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City of Elko New Market
2040 Sanitary Sewer Plan

February 2018

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2040 Sanitary Sewer Plan

For the City of

Elko New Market, Minnesota

BMI Project No. T17.112950

February 10, 2018

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

By: ______________________
Richard J. Revering, P.E.
License No. 20711

Date: 02/23/18

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I. EXECUTIVE SUMMARY

In the past, the City of Elko New Market had been a remote, rather isolated rural community to the Twin City Metropolitan Area. Today, it has changed to that of a “bedroom community” and in the near future it will reach that of a full “suburb” to the Twin City Metropolitan Area. The City has significant commercial and industrial growth potential. These changes will place new demands on the infrastructure and public services. For the purpose of this Sanitary Sewer System Study, the following two study areas were chosen: 1) The ultimate boundary of the City, and 2) The 2040 boundary of the City.

The topography, wetland presence, interstate, and location of the Metropolitan Council’s interceptor sewer all dramatically influence the ultimate configuration and sequence of construction of the wastewater collection system. The system will rely on 17 local and regional lift stations within the 2040 growth boundary, with forcemains to transport the wastewater to the MCES Interceptor or a gravity branch sewer. During the growth process, some lift stations will be interim to serve areas where gravity sewer may not yet be available. The areas served by this type of station will be served by future development of the gravity system, so interim designs should facilitate decommissioning of the interim lift station.

Eventually, when the entire system is developed the following will be a result:

1. Approximately 30 permanent lift stations and forcemains will remain in use (eight of which are already in service).

2. Seven locations where connections to the MCES interceptor have been provided as it was constructed as described below. Three were installed along with the County Road 2 reconstruction project in 2006. MCES prefers connection at these locations; however, exceptions have historically been granted under certain circumstances in other communities. MCES approval would be required for any variance to the following points:

    a) #1: East side of CR 91, south of CR 2.
    b) #2: West side of Xerxes Avenue, south of CR 2.
    c) #3: East side of Newton Circle, north of CR 2.
    d) #4: West side of I-35, south of the Vermillion River.
    e) #5: West side of I-35, north of the Vermillion River.
    f) #6: East side of I-35, intersection of 250th St. & Dupont Avenue.
    g) #7: East side of I-35, on CR 62 east of Pillsbury Avenue.

A. RECOMMENDATIONS

1. It is suggested that the City of Elko New Market periodically revisit this study to update the underlying assumptions, and make such adjustments as are appropriate.

2. The characteristics of actual development, i.e. density of residential, wet industry, percentage of higher density residential, will change the sizing of the proposed lift stations.

3. The City should compare existing well pump and waste water discharge records to see if there is a clear correlation between the two. If a spike in the waste water flow shows up during fall and spring wet periods, then a sump pump inspection program should be considered.

4. The City has a policy of requiring rear-yard drainage systems to prevent the development of chronically wet turf grass areas due to tight soils, dense lawns, irrigation, and builder/homeowner alterations that can affect drainage ways over time. The policy requires the provision of connections for sump pump systems to the drainage system. It is recommended this policy be retained and enforced. While intended primarily to benefit drainage, the sump connections offer the additional benefit of dis-incenting illicit connections of sump pumps to the sanitary system by homeowners fed up with wet yards. The inflow from illicit connections means clear water must be unnecessarily treated, raising costs and taking up capacity needed for wastewater. The inflow also is not metered at the house by the City, which would increase sewer bills and generate revenue to cover the costs incurred by the City for it. The clear water does show up at the MCES meter for the City's wastewater flow and affects City charges.

B. ESTIMATED COSTS

1. The costs incurred to achieve these improvements should be borne by new development by application of the City's Sewer Trunk Fee. The fee should be updated and published annually in the City's Fee Schedule.

2. The trunk fee collected from new development on an area or unit basis as adopted by the Council is intended to offset sewer system investments made by the City to prepare for and/or accommodate new development. Trunk fees cover those costs that will be incurred by the development whether the lots or parcels develop. These are the "make-ready" costs.

The minimum fee recommended would recover oversizing of systems illustrated at a conceptual level in this report. At any time during implementation of this system there may be other factors affecting the trunk fee the City would charge in order to maintain a minimum projected fund balance and protect existing rate payers. These factors may include the development climate, debt service for past sewer investments, existing fund balances, or other factors. A "floor-level" trunk fee based on an estimate of the costs for the 2040 system in this report follows:

ESTIMATED COSTS	
ITEM	**COST**
Lift Stations	$1,760,000
Forcemain	$831,550
Power Generation	$400,000
Gravity Sewer Over-sizing	$2,126,644
Subtotal	$5,118,194
Price Contingency, Engineering & Administration	$1,791,368
Total	$6,909,562
Net Acreage Served	3,570
Approximate Cost Per Acre	**$1,935**

II. INTRODUCTION

A. Purpose of Study

The purpose of this study is to examine the wastewater collection system for the city. The study provides a layout of a future system required to serve the City as it grows. This layout is based on topography, constraints such as wetlands and highways, and planned land uses. The layout includes gravity pipes and lift stations with forcemains. The layout will be referenced to influence investment decisions as development occurs. The intention is to avoid under-building initial sewer facilities so they can be expanded in an efficient manner, avoiding the need to re-build them, as the City grows. The layout offers a base of estimating the minimum cost the City will need to recover from development as it occurs.

The study also seeks to identify challenges the City may face related to wastewater collection and provide recommendations to meet these challenges.

