



Town of Strathmore

Master Servicing Study – 2017 Update

Sanitary System

Prepared For: Town of Strathmore

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1 INTRODUCTION

The Town of Strathmore has experienced significant changes in the development growth patterns and new infrastructure in place since the previous Master Servicing Study Update 2012, Water and Sanitary ("MSS 2012"). These changes include:

- Updated actual and planned growth of the Town
- Updated population growth based on the Town of Strathmore Population Projection 2015
- Significant change in water consumption resulting from the start-up of regional water system (East Calgary Regional Water Line)
- New infrastructure installed through the development process

In order to accommodate these changes, an update to the MSS 2012 was necessary. This 2017 update utilizes the existing MSS as a basis, with updates to design criteria, modelling, and recommendations as appropriate. Due to the changing water consumption and sewage generation rates in Strathmore, it is generally recommended that the Master Servicing Study be updated every five years.

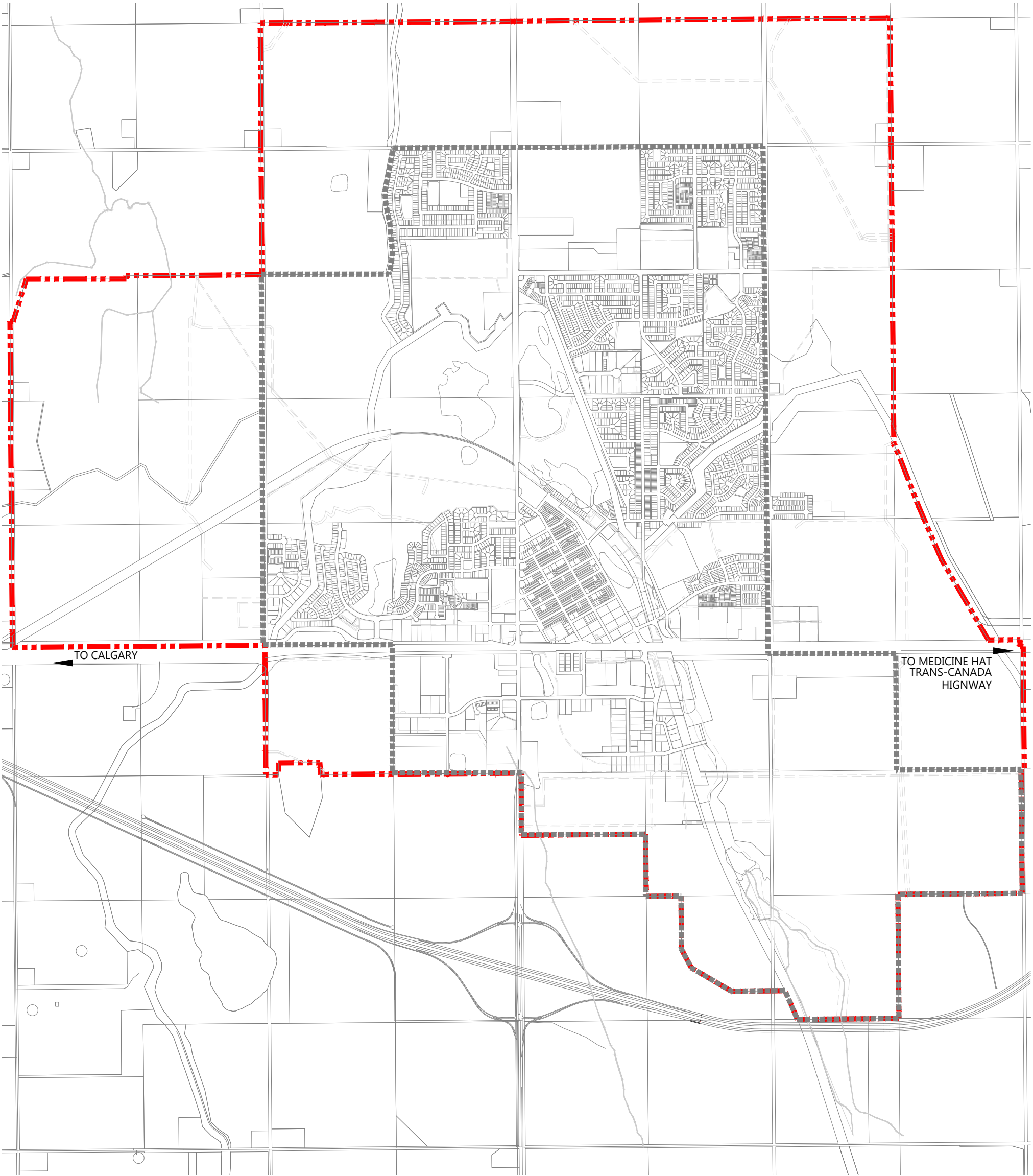
This report provides an update to the following systems only:

- Sanitary Sewerage System

2 STUDY AREA

The Town is located approximately 40 km east of the City of Calgary limits along Highway 1, the TransCanada Highway (TCH). The topography of the Town is generally flat with a maximum elevation difference of 27 m generally draining from north to southeast. The TCH bisects the Town from east to west. The main irrigation canal owned and maintained by the Western Irrigation District (WID) flows through the Town.

The study area includes the area within the original Town boundaries (pre-annexation) of 1,544 ha and approximately 18.5-quarter sections (1,184 ha) of annexation lands, for a total of 2,728 ha as shown in **Figure 2-1**.



Legend

- NEW TOWN BOUNDARY
- OLD TOWN BOUNDARY

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B	17/01/10	ISSUED FOR REPORT	LX -
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TITLE:

Study Area

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Town of Strathmore
Master Servicing Study
Update 2016

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Figure 2-1

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3 POPULATION ANALYSIS AND PROJECTIONS

3.1 Population Projections

Table 3-1 shows the population statistics for the Town for the past 38 years, for reference.

Table 3-1 – Town of Strathmore Historical Population, 1978-2015

Source: *Town of Strathmore Population Projection 2015*

Year	Population	% Growth	Year	Population	% Growth
1978	2,250	31.1	1997	5,471	3.75
1979	2,479	10.1	1998	6,045	10.4
1980	2,724	9.88	1999	6,794	12.3
1981	2,975	9.21	2000	7,165	5.46
1982	3,199	7.53	2001	7,455	4.05
1983	3,436	7.41	2002	8,022	7.61
1984	3,531	2.76	2003	8,640	7.70
1985	3,530	-0.03	2004	9,115	5.50
1986	3,530	0.00	2005	9,653	5.90
1987	3,544	0.40	2006	10,336	7.08
1988	3,544	0.00	2007	11,102	7.41
1989	3,564	0.56	2008	11,335	2.10
1990	3,746	5.11	2009	11,838	4.44
1991	4,185	11.7	2010	12,139	2.54
1992	4,408	5.33	2011	12,248*	0.90
1993	4,603	4.42	2012	12,352	0.85
1994	4,880	6.02	2013	12,612*	2.10
1995	5,088	4.26	2014	12,937*	2.58
1996	5,273	3.64	2015	13,327	3.01

* Estimate

The projected population of the Town and growth sequence have been updated for the next 30 years using the Town of Strathmore Population Projection 2015, as shown in **Table 3-2**.

**Table 3-2 – Town of Strathmore Population Projections, 2015-2056**

Year	Population	% Growth	Year	Population	% Growth
2015	13,327	2.0	2035	21,016	2.5
2016	13,594	0.8	2036	21,542	2.5
2017	13,702	0.8	2037	22,080	2.5
2018	13,812	2.5	2038	22,632	2.5
2019	14,157	2.5	2039	23,198	2.5
2020	14,511	2.5	2040	23,778	2.5
2021	14,874	2.5	2041	24,372	2.5
2022	15,246	2.5	2042	24,982	2.5
2023	15,627	2.5	2043	25,606	2.5
2024	16,017	2.5	2044	26,246	2.5
2025	16,418	2.5	2045	26,903	2.5
2026	16,828	2.5	2046	27,575	2.5
2027	17,249	2.5	2047	28,265	2.5
2028	17,680	2.5	2048	28,971	2.5
2029	18,122	2.5	2049	29,695	2.5
2030	18,575	2.5	2050	30,438	2.5
2031	19,040	2.5	2051	31,199	2.5
2032	19,516	2.5	2052	31,979	2.5
2033	20,004	2.5	2053	32,778	2.5
2034	20,504	2.5	2054	33,598	2.5
2035	21,016	2.5	2055	34,438	2.5
2036	21,542	2.5	2056	35,299	2.5

3.2 Population Density

For the population density of the existing developed area, the number of residential units listed in the Town of Strathmore 2015 Census was used, plus 20% for future densification and redevelopment. The density for all undeveloped areas is assumed to be 20 units per hectare for the net undeveloped lands. For each developed and undeveloped area, it has been assumed that there will be 2.6 persons per dwelling unit. For commercial and industrial lands, it has been assumed that there is an equivalent population density of 2.0 persons per unit.

Due to the Town of Strathmore having significant wetlands and significant stormwater control infrastructure required within Town boundaries, the area that can be practically considered for development is less than the gross area. For undeveloped lands, net developable area is assumed to be 85% of gross area (current ASPs indicate 78% to 86%). Based on the above, a population density for residential areas of 44.3 persons per gross hectare (17.9 persons per gross acre) was assumed. Similarly, for commercial and industrial areas, an equivalent population density of 34.0 persons per gross hectare (13.8 persons per gross acre) was assumed.



3.3 Development Cells

The proposed development cells are shown in **Table 3-3** and **Figure 3-1**. These development cells incorporate both existing and future developments.

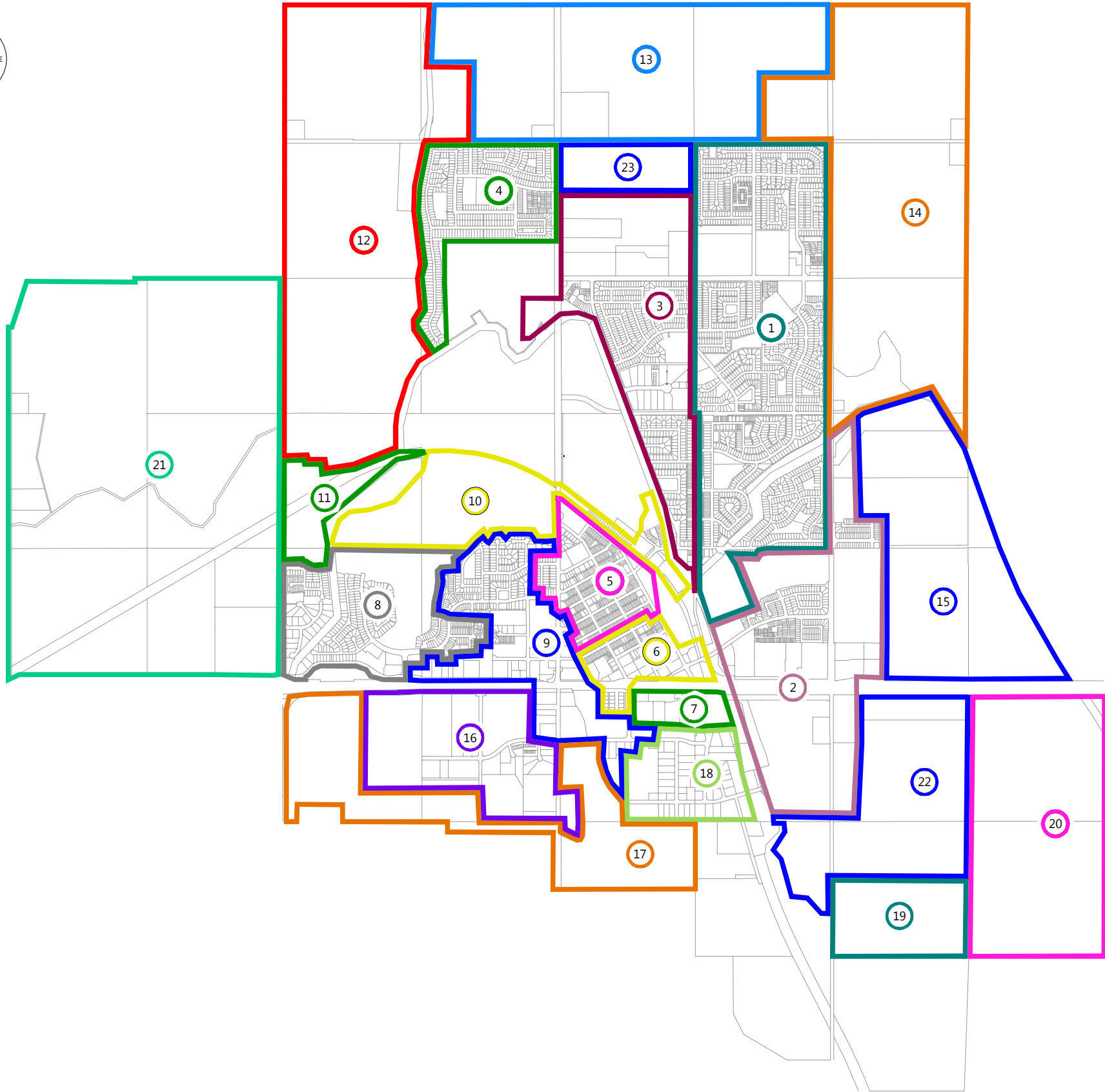
As the below table shows, there will be approximately 2,454 ha of land with 38,550 equivalent housing units at build-out of all lands currently zoned for development. Based on 2.6 persons per unit for residential and 2.0 equivalent persons per unit for commercial and industrial, this equates to an equivalent build-out population of 96,200 (including residential, commercial, and industrial areas).

