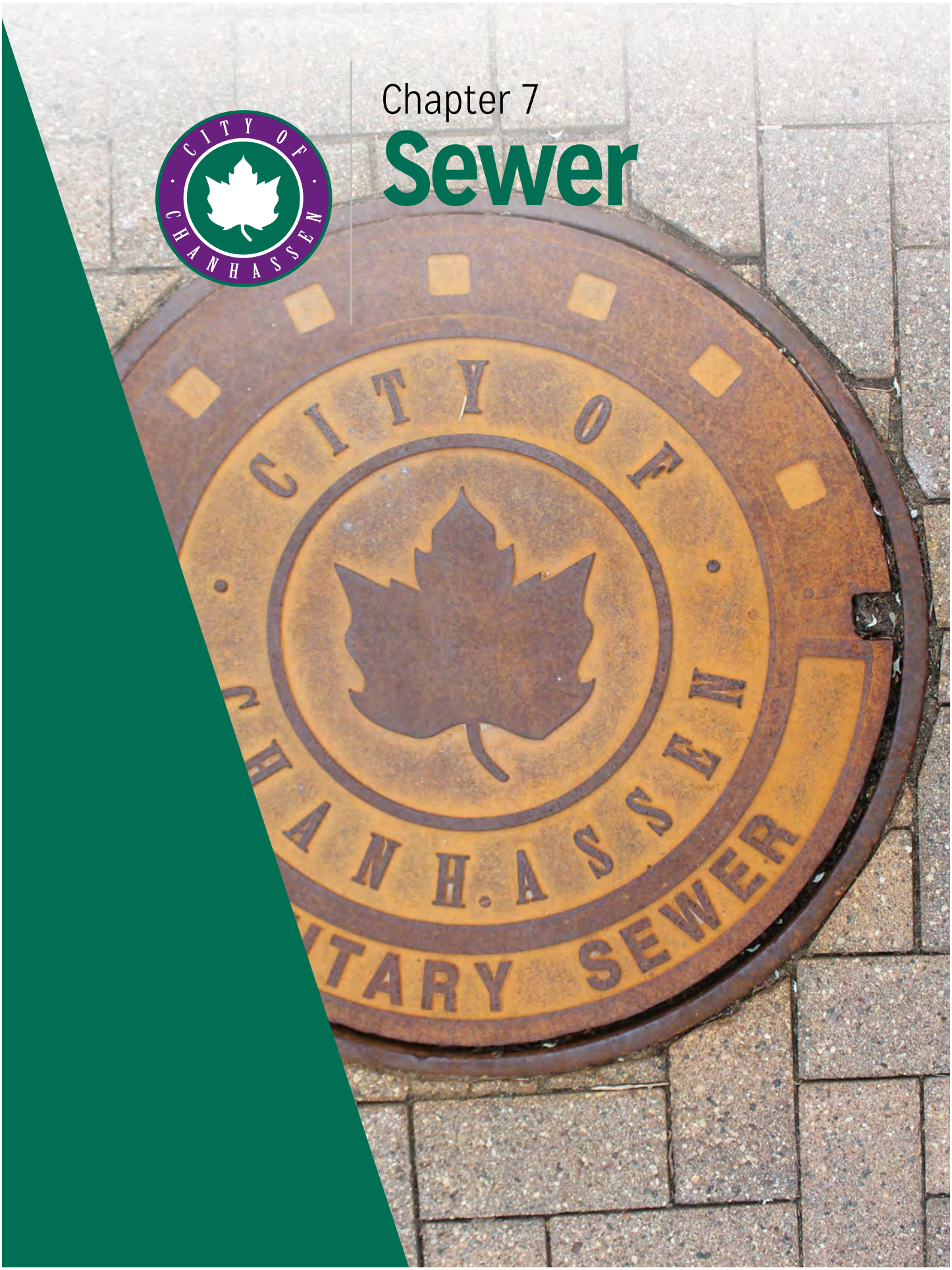
Chapter 7

Sewer



7 | Sewer

7.1 | Executive Summary

The City of Chanhassen's Comprehensive Sanitary Sewer System Plan (plan) is intended to be an update to the city's previous Comprehensive Sewer Plan dated 2008 and to assist the City of Chanhassen in meeting its short-term and long-term sanitary sewer needs. The plan is also intended to serve as an inventory of the city's existing sanitary sewer facilities and an updated guide for completing the future sanitary sewer trunk system improvements.

The city is divided into eight major sanitary sewer service areas or districts as shown in Figure 3.2 in Appendix A. For the purpose of sanitary sewer planning, these major districts are further divided into sub-districts based on both lift station and gravity sewer service areas as shown in Figure 3.3 in Appendix A. Each sub-district contributes wastewater flow to the sanitary sewer collection system dependent upon a variety of parameters. These parameters include but are not limited to land use, population density, wastewater generation rates, development restrictions, wetlands and dedicated green space.

Approximate future trunk facility locations were determined based on the topography of undeveloped areas. An objective to planning the trunk sanitary sewer system is to minimize the number of trunk lift stations, while keeping the maximum depth of gravity sewers to realistic depths. The existing and proposed system layout is also shown on Figure 3.4. The system layout is general in nature and exact pipe alignments and lift station locations will be determined by the actual conditions at the time of final design. It is important that the general overall concept and sizing plan is utilized to assure an economical and adequate future system.

A 22-year capital improvement plan (CIP) was developed for the completion of the trunk system. These trunk facilities include all gravity sewer mains for each sub-district, lift stations, and force mains. The CIP includes costs for each trunk improvement project; however, the approximate trunk costs do not include the cost of installing lateral sewers for development. The cost for lateral improvements would be funded directly through assessments to the development or redevelopment. The following table summarizes the proposed 22-year CIP and associated costs:

FIGURE 7-1 | Capital Improvement Plan Summary

Improvement Description	*Extended Cost*
2018	
Inflow and Infiltration Abatement	$200,000
Sanitary Sewer Replacement	$150,000
Lift Station #18,26	$75,000
Subtotal	**$425,000**
2019	
Inflow and Infiltration Abatement	$200,000
2010 MUSA Lift Station	$1,900,000
Sanitary Sewer Replacement	$50,000
Lift Station #16	$50,000
Subtotal	**$2,200,000**
2020	
Inflow and Infiltration Abatement	$200,000
Sanitary Sewer Replacement	$250,000
Lift Station #22	$50,000
Subtotal	**$500,000**
2021	
Inflow and Infiltration Abatement	$200,000
Sanitary Sewer Replacement	$50,000
Lift Station #2,17	$75,000
Subtotal	**$325,000**
2022	
Lower Bluff Creek Trunk Sanitary Sewer	$10,800,000
Inflow and Infiltration Abatement	$200,000
Sanitary Sewer Replacement	$250,000
Lift Station #13	$50,000
Subtotal	**$11,075,000**
2023	
Inflow and Infiltration Abatement	$200,000
Sanitary Sewer Replacement	$50,000
Lift Station #1,20	$120,000
Subtotal	**$370,000**
2024	
Inflow and Infiltration Abatement	$200,000
Sanitary Sewer Replacement	$150,000
Lift Station #7	$50,000
Subtotal	**$400,000**
2025 - 2030	
2026-2030 Sanitary Sewer I/I Rehabilitation	$1,000,000
2026-2030 Sanitary Sewer Reconstruction Program	$850,000
Lift Station No. Improvements	$455,000
Subtotal	**$2,305,000**
2031 - 2035	
2031-2035 Sanitary Sewer I/I Rehabilitation	$1,000,000
2031-2035 Sanitary Reconstruction Program	$650,000
Lift Station No. Improvements	$330,000
Subtotal	**$1,980,000**
2036 - 2040	
2036-2040 Sanitary Sewer I/I Rehabilitation	$1,000,000
2036-2040 Sanitary Reconstruction Program	$850,000
Lift Station No. Improvements	$800,000
Subtotal	**$2,650,000**
Total Capital Improvements Plan Costs	***$22,445,000***

- Costs are for budgeting purposes only, and are subject to change as projects are studied, designed and constructed.
- Project Costs include 10% for construction contingency and 25% indirect costs where applicable.
- Costs are estimated based on 2017 construction costs.

7.2 | Introduction

Purpose

The purpose of this study is to provide the city with an updated plan to serve future development and to identify existing system facilities and deficiencies.

Scope

The scope of this study includes population and sanitary sewer flow projections for the City of Chanhassen through the year 2040. The potential 2040 service area was defined as areas that can be feasibly served by sanitary sewer in the future and was based on the current Land Use Plan prepared for the city's Comprehensive Plan. The 2040 service area for the city is considered to be the full build-out of the current city limits. Based on the 2040 service area, sanitary sewer districts and sub-districts were defined. Existing and future sanitary sewer flow rates were calculated for each sub-districts based on the respective land uses. Projected sanitary sewer flow rates were used to analyze the existing trunk system capacity and size future trunk system facilities.

Future trunk improvements were defined with the intention that the trunk system would serve the 2040 service area. An approximate layout of potential trunk system improvements along with an opinion of probable cost is provided. Future improvements were prioritized and incorporated into a Capital Improvement Program (CIP) based on an approximate phasing plan provided by the city staff.

Data Available

In preparing this report, the following sources of information were utilized:

- Existing Sanitary Sewer GIS Information
- Sanitary Sewer As-builts
- City of Chanhassen Comprehensive Sewer Policy Plan, dated November 2008, prepared by WSB & Associates
- City of Chanhassen Infiltration and Inflow Reduction Plan, dated June 12, 2006, prepared by WSB & Associates
- County Road 61 Corridor Plan, dated December 2, 2014, prepared by SRF Group in association with Hoisington Koegler Group
- 2040 Thrive MSP Water Resources Policy Plan

Existing City Sanitary Sewer System

Overall Sanitary Sewer Service Area

Typically, sanitary sewer systems consist of two elements; collection and treatment. Collection systems include sewer services, trunk sewer pipe, manholes, lift stations and forcemains which collect the sewer flows from private resident, commercial and industrial properties within a city. Treatment systems include the biological or chemical treatment in order to remove targeted contaminants from the wastewater.

