatment Systems

There are no public or private community treatment system within the City of Savage. All properties within the City are served by the public collection system or by ISTS.

Figure 9-4: Individual Sewage Treatment Systems

Sewage Generation Rates

The City of Savage's zoning policy encourages development in "planned developments." These developments result in housing densities on the order of 2.5 to 11 units per acre. Table 9-6 displays the sanitary sewer generation rates used in this Sanitary Sewer Plan. These generation rates are based on the existing land use densities of the City of Savage.

Table 9-6. Assumed Sanitary Sewer Flows by Land Use Type

Land Use	Average Flow (gallons/acre/day)
Single Family Residential (SFR)	650
Med-Density Residential (MDR)	950
High-Density Residential (HDR)	1,250
Mixed Use	1,500
Commercial	800
Industrial & Office	800
Business Park	800
Institutional	800
Park	50

Historical flow meter data was used in conjunction with the assumed sewer generation rates listed in Table 9-6 to allocate existing wastewater flows to each district and sub-district. These flows were entered into the SewerCAD model to evaluate existing trunk sewer capacity. The residual capacities obtained from modeling are displayed in Figure 9-3. The assumed sewer generation rates shown in Table 9-6 were also applied to future land use designations to project future wastewater flows.

Flow Variation Factors

To ensure that the sanitary sewer system is capable of handling flow fluctuations throughout the day and during rainfall events, peak flow factors are applied based on average flows. Pipes that serve smaller areas are more likely to experience larger fluctuations in flow. Therefore, the peak factor decreases as average flow increases. The MCES flow variation factors for sewer design are listed in Table 9-7 below. These factors were used to calculate future peak hourly flows. Existing peak hourly flows were calculated using the peak factors obtained from MCES meter data.

Table 9-7. MCES Flow Variation Factors for Sewer Design

Average Flow (MGD)	Peak Hourly Flow Factor
0.00 to 0.11	4.0
0.12 to 0.18	3.9
0.19 to 0.23	3.8
0.24 to 0.29	3.7
0.30 to 0.39	3.6
0.40 to 0.49	3.5
0.50 to 0.64	3.4
0.65 to 0.79	3.3
0.80 to 0.99	3.2
1.00 to 1.19	3.1
1.20 to 1.49	3.0
1.50 to 1.89	2.9

Average Flow (MGD)	Peak Hourly Flow Factor
1.90 to 2.29	2.8
2.30 to 2.89	2.7
2.90 to 3.49	2.6
3.50 to 4.19	2.5
4.20 to 5.09	2.4
5.10 to 6.39	2.3
6.40 to 7.99	2.2
8.00 to 10.39	2.1
10.40 to 13.49	2.0
13.50 to 17.99	1.9
18.00 to 29.99	1.8
Over 30.00	1.7

Projected Population and Sanitary Sewer Flow

Projected Population

The Metropolitan Council projects populations and sanitary sewer flows for each community in the Metropolitan Area. The Metropolitan Council's population projections for the City of Savage are listed in Table 9-8 below.

Table 9-8. Population Projections

Year	Total			Sewered		
	Population	Households	Employment	Population	Households	Employment
2010	26,911	9,116	6,753	24,577	8,305	6,135
2020	33,400	11,600	8,100	31,070	10,790	7,480
2030	37,400	13,000	8,800	35,070	12,190	8,180
2040	41,100	14,300	9,400	38,770	13,490	8,780

The sewered population projections have been allocated to the MCES Meter Service Areas within the City of Savage as listed in Table 9-9 below. The vast majority of growth is expected to occur within Metershed M406.

Table 9-9. Projections by Meter Service Area & Interceptor

Meter	M404 (Prior Lake)*			M405 (Burnsville)			M406 (MCES Lift Station in Savage)		
Interceptor	7120			3-BV-39			8560		
Year	Popn.	Hhds.	Empl.	Popn.	Hhds.	Empl.	Popn.	Hhds.	Empl.
2010	324	120	5	3,524	1,305	10	20,729	6,880	6,120
2020	338	125	5	3,532	1,308	10	27,200	9,357	7,465
2030	351	130	5	3,542	1,312	10	31,177	10,748	8,165
2040	0	0	0	3,553	1,316	10	35,217	12,174	8,770

**The flows generated in SW-1 and SW-2, which contribute to the flow metered in M404, will be rerouted to flow towards the Big Sky Lift Station. When this happens, the flows generated within SW-1 and SW-2 will be metered by MCES Meter M406, instead of MCES Meter M404. This is expected to occur between 2030 and 2040.*