Approximately 18.5-quarter sections of annexation lands are to be included as future development cells to be serviced by the Town's systems, which is the same as in the MSS 2012 update. However, the quarter section of NW-01-024-25-W4 (within the Town boundary, adjacent to "South Pivot Fields" development cell) has been excluded from the development cells due to the proposed Stormwater Pond 7 occupying this quarter section.

**Table 3-3 – Summary of development cells**

#	Development cell	Neighborhoods	Gross Area (ha)	Equivalent Units		Type
				Current*	Build-out	
1	Parkwood	Strathaven, Parkwood, Green Meadows, Maplewood, Cambridge Glen, Aspen Creek, Ranch Estates	202	2566	3,045	Residential/ Commercial
2	Ranch	The Ranch, Edgefield West, Prairie's View West	136	433	1,699	Residential
3	Thornclyff	Brentwood, Brentwood Business Park, Thornclyff, Crystal Ridge, 1/2 Ag Grounds	106	804	1,056	Residential/ Commercial
4	Hillview	Hillview	53	688	826	Residential
5	Downtown North	Downtown North	39	1092	1,178	Downtown
6	Downtown South	Downtown South	25	597	631	Downtown
7	Pine Road	Pine Road	16	272	272	Commercial
8	Strathmore Lakes	Strathmore Lakes West, Wildflower Ranch 1, Wildflower Heights	73	533	751	Residential
9	Westmount	Strathmore Lakes East, Westmount	77	444	533	Residential
10	West Creek	West Creek	95	81	1,615	Residential
11	Wildflower South	Wildflower South	23	-	391	Residential
12	Lakewood	Lakewood North, Lakewood East, Lakewood, North Hill Heights West, Wildflower North, +1 Quarter Section	227	-	3,059	Residential
13	North Hill	North Hill Heights East, Heritage Heights West, SW26-24-25 W5M & SE 26-24-25W4M	166	-	2,822	Residential
14	Prairie's Edge	Prairie's Edge, Grandview Gardens, Heritage Heights East, SW24-24-25-W4M	215	-	3,655	Residential
15	Edgefield	Edgefield East, Prairie's View East, +1 Quarter Section	125	-	2,125	Residential
16	Canal Gardens	Canal Gardens	74	264	1,258	Industrial
17	South Strathmore	West 1/2 of NW 10-24-25 W4M	99	-	1,683	Commercial
18	Spruce Park	Orchard Park, Spruce Park	35	494	595	Commercial
19	South Pivot Fields	SW12-24-W4M and NW 24-25-W5M	36	-	612	Industrial
20	East Pivot Fields	NE 12-24-25-W5M and SE 12-24-25-W4M	130	-	2,210	Industrial
21	West Strathmore	6 Quarters West of Wildflower Road and North of Highway 1 and east of West Boundary Road	382	-	6,494	Residential
22	North Pivot Fields	NW Quarter Section of 12-24-25-W4M & Legacy Creek	88	-	1,632	Industrial
23	Ag Grounds	Ag Grounds	24	-	408	Residential
-	Total	All	2,454	6,306	38,550	All

* Based on Town of Strathmore 2015 Census data



Neighbourhood Legend			
#	Gathering Group	Neighbourhoods	Area (ha)
1	Parkwood	Strathaven, Parkwood, Green Meadows, Maplewood, Cambridge Glen, Aspen Creek, Ranch Estates	202
2	Ranch	The Ranch, Edgefield West, Prairie's View West	136
3	Thorncilff	Brentwood, Brentwood Business Park, Thorncilff, Crystal Ridge, 1/2 Ag Grounds	106
4	Hillview	Hillview	53
5	Downtown North	Downtown North	39
6	Downtown South	Downtown South	25
7	Pine Road	Pine Road	16
8	Strathmore Lakes	Strathmore Lakes West, Wildflower Ranch 1, Wildflower Heights	73
9	Westmount	Strathmore Lakes East, Westmont	77
10	West Creek	West Creek	95
11	Wildflower South	Wildflower South	23
12	Lakewood	Lakewood North, Lakewood East, Lakewood, North Hill Heights West, Wildflower North, additional single quarter section	227
13	North Hill	North Hill Hieghts East, Heritage Heights West, SW quarter section of 26-24-25 M4M & SE quarter section of 26-24-25 W4M	198
14	Prairie's Edge	Prairie's Edge, Grandview Gardens, Heritage Heights East, SW quarter section of 24-24-25 W4M	215
15	Edgefield	Edgeview East, Prairie View East	123
16	Canal Gardens	Canal Gardens	74
17	South Strathmore	West half of quarter section NW 10-24-25 W4M	99
18	Spruce Park	Orchard Park, Spruce Park	35
19	South Pivot Fields	SW quarter section of 12-24-25 W4M & NW quarter section of 24-25-25 W4M	36
20	East Pivot Fields	NE quarter section of 12-24-25 W4M & SE quarter section of 01-24-25 W4M	130
21	West Strathmore	Six quarter sections West of Wildflower Road and North of highway #1, East of West Boundary Road	382
22	North Pivot Field	NW quarter section of 12-24-25 W4M & Legacy Creek	88
23	Ag Grounds	Ag Grounds	24

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4 WATER SUPPLY AND DISTRIBUTION

See 2012 Master Servicing Study Update – Section 4 – Water Supply and Distribution.

5 SANITARY SEWERAGE SYSTEM

5.1 Introduction

The Town of Strathmore has requested that Allnorth review the Sanitary Master Servicing study in light of the significant changes in the development growth patterns and new infrastructure in place. The purpose of the review is to update the servicing concept presented in the AECOM Master Servicing Study Update 2012 Water and Sanitary ("MSS 2012") with the actual and planned growth of the Town. In addition, the Town requested a review of the sewage generation based on the significant change in water consumptions since the change resulting from the start-up of regional water system (East Calgary Regional Water Line).

To enable the evaluation of existing and proposed sanitary servicing requirements, the design criteria used in the MSS 2012 have been updated. An updated servicing concept was developed based on the updated design criteria and developments since 2012. An updated staging plan has also been developed based on anticipated system bottlenecks as the town continues to grow.

The Waste Water Treatment Plant was upgraded in 2010 to increase the capacity to serve a population equivalent to 30,000 and to upgrade the treatment process to a conventional Biological Nutrient Removal (BNR) configuration. The upgrade also added sludge handling and dewatering facilities, an odour control system and operations building expansion. The per capita generation rates and peaking factors used in the process design were based on wastewater characterization provided by the Town for the years of 2006 and 2007.

The Town of Strathmore first completed the construction of the existing treated wastewater effluent pipeline and outfall in 2006. This pipeline conveyed the treated wastewater effluent from the Wastewater Treatment Plant to a secondary channel of the Bow River 21 km from the Town.

5.2 Reference Documents

1. Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems Part 4 Wastewater System Guidelines for Design, Operating and Monitoring of a Total of 5 Parts, 2013 (**"the Standards"**)
2. Town of Strathmore Master Servicing Study Annexation 2006 prepared by UMA Engineering Ltd. May 2007 (**"MSS 2006"**)
3. Town of Strathmore Master Servicing Study Update 2012 Water and Sanitary prepared by AECOM Canada Ltd. January 2013 (**"MSS 2012"**)
4. Lakewood Meadows Sanitary Lift Station Design Report prepared by Lee Maher Engineering Associates Ltd. February 13, 2015
5. Functional Service Report West Creek Subdivision Prepared by Pasquini & Associates Consulting Ltd. February 2015
6. Town of Strathmore 2011 Flow Monitoring Program Final Report – DRAFT prepared by Stantec September 12, 2011



7. Town of Strathmore Census Reports 2010 & 2012 prepared by the Town of Strathmore
8. Town of Strathmore Census Results – 2015 prepared by Town of Strathmore Legislative Services
9. Area Structure Plan summaries for Lakewood Meadows, Edgefield, Grandview Gardens, Heritage Heights, North Hill Heights, Prairies, West Creek, Wildflower Ranch prepared by Town of Strathmore October 2015
10. GIS base, LiDAR contour, air photo prepared by the Town of Strathmore
11. Record Drawings of Influent Sewer Pipeline Plan Profile 02-CM1001/1002 prepared by Maple Reinder Inc. May 10 2011
12. Wastewater Treatment Design Brief prepared by UMA Engineering Ltd. April 2008
13. Ranch Lift Station and Forcemain Cost Sharing Evaluation prepared by Stantec November 2005

5.3 Design Criteria

The design criteria for this study are as follows:

- The existing trunk sewers are utilized to the full extent and assumed not to be removed unless specifically stated in the design.
- The number of permanent lift stations as outlined in the MSS 2012 will remain the same.
- For the purposes of the model, industrial and commercial zoned areas are assumed to generate the same flow as residential areas, using equivalent population as described in Section 4.
- For Hillview flow generation, a constant point load 29.4 L/s was used, which is the lift station capacity
- Inflow and Infiltration (I & I) rate is assumed to be 0.28 L/s/ha (per the Standards) using net developable land area.
- Peaking factor is based on the larger of 2.5 or Harmon's Peaking Factor = $1 + 14/(4 + P^{1/2})$ where P = design contributing population in thousands.
- Minimum design slopes for sanitary sewer to meet 0.6 m/s minimum velocity as per AENV, as follows:

Table 5-1 – Minimum Sewer Slopes

Sewer Diameter (mm)	Minimum Design Slope (m/100m)
300	0.22
375	0.15
450	0.12
525	0.10
600+	0.08

5.4 Analysis of Flow Generation

The following is a review of the per-capita flow generation for the Town of Strathmore. With the implementation of the East Calgary Regional Water (ECRW) Line and the water conservation measures the Town has undertaken, there has likely been a corresponding reduction in sewage generation in recent years. The water conservation measures included a significant increase in the variable rate charge for both water and sanitary sewer, which has likely caused a reduction in usage. In addition, new homes are fitted with more water-smart devices such as low flow toilets, further reducing both water consumption and sanitary sewer production.



In the 2012 Master Servicing Plan, the per capita flow generation of 332 L/c/d was unchanged from the previous MSSA 2006. In order to update the per-capita flow sewage flow generation for current conditions, an analysis of water supply data was conducted using data provided by the Town (**Table 5-2**).

Table 5-2 – East Calgary Regional Water Line 2014 Volumes (m³ per month)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
106,820	98,362	110,570	106,639	120,817	131,062	171,722	137,784	120,202	120,202	105,613	108,607	1,438,400

During the winter months (November to April), it was assumed that almost 100% of supplied water returns to the sanitary sewer, as no lawn watering occurs. During this period there is also typically very limited I & I*, meaning that the volume of water supplied very closely matches the volume of sanitary sewage produced. Based on this, the average monthly water consumption was taken for the winter months and multiplied by 12 to obtain an estimate for the average annual sewage production (1,273,222 m³/yr).

As an annual percentage, the ratio of water supplied to sewage produced is 88.5% based on the 2014 data. The 2012 MSS used a rule-of-thumb assumption of 80% for this ratio, as no data was available at the time. For this update, the ratio has been increased to 90%, which better matches the data and is more conservative than the 80% previously used. A comparison illustrating this change is shown in **Table 5-3**.

Table 5-3 – Historical Water Consumption and Sewage Generation

Year	Population	Total Metered Water Consumption	90% of Total Metered Water Consumption	Per Capita Water Consumption	Per Capita Sewage Flow generated based on 90% of Consumption	Per Capita Sewage Flow generated based on 80% of Consumption
-	-	(m ³)	(m ³)	(L/c/d)	(L/c/d)	(L/c/d)
2001	7,455	924,565	832,109	340	306	272
2002	8,022	1,213,847	1,092,462	415	373	332
2003	8,640	1,277,556	1,149,800	405	365	324
2004	9,115	1,320,417	1,188,375	397	357	318
2005	9,653	1,305,704	1,175,134	371	334	296
2006	10,336	1,619,866	1,457,879	429	386	343
2007	11,102	1,483,773	1,335,396	366	330	293
2008	11,335	1,555,299	1,399,769	376	338	301

* *Infiltration and Inflow* (I & I) consists of water entering the sanitary sewer from sources other than sewage production. The primary routes are through manholes or pipe joints during rainfall, snow melt, or elevated groundwater levels, all of which are relatively rare in winter.