The age and condition of individual elements in the collection system were not a part of this study. Conclusions and recommended priorities may have to be adjusted in the future, if failures in the existing system occur or as development conditions or technology changes. Comprehensive televising, rating and consistently performing preventative maintenance of the sewers in the existing system could lessen the impact of these unexpected events.

III. BACKGROUND

A. Location

The City of Elko New Market is located approximately 30 miles south of Minneapolis and is bisected by CR 91/Natchez Avenue. Its northern boundary on the east side of CR 91 is approximately the Vermillion River headwaters (see Figure 1).

B. Flow Characteristics

A conceptual understanding of the flow characteristics of sanitary sewers is helpful to appropriately interpret the information in this report.

1. The vast majority of the time, sanitary sewers appear virtually unused and the sewer is barely flowing.
2. However, given the normal patterns of human habitation, there is a consistency in the total volume of water used per person that is focused during a limited number of hours in the day.

3. In order not to cause backups into peoples' homes, sanitary sewers must be designed to accommodate this maximum peak rate of flow that occurs during that focused period each day.

4. The City first started installing a wastewater system in the 1980s, but the majority of the existing system has been constructed since 1990. Therefore, the materials used have modern joints that are capable of resisting inflow & infiltration (I & I). For that reason, no analysis of I & I or allowance for additional flow has been included in past studies by the City.

C. Topography of the Area

1. The unusual land forms that dominate the City of Elko New Market can be described as:

   a) "Dead ice moraine" - It is a rugged landscape that formed as the last glaciers were melting at the end of the Ice Age, between about 12,000 and 9,000 years ago.….They are rough, boulder-strewn, and undrained. They do, however, include a lot of excellent rangeland and thousands of undrained depressions - lakes, ponds, and sloughs known collectively as prairie potholes - that serve as important nesting and feeding areas for waterfowl. [1]

2. This landform presents unique challenges to the efficient and orderly collection of wastewater in that there are very few natural tributary flow patterns that could be described as the branches of a tree. Rather, the underlying dead ice moraine left numerous individual low pockets with intermediate high points that are fifty to seventy feet higher. This topography is a significant obstacle to the efficient use of gravity sewers to collect wastewater for treatment. The protocol to overcome these obstacles is:

   a) Analyze the natural tributary patterns that do exist in an effort to maximize the use of gravity sewers.

   b) This analysis will result in identifying the locations of the "pockets" which can only be drained by either:

      (1) Extending deeper interceptor sewers through the intermediate high areas.

      (2) Constructing gravity sewers to deliver wastewater to lift stations that pump it through forcemains to the treatment plant or other drainage districts closer to the treatment plant.

      (3) Constructing pressure sewer systems where every few houses have a lift station which pumps into a pressurized sewer system that eventually reaches the treatment plant. At this time, the use of

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[1] Bluemle, John P.; North Dakota Geological Survey as described in *NORTH DAKOTA NOTES NO. 14* published on May 19, 2004 at http://www.state.nd.us/ndgs/ndnotes/ndn14_h.htm.

pressurized sewer systems is limited for financial and maintenance reasons to special circumstances like around lakes or through historic districts. Therefore, little consideration was given to this option.

3. Superimposed on the drainage patterns are the potential developable and non-developable areas. Non-developable properties include:

   a) Protected waters of the state.

   b) Wetland areas that would require mitigation. Given that the first rule of mitigation is "avoidance", which is in conformity with the stormwater management plan, it is anticipated that little or no development will occur in these areas.

D. Sewer Routing

1. Five system constraints have a major influence on the ultimate sewer pattern to serve the City of Elko New Market. They are:

   a) <u>Vermillion River Corridor</u> - Shared Goal #1 in the Southeast Comprehensive Plan Update is to: Protect and preserve the Vermillion River, and "exceptional" and "high quality" sites identified in the Natural Resource Inventory as unique and valuable state and regional resources. Therefore, it is recommended that a protective 100 to 200-foot natural buffer be maintained from the Vermillion River through the City.

   b) <u>Metropolitan Council Environmental Services (MCES) Interceptor Sewer</u> – A Metropolitan Council interceptor sewer provides wastewater collection service to the Elko New Market area. The wastewater from Elko New Market is carried by this interceptor pipe to the MCES Empire WWTF for treatment. Flow from Elko New Market is metered for billing purposes downstream of the City's future service boundary. The interceptor will have service connections for the City of Elko New Market at seven (7) locations, as previously discussed.

   c) <u>Interstate 35</u> – The I-35 freeway runs north/south on the east side of the city. This influences the wastewater system in two ways:

      (1) Development patterns are expected to focus commercial, industrial and high residential land uses on either side of the highway.

      (2) The highway presents a physical barrier against the efficient <u>routing of sanitary sewers and forcemains. The future system will</u> largely rely upon the interceptor sewer that already provides a crossing of this freeway. This means; however, that what would appear on the map to be the "closest" available sewer may not offer the most effective route because of the high cost associated with boring or drilling under the freeway.

d) Development Pressure – The Twin City Metropolitan Area is gradually enveloping the City of Elko New Market. As such, developers will investigate sites, purchase property, establish development plans and approach the City for the extension of municipal services. These requests will come at times that are opportune to the developers. It may be difficult or impossible for the City to meet these requests in the developers' timeframes. It is also not possible to reliably predict when development requests will occur, or where.