The City of Chanhassen's existing sanitary sewer system is a collection system only; the Metropolitan Council Environmental Services (MCES) provides treatment for Chanhassen's entire sanitary sewer flows. MCES is also responsible for major trunk facilities conveying wastewater across city boundaries to regional treatment facilities. All wastewater flows from the City of Chanhassen enter the MCES interceptor system and is conveyed to the MCES Blue Lake Wastewater Treatment Plant (WWTP) located in the City of Shakopee, just north of Highway 101.

The sanitary sewer service area is defined as the area from which wastewater flows are collected by the city's regional system. The existing serviced area within the City of Chanhassen is comprised of approximately 10,600 gross acres which includes the lakes, open park land and road right-of-ways. This service area is shown in Figure 3.2. (Appendix A) Sanitary sewer service districts (districts) were developed within the city boundaries based on gravity service and lift station service areas. The existing serviced area has been developed within several districts, many of which are not fully developed.

Gravity Sanitary Sewer

The City of Chanhassen gravity sanitary sewer system consists of 6- to 36-inch diameter vitrified clay pipe (VCP), acrylonitrile butadiene styrene (ABS), reinforced concrete pipe (RCP), ductile iron pipe (DIP), and polyvinyl chloride (PVC) plastic sewer pipe. The original sanitary sewer system for the area southwest of Lotus Lake was constructed in the 1950s and consisted of two lift stations. Following the initial construction, a majority of the system was constructed in the 1970s.

The existing gravity sanitary sewer system appears to be in good overall condition; however, limited televising inspections have found root penetrations at joints, cracked pipe, leaking manholes and castings, as well as mineral deposits. In recent years, the City of Chanhassen has been identified as having excessive infiltration and inflow (I/I) by MCES. The city is currently included on the MCES "List of Communities with Observed Excess I/I, June 30, 2006." The city was also assessed a surcharge by MCES according to the adopted MCES 2007 Surcharge Policy. The City of Chanhassen developed an Infiltration and Inflow Reduction Plan dated June 12, 2006 which identified a number of gravity sanitary sewer improvements to reduce the amount of I/I entering the city's system.

The gravity sanitary sewers are directed to several MCES interceptors described in Section 4 that convey wastewater to the Blue Lake WWTP. The existing gravity sanitary sewer trunk mains (8-inch diameter and larger) and the MCES interceptor are shown on Figure 3.1. (Appendix A)

Lift Stations

The City of Chanhassen sanitary sewer system consists of 31 lift stations ranging from a small 16 gallons per minute (gpm) grinder station to a large 1,448 gpm lift station. The lift station capacities vary depending on size of service area.

The locations of the existing lift stations are shown on Figure 3.1 (Appendix A) and the following table summarizes capacity information for each of the lift stations:

FIGURE 7.2 | Existing Lift Station Information

General Lift Station Information						General Sewer Shed Information		
Lift Station Area	Year Constructed	Approx. Length of Forcemain	Pumping Capacity (gpm)	Control Panel Age	Pump Age	Length of pipe (ft)	Approx. Number of Manholes	Approx. Number of Services
1	1967	5,486	103	1999	2003	3,610	20	40
2	1967	1,420	353	2005	2005	18,287	100	293
3	1971	1,200	860	2008	2008	33,617	164	413
4	1971	882	560	2008	2008	18,559	96	191
5	1971	1,175	325	2008	2008	22,843	105	271
6	1971/1990	400	198	2008	2002	13,997	97	154
7	1971/2000	1,365	370	1999	2006/ 2015	14,499	68	159
8	1971	425	76	2008	2008	470	3	6
9	1975	1,104	288	2008	2008	7,398	43	85
10	1975	1,726	905	2013	2013	51,313	286	827
11	1975	893	126	2011	2005/ 2006	4,254	19	39
12	1975	959	304	2008	2008/ 2007	9,287	56	106
13	1975	2,336	95	1999	2005/ 2000	6,322	34	73
14	1975	485	101	2008	2005/ 2000	663	5	7
15	1975	1,352	136	2006	2006	6,294	37	53
16	1975	174	64	2010	2010/ 2009	755	7	9
17	1977/1993	2,477	956	1996	1996	26,389	153	412
18	1977/1993	1,360	99	1996	2007	5,802	35	61
19	1982	1,590	89	2007	2007	2,874	17	39
20	1985	1,383	16	1986	2004/ 2014	1,393	6	18
21	1985	571	123	2015	2015	5,937	37	88
22	1985/1990	1,600	202	1987	2008/ 1987	2,556	12	7
23	1988	2,775	73	2016	2016	782	3	1
24	1991	1,917	1,448	2010	2010/ 2009	114,733	632	2,850
25	1991	1,460	143	1993	1993	6,920	45	81
26	1991	1,304	396	1993	1998	18,685	100	246
27	1992	676	382	2006	2006	10,789	75	166
28	1994	591	78	1997	1997	762	7	9
29	1993	696	226	1997	1997	1,116	5	7
30	2004	1,128	264	2004	2004	2,163	16	17
31	2006	757	82	2006	2006	1,481	11	28

Existing System Analysis and Deficiencies

A SewerCAD computer model was developed in 2006 to verify existing system's capacity to convey existing system wastewater flows to the MCES collection system. Existing system as-built information was used to develop the model and determine system capacity. Average day and peak flows were calculated by determining the existing developed area in each district, area of each existing land use, number of existing units and assuming a flow generated for each land use.

The model was calibrated by reducing the flow generated for each land use until the total system flow matched sewer flows metered by MCES. The existing system model includes the following parameters:

- Existing sewer mains – 10-inch diameter and larger
- Existing trunk lift stations
- Existing trunk main flows (MCES)

Figure 7.3 illustrates the remaining pipe capacity resulting from the 2006 analysis trunk mains. Modeling results indicated two sections (of 23 sections) of the 36-inch trunk main parallel to the MCES interceptor flowing east along the north side of Lake Susan near Highway 101 exceeded capacity as shown on Figure 7.3. The model indicated a slight surcharge at the manholes in the two sections where existing flows exceeded capacity, however the capacity of the overall trunk system is adequate.

The MCES Lake Ann interceptor exhibited a few sections exceeding capacity; however, MCES is responsible for monitoring flows and determining deficiencies for this main.

Figure 7.3 shows all trunk lift stations (with influence lines greater than 10-inches diameter) with the exception of Lift Station No. 7 exhibit adequate capacity. The figure below shows existing lift station pump capacity and existing peak inflow information.

FIGURE 7.3 | Existing Trunk Lift Station Analysis

Lift Station Area	*Pumping Capacity (gpm)*	*Existing Peak Flow (gpm)*	*Remaining Capacity (gpm)*
1	103	38	65
3	594	544	50
4	560	229	331
6	198	130	68
7	135	145	-10
10	905	609	296
12	100	88	12
24	1,448	725	423
26	396	339	57

On-site Disposal Systems

There are several areas within the City of Chanhassen that are currently on septic systems. Some of these areas are developed with one or two acre lots that could be developed or subdivided with sanitary sewer service.

Figure 3.6 in Appendix A presents the lots which currently utilize septic systems. The areas are primarily located in the districts south of the Highway 212 corridor. The remaining existing septic systems are scattered throughout the remainder of the city in areas with larger lots. There are currently 388 Subsurface Sewage Treatment Systems (SSTS) in the community with 380 serving residential and eight serving commercial/industrial uses. Chapter 19, Article IV of the Chanhassen City Code addresses SSTS.

MCES SANITARY SEWER SYSTEM

The majority of the wastewater generated from the City of Chanhassen is conveyed to one of two MCES interceptor sewers, identified as the Shorewood Interceptor (7017) and the Lake Ann Interceptor (7138).

Shorewood Interceptor

The Shorewood Interceptor is a combination forcemain and gravity sewer interceptor, which begins at the MCES L21 Lift Station near Lake Virginia and flows eastward through Shorewood, Excelsior, Greenwood, and Tonka Bay. There are four extensions of the Shorewood Interceptor, which extend southward to the north boundary of Chanhassen (information obtained from the 2006 Comprehensive Sewer Policy Plan).

- Shorewood interceptor extension 7017-1 is a 15-inch diameter RCP gravity flow sewer extending northeasterly from the Chanhassen boundary at Washta Bay Road along Pleasant Avenue to the northwest side of Mary Lake in Shorewood to the major interceptor.
- Shorewood interceptor extension 7017-2 is a 9-inch diameter PVC forcemain that extends from the Chanhassen boundary at Chaska Road to the west shore of Galpin Lake in Shorewood to the major interceptor.
- Shorewood interceptor extension 7017-3 is a combined gravity and forcemain facility that flows north from the Chanhassen boundary along Christmas Lake Road through a 15-inch diameter RCP to a lift station, then through a 9-inch diameter PVC pipe and an 8-inch diameter DIP to the major interceptor.
- Shorewood interceptor extension 7017-4 is a 12-inch diameter RCP gravity flow sewer extends between Christmas Lake and Silver Lake from the Chanhassen boundary to the Shorewood Interceptor.

Wastewater generated from the northern area, the area on the north side of Lake Lucy, and the area around the north and west sides of the Lake Minnewashta area flow north to the Shorewood Interceptor and is ultimately treated at the Blue Lake Wastewater Treatment Facility in Shakopee.

