Watford City
North Dakota

December 2021

2040 INFRASTRUCTURE MASTER PLAN

WATFORD CITY, NORTH DAKOTA

Final Report

BURIAN & ASSOCIATES LLC

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In Conjunction With:
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ICON Architectural Group
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Chapter 1. Introduction

Over the last decade, communities across western North Dakota have experienced rapid population growth, primarily due to increased oil and gas activity during the recent surge in the oil and gas industry. Watford City was one of the fastest growing communities in the State, growing from 1,800 people in 2010 to an estimated 6,207 people today[1]. Population growth presents many benefits and opportunities, including local economy stimulation and increased amenities in the community, but also comes with potential challenges such as strained municipal services and finances.

The City of Watford City relies on gross production tax (GPT) revenues, sales tax revenues, property tax revenues, and utility (water, sewer, garbage) fees to fund new infrastructure, infrastructure renewal and replacement, and infrastructure operation and maintenance (O&M). With the cyclical nature of the oil industry and the recent slowdown in western North Dakota and the world due to the ongoing COVID-19 pandemic, the City wanted to better position themselves for the future and align funding sources with existing and proposed infrastructure to ensure a resilient infrastructure plan is in place.

In 2020, the City made the decision to embark on a master planning process to develop the Watford City 2040 Infrastructure Master Plan (Master Plan). The purpose of this Master Plan is to help Watford City plan and implement capital and operational infrastructure improvements over the next 20 years. Specifically, this project included thorough assessments of the City's existing transportation systems, water system, wastewater system, and stormwater system, a review of City facilities, identifying and establishing plans for future infrastructure investments, development of a robust financial model, and the creation of capital improvements plans and a resiliency plan to help the City achieve infrastructure and financial resiliency in a methodical and cost-effective manner for years to come.

1.1 Core Project Team

The core Project Team was comprised of the following individuals:

<u>Watford City</u>

- Grace Demars, PE, City Engineer
- Justin Smith, Public Works Director
- Laura Dokken, Finance Director
- Curt Moen, City Administrator

<u>Consulting Team</u>

- Burian & Associates
- ICON Architectural Group
- SRF Consulting Group
- Raftelis

[1] United States Census Bureau. Watford City 2020 Census Population.

1.2 Project Drivers, Mission Statement, and Goals

There are several factors that drove the inception of this Project. These include internal factors (factors that the City has some control over), as well as external factors (factors outside of the City's control). The primary drivers for the Project include:

Internal Factors

- Long-Term Operations and Maintenance (O&M) Expenditures
- Aging Infrastructure Renewal and Replacement
- New Infrastructure Improvements to Support Growth
- Connectivity between Existing and New Infrastructure Networks

External Factors

- Gross Production and Sales Tax Volatility
- Rapid Population Increases and Decreases
- Changing Citizen Expectations
- Infrastructure Inheritances

During the early stages of the Project, the Project Team met to develop a Project-specific Mission Statement, that embodied the City's existing vision statement. Watford City's vision statement and the Master Plan's Mission Statement are provided below, respectively.

Community Vision

"Watford City will be a vibrant and inclusive community:

- *Where a diverse economy is fostered;*
- *Where residents enjoy a high quality of life and a strong sense of belonging;*
- *Where collaboration and strategic growth are prioritized; and*
- *Where people are proud to call McKenzie County "home".*

Watford City 2040 Infrastructure Master Plan Mission Statement

The Watford City 2040 Infrastructure Master Plan is an overarching policy document which is intended to guide decision making related to the City's infrastructure assets and financials to ensure decisions move the City towards the Community's Vision.

Once the Project Team developed the Mission Statement for the Project, Project Goals were established to ensure that the Project stayed on course, fulfilling the goals, and living up to the Master Plan Mission Statement. The Project goals include:

Goal #1

Determine the existing condition of the City's wet infrastructure, transportation network, and facilities that are owned and/or maintained by the City so service may continue to be provided that meets or exceeds regulatory requirements and defined levels of service.

Goal #2

Determine future infrastructure needs based on proposed development, population projections, and funding scenarios to understand how additional growth will affect the City's financials.

Goal #3

Assess current service delivery, operational processes, and maintenance processes against the established levels of service. Determine if improvements to the processes are necessary to maintain levels of service and prolong the life of existing and future infrastructure.

Goal #4

Prioritize wet infrastructure, transportation network, and facility projects and develop cost estimates for each project.

Goal #5

Establish a budget stabilization fund to maintain the City's essential services to be resilient during varying economic conditions.

Goal #6

Create an annual budget which incorporates current debt requirements, ongoing operations and maintenance costs, capital improvement priorities and future renewal costs associated with existing facilities.

Goal #7

Develop an infrastructure master planning program and capital improvement prioritization process that is documented, repeatable, affordable, and implementable. Plan should be able to be incorporated into the staff's daily work and annual budgeting process.

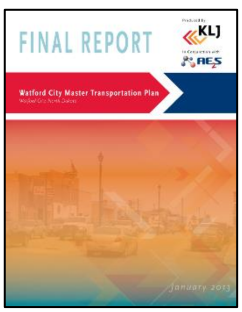
1.3 Previous Planning Efforts

Several previous planning efforts were drawn upon and utilized as resources throughout the development of this Master Plan. The previous planning efforts that were utilized as a foundation for this planning effort are provided in Table 1, and are also briefly summarized in the following subsections.

Table 1. Previous Planning Efforts

Planning Effort	Completed By
Watford City Master Transportation Plan (2013)	KLJ and AE2S
McKenzie County 2025 Comprehensive Plan (2016)	SRF Consulting Group
Watford City Area Long Range Transportation Plan (2017)	HDR
6-Cities Energy Impact Study (2017)	AE2S
Watford City Capital Improvements Plan (2019)	AE2S
2020-2024 Community Sustainability Study (2019)	StrengthenND

1.3.1 Watford City Master Transportation Plan (2013)



The 2013 Master Transportation Plan was Watford City's first strategic planning effort in the wake of the oil boom. The plan allowed the community to take a step back and take stock of growth, update data, identify roadway system deficiencies, and develop a rational basis for future transportation improvement programming.

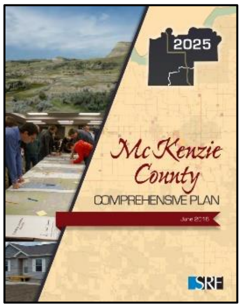
The plan included corridor improvement plans for the ND 23 Alternate Business Route and the ND 23 Urban Business Route. Many improvements have been implemented outside of the city core. However, proposed access modifications on 4th Ave NE have not been completed.

The plan also proposed three specific improvements for local roadways:

- Intersection realignment at Park Avenue and 5th Street
- Removal of all-way stop control at Park Avenue and 2nd Street
- Proposed West ND Alternate Business Route parallel to 3rd Avenue SW

The first recommendation has been carried forward, as there have been ongoing discussions between the City and impacted landowners. Intersection realignment could be completed with reconstruction of Park Avenue and 5th Street. The proposed West ND Alternate Business Route has not been constructed, as demand for this connection has not fully materialized. In addition, there would be several logistical challenges to implementation, including coordination with NDDOT, right-of-way acquisition, wetland impacts, and impacts to existing development.

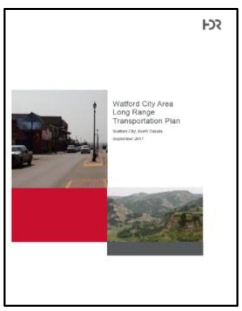
1.3.2 McKenzie County 2025 Comprehensive Plan (2016)



McKenzie County's Comprehensive Plan was completed in 2016. The plan has a 10-year horizon (2025), so it should be evaluated for update in the next few years. The plan provides guidance for land use and development in the unincorporated areas of the County, with future growth guided toward urban areas and highway nodes. The primary growth areas for Watford City are depicted to its south and west, across Highway 85. These areas have not yet developed as envisioned in the plan.

The plan includes a transportation element that supports the growth plan and defines goals and objectives for managing the roadway system. These goals prioritize safety, freight mobility, traffic control, and interagency coordination. The plan also provided the basis for establishing a multi-year Capital Improvement Plan for McKenzie County, which was recently completed. It depicts conceptual roadway improvements, including several connections in Watford City's southwest growth area. Many connections have been improved as shown (e.g., CR 30, CR 34). Other recommendations have been carried forward into the County's CIP update.

1.3.3 Watford City Area Long Range Transportation Plan and Future Land Use Plan (2017)



The Watford City Area Long Range Transportation Plan (LRTP), adopted in October 2019 , is a holistic plan for Watford City's transportation system. Although it focused on the municipal roadway system, it also included recommendations for multimodal projects and an analysis of the state highway system. A traffic forecast and a capacity analysis were completed for state highway segments for the Year 2025 and Year 2040 planning scenarios.

The LRTP included an evaluation of 50 alternative roadway projects, using planning-level cost estimates and performance measures to develop a prioritized project list. Ultimately, the LRTP provided a preferred list of fiscally constrained projects that satisfy reasonable assumptions of available future funding. The list of fiscally constrained projects included 14 improvements, which were prioritized for completion in the Near-Term (2018), Mid-Term (2025-2030), or Long-Term (2031-2040) Planning Periods.

1.3.4 6-Cities Energy Impact Study (2017)

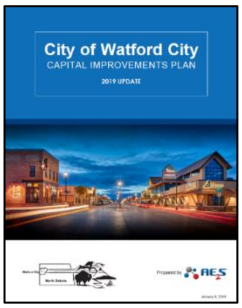
The Western Dakota Energy Association cost-shared with each participating city to perform an Impacts Forecasting and Financial Gap Analysis for the six participating cities of Williston, Dickinson, Watford City, Stanley, Tioga, and Killdeer.

At the onset of the study development, oil prices had dipped and development had slowed, but cities throughout the Bakken were still anticipating significant future demands in necessary resources to serve the developing energy industry and population in Western ND.

This Study was intended to evaluate and quantify the core City needs including traditional capital infrastructure needs (water, sewer, roads, etc.) and identify City services and operational needs to keep up with the development pace.

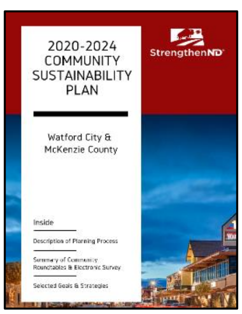
The results of the study provided a seven-year financial roadmap for the City's capital and operational needs and quantified the financial impacts that were beyond each City's ability to support with local revenue streams (i.e. identification of each Cities 7-year financial "gap"). Population projections developed during this effort were carried forward for this Master Plan.

1.3.5 *Watford City Capital Improvements Plan Update (2019)*



Since 2011, Watford City had conducted routine updates on a biannual basis to their Capital Improvements Plan, with the latest update being conducted in 2019. The Capital Improvements Plans were primarily geared towards new infrastructure to support growth and new development, where O&M and rehabilitation and replacement projects of existing infrastructure were not considered. The Capital Improvements Plan Update included water system, wastewater system, and transportation system infrastructure improvements. The Capital Improvements Plan Update (2019) was primarily utilized as a funding tool to demonstrate to the State the infrastructure requirements and respective costs associated with continued growth and development in Watford City and McKenzie County. Since completion, the City has recognized that timing of the recommended infrastructure improvements are not appropriate given the recent slowdown in oil activity and economic downturn associated with the ongoing COVID-19 pandemic.

1.3.6 *2020-2024 Community Sustainability Plan*



In the summer of 2019, the City of Watford City and the McKenzie County Job Development Authority engaged with Strengthen ND to develop a five-year Community Sustainability Plan. Through a community survey, community roundtable sessions, and a leadership-driven planning session, data was collected on the current state of Watford City and McKenzie County as well as what could be future priorities. Laid out in the sustainability plan are the details of the community planning process, relevant outcomes, and the distilled goals and strategies to guide future growth and development of Watford City and the broader McKenzie County area. The City's vision as well as the goals outlined in this planning effort were carried forward within this Master Plan.

1.4 Master Planning Process

Municipalities must continuously update infrastructure master plans to identify opportunities and to address infrastructure system challenges. Infrastructure master planning provides policymakers and the public with a detailed report on infrastructure needs and the recommended actions to accommodate those needs. Master planning helps establish priorities for the orderly construction and implementation of necessary improvements. Lastly, a master plan can be used as a tool to pursue and support requests for capital improvement funding. For these reasons and many others, Watford City has adopted the master planning process for its municipal infrastructure systems.

The City recognizes that prudent management of annual operation and maintenance budgets, optimizing short-term capital improvement expenditures, and maximizing the benefits of long-term capital improvements require a consistent direction for the City, which can be attained through a robust planning process.

As the City adopts and cycles through the master planning process, some uncertainties and changes are expected. The impacts of these changes are best managed through a continued proactive planning approach. Responding to future challenges is most appropriately accomplished through a fluid planning process that enables the City to maintain a clear vision and consistent direction for the City's infrastructure systems.

The Watford City 2040 Infrastructure Master Plan provides a guide for 5- and 10-year capital improvements, as well as infrastructure resiliency recommendations beyond the capital improvement planning horizons. The recommended improvements included in the Capital Improvements Plan (CIP) will serve as the basis for planning, financing, designing, constructing, and implementation of solutions to meet Watford City's infrastructure needs for years to come.

1.5 Project Deliverables

The following list of deliverables was prepared and turned over to the City:

- Master Plan Executive Summary
- Master Plan Report and Appendices (this document), including:
  - Report
  - Appendix A – TM1 – Levels of Service Technical Memorandum
  - Appendix B – TM2 – Financial Policies Technical Memorandum
  - Appendix C – TM3 – Golf Course Irrigation Supply Technical Memorandum
  - Appendix D – TM4 – Digital Survey Responses
  - Appendix E – Unit Costs (2021$)
  - Appendix F – Capital Improvements Plan (CIP) Ledger
  - Appendix G – Financial Model User Manual
  - Appendix H – Bridge Inspections Report
- Applicable GIS Files
- Applicable Excel Files
  - Financial Model
  - Capital Improvements Planning Model
  - Levels of Service Tracking Spreadsheet

Chapter 2. Existing Conditions

This chapter includes descriptions of the City's existing infrastructure network characteristics, the processes utilized to review each existing infrastructure system, and the findings from the infrastructure system evaluations. The primary sections of this Chapter outline the following infrastructure systems: Transportation System, Water System, Wastewater System, Stormwater System, and Facilities.

2.1 Transportation System

The Transportation System assessment is comprised of the following subsections:

- Roadway Network
- Pavement Condition Analysis
- Sidewalks and Trails
- Bridges
- Safety Analysis
- Summary

2.1.1 Roadway Network

With historic growth, Watford City's roadway network has evolved dramatically within the past 10 years. In 2014 and 2015, the City and private developers constructed over 28 miles of roads (see Figure 1). The developing City includes distinct areas, characterized by an urban core, peripheral growth areas, and rural areas.

The urban core is defined by an original grid of aging streets. This area has high connectivity, a sidewalk system that is nearly complete, and curb and gutter design throughout. However, with the City forced to expand the transportation systems to keep up with growth, pavement quality has declined in some areas of the urban core.

Peripheral development introduces curvilinear streets. New subdivisions are more isolated from the city core and from one another; in some cases, there is only one point of access to the collector/arterial system. The developing street system is a mixture of paved and gravel surfaces, with partial curb and gutter. Some roads have private ownership, and some roads are within newer developments that have not yet been turned over to the City. Sidewalk connectivity varies from subdivision to subdivision.

Rural areas are served by section line roads. These collectors provide direct access to farms and oil well pads. The collectors exist in various stages of development. As the City grows, some will form the backbone of the City's future primary roadway network.

In addition, Watford City is well-connected to the state highway system. Several important business routes connect the City's core to the state highway system, including Main Street (Highway 85B), 2nd Ave SW (Highway 85B), 6th Ave SE/12th Street NE (Highway 23A), and 4th Ave NE (Highway 23B). Meanwhile, two new bypass routes, Highway 85 and Highway 23, circulate traffic around the south side of the City.

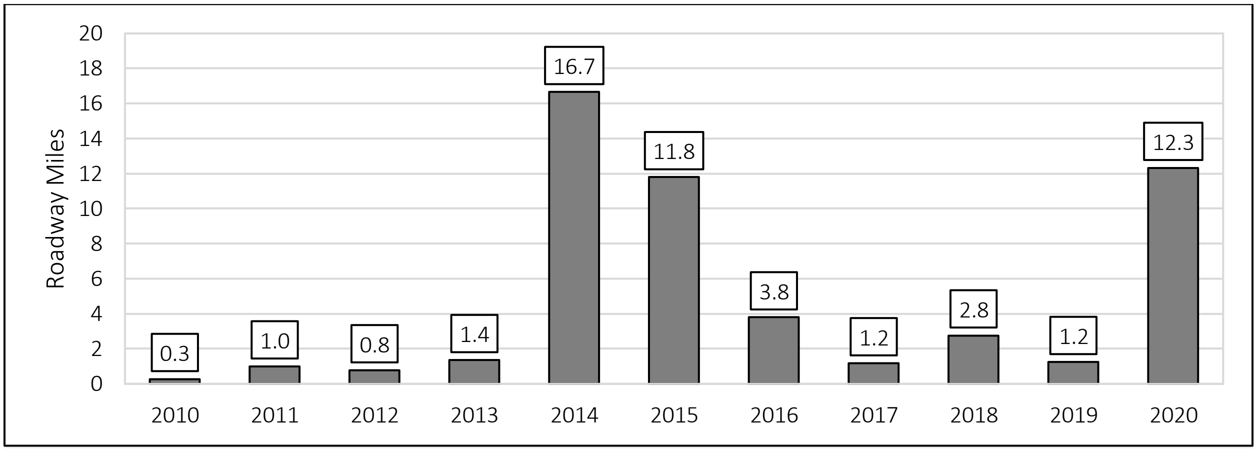


Figure 1. Annual Roadway Construction Mileage from 2010 to 2020

2.1.1.1 Functional Classification

The functional classification system defines the function and role of each road within a roadway network. Functional classification planning works to manage mobility, access, and alignment of routes. It also aligns roadway designations with the current and future land use pattern; for example, commercial uses often locate along prominent highway corridors where they are highly visible to passing traffic.