Projected Wastewater Flows

Table 9-10 lists the projected total average wastewater flow for the City of Savage from the MCES Water Resources Policy Plan (WRPP) and this Sanitary Sewer Plan. The projections in this report are greater than the MCES projections since they rely on flow estimates for each parcel of developable land rather than population growth. Additionally, it is anticipated that flow generated in the Credit River West Sewer District (CRWSD), located immediately south of Savage, will discharge to the Big Sky lift station as indicated in the Big Sky Station Feasibility Study completed in 2016. Thus, this flow was included in the future flow projections for the Western district. The flow generated by the CRWSD is expected to be 0.7 MGD on average in 2040, based on the capacity of an 18-inch trunk sewer.

Table 9-10. Total Average Wastewater Projections

Projection Source	2020 Projected Flow (MGD)	2030 Projected Flow (MGD)	2040 Projected Flow (MGD)
MCES WRPP	2.35	2.54	2.71
Sanitary Sewer Plan	2.30	3.01	3.72

Future flow projections were divided by sewer district and are shown in Table 9-11. Note that although there will be a minor increase in the wastewater generated in the Southeast and Southwest districts given the projections shown in Table 9-9, this flow increase is not perceptible in Table 9-11 since the average wastewater flows are expressed in million gallons per day.

Table 9-11. Average Wastewater Projections by Sewer District

Sewer District	2020 Projected Flow (MGD)	2030 Projected Flow (MGD)	2040 Projected Flow (MGD)
East	0.82	0.91	1.00
Southeast	0.25	0.25	0.25
Southwest	0.07	0.07	0.07
West	1.16	1.78	2.40

Proposed Sanitary Sewer System

The sanitary sewer system will require expansion to serve future development. The proposed future sanitary sewer districts are shown in Figure 9-5 and the proposed future sanitary sewer system is shown in Figure 9-6. The new trunk sewers were sized and located based on the areas that the City expects to develop. The exact alignment of the proposed trunk sewers and lift stations may change during the design phase of each project. The purpose of these recommendations is to provide the City with an overall plan for large infrastructure additions and replacements. Future wastewater flows generated throughout the City of Savage were calculated using the assumed sewer generation listed under Table 9-6 and future land use data provided by the City. Recommended peak factors displayed in Table 9-7 were used to estimate future peak hourly flows.

Lift Station Analysis

The SewerCAD model was used to evaluate the residual capacity of each lift station. The peak flows and residual capacities of City lift stations are listed in Table 9-12 below. The majority of the lift stations are projected to have adequate capacity through full build out development.

Table 9-12. Future Lift Station Capacity Analysis

Lift Station	Firm Pumping Capacity (gpm)	Future Peak Hourly Flow (gpm)	Residual Capacity (%)
139th St	110	6	95
Natchez	50	22	56
Utica	350	280	20
Ottawa	50	13	73
Hwy 13	600	619	-3
Deer Run	100	12	88
River Bend	1,700	647	62
Steiner	720	410	43
Bunge	150	152	-2
Cty Rd 42	1,000	340	66
Downtown	850	632	26
Oak Hills	400	52	87
Big Sky	2,300*	2,141**	7

** Dual forcemains*

*** The Big Sky Lift Station has capacity for rerouted flows from SW-1 and SW-2, as well as wastewater collected in the CRWSD. The future peak hourly flow reflects these additions.*

As seen in Table 9-12, the future peak hourly flows at two lift stations (Hwy 13 and Bunge) may exceed their firm pumping capacities. It is recommended that the City review runtime records and monitor flows at these lift stations as development progresses within their service areas.

The Hwy 13 Lift Station has a small wet well (6-foot diameter) relative to its capacity, which causes the pumps to have short pumping cycles. Due to the short pumping cycles, the pumps require frequent maintenance and replacement. Given the future flows forecasted for this lift station's service area, consideration should be given to upsizing the lift station's wet well in the future.

Trunk Sewer Analysis

The SewerCAD model was used to evaluate the estimated future peak hourly sanitary flow for each trunk sanitary sewer (larger than 8-inch) in the system. These peak flows and the subsequent residual capacities in each trunk are listed in Table 9-12 below. All trunk sewers exhibit adequate capacity through full build out development. The projected residual capacity of the future sanitary sewer system is shown in Figure 9-7.