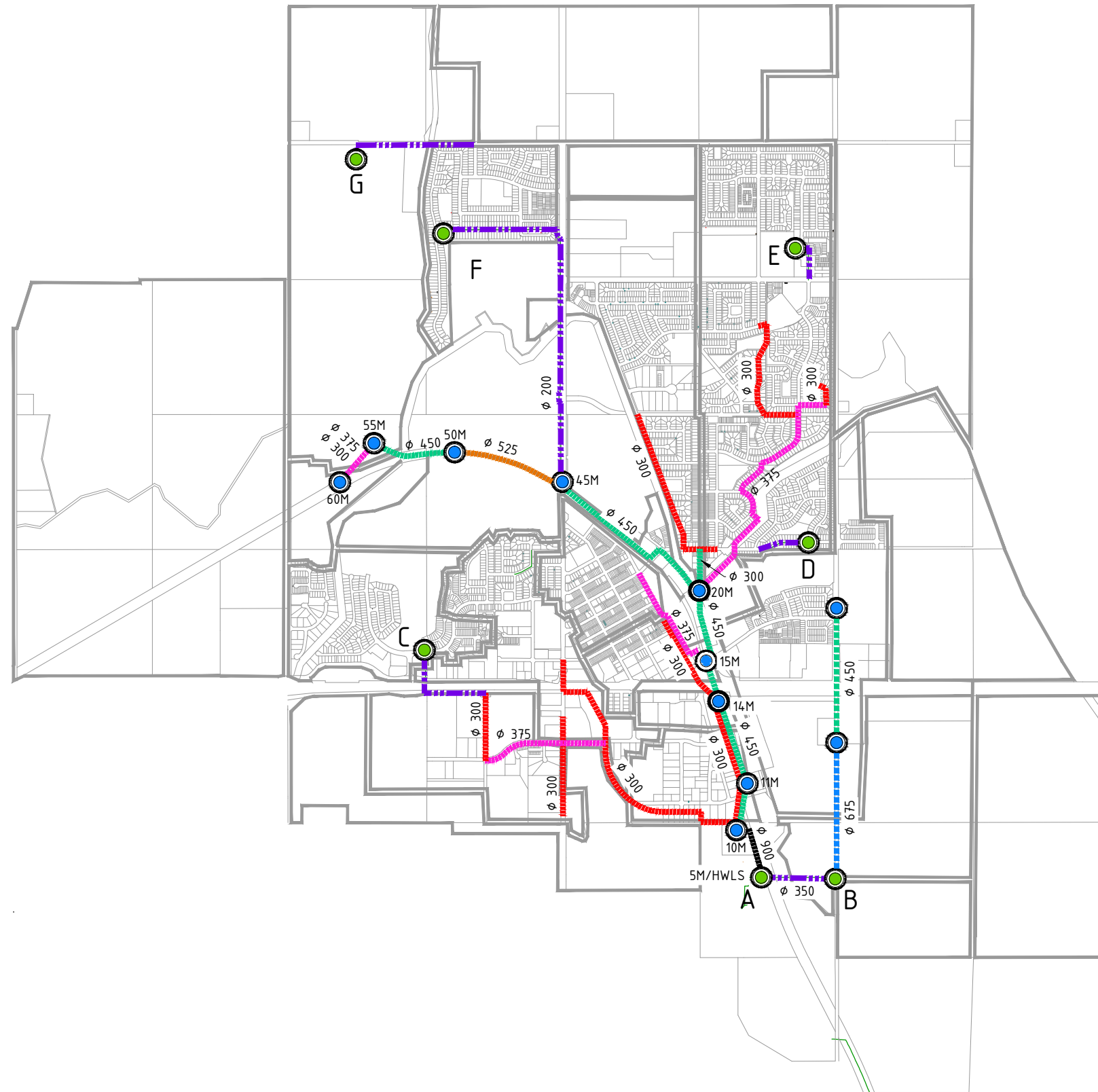
Year	Population	Total Metered Water Consumption	90% of Total Metered Water Consumption	Per Capita Water Consumption	Per Capita Sewage Flow generated based on <u>90%</u> of Consumption	Per Capita Sewage Flow generated based on <u>80%</u> of Consumption
-	-	(m ³)	(m ³)	(L/c/d)	(L/c/d)	(L/c/d)
2009	11,838	1,510,659	1,359,593	350	315	280
2010	12,139	1,450,443	1,305,399	327	295	262
2011	12,245	1,469,802	1,322,822	329	296	263
2012	12,352	1,455,908	1,310,317	323	291	258
2013	12,677	1,257,206	1,131,485	272	245	217
2014	13,002	1,438,400	1,294,560	303	273	242
5 year Average				311	280	249
10 year Average				345	310	276

The above table demonstrates that even with the change from 80% to 90% return sewage flow per capita, the design rate for sewage production could be lowered from 332 L/c/d to 310 L/c/d. In addition, there is a clear reduction in water usage since water conservation measures have been implemented. Based on this analysis, a sewage generation rate of 310 L/c/d has been used for the design of the trunk sewer system.

5.5 Evaluation of Existing System

The Town's existing sanitary sewer collection system consists of a main central trunk system, as well as a system of eastern trunks. The central trunk system consists of several trunks ranging in size from 300 mm to 900 mm diameter gravity sewers, and services the entire Town excluding United's "The Ranch" development, which is serviced by the eastern trunk sewer. **Figure 5-1** shows the current areas serviced by each trunk system and the general location including the trunk size.

In order to evaluate the current capacity and flow in each trunk section, the existing system was modelled using a static model, based on the development cells in **Section 3.3**. The peak dry weather flow component for each development cell was calculated using the 2011 flow monitoring data, with additional flows due to growth from 2011 to 2016 calculated using the Town Population Projections (see **Section 3.1**) and the residential design flow of 310 L/c/d. All I & I contributions were calculated using 0.28 L/s/ha per the Standards. The existing system model results, trunk dimensions, and areas serviced are summarised in **Sections 5.5.1, 5.5.2, and 5.5.3**.



Existing Lift Station

Proposed Lift Station

Tie Location

Force Main

300 ϕ Trunk

375 ϕ Trunk

450 ϕ Trunk

525 ϕ Trunk

675 ϕ Trunk

900 ϕ Trunk

[illegible]

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PROJECT NO:	15CG0122	DSGN:	MER	DATE:	15/12/17
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FIGURE 5-1

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5.5.1 Central Trunk System

The central trunk system has several service branches, which are shown **Figure 5-1** and are described as follows. The manhole numbers in brackets correspond to the manhole labels on **Figure 5-1**.

5.5.1.1 Wildflower Trunk (Main Central Trunk – 55M to 50M)

This main trunk consists of a 450 mm diameter sewer pipe. This trunk provides service to:

Existing

- Wildflower Phase 2

Future Additions

- Wildflower South development cell (#11)
- Lakewood development cell (#12):
 - Lakewood (Main, North, East)
 - North Hill Heights West
 - Wildflower North
 - 1 additional quarter section

The developments served by this trunk are currently undeveloped per the 2015 census data, although Wildflower Phase 2 has been constructed. The peak design flow generated by this development is approximately 1 L/s. The pipe capacity is 130 L/s at 0.18% slope.

At build-out of all future development cells, the design flow handled by this trunk will be 129 L/s, indicating that at build-out, the existing trunk will have sufficient capacity.

5.5.1.2 West Central Trunk (Main Central Trunk – 50M to 45M)

This main trunk consists of a 525 mm diameter sewer pipe. This trunk provides service to:

Existing

- Wildflower Trunk (450 mm)
- Lakeside area (portion of cell #10)

Future Additions

- West Creek development cell (#10)

The peak design flow generated by the existing developments served by this trunk is 3 L/s, while the average pipe capacity is 188 L/s, at 0.16% slope. This indicates that the trunk has sufficient capacity to serve the existing developments.

At build-out of all future development cells, the design flow handled by this trunk will be 199 L/s. Although the calculated build-out design flow slightly exceeds the pipe capacity, it is exceeded by less than 10%. The conservative assumptions made during the modeling process mean that this small overage is unlikely to cause concern, however closer to build-out, the capacity of this trunk should be reviewed.

5.5.1.3 Lakeside Trunk (Main Central Trunk – 45M to 20M)

This main trunk consists of a 450 mm diameter sewer pipe and the Hillview lift station that serves Hillview. This trunk provides service to:

**Existing**

- Hillview development cell (#4)
- Parklane Place
- West Central Trunk

Future Additions

- North Hill development cell (#13):
 - North Hill Heights East
 - Heritage Heights West
 - 2 additional quarter sections
- West Strathmore development cell (#21)

The peak design flow generated by the existing developments served by this trunk is 36 L/s, while the pipe capacity is 86 L/s at 0.08% slope. This indicates that the trunk has sufficient capacity to serve the existing developments.

At build-out of all future development cells, the design flow handled by this trunk will be 575 L/s. This indicates that a trunk upgrade will be required in order to handle the proposed future developments.

5.5.1.4 Parkwood Trunk (Central Trunk Branch – ties to 20M)

This branch trunk consists of a 375 mm diameter sewer pipe and the Strathaven Heights lift station that serves Strathaven and Strathaven Heights. This trunk provides service to:

Existing

- Parkwood development cell (#1):
 - Strathaven
 - Strathaven Heights
 - Maplewood
 - Cambridge Glen
 - Green Meadows
 - Parkwood
 - Aspen Creek

Future Additions

- 20% redevelopment allowance

The peak design flow generated by the existing developments served by this trunk is 69 L/s, while the average pipe capacity is 140 L/s, at 0.55% slope. This indicates that the trunk has sufficient capacity to serve the existing developments.

At build-out, the design flow handled by this trunk will be 134 L/s, indicating that the existing trunk will continue to have sufficient capacity in the ultimate system.

5.5.1.5 Thorncliff Trunk (Central Trunk Branch – ties to 20M)

This branch trunk consists of a 300 mm diameter sewer pipe. This trunk provides service to:

Existing

- Thorncliff development cell (#3)
 - Brentwood
 - Brentwood Business Park
 - Thorncliff
 - Crystal Ridge

Future Additions

- 20% redevelopment allowance



The peak design flow generated by the existing developments served by this trunk is 30 L/s, while the average pipe capacity is 81 L/s, at 0.60% slope. This indicates that the trunk has sufficient capacity to serve the existing developments.

At build-out, the design flow handled by this trunk will be 59 L/s, indicating that the existing trunk will continue to have sufficient capacity in the ultimate system.

5.5.1.6 North Center Street Trunk (Main Central Trunk – 20M to 15M)

This main trunk consists of a 450 mm diameter sewer pipe. This trunk provides service to:

Existing

- Parkwood Trunk (375 mm)
- Thorncliff Trunk (300 mm)
- Lakeside View Trunk (450 mm)

Future Additions

- Upstream trunk contributions only

The peak design flow generated by the existing developments served by this trunk is 135 L/s, while the pipe capacity is 128 L/s, at 0.17% slope. Although the flow from existing developments slightly exceeds the pipe capacity, it is exceeded by a small margin (less than 10%). The existing trunk may therefore be considered to have sufficient capacity for existing developments.

At build-out of all future development cells, assuming no upgrades, the design flow handled by this trunk would be 742 L/s. This indicates that a new trunk or trunk upgrade will be required in order to handle the proposed future developments.

5.5.1.7 Downtown North Trunk (Central Trunk Branch – ties to 15M)

This branch trunk consists of a 375 mm diameter sewer pipe. This trunk provides service to:

Existing

- Downtown North development cell (#5)

Future Additions

- 20% redevelopment allowance

The peak design flow generated by the existing developments served by this trunk is 18 L/s, while the pipe capacity is 104 L/s, at 0.30% slope. This indicates that the trunk has sufficient capacity to serve the existing developments.

At build-out, the design flow handled by this trunk will be 42 L/s, indicating that the existing trunk will continue to have sufficient capacity in the ultimate system.

5.5.1.8 South Center Street Trunk (Main Central Trunk – 15M to 14M)

This main trunk consists of a 450 mm diameter sewer pipe. This trunk provides service to:

Existing

- North Center Street Trunk (450 mm)
- Downtown North Trunk (375 mm)

Future Additions

- Upstream trunk contributions only

The peak design flow generated by the existing developments serviced by this trunk is 153 L/s, while the pipe capacity is 113 L/s, at 0.14% slope. This indicates that the existing trunk is over capacity, and



may experience surcharging and/or flooding in a severe wet weather event. A new trunk or trunk upgrade will be required in the near future in order to mitigate risk for the existing developments, and to allow for the 775 L/s design flow at build-out.

5.5.1.9 Downtown South Trunk (Central Trunk Branch – ties to 14M)

This branch trunk provides service to the southern part of downtown and Glenwood and consists of a 350 mm diameter sewer pipe. This trunk provides service to:

Existing

- Downtown South development cell (#6)

Future Additions

- 20% redevelopment allowance

The peak design flow generated by the existing developments serviced by this trunk is 11 L/s, while the pipe capacity is 76 L/s, at 0.24% slope. This indicates that the trunk has sufficient capacity to serve the existing developments.

At build-out, the design flow handled by this trunk will be 24 L/s, indicating that the existing trunk will continue to have sufficient capacity in the ultimate system.

5.5.1.10 Spruce Business Park Trunk (Main Central Trunk – 14M to 11M to 10M)

This main trunk consists of a 350 mm (west side) and 450 mm (east side) twinned sewer pipe, which are interconnected at several locations. This trunk provides service to:

Existing

- South Center Street Trunk (450 mm)
- Downtown South Trunk (350 mm)

Future Additions

- Upstream trunk contributions
- Edgefield development cell (#15):
 - Edgefield East
 - Prairie's View East
 - 1 additional quarter section

The peak design flow generated by the existing developments served by this trunk is 181 L/s, while the combined pipe capacity is 196 L/s. This indicates that the trunk has sufficient capacity to serve the existing developments.

At build-out of all future development cells, the design flow handled by this trunk will be 910 L/s. This indicates that a new trunk or trunk upgrade will be required in order to handle the proposed future developments.

5.5.1.11 Orchard Business Park Trunk (Central Trunk Branch – ties to 11M)

This branch trunk consists of 300 mm diameter to 375 mm diameter sewer pipes. The Orchard Business Park area is also served by the following lift stations:

- Westmount lift station that serves Westlake Glen and part of Westmount Drive.
- Wheeler Street lift station that serves Westview, Wheeler and parts of Strathmore Lakes Way and Willow Drive.
- Coupled with these lift stations, this trunk provides service to:

**Existing**

- Strathmore Lakes development cell (#8)
 - Strathmore Lakes West
 - Wildflower Ranch 1
 - Wildflower Heights
 - Westmount development cell (#9)
 - Strathmore Lakes East
 - Westmount
- Canal Gardens development cell (#16)
- Spruce B. Park development cell (#18):
 - Spruce Business Park
 - Orchard Business Park

Future Additions

- 20% redevelopment allowance

The peak design flow generated by the existing developments served by this trunk is 48 L/s while the limiting pipe capacity is 62 L/s at 0.11% in the 375 mm section. This indicates that the trunk has sufficient capacity to serve the existing developments.