A roadway's functional class is determined by several factors, including:

- Trip characteristics, such as the length of route, type and size of activity centers, and route continuity
- Access to regional population centers, activity centers, and major traffic generators
- Proportional balance of access, ease of approaching or entering a location
- Proportional balance of mobility and ability to move without restrictions
- Continuity between travel destinations
- Relationship with neighboring land uses
- Eligibility for state and federal funding

Within the functional classification system, roads provide varying levels of access and mobility (shown in **Figure 2**). High-order roads, such as principal arterials, emphasize mobility over access; arterial standards may limit access and intersection spacing. On the other hand, city streets emphasize access over mobility. Challenges sometimes arise when planning for roads that must serve several functions – for example, Main Street in Watford City.

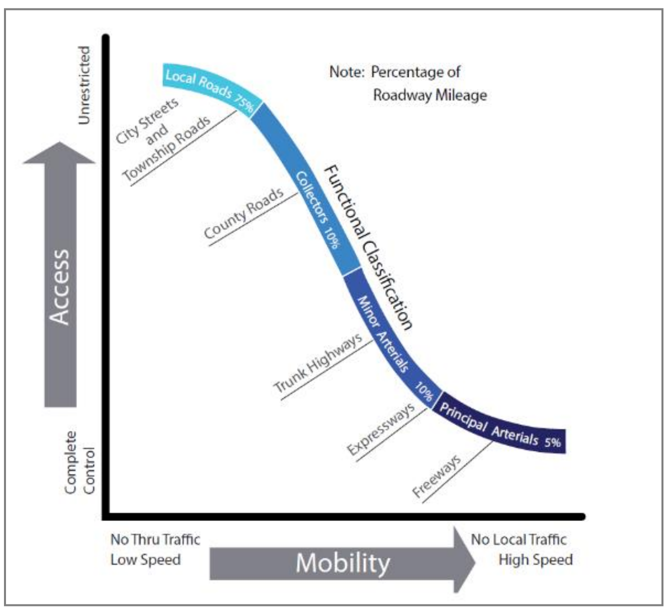


Figure 2. Functional Classification Examples

2.1.1.1.1 Existing Functional Classifications

Reviewing the functional classification system is important to ensure that designations align with the current and future roadway purpose and the future land use plan. Figure 3 depicts the existing federal functional classification system. This system includes principal arterials (most state and federal highways), minor arterials (State Highway 23B), and major collectors (County highways and State Highway 1806).

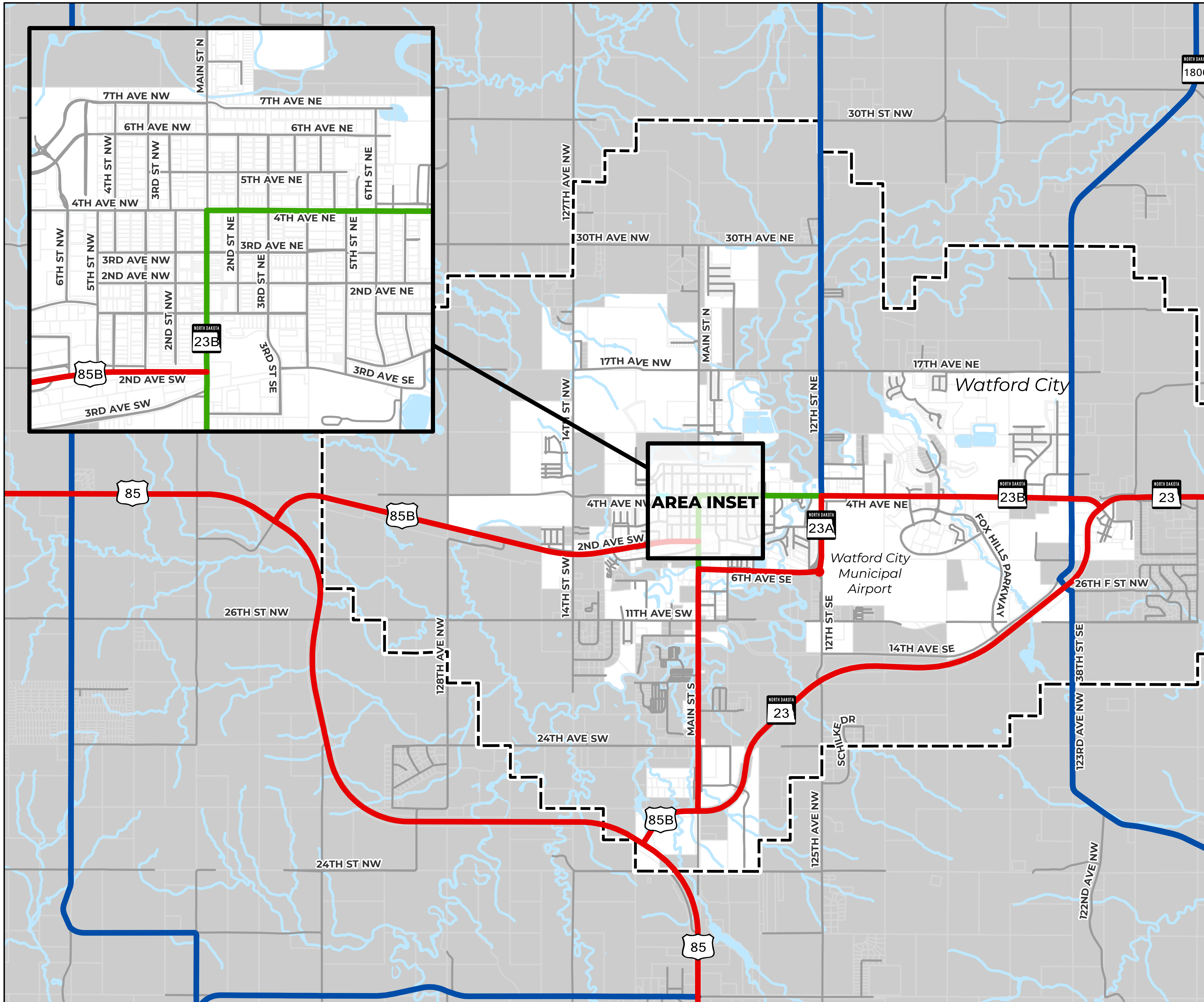
2.1.1.1.2 Proposed Functional Classifications

While federal functional classifications serve NDDOT's roadway system, it provides limited for Watford City roads. Watford City should adopt additional classifications to fully differentiate the community's roadway network. One recommendation is to adopt a system of minor collectors. This designation would primarily apply to section line roads (and half section roads where applicable) within the City and its urban growth areas. Figure 4 depicts recommended functional classification changes. Many proposed minor collectors exist as gravel roads and would need to be upgraded to paved urban sections as growth occurs. Other proposed minor collectors are currently gaps in the roadway network – for example, 14th Avenue SE from Main Street to 12th Street SE and 4th Avenue NW from 14th Street NW to 128th Avenue NW. One realignment is also recommended at the intersection of 128th Ave W and Highway 85 B.

Other recommendations include:

- Change 12th St SE to minor arterial, as shown in the 2017 LRTP
- Change Main Street N to minor arterial from Highway 23A to 30th Avenue N

In addition, Watford City could consider reclassifying Highway 23A (6th Avenue SE/12th Street SE), Highway 85B (2nd Avenue SW and Main Street S) as urban minor arterials within City limits. Note that larger cities typically use the minor arterial designation urban section line roads (1-mile spacing). However, because existing and forecasted roadway volumes on Watford City's local roadway system are lower, the minor collector designation is appropriate. It is recommended to reserve the minor arterial designation for the state and federal highways that pass through the City's urban area.



Watford City North Dakota

Watford City 2040 Infrastructure Master Plan

Figure 3. Existing Functional Classification

Map Legend

- Principal Arterial
- Minor Arterial
- Major Collector
- Watford City ETA

0 1 2 Miles

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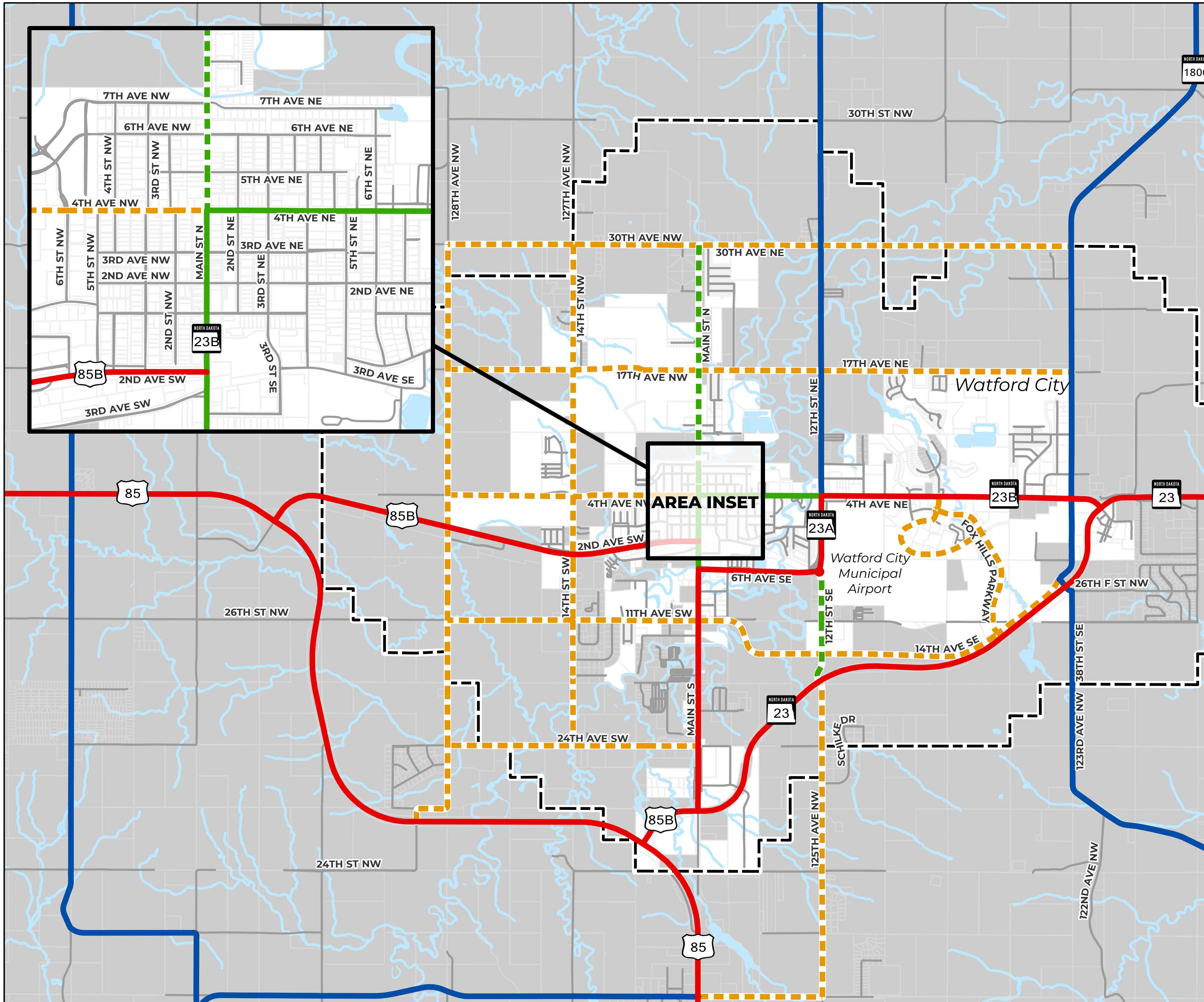

Watford City
North Dakota

Watford City 2040 Infrastructure Master Plan

Figure 4. Proposed Functional Classification

Map Legend

- Principal Arterial
- Minor Arterial
- Major Collector
- Minor Arterial - Proposed
- Minor Collector - Proposed
- Watford City ETA

0 1 2 Miles

N

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2.1.1.2 Jurisdictional Analysis

Jurisdictional classification establishes roadway responsibilities for state, county, township, and municipal agencies. It defines the regulatory, maintenance, construction, and financial obligations of each government unit. Ideally, jurisdictions should be organized so that each road is owned by the agency that is best suited to maintain it. The 2017 LRTP does not identify any roadway candidates for jurisdictional transfer. A summary of the existing jurisdictional classification system mileage is shown in Table 2. System mileage was calculated within the extent of the City's 1-mile extraterritorial area (ETA). The existing roadway jurisdictions are also represented on a map in Figure 5.

Table 2. Existing Jurisdictional Classification System Mileage

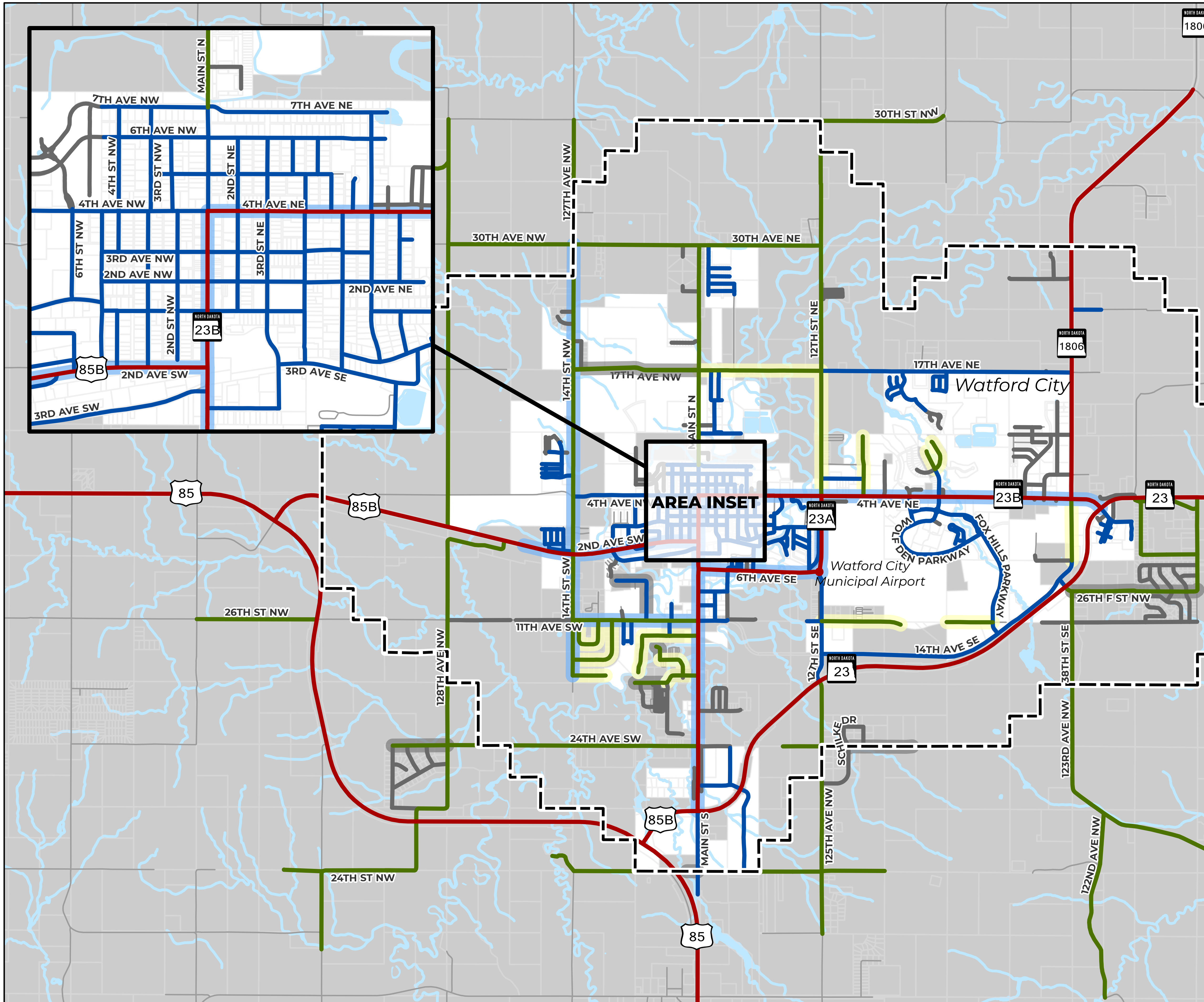
Ownership	System Miles (ETA)	System %
City	39.74	32.3%
County	29.63	24.1%
County Roads Maintained by City	13.20	10.7
State	31.42	25.5%
State Roads Maintained by City	9.70	7.9
Total City Maintenance Responsibility	62.64	50.9%
Private	21.01	17.1%
Other	1.27	1.0%
Total	123.07	100.0%

Some jurisdictional transfers are expected in the future. Transfers will occur as Watford City expands and adds roads to the City's system. Any roads that are prioritized for future paving, trail construction, or other improvements could be candidates for acquisition. However, the City may need to acquire certain roads to implement desired improvements. In fringe areas where future roadway improvements are anticipated, ownership/maintenance responsibilities may not always be clearly defined. In targeted growth areas, Watford City could look to acquire future collectors (i.e., section line roads) from McKenzie County ahead of development; this would give the City additional control over roadway system planning.

Jurisdictional transfer may also be appropriate to achieve consistent or streamline maintenance along a route with multiple owners. Ultimately, the list of priority improvements that is developed as part of this Master Plan will guide discussions on future jurisdictional changes.