Lake Ann Interceptor

The Lake Ann Interceptor (7138) is an MCES sewer that serves Chanhassen in the Bluff Creek, Rice Marsh Lake, Lake Susan, Lake Ann, Lotus Lake, Lake Lucy and Lake Riley vicinity. The Lake Ann Interceptor sewer system was constructed in three phases and was completed in 1988. The interceptor extends southeast, beginning at Trunk Highway 41 near the north City limits and approximately 4.5 miles to the Red Rock Interceptor at the Chanhassen/ Eden Prairie border. The city's Lake Ann trunk sewer is parallel to the MCES trunk sewer between the Red Rock Interceptor and Highway 5.

The Red Rock Interceptor starts at the termination of the Lake Ann Interceptor and continues southeasterly through Eden Prairie where it discharges into the Purgatory Creek Interceptor and eventually to the Blue Lake Wastewater Treatment Facility in Shakopee.

During the 2007 SewerCAD model analysis for the existing City of Chanhassen sanitary sewer system and as discussed previously, the MCES Lake Ann interceptor exhibited a few sections exceeding capacity; however, MCES is responsible for monitoring flows and determining deficiencies for this main.

7.3 | Land Use

Land Use Breakdown

The current land use plan for the City of Chanhassen is shown in Chapter 2, Figure 2-9. This plan was developed by the city and separates the planning area into eleven (11) different land use categories. Land use is a critical factor in determining future sanitary sewers alignments and sizes due to the fact that different land uses generate different wastewater flow rates. The following table presents the current city land use breakdown and the associated abbreviations:

FIGURE 7.4 | Land Use Summary

Land Use Designation	*Abbreviation*
Residential – Large Lot	RLL
Residential – Low Density	RLD
Residential – Medium Density	RMD
Residential – High Density	RHD
Commercial	C
Office	O
Office/Industrial	O/I
Parks/Open Space	P/OS
Public/Semi-Public	P/SP
Mixed	M
Agricultural	A

Existing Developed and Developable Areas

The area within the City of Chanhassen's planning area is approximately 21 square miles or 13,700 acres. The existing area within Chanhassen with sewer service is approximately 16.6 square miles or 10,600 gross acres. For sewer planning purposes, land that is not served by sanitary sewer is considered not developed and not all of this acreage is considered developable. Undevelopable land use categories include open space and water.

Existing developed and undevelopable areas were subtracted to obtain developable acreage. Developable acres are shown on Figure 5.1, (Appendix A) along with the existing sewer service area. This is identified as "Gross" Developable Acreage because it includes roads and common or public/park areas potentially included in developments. Roads, common areas and parks typically consume 25% to 30% of the gross area within a development.

GROWTH PROJECTIONS

Projected Residential Growth

Historical growth data for the study area from the Minnesota State Demographer's office is included on Figure 7.5. The City of Chanhassen exhibited stable growth between 1900 and 1960; however, it grew exponentially between 1960 and 2000 with approximately 73% growth between 1990 and 2000.

FIGURE 7.5 | Historical Census Data

Year	Population	Total Households	Employees
1970	4,839	1,349	900
1980	6,351	2,075	2,102
1990	11,732	4,016	6,105
2000	20,321	6,914	9,350
2010	22,952	8,679	10,905

Figure 7.6 below shows the assumed residential population growth and sewered population through the year 2040 from the 2040 Thrive MSP Water Resources Policy Plan. Based on the data provided below, there would be an approximately 16% to 19% growth in population every 10 years.

It is assumed that as development occurs, sanitary sewer service will be extended to the new development. Sanitary sewer service will also be extended to current large lot developments based on need such as failing septic systems. Sanitary sewer service would only be extended to new developments and existing large lot developments that have been incorporated into the MUSA area.

FIGURE 7.6 | 2040 Thrive MSP Water Resources Policy Plan Population Projections

	2020	2030	2040
Total Population	26,700	31,700	37,100
Sewered Population	24,300	29,300	34,700
Unsewered Population	2,400	2,400	2,400
Total Households	10,000	11,900	14,000
Sewered Households	9,200	11,100	13,300
Unsewered Households	800	800	700
Total Employees	15,600	17,000	18,400
Sewered Employees	15,400	16,800	18,200
Unsewered Employees	200	200	200

**Note: In TAZ 386 there are 18 properties where the homes empty into a holding tank at the back of the home, which then connect to a public sanitary sewer within West 96th Street to Lift Station 20. These properties are included in the sewered household category.*

Projected Non-Residential Growth

Non-residential customers are located in the following land use areas: Commercial, Office, Office/Industrial, Industrial, Mixed Use, Parks/Open Land and Public/Semi Public. Tracking the exact acreage developed each year for the preceding land uses is difficult; however, it is possible to track the number of total non-residential connections based on water use records. Typically, the above land use categories are grouped into two water use types, commercial and industrial. Since it is not possible to relate land use categories to water use records, the previously listed land use categories have been grouped together as non-residential for determining growth rates.

To project future non-residential growth, some trends over the past few years can be analyzed. Figure 7.7 illustrates the growth in non-residential water connections over the past ten years, and the percentage of non-residential connections relative to residential connections for the City of Chanhassen water system.

FIGURE 7.7 | Non-Residential Historical Growth

Year	Non-residential connections	Non-residential annual growth	Residential connections	Residential annual growth	Percent non-residential connections
2007	251		6,545		3.69%
2008	345	37.45%	6,931	5.90%	4.74%
2009	342	-0.87%	7,019	1.27%	4.65%
2010	431	26.02%	7,145	1.80%	5.69%
2011	426	-1.16%	7,229	1.18%	5.56%
2012	382	-10.33%	7,310	1.12%	4.97%
2013	341	-10.73%	7,530	3.01%	4.33%
2014	292	-14.37%	7,612	1.09%	3.69%
2015	295	1.03%	7,780	2.21%	3.65%
2016	296	0.34%	7,904	1.59%	3.61%
				Average	4.46%

Historically there is a correlation in the ratio of non-residential to residential connections. The ratio has averaged 4.05% over the last five years.

Based on a ratio of non-residential to residential connections of 4.05%, Figure 7.8 was developed to project future non-residential connection growth in a similar fashion to Figure 7.6 projecting future population.

FIGURE 7.8 | Non-Residential Growth Projections

Year	*Population*	*Residential Connections*	*Non-Residential Connections*
2016	24,951	7,904	296
2020	26,700	9,200	373
2030	31,700	11,100	450
2040	37,100	13,300	539

Existing Wastewater Flows

Future sanitary sewer flows, in conjunction with available slope, govern the capacity of sanitary sewers. To determine future sanitary flows, existing water demand and MCES recommendations were considered. MCES typically estimates 274 gpd/connection or 75 gallons per capita per day (gpcd) for residential estimates and 800 gallons per acre per day (gpad) for non-residential developments.

Total existing city wastewater flows are not measured for individual users; the total flows are only measured by MCES at the city flow meter for the entire City of Chanhassen. Wastewater flows are therefore not categorized by land use type. However, the City of Chanhassen does collect water demand data. Water demand data by customer type for 2010-2016 is shown below in Figure 7.9. The actual annual wastewater generated is also shown in the following table, along with the percent of wastewater generated per actual gallons of water used. From the information provided, the wastewater generated during the years 2010 to 2016 ranged from 58% to 83% of the actual water usage.

FIGURE 7.9 | Water Demand By Customer Category

Customer Category	2010	2011	2012	2013	2014	2015	2016
Residential (1,000 Gal)	689,522	738,107	863,567	764,214	672,717	667,903	630,530
Commercial (1,000 Gal)	465,669	180,144	176,868	161,122	147,411	138,082	112,660
Industrial (1,000 Gal)	97,806	120,152	107,630	94,111	86,864	84,117	62,132
Other[1] (1,000 Gal)	21,456	19,744	29,005	22,948	22,257	20,890	107,052
Total (1,000 Gal)	971,453	1,058,147	1,117,070	1,042,395	929,249	910,992	912,374
Wastewater Flow (1,000 Gal)[2]	757,900	784,200	652,800	725,600	721,800	620,200	753,500
% of Wastewater to Water Usage	78%	74%	58%	70%	78%	68%	83%
Average Water Demand (MGD)	2.7	2.9	3.1	2.9	2.5	2.5	2.6
Average Wastewater Flow (MGD)	2.1	2.1	1.8	2.0	2.0	1.7	2.1

» The other water usage category includes institutions, schools, and parks.

» The total annual wastewater flow was provided by MCES and based on the flows that the City of Chanhassen was billed for.

The industry standard design for water consumption is 100 gallons per person per day and for sewer it's 75 gallons per person per day which accounts for losses occurring largely due to lawn watering; therefore for communities that do not have excessive I/I the average wastewater flow is approximately 75% of the water demand. Figure 7.10 summarizes the wastewater to water consumption since 2000. As the City of Chanhassen continues to implement the I/I reduction plan, it is expected that the percent of wastewater flow to water demand will decrease and will become consistent with other communities that currently do not have excessive I/I.

Year	Wastewater to Water Consumption
2000	94%
2001	102%
2002	120%
2003	89%
2004	108%
2005	100%
2006	66%
2007	83%
2008	74%
2009	65%
2010	78%
2011	74%
2012	55%
2013	70%
2014	78%
2015	68%
2016	83%

FIGURE 7.10 | Historic Wastewater to Water Consumption Percentages

FIGURE 7.11 | Wastewater Flow Calculation Assumptions

Land Use Abbreviation	Land Use Description	Units/Acre	Gallons/Acre/Day
RLL	Residential – Large Lot	1	274
RLD	Residential – Low Density	3	822
RMD	Residential – Medium Density	7	1,918
RHD	Residential – High Density	12	3,288
C	Commercial	-	800
O	Office	-	800
O/I	Office/Industrial	-	800
P/OP	Parks/Open Space	-	100
P/SP	Public/Semi-Public	-	800
M	Mixed	-	800

This table presents a number of assumptions utilized during the development of this report to calculate existing wastewater flows by actual developed units and future flows by number of units per acre and/or gallons per day per acre:

Residential Flow Rates

To determine the residential flow generation rates in gallons per gross acre several factors were reviewed and several assumptions made. As discussed previously, MCES typically uses 75 gpcd. Based on the residential water use from Figure 7.9 and the actual percentages of wastewater to water usage, Figure 7.12 indicates that the average Chanhassen residential wastewater flow is below 75 gpcd.