At build-out, the design flow handled by this trunk will be 183 L/s. This indicates that a new trunk or trunk upgrade will be required in order to handle the proposed future developments.

5.5.1.12 Slater Trunk (Main Central Trunk – 10M to 5M)

This main trunk consists of a 900 mm diameter sewer pipe that leads directly to the wastewater treatment plant. This trunk provides service to:

Existing

- Orchard Business Park Trunk (375 mm)
- Spruce B. Park Trunk (350 & 450 mm)

Future Additions

- Upstream trunk contributions only

The peak design flow generated by the existing developments served by this trunk is 229 L/s, while the pipe capacity is 973 L/s, at 0.25% slope. This indicates that the trunk has sufficient capacity to serve the existing developments.

At build-out, the design flow handled by this trunk will be 900 L/s, indicating that the existing trunk will continue to have sufficient capacity in the ultimate system.

5.5.2 Eastern Trunk System (Eastern Trunks)

This trunk provides service to United's "The Ranch" development and consists of 450 mm and 675 mm diameter sewer pipes. Sewage flows from north of the TCH along East boundary road to a lift station east of the wastewater treatment plant. The lift station is connected to the wastewater treatment plant by a 350 mm diameter force main.

The peak design flow generated by the existing developments served by this trunk is 19 L/s while the average pipe capacity is 199 L/s at 0.42% in the 450 mm section. This indicates that the trunk has sufficient capacity to serve the existing developments.



At build-out of all future development cells, the design flow handled by the 675 mm section trunk will be 224 L/s, with 196 L/s in the 450 mm section. This indicates that the existing trunks will sufficient capacity at build-out.

5.5.3 Headworks (5M to HWLS)

Both the central and eastern trunks flow into the Waste Water Treatment Plant (WWTP). The headworks consists of a 19 m long 900 mm diameter sewer pipe from a manhole combining the central and eastern trunks, to a low lift pump station from where the sewage is pumped out to mechanical screens at the wastewater treatment plant.

The peak design flow generated by the existing developments served by this trunk is 248 L/s while the pipe capacity is 1,809 L/s, at 0.86% slope. This indicates that the trunk has sufficient capacity to service the existing developments.

At build-out, the design flow handled by this trunk will be 1,423 L/s, indicating that the existing trunk will continue to have sufficient capacity in the ultimate system.

5.6 Ranch Lift Station Evaluation

The Ranch Lift Station is located within SE ¼ 11-24-25 W4M, with a 350 mm forcemain running west for approximately 520 m to the Headworks Lift Station (HWLS). The Ranch Lift Station and forcemain have a design capacity of approximately 150 L/s, based on a pipe velocity of 1.5 m/s, with an existing flow of 26 L/s based on the 2011 Flow Monitoring data. The remaining capacity is therefore 124 L/s, which is equivalent to 200 ha of additional developable land based on the design criteria (**Section 5.3**), and the flow generation criteria (**Section 5.4**).

At build-out, the Ranch Lift Station will service four development cells (Ranch, Prairie's Edge, South Pivot Fields, and North Pivot Field), with a design flow of 296 L/s and a total area of 475 ha. An upgrade will be required for both the Ranch Lift Station and forcemain in order to handle this design flow.

In 2005, a report was prepared by Stantec covering the build-out design, cost estimate, and cost sharing of the Ranch Lift Station, although this was based on different boundaries of the lands to be serviced. For the new boundaries, the total required capacity at build-out is 296 L/s, which is approximately double the capacity of the existing Ranch lift station and forcemain. To accommodate the additional design flow, a new 350 mm forcemain would be required to twin the existing forcemain, as well as an approximate doubling of the lift station capacity.

An updated cost estimate for the Ranch Lift Station and forcemain upgrades, based on the 2005 Stantec report, is included in **Section 8**, with the cost estimate basis included in **Appendix B**.

5.7 Proposed Future Sanitary Servicing Concept

There has been significant growth in town area compared to the 50+ year projections made when the existing trunk sewers were reviewed in the MSS 2012. The MSS 2012 concept was to construct new trunk sewers on the east and west sides of the Town to service the growth areas, with a Parkwood bypass relief trunk sewer used to maximize the existing sanitary infrastructure.



Since the predicted areas for growth have changed, a new concept is proposed to install a large trunk sewer through the centre of the existing Town (following roughly the existing central trunk sewers), while utilizing the existing trunks where appropriate. The proposed future concept is shown in **Figure 5-2** (note existing sewers are not shown but are assumed to be maintained).

A new static hydraulic model was set up to evaluate the proposed future concept, using the design criteria (**Section 5.3**), and the flow generation criteria (**Section 5.4**). The model was based on the development cells outlined in **Table 3-3** and shown in **Figure 3-1**. The average dry weather flow was based on 310 L/c/d, as well as the estimated units at build-out for each development cell, the population density of 2.6 persons per unit (residential) and 2.0 equivalent persons per unit (commercial and industrial). The peak dry weather flow was computed by applying Harmon's Peaking Factor to the average dry weather flow. The peak wet weather flow was determined by adding I & I contributions based on the net developable area at build-out for each development cell, and 0.28 L/s/ha per the Standards.

There are two development cells served by existing lift stations with special modelling conditions as follows:

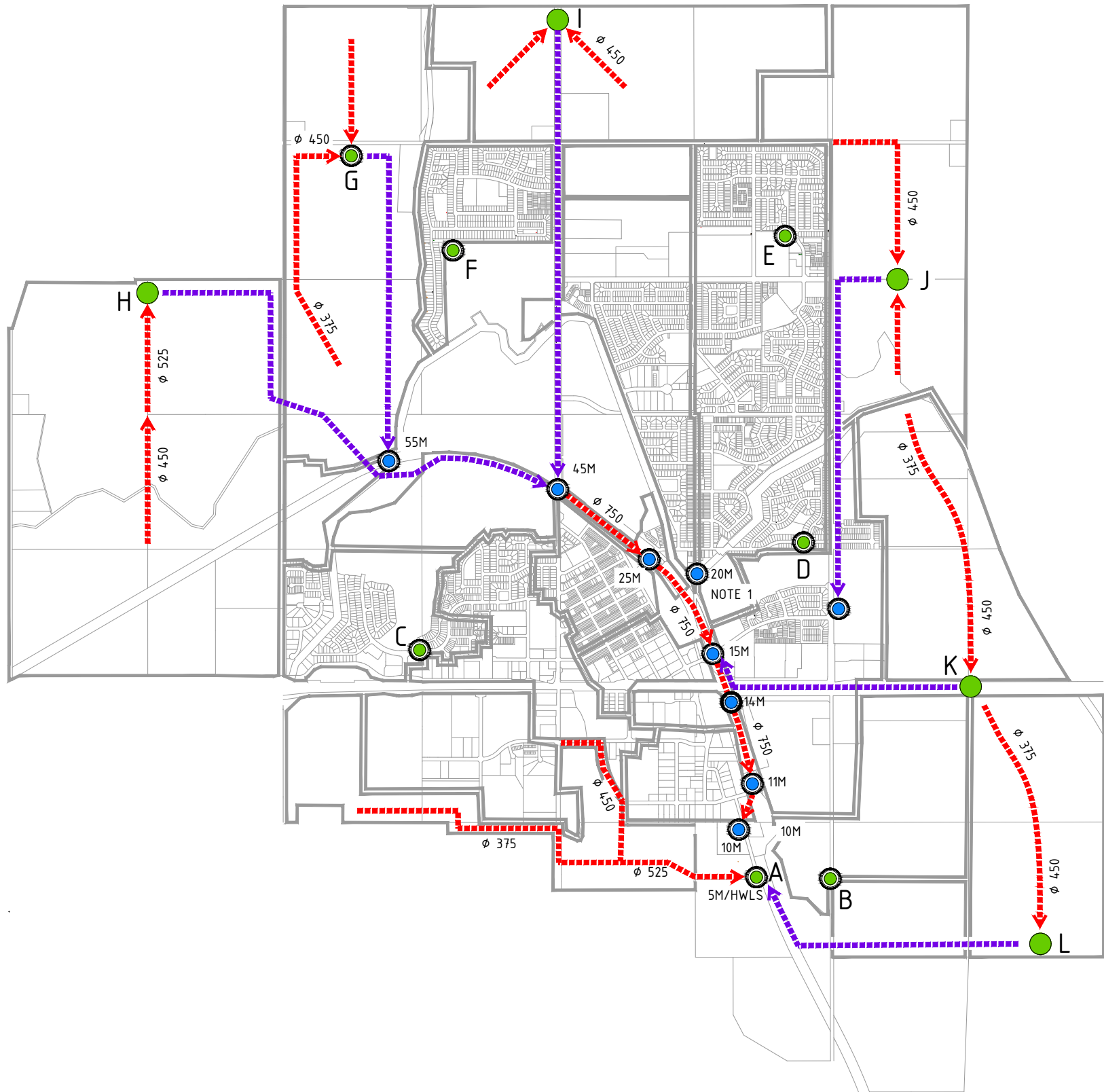
- Lakewood Meadows Lift Station, which services the Lakewood development cell, contains integrated storage of roughly 250 m³. The estimated peak wet weather flow rate handled by this lift station at build-out is 145 L/s. This allows a forcemain flow rate of 110 L/s, assuming the excess of 35 L/s is stored storm event of two hours duration. This flow of 110 L/s is added as a constant flow point load at manhole 55M, and represents all flow from the Lakewood development cell.
- Hillview Lift Station, which services the Hillview development cell, has a capacity of 29.4 L/s. This flow of 29.4 L/s is added as a constant flow point load at manhole 45M, and represents all flow from the Hillview development cell.

The following is a detailed description of the proposed future concept, including differences from the 2012 concept:

1. Provide a new 750 mm Trunk sewer in a new alignment running north from the 900 mm headworks trunk (Slater Trunk), along the existing 350 mm/450 mm trunk alignment to Wheatland Trail at the old railway. This new trunk line would replace the need for proposed Parkland Bypass. Due to limited easement area and existing sewer grades, the new 750 mm trunk sewer has been designed with sufficient capacity to replace the existing Spruce Trunk (twin 350 mm and 450 mm sewer) and the South Centre Street Trunk (single 450 mm sewer, including highway crossing). The existing Central Trunk sewer north of Highway 1, which includes the Lakeside and North Centre Street Trunks, will remain in operation. For the purposes of temporary servicing during installation of the new 750 mm sewer, one of the existing twin Spruce Trunk sewers and the South Centre Street Trunk will be utilized. After installation is complete, both existing Spruce Trunk sewers and the South Centre Street Trunk may be taken out of service.
2. Removal of the proposed Lift Station on the northeast corner of Wildflower (as currently outlined in the Wildflower FSR), and flow the sewer by gravity to Lakewood Meadows Lift Station. The Lakewood Meadows lift station will be directed to discharge via forcemain to the existing 450 mm pipe along the old railway line (MH 55M) at 110 L/s. Alternatively, the Lakewood Meadows lift station may be directed via existing and new forcemains to tie into the new 750 mm at Wheatland Trail (MH 45M).



3. The West Strathmore development cell (6 quarters to the west of Wildflower Road) will be pumped to the new trunk at Wheatland Trail, rather than via a new trunk to the wastewater treatment plant (WWTP).
4. Lands to the north of Hillview and Ag Grounds will pump via new forcemains to tie into the new 750 mm trunk at Wheatland Trail and the old railway, rather than a route east via the Aspen/Strathview area.
5. Ranch lift station and drainage will function as originally proposed when Walmart went in, except a new lift station will be installed at just north of Highway 1 and sewage pumped to the proposed central 750 mm trunk just north Highway 1 (Removes a 11m deep trunk south of Highway 1).
6. The Prairie's Edge development cell will be serviced via a new Prairie's Edge lift station, which will have flows directed via a new forcemain to the existing Ranch trunk, which will require an "endeavour to assist" to be paid to the developer.
7. The original proposed West Trunk will be downsized from 900 mm to 375 mm/525 mm as it will no longer drain the lands west of Wildflower Road.
8. The Orchard Business Park Trunk will be connected south to the proposed new West Trunk and drain directly to the HWLS. The existing 300 mm trunk running through property along the south side of the industrial park is to be abandoned.



Location Legend

Existing Lift Stations

A	Headworks
B	Ranch
C	Westmount
D	Aspen
E	Strathview
F	Hill View
G	Lakewood

Future Lift Stations

H	West Strathmore
I	North Hill
J	Prairie Edge
K	Edge Field
L	East Pivot

Sewer Legend

	Existing Lift Station
	Proposed Lift Station
	Tie Location
	Trunk
	Proposed Force Main

NOTES:
1. MANHOLE 20M NOT CONNECTED TO NEW 750mm TRUNK. PARKWOOD AND THORNCLIFF DEVELOPMENT CELLS SERVICED BY EXISTING 450mm TRUNK.