Watford City 2040 Infrastructure Master Plan

Figure 5. Existing Road Jurisdiction



Map Legend

Ownership

- City
- County
- State
- Private

Maintenance

- City*
- City Bill County*
- Private

Watford City ETA

0 1 2 Miles

N

Watford City
North Dakota

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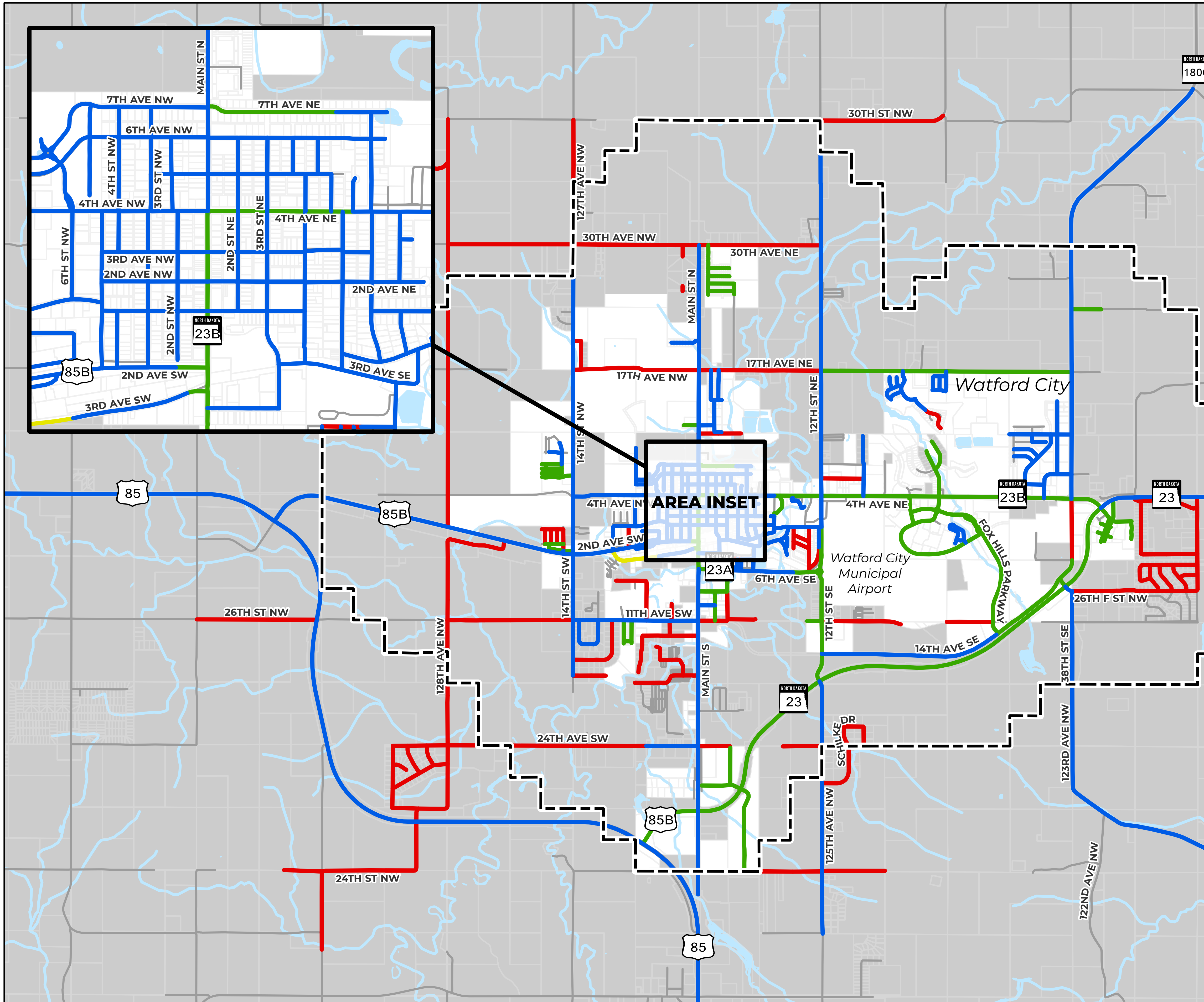
2.1.1.3 Roadway Surfaces

Watford City's roadway system consists primarily of paved and gravel roads. Most roads within city limits are paved (asphalt or concrete), but some roads serving newer developments have gravel surface. Often, roads in developing areas are privately owned. The CIP recommended in this Master Plan includes most public roads with gravel surface be paved to an urban section. Paving should occur if/when warranted by planned development or traffic volumes. If traffic volumes do not warrant paving, it is more cost-effective to maintain roads as gravel surface. Table 3 and Figure 6 summarize all the roadway surface types within the City's ETA extents. The ownership and maintenance responsibilities for the mileages shown vary between the City, McKenzie County, State (NDDOT) and private developers.

Table 3. Existing Roadway Surface

Roadway Surface Type	System Miles (ETA)	System %
Asphalt	57.93	47.1%
Concrete	25.90	21.0%
Double Chip Seal[1]	0.41	0.3%
Gravel	25.25	20.5%
Unimproved	0.36	0.3%
NA	13.22	10.7%
Total	**123.07**	**100.0%**

1 Double chip seal refers to a two-layer chip seal, where the second layer is applied immediately after the first.



Watford City North Dakota

Watford City 2040 Infrastructure Master Plan

Figure 6. Existing Road Surfaces

Map Legend

- Asphalt
- Concrete
- Double Chip Seal
- Gravel
- Watford City ETA

0 1 2 Miles

N

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2.1.1.4 Street Section Design

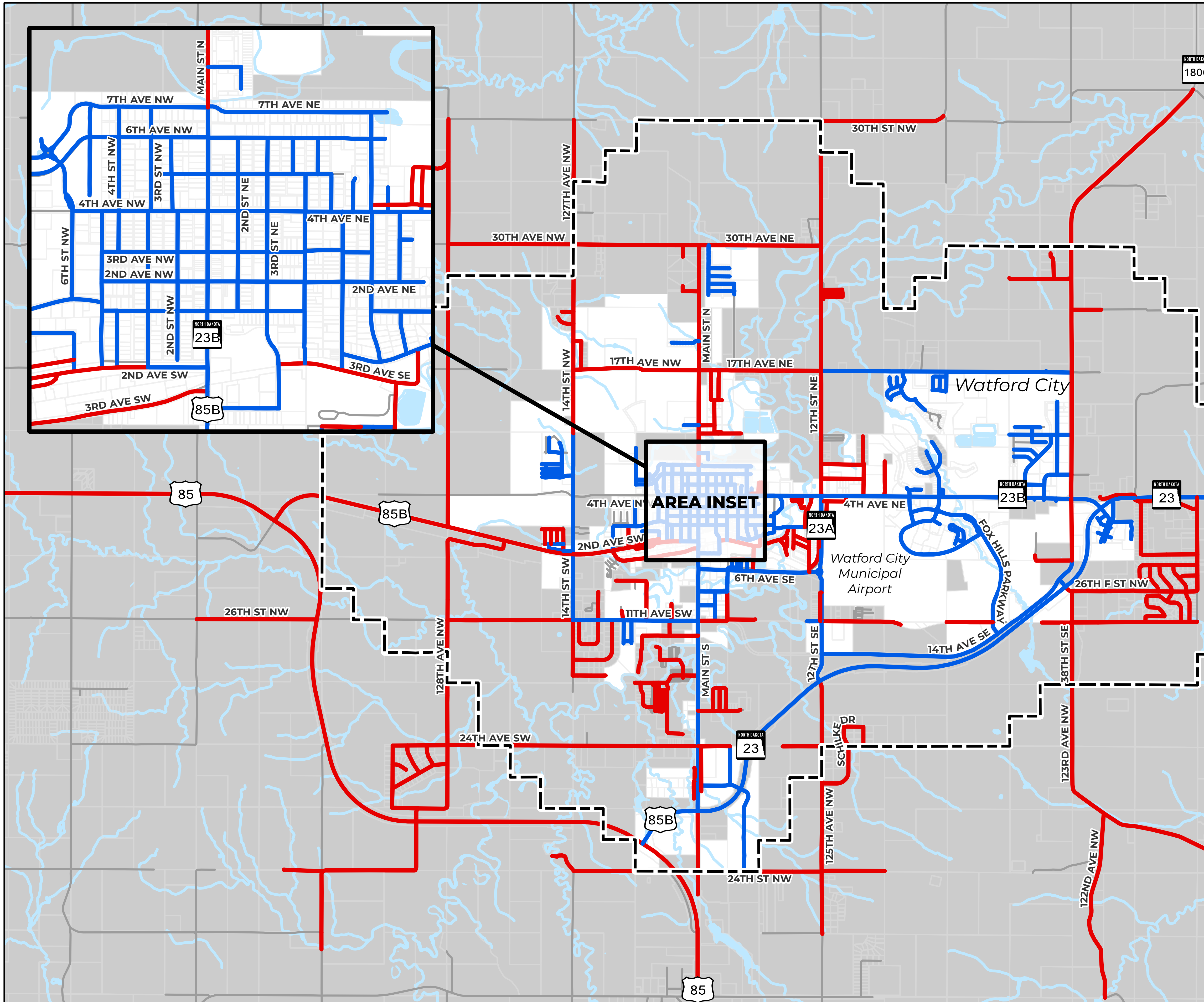
Streets can be classified as "rural" or "urban". Urban sections have full curb and gutter, and often include sidewalks. Rural sections lack curb and gutter, and generally lack sidewalks/trails. For the existing conditions analysis, street sections were coded as rural or urban. Urban segments were identified by referencing the City's storm sewer data and confirming gutter presence with aerial imagery from Pictometry. In general, paved City roads have full curb and gutter. When the City acquires roads from McKenzie County or private owners, the City typically must account for the cost of adding urban facilities. **Figure 7** includes a map of urban and rural street sections throughout Watford City.

2.1.1.5 Roadway System Connectivity

Roadway system connectivity is another consideration for transportation planning. Downtown Watford City has high connectivity via a gridded system. On a gridded street system, there are multiple ways to walk or drive to your destination. Peripheral development has lower connectivity compared to Downtown. Newer subdivisions tend to be isolated from downtown. Intersection density is lower in newer developments and there are fewer ways to get to/from these neighborhoods. Some neighborhoods have only one or two points of access to the primary roadway network.

As Watford City develops, roadway planning should be considered when prioritizing projects that improve overall system connectivity, among other various factors. **Figure 8** identifies several conceptual alignments that would improve system connectivity, two of which are planned for construction as part of this Master Plan's CIP (9th Street SW and 6th Avenue NE will be converted from gravel to paved urban sections).

In addition, 26th F Street W/122nd Ave NW are programmed for construction within McKenzie County's Capital Improvements Plan. The map also shows where existing platted right-of-way is undeveloped. Developing available right-of-way as currently platted is efficient and captures the logic and intent of existing plans. The map illustrates how platted alignments could be integrated within an expanding roadway system. Concepts are illustrated to complete road connections, extend open roads where development allows, achieve good spacing, and avoid constraints (i.e., wetlands). The map is intended to illustrate how the City's peripheral roadway system could fill in as development occurs.



Watford City
North Dakota

Watford City 2040 Infrastructure Master Plan

Figure 7. Street Section Design

Map Legend

- Rural Segment
- Urban Segment (Curb and Gutter)
- Watford City ETA

0 1 2 Miles

N

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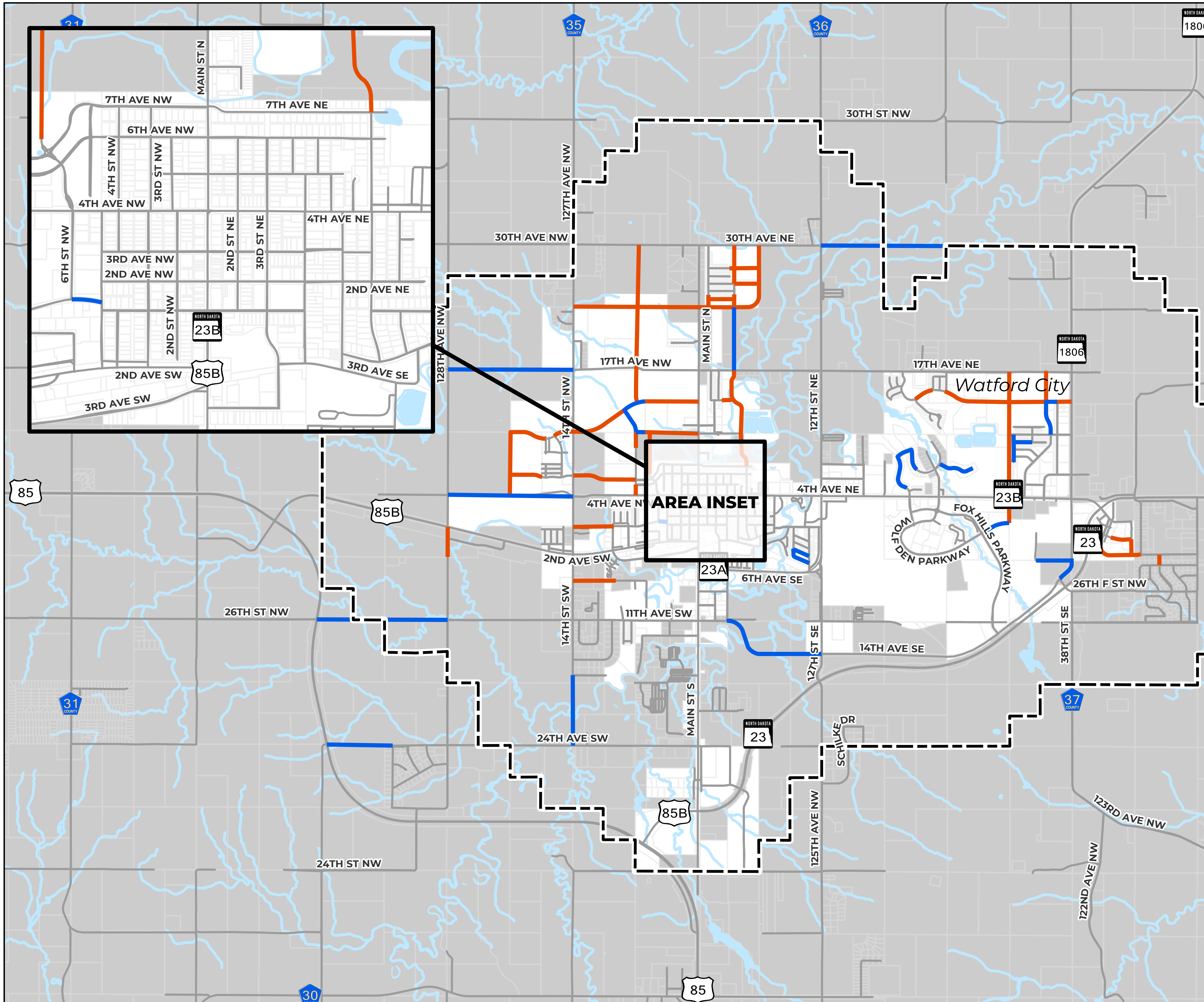

Watford City 2040 Infrastructure Master Plan

Figure 8. Connectivity Analysis

Map Legend

- Existing ROW or Section Line
- Other Gap
- Watford City ETA

Miles 0 1 2

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2.1.1.6 Access Spacing

The number of intersections and access points along the roadway greatly affects the functionality of the corridor. More access generally equates to less mobility and vice versa. Tight access control lowers the level of crashes by volume due to the reduced number of turning movements/conflict points. On high-volume/high-speed corridors, modified access such as ¾ access or right-in/right-out design improves safety by eliminating the most dangerous movements from the intersection. However, it is important to note that overly restrictive access control can diminish overall system connectivity may lead to unintended consequences, such as increasing the number of illegal U Turns or cut-across movements to circumvent access restrictions.

- Principal arterials – Principal arterials are managed by NDDOT, so construction/modification of an access requires NDDOT approval. In general, signals should be spaced at least ½ mile apart to allow for progression through the corridor.
- Minor arterials – In Watford City, minor arterials include Main Street N (HWY 85B) and 4th Ave NE (HWY 23B). In older areas of the city, street intersections are spaced about 350-450 feet apart. While there are limited opportunities to close or consolidate access within the city core, restricting access is less of a concern because the finer-grained street grid helps disperse traffic and lower ADTs.
- Collectors – Typical access spacing standard is 400-500 feet or 10-12 access points per mile. Some driveways may be permitted, particularly commercial driveways and consolidated access to multifamily residential.
- Local Roads – Local street access is primarily concerned with permitting vehicles to back onto the road safely and maintain adequate sight distance at intersections. Driveways should be spaced at least 50 feet apart.

The access recommendations developed as part of this Master Plan are provided in Table 4.

Table 4. Access Recommendations

<table>
<tr><th colspan="2">Planning Area</th><th colspan="4">Urban Core[1]</th><th colspan="4">Suburban Areas</th></tr>
<tr><th colspan="2">Functional Classification</th><th>Principal Arterial</th><th>Minor Arterial</th><th>Collector</th><th>Local</th><th>Principal Arterial</th><th>Minor Arterial</th><th>Collector</th><th>Local</th></tr>
<tr><td rowspan="2">Intersection Spacing</td><td>Primary Full Movement</td><td rowspan="2">330’-660’</td><td rowspan="2">330’-660’</td><td rowspan="2">330’-660’</td><td rowspan="2">330’-660’</td><td>1/2 mile</td><td>1/4 mile</td><td>1/8 mile</td><td rowspan="2">330’-660’</td></tr>
<tr><td>Secondary Full Movement</td><td>¼ mile</td><td>1/8 mile</td><td>330’-660’</td></tr>
<tr><td colspan="2">Private Access</td><td>330’</td><td>330’</td><td>150’</td><td>50’</td><td>¼ mile</td><td>660’</td><td>330’</td><td>50’</td></tr>
<tr><td colspan="2">Minimum Signal Spacing</td><td>½ mile</td><td>¼ mile</td><td>1/8 mile</td><td>As warranted</td><td>1 mile</td><td>½ mile</td><td>¼ mile</td><td>As warranted</td></tr>
</table>

1 The urban core wasn’t defined as part of this Master Plan; however, it’s assumed to be generally as follows: Areas north of 6th Avenue SE, south of 7th Avenue NE, west of 12th Street NE, and east of 6th Street NW.

2.1.1.7 Traffic Volumes

Traffic volumes should be reviewed periodically to understand existing travel patterns, project how travel patterns may shift with system changes, and revise assumptions about future travel forecasts, if necessary.

2.1.1.7.1 McKenzie County Travel Demand Model

McKenzie County is currently updating their Capital Improvements Plan. A travel demand model was developed for this project. The model relies on origin-destination data from INRIX (a transportation data company) and was scaled to be consistent with NDDOT traffic counts. The McKenzie County Capital Improvements Plan model forecasts traffic volumes for 2030 and includes a range of scenarios with varying assumptions for oil industry growth. As such, it would be beneficial for Watford City to review the findings and recommendations that are ultimately developed for McKenzie County.

Figure 9 shows existing scaled traffic volumes from the McKenzie County model. Labeled volumes indicate average daily traffic (ADT) volumes derived from NDDOT counts taken from 2018 through 2020.