FIGURE 7.12 | Historical Residential Wastewater Flow Rates

Year	Residential Connections	Estimated Population Served[1]	Persons per Connection	Residential Water Use (gal/day)	Actual Percent of Wastewater to Water Usage	Estimated Residential Wastewater Flow (gal/day)	Average Residential Wastewater Flow per Connection (gal/day)	Average Residential Wastewater Flow per Person (gal/day)
2010	7,145	22,157	3.10	1,889,101	78%	1,473,499	206.2	66.5
2011	7,229	22,384	3.10	2,022,211	74%	1,496,436	207.0	66.9
2012	7,310	22,689	3.10	2,365,937	55%	1,301,265	178.0	57.4
2013	7,530	23,159	3.08	2,093,737	70%	1,465,616	194.6	63.3
2014	7,612	23,593	3.10	1,843,060	78%	1,437,587	188.9	60.9
2015	7,780	23,860	3.07	1,829,871	68%	1,244,312	159.9	52.2
2016	7,904	24,156	3.06	1,727,479	83%	1,433,808	181.4	59.4
						Average	188.0	60.9

» Estimated population served per City of Chanhassen Planning Department. Assumes unsewered population is approximately 795.

Non-Residential Flow Rates

Non-residential wastewater generators consist of Commercial, Office, Office/Industrial, Industrial, Mixed Use and Public/Semi Public land uses. As discussed previously, it is not possible to separate land use areas based on water use records. Therefore, existing wastewater flows were developed based on the water usage records and allocating the remaining water demand flows to each non-residential acre. Water demand was used because it can be separated by non-residential and residential use based on provided data. Verifying water usage records and applying the MCES assumption for non-residential users of 800 gpd is a reasonable assumptions for overall planning.

It is possible a large user could develop within the system; therefore, some laterals may need to be increased in size at the time of construction. The cost to install larger laterals has not been accounted for as a part of this plan. These developments would need to be reviewed on a case-by-case basis as the development occurs.

Peak Flow Factors

The sanitary sewer collection system must be capable of handling not only average flows, but also the anticipated peak flows. These peak flows can be expressed as a variable ratio applied to average flow rates. This variable ratio, called the peak flow factor, has been found to decrease as the average flow increases. The peak flow factors applied in this study were based on typical MCES supplied peaking factors. They are generally considered conservative, and are widely used for planning in municipalities throughout the twin cities metropolitan area. Appendix B lists the peaking factors used for this study.

Infiltration and Inflow (I/I)

Infiltration is clear water that enters the sanitary sewer system through defects in the sewer pipes, joints, manholes, and service laterals. Water that enters the sewer system from cross connections with storm sewer, sump pumps, roof drains, or manhole covers is considered inflow.

The quantity of I/I entering a wastewater collection system can be estimated utilizing wastewater pumping records, daily rainfall data and water usage characteristics. Water from inflow and infiltration can consume available capacity in the wastewater collection system and increase the hydraulic load on the treatment facility. In extreme cases, the added hydraulic load can cause bypasses or overflows of raw wastewater. This extra hydraulic load also necessitates larger capacity collection and treatment components, which results in increased capital, operation and maintenance, and replacement costs. As sewer system age and deteriorate, I/I can become an increasing problem. Therefore, it is important that I/I be reduced whenever it is cost effective to do so.

The MCES has established wastewater flow goals for each community discharging wastewater into the Metropolitan Disposal System (MDS) based on average day flows and allowable peaking factors. These enforced wastewater flow goals are aimed at reducing excessive I/I within the city's sanitary sewer system and also the MCES interceptor system. In February 2006, MCES adopted an I/I Surcharge Program which requires communities within the MCES service area to reduce or minimize excessive I/I over a period of five years. In the case that communities exceed the wastewater flow goals set by MCES during the five-year surcharge period, the community will be assessed a surcharge for flows above the goal.

The City of Chanhassen was identified by the MCES as having excessive I/I during the development of the I/I Surcharge Program. As part of the MCES surcharge program, the City of Chanhassen has the ability to recover or avoid the imposed surcharges. Surcharges can be avoided by taking official steps to reduce excess I/I through planned city (or private) fund expenditures. In addition, costs spent on repair or reconstruction of the MCES interceptor may be directly credited to the City of Chanhassen's surcharge amount.

The City of Chanhassen's goal is to abate I/I in a measurable manner: reducing wastewater flows such that they are 75% or less than the water consumption. Figure 7.13 shows the percentage of wastewater to water consumption for the last 17 years. From 2000 to 2006, six of the seven years monitored exceeded 75%. Over the next five years two years exceeded the threshold. From 2012 to 2016 two years exceeded the 75% threshold.

Year	*Wastewater to Water Consumption*	*Year*	*Wastewater to Water Consumption*	*Year*	*Wastewater to Water Consumption*
2000	94%	2007	83%	2012	55%
2001	102%	2008	74%	2013	70%
2002	120%	2009	65%	2014	78%
2003	89%	2010	78%	2015	68%
2004	108%	2011	74%	2016	83%
2005	100%	***Average***	***75%***	***Average***	***71%***
2006	66%				
Average	***95%***				

FIGURE 7.13 | Historic Wastewater to Water Consumption Percentages

Potential sources of I/I within the city include: sanitary sewer manholes, laterals and services; and sump pump and draintile connections to sanitary sewer services. Every year, a portion of public sanitary sewer infrastructure- manholes and laterals- is inspected and the necessary repairs are made. Section 19-44 of the City Code is used to enforce the city's I/I policies with regards to private sewer infrastructure and can be found in Appendix C.

Public Sanitary Sewer and Manholes

Annually, the city reviews the condition of a portion of the public infrastructure, televising the sewer pipe and inspecting manholes. The sections chosen include pipe and manholes within the next year's street improvement project and areas that have been identified as high potential for I/I, such as pipe located next to a surface water feature. Issues identified are repaired or replaced. Examples of repair work includes installing I/I barriers and gasketed manhole covers, chemical grout and short lining.

Typically, the city reconstructs approximately one mile of streets in even-numbered years based on the condition of the street, water main and sanitary sewer. In odd-numbered years, the city rehabilitates between three and six miles of streets. It is the city's policy to install drain tile throughout street reconstruction projects and in select areas in rehabilitation projects. Drain tile desaturates the street subgrade, reducing the groundwater available for infiltration into the sanitary sewer system. The drain tile also provides homeowners an option to connect their sump pump discharge which reduces inflow into the sanitary sewer system.

Private Sewer Services

Public sewer televising includes a visual of the service wye. As of 2014, the city offers residents within street project areas the opportunity to have their sanitary sewer service from the home to the public sewer televised. Participation is voluntary and is intended to identify services that are a source of I/I or are in need of other repairs. This service will continue to be offered to residents within street improvement project areas.

Private Sump Pump and Drain Tile Illicit Connections

According to information provided by the Metropolitan Council, prior to 1969 the Plumbing Code allowed sump pumps to discharge into the sanitary sewer and perimeter drain tile was permitted to be directly connected to the sanitary sewer service. According to the 2016 records, there were 733 buildings within the city that were built in or before 1969; the remaining 8,097 homes within Chanhassen were built after 1969. Of the homes built before 1969, 62% of the service wyes and 1% of the service laterals have been televised. Figure 7.1 in Appendix A shows the properties which contain buildings constructed in or before 1969.

In an effort to reduce the number of illicit discharges (inflow) to the sanitary system, the city inspected 924 homes as part of the Sump Pump Inspection Program in 1996: 84% of homes were in compliance, meaning their sump pump was not connected to the sanitary sewer. Throughout the next seven years, the city reinspected the non-compliant properties to ensure that the sump pump discharge was disconnected from the sanitary sewer.

More detailed information including specific projects and associated costs are included in the prepared I/I reduction plan. Total annual costs for I/I reduction efforts are included in the overall sanitary sewer Capital Improvements Plan prepared with this comprehensive study. A copy of the detailed I/I Capital Improvements Plan from the I/I reduction plan is included in Appendix C.

The clearwater flow from residential uses is estimated using the data presented in Figure 7.12. Design assumptions for sewer discharge is 75 gallons per person per day and 100 gallons per person per day for water consumption, or sewer discharge is 75% of water consumption. Using this rationale wastewater flow in excess of 75% is an estimation of clearwater flow and is summarized in Figure 7.14.

FIGURE 7.14 | Historical Residential Wastewater Flow Rates

Year	Actual Percent of Wastewater to Water Usage	Amount Above 75% Threshold	Estimated Residential Wastewater Flow (gal/day)	Estimated Clearwater Flow (gal/day)
2010	78%	3%	1,473,499	44,205
2011	74%	-	1,496,436	-
2012	55%	-	1,301,265	-
2013	70%	-	1,465,616	-
2014	78%	3%	1,437,587	43,128
2015	68%	-	1,244,312	-
2016	83%	8%	1,433,808	114,705

7.4 | Sanitary Sewer Districts

To develop the future sanitary sewer trunk system, the ultimate potential service area was divided into major service areas or districts and then dividing those major service districts into sub-districts. Generally the selection of these areas is governed by existing topography and/or other existing features such as roadways. The ultimate potential service area for Chanhassen is divided into eight major sanitary sewer districts: Minnewashta (MW), Bluff Creek (BC), Lake Ann (LA), Lake Lucy (LC), North (NO), Lotus Lake (LL), Lake Riley (LR), and Lower Bluff Creek (LB). Figures 7.15 and Figures 3.2 and 3.3 in Appendix A show the major sanitary sewer districts and the sub-districts.