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C	17/02/06	STRATHMORE SEWERS	FI MER
B	17/01/31	STRATHMORE SEWERS	JHC MER
A	16/01/06	STRATHMORE SEWERS	JHC MER
REV	YY/MM/DD	DESCRIPTION	DRWN APVD



LIFT STATIONS & FORCE MAINS			
CLIENT NO:	-	DRWN:	JHC DATE: 15/12/17
PROJECT NO:	15CG0122	DSGN:	MER DATE: 15/12/17
DRAWING SIZE:	ANSI "B"	CHKD:	MT DATE: 17/01/31
SCALE:	NTS	APVD:	MER DATE:

PROJECT:		2016 MASTER SERVICING STUDY UPDATE	
DWG NO:	FIGURE 5-2	REV:	C



5.7.1 Future Concept Model Results

The full model results for the future concept are included in **Appendix A**. When evaluating trunk capacity under build-out conditions, a 10% overage allowance is made to account for the ongoing trend in reduced wastewater generation. This trend is due to progressive upgrades made to the existing sanitary collection system, improved design standards of new sewer installations, and reduction in water consumption.

The following is a summary of model results for each trunk system:

Central Trunk System

- The model suggests that the future growth areas along the north and west sides of Town can be serviced by the proposed new 750 mm diameter trunk sewer from the existing 900 mm headworks trunk sewer, along the same alignment as the existing central trunk (Eagle Lake drainage then along the old railway), terminating at Wheatland Trail.
- The model also suggests that the existing sections of the central trunk sewer will have sufficient capacity at build-out, including the 450 mm and 525 mm central trunk section upstream of Wheatland Trail, and the 900 mm central trunk section from the existing collection box to the HWLS.
- For the 450 mm pipe section between manholes 20M and 15M at build-out, the ultimate system hydraulic model also shows that there would be insufficient capacity based on pipe grade. However, this pipe section only services the Parkwood and Thorncliff development cells in the future concept, which are already largely built-out, and the existing system model shows this trunk has sufficient capacity for existing flows. If there is significant redevelopment and densification in these development cells, an upgrade may be required for this 450 mm trunk. If required, this upgrade could consist of replacement or twinning with another trunk at increased depth, as it would be tying into the new 750 mm trunk, which will be approximately 0.45 m deeper than the current tie-in. The proposed ultimate system assumes that this upgrade will not be required, although this should be re-evaluated prior to implementation of Phase 2 (see **Section 5.7.3**).

West Trunk and Orchard Business Park Trunk

- The model suggests that the sizing of the new West Trunk at 375 mm and 525 mm is sufficient for build-out conditions. The proposed reroute and upgrade of the Orchard Business Park Trunk to 450 mm (ties into the West Trunk) is also sufficient for build-out conditions.

Eastern Trunk System

- The model suggests that an upgrade will be required for the Ranch forcemain and lift station under build-out conditions (see **Section 5.6**). The eastern trunks will have sufficient capacity under build-out conditions.



5.7.2 Preliminary Central Trunk Profile Evaluation

A preliminary profile has been created for the proposed new 750 mm central trunk, in order to evaluate the details of tie-ins, staging, and the crossing of Highway 1. **Table 5-4** shows a summary of manhole and pipe segment data for the preliminary profile.

Table 5-4 – Preliminary Central Trunk Profile Summary

Manhole Data					Segment Data (from previous MH to this MH)					
Dist. (m)	MH#	Elevation (m)			Dia. (mm)	Grade	Length (m)	Avg. Cover (m)	Avg. Depth (m)	Est. Trench Width (m)
		Ground	Obvert	Invert						
0+000	10M	965.08	961.75	961.00	750	-	-	-	-	-
0+150	11M	965.52	962.73	961.98	750	0.65%	150	2.8	3.6	6.1
0+770	14M	969.79	966.14	965.39	750	0.55%	620	3.3	4.0	7.0
0+876	-	970.30	966.82	966.07	750	0.65%	106	3.9	4.7	8.3
0+990	-	970.89	967.23	966.48	750	0.35%	114	3.8	4.6	8.1
1+055	15M	971.36	967.47	966.72	750	0.35%	65	3.7	4.5	7.9
1+697	25M	973.07	968.75	968.00	750	0.20%	642	3.7	4.5	7.9
2+366	40M	973.26	969.96	969.21	750	0.18%	669	3.5	4.2	7.4
Overall Data:					750	Varies	2366	3.5	4.2	6.1 to 8.3

Cover

The preliminary profile shows that on average, the pipe cover exceeds the design minimum of 2.5 m. At the upstream end of the proposed new trunk, between Wheatland Trail and Lakeside Boulevard, the cover locally falls below the minimum for roughly 150 m, with the minimum cover at this location being 2.2 m. At this location, the pipe could be insulated to prevent freezing issues.

Highway Crossing

The preliminary profile at the highway crossing has a grade of 0.65%. At this location, the minimum required grade to provide sufficient capacity at build-out is the 0.35%. The additional allowance of 0.30% (factor of 1.9x) was chosen to provide certainty that the cased bored crossing will meet the minimum required pipe grade, and to allow for obstacles encountered during design and construction.



5.7.3 Central Trunk Staging Plan

The existing central trunk system has no remaining capacity between manholes MH 15M and MH 14M, based on the hydraulic modeling evaluation in **Section 5.5**. However, this evaluation assumes a design flow based on an I & I of 0.28 L/s/ha. This design I & I is intended to allow for an extreme wet weather (storm) event, and has a significant factor of safety built in. The Town has detailed flow monitoring data for six locations on the central trunk, from the 2011 Flow Monitoring report. The peak wet weather flows identified in the flow monitoring data are consistent with a typical storm event in Strathmore. Note that when staging based on a typical storm event rather than a design wet weather flow, there exists a risk of surcharging and/or flooding if an extreme event arises prior to installation of the new trunk. It is therefore recommended to install Phase 1 as early as possible to mitigate this risk. The following staging plan identifies the estimated time that each phase would need to be constructed, based on the peak wet weather flow values from the flow monitoring data.

The staging methodology using the flow monitoring data is as follows:

- The capacity of the critical (bottleneck) trunk section for the system prior to installing each new phase is identified
- The peak wet weather flow in this trunk section is determined from the 2011 Flow Monitoring data
- The remaining capacity is determined as the difference between the bottleneck trunk capacity and the peak wet weather flow
- The remaining capacity is converted to a remaining gross developable area since 2011, based on residential land use (44.3 persons per ha), ADWF of 310 L/s/ha, Harmon's peaking factor (using 2016 population), and I & I of 0.28 L/s/ha
- The gross developable area is then converted into a remaining capacity for population growth since 2011, using 44.3 persons per ha.
- The remaining capacity for population growth since 2011 is added to the population in 2011 (from the population data in **Table 3-1**) to obtain the estimated year each phase is required

* Note that for the below phasing plan, where it is noted that development may take place upstream of MH 10M, the model uses the conservative assumption that the development is upstream of MH 45M.

5.7.3.1 Phase 0 – Existing Central Trunk System

The staging analysis for the existing system is as follows:

- The critical (bottleneck) section is from 15M to 14M of the existing central trunk, capacity 134 L/s
- The peak wet weather flow from the 2011 Flow Monitoring data for this trunk section is 95 L/s
- The remaining capacity is therefore 39 L/s, which is equivalent to an additional **49 ha** of gross developed land

The capacity prior to implementation of Phase 1 is therefore as follows:

- **49 ha** for development of areas upstream of the existing 900 mm trunk collection box at Slater Road (MH 10M)*, prior to implementation of Phase 1. This includes the following development cells:
 - Parkwood (#1)
 - Thorncliff (#3)
 - Hillview (#4)
 - Downtown North (#5)
 - Wildflower South (#11)
 - Lakewood (#12)
 - North Hill (#13)
 - Edgefield (#15)



- Downtown South (#6)
- Pine Road (#7)
- West Creek (#10)
- West Strathmore (#21)
- Ag Grounds (#23)
- **716 ha** of additional capacity for development downstream of the existing 900 mm trunk collection box at Slater Road (MH 10M). Development in these areas does not depend on the central trunk upgrades, as the flows tie in directly to the existing 900 mm trunk. However, the collection systems upstream of the existing 900 mm trunk for these areas would need to be upgraded in order to tie in the full areas at build-out.
 - Ranch (#2)
 - Strathmore Lakes (#8)
 - Westmount (#9)
 - Prairie's Edge (#14)
 - Canal Gardens (#16)
 - South Strathmore (#17)
 - Spruce Park (#18)
 - South Pivot Fields (#19)
 - East Pivot Fields (#20)
 - North Pivot Fields (#22)

5.7.3.2 Phase 1 – Replace twin centre trunk (350 mm & 450 mm) from Slater Road Collection Box (MH 10M) to Fire Dept. (MH 15M)

Trigger Conditions:

Town growth causes sanitary sewer capacity to be exceeded in the 450 mm main central trunk (South Centre Street Trunk) between East Ridge Road (MH 14M) and the Fire Department (MH 15M) north of Highway 1. This is the location of a bottleneck caused by a single 450 mm trunk (the South Centre Street Trunk) handling incoming flows from a 450 mm (North Centre Street Trunk) and a 375 mm (Downtown North Trunk). The upstream 450 mm trunk itself handles incoming flows from a further 450 mm trunk, 300 mm trunk, and 375 mm trunk (Lakeside, Thorncliff, and Parkwood Trunks).

A list of upstream developments with growth contributing to this trigger condition may be found in **Section 5.5.1**, listed under the Lakeside Trunk, Thorncliff Trunk, Parkwood Trunk, and Downtown North Trunk.

Additionally, Phase 1 of the new 750 mm central trunk will cross through the proposed new Southland Station development ("Southland Station"), which is to be located within a lot bounded by Highway 1 on the north side and Spruce Park Drive on the west side. The new 750 mm trunk will pass through the full length (230 m) of the development, along a new road and across several new structures and intersections. Phase 1 also contains a new cased bored crossing of Highway 1, for which a large sending pit will also have to be located within the development.

In order to avoid substantial restoration costs, Phase 1 of the central trunk should be constructed before development of Southland Station occurs in the areas required for the trunk and crossing installation. The developer wishes to proceed with approvals for the development in 2017, and so the timing for Phase 1 will be dependent on when Southland Station is approved for construction.

If Phase 1 of the new central trunk is not installed prior to development of Southland Station, there would be significant additional restoration costs, as estimated in **Appendix B**.

Scope:

Replacement of approximately 765 m of twin 350 mm & 450 mm trunk sewer and 265 mm of single 450 mm trunk sewer with 1,050 m of 750 mm trunk sewer between the existing 900 mm tie-in box on Slater Way and the Fire Dept. (MH 15M to MH 10M). This includes a new crossing of Highway 1. The new 750 mm pipe would run along the same alignment as the existing 350 mm trunk, with the existing 350 mm trunk removed during installation. The 450 mm trunk would remain in place for temporary servicing until the new 750 mm trunk was completed.

There are several sections of the existing 350 mm and 450 mm central trunk sewers which are at or below minimum grade. The new 750 mm pipe will therefore be installed deeper than the existing trunk sewers, in order to improve grade and pipe capacity. This deeper installation will require that the full length of sewer is replaced between the bottleneck and the existing downstream 900 mm sewer. It would not be hydraulically feasible to replace only the bottleneck section (MH 15M to MH 14M).

Estimated Year Required: **As soon as practical** (based on design storm event), **2020** (based on 2011 Flow Monitoring data, typical storm event)

Developable Area Added by Phase 1:

- The capacity of Phase 1 is limited by the critical (bottleneck) section from 20M to 15M of the existing central trunk, which has capacity 128 L/s
- The peak wet weather flow from the 2011 Flow Monitoring data for this trunk section is 67 L/s
- The remaining capacity is therefore 61 L/s, which is equivalent to an additional 77 ha developed since 2011. Subtracting the 49 ha added in Phase 0, this leaves 28 ha of gross developable land added by Phase 1.
- Phase 1 also allows development of the Edgefield Development Cell, which will tie into MH 15M via a new lift station and forcemain.

The developable area added by Phase 1 is therefore as follows:

- **28 ha** (Upstream of MH 10M*)
- **125 ha** (Edgefield Development Cell, assuming lift station and forcemain constructed)

5.7.3.3 Phase 2 – New 750 mm from Fire Dept. (MH 15M) to 2nd Ave near Lakeside Blvd. (MH 25M)

Trigger Conditions:

Town growth causes sanitary sewer capacity to be exceeded in the 450 mm main central trunk (North Centre Street Trunk) between the Fire Department (MH 15M) and 2nd Ave near Lakeside Blvd (MH 25M). This is the location of a bottleneck caused by a single 450 mm trunk (the North Centre Street Trunk) handling incoming flows from a 450 mm trunk, 300 mm trunk, and 375 mm trunk (Lakeside, Thorncliff, and Parkwood Trunks).

A list of upstream developments with growth contributing to this trigger condition may be found in **Section 5.5.1**, listed under the Lakeside Trunk, Thorncliff Trunk, and Parkwood Trunk.

Scope:

Addition of approximately 650 m of 750 mm sanitary sewer between 2nd Ave. near Lakeside Blvd. and the Fire Dept. (MH 25M to MH 15M). The new 750 mm pipe would run along the north side of Kinsmen Park, roughly parallel to the existing 450 mm, between the Fire Department and a tie-in to the existing 450 mm trunk at 2nd Ave near Lakeside Blvd (MH 25M). This new 750 mm would handle all flows from the northwest of town (i.e. all flows upstream of MH 20M), which would remove the bottleneck in the 450 mm North Centre Street trunk by reducing its serviced area to just the northeast of town (Parkwood and Thorncliff trunks).

For staging purposes, there is an option to install a 600 mm trunk rather than a 750 mm trunk during this phase, which would require future twinning with a section 600 mm trunk in a later phase (see **Section 5.7.3.5** Optional Phase 4). If this option is taken, it will not affect the timing of Phase 3.