Table 9-12. Trunk Sewer Capacity Analysis

Trunk Main Location	Diameter (in)	Capacity (gpm)	Future Peak Hourly Flow (gpm)	Residual Capacity (%)
W-15	15	1,095	331	70
W-14	33	6,337	514	92
W-13*	33	4,434	2,524	43
W-12*	33	4,118	2,803	32
W-11	15	1,321	317	76
W-10*	36	6,746	3,284	51
W-9	18	2,687	316	88
W-8	18	5,536	325	94
W-6	15	9,024	211	98
W-4	12	619	279	55
W-5*	36	5,184	4,630	11
E-17	10	609	213	65
E-16	15	2,673	282	89
E-9	12	639	454	29
E-7	18	2,033	610	70
E-5	12	856	712	17
E-8	15	1,381	403	71
E-6	12	1,113	614	45
E-4	10	580	162	72
E-1*	36	6,693	6,266	6

** These trunks will convey the flow generated in SW-1, SW-2, and the CRWSD in the future since those sub-districts will likely be rerouted to flow by gravity to the Big Sky Lift Station. Note that these trunks are not currently conveying the flow generated in those sub-districts.*

It is recommended that the City reviews flows and capacities in three parts of the trunk sanitary sewer system as development progresses: (1) the 36-inch trunks immediately upstream of the MCES Lift Station, (2) the 21-inch trunks immediately downstream of the Big Sky Lift Station, and (3) the 15-inch trunk located downstream of the CR42 Lift Station.

MCES Interceptor Facility Forecasts

The projected sanitary flows to the MCES Meters and Interceptors that serve the City of Savage are listed in Table 9-13 below. Note that these flow projections include only the flow contributed from the City of Savage. Future flows to the Blue Lake WWTP from the City of Savage may be eliminated if the City decides the reroute the flows from SW-1 and SW-2 to the Big Sky Lift Station. If this were to occur, those flows would then be conveyed to the Seneca WWTP in Eagan. Future flows in Table 9-13 reflect this scenario.

Table 9-13. Projected MCES Facility Flows

MCES Meter	MCES Interceptor	MCES WWTP	Future Average Flow (MGD)	Future Peak Hourly Flow (MGD)
M404 (Prior Lake)	7120	Blue Lake WWTP	0	0
M405 (Burnsville)	3-BV-39	Seneca WWTP	0.252	0.932
M406 (MCES Lift Station in Savage)	L66, 8560	Seneca WWTP	3.470	9.022

Figure 9-5: Future Sanitary Sewer Districts

Figure 9-6: Future Sanitary Sewer System

Figure 9-7: Future Residual Capacity

INFLOW/INFILTRATION (I/I)

I/I Background

Inflow is clear water, typically stormwater, which enters the sewer system through broken manhole covers, sewer cleanouts, sump pumps, foundation drains, and rain leaders. Infiltration is water, typically groundwater, which leaks into the sewer system through cracks in the sewer mains, laterals, joints, and manholes.

I/I consumes available capacity in the wastewater collection system and increases the flow into treatment facilities. In extreme cases, the added flow can cause bypasses or overflows of raw wastewater. This extra flow also requires a larger capacity in the City's collection and treatment components, which results in increased capital, operation and maintenance, and replacement costs. As a sewer system ages and deteriorates, I/I can become an increasing burden on a City's system. Therefore, it is imperative that I/I be reduced whenever it is cost effective to do so.

In 1993, the City of Savage commissioned an I/I Study. The study was completed and adopted by the City Council in 1995. A complete study was forwarded to MCES shortly after City Council adoption. The I/I Study found two main sources of I/I. One source is the old sewer pipes in the Downtown District. The other source was determined to be illegal sump pump connections. The report recommended addressing the deficient sewer pipes in the Downtown District through an Infrastructure Replacement Program and the illegal sump pump program through the adoption of a "tough" sump pump ordinance and an aggressive inspection program. A complete accounting of the I/I reduction activities completed by the City over the last twenty years is provided in the I/I Reduction section that follows.

The City of Savage prohibits the discharge of stormwater to the sanitary sewer system and requires the disconnection of existing I/I sources per the City Code excerpted below. The majority of sump pump connections have been eliminated through the adoption of ordinance, extensive public relations campaigns, and comprehensive inspection programs. The City requires sump pumps to be installed prior to final occupancy, thereby assuring that the installation will be inspected by City staff.

§ 53.05 PROHIBITION OF CLEAN WATER DISCHARGES INTO THE SANITARY SEWER SYSTEM.