The existing and projected flows for each sanitary sewer district is presented in Appendix B. The existing flows noted in Appendix B are higher than the sewer flow rates provided by the Metropolitan Council. The difference between calculated and realized sewer flows can be attributed to the fact that properties within each land type can contain undevelopable acreage such as wetland, storm water feature or steep slopes which cannot be readily deleted from the property area.

Minnewashta District (MW)

The Minnewashta (MW) Sewer District includes the area around the south, west, and north sides of Lake Minnewashta. There are approximately 1,200 acres of developed land consisting of low density residential and commercial uses, including approximately 40 acres of single family residential land within the City of Victoria. The district also includes park/open space and significant acreage of public/semi-public land within the Minnesota Landscape Arboretum property. Approximately 20 acres of low density residential developable land remains within the MW Sewer District.

The MW Sewer District is subdivided into seven sub-districts. The flows from the MW district are collected by several sewer lines ranging in size from 8-inch to 10-inch pipe. There are six lift stations that service the MW Sewer District as summarized in Figure 7.16.

FIGURE 7.15 | Sanitary Sewer Districts

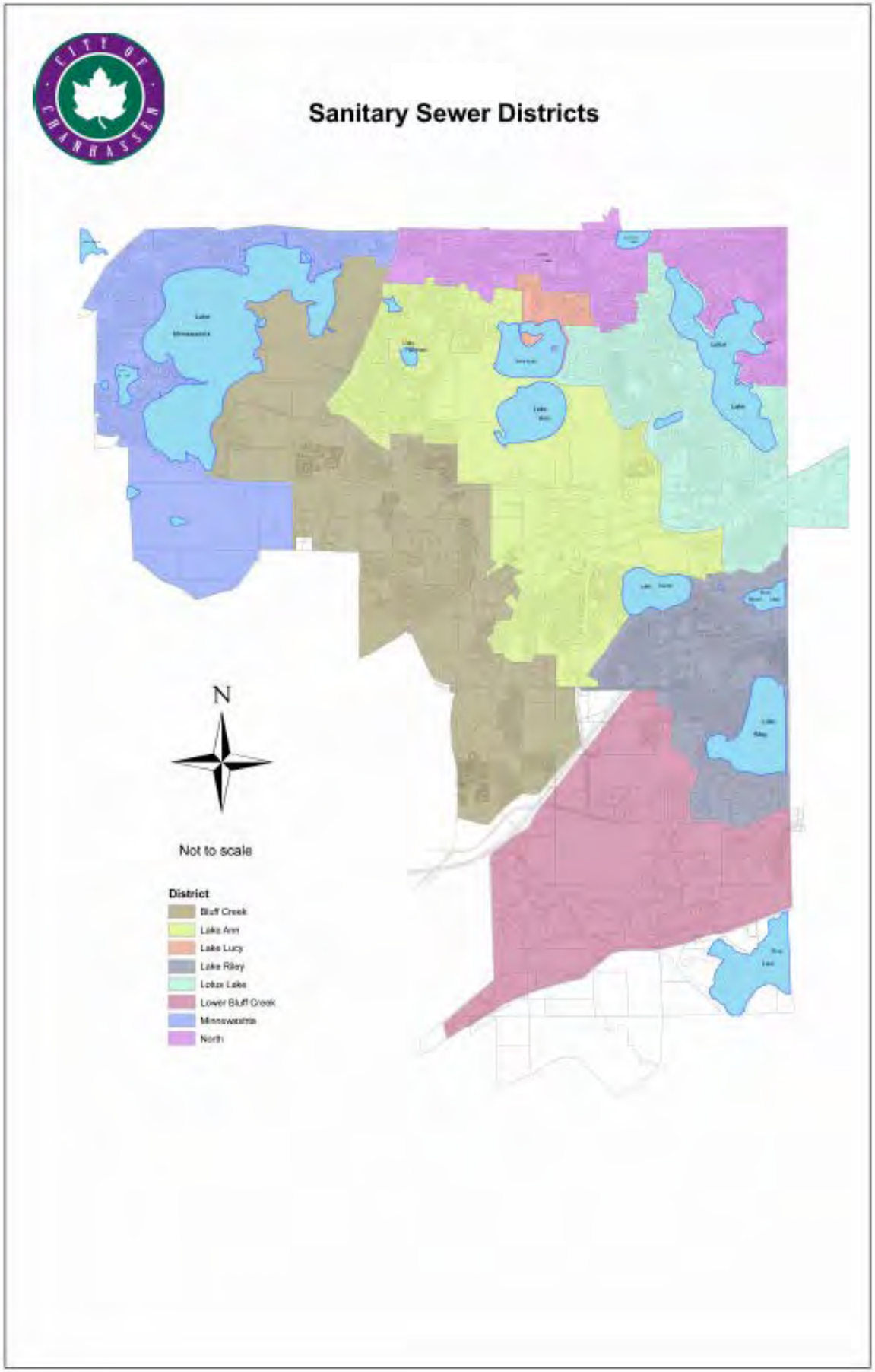


FIGURE 7.16 | Summary of Lift Stations within the Minnewashta Subdistricts

Subdistrict	Serviced by	Discharges to
MW 1	Lift Station 3	MCES Shorewood Interceptor Sewer (7017)
MW 2	Lift Station 28	MW 3
MW 3	Lift Station 7	MW 1
MW 4	Lift Station 6	MW 3
MW 5	n/a*	n/a
MW 6	Lift Station 8	MW 7
MW 7	Lift Station 4	MCES Shorewood Interceptor Sewer (7017)

**There is currently no collection system that serves sub-district MW-5, which contains the Minnesota Landscape Arboretum research fields and natural areas.*

Bluff Creek District (BC)

The Bluff Creek (BC) Sewer District includes the area from the east side of Lake Minnewashta and extends southeasterly along the Chanhassen/Chaska border to the Highway 212 corridor. There are approximately 1,250 acres of developed land and 400 acres of developable land within the BC Sewer District.

The BC District is partially developed with a combination of low and medium density residential, large lot residential, parks/open space, public/semi-public and office/industrial properties.

The BC Sewer District is subdivided into 11 sub-districts. The wastewater generated is collected by gravity sewers ranging from 8-inches to 21-inches diameter. There are three lift stations within the BC Sewer District: Lift Stations 19, 24 and 26. Lift Station No. 19 serves the BC-2 sub-district and Lift Station No. 26 serves the BC-3 sub-district. All of the wastewater from the BC sub-districts flows to Lift Station 24, where it is then pumped north to an 18-inch trunk sewer in the Lake Ann Sewer District

Lake Ann District (LA)

The Lake Ann District (LA) Sewer District includes the area that runs through the central part of Chanhassen. There are approximately 1,656 acres of existing developed land and 295 acres of developable land within the LA Sewer District. The LA District is sub-divided into 11 sub-districts. The majority of the sub-districts have been developed but there will still be need for lateral sewer lines as LA-4, -5 and -6 are sub-districts that are not fully developed. The LA District consists of low, medium and high density residential properties as well as large lots, park/open space, public/semi-public and office industrial areas.

The wastewater generated in the LA District is collected by gravity sewers ranging from 8-inches to 36 inches in diameter. There are five existing lift stations within the LA Sewer District: Lift Stations 23, 27, 29, 30 and 31. Lift Station No 23 is a small station within the LA-4 sub-district that serves Lake Ann Park and discharges to Lake Susan Sub District 11. Lift Station No. 27 serves the LA-7 sub-district and discharges to LA-6. Lift Station No. 29 was constructed to serve approximately nine large lots in the southern part of LA-3 sub-district; however, its use has been very minimal, as it only services one home at this time. Lift Station 30 serves the LA-9 sub-district and discharges to LA-8. Lift Station 31 serves approximately 28 single family lots in the southern part of LA-3 sub-district.

The MCES Lake Ann Interceptor runs southeast through the center of the LA Sewer District. The city's major trunk line, which ranges in size from 21-inches in diameter to 36-inches in diameter, parallels the MCES Lake Ann Interceptor from State Highway 5 to near Market Boulevard, where it discharges into the Lake Ann Interceptor.

Lake Lucy District (LC)

The Lake Lucy (LC) Sanitary Sewer District is located around the north side of Lake Lucy. The LC District is not subdivided in to sub-districts due to its size. There is approximately 91 acres of existing developed land within the LC District, which is all low density residential. A 10 acre parcel in the southwest corner of the LC District may further subdivide in the future.

Sanitary sewers 8-inches in diameter collect the wastewater and direct it to Lift Station No. 25. Lift Station No. 25 is the only lift station within the LC District, which collects the entirety of wastewater generated and pumps the wastewater to the North District

North District (NO)

The North District (NO) is located along the north border of the city and extends east from the Minnewashta District to the eastern border of the city. The NO District also includes the area along the northeast side of Lotus Lake and is fully developed. There is approximately 725 acres of existing developed land within the NO Sewer District. The existing development within the NO District consists of low density residential, park/open space and public/semi-public uses. This district also includes approximately 17 acres of low density residential within the City of Shorewood. The only properties that may be developed in the future are low density residential lots that lie within sub-districts NO-7 and NO-8.

The NO District is subdivided into 12 sub-districts. The wastewater generated is collected by gravity sewers ranging in size from 8-inches to 15-inches in diameter. There are six lift stations within the NO District and include Lift Stations 5, 13, 14, 15, 16 and 21.

Lotus Lake District (LL)

The Lotus Lake District (LL) is located along the western and southern sides of Lotus Lake and is divided into 10 sub-districts. Most of the area within the LL District is developed and is composed of low and high density residential, parks/open space, public/semi-public, office/industrial and commercial properties. There is approximately 925 acres of developed land within the LL Sewer District. Sub-district LL-3 has approximately eight acres of developable low density residential land. LL-7 has one 1.2 acre commercial property that is possible for redevelopment.