Estimated Year Required: **2022** (based on 2011 Flow Monitoring data, typical storm event)

Developable Area Added by Phase 2:

- The capacity of Phase 2 is limited by the critical (bottleneck) section from 45M to 25M of the existing central trunk, which has capacity 86 L/s
- The peak wet weather flow from the 2011 Flow Monitoring data for this trunk section is 11 L/s
- The remaining capacity is therefore 75 L/s, which is equivalent to an additional 95 ha developable since 2011. Subtracting the 77 ha added in Phases 0 & 1, this leaves 18 ha of gross developable land added by Phase 2.

The developable area added by Phase 2 is therefore:

- **18 ha** (Upstream of MH 10M*)

5.7.3.4 Phase 3 – New 750 mm from 2nd Ave near Lakeside Blvd. (MH 25M) to Wheatland Trail (MH 45M)

Trigger Conditions:

Town growth causes sanitary sewer capacity to be exceeded in the 450 mm main central trunk (Lakeside Trunk) between 2nd Ave. near Lakeside Blvd. (MH 25M) and Wheatland Trail (MH 45M). This is the location of a bottleneck caused by a single 450 mm trunk (the Lakeside Trunk) handling incoming flows from a 525 mm trunk, a 200 mm forcemain, and a future forcemain from the West Strathmore development cell (six quarter sections).

A list of upstream developments with growth contributing to this trigger condition may be found in **Section 5.5.1**, listed under the Lakeside Trunk.

Scope:

Addition of approximately 670 m of 750 mm sanitary sewer between Wheatland Trail and 2nd Ave near Lakeside Blvd. (MH 45M to MH 25M). The new 750 mm pipe would run roughly parallel to the existing 450 mm as a twinned trunk, along Lakeside Blvd and then beside the existing 450 mm trunk. Due to a lack of grade, this new trunk must be sized at 750 mm, as a 675 mm trunk does not provide adequate capacity at build-out.



For staging purposes, there is an option to install a 600 mm trunk rather than a 750 mm trunk during this phase, which would require future twinning with a section 600 mm trunk in a later phase (see **Section 5.7.3.5** Optional Phase 4). If the 600 mm option is taken in Phase 2, it must also be taken in this phase (Phase 3) for continuity.

Estimated Year Required: **2024** (based on 2011 Flow Monitoring data, typical storm event)

Developable Area Added by Phase 3:

- If 750 mm trunk installed: All remaining development, 824 ha
- If 600 mm trunk installed:
 - The capacity of Phase 3 is limited by the capacity of the 600 mm trunk added in Phase 3, which has capacity 272 L/s
 - The peak wet weather flow from the 2011 Flow Monitoring data for this trunk section is 11 L/s
 - The remaining capacity is therefore 261 L/s, which is equivalent to an additional 331 ha developable since 2011. Subtracting the 95 ha added in Phases 0, 1 & 2, this leaves 236 ha of gross developable land added by Phase 3.

The developable land added by Phase 3 is therefore:

- **If 750 mm trunk installed: 824 ha** (all remaining development)
- **If 600 mm trunk installed: 236 ha** (upstream of MH 10M*)

5.7.3.5 Optional Phase 4 – New 600 mm to twin Phase 2 & 3 600 mm from Fire Dept. (MH 15M) to Wheatland Trail (MH 45M)

Trigger Conditions:

This phase is only required if the 600 mm trunk option was installed during Phase 2 and Phase 3.

Town growth causes sanitary sewer capacity to be exceeded in the 600 mm main central trunk installed during Phase 3, between MH 25M and MH 45M. This section of the new 600 mm trunk has the limiting capacity due to the need for installation at a lower grade than the Phase 2 trunk section.

A list of upstream developments with growth contributing to this trigger condition may be found in **Section 5.5.1**, listed under the Lakeside Trunk.

Scope:

Addition of approximately 1,320 m of 600 mm sanitary sewer between Wheatland Trail and the Fire Dept. (MH 45M to MH 15M). The new 600 mm pipe would run roughly parallel to the 600 mm trunk installed during Phase 2 and Phase 3.

Estimated Year Required: **2037** (based on 2011 Flow Monitoring data, typical storm event)

Developable Area Added by Phase 4: **588 ha** (all remaining development)



5.8 Wastewater Treatment Plant Upgrades

5.8.1 Treatment Plant Staging

The Town of Strathmore's sewage disposal facilities are located on the southeast side of town and consist of a mechanical tertiary wastewater treatment plant. In addition to the mechanical plant, the Town has off-specification storage cells and equalization storage cells. The equalization storage cells and the mechanical plant are tied directly to the effluent pump station (known as the Pink Palace) that, prior to construction of the BTO, discharged effluent to the Town's irrigation lands. Subsequent to the construction of the BTO, the effluent pump station pumps originally designed to pump to the irrigation system to the west were modified to pump down the BTO pipeline at a maximum rate of 195 L/s.

The design brief that was prepared by UMA Engineering Ltd. in April 2008 indicates that the upgrades to the Strathmore WWTP were to be designed to accommodate a service population of 30,000, or approximately three times the 2008 service population. Given the 2008 population of just over 10,000 and the design population of 30,000, an intermediate stage based on a service population of 20,000 was used to distribute the upgrades over a longer period of time.

5.8.2 Raw Wastewater Flow and Loading Projections

The raw wastewater design flows and loadings for the Strathmore WWTP are summarized in **Table 5-5**.

Table 5-5 – Design Flows and Loadings

PARAMETER		Stage 1	Stage 2
FLOW			
Annual average day flow	ML/d	8.6	13.0
Average month flow	ML/d	8.3	12.4
Maximum month flow	ML/d	8.8	13.2
Maximum week flow	ML/d	9.3	14.0
Maximum day flow	ML/d	9.8	14.8
Peak flow to full treatment	ML/d	21.5	32.5
Peak flow to full treatment	L/s	249.0	376.2
BOD			
Maximum day load	kg/day	4,160	6,240
COD			
Maximum day load	kg/day	9,152	13,728
TSS			
Maximum day load	kg/day	5,980	8,970
TKN			
Maximum day load	kg/day	334	500
TP			
Maximum day load	kg/day	72	108



Effluent Discharge Limits

The effluent discharge limits for the Strathmore WWTP are summarized in **Table 5-6**.

Table 5-6 – Effluent Discharge Limits

	STAGE 1	STAGE 2
cBOD ₅	< 20 mg/L	< 20 mg/L
Total Phosphorus	< 0.5 mg/L	< 0.5 mg/L
Total Suspended Solids (TSS)	< 20 mg/L	< 20 mg/L
Ammonia (NH ₃ -N)	< 10 mg/L (winter)	< 10 mg/L (winter)
	< 5 mg/L (summer)	< 5 mg/L (summer)
Fecal Coliforms (FC)	< 200 CFU per 100 mL	< 200 CFU per 100 mL
Total Coliforms (TC)	< 1000 CFU per 100 mL	< 1000 CFU per 100 mL

5.9 Bow Tertiary Outfall (BTO)

In 2006, the Town first completed the construction of the BTO (treated wastewater effluent pipeline) and outfall. This BTO conveyed the treated wastewater effluent from the Wastewater Treatment Plant to a secondary channel of the Bow River 21 km from the Town. The BTO outfall consisted of an energy dissipator in a manhole that then spilled by gravity over a rip rap spillway into a stilling pond, and then flowed by gravity down a rip rap channel to the secondary channel of the Bow River.

Alberta Environment Approval 1190-02-00 required the Town to relocate the effluent discharge point from its original location on the secondary channel to a new location on the main stem of the Bow River. The Town completed the relocation in 2011.

In addition to discharge to the Bow River, a second discharge point was installed in 2012 to a holding pond on Namaka Farms. Namaka Farms then utilizes the effluent for irrigation of their lands when required. Specific procedures are in place to enable the Town to supply Namaka farms.

5.9.1 Design Flow

The design population for the effluent pipeline was projected from the year 2005 by utilizing the average historical growth rate of the Town and this method estimated a population of approximately 32,500, with requirement of pumping based on the effluent generated and the equalization storage available.

The effluent pipeline was designed for the following flow parameters:

- Design flow (pumped) of 247 L/s
- Design flow (gravity) of 100 L/s

Based on the BTO preliminary design report, and the current per-capita sewage generation, the BTO pump system would need to be installed when the population reaches approximately 20,000, which according to population projects will occur in the year 2032.



6 STORMWATER SYSTEM

See Master Servicing Study Annexation Update 2006.

7 ROAD NETWORK PLANNING

See Master Servicing Study Annexation Update 2006.

8 CAPITAL COSTING

8.1 Major Sanitary System Upgrades

The Town has invested into the sanitary system in the last decade, including the construction of the BTO pipeline, relocation of BTO pipeline outfall, new WWTP and master plans. In order for these capital investments to be fully realized private developers will need to upgrade the collection system to connect the new services areas directly to the treatment and disposal system. In addition to these developers' direct investments, it is recommended that endeavours to assist are utilized to finance localised major collection infrastructure which services approximately three quarter sections or less. For major sewer collection infrastructure, offsite levies should be considered, where the infrastructure benefits a large percentage of the existing and/or future population. Based on this, the proposed Central Trunk, South Trunk, Orchard Trunk, Ranch Lift Station capacity increase, and Ranch forcemain upgrades should be installed by the Town, with the projects financed through offsite levies.

Cost estimates were developed for each of this project along with approximate staging. The cost estimates for the gravity trunks were developed using the unit rates from the City of Calgary 2016 Master Development Agreement (Schedule 1), applied to the lengths and sizes identified in the ultimate system model. The cost estimates for the Ranch Lift Station and forcemain are based on the 2005 cost estimates prepared by Stantec, adjusted for inflation using the Alberta CPI data published by Statistics Canada (CANSIM table 326-0021). **Table 8-1** summarizes the costs, with basis of this estimate included in **Appendix B**.

**Table 8-1 – Major Sanitary System Cost Estimates**

Item	Description	Estimated Capital Cost
Central Trunk Sewer Option 1	New 750 mm from MH 10M to MH 45M	\$ 4,678,000 (Total, all phases)
Phase 1	Slater Road Collection Box (MH 10M) to Fire Dept. (MH 15M)	\$ 2,735,000
Phase 2	New 750 mm from Fire Dept. (MH 15M) to 2nd Ave near Lakeside Blvd. (MH 25M)	\$ 942,000
Phase 3	New 750 mm from 2nd Ave near Lakeside Blvd. (MH 25M) to Wheatland Trail (MH 45M)	\$ 1,001,000
Central Trunk Sewer Option 2	New 750 mm from MH 10M to MH 15M Staged twin 600 mm from MH 15M to MH 45M	\$ 5,820,000 (Total, all phases)
Phase 1	Slater Road Collection Box (MH 10M) to Fire Dept. (MH 15M)	\$ 2,735,000 (same as Option 1)
Phase 2	New 600 mm from Fire Dept. (MH 15M) to 2nd Ave near Lakeside Blvd. (MH 25M)	\$ 730,000
Phase 3	New 600 mm from 2nd Ave near Lakeside Blvd. (MH 25M) to Wheatland Trail (MH 45M)	\$ 813,000
Phase 4	New 600 mm from Fire Dept. (MH 15M) to Wheatland Trail (MH 45M) (twins Phases 2 & 3)	\$ 1,542,000
Western Trunk System	South, Orchard Park, and West Trunks	\$ 2,409,000 (Total, three trunks)
South Trunk	From WWTP Headworks to Orchard Park Trunk and West Trunk Connection	\$ 723,000
Orchard Park Trunk	From South Trunk to Canal Garden Connection	\$ 596,000
West Trunk	From Orchard Park /South Trunks Tie-in to West	\$ 1,090,000
Ranch Lift Station & Forcemain	Stage II Upgrades	\$ 604,000 (Total, LS & Forcemain)
Lift Station	Lift Station Upgrade	\$ 316,000
Forcemain	New 350 mm forcemain (twins existing forcemain)	\$ 288,000
BTO – Effluent Pump Station Upgrades	Install two new vertical turbine pumps, new controls and minor pump upgrades	\$ 513,000



We trust this report satisfies your requirements at this time and thank you for the opportunity to work with you on the project. If you have questions or concerns do not hesitate to contact our office.

Yours truly,

ALLNORTH CONSULTANTS LIMITED

Allnorth Permit to Practice/Certificate of Authorization #: 06366

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Any opinions of probable cost provided in the report are based on Allnorth's experience and information available to Allnorth at the time such estimates are made. Client acknowledges that due to assumptions that must be made, Allnorth shall not be liable for the accuracy of such estimates.