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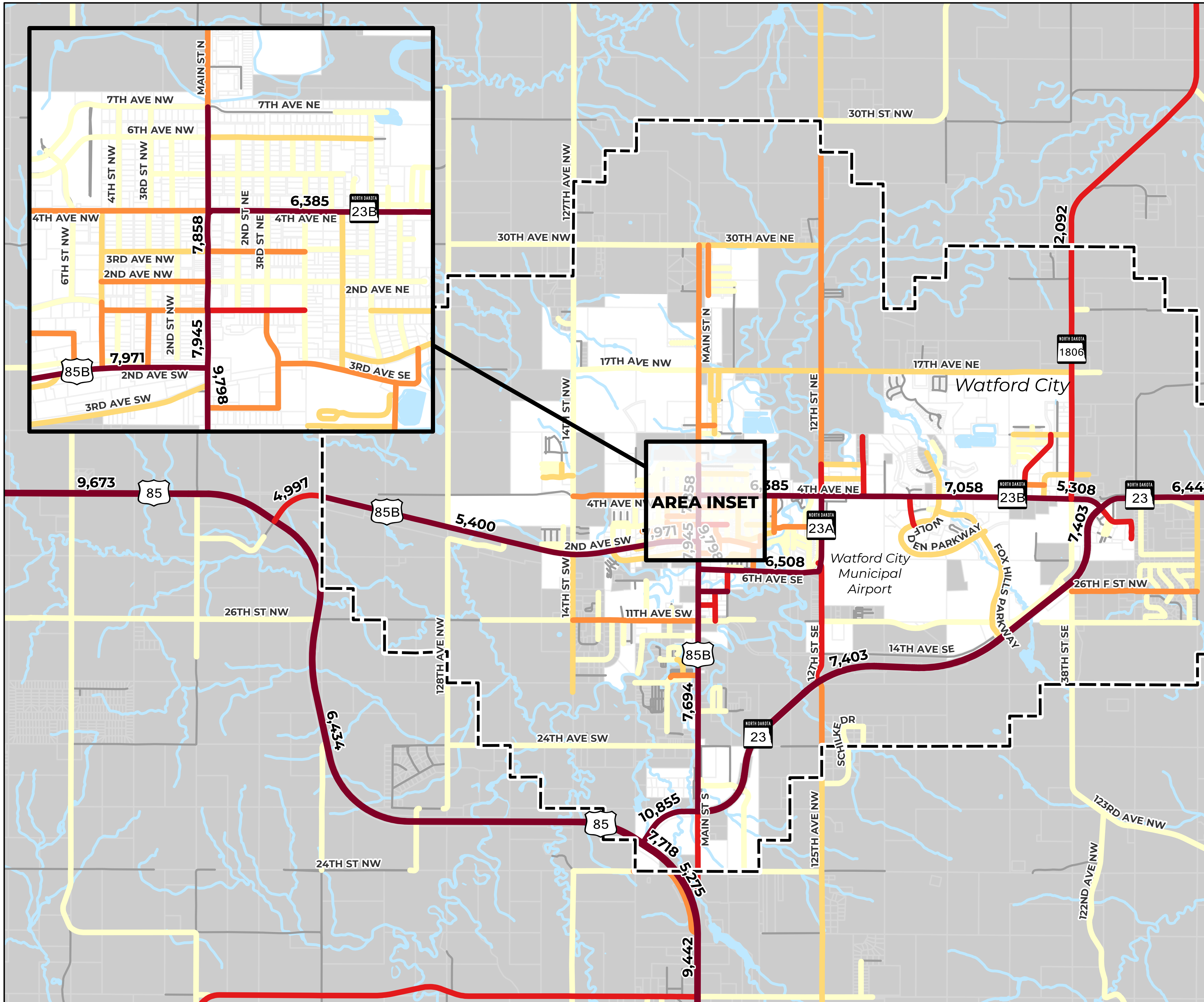
Figure 9. Existing Traffic Volumes



Map Legend

Existing Traffic Volumes (ADT)

- <500
- 500-999
- 1,000-1,999
- 2,000-4,999
- 5,000+
- Watford City ETA

**Line symbols depict 2019 volumes modeled for the McKenzie County CIP. Modeled volumes were derived from INRIX origin-destination data and were validated against available NDDOT counts. Current NDDOT counts are labeled on the map.*

0 1 2 Miles

N

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2.1.1.7.2 LRTP Highway Capacity Analysis

The LRTP provided a 2040 highway capacity analysis for state highway segments and other prominent roads within Watford City. This analysis showed that highways will perform acceptably under modeled 2040 volumes (see Table 5). Note that LOS D is generally considered acceptable, since average daily traffic volumes do not exceed the roadway's capacity; however, users may perceive congestion at times, especially during peak travel periods. Highway segments that were forecasted to fall within the LOS D range include Main Street from 6th Avenue SE (ND 23A) to 4th Avenue NE (ND 23B) and 4th Avenue NE from 36th Street NE (ND 1806) to ND 23. Portions of Main Street were recently reconstructed. Other segments are programmed in Watford City's current CIP.

Table 5. LRTP Highway Capacity Analysis

Highway Segment / Corridor	2040 Forecast ADT	2040 LOS
US 85 from 2nd Ave SW (US 85B) to ND 23	17,200-17,770	A
ND 23 from US 85 to ND 4th Ave NE (ND 23B)	13,800-17,600	A
Main Street from ND 23 to 6th Ave SE (ND 23A)	5,800-9,100	C
Main Street from 6th Ave SE (ND 23A) to 4th Ave NE (ND 23B)	12,400	D
2nd Ave SW (US 85B) from US 85 to Main Street	8,600-11,100	C
4th Ave NE (ND 23B) from Main Street to 37th St NE (ND 1806)	7,500-13,000	C
4th Ave NE from 37th St NE (ND 1806) to ND 23	11,900	D

2.1.2 Pavement Condition Analysis

Roadway condition is a key variable that determines system needs and investment priorities. A detailed pavement condition survey was conducted for this Master Plan. The survey focused on city roads. Approximately 44.1 miles of road were analyzed. The American Society for Testing and Materials (ASTM) 6433-11 Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys was followed. Each segment was given a Pavement Condition Index (PCI) score based on the distresses observed on the surface of the pavement (e.g., transverse cracking, rutting, slab cracking, etc.). PCI ratings use a 0-100 scale, where 100 is essentially a brand-new road. The lowest PCI rating for Watford City was 31.

To visualize pavement condition, PCI scores were classified as Very Good, Good, Fair, Poor, or Very Poor. Note that this rating scale is the same for asphalt and concrete surfaces. The primary difference between the two is that rate of deterioration is slower for concrete. Table 6 indicates the PCI ranges, classifications, mileages, and recommendations for asphalt roadways. Table 7 provides similar data for concrete pavement. Table 8 provides photos taken from the survey of asphalt and concrete sections within each PCI category. Figure 10 maps pavement quality for surveyed roads.

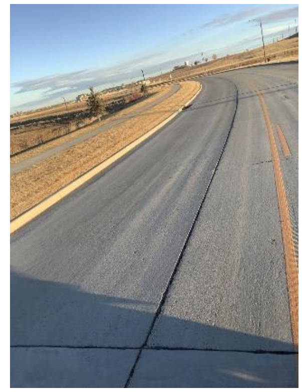
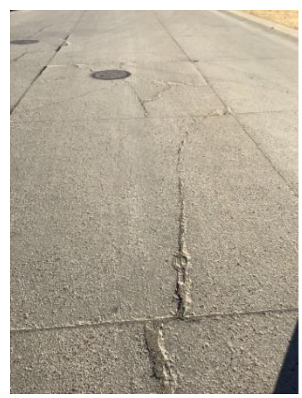
Table 6. Pavement Condition Analysis (Asphalt)

Pavement Condition	PCI Range	Miles	Percent	Recommended Treatment Options
Very Good	86-100	13.8	46.3%	- Do nothing (new roads) - Crack sealing/filling - Seal coating
Good	71-85	5.7	19.1%	- Crack sealing/filling - Seal coating - Microsurfacing
Fair	56-70	5.4	18.1%	- Microsurfacing - Overlay - Mill and Overlay
Poor	41-55	4.5	15.1%	- Mill and Overlay - Full Depth Reclamation - Cold In Place Recycling
Very Poor	40 and below	0.4	1.3%	- Full Depth Reclamation - Cold In Place Recycling - Reconstruction
Total		29.8	100.0%	N/A

Table 7. Pavement Condition Analysis (Concrete)

Pavement Condition	PCI Range	Miles	Percent	Recommended Treatment Options
Very Good	86-100	11.04	78.7%	- Do nothing (new roads)
Good	71-85	2.62	18.7%	- Do nothing - Joint Seal
Fair	56-70	0.36	2.6%	- Minor Concrete Pavement Repair (CPR)
Poor	41-55	0.0	0.0%	- Major Concrete Pavement Repair (CPR)
Very Poor	40 and below	0.0	0.0%	- Reclaim/Reconstruct
Total		14.02	100.0%	N/A

Table 8. Pavement Condition Examples

Pavement Condition	PCI Range	Asphalt	Concrete
Very Good	86-100		
Good	71-85		
Fair	56-70		

Pavement Condition	PCI Range	Asphalt	Concrete
Poor	41-55		No photographs were recorded for concrete sections that had a PCI between 41 and 55.
Very Poor	40 and below		No photographs were recorded for concrete sections that had a PCI of 40 and below.

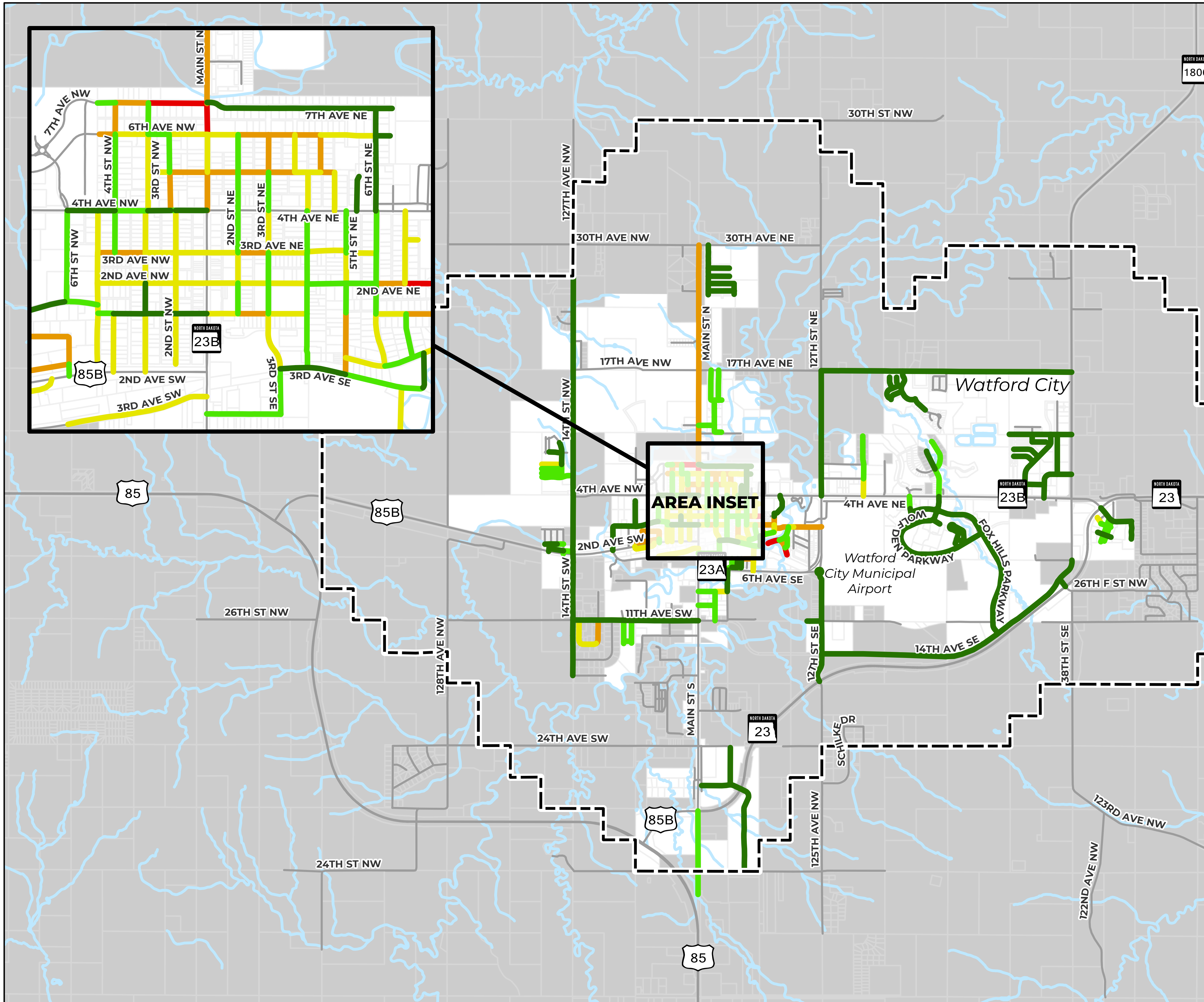


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Figure 10. Existing Pavement Condition

Map Legend

Pavement Quality

- Very Good
- Good
- Fair
- Poor
- Very Poor
- Watford City ETA

0 1 2 Miles

N

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2.1.2.1 Findings and Recommendations

The pavement survey shows that over half of Watford City's paved roadway inventory is in very good condition. For the most part, "Very Good" roads were constructed during the city's recent growth period, meaning pavement is at most 6-7 years old. However, many roads within the city's core have fallen into the "Fair" condition or worse. Segments classified as "Poor" or "Very Poor" are exclusively asphalt surface.

The implementation of a pavement preservation program is good practice, as it focuses on maximizing the condition and life of a network of pavements while minimizing the network's lifecycle cost. It may seem counter-intuitive, but when it comes to maintaining the City's system, roads that should receive attention are the ones that are in good condition. The primary goal should be to proactively keep good condition roadways in good condition, when repairs for these roadways are less costly.

Figure 11 shows how lifecycle maintenance investments extend the life of asphalt and concrete pavement by roughly three times. A mill and overlay can typically be performed at least two times - roughly every 15-20 years - before asphalt roads are reconstructed. Ideally, this preservation treatment should be performed when PCI is in the 50-60 range. Crack fills and seal coating should be performed soon after resurfacing and maintained every 3-4 years. Under this preservation plan, an asphalt roadway will last 50-60 years.

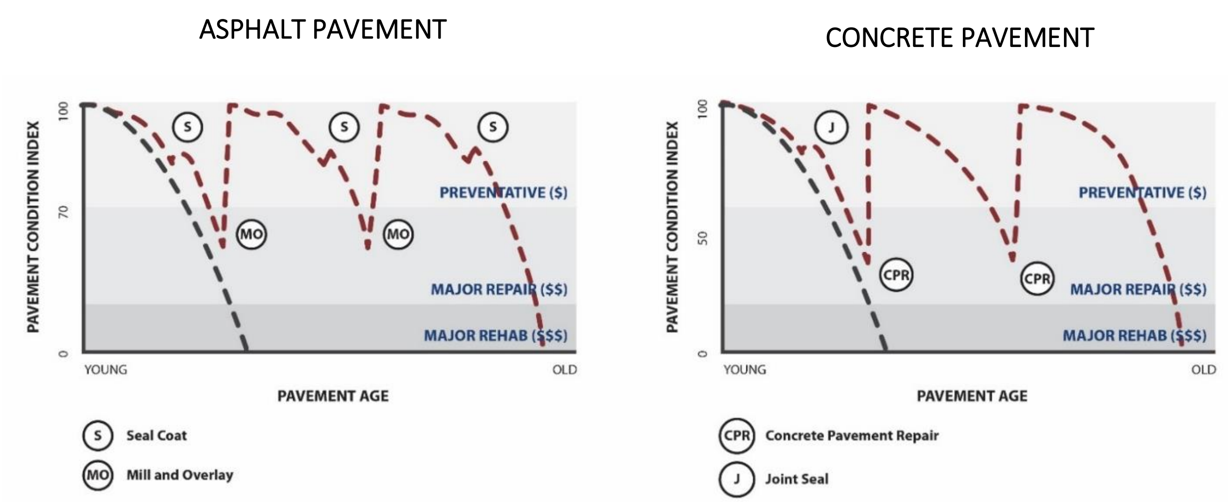

Figure 11. Pavement Life Cycles with and without Preventative Maintenance

Figure 12 illustrates a generalized schedule of lifecycle investments for asphalt roads. Figure 13 illustrates a similar schedule for concrete pavement, which should be treated with a joint seal approximately 10 years after new construction. Ideally, two concrete pavement repairs (CPR) can be performed during the lifecycle of a concrete road. These repairs should be targeted when PCI is in the 30-40 range.