The wastewater generated is collected by gravity sewers ranging in size from 8-inches to 21-inches in diameter. There are seven lift stations within the LL District and include Lift Stations 1, 2, 9, 10, 11, 12 and 22.

Lake Riley District (LR)

The Lake Riley District (LR) is located around the north, west and south sides of Lake Riley. There are approximately 485 acres of developed land and 40 acres of developable land within the LR Sewer District. The potential future development within the LR District is around the US Highway 212 corridor and Great Plains Boulevard. The developed areas consist of low and high density residential, large lots, park/open space and mixed use properties. Sub-districts LR-3 and LR-4 have areas of potential low and medium density residential as well as mixed use developable properties.

The LR District is subdivided into five sub-districts. The wastewater is collected by gravity sewers ranging in size from 8-inches to 36-inches in diameter. There are two lift stations within the LR District and include Lift Station 17 and 18.

Lower Bluff Creek District (LB)

The LB District is located south of Lyman Boulevard between Powers Boulevard and Great Plains Boulevard, and between Pioneer Trail and the southern city limits. This area within the district is partially developed with very little city sewer service. There is a strong possibility for redevelopment, namely along the Highway 212 corridor, as well as the Bluff Creek Golf Course. There are approximately 610 acres of developed land and 1,000 acres of developable land within the LB Sewer District.

The LB District is subdivided into five sub-districts. An 8-inch sanitary extends along 96th Street to Lift Station No. 20 and serves the existing developed lots within LB - 4. Lift Station No. 20 pumps wastewater through a forcemain that runs north along Great Plains Boulevard that discharges to the Lake Riley District. There is also an existing 15-inch and 18-inch trunk sewer line that was constructed along Pioneer Trail and Powers Boulevard; however, this existing trunk sewer does not serve any development at this time. Development of the land within this sewer district and future densities is contingent upon the installation of a lift station and forcemain to bring the sewage to the 21-inch sewer main at Great Plains Boulevard and Lyman Boulevard. The lots within sub-district LB-2 are served by an existing 8-inch diameter sewer that discharges to the Eden Prairie sewer system.

Sub-district LB-1 is proposed to have low, large lot and high density residential and office, parks/open space and office industrial properties. The area encompassed in sub-district LB-3 is currently large lot development with area for future residential low density development.

Sub-district LB-5 is primarily undeveloped. There are large lots located on Homestead Lane and Flintlock Trail but there is no sewer service. Eight-inch sanitary sewer would be required to convey the flows from these existing lots and potentially from the proposed lift station in LB-4. The northern portion of LB-5 is proposed for low density and large lot residential, office and parks/open space.

7.5 | Future Sanitary Sewer System

Wastewater Flow Projections

Wastewater flow projections were generated for each sanitary sewer district and corresponding sub-districts based on the gross developable acreage available, anticipated land uses, and wastewater flow generation rates. The wastewater flow generation rates for the various land uses found in Section 7 of this report were used to project the future wastewater flows for the service area.

The total district existing average and peak flows and also the ultimate 2040 average and peak flows were calculated using the actual development for existing flows and the projected land use for ultimate flows. Estimated peak hour flows are not totaled as the peaking factor is dependent upon the average day flow rate. Summing the projected peak hour flow rates would produce a flow rate higher than the peak hour flow rate for the entire city; therefore, the peak hour flows are calculated by multiplying the total average flows by the MCES peaking factor. Table 9.1 below presents the existing and projected 2040 flows for each sanitary sewer district.

FIGURE 7.17 | 2040 Wastewater Flows Per Sewer District

Sanitary Sewer District	*Existing Average Day Flow (MGD)*	*Existing Peak Hour Flow (MGD)*	*2040 Average Day Projected Flow (MGD)*	*2040 Peak Hour Projected Flow (MGD)*
Minnewashta (MW)	0.150	0.589	0.310	1.126
Bluff Creek (BC)	0.718	2.370	1.017	3.153
Lake Ann (LA)	0.681	2.25	1.114	3.45
Lake Lucy (LC)	0.019	0.074	0.027	0.106
North (NO)	0.316	1.137	0.363	1.308
Lotus Lake (LL)	0.595	2.02	0.642	2.18
Lake Riley (LR)	0.222	0.843	0.383	1.377
Lower Bluff Creek (LB)	0.015	0.061	1.192	3.696
Total System	2.716	7.333	5.051	12.122

» The sum of the existing peak hour flow does not equal the sum of the peak discharges from each district since the peaking factor decreases as the average flow increases.

» Peaking factors were taken from MCES factors included in Appendix B.

Future Trunk Sanitary Sewer System Analysis

The 2007 SewerCAD model developed for the analysis of the existing sanitary system flows was utilized to determine the ability of the existing trunk sanitary system to convey future wastewater flows. Future trunk mains and lift stations will be extended to accommodate future development, which in turn will increase the flows conveyed to the existing trunk system. The trunk sewer system has not been extended since 2007, therefore an updated analyses was not done.

Proposed flows were entered into the model and results indicated a reduction in remaining capacity throughout the system, primarily in the Lower Bluff Creek District. Figure 7.3 presents the remaining sewer capacity taking into account proposed future flows. The two sections of the 36-inch trunk main parallel to the MCES interceptor flowing east along the north side of Lake Susan near Highway 101 that exceeded capacity in the existing flow model remained the only two sections exceeding capacity in the future system model.

Similar to the existing system model, the MCES interceptor exhibited a few sections exceeding capacity; however, MCES is responsible for monitoring flows and determining deficiencies for this main. The City of Victoria future flows conveyed through the MCES interceptor were not included in the model to analyze future capacities in the MCES Lake Ann interceptor.

All existing trunk lift stations with the exception of Lift Station Nos. 7 exhibit adequate pumping capacity to serve future development. Figure 7.18 below shows existing lift station pump capacity and existing peak inflow.

Lift Station Area	*Existing Pumping Capacity (gpm)*	*Existing Peak Hour Inflow (gpm)*	*Estimated Future Peak Hour Inflow (gpm)*	*Remaining Pumping Capacity (gpm)*
4	560	229	21	310
5	325	69	44	212
7	135	145	4	-14
10	905	609	19	227
17	956	77	425	454
18	99	20	371	292
19	89	20	23	46
24	1,448	725	407	316
25	143	22	22	99
26	396	339	55	2
30	264	30	149	85

FIGURE 7.18

Future Trunk Lift Station Analysis

Lift stations 17, 18, 19 and 30 may need to be upgraded if existing large lot residential properties in subdistricts LR-1 (will flow to LS 17, then LS 19), BC-10 and LA-9 (respectively) are rezoned to low or medium density and serviced by municipal sanitary sewer. A feasibility report would need to be completed to determine the sewer impacts to the existing lift stations. Typically if development impacts from up-zoning are identified, upgrades to existing infrastructure are paid for by the developer or land owner(s).

Future Trunk Sanitary Sewer System

Minnewashta District (MW)

Additional trunk sanitary sewer main improvements will not be necessary to serve the identified future development within the Minnewashta Sewer District. The properties remaining for development are located near trunk and lateral facilities and remaining capacity within the existing facilities is sufficient for estimated peak flows at full build-out.

The 2030 Comprehensive Plan addressed the possibility of serving the northeast portion of Victoria through the Minnewashta District. Subsequently, the City of Victoria further examined this service connection and opted to service this area via a future lift station and force main that connect to the Met Council interceptor.

Lift Station No. 7 may need to be increased in capacity in the future. Currently, Lift Station No. 28 has a capacity of 100 gpm, with an estimated 25 gpm of existing peak flow. Both of these lift stations would need to have the incapacity increased if undeveloped property in Victoria to the west of these lift stations where to development and sanitary sewer service connected to the City of Chanhassen sewer system. The estimated future peak flow from the Victoria development area totals 160 gpm (0.2302 MGD).

Bluff Creek District (BC)

Improvements to the existing lateral and trunk sanitary sewer system will be required to provide service to currently undeveloped properties as well as existing properties that do not have city service. Several of the sub-districts will require improvements to service the developable areas.

Sub-district BC-1:
Requires an 8-inch trunk line to service a public/semi-public piece of land with the addition of a lift station to pump the wastewater to BC-4.

Sub-district BC-2:
Contains a nine acre parcel that can be redeveloped into low density residential with the future installation of an eight inch lateral.

Sub-district BC-3:
This area is fully developed, however several large lots in the Timberwood development are within this district and on a septic system. Future installation of eight inch lateral sanitary sewer will service these properties.

Sub-district BC-4:
Potential development of low density residential and public/semi-public land with the future installation of an eight inch lateral.

Sub-district BC-5:
Fully developed and will not require additional sewer installation.

Sub-district BC-6:
An 11 acre parcel was redeveloped to residential low density in 2017. The extension of an eight inch lateral from the existing stub within the southern portion of Fawn Hill Road served this parcel.

Sub-district BC-7:
This area is fully developed. However, several large lots in the Timberwood development are within this district and on a septic system. Future installation of eight inch lateral sanitary sewer will service these properties.

Sub-district BC-8:
There is one undeveloped office industrial property within sub-district BC-8 that will require an 8-inch sanitary sewer line to tie into Chaska's system or a new lift station to convey flow to Lift Station No. 24

Sub-district BC-9:
Future installation of eight inch lateral sanitary sewer will service the properties on Sunridge Court, Audubon Road and Sunset Trail that are currently serviced by septic systems. The vacant land southwest of Lyman Boulevard and Powers Boulevard is guided for medium and high density residential, office and dual guided for commercial as part of the Avienda development pending the extension of eight or ten inch sanitary sewer that flows to Lift Station No. 24.

Sub-district BC-10:
This area is fully developed as large lot residential. All properties are currently on septic systems. Future improvements include installation of eight inch lateral sanitary sewer and a lift station that connects to the BC-2 system.