Appendix A Static Hydraulic Model Results – Future Sanitary System

Client:Town of Strathmore

Job #15CG0122

Date Initiated1-Oct-16

Last Edit19-Apr-17

Calculated By:Mirren Turnbull

Residential Flow	310	L/d/c
I/I Allowance	0.28	L/sec./ha
Population Density		
Res People per unit	2.6	
Com/Ind People per unit	2.0	

CONCEPT SANITARY DESIGN SHEET

Case: Ultimate System (Build-out)

* Added as a point load where needed

Network Information				Added Development Cells - Lots & Areas										# of Lots	Population		Area	Dry Weather (Domestic)			I/I	Point	Total	Velocity and Flow		Delta	Pipe Detail		
	Location	From u/s MH	To d/s MH	#	Added 1	#	Added 2	#	Added 3	#	Lots Added		Area Total	Current	Added	Cumul.	Current ha	Peak Factor	ADWF L/s	PDWF L/s	Cumul. L/s	Loads L/s	Design Flow (L/s)	Velocity m/s	Capacity L/s	Capacity L/s	Len m	Dia mm	Slope %
											Curr.	Ult.																	
	Forcemain from Lakewood Lift Station to 55M	56FM	55M		Lakewood*									0	0	0	0	4.5	0.0	0.0	0.0	110.0	110.0	1.56	110.3	0.3	2100	300	1.30%
	Central Trunk (450) @ West Creek tie-in	55M	55.01	11	Wildflower South						391	391	20	391	1017	1017	20	3.8	3.6	13.8	5.5	110.0	129.3	0.83	130.0	0.7	146	450	0.18%
	Central Trunk (450)	55.01	55.02											391	0	1017	20	3.8	3.6	13.8	5.5	110.0	129.3	0.83	130.0	0.7	118	450	0.18%
	Central Trunk (450)	55.02	50M											391	0	1017	20	3.8	3.6	13.8	5.5	110.0	129.3	0.83	129.8	0.5	141	450	0.18%
	Central Trunk (525)	50M	55.03	10	West Creek						1615	1615	81	2006	4199	5216	100	3.2	18.7	60.4	28.1	110.0	198.5	0.88	187.9	-10.6	119	525	0.17%
	Central Trunk (525)	55.03	55.04											2006	0	5216	100	3.2	18.7	60.4	28.1	110.0	198.5	0.88	187.7	-10.8	120	525	0.16%
	Central Trunk (525)	55.04	55.05											2006	0	5216	100	3.2	18.7	60.4	28.1	110.0	198.5	0.88	187.7	-10.8	182	525	0.16%
	Central Trunk (525)	55.05	55.06											2006	0	5216	100	3.2	18.7	60.4	28.1	110.0	198.5	0.88	187.7	-10.8	182	525	0.16%
	Central Trunk (525)	55.06	55.07											2006	0	5216	100	3.2	18.7	60.4	28.1	110.0	198.5	0.88	187.7	-10.8	175	525	0.17%
	Central Trunk (525)	55.07	55.08											2006	0	5216	100	3.2	18.7	60.4	28.1	110.0	198.5	0.88	186.2	-12.3	18	525	0.16%
	Central Trunk (525)	55.08	45M											2006	0	5216	100	3.2	18.7	60.4	28.1	110.0	198.5	0.89	188.4	-10.1	33	525	0.17%
	Parkwood Branch (375)	21N	1021.01	1	Parkwood						3045	3045	172	3045	7824	7824	172	3.1	28.1	85.9	48.1	0.0	134.0	1.29	139.7	5.7	69	375	0.55%
	Parkwood Branch (375)	1021.01	1021.02											3045	0	7824	172	3.1	28.1	85.9	48.1	0.0	134.0	1.29	139.7	5.7	3	375	0.55%
	Parkwood Branch (375)	1021.02	20M											3045	0	7824	172	3.1	28.1	85.9	48.1	0.0	134.0	1.29	139.7	5.7	73	375	0.55%
	Thorncriff Branch (300)	23N	22N	3	Thorncriff						1056	1056	90	1056	2715	2715	90	3.5	9.7	33.9	25.2	0.0	59.1	1.16	80.5	21.4	45	300	0.60%
	Thorncriff Branch (300)	22N	20M											1056	0	2715	90	3.5	9.7	33.9	25.2	0.0	59.1	1.16	80.5	21.4	13	300	0.60%
	Forcemain from Hillview Lift Station to 45M	48FM	45M		Hillview*									0	0	0	0	4.5	0.0	0.0	0.0	29.4	29.4	1.61	28.5	-0.9	1600	150	3.50%
	Forcemain from North Hill Lift Station to 45M	47FM	45M	13	North Hill	23	Ag Grounds				3230	3230	162	3230	8398	8398	162	3.0	30.1	91.3	45.2	0.0	136.5	1.78	126.1	-10.4	2000	300	1.70%
	Forcemain from West Strathmore LS to 45M	46FM	45M	21	West Strathmore						6494	6494	325	6494	16884	16884	325	2.7	60.6	165.2	90.9	0.0	256.1	1.61	256.6	0.5	3200	450	0.81%
	Central Trunk (450) @ Hillview tie-in	45M	40M											587	0	1525	29	3.7	5.5	20.1	8.2	7.0	35.3	0.57	89.6	54.3	22	450	0.09%
	Central Trunk (450)	40M	40.01											587	0	1525	29	3.7	5.5	20.1	8.2	7.0	35.3	0.80	124.1	88.8	83	450	0.16%
	Central Trunk (450)	40.01	40.02											587	0	1525	29	3.7	5.5	20.1	8.2	7.0	35.3	0.48	74.2	39.0	119	450	0.06%
	Central Trunk (450)	40.02	35M											587	0	1525	29	3.7	5.5	20.1	8.2	7.0	35.3	0.76	118.7	83.4	43	450	0.15%
	Central Trunk (450)	35M	35.01											587	0	1525	29	3.7	5.5	20.1	8.2	7.0	35.3	0.55	85.8	50.5	134	450	0.08%
	Central Trunk (450)	35.01	30M											587	0	1525	29	3.7	5.5	20.1	8.2	7.0	35.3	0.56	87.0	51.7	143	450	0.08%
	Central Trunk (450)	30M	30.01											587	0	1525	29	3.7	5.5	20.1	8.2	7.0	35.3	0.84	130.6	95.3	112	450	0.18%
	Central Trunk (450)	30.01	25M											587	0	1525	29	3.7	5.5	20.1	8.2	7.0	35.3	0.84	131.4	96.1	81	450	0.18%
	NEW Central Trunk (750) - PHASE 3: Wheatland Tr to Centre St South of Canal "A"	45M	25M											11144	0	28973	557	2.5	104.0	259.1	156.0	132.4	547.5	1.17	507.5	-40.0	669	750	0.18%
	NEW Central Trunk (750) - PHASE 2: Centre St South of Canal "A" to Fire Dept	25M	15M											11730	0	30498	587	2.5	109.4	271.4	164.2	139.4	575.0	1.23	535.0	-40.0	642	750	0.20%
	Central Trunk (450) @ NE trunks tie-in	20M	20.01											4101	0	10539	262	2.9	37.8	110.9	73.3	0.0	184.2	0.95	148.5	-35.7	104	450	0.23%
	Central Trunk (450)	20.01	20.02											4101	0	10539	262	2.9	37.8	110.9	73.3	0.0	184.2	1.17	183.3	-0.9	120	450	0.36%
	Central Trunk (450)	20.02	20.03											4101	0	10539	262	2.9	37.8	110.9	73.3	0.0	184.2	0.93	144.8	-39.4	100	450	0.22%
	Central Trunk (450)	20.03	15M											4101	0	10539	262	2.9	37.8	110.9	73.3	0.0	184.2	0.82	128.1	-56.1	49	450	0.17%
	Downtown North Branch (375 mm)	16W	1016.01	5	Downtown North						1178	1178	33	1178	2633	2633	33	3.5	9.4	33.0	9.3	0.0	42.3	1.41	153.3	111.0	27	375	0.66%
	Downtown North Branch (375 mm)	1016.01	1016.02											1178	0	2633	33	3.5	9.4	33.0	9.3	0.0	42.3	0.99	106.9	64.7	99	375	0.32%
	Downtown North Branch (375 mm)	1016.02	1016.03											1178	0	2633	33	3.5	9.4	33.0	9.3	0.0	42.3	0.96	104.0	61.8	128	375	0.30%
	Downtown North Branch (375 mm)	1016.03	1016.04											1178	0	2633	33	3.5	9.4	33.0	9.3	0.0	42.3	1.10	119.5	77.2	89	375	0.40%
	Downtown North Branch (375 mm)	1016.04	15M											1178	0	2633	33	3.5	9.4	33.0	9.3	0.0	42.3	1.20	129.5	87.3	28	375	0.47%
	Downtown South Branch (350 mm)	15W	1015.01	6	Downtown South						631	631	21	631	1372	1372	21	3.7	4.9	18.2	6.0	0.0	24.2	0.84	79.3	55.1	116	350	0.26%
	Downtown South Branch (350 mm)	1015.01	1015.02											631	0	1372	21	3.7	4.9	18.2	6.0	0.0	24.2	0.81	76.2	52.0	92	350	0.24%
	Downtown South Branch (350 mm)	1015.02	14M											631	0	1372	21	3.7	4.9	18.2	6.0	0.0	24.2	0.93	87.6	63.4	24	350	0.31%

Client:Town of Strathmore
Job #15CG0122
Date Initiated1-Oct-16
Last Edit19-Apr-17
Calculated By:Mirren Turnbull

Residential Flow	310	L/d/c
I/I Allowance	0.28	L/sec./ha
Population Density		
Res People per unit	2.6	
Com/Ind People per unit	2.0	

CONCEPT SANITARY DESIGN SHEET

Case: Ultimate System (Build-out)

* Added as a point load where needed

Network Information				Added Development Cells - Lots & Areas										# of Lots	Population		Area	Dry Weather (Domestic)			I/I	Point	Total	Velocity and Flow		Delta	Pipe Detail		
	Location	From u/s MH	To d/s MH	#	Added 1	#	Added 2	#	Added 3	#	Lots Added		Area Total	Current	Added	Cumul.	Current ha	Peak Factor	ADWF L/s	PDWF L/s	Cumul. L/s	Loads L/s	Design Flow (L/s)	Velocity m/s	Capacity L/s	Capacity L/s	Len m	Dia mm	Slope %
											Curr.	Ult.																	
	Orchard B. Park Branch (450)	O1	S1	8	Strathmore Lakes	9	Westmount	16	Canal Gardens		2542	2542	190	2542	6609	6609	190	3.1	23.7	74.2	53.3	0.0	127.6	1.33	207.8	80.2	760	450	0.46%
	West Trunk (375)	W1	S1	17	South Strathmore						1683	1683	84	1683	3366	3366	84	3.4	12.1	41.1	23.6	0.0	64.6	1.55	168.5	103.9	1400	375	0.80%
	South Trunk (525)	S1	5M											4225	0	9975	275	3.0	35.8	105.8	76.9	0.0	182.7	1.34	284.9	102.2	780	525	0.38%
	NEW Central Trunk (750) - PHASE 1: Highway 1 to East Ridge Road	15M	14.2M											17009	0	43671	881	2.5	156.7	388.6	246.8	139.4	774.8	1.63	707.7	-67.1	65	750	0.35%
	NEW Central Trunk (750) - PHASE 1: East Ridge Road to North of Hwy 1	14.2M	14.1M											17009	0	43671	881	2.5	156.7	388.6	246.8	139.4	774.8	1.63	707.7	-67.1	114	750	0.35%
	NEW Central Trunk (750) - PHASE 1: North of Hwy 1 to Pine Road (Hwy Crossing)	14.1M	14M											17009	0	43671	881	2.5	156.7	388.6	246.8	139.4	774.8	2.22	964.4	189.6	106	750	0.65%
	NEW Central Trunk (750) - PHASE 1: Pine Road to Slater Road	14M	11M											20037	6069	51111	1023	2.5	183.4	454.8	286.3	139.4	880.5	2.05	887.1	6.6	620	750	0.55%
	NEW Central Trunk (750) - PHASE 1: Slater Road to S MH1 on Slater Way	11M	10M											20632	1190	52301	1052	2.5	187.7	465.4	294.6	139.4	899.4	2.22	964.4	65.0	150	750	0.65%
	Ranch Trunk (450)	20E	6020.01	2A	Ranch North	14	Prairie's Edge				4674	4674	252	4674	12153	12153	252	2.9	43.6	125.2	70.6	0.0	195.7	1.61	250.7	54.9	125	450	0.67%
	Ranch Trunk (450)	6020.01	6020.02											4674	0	12153	252	2.9	43.6	125.2	70.6	0.0	195.7	1.19	185.7	-10.0	161	450	0.37%
	Ranch Trunk (450)	6020.02	6020.03											4674	0	12153	252	2.9	43.6	125.2	70.6	0.0	195.7	1.12	175.5	-20.3	94	450	0.33%
	Ranch Trunk (450)	6020.03	6020.04											4674	0	12153	252	2.9	43.6	125.2	70.6	0.0	195.7	1.04	162.3	-33.4	118	450	0.28%
	Ranch Trunk (450)	6020.04	6020.05											4674	0	12153	252	2.9	43.6	125.2	70.6	0.0	195.7	1.49	232.8	37.1	125	450	0.58%
	Ranch Trunk (450)	6020.05	6020.06											4674	0	12153	252	2.9	43.6	125.2	70.6	0.0	195.7	1.36	212.9	17.2	180	450	0.48%
	Ranch Trunk (450)	6020.06	6020.07											4674	0	12153	252	2.9	43.6	125.2	70.6	0.0	195.7	0.93	144.4	-51.3	180	450	0.22%
	Ranch Trunk (450)	6020.07	6020.08											4674	0	12153	252	2.9	43.6	125.2	70.6	0.0	195.7	1.40	218.7	22.9	183	450	0.51%
	Ranch Trunk (450)	6020.08	15E											4674	0	12153	252	2.9	43.6	125.2	70.6	0.0	195.7	1.59	247.8	52.0	185	450	0.65%
	Ranch Trunk (675)	15E	6015.01	2B	Ranch South						679	679	46	5354	1767	13920	298	2.8	49.9	140.4	83.5	0.0	223.9	1.16	406.8	182.9	177	675	0.20%
	Ranch Trunk (675)	6015.01	6015.02											5354	0	13920	298	2.8	49.9	140.4	83.5	0.0	223.9	1.04	363.6	139.6	142	675	0.16%
	Ranch Trunk (675)	6015.02	6015.03											5354	0	13920	298	2.8	49.9	140.4	83.5	0.0	223.9	1.13	398.5	174.5	26	675	0.19%
	Ranch Trunk (675)	6015.03	10E											5354	0	13920	298	2.8	49.9	140.4	83.5	0.0	223.9	1.31	459.4	235.5	4	675	0.26%
	Forcemain from Ranch LS to HW LS via 5M	10E	5M	19	South Pivot Fields	20	East Pivot Fields	22	North Pivot Fields		4454	4454	223	9808	9887	23807	521	2.6	85.4	220.1	145.9	0.0	366.0	1.54	333.1	-32.9	1600	525	0.60%
	Central Trunk (900) @ 350/450 twin end	10M	10.01											20632	0	52301	1052	2.5	187.7	465.4	294.6	139.4	899.4	2.22	1386.3	486.9	42	900	0.51%
	Central Trunk (900)	10.01	10.02											20632	0	52301	1052	2.5	187.7	465.4	294.6	139.4	899.4	1.56	972.4	73.0	110	900	0.25%
	Central Trunk (900)	10.02	10.03											20632	0	52301	1052	2.5	187.7	465.4	294.6	139.4	899.4	1.56	972.6	73.2	120	900	0.25%
	Central Trunk (900)	10.03	5M											20632	0	52301	1052	2.5	187.7	465.4	294.6	139.4	899.4	1.56	973.2	73.7	119	900	0.25%
	Central Trunk (900) @ HWLS	5M	HWLS											34665	0	86084	1848	2.5	308.9	766.0	517.4	139.4	1422.8	2.90	1808.9	386.1	19	900	0.86%