E. Existing Facilities

1. Collection System - The existing wastewater collection system in the City of Elko New Market consists of sewers ranging in size from 8-inches to 18-inches and eight lift stations. The sewer locations, manhole and pipe sizes are shown on Figure 1.

EXISTING PUMP STATIONS				
Service Area	**Commonly Used Name**	**Location**	**Discharges to:**	**Capacity**
LS #1	City Hall Lift Station	City Hall	MH approx. 600 LF west of CR 91 and CR 2; MH is behind curb	350
LS #1A	Dakota Lift Station	CR 2 @ Dakota Ave	MH approx. 600 LF west of CR 91 and CR 2; MH is behind curb	210
LS #1B	Carter Lift Station	Carter Street @ James Pkwy	MH approx. 250 ft west of Carter/James intersection on James Pkwy; in the future will discharge to MH in James Pkwy @ at Riley/James intersection	200
LS #2	Elko Downtown Lift Station	Main St. @ Chowen Ave	MH 3001 in CR 2 @ France Ave.	200
LS #2A	Ptarmigan Lift Station	Ptarmigan Drive @ Woodcrest	MH 2001 in Xerxes Avenue, 210 LF northeast of Xerxes/Main intersection.	250
LS #4	Glenborough Lift Station	Glenborough @ Chowen	MH 3064 in Glenborough, 200 LF southeast	200

EXISTING PUMP STATIONS				
			of Stirling Court	
name	Public Works Lift Station	Public Works Campus	MCES Interceptor at CRs 91 and 2 intersection	find
LS #6	Oxford Lift Station	Beard Ave @ Oxford Ln	MH 4043 in Xerxes @ Beard Ave	110

a) Given the relative young age of most of the collection system, no investigation or assessment of the materials or condition of these sewer lines was included in this study.

2. Subsurface Sewage Treatment Systems (SSTS) – Currently the City has approximately ninety SSTSs within the city limits, see Figure 1. Scott County is the regulative authority for administering ordinances related to SSTS permitting and inspections. There are no community systems within the City. Scott County has no point of sale compliance inspection requirement; however, inspections are triggered by certain building permits. Scott County officials estimate a third or more of systems in the City would not pass a compliance inspection.

3. Existing SSTSs will be generally be connected to the municipal sanitary sewer system when these services become available or are made so by the City to address compliance issues or demand from the neighborhood. The City has established a policy for providing City sewer in the Woodcrest neighborhood, for example, where lots relatively undersized for SSTS, tight soils, and extensive tree cover are expected to make it infeasible for many parcels to replace SSTS systems as they age. Three of the 40-odd homes in the neighborhood have already hooked up and sewer in place for several more to gain sewer availability by adding individual packaged pump stations at their properties.

F. Inflow and Infiltration (I &I)

Due to the size of the City and the relatively modern piping system infiltration has not been a major issue in the past. Flow records to indicate a correlation between rainfall and flow. It is believed this is largely due to inflow from illicit sump pump connections and possibly at some manholes subject to sheet flow or low-point flooding.

The Metropolitan Council established a regional waste water surcharge program that took effect in January, 2007. This program was for metropolitan communities that discharge into MCES treatment plants. With the addition of clean rainwater the capacity of the MCES treatment plants is greatly reduced, which may result in sewage backups into basements and/or sewage overflows that could cause environmental damage. The surcharge program establishes goals for communities with time periods set for eliminating excessive I & I.

The City should continue to compare existing well pump and waste water discharge records to see if there is a clear correlation between the two. If there is a surcharge of waste water flows in the fall or spring months during a precipitation event, this may suggest that there are sump pump connections to the sanitary sewer, or that there are leaks in the system. Given the relatively young age of the sanitary piping system, the connection of sump pump discharge lines would likely be a major cause for flow spikes. If a correlation is found a sump pump inspection program should be considered that would disconnect sump pump discharge lines from the sanitary sewer system.

The City has an ordinance that prohibits the connection of roof downspouts, foundation drains, areaway drains, surface runoff and groundwater to a building sewer or indirectly to the sanitary sewer system.

IV. CONDUCT OF THIS STUDY

A. Standards

1. The Great Lakes-Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers have developed a standard for wastewater facilities that is commonly referred to as Ten States Standards. The development of this study followed these standards.

B. Methods Employed

1. Two features determine the potential extension of an existing sewer.

    a) The Elevation of the Existing Sewer Versus the Topography - Given the required slope for the sewer, there is established a gravity service area boundary. Properties beyond this boundary cannot be directly served with gravity sewers.

    b) The Size and Grade of the Existing Sewers - These determine a maximum flow capacity that the existing system can carry.

2. Sanitary sewer service to areas beyond this gravity service boundary, can only be serviced by either:

    a) Constructing a new interceptor sewer, or

    b) Constructing lift stations and forcemains to pump the sewage, or

c) Constructing pressure sewer systems to transport the wastewater.

3. Existing Capacities

a) The driving energy of flow in a sanitary sewer is gravity. Therefore, the pipes must be laid on a grade (or slope) to force the flow. Slopes are expressed in percentage (%) and represent the number of feet of fall in 100 feet of length. i.e., a grade of 1.00% is one foot of fall in 100 horizontal feet.

b) The slope, together with the diameter and material type, are used to calculate the actual volume of flow that a full pipe can carry. Typically, this volume is expressed in cubic feet per second (cfs) or gallons per minute (gpm). This rate of flow is the actual capacity of the sewer line.