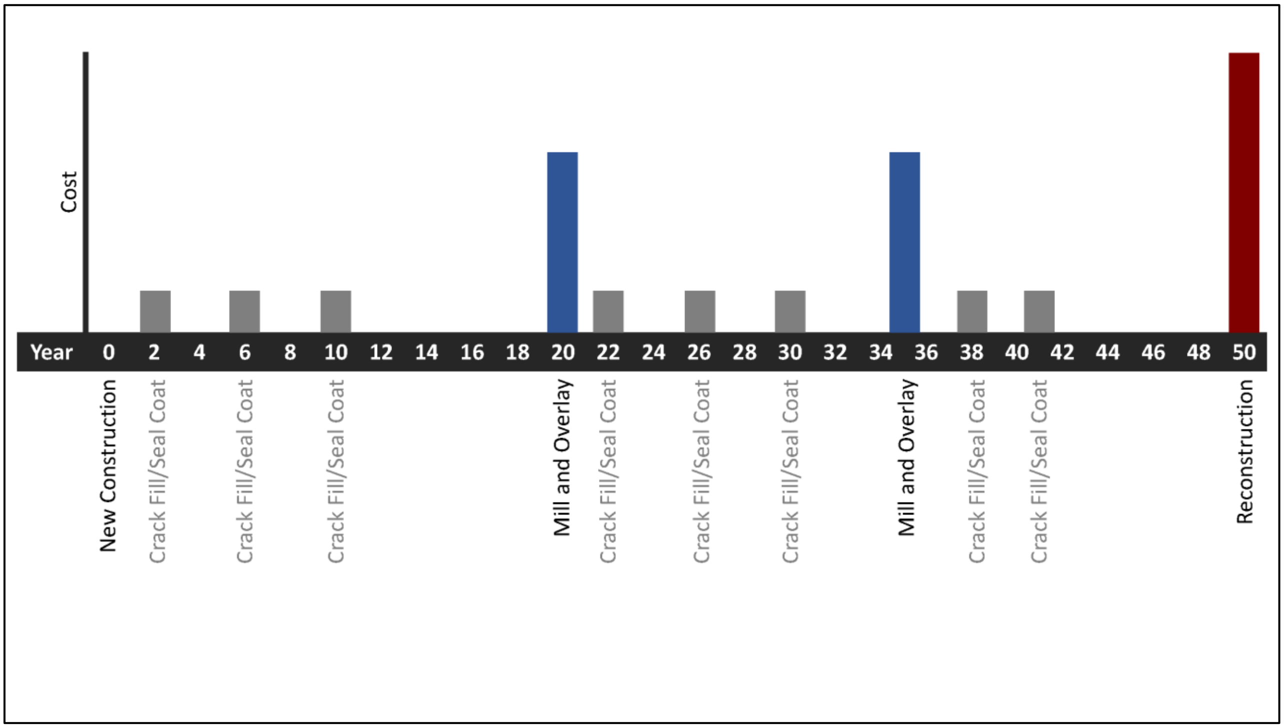

Figure 12. Ideal Lifecycle Investments – Asphalt Roads

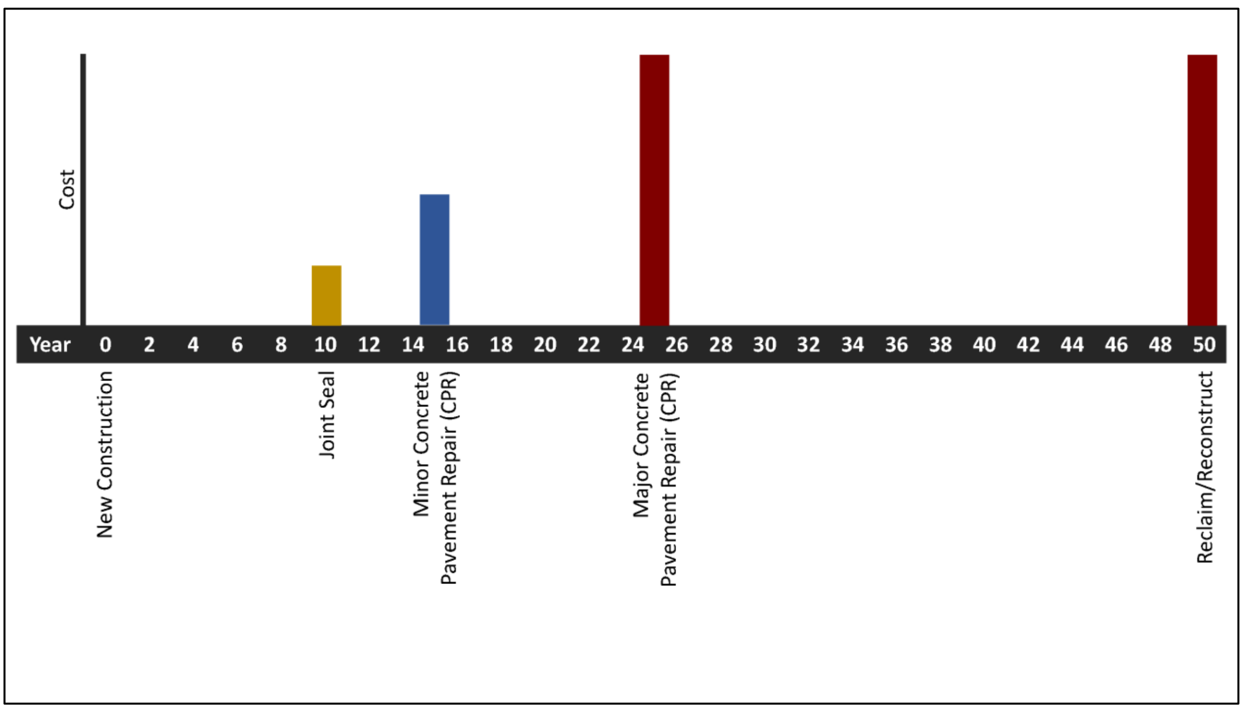

Figure 13. Ideal Lifecycle Investments – Concrete Pavement

Moving forward, "Fair" roads should be prioritized for resurfacing, provided that the subsurface is in good condition (the City should conduct coring to assess underlying bituminous conditions prior to performing overlays) and the underground utilities are in good condition. Roads where the subsurface is not in good condition or have failing underground utilities should be prioritized for reconstruction. The City should strive to prioritize maintenance on roads in "Good" condition (PCI around 80) to prolong pavement life. Once the PCI degrades to about 50 for asphalt pavement (30 for concrete), the rate of deterioration accelerates and the window to avoid more costly improvements begins to close.

2.1.3 Sidewalks and Trails

The transportation system in Watford City is traveled by users of all ages and abilities. This includes people walking, rolling, bicycling, and driving. A well-connected system of sidewalks, trails, and on-street bicycle routes is an asset to a growing, family-friendly community.

The LRTP proposed a future trail system, including the following:

- **Regional trails** that parallel state highways in and around Watford City (projects would need to be integrated with NDDOT plans)
- **Local trails** along the City's future minor arterial corridors and collectors that are identified in the CIP (construction could take place with local street improvements)
- **A riparian trail** along Cherry Creek. This trail would enhance overall system connectivity and could become a strong asset for the community. However, it would take considerable planning and coordination to execute as shown, and one or more new pedestrian bridges may be needed.
- **On-street bicycle routes**, including routes extending to new development north of the downtown. Considerable development has taken place north of town, including new multifamily construction. On-street bicycle routes could be utilized on streets with narrower right-of-way widths. Design could consist of dedicated striped lanes, sharrows, or simply wider shoulders to better accommodate bicycles and other uses.

The City has provided GIS data with conceptual trail alignments that were identified in the LRTP. The proposed system is extensive; it may be impractical to construct all facilities as shown. The LRTP did not prioritize trail improvements. For the Master Plan, the priority trail network should be refined. Therefore, it is worthwhile to examine sidewalk and trail gaps with fresh eyes. Figure 14 identifies existing sidewalks and trails in Watford City. Sidewalk locations were verified using Pictometry. In addition, the map highlights existing paved roads as well as corridor segments that are programmed in the current CIP. The intent is to show practical gaps in the system (i.e., paved roads that lack sidewalk/trail connectivity) and opportunities to expand facilities through future corridor improvements that are already planned. The map also shows several priority projects that have been identified by the City. Table 9 describes these projects.

Table 9. Known Sidewalk and Trail Gaps

Gap Description
2^{nd} Ave SW (Sidewalk Improvement)
Post Office – Sidewalks at 12^{th} St NE and 4^{th} Ave NE
Fox Hills Village – Sidewalk connections to 4^{th} Ave NE
Golf Course to Stepping Stone Subdivision – Multiuse trail connection
Linear Park – Repair extensive sidewalk cracking
2^{nd} Avenue NE – sidewalk connections from 4^{th} St NE to 6^{th} St NE
2^{nd} Avenue SW – sidewalk/trail connection from 10^{th} St to Kennedy St
Park Avenue SW – 5^{th} St SW to 10^{th} St SW
4^{th} Avenue NE – Golf Course approach to HWY 1806
4^{th} Avenue NW 2^{nd} St NW to 8^{th} St NW
4^{th} Avenue SE – Main St to Wolf Run Village approach
Main St N – 7^{th} Ave NE to 30^{th} Ave NE
Main St S – 13^{th} Ave S to HWY 85 Business
Prairie Hills Road – extend sidewalk to 4^{th} Ave NE

Through the Master Planning process, it was deemed important to create two annual programs related to sidewalks and trails. They include the Sidewalk Gap Infill Annual Program, reserved for projects to address to sidewalk and trail gaps (the intent is to include the above projects within this program), and the Sidewalk Repair and ADA Annual Program, reserved for projects to address sidewalk and trail defects/repairs, as well as ADA improvements. Each of these programs are incorporated into the Capital Improvements Plan (outlined in Chapter 7), with \$35,000 and \$75,000 allocated per year, respectively. As the City utilizes these allocations, it's recommended to increase/decrease the annual amounts as deemed necessary to continue to maintain safe and reliable sidewalk and trail systems.

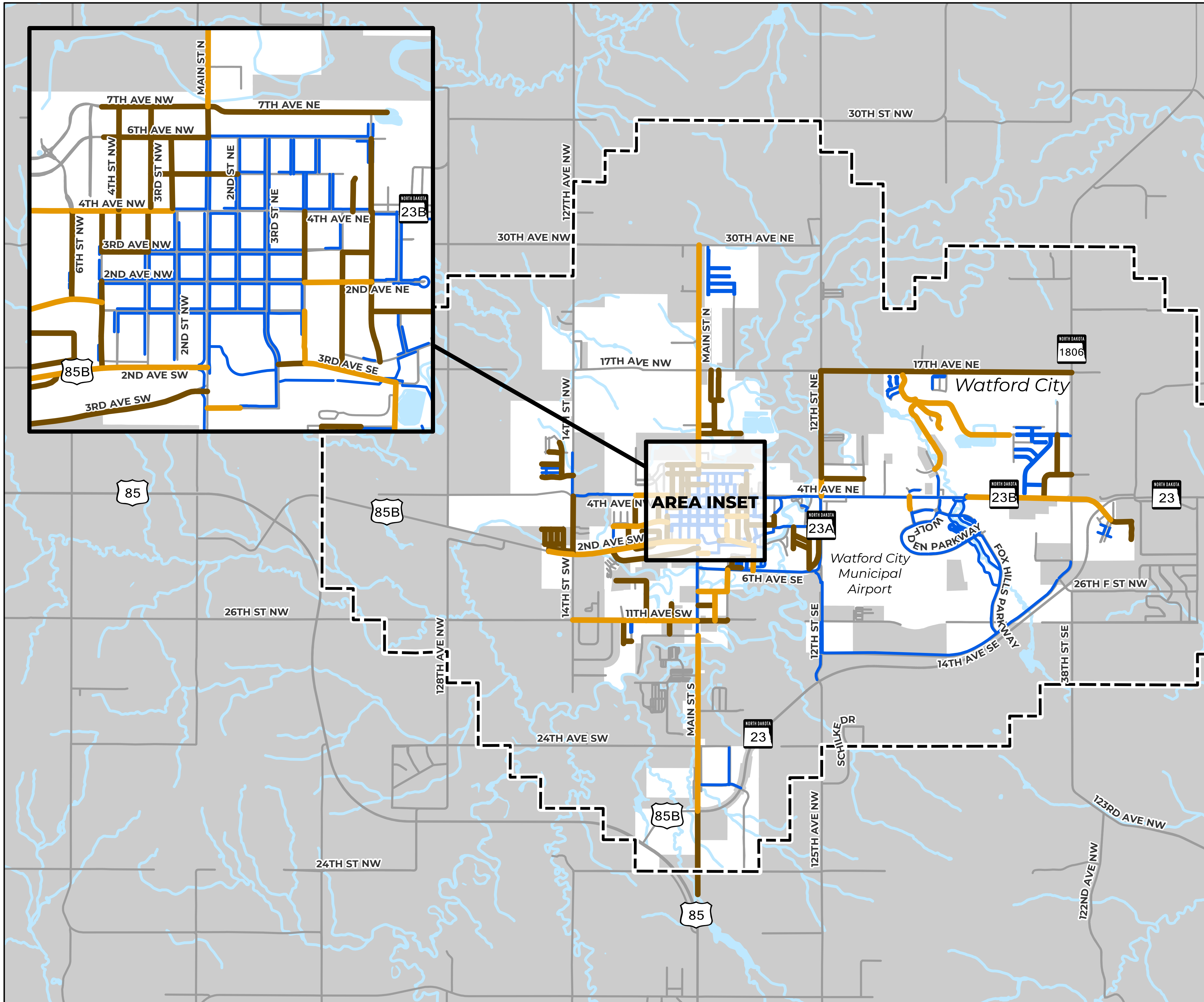

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Figure 14. Sidewalks, Trails, and Gaps

Map Legend

- Existing Sidewalk or Trail
- Priority Gap*
- Other Gap
- Watford City ETA

Includes NDDOT TAP grant examples and other gaps identified by community stakeholders.

0 1 2 Miles

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2.1.3.1 Findings and Recommendations

Trail improvements should be made where the City sees the greatest public benefit and can achieve project efficiencies. Priority considerations could include:

- Does the proposed trail provide a new connection from the City's core to developing areas?
- Does the proposed trail complete an existing trail segment?
- Does the proposed trail or sidewalk improvement enhance access to important destinations, such as schools, parks, and community services?
- Does the proposed trail improvement align with a roadway corridor that is identified for priority improvement?

Using this framework, some priority projects can be quickly identified. One priority could be to establish a connection from downtown to new development north of the city. An off-street trail could be constructed along Main Street, or facilities could be added to the future extension of 6th Street NE.

Sidewalk improvements can be similarly prioritized. Some communities use a tier system to prioritize sidewalk improvements in different areas. For example, Tier 1 priorities might be to complete sidewalk gaps within ¼ mile of schools; Tier 2 might be sidewalks within ½ mile, etc. Once neighborhoods are developed, sidewalk improvements can be difficult to achieve. One recommendation is to strengthen subdivision standards for sidewalk construction in new development. Another opportunity is to add sidewalks when gravel streets are converted to paved, providing there is sufficient right-of-way, or adding/replacing sidewalks when rural street sections are improved to urban standards (i.e., curb and gutter).

2.1.4 Bridges and Structures

Watford City is currently responsible[2] for 13 structures within the planning area, including:

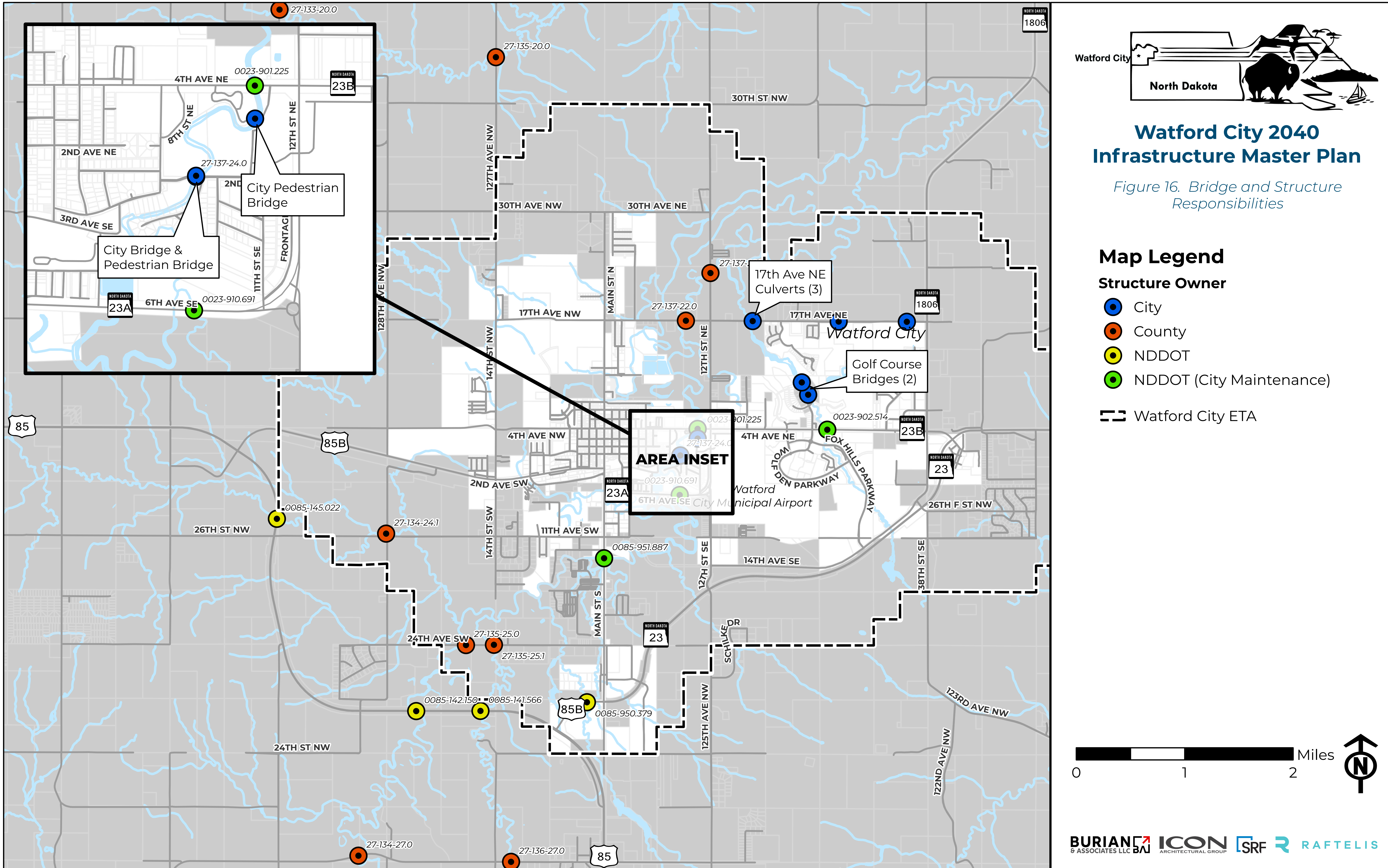
- 2nd Ave SE bridge and pedestrian bridge
- 11th Street NE Tourist Park pedestrian bridge
- 17th Ave NE box culverts (3)
- Fox Hills Golf Course bridges (2)
- NDDOT structures within city limits (5)
    - The 4th Avenue NE (HWY 23) Bride is shown in **Figure 15**

Figure 16 identifies these structures, along with additional County and NDDOT structures. Appendix H contains a Bridge Inspections Report, which provides recent inspections for City-owned structures. In addition, the NDDOT maintains a GIS dashboard for State-owned structures.

Figure 15. 4th Avenue NE (HWY 23) Bridge

It can be difficult to predict when structural work will be needed. However, a design life of 75 years can be expected for all existing bridges within the planning area. Both pedestrian bridges are unique in that they have timber decking. Treated timber decking lasts an average of 20 years before replacement is needed. A variety of protective coatings can be applied periodically to the decking to extend its average lifespan. Otherwise, general maintenance for all bridges includes removing silt and debris and maintaining joint seals to prevent soil infiltration. In addition, riprap should be monitored to maintain the area of protection it is designed to protect (i.e., abridge abutments). Routine inspections are recommended every two years for bridges and every four years for box culverts.