Lake Ann (LA)

Sub-districts LA-1, LA-2, LA-7, LA-8, LA-10 and LA-11 have developed to their full potential and are sufficiently serviced by the existing sewer systems.

Subdistrict LA-3. The 19 acre property east of Audubon Road and south of Alisa Lane can be redeveloped into low density residential and serviced by the extension of eight inch lateral sanitary sewer that connects to the system within Alisa Lane and/or Stonefield Lane.

Sub-district LA-4 also will require an 8-inch line to be extended from Coulter Boulevard to the north to service the future office-industrial property located west of McGlynn Drive.

Sub-districts LA-5 and LA-6 are proposed to have large areas of development consisting of low, medium, and high density residential properties. Eight-inch sewer laterals will be needed to convey the wastewater from these sub-districts to the existing MCES Interceptor.

LA-9 is fully developed, but there are some low density and large lot properties without sewer service. Eight-inch sanitary sewer would be used to connect to the existing sewer system should future connection be asked for by the residents.

Lake Lucy (LC)

Most of the LC District has sewer service, with the exception of approximately a 10 acre parcel south of Lake Lucy Road at Yosemite Avenue. Eight-inch laterals were stubbed to the property line when the area to the east developed.

North District (NO)

The only properties that may be developed in the future are low density residential lots and lie within sub-districts NO-7, NO-8 and NO-9. Additional sanitary sewer trunk lines would not be needed to serve these lots as there are sufficient facilities adjacent to the properties.

Lotus Lake (LL)

The majority of this district is fully developed. The potential future developments within sub-district LL-3 and extension of sanitary sewer to existing lots within LL-10 would be served by the existing trunk sanitary sewer system facilities. Eight inch laterals would be needed to accommodate these properties.

Lake Riley (LR)

Sub-district LR-1 is fully developed with large lots that will require a future eight-inch sanitary sewer and a lift station to pump the wastewater to sub-district LR-2. The proposed sewer would be needed if the residents requested City service, if the area redevelops, or if septic system failures lead to health or safety issues requiring centralized sanitary sewer service.

Sub-districts LR-2 and LR-5 are fully developed are sufficiently serviced by the existing sewer systems.

Sub-districts LR-3 and LR-4 are mostly developed and contain future low and medium density residential as well as mixed use properties. To serve future development within these sub-districts, eight inch laterals are proposed.

Lower Bluff District (LB)

Sub-district LB-1 contains low density residential and large lot properties that will be serviced by eight-inch gravity sanitary sewer. In 2014, the "County Road 61 Corridor Plan" by SRF Consulting Group and Hoisington Koegler Group was finalized and included the trunk sanitary layout and estimated costs. The properties west of the Seminary Fen Scientific and Natural Area (SNA) will require eight-inch sanitary sewer to convey flow to a future lift station at the western edge of the SNA. The remainder of Sub-District LB-1 will be serviced by eight-inch lateral. A future lift station at Highway 101 and County Road 61 will take all of the flow of LB-1 and pump it north along Highway 101 to LB-5.

Sub-district LB-2 is fully developed and is serviced by eight inch sanitary sewer that connects to the City of Eden Prairie.

Sub-district LB-3 consists of existing large lot development and future low density residential development. To service this area, eight-inch sanitary sewer and lift station just west of Deerbrook Drive will be required. Flow from this area will be discharged to LB-5.

Sub-district LB-4 is fully developed as residential homes connected to the sanitary sewer via a "201 System". The "201 Program" instituted by the Metropolitan Waste Control Commission (MWCC) based on Section 201 of the Federal Water Pollution Control Act of 1972. The 201 Facilities Planning identified facilities that were required in order to achieve water quality requirements. As a result, Carver County led a project in the 1980s to install sanitary sewer along 96th Street to service the existing properties. The project was to correct the existing problems without providing sanitary sewer facilities to accommodate additional growth in the area. The project was paid using federal and local funds; also, benefiting property owners were assessed.

When this sewer was installed, the services were connected directly to the existing septic tanks instead of abandoning the septic tanks. The old septic tanks are a suspected source on infiltration into the sanitary sewer system. With the proposed sewer layout it may be feasible to abandon Lift Station No. 20 and route the flow west to the new lift station located along Powers Boulevard in LB-5. To reduce the amount of infiltration entering the city's sanitary sewer system, when the new sewer is constructed, services should be installed directly to the homes and all septic tanks should be abandoned.

Sub-district LB-5 is primarily undeveloped. There are large lots located on Homestead Lane and Flintlock Trail but there is no sewer service. To convey the flows from these existing lots and potentially from the proposed lift station in LB-4, eight-inch sanitary sewer would be required. The northern portion of LB-5 is proposed for low and medium density residential and office properties. These properties will require 8-inch trunk mains to carry the wastewater flow.

A portion of LB-5 south of Highway 212 and east of Powers Boulevard may be rezoned from low density residential to office. The comprehensive plan assumes the land use will be low density residential as the sewer generation per acre is higher than that of office (822 versus 800 gpad).

The Bluff Creek Golf Course may potentially be redeveloped into low density residential properties. Redevelopment of the Bluff Creek Golf Course may be required to convey the gravity sewer flows from the southern and eastern portions of the LB District. To service the existing properties on Delphinium Lane, Raspberry Hill, and Halla Nursery Drive West, eight-inch sanitary sewer will be needed. To convey the flow from the LB-1 -3 and -5 a 15-inch line will be needed. All of the LB-5 wastewater flows would be taken by gravity sewer to a proposed lift station north of Pioneer Trail and south east of the Highway 212/Powers Boulevard intersection. This proposed lift station would pump flows to the northeast along the Highway 212 and tie into an existing 21-inch sewer stub in LR-4 of the Lake Riley District. This lift station is critical in pumping all sewer south of Hwy. 212 to the MCES interceptor system.

Alternative sewer alignments have been considered to service sub-district LB-3 and the portion of LB-5 south of Pioneer Trail. The alternative alignments, estimated cost (2016 dollars) and design considerations are included in Appendix D.

7.6 | Capital Improvement Program

Analysis of Area South of Pioneer Boulevard

The MUSA expansion area generally lies south of Pioneer Trail. Over the past 10 years, two studies have been performed to analyze utility extension to the area: the December, 2014 County Road 61 Corridor Plan by SRF Consulting Group, and the 2016 Kimley Horn Lower Bluff Creek District Sanitary Sewer Study. These studies are intended to serve as guiding documents; actual alignments will be established as development proposals are submitted. These studies are included in Appendix D.

The Kimley Horn study included Option 2A, the trunk sewer alignment through the Bluff Creek Golf Course property, and four alternate alignments. Figure 3.4, Appendix A, depicts Option 2A as the future sewer alignment, which is consistent with the previous comprehensive plan.

Figure 7.19 includes a summary of only the estimated oversizing cost for trunk sewer and lift station costs to serve the sewer sub-districts south of Pioneer Boulevard. Figure 3.1 in Appendix A, details the existing MUSA area and the proposed MUSA expansion area.

FIGURE 7.19 | Lift Station and Trunk Main Oversizing Cost for the MUSA Expansion Sewer Improvements

Sewer Sub-District	*Utility Extension Cost*
LB – 5 Trunk Sewer, Lift Station & Forcemain	$3,620,000
LB – 1 Trunk Sewer, Lift Station & Forcemain**	$11,100,158

**Source: Kimley Horn & Associates for Option 2A*

***Source: County Road 61 Corridor Plan by SRF Consulting Group, Inc. in association with Hoisington Koegler Group, Inc.*

Alternative alignments for the LB-3 -4 and -5 subdistricts and the associated estimated costs are included in Appendix D.

Lift Station Improvements

As discussed in previous sections, the city owns and operates 31 lift stations, which require routine maintenance and upgrades. The expected service life of the controls and equipment in these lift stations is 20 years. Pumps and motors should be replaced at approximately 33,000 hours of use on an intermittent duty pump station. The city has routinely replaced and upgraded outdated pumping equipment and controls in many lift stations over the past several years. It is recommended that this program continue to prevent failure of older and outdated lift station equipment. This replacement program will need to continue over the next 20 years and beyond to keep all the lift stations running efficiently, with minimal maintenance and breakdowns.

Replacement of outdated pumps and controls in the lift station should be scheduled as part of the city's capital improvements program. Figure 7.20 presents a detailed capital improvement program in 5-year increments as a proposed schedule for upgrades to the city's lift stations. These tables also include the recommended improvements to be made to each of the lift stations listed. This list of improvements is based on information obtained from city staff and from a site investigation of each lift station. New lift stations that are constructed will need to be incorporated into the lift station capital improvements schedule in the appropriate time period. Figure 7.21 presents the cost for the Lift Station Capital Improvements Program per 5-year increment of construction. Most costs include construction costs only and do not include administration, legal, or engineering fees as the work would be completed in-house by city staff; however, larger projects may need to be outsourced for design.

FIGURE 7.20 | Lift Station Capital Improvement Plan

Lift Station Number	Proposed Improvements						
	Refurbish Control Panel[1]	New Controls and Control Panel[2]	New Pump[3]	New Concrete Top Slab & Hatch[4]	Wet Well Cleaning& Rehab[5]	Site Work[6]	Piping[7]
2018							
26		●	●	●		●	●
18		●	●	●	●	●	●
2019							
16	●		●		●		
2020							
22		●	●	●	●	●	●
2021							
2	●		●		●		
17			●				●
2022							
13		●	●				
2023							
1		●	●				
20	●	●	●		●		●
2024							
7		●	●		●		●
2025 to 2030							
6	●		●		●		●
9	●		●		●		●
10	●	●	●				
11			●				
12		●	●				●
15		●	●				
30		●	●	●	●	●	
31		●	●				●
2031 to 2035							
3		●	●				●
8		●	●	●			●
14		●	●	●			●
19		●	●	●			●
27		●	●				●
2036 to 2040							
4		●	●				●
5		●	●				●
21		●	●				●
23		●	●				●
24		●	●				●
25		●	●				●
28		●	●				●
29		●	●				●
32		●	●				●

» 1. Includes replacement of panel and replacement of outdated electrical components.