4. Required Capacities

a) The 2030 sewer plan relied on land use data from the Southeast Comprehensive Plan Update - Land Use Plan prepared by the City and Scott County. All areas were identified with an anticipated land use and density to model wastewater generation rates as follows:

(1) For areas that are already developed, actual lot counts were used. For undeveloped low-density residential areas, a 2.7 units per acre lot count was predicted.

(2) For areas designated as "mixed use" the distribution of land use is:

(a) Seventy percent - low density residential (2.7 units per acre).

(b) Twenty percent – high density residential (8 units per acre).

(c) Ten percent commercial / industrial.

(3) Commercial and industrially zoned areas - 1,000 gallons per acre per day. This is much more difficult to predict, since the character and size of specific occupants is unknown at this time. Further, the water use patterns of commercial and industrial property can easily change. For example, a warehouse could be replaced by a much larger user, resulting in a significantly higher flow. Therefore, any temptation to lessen the design standards could prove to be ill advised.

(4) Institutional use was predicted at the same rate as commercial.

(5) Recreational areas, cemeteries, ravines, escarpments, flood plain, and wetlands were not considered to contribute wastewater flow.

b) For the 2040 plan we reviewed effects of the land use plan proposed by the City for the 2040 Comprehensive Plan update. Our finding is that wastewater generation either stayed the same or was reduced. Where commercial or industrial uses replaced single family, the higher generation rate was offset by a reduced peaking factor. No changes in pipe sizes due to land use changes were made. Our opinion is that the 2030 plan provided conservative pipe sizes that allow for increased density or other flexibility in development without unduly affecting minimum required trunk fees. The alignment, size, material, and depth of any future facility will need to consider this layout, but also the developments preceding and proposed at the time and other conditions present.

V. LAND USE / DESIGN FLOW

A. General

1. The rolling nature of the topography requires that the sanitary sewer system collection system make extensive use of lift stations and forcemains to service the area.

2. The land use of each sub-district for 2030 flow modeling is summarized in the Appendix. The 2030 plan's design flows* remain the basis for determining the necessary pipe sizing and lift station capacities for future improvements.

   * The flow rate numbers have been designed for purposes of sizing the City's sanitary sewer piping network for future development and may not represent the flows to be expected by the MCES.

3. For planning purposes, the city has been divided into nine service districts and those districts have been further divided into forty sub-districts, see Figure 2. Each sub-district is served by a lift station that pumps wastewater to a gravity sewer line. The lift stations are summarized in the following table:

LIFT STATION SUMMARY					
	Lift Station Number	**Lift Station Capacity (GPM)**	**Located in District:**	**Location**	**Discharges to:**
District	LS 1S-2	292	1S-2	Glenborough Dr./Chowen Ave.	Gravity sewer at Glenborough Dr./Stirling Ct.
	LS 1S-3	97	1S-3	Beard Ave./Oxford Ln.	Gravity sewer at Xerxes Ave./Beard Ave.
	LS 1S-4	174	1S-4	990' west of CR 91/Glenborough Dr.	Gravity sewer at CR 91/ Glenborough Dr.
	LS 1S-5	632	1S-5	1500' north of 275th St./CR 91 on CR 91	Gravity sewer at CR 91/ Glenborough Dr.
	LS 1S-6	201	1S-6	275th St./Oxford Ln.	Gravity sewer 525' west of 275th St./Oxford Ln. on 275th St.
	LS 1S-7	361	1S-7	1040' north of 280th St. on CR 91	Trunk gravity line 450' west of 275th/CR 91
East	LS 5A-3	424	5A-3	460' west of Pillsbury Ave./270th St. on 270th St.	Gravity sewer line at Pillsbury Ave./270th St.
Elko	LS 2S-2	514	2S-2	Chowen Ave./Main St.	Trunk gravity line at 265th/Beard
	LS 2S-3	264	2S-3	Xerxes Ave./Ptarmigan Ave.	Trunk gravity line at Xerxes Ave./Ptarmigan Ave
New Market	LS NM-2	7048	NM-2	City Hall	Trunk gravity line 600' west of CR 91/CR 2; MH is behind curb
	LS NM-3	153	NM-3	320' north of Carter Ave./James Pkwy on Carter Ave.	Gravity sewer. 250' west of Carter/James intersection on James Pkwy
Southeast	LS 3S-2	4985	3S-2	1290' north of Logan Rd./280th St. on Logan Rd.	Trunk gravity line 2348' east of Thomas Ave./270th St. on 270th St.
	LS 3S-2A	Not Available	3S-2	1700' west of Pillsbury Ave./280th and 1855' south of 280th St.	1700' west of Pillsbury Ave./280th St. on 280th St.
	LS 3S-3	1576	3S-3	6250' south of Beard Ave./280th St.	Trunk gravity line 2630' south of Beard Ave./280th St.
	LS 3S-4	868	3S-4	2740' south of CR 91/280th St.	Trunk gravity line 4000' south of CR 91/280th St.
	LS 3S-5	229	3S-5	Thomas Ave./273rd St.	Trunk gravity line at Thomas Ave./270th St.
	LS 3S-6	1097	3S-6	9130' south of I35/280th St.	Trunk gravity line 7515' south of I35/280th St.
	LS 3S-7	465	3S-7	5700' south of 280th St. (CR 86)/CR 46 on CR 46	Trunk gravity line 4150' south of 280th St. (CR 86)/CR 46 on CR 46
	LS W-1	7000	W-1	CR2/Dakota Ave.	Trunk gravity line 600' west of CR 91 and CR 2; MH is behind curb
	LS W-2	694	W-2	2620' south of CR 2/Texas Ave. on Texas Ave.	Trunk gravity line 1480' east of CR 2/Texas Ave. on CR 2