[2] In North Dakota, NDDOT oversees inspections of all major structures with spans over 20 feet, while cities and counties oversee inspections of all minor structures (with spans of less than 20 feet).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North Dakota
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Figure 16. Bridge and Structure Responsibilities
Map Legend
Structure Owner
City
County
NDDOT
NDDOT (City Maintenance)
Watford City ETA
AREA INSET
City Pedestrian Bridge
City Bridge & Pedestrian Bridge
17th Ave NE Culverts (3)
Golf Course Bridges (2)
Watford City
Watford City Municipal Airport
27-133-20.0
27-135-20.0
27-137-24.0
27-137-22.0
0023-901.225
0023-910.691
0023-902.514
0085-145.022
27-134-24.1
0085-951.887
27-135-25.0
27-135-25.1
0085-142.150
0085-141.566
0085-950.379
27-134-27.0
27-136-27.0
4TH AVE NE
2ND AVE NE
3RD AVE SE
6TH AVE SE
8TH ST NE
12TH ST NE
11TH ST SE
30TH ST NW
30TH AVE NW
30TH AVE NE
127TH AVE NW
128TH AVE NW
17TH AVE NW
17TH AVE NE
MAIN ST N
MAIN ST S
14TH ST NW
14TH ST SW
12TH ST NE
12TH ST SE
4TH AVE NW
2ND AVE SW
11TH AVE SW
14TH AVE SE
26TH ST NW
26TH F ST NW
24TH AVE SW
24TH ST NW
38TH ST SE
125TH AVE NW
123RD AVE NW
122ND AVE NW
SCHILKE DR
WOLF DEN PARKWAY
FOX HILLS PARKWAY
85
85B
23
23A
23B
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Miles
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2.1.5 Safety Analysis

Safety for the traveling public – including those walking, bicycling, rolling driving, using transit, or transporting freight – is a top priority for Watford City, partner jurisdictions, and the traveling public. This section provides an overview of existing safety concerns throughout the study area. The assessment sets a foundation for identifying potential safety improvements. The analysis uses five years of crash data (January 1, 2015 through December 31, 2019). To capture all data within and around Watford City, crash data was filtered to include only crashes located on the base roadway network or within 2 miles of city limits. This dataset represents all recorded crashes within the study area but does not include minor crashes that were unreported. A thorough analysis of the entire dataset has been completed for the McKenzie County Road Safety Plan, which is still in draft form.

Within this selection area, a total of 727 crashes occurred during the five-year study period, for an average of 145 crashes per year. Figure 17 shows that the number of crashes declined from 2015 through 2017 and then increased, peaking at 170 crashes in 2019.

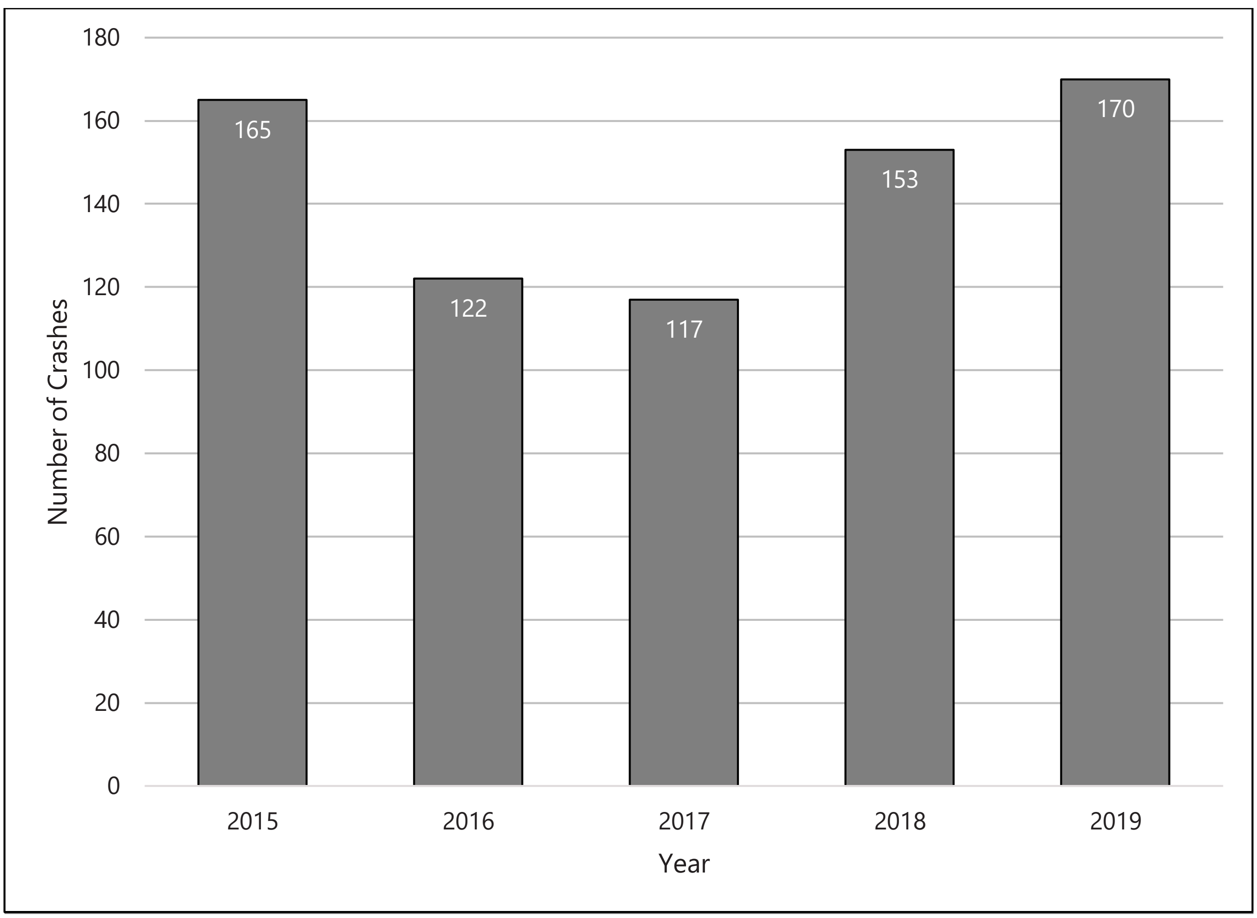

Figure 17. Total Crashes by Year (2015 - 2019)

2.1.5.1 Crash Density

Figure 18 maps crash density – i.e., the total number of crashes per segment or intersection. High-density locations are obviously worrisome and safety improvements can have a significant impact. It should be no surprise that intersecting arterials have the highest crash density, including:

- 12th Street NE (Highway 23A) and 4th Ave NE (Highway 23B)
- Main Street and 6th Ave SE (Highway 23A)
- Main Street and 2nd Ave SW (Highway 85B)
- Main Street and 4th Ave NW/NE (Highway 23B)

Other high-crash intersections feature unique geometries or design challenges. For example, some intersections are located on one or more curves, creating a visibility issue. Elsewhere, challenges arise where there is poor intersection spacing; for example, the area where Highway 23/23B, Highway 1806, and 38th Street SE all intersect.

Main Street is a unique challenge given high traffic volumes, high driveway/intersection density, and high travel speeds as vehicles enter the city from the rural highway system. Several rural roadway segments also have higher crash volumes, including CR 35, CR 37, CR 30. There may be a variety of contributing factors on rural roads, such as narrow shoulders, limited clear zones, poor roadway lighting, and other factors.

2.1.5.2 Crash Severity

In addition to studying crash density, it is important to identify locations where severe crashes occur. Figure 19 maps the study area crashes by severity. It also identifies crashes that involved a bicyclist or pedestrian. A summary of crash severity is as follows:

- Fatal – 3
- Serious Injury – 30
- Minor Injury – 57
- Possible Injury – 42
- No Injury – 595
- **Total – 727**

Speed is an aggravating factor in nearly all severe crashes. The risk of severe crash increases exponentially as speed increases; at higher speeds, even a moderate increase is speed is associated with a significant increase in the risk of fatal crash. In the Watford City analysis, all fatal crashes occurred on high-speed roads. In addition, many severe crashes were located on highway business routes, State Highway 1806, or county roads. Other factors under drivers' control involve the use of alcohol or a seatbelt. According to NDDOT's 2019 crash summary, the driver/passenger was not wearing a seatbelt in about 46 percent of fatal crashes, and another 42 percent of fatal crashes were alcohol-related.

Further analysis could explore priority intersections, segments, or corridors to evaluate potential crash patterns. For example, if certain crash types (e.g., T-bone) are prevalent, this could indicate a movement conflict that could be addressed through targeted intervention.

2.1.5.2.1 Bicycle and Pedestrian Crashes

During the five-year study period from 2015 to 2019, there were three documented crashes that involved a pedestrian and one documented crash that involved a bicyclist. One of the pedestrian crashes involved a wheelchair user. The bicycle crash and two of the pedestrian crashes occurred within the core downtown area. One pedestrian crash occurred along 4th Avenue NE outside of city limits.

Bicycle and pedestrian safety improvements should be considered in areas that have frequent bicycle and/or pedestrian traffic and historical safety issues. The Main Street corridor and surrounding grid has the highest level of pedestrian and bicycle activity and the highest risk of crash. Improvements that could be considered for installment in this area include:

- High visibility crosswalks
- Striped bicycle lanes or sharrows
- Curb extensions (bumpouts) to shorten crossing distance, increase visibility, and calm traffic
- ADA-compliant curb ramp improvements
- Improved lighting
- Improved signage/wayfinding
- Pedestrian beacon/HAWK signal
- Pedestrian priority signal phasing

2.1.5.2.2 McKenzie County Road Safety Plan

McKenzie County is currently preparing a road safety plan. While this plan is focused on the county roadway system, some of the data analysis, recommendations, and public feedback received for the plan are relevant for Watford City. Figure 20 provides a summary of online feedback received for this project that identifies areas of public concern within and around Watford City. Note that the City's current work program and CIP address some but not all of these concerns. Recommendations from the Road Safety Plan that pertain to Watford City can be incorporated into this Master Plan.

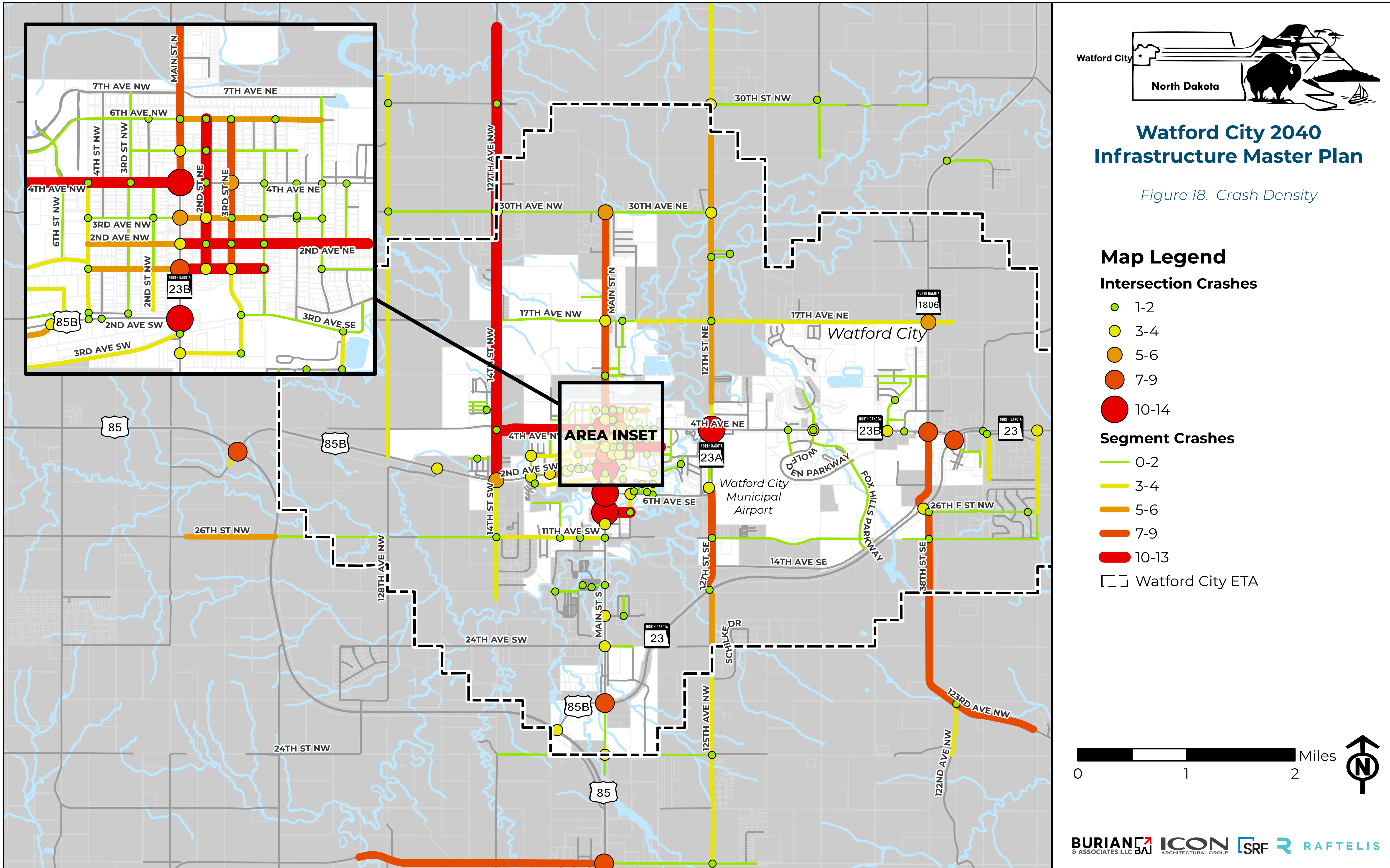

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Figure 18. Crash Density
Map Legend
Intersection Crashes
1-2
3-4
5-6
7-9
10-14
Segment Crashes
0-2
3-4
5-6
7-9
10-13
Watford City ETA
Miles
0
1
2
AREA INSET
7TH AVE NW
7TH AVE NE
6TH AVE NW
4TH AVE NW
4TH AVE NE
3RD AVE NW
2ND AVE NW
2ND AVE NE
2ND AVE SW
3RD AVE SE
3RD AVE SW
MAIN ST N
4TH ST NW
3RD ST NW
2ND ST NE
3RD ST NE
6TH ST NW
2ND ST NW
30TH ST NW
30TH AVE NW
30TH AVE NE
17TH AVE NW
17TH AVE NE
127TH AVE NW
14TH ST NW
14TH ST SW
12TH ST NE
12TH ST SE
4TH AVE NE
6TH AVE SE
11TH AVE SW
14TH AVE SE
26TH ST NW
26TH F ST NW
24TH AVE SW
24TH ST NW
128TH AVE NW
125TH AVE NW
122ND AVE NW
123RD AVE NW
38TH ST SE
SCHILKE DR
FOX HILLS PARKWAY
WOLF DEN PARKWAY
Watford City
Watford City Municipal Airport
85
85B
23
23A
23B
1806
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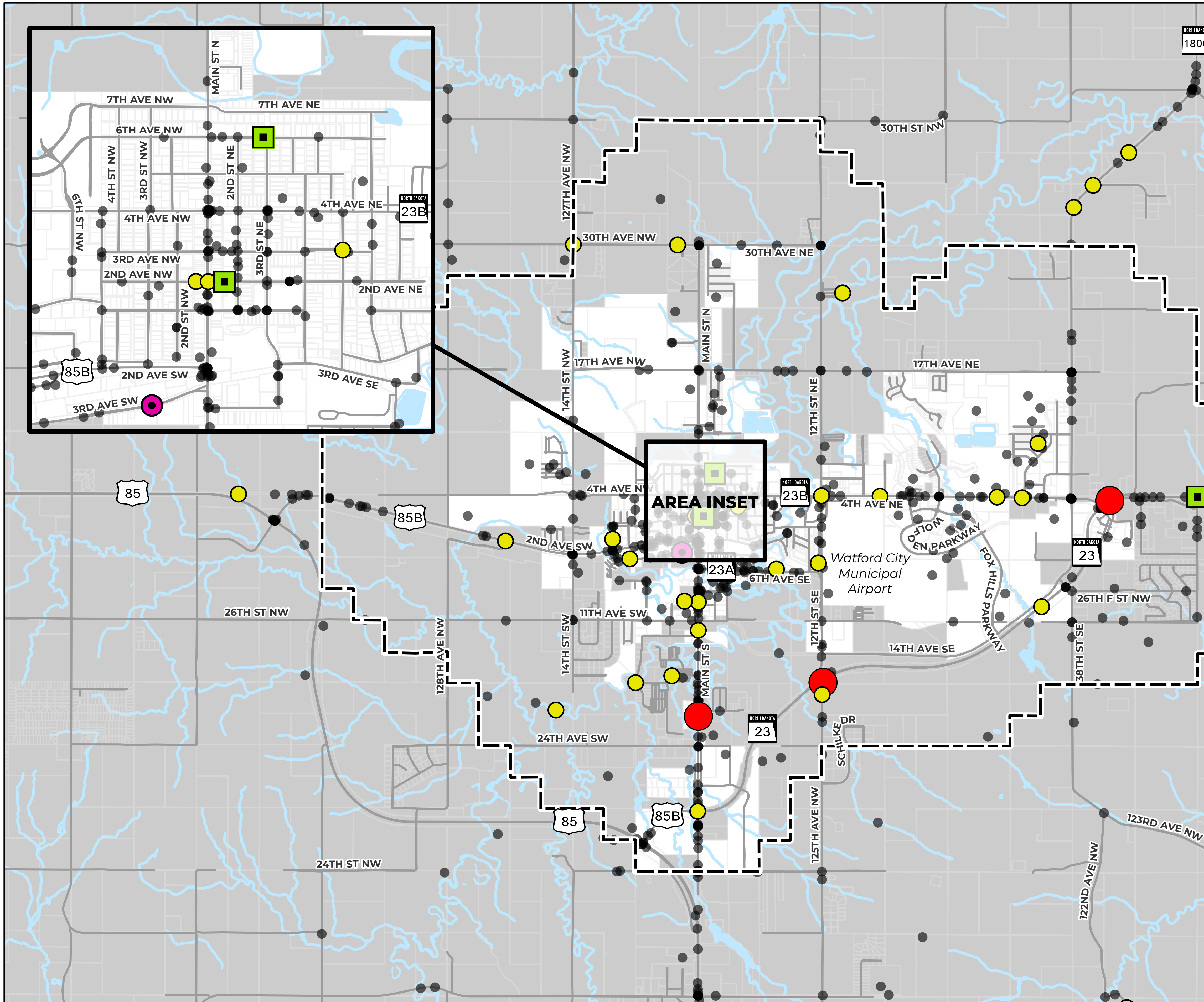