» 2. New controls and control panels are recommended for the lift stations that have panels that were installed in the 1980s and 1990s.

» 3. Pumps that are over 20 years old need to be replaced.

» 4. Includes replacement of sagging hatches or those without safety grates and replacement of the concrete top slab.

» 5. Includes cleaning, inspection and applying a protective coating to the wet wells at the time pumps are replaced.

» 6. Includes replacement of the bituminous driveways and regrading for proper drainage around the lift station.

» 7. Includes restraining discharge piping.

FIGURE 7.21 | Lift Station Improvements

Lift Station Number	2018 to 2024	2025-2030	2031-2035	2036-2040	Total Lift Station Costs
1	$75,000				$75,000
2	$45,000				$45,000
3			$75,000		75,000
4				$75,000	$75,000
5				$75,000	$75,000
6		$45,000			$45,000
7	$50,000				$50,000
8			75,000		$75,000
9		$75,000			$75,000
10		$85,000			$85,000
11		$45,000			$45,000
12		$50,000			$50,000
13	$45,000				$45,000
14			$50,000		$50,000
15		$45,000			$45,000
16	$45,000				$45,000
17	$45,000				$45,000
18	$45,000				$45,000
19			$65,000		$65,000
20	$45,000				$45,000
21				$75,000	$75,000
22	$55,000				$55,000
23				$75,000	$75,000
24				$200,000	$200,000
25				$75,000	$75,000
26	$45,000				$45,000
27			$65,000		$65,000
28				$75,000	$75,000
29				$75,000	$75,000
30		$65,000			$65,000
31		$45,000			$45,000
32				$75,000	$75,000
Total Costs	**$495,000**	**$455,000**	**$330,000**	**$800,000**	**$2,080,000**

- Costs are for budgeting purposes only, and are subject to change as projects are studied, designed and constructed.
- Project Costs include 10% for construction contingency.
- Costs are estimated based on 2017 construction costs.

Capital Improvements Summary

A Capital Improvement Plan based on estimated phasing of trunk sewer construction is presented in Figure 7.1 and Figure 7.22. This figure includes trunk system improvements for service areas added, list station improvements and improvements for I/I reduction efforts. The projected 2040 sanitary sewer trunk system was broken down into improvements based on flow districts. The overall cost associated with these improvements over the next 22 years is approximately $22.5 million. These costs based upon 2017 dollars.

FIGURE 7.22 | Capital Improvements

Improvement Description	*Extended Cost*
2018	
Inflow and Infiltration Abatement	$200,000
Sanitary Sewer Replacement	$150,000
Lift Station #18,26	$75,000
Subtotal	**$425,000**
2019	
Inflow and Infiltration Abatement	$200,000
2010 MUSA Lift Station	$1,900,000
Sanitary Sewer Replacement	$50,000
Lift Station #16	$50,000
Subtotal	**$2,200,000**
2020	
Inflow and Infiltration Abatement	$200,000
Sanitary Sewer Replacement	$250,000
Lift Station #22	$50,000
Subtotal	**$500,000**
2021	
Inflow and Infiltration Abatement	$200,000
Sanitary Sewer Replacement	$50,000
Lift Station #2,17	$75,000
Subtotal	**$325,000**
2022	
Lower Bluff Creek Trunk Sanitary Sewer	$10,800,000
Inflow and Infiltration Abatement	$200,000
Sanitary Sewer Replacement	$250,000
Lift Station #13	$50,000
Subtotal	**$11,075,000**
2023	
Inflow and Infiltration Abatement	$200,000
Sanitary Sewer Replacement	$50,000
Lift Station #1,20	$120,000
Subtotal	**$370,000**
2024	
Inflow and Infiltration Abatement	$200,000
Sanitary Sewer Replacement	$150,000
Lift Station #7	$50,000
Subtotal	**$400,000**
2025 - 2030	
2026-2030 Sanitary Sewer I/I Rehabilitation	$1,000,000
2026-2030 Sanitary Sewer Reconstruction Program	$850,000
Lift Station No. Improvements	$455,000
Subtotal	**$2,305,000**
2031 - 2035	
2031-2035 Sanitary Sewer I/I Rehabilitation	$1,000,000
2031-2035 Sanitary Reconstruction Program	$650,000
Lift Station No. Improvements	$330,000
Subtotal	**$1,980,000**
2036 - 2040	
2036-2040 Sanitary Sewer I/I Rehabilitation	$1,000,000
2036-2040 Sanitary Reconstruction Program	$850,000
Lift Station No. Improvements	$800,000
Subtotal	**$2,650,000**
Total Capital Improvements Plan Costs	***$22,445,000***

- Costs are for budgeting purposes only, and are subject to change as projects are studied, designed and constructed.
- Project Costs include 10% for construction contingency and 25% indirect costs where applicable.
- Costs are estimated based on 2017 construction costs.

Funding

The city's current sewer fee structure is provided in Appendix E. Fees consist of sewer user fees, trunk sewer fees and sewer access charges (SAC).

Utility usage fees are charged to both residential and non-residential users based on the actual water usage metered during the winter months. The purpose of the user charges is to fund the operation, maintenance and replacement costs of existing collection systems. User charges are primarily based on the actual costs of operations, maintenance and replacement of all wastewater system facilities.

Trunk and SAC fees provide a funding mechanism for construction of the major infrastructure improvements needed to serve growth. The City of Chanhassen has established that growth should be funded and paid for by those who are in need of the facilities. The development creating the need for additional sanitary sewer system improvements are expected to pay for new trunk facilities and expansion of existing facilities through trunk and SAC fees. Currently, the trunk sewer fees are a per unit cost at the time of development and the SAC fees are calculated based upon the Metropolitan Council's SAC Procedure Manual, which assigns non-residential properties a SAC unit for office or industrial/ commercial buildings.

Developments and redevelopments that currently are not serviced by the city's sanitary sewer system must construct lateral sanitary service to the parcel. The design and installation costs of the lateral sanitary sewer shall be bore by the project developer.

Goals and Policies

The timing of future trunk sanitary sewer improvements will be influenced by several parameters including development pressures in specific areas, failing on-site septic systems, regulatory requirements, availability of funds, etc. As a result it is difficult to accurately predict the timing of future improvements especially those which may occur far into the future. Therefore, the Capital Improvement Program is intended to serve as a guide only for future fiscal planning and should be reviewed on a regular basis as more current planning and cost data becomes available.

The following items are general policy guidelines to be considered when reviewing and/or revising the city's fee structure:

System Expansion (Orderly Development)

Development shall occur in an orderly fashion. Properties that abut parcels served by municipal utilities will be considered as the next feasible property for development. The city may limit development activities to selected areas. Petitions to expand in areas not already under development will be considered. Factors that will be considered include, but are not limited to capacity in the MCES interceptor, capacity in the city's collection system, economic factors including costs, number of developments under construction and the staff resources available to review the requested development.

Leapfrogging

Leapfrogging refers to the circumstance where certain parties want to develop an area not currently adjacent to the limits of the City of Chanhassen's existing sewer system. The applicant wants to "leapfrog" over areas located adjacent to the city's existing services that would be the next logical area to be developed. In this circumstance, the City of Chanhassen could decide whether or not to approve such development. If approved, it is recommended that the interested property owner pay for the entire cost of installing services to their property and resulting system upgrades. The developer shall be offered no credit or reimbursement for these costs. If development of the property that was "leapfrogged" is later initiated, payment of all trunk charges for the property will still be required regardless of the fact that the facilities were already installed before development occurred.

Overdepth and Oversizing

The costs of additional depth shall be defined by differences in cost for the depth required by the development and the depth required for trunk facilities. Trunk oversizing as defined by the city and installed by the developer will be credited using the differential of pipe costs between the larger and the minimum pipe size required for the development. Bid pricing shall not be the sole determinate in defining a developer credit. The city shall determine if a credit will be given for a project.

Lift Stations

Trunk lift stations should be defined as those servicing more than one single development project. The trunk fees will pay for 100 percent of the cost of trunk lift stations. Lift stations that do not fit the definition for a trunk lift station are to be paid for by the developer. All lift stations shall be designed and constructed in accordance with city standards. The city will consider cost sharing for other lift stations if it is found that a particular lift station may be able to serve a greater area than the single development. The cost sharing shall include the oversizing or overdepth required to serve additional area and associated SCADA system costs to establish the lift station on the city's SCADA system.

Existing Developed Unserviced Properties

There are a number of existing developed areas that do not receive sewer and water service within the city limits. The trunk system has been designed to handle all existing developed unserviced properties within the city, but it is not the policy of the city to initiate a sewer extension project. If an individual property owner or group of neighboring property owners would like city sanitary sewer services where it is not yet available, the city will review whether or not it is economically viable. Existing developed, unserviced residential properties will be assessed or required to pay connection fees as required by the City Code.

Existing Non-Residential Unserviced Properties

Existing unserviced commercial/industrial or other non-residential properties wishing to expand or hookup to municipal utilities shall be treated the same as new development and will be assessed or required to pay connection fees as required by the city.

7.7 | Recommendations

Based on the results and analysis of this study, it is recommended that the City of Chanhassen and the City Council, where applicable:

- Adopt this report as the Comprehensive Sanitary Sewer Plan for the City of Chanhassen.
- Review and update the CIP for trunk sanitary sewer facilities every year to reflect sewer improvement projects necessary for the next five year period.
- Proceed with future sanitary sewer improvements in accordance with the initial 5-year capital improvement program.
- Continue to reduce I/I to the existing collection system and maintain provisions for preventing I/I from entering the sanitary sewer system with new construction.