LIFT STATION SUMMARY					
West	LS W-3	236	W-3	880' north of CR 2/Texas Ave. on Texas Ave.	Trunk gravity line 1480' east of CR 2/Texas Ave. on CR 2
	LS W-5	368	W-5	Nevada Ave./255th St.	Gravity sewer at James Pkwy./Nevada Ave.
	LS W-6	5555	W-6	2200' west of CR 2/Texas Ave. on CR 2	Trunk gravity line 1480' east of CR 2/Texas Ave. on CR 2
	LS W-7	548	W-7	1870' south of Harvest Dr./Saxon Dr.	Gravity sewer at Harvest Dr./Cedric Lane
	LS W-8	1111	W-8	1830' north of CR 2/ Jonquil Ave.	Trunk gravity line at CR 2/Jonquil Ave.
	LS W-9	3534	W-9	4130' north of 280th St./Texas Ave. on Texas Ave.	Trunk gravity line at 5510' north of 280th St./Texas Ave. on Texas Ave.
	LS W-10	1215	W-10	2050' west of 280th St./ Vernon Ave and 1450' south of 280th St.	Trunk gravity line 2050' west of 280th St./ Vernon Ave. on 280th St.
	LS W-11	854	W-11	730' west of 280th St./Vernon Ave. and 2650' south of 280th St.	Trunk gravity line 730' west of 280th St./Vernon Ave. and 1040' south of 280th St.
North	LS 4A-3	417	4A-3	950' east of 250th St/Dakota and 200' south of 250th St.	2600' east of 250th St/Dakota Ave. on 250th St.

The table below shows the population, household, employment and estimated wastewater flows projected by the Metropolitan Council through the year 2040.

Forecast of population, households, employment and wastewater flow:

FORECAST 2010 THROUGH 2040				
	2010	**2020**	**2030**	**2040**
Population	4,110	6,100	8,600	11,900
Households	1,259	2,000	3,030	4,400
Employment	317	1,630	1,780	1,940
Estimated Average Flow (MGD)	0.23	0.35	0.49	0.69

VI. SUMMARY

The topography, wetland presence, interstate, and location of the Metropolitan Council's interceptor sewer all dramatically influence the ultimate configuration and sequence of construction of the wastewater collection system. The system will rely on 17 local and regional lift stations within the 2040 growth boundary, with forcemains to transport the wastewater to the MCES Interceptor or a gravity branch sewer. During the growth process, some lift stations will be interim to serve areas where gravity sewer may not yet be available. The areas served by this type of station will be served by future development of the gravity system, so interim designs should facilitate decommissioning of the interim lift station.

Eventually, when the entire system is developed the following will be a result:

1. Approximately 30 permanent lift stations and forcemains will remain in use (eight of which are already in service).

2. Seven locations where connections to the MCES interceptor have been provided as it was constructed as described below. MCES prefers connection at these locations; however, exceptions have historically been granted under certain circumstances in other communities. MCES approval would be required for any variance to the following points:

   a) #1: East side of CR 91, south of CR 2.
   b) #2: West side of Xerxes Avenue, south of CR 2.
   c) #3: East side of Newton Circle, north of CR 2.
   d) #4: West side of I-35, south of the Vermillion River.
   e) #5: West side of I-35, north of the Vermillion River.
   f) #6: East side of I-35, intersection of 250th St. & Dupont Avenue.
   g) #7: East side of I-35, on CR 62 east of Pillsbury Avenue.

3. For areas designated as "mixed use" the distribution of land use is:

   a) Seventy percent - low density residential (2.7 units per acre).
   b) Twenty percent – high density residential (8 units per acre).
   c) Ten percent commercial / industrial.

VII. RECOMMENDATIONS

1. It is suggested that the City of Elko New Market periodically revisit this study to update the underlying assumptions, and make such adjustments as are appropriate.

2. The characteristics of actual development, i.e. density of residential, wet industry, percentage of higher density residential, will change the sizing of the proposed lift stations.

3. The City should compare existing well pump and waste water discharge records to see if there is a clear correlation between the two. If a spike in the waste water flow shows up during fall and spring wet periods, then a sump pump inspection program should be considered.

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VIII. ESTIMATED COSTS

A summary of costs and computation of minimum recommended trunk fee in 2018 dollars is provided in the Executive Summary at the beginning of this document.

Appendix A: Figure 1 – Existing Sanitary Sewer Map

CITY OF ELKO NEW MARKET
SMALL-TOWN CULTURE. EMERGING POSSIBILITIES.