Watford City

North Dakota

Watford City 2040 Infrastructure Master Plan

Figure 19. Crash Severity

Map Legend

- Fatal*
- Serious Injury**
- Other Crash
- Bicycle Crash
- Pedestrian Crash
- Watford City ETA

**A fatal injury is any injury that results in death within 30 days after the motor vehicle crash in which the injury occurred. (FWHA definition)*

***A serious injury is any non-fatal injury that results in severe laceration or significant loss of blood; broken or distorted limbs; a crush injury; a suspected skull, chest, or abdominal injury other than bruising or minor laceration; significant burns; paralysis; or unconsciousness. (FHWA definition)*

Miles
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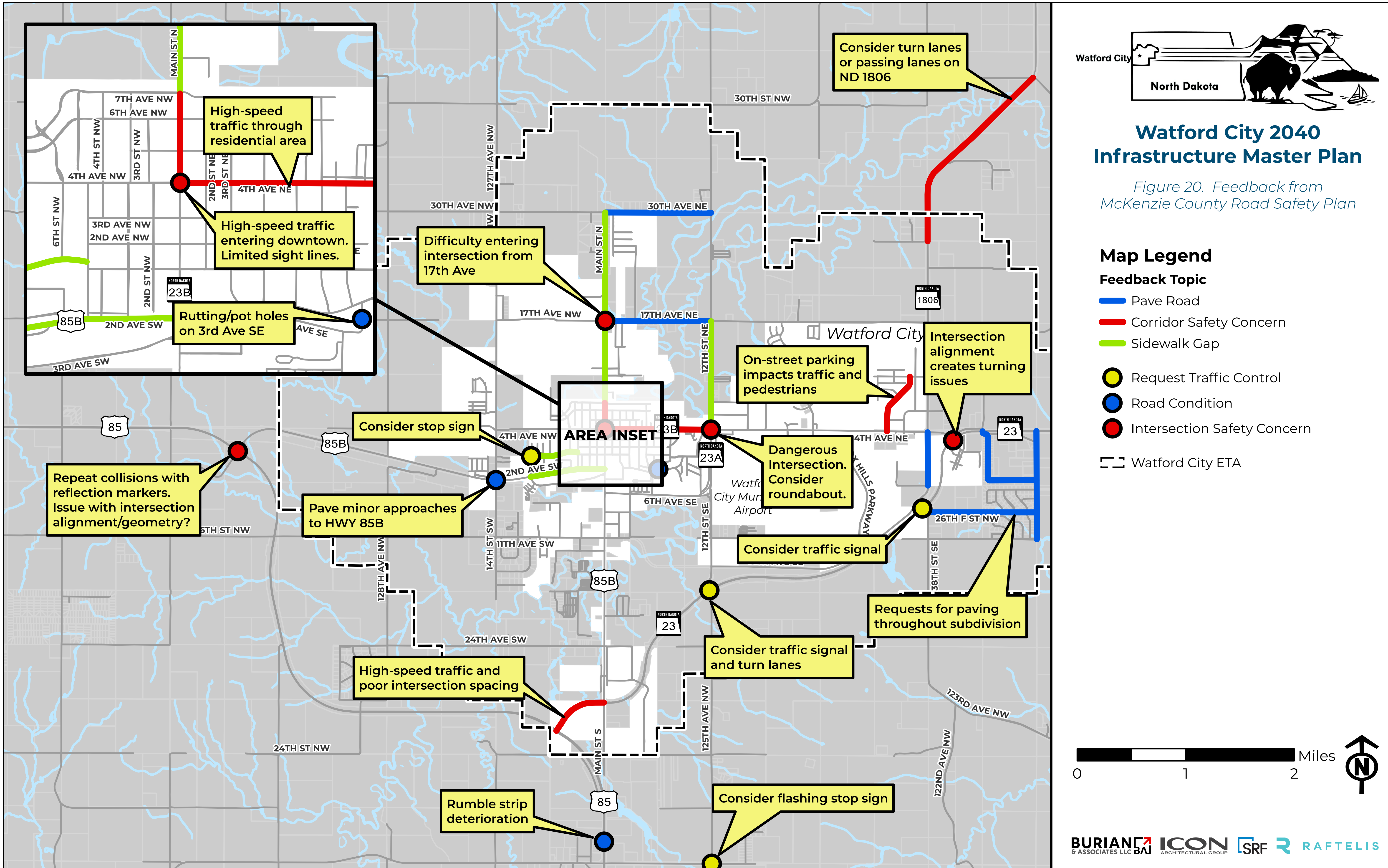
Figure 20. Feedback from McKenzie County Road Safety Plan



2.1.6 *Existing Transportation System Summary and Recommendations*

Watford City's transportation system is a critical component of this Master Plan. After analysis of the existing conditions along the roadway, the following concerns and/or general recommendations are provided in Table 10.

Table 10. Transportation System – General Recommendations

Category	Action
Functional Classification	- Implement the recommended functional classification changes from this Plan. - Develop/apply roadway design standards and access management standards for each roadway type.
Operations	- No significant capacity issues. - Evaluate need for projects identified by the public through the McKenzie County Road Safety Plan (e.g., new traffic controls, roadway geometry improvements)
Pavement Condition	- Over half of Watford City's paved roadway inventory is in very good condition. - Many roads within the city's core have fallen into "Fair" condition or worse. - Prioritize pavement preservation projects to prolong roadway surface life. - The City currently conducts a city-wide chip seal (for corridors deemed necessary) project every 2 – 3 years.
Sidewalk and Trails	- Complete priority sidewalk/trails as shown. - Coordinate with NDDOT and McKenzie County to address gaps on their roadways. - Align sidewalk/trail construction with adjacent roadway improvements. - Implement sidewalk/trail standards through subdivision regulations.
Safety	- Crash history factored in to project evaluation. - Evaluate need for projects identified by the public through the McKenzie County Road Safety Plan. - Address priority sidewalk gaps.

2.2 Water System

In 2011, the Western Area Water Supply Authority (WAWSA) initiated the Western Area Water Supply Project (WAWSP), a $500M water supply project that utilizes Missouri River water treated at the Williston Regional Water Treatment Plant (WRWTP) and supplemented by groundwater through the R&T Water District Water Treatment Plant to supply water to the region. Today, WAWSA provides water service to four Members including the City of Williston, Northwest Rural Water District (NRWD), McKenzie County Water Resource District (MCWRD) and R&T Water District. All of these Members also supply water to Submembers (except the City of Williston).

Pre-WAWSA, the City of Watford City supplied and treated groundwater from two groundwater wellfields to its customers and MCWRD. Today, MCWRD purchases water from WAWSA at a wholesale rate and the City of Watford City purchases wholesale water from MCWRD, so the City's groundwater wellfields are no longer used to provide domestic water to residents of Watford City. This section outlines the components of the City's existing water system.

After the City receives water supply from MCWRD, the primary components of the water system under the City's ownership include water main pipes, pressure reducing valves, water towers, ground storage reservoirs, hydrants, and gate valves. These water system components are outlined in greater detail in forthcoming sections, where operational and maintenance recommendations are provided in Section 2.2.6.

2.2.1 Water Mains

Watford City owns and maintains approximately 64 miles of water main pipes, ranging in pipe diameter, pipe age, and pipe material. Table 11 provides a breakdown of the City's water main pipe diameters. As shown in the table, most of the City's water main system are 6-inch, 8-inch, and 12-inch pipes, which make up roughly 85% of the system.

Table 11. Water Main System - Pipe Diameters

Diameter	Length (ft)	Length (mi)	Distribution (%)
Unknown	7,706	1.5	2.3%
< 4"	6,157	1.2	1.8%
6"	75,682	14.3	22.3%
8"	115,323	21.8	34.0%
10"	9,440	1.8	2.8%
12"	98,036	18.6	28.9%
16"	23,729	4.5	7.0%
20"	3,594	0.7	1.1%
Total(s)	**339,667**	**64.3**	**100%**

Many of the water mains that were installed decades ago have been replaced or improved, but the City still has some water mains in service dating back to the mid-1940s. **Figure 21** below provides a graph showing the linear feet of water main that remain in-service as well as the respective year the pipes were installed. As shown, there was a slight jump in water main installation attributed to the oil boom in the early 1980s, and an even more aggressive jump in pipe installations from the most recent oil boom in the early and mid 2010s.

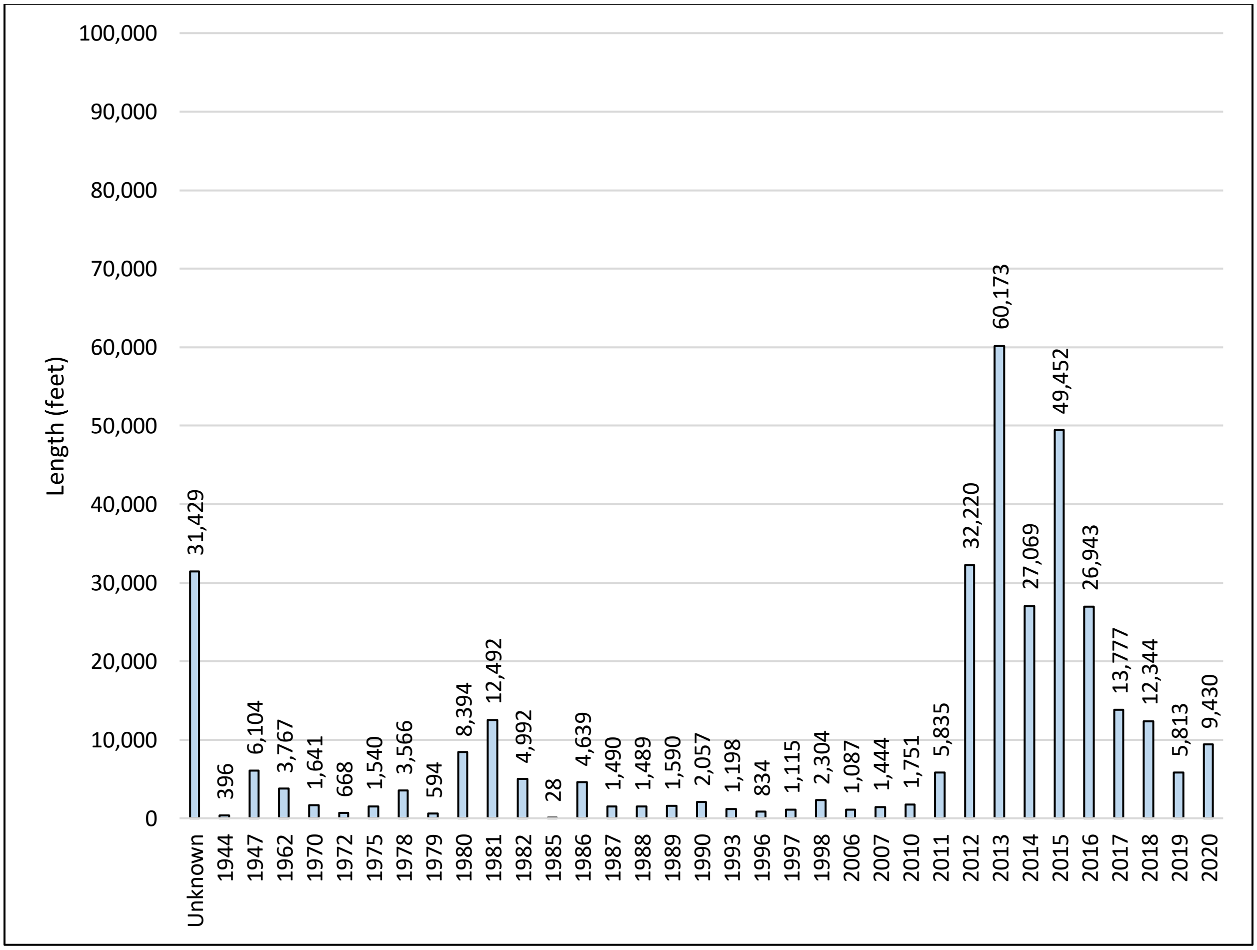


Figure 21. Water Main System - Pipe Install Dates

Approximately 72% of the City's water main system has an install date of 2010 or later. This is good news, as these pipes should last 70 to 100 years before showing significant signs of degradation and needing replacement, assuming they were installed utilizing sound construction methods. A map showing water main pipe age is provided on the following page as **Figure 22**. As provided in the map, most of the recent growth that occurred in Watford City is serviced by new pipes, and much Watford City's core area is serviced by older pipes.

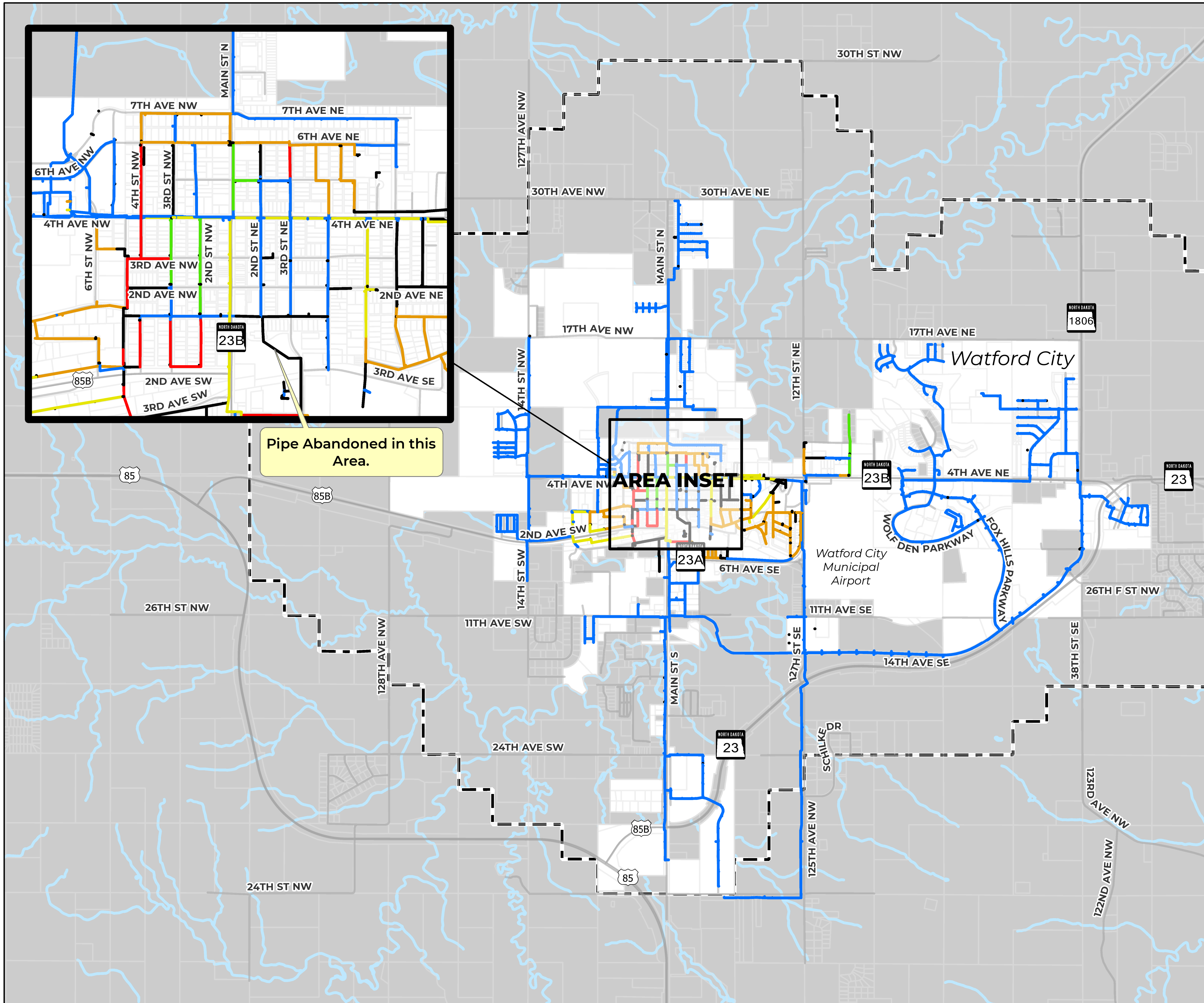


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Figure 22. Map of Water Main Age

Map Legend

- 0 - 19 Years Old
- 20 - 29 Years Old
- 30 - 39 years Old
- 40 - 59 Years Old
- 60+ Years Old
- Unknown
- Watford City ETA

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Figure 23 provides a graph showing the City's water main distribution of pipe materials. The City's water main system is made up of asbestos cement pipe (ACP), polyvinyl chloride (PVC) pipe, cast iron pipe (CIP, fiberglass pipe, and high-density polyethylene pipe (HDPE). As shown in the graph below, the overwhelming majority of the City's water main system is PVC, which is ideal due to its strength, life expectancy of approximately 70+ years, and corrosion resistance properties.