...

(B) Definition and method. No water from any roof, surface, groundwater sump pump, footing tile, swimming pool or other natural precipitation water shall be discharged into the sanitary sewer system. Dwellings and other buildings and structures which require, because of infiltration of water into basements, crawl spaces and the like, a sump pump discharge system, shall have a permanently installed discharge line which shall not at any time discharge water into the sanitary sewer system, except as provided herein. A permanent installation shall be one which provides for year-round surface discharge capability to the outside of the dwelling, building or structure, or is connected to the city storm sewer. Permanently installed discharge lines discharging water to the surface shall be terminated on private property prior to any curb, gutter, or street. A permanent installation shall consist of a rigid discharge line without valving or quick connections for altering the path of discharge, and if connections for altering the path of discharge, and if connected to the city storm sewer line, include a check valve and an air gap located in a small diameter structure as shown in the city's standards plates. The Utility Services Superintendent or his or her designated agent shall determine the appropriate method for providing a permanent installation to avoid flooding of adjacent properties, sidewalks, streets and the like. A permanent sump pump discharge system may not create a public nuisance under §95.01(B) of the city code.

(C) Disconnection. Beginning April 1, 1996, any person, firm or corporation having a roof surface, groundwater sump pump, footing tile or swimming pool, or unpolluted industrial waste now connected and/or discharging into the sanitary sewer system shall disconnect and/or remove same. Any disconnects or openings in the sanitary sewer shall be closed or repaired in an effective, approved manner, as approved by the Utility Services Superintendent or his or her designated agent.

I/I Analysis

The sanitary sewer system currently consists of 129 miles of gravity main, fourteen (14) lift stations, and 6.1 miles of forcemain. Approximately five percent of the residential housing in the City was constructed before 1970. All homes in the City were inspected in the late 1990s to eliminate illicit sump pump connections. I/I reduction activities are discussed in greater detail in the following section.

The amount of clearwater flow within the City was estimated by calculating the average annual and peak month I/I rates, equal to the average wastewater flow minus the base wastewater flow, using data from 2013-2017. The average flow, both annual and monthly, was calculated from MCES meter data. The peak month flow was determined for each year from 2013-2017, and then those peak month flows were averaged to give the value listed in Table 9-14. The base flow was approximated as the lowest monthly average flow within each year.

Table 9-14. Estimated I/I Rate

Metershed	M405	M406
Average Flow (MGD)	0.248	1.841
Peak Month Flow (MGD)	0.278	2.097
Base Flow (MGD)	0.232	1.713
Average Annual I/I Rate (MGD (%))	0.016 (7%)	0.128 (7%)
Peak Month I/I Rate (MGD (%))	0.046 (17%)	0.384 (17%)

I/I Reduction

From 1995-2005, the City of Savage took the following corrective steps to address I/I in the sewer system:

- In 1996, the City adopted a sump pump ordinance, as excerpted previously.
- In 1996, the City hired a consultant to inspect every home in Savage for sump pump connections to the sanitary sewer system. The final report was completed in 1997. The inspections identified several areas where the City must install storm sewers or drain tiles to provide an outlet for sump pump discharges prior to homeowner disconnections. Two projects were completed in 1997/98 in which sump pump discharge lines were connected to the City's storm sewer system.
- In 1998, a feasibility report and planning study was completed for the Downtown area (the Hamilton District). The City Council embarked on a multi-year, phased project to replace all the infrastructure downtown and provide development/redevelopment opportunities of the commercial downtown area that started in 2000. All aging sanitary sewer pipes will be replaced as part of this program and an extensive storm system installed, with water quality ponding elements, to capture all surface runoff.
- An extensive public relations campaign was completed regarding sump pumps, including newspaper articles, direct mailings, two public informational meetings and an educational video that ran weekly on the City's local cable access channel.
- As part of the sump pump program, the City of Savage applied for and received an MCES grant for I/I reduction and subsequently entered into an agreement with MCES for follow-up inspections and monitoring of the program results for five years.
- In October of 2005 the City had a study prepared evaluating I/I near Xenwood Avenue/TH 13. In conjunction with the TH 13 Frontage Road project the City abandoned a significant portion of the sewer main that was contributing to I/I in this area.

More recently, the City's I/I reduction efforts have shifted to rehabilitation of the collection system, both public and private. The I/I reduction projects completed in the last ten years are listed in Table 9-15 below.