2040 Comprehensive Plan

Elko New Market, MN

Figure 1 - Existing Sanitary Sewer System

February 2018

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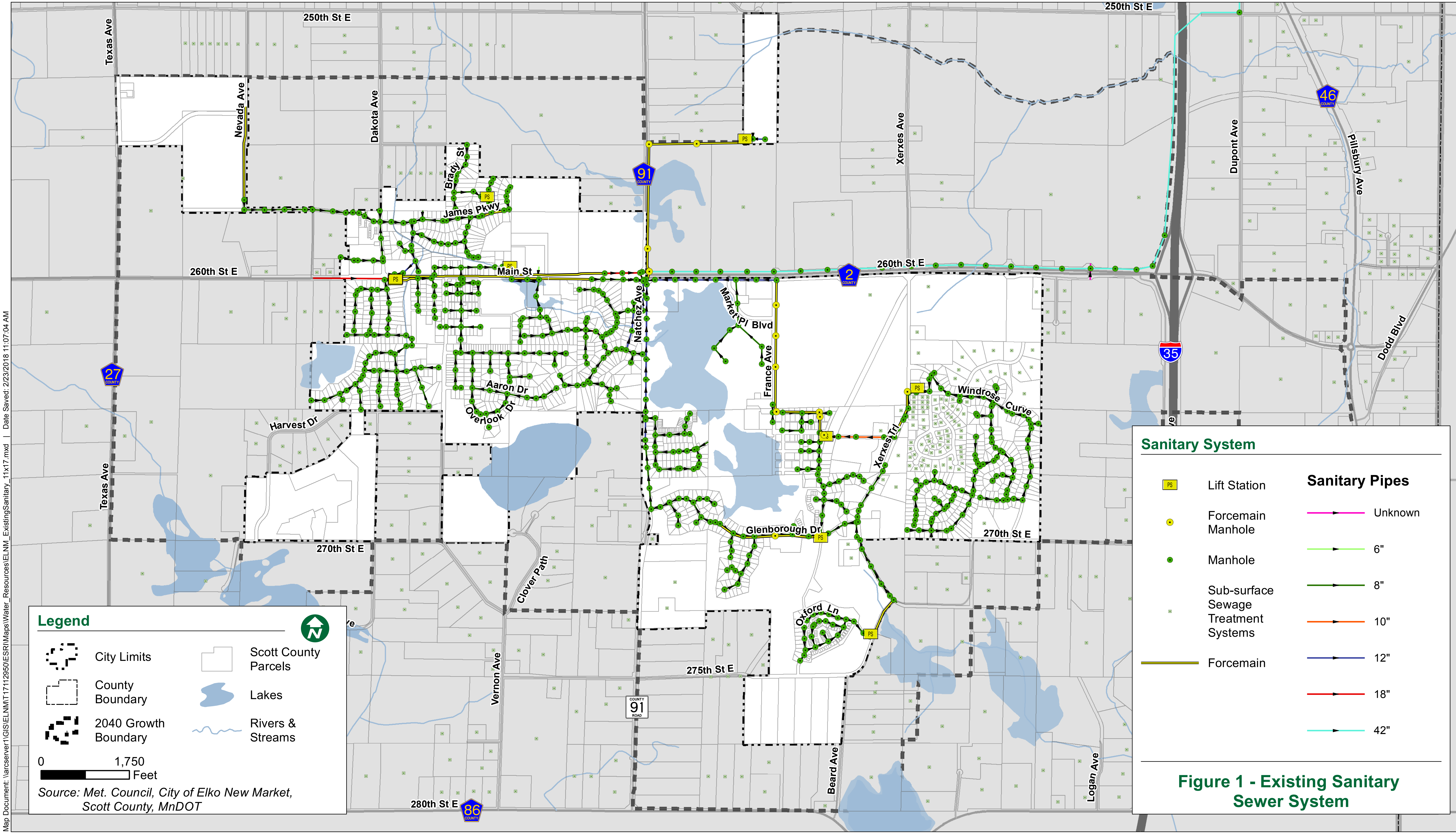

Map Document: \\arcserver1\GIS\ELNM\T17112950\ESRI\Maps\Water_Resources\ELNM_ExistingSanitary_11x17.mxd | Date Saved: 2/23/2018 11:07:04 AM

Appendix B: Figure 2 – Future Sanitary Sewer Map

City of Elko New Market
Small-Town Culture. Emerging Possibilities.