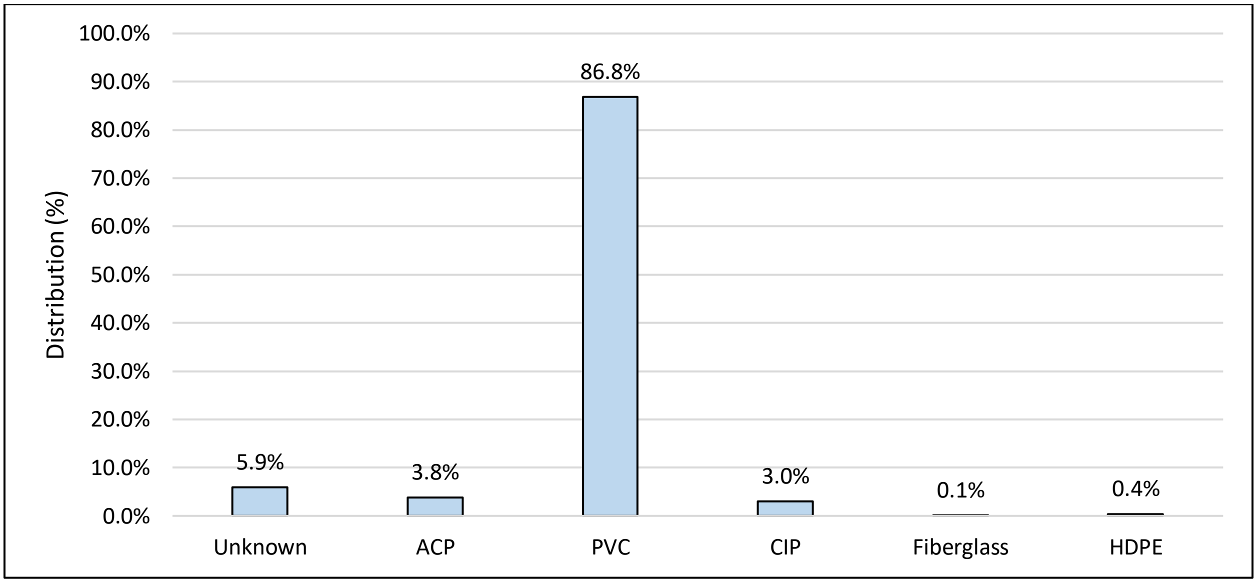

Figure 23. Water Main System - Pipe Material

ACP and CIP are still very much prevalent in water distribution systems today but are no longer utilized in new construction of municipal water systems.

A study[3] was completed in 2018 on water main breaks in the United States and Canada that comprehensively analyzed water main break rates in various regions and for various pipe materials, pipe install dates, pipe lengths, and pipe diameters. Based on information provided from the survey respondents (approximately 300 water utilities), this study concluded the following break rates, which were determined over a 12-month period:

- ACP – 10.4 breaks per 100 miles
- CIP – 34.8 breaks per 100 miles
- Ductile Iron Pipe (DIP) – 5.5 breaks per 100 miles
- PVC – 2.3 breaks per 100 miles

As shown, both ACP and CIP are inferior to other pipe material counterparts including ductile iron pipe (DIP) and PVC. Most systems are striving to replace ACP and CIP throughout their distribution systems. The CIP recommendations outlined in Chapter 7 will result in nearly all of the City's ACP and CIP being replaced.

The following page includes Figure 24, which shows the City's water main materials displayed on a map.

[3] Utah State University. Water Main Break Rates In the USA and Canada. March 2018.

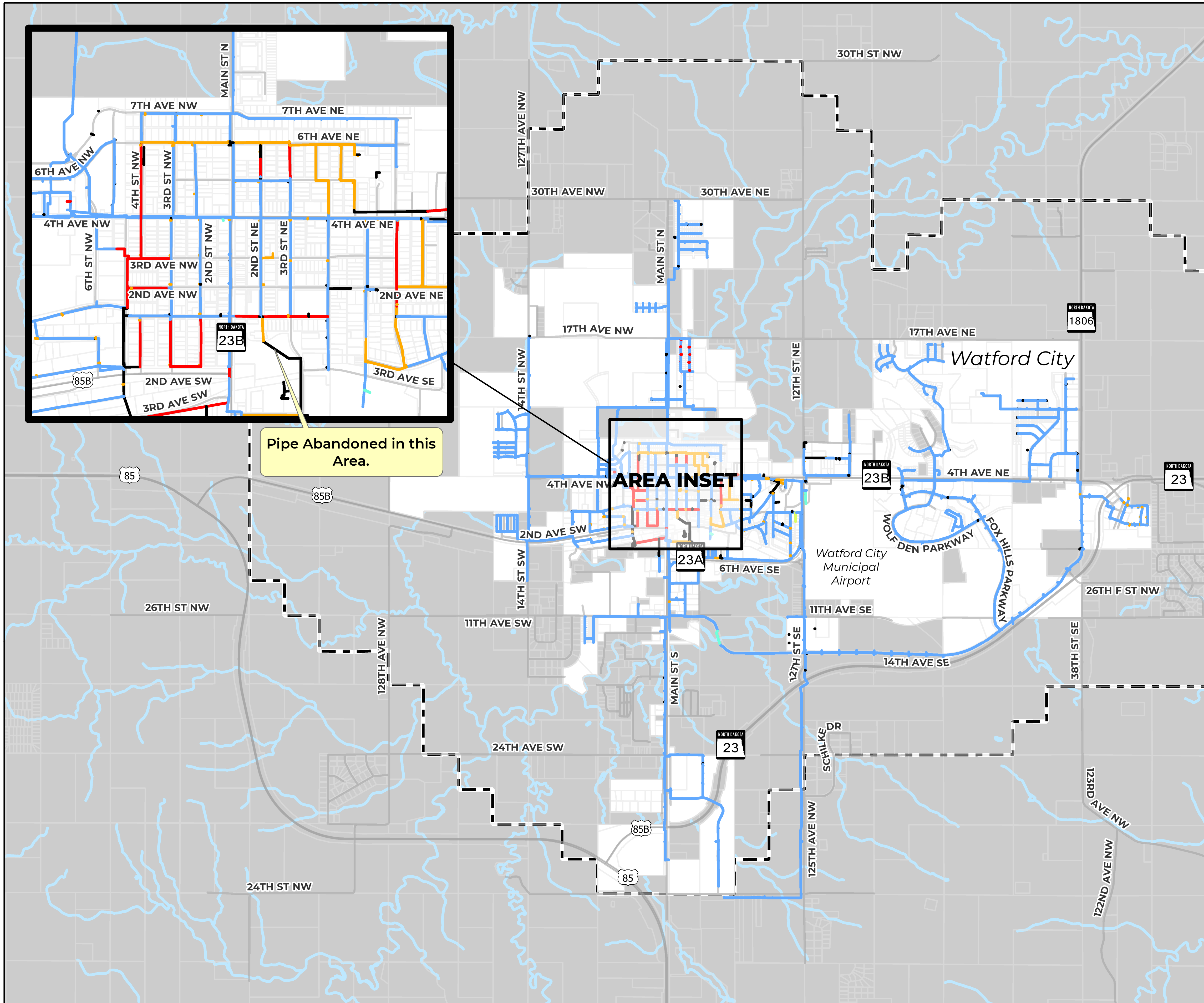

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Figure 24. Map of Water Main Materials

Map Legend

- Asbestos Cement Pipe (ACP)
- Cast Iron Pipe (CIP)
- Fiberglass
- High Density Polyethylene (HDPE)
- Polyvinyl Chloride (PVC)
- Unknown
- Watford City ETA

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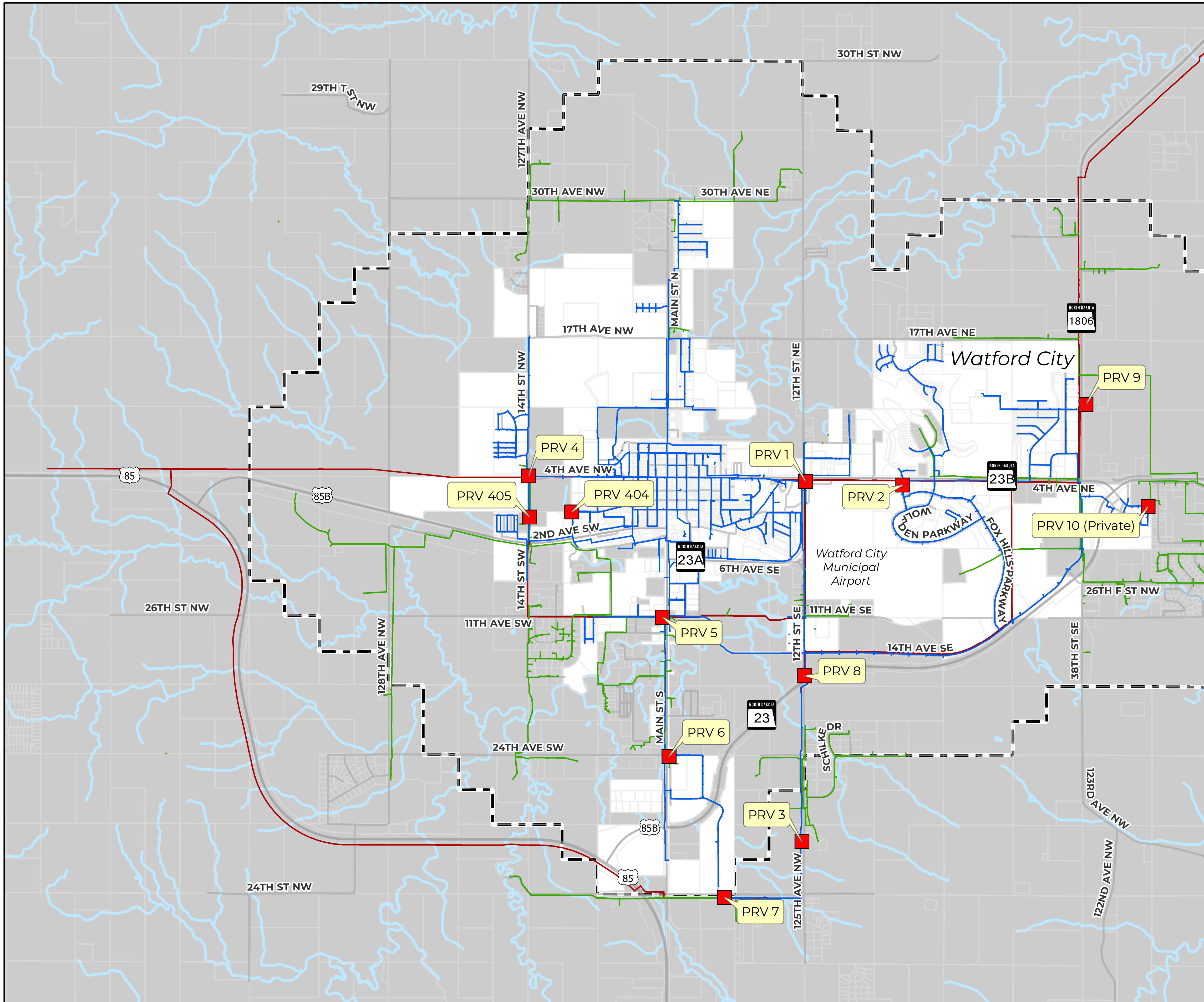
2.2.2 Pressure Reducing Valves

The City of Watford City utilizes pressure reducing valves (PRVs) to reduce the pressure within the water system. In total, there are 12 PRVs located throughout the City, some of which are owned and maintained by the City, WAWSA, or MCWRD. Cursory visual inspections were performed at each PRV in 2021 to determine the general condition of each PRV. A table outlining the PRVs that were reviewed is provided below as **Table 12**, and a location map of the PRVs is shown on the following page as **Figure 25**.

Table 12. Overview of Pressure Reducing Valves

PRV No.	Responsibility	Inspected (Yes/No)	General Inspection Comments
PRV 1	Watford City	Yes	Good condition; water in vault.
PRV 2	Watford City	Yes	Good condition; water in vault.
PRV 3	Watford City	Yes	Good condition; located in manhole instead of vault.
PRV 4	WAWSA	No (locked)	Couldn't access; assumed to be excellent condition based on WAWSA's inception date.
PRV 5	Watford City	Yes	Good condition.
PRV 6	WAWSA	No (locked)	Couldn't access; assumed to be excellent condition.
PRV 7	WAWSA	Yes	Excellent condition.
PRV 8	WAWSA	Yes	Excellent condition.
PRV 9	Watford City	Yes	Good condition.
PRV 10	Private	No	Private PRV – Did not inspect.
PRV 404	Watford City	Yes	Good condition; located in manhole instead of vault.
PRV 405	Watford City	Yes	Excellent condition.

In general, all the PRVs are in good to excellent condition, and no programmed capital improvements were identified for PRVs based on the visual inspections. Some images of the PRVs from the visual inspections are provided in **Figure 26** and **Figure 27**.



Watford City North Dakota

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Figure 25. Map PRV Locations

Map Legend

- Pressure Reducing Valve (PRV)
- Watford City Existing Water Mains
- MCWRD Existing Water Mains
- WAWSA Existing Water Mains
- Watford City ETA

Miles
0 0.5 1

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Site View

Interior View

Figure 26. Example of PRV in Excellent Condition (PRV 8)

Site View

Interior View

Figure 27. Example of PRV in Good Condition (PRV 9)

2.2.3 Hydrants, Gate Valves, Curb Stops, and Water Service Lines

According to data received from the City, Watford City has the following ancillary water system components:

- 582 Water Hydrants
- 1,804 Gate Valves
- 2,255 Curb Stops
- 1,413 Water Service Lines

Based on discussions with the City, the hydrants, gate valves, and curb stops, are all believed to be in adequate to good condition. There is known missing data in the curb stops and water service line database, but the City is in the process of utilizing GPS to locate all of the curb stops throughout the City.

Additionally, there appears to be some missing data in the water service line database. Water service line characteristics such as diameter and material are incomplete throughout much of the dataset. In December of 2021, the EPA announced the development of a new regulation, Lead and Copper Rule Improvements (LCRI), to better protect communities from exposure to lead in drinking water. According to the EPA, the LCRI better protects children and communities from the risks of lead exposure. Improvements under the new rule include:

- Using science-based testing protocols to find more sources of lead in drinking water.
- Establishing a trigger level to jumpstart mitigation earlier and in more communities.
- Driving more and complete lead service line replacements.
- For the first time, requiring testing in schools and child care facilities.
- Requiring water systems to identify and make public the locations of lead service lines

Under this new rule, all water systems must develop an initial inventory of lead service lines by October 16, 2024. Given this new rule, it's imperative for the City to gain a strong understanding of the City's water service line materials in order to comply with the LCRI.

On November 15, 2021, the President signed the $1.2 trillion Infrastructure Investment and Jobs Act. State and local governments will receive federal funding from programs authorized in the Act during federal fiscal years 2022 through 2026. The plan includes an investment of approximately $15 billion to help expand access to clean drinking water to communities through lead service line replacement projects. It's recommended for the City to take advantage of available funding opportunities (grants and low interest loans [Drinking Water State Revolving Fund]) to help support replacement of lead service lines.

2.2.4 Water Meters

The City utilizes Sensus water meters and an automated meter reading (AMR) water metering system, along with Black Mountain billing software, to collect water use data from water meters and charge customers for their water consumption. AMR systems are configured with an endpoint that is connected to the meter's encoder register. AMR technology is sophisticated in that the data can be collected by either walking by or driving by the endpoint, rather than physically entering residences and businesses to record water use.

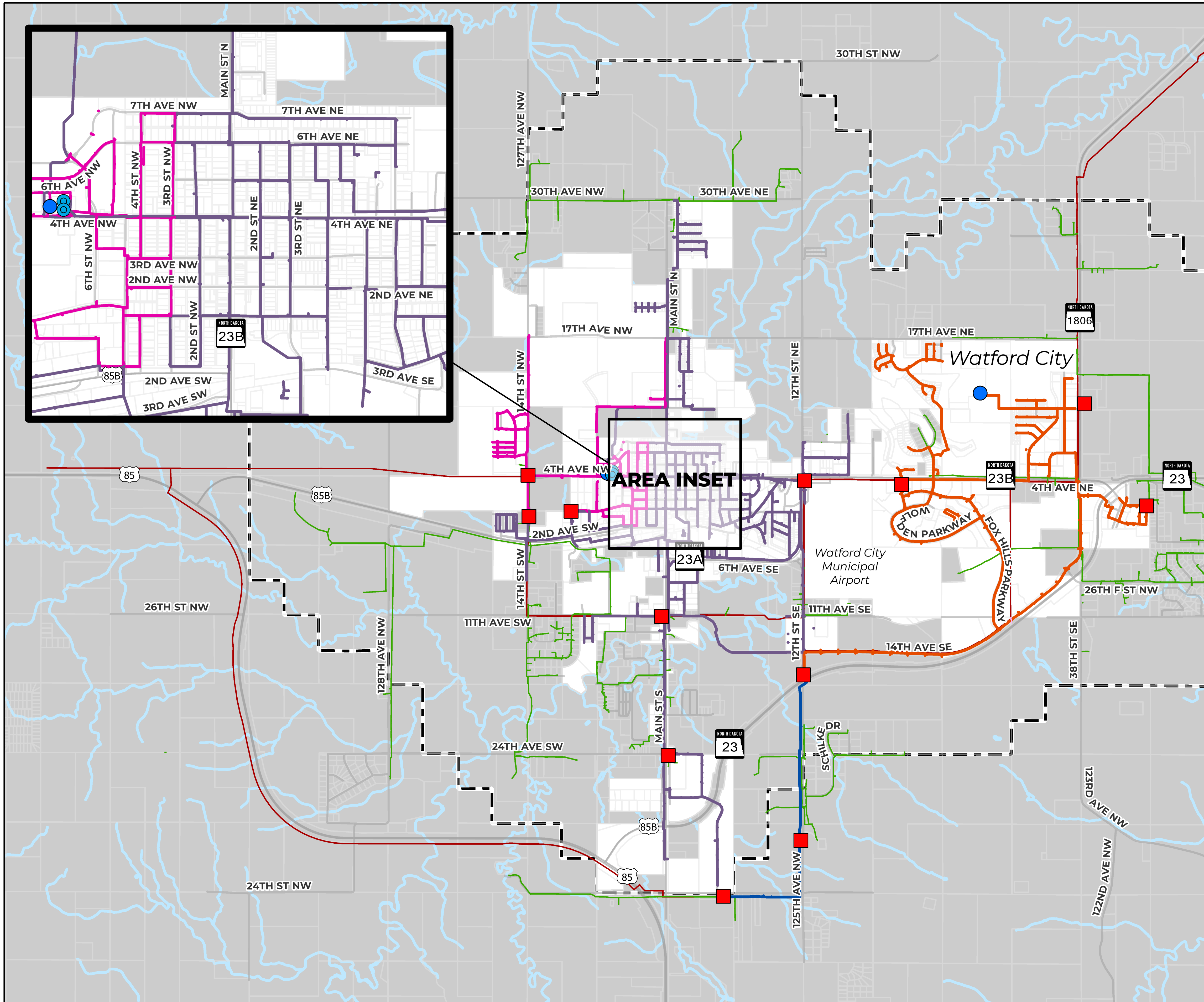
MCWRD recently configured their water metering system as an advanced metering infrastructure (AMI) system. AMI serves as an integrated system of water