Table 9-15. I/I Projects Completed

Year	Approximate Location(s)	Description	Cost
2009	Alabama Ave, Zarthan Ave	Adjust SSMH Casting Reconstruct SSMH	$13,230.00
2010	Inglewood Ave, Lynn Ave, Glenhurst Ave	Adjust SSMH Casting Reconstruct SSMH	$44,946.50
2011	Alabama Ave, Brunswick Ave, Huntington Ave, 141st St	Adjust SSMH Casting	$39,655.00
2012	132nd St, 134th St, 135th St, Natchez Ave, Ottawa Ave, Monterrey Ave.	Adjust SSMH Casting Repair SSMH Replace Sewers and Services Televise Sewers	$329,343.69
2013	Quentin Ave, Monterrey Ave, Joppa Ave, Glenhurst Ave, Dakota Ave	Adjust SSMH Casting Repair SSMH Replace Sewers and Services Televise Sewers	$335,426.62
2014	Connelly Pkwy	Adjust SSMH Casting Repair SSMH	$10,560.00
2015	Quentin Ave, 139th St, 140th St	Adjust SSMH Casting Repair SSMH Replace Sewers and Services	$68,051.00
2016	Connelly Pkwy, Boone Ave	Adjust SSMH Casting Repair SSMH	$29,325.00
2017	136th St, 145th St, South Park Dr, Zinran Ave	Adjust SSMH Casting Repair SSMH Seal SSMH Joints	$226,655.00
2018	Dufferin Dr, Ottawa Ave, River Crossing, Vernon Ave	Adjust SSMH Casting Seal SSMH Joints	$164,508.32
Total			$1,261,701.13

SSMH = sanitary sewer manhole

I/I Implementation

The City has invested approximately $126,000 annually in I/I reduction over the last ten years and plans comparable investment going forward. Over the next ten (10) years, the City plans to implement the sanitary sewer rehabilitation projects listed in Table 9-16 below. The rehabilitation and replacement work that has been completed over the last ten years has resulted in a reduction of I/I, and the City of Savage is committed to further eliminating sources of I/I in its sanitary sewer system.

Table 9-16. I/I Implementation

Year	Approximate Location(s)	Description
2019	Glendale Rd, Bridgewater Dr, 150th St, Hampshire Ave	Televise Sewers Adjust SSMH Casting Repair SSMH Seal SSMH Joints Replace Sewers and Services
2020	Yosemite Ave, W Hidden Valley Dr, Dufferin Dr	
2021	137th St, 154th St, Aquila Ave	
2022	South Park Dr, O'Connell Rd, Kipling Ave, Joppa Ave	
2023	Flag Ave, Eagle Creek Pkwy, Credit View Dr, River Oak Dr, Allen Dr	
2024	125th St, 126th St	
2025	Carriage Hill Rd, Foxberry Rd, Heatherton Ridge Dr	
2026	Wyoming Ave, Preserve Tr, Yosemite Ave, Woodhill Dr	
2027	Hwy 101 Frontage Rd, Boone Ave, 126th St, Quentin Ave, 143rd St	
2028	Taylor Dr, Quebec Ave, Nevada Ave, Sumter Ave, Virginia Ave	

SSMH = sanitary sewer manhole

Proposed Improvements

The sanitary sewer system will require trunk extensions to serve the remaining unserved portions of the City. The estimated costs of these improvements, as well as planned maintenance and rehabilitation work, are listed in Table 9-17 below. The estimated costs are in 2018 dollars, include only trunk oversizing (the incremental cost above 8-inch pipe), and include a construction contingency and indirect costs.

Table 9-17. Proposed Improvements

Year	Description	Estimated Cost
Annual	I/I Reduction	Approx. $126,000
TBD	W-16 Trunk Main Extension	$320,000
TBD	W-5 Trunk Main Extension	$150,000
TBD	W-14 Trunk Main Extension	$110,000
TBD	Hwy 13 LS Wet Well Expansion	$280,000
TBD	154th St Lift Station Abandonment	$25,000

Outcomes

The analysis provided in this Comprehensive Sanitary Sewer Plan is intended to provide the City of Savage and the Metropolitan Council assistance in planning for wastewater collection and treatment. It is anticipated that the design criteria and flow projections will be referenced for utility planning as development continues. Tables and figures can be utilized to create budget-level estimates and schematic representations of infrastructure improvements, while specific sizing and routing will need to be determined during the design phase of individual projects.