2040 Comprehensive Plan

Elko New Market, MN

Figure 2 - Proposed 2040 Sanitary Sewer Plan

February 2018

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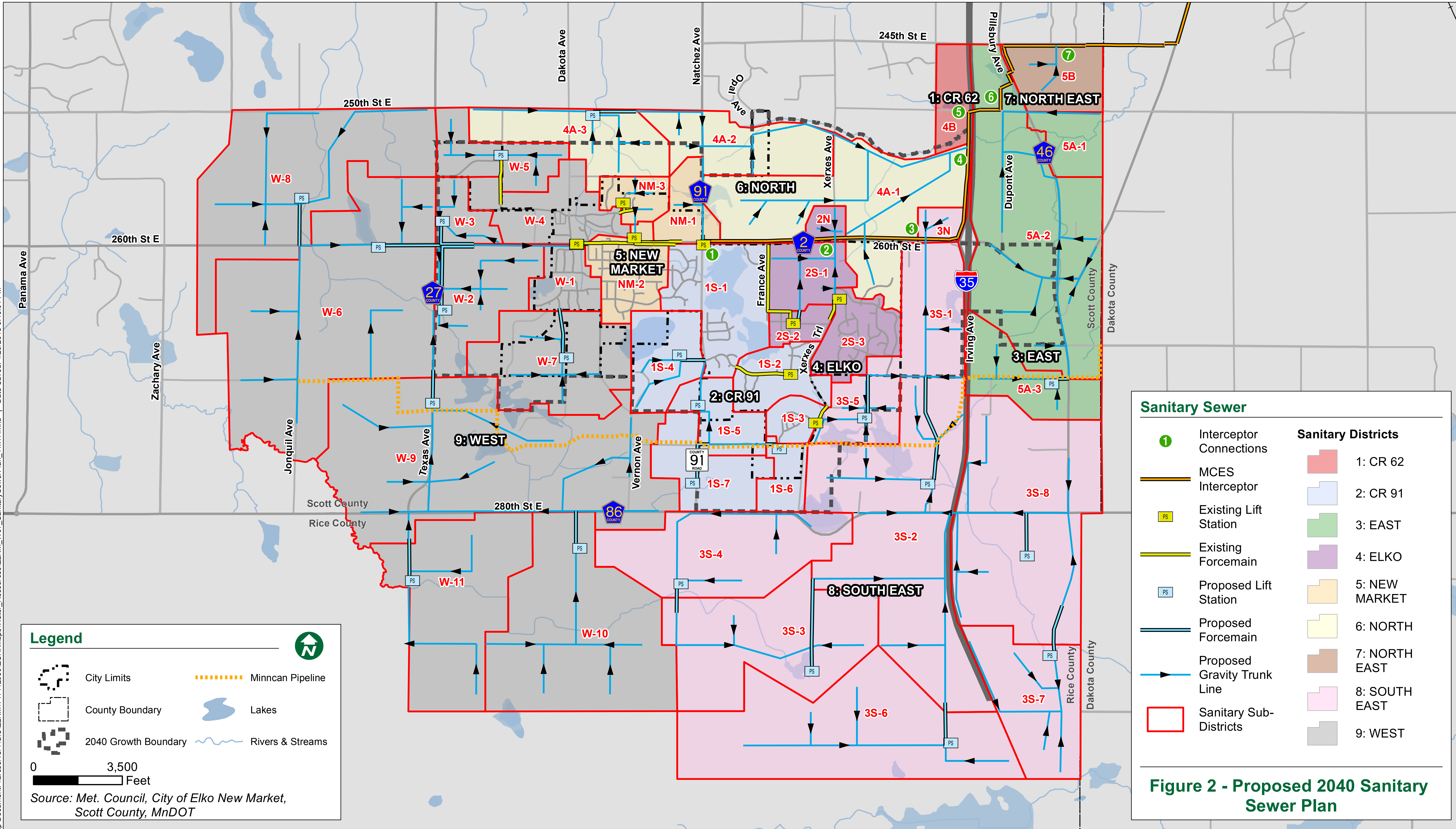

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Appendix C: Design Flow Tabulation

LAND USE / DESIGN FLOW (ULTIMATE POTENTIAL) FROM 2030 PLAN										
District	Area	Total Area (Acres)	Wetland Area (Acres)	Residential – Low Density (Acres)	Mixed Use (Acres)	Comm/ Industrial (Acres)	Town Center (Acres)	Average flow (MGD)	Design Flow (MGD)	MCES Connection Point
West	W-3	95	4	0	55	0	0	0.085	0.31	1
	W-5	221	18	112	91	0	0	0.137	0.47	1
	W-7	490	74	416	0	0	0	0.208	0.69	1
	W-2	357	33	0	0	0	0	0.269	0.83	1
	W-4	305	38	68	68	0	9	0.196	0.59	1
	W-11	712	104	510	98	0	0	0.342	1.03	1
	W-8	934	111	706	116	0	64	0.456	1.32	1
	W-10	983	124	728	64	0	68	0.514	1.49	1
	W-9	1542	241	651	650	0	0	0.901	2.16	1
	W-6	1493	128	896	469	0	0	0.863	1.81	1
	W-1	137	23	8	1	0	0	0.060	0.13	1
CR-91	1S-3	77	9	0	0	0	0	0.034	0.13	1
	1S-4	226	100	126	0	0	0	0.063	0.23	1
	1S-6	105	3	46	57	0	0	0.073	0.27	1
	1S-2	180	38	212	0	0	0	0.071	0.25	1
	1S-7	253	33	162	58	0	0	0.133	0.45	1
	1S-5	175	17	157	0	0	0	0.079	0.24	1
	1S-1	377	133	39	0	28	8	0.191	0.55	1
New Market	NM-3	100	9	52	0	0	6	0.054	0.21	1
	NM-2	212	26	0	0	0	0	0.145	0.30	1
	NM-1	132	15	0	52	0	66	0.136	0.27	1
***Total to MCES connection point 1 =**									**12.02**	

LAND USE / DESIGN FLOW (ULTIMATE POTENTIAL) FROM 2030 PLAN										
District	Area	Total Area (Acres)	Wetland Area (Acres)	Residential – Low Density (Acres)	Mixed Use (Acres)	Comm/ Industrial (Acres)	Town Center (Acres)	Average flow (MGD)	Design Flow (MGD)	MCES Connection Point
Elko	2N	49	3	0	33	13	0	0.042	0.16	2
	2S-3	196	8	28	0	0	0	0.094	0.34	2
	2S-2	75	13	14	0	0	13	0.057	0.19	2
	2S-1	179	18	38	98	9	17	0.139	0.40	2
***Total to MCES connection point 2 =**									**12.29**	
Southeast	3N	57	1	0	0	0	0	0.056	021	3
	3S-5	181	30	135	16	0	0	0.082	0.30	3
	3S-7	433	90	343	0	0	0	0.172	0.57	3
	3S-4	597	71	305	221	0	0	0.348	1.04	3
	3S-6	1041	140	901	0	0	0	0.451	1.31	3
	36-3	733	51	682	0	0	0	0.341	0.95	3
	3S-2	2264	375	956	467	221	0	1.347	2.96	3
	3S-1	324	48	106	87	18	0	0.208	.46	3
***Total to MCES connection point 3 =**									**17.53**	