Appendix B Sanitary System Cost Estimates

Cost Estimate

Client	Strathmore , AB	Date	18 Apr, 2017
Subject	Central Trunk System	Project No.	15CG0122
		By:	MT

SCH A Phase 1 – New 750 mm from Slater Road Collection Box (MH 10M) to Fire Dept. (MH 15M)					
ITEM NO.	DESCRIPTION OF WORK	UNIT	EST. QTY.	UNIT PRICE	EXT. AMT
1	750 mm Sanitary Sewer	m	1050	\$608	\$638,400
2	Abandonment of Ex / Cage Installation	m	1050	\$200	\$210,000
3	Manholes	ea	11	\$9,300	\$102,300
4	Crossing	m	130	\$4,000	\$520,000
5	Open Area Restoration	m	900	\$220	\$198,000
6	Asphalt Area	m	20	\$500	\$10,000
SUBTOTAL					\$1,678,700
35% Engineering / Contingency					\$587,545
TOTAL - SCHEDULE A					\$2,267,000

SCH B Phase 2 – New 750 mm from Fire Dept. (MH 15M) to 2nd Ave near Lakeside Blvd. (MH 25M)					
ITEM NO.	DESCRIPTION OF WORK	UNIT	EST. QTY.	UNIT PRICE	EXT. AMT
1	750 mm Sanitary Sewer	m	650	\$608	\$395,200
2	Manholes	ea	6	\$9,300	\$55,800
3	Crossing	m	20	\$4,000	\$80,000
4	Open Area Restoration	m	530	\$220	\$116,600
5	Asphalt Area	m	100	\$500	\$50,000
SUBTOTAL					\$697,600
35% Engineering / Contingency					\$244,160
TOTAL - SCHEDULE B					\$942,000

SCH C Phase 3 – New 750 mm from 2nd Ave near Lakeside Blvd. (MH 25M) to Wheatland Trail (MH 45M)					
ITEM NO.	DESCRIPTION OF WORK	UNIT	EST. QTY.	UNIT PRICE	EXT. AMT
1	750 mm Sanitary Sewer	m	670	\$608	\$407,360
2	Manholes	ea	8	\$9,300	\$74,400
3	Crossing	m	0	\$4,000	\$0
4	Open Area Restoration	m	270	\$220	\$59,400
5	Asphalt Area	m	400	\$500	\$200,000
SUBTOTAL					\$741,160
35% Engineering / Contingency					\$259,406
TOTAL - SCHEDULE C					\$1,001,000

OVERALL TOTAL - CENTRAL TRUNK OPTION 1 \$4,210,000

Cost Estimate

Client	Strathmore , AB	Date	18 Apr, 2017
Subject	Central Trunk System (Option - 600 mm Phases 2 & 3)	Project No.	15CG0122
		By:	MT

SCH A Phase 1 – New 750 mm from Slater Road Collection Box (MH 10M) to Fire Dept. (MH 15M)					
ITEM NO.	DESCRIPTION OF WORK	UNIT	EST. QTY.	UNIT PRICE	EXT. AMT
1	750 mm Sanitary Sewer	m	1050	\$608	\$638,400
2	Abandonment of Ex / Cage Installation	m	1050	\$200	\$210,000
3	Manholes	ea	11	\$9,300	\$102,300
4	Crossing	m	130	\$4,000	\$520,000
5	Open Area Restoration	m	900	\$220	\$198,000
6	Asphalt Area	m	20	\$500	\$10,000
SUBTOTAL					\$1,678,700
35% Engineering / Contingency					\$587,545
TOTAL - SCHEDULE A					\$2,267,000

SCH B Phase 2 – New 600 mm from Fire Dept. (MH 15M) to 2nd Ave near Lakeside Blvd. (MH 25M)					
ITEM NO.	DESCRIPTION OF WORK	UNIT	EST. QTY.	UNIT PRICE	EXT. AMT
1	600 mm Sanitary Sewer	m	650	\$400	\$260,000
2	Manholes	ea	6	\$9,300	\$55,800
3	Crossing	m	20	\$2,900	\$58,000
4	Open Area Restoration	m	530	\$220	\$116,600
5	Asphalt Area	m	100	\$500	\$50,000
SUBTOTAL					\$540,400
35% Engineering / Contingency					\$189,140
TOTAL - SCHEDULE B					\$730,000

SCH C Phase 3 – New 600 mm from 2nd Ave near Lakeside Blvd. (MH 25M) to Wheatland Trail (MH 45M)					
ITEM NO.	DESCRIPTION OF WORK	UNIT	EST. QTY.	UNIT PRICE	EXT. AMT
1	600 mm Sanitary Sewer	m	670	\$400	\$268,000
2	Manholes	ea	8	\$9,300	\$74,400
3	Crossing	m	0	\$2,900	\$0
4	Open Area Restoration	m	270	\$220	\$59,400
5	Asphalt Area	m	400	\$500	\$200,000
SUBTOTAL					\$601,800
35% Engineering / Contingency					\$210,630
TOTAL - SCHEDULE C					\$813,000

* Cost Estimate Based on Schedule "1" of City of Calgary 2016 Master Development Agreement Unit Rates Schedule

Cost Estimate

Client	Strathmore , AB	Date	18 Apr, 2017
Subject	Central Trunk System (Option - 600 mm Phases 2 & 3)	Project No.	15CG0122
		By:	MT

SCH D Phase 4 – New 600 mm from Fire Dept. (MH 15M) to Wheatland Trail (MH 45M) (twins Phases 2 & 3)					
ITEM NO.	DESCRIPTION OF WORK	UNIT	EST. QTY.	UNIT PRICE	EXT. AMT
1	600 mm Sanitary Sewer	m	1320	\$400	\$528,000
2	Manholes	ea	14	\$9,300	\$130,200
3	Crossing	m	20	\$2,900	\$58,000
4	Open Area Restoration	m	800	\$220	\$176,000
5	Asphalt Area	m	500	\$500	\$250,000
				SUBTOTAL	\$1,142,200
35% Engineering / Contingency					\$399,770
				TOTAL - SCHEDULE D	\$1,542,000

OVERALL TOTAL - CENTRAL TRUNK OPTION 2 \$5,352,000

* Cost Estimate Based on Schedule "1" of City of Calgary 2016 Master Development Agreement Unit Rates Schedule

Cost Estimate

Client	Strathmore , AB	Date	18 Apr, 2017
Subject	Southland Station Restoration (Central Trunk System Option)	Project No.	15CG0122
		By:	MT

SCH A Southland Station Restoration					
ITEM NO.	DESCRIPTION OF WORK	UNIT	EST. QTY.	UNIT PRICE	EXT. AMT
1	Mobilization & Traffic Control	L.S.	1	\$30,000	\$30,000
2	Asphalt Removal & Restoration	m ²	2600	\$70	\$182,000
3	Concrete Removal & Restoration (islands)	m ²	300	\$150	\$45,000
4	Road core	m ²	3500	\$10	\$35,000
5	Shoring for pit area due to limited space	L.S.	1	\$50,000	\$50,000
6	Credit for no temporary working easement	ha	-0.3	\$25,000	(\$7,500)
7	Shallow utilities crossings	ea	6	\$2,000	\$12,000
				SUBTOTAL	\$346,500
35% Engineering / Contingency					\$121,275
				TOTAL - SCHEDULE A	\$468,000

OVERALL TOTAL - SOUTHLAND STATION RESTORATION	\$468,000
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Cost Estimate

Client	Strathmore , AB	Date	18 Apr, 2017
Subject	Western Trunk System (South Trunk and West Trunk)	Project No.	15CG0122
		By:	MT

SCH A South Trunk - WWTP Headworks to Orchard Park Trunk and West Trunk Tie-in					
ITEM NO.	DESCRIPTION OF WORK	UNIT	EST. QTY.	UNIT PRICE	EXT. AMT
1	525 mm Sanitary Sewer	m	780	\$375	\$292,500
2	Manholes	ea	6	\$6,200	\$37,200
3	Open Area Restoration	m	660	\$220	\$145,200
4	Asphalt Area	m	120	\$500	\$60,000
SUBTOTAL					\$534,900
35% Engineering / Contingency					\$187,215
TOTAL - SCHEDULE A					\$723,000

SCH B Orchard Park Trunk					
ITEM NO.	DESCRIPTION OF WORK	UNIT	EST. QTY.	UNIT PRICE	EXT. AMT
1	450 mm Sanitary Sewer	m	760	\$300	\$228,000
2	Manholes	ea	7	\$6,200	\$43,400
3	Open Area Restoration	m	750	\$220	\$165,000
4	Asphalt Area	m	10	\$500	\$5,000
SUBTOTAL					\$441,400
35% Engineering / Contingency					\$154,490
TOTAL - SCHEDULE B					\$596,000

SCH C West Trunk from Orchard Park Trunk/South Trunk Tie-in to West					
ITEM NO.	DESCRIPTION OF WORK	UNIT	EST. QTY.	UNIT PRICE	EXT. AMT
1	375 mm Sanitary Sewer	m	1400	\$250	\$350,000
2	Manholes	ea	12	\$6,200	\$74,400
3	Crossing	m	50	\$1,500	\$75,000
4	Open Area Restoration	m	1400	\$220	\$308,000
5	Asphalt Area	m	0	\$500	\$0
SUBTOTAL					\$807,400
35% Engineering / Contingency					\$282,590
TOTAL - SCHEDULE B					\$1,090,000

OVERALL TOTAL - WESTERN TRUNK SYSTEM \$2,409,000

Cost Estimate

Client	Strathmore , AB	Date	18 Apr, 2017
Subject	Ranch Lift Station and Forcemain Upgrades	Project No.	15CG0122
		By:	MT

SCH A Ranch Stage II Lift Station Upgrade					
ITEM NO.	DESCRIPTION OF WORK	UNIT	EST. QTY.	UNIT PRICE	EXT. AMT
1	Stage II Sanitary Lift Station Upgrade	L.S.	1	\$233,563	\$233,563
				SUBTOTAL	\$233,563
	35% Engineering / Contingency				\$81,747
				TOTAL - SCHEDULE A	\$316,000

SCH B Ranch Stage II Forcemain (new 350 mm in addition to existing 350 mm forcemain)					
ITEM NO.	DESCRIPTION OF WORK	UNIT	EST. QTY.	UNIT PRICE	EXT. AMT
Supply & Install 350 mm HDPE, DR17					
1	2.5-3.0 m depth	m	7	\$400	\$2,798
2	3.5-4.0 m depth	m	55	\$400	\$21,982
3	4.0-4.5 m depth	m	278	\$337	\$93,750
4	4.5-5.0 m depth	m	36	\$250	\$8,993
5	5.0-6.0 m depth	m	151	\$325	\$49,036
6	Bedding	m	521	\$40	\$20,823
Compaction					
7	2.5-3.0 m depth	m	7	\$12	\$87
8	3.5-4.0 m depth	m	55	\$19	\$1,030
9	4.0-4.5 m depth	m	278	\$25	\$6,944
10	4.5-5.0 m depth	m	36	\$31	\$1,124
11	5.0-6.0 m depth	m	151	\$44	\$6,601
				SUBTOTAL	\$213,169
	35% Engineering / Contingency				\$74,609
				TOTAL - SCHEDULE B	\$288,000

OVERALL TOTAL - RANCH UPGRADES \$604,000

Cost Estimate

Client	Strathmore , AB	Date	08 May, 2017
Subject	BTO – Effluent Pump Station Upgrades	Project No.	15CG0122
		By:	MT

SCH A Install two new vertical turbine pumps, new controls and minor pump upgrades					
ITEM NO.	DESCRIPTION OF WORK	UNIT	EST. QTY.	UNIT PRICE	EXT. AMT
1	Vertical Turbine Pump materials (247 L/s @ 47.25 m)	ea	2	\$95,000	\$190,000
2	Pump installation, incl. concrete work, new controls and minor pump upgrades	L.S.	1	\$190,000	\$190,000
SUBTOTAL					\$380,000
35% Engineering / Contingency					\$133,000
TOTAL - SCHEDULE B					\$513,000

OVERALL TOTAL - BTO EFFLUENT PUMP STATION UPGRADES	\$513,000
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