LAND USE / DESIGN FLOW (ULTIMATE POTENTIAL) FROM 2030 PLAN										
District	Area	Total Area (Acres)	Wetland Area (Acres)	Residential – Low Density (Acres)	Mixed Use (Acres)	Comm/ Industrial (Acres)	Town Center (Acres)	Average flow (MGD)	Design Flow (MGD)	MCES Connection Point
North	4A-3	341	36	305	0	0	0	0.153	0.52	4
	4A-2	328	27	18	283	0	0	0.260	0.78	4
	4A-1	741	129	0	400	0	18	0.562	1.46	4
***Total to MCES connection point 4 =**									**19.58**	
CR 62	4B	133	15	0	109	3	0	0.104	0.36	5
East	5A-1	141	33	0	108	0	0	0.095	0.34	6
	5A-3	261	24	141	97	0	0	0.157	0.53	6
	5A-2	1102	106	40	470	465	0	0.923	2.86	6
***Total to MCES connection point 6 =**									**21.20**	
Northeast	5B	216	47	0	87	83	0	0.159	0.54	7
***Total to MCES connection point 7 =**									**21.52**	

Appendix D: 2040 Trunk Sewer Design and Capacity Tabulation

TRUNK SEWER DESIGN AND CAPACITY INFORMATION						
From Point	**To Point**	**Design Flow (MGD)**	**Pipe- Existing/Proposed**	**FM Size (in.)**	**FM Length (ft.)**	**Length to be Oversized (ft.)**
CR 62						
4B	**Interceptor**	0.42	PROPOSED	--	--	0
CR 91						
1S-1	**Interceptor**	1.58	EXISTING	Ex 8	--	0
1S-2	**1S-1**	0.42	EX. FM	Ex 6	--	0
1S-3	**1S-2**	0.14	EX. FM	Ex 4	--	0
1S-4	**1S-1**	0.25	PROP. FM	8	1000	4750'(10")
1S-5	**1S-1**	1.05	PROPOSED	8	1820	1650'(10")
1S-6	**1S-5**	0.29	PROPOSED	4	550	0
1S-7	**1S-5**	0.52	PROPOSED	6	2070	0
EAST						
5A-1	**Interceptor**	0.38	PROPOSED	--	--	0
5A-2	**Interceptor**	1.13	PROPOSED	--	--	10700'(24")
5A-3	**5A-2**	0.61	PROPOSED	6	500	2160' (12")
ELKO						
2N	**Interceptor**	0.17	PROPOSED	--	--	0
2S-1	**Interceptor**	1.50	PROPOSED	--	--	5950'(15")
2S-2	**2S-1**	0.74	PROPOSED	Ex 6	--	0
2S-3	**2S-1**	0.38	EXISTING	Ex 6	--	0
NORTHEAST						
5B	**Interceptor**	0.62	PROPOSED	--	--	2050'(10")

TRUNK SEWER DESIGN AND CAPACITY INFORMATION - CONTINUED						
NORTH						
4A-1	**Interceptor**	3.12	PROPOSED	--	--	5700'(21"), 12469'(10")
4A-2	**4A-1**	1.44	PROPOSED	--	--	3955'(12"), 5724(18")
4A-3	**4A-2**	0.60	PROPOSED	8	1700	0
NEW MARKET						
NM-1	**Interceptor**	10.48	EXISTING	Ex 12, Ex 6	--	0
NM-2	**NM-1**	10.15	EXISTING	Ex 12, Ex 6	--	0
NM-3	**NM-2**	0.22	PROPOSED	--	--	0
Incoming Flow	**NM-2**	10.08	--	--	--	--
SOUTHEAST						
3N	**Interceptor**	0.22	PROPOSED	--	--	0
3S-1	**Interceptor**	7.66	PROPOSED	--	--	5430'(36")
3S-2	**3S-1**	7.18	PROPOSED	6 & 20	1615'(6"), 4190'(20")	3066'(36"), 5202'(21"), 7493'(18")
3S-3	**3S-2**	2.27	PROPOSED	12	3530	7530'(21")
3S-6	**3S-2**	1.58	PROPOSED	10	1680	7980'(18")
3S-7	**3S-2**	0.67	PROPOSED	6	2130	4550'(12")
3S-5	**3S-1**	0.33	PROPOSED	--	1750	0
3S-4	**3S-3**	1.25	PROPOSED	8	1280	6310'(15")

TRUNK SEWER DESIGN AND CAPACITY INFORMATION - CONTINUED						
WEST						
W-1	**Outgoing Flow**	10.08	PROPOSED	--	--	1400'(21")
W-2	**W-1**	1.00	PROPOSED	8	3770	0
W-3	**W-2**	0.34	PROPOSED	6	2020	2742'(24")
W-4	**W-1**	1.20	EX. FM	Ex 12	465	0
W-5	**W-1**	0.53	EXISTING	Ex 6	--	0
W-6	**W-1**	8.00	PROPOSED	18	3700	3167'(33"), 7398'(24")
W-7	**W-1**	0.79	PROPOSED	8	2000	4160' (12")
W-8	**W-6**	1.60	PROPOSED	10	1640	9830'(12")
W-9	**W-6**	5.09	PROPOSED	16	1470	4120'(27"), 7660'(24"), 4090'(15")
W-10	**W-9**	1.75	PROPOSED	10	1490	6400'(18")
W-11	**W-9**	1.23	PROPOSED	8	1600	11400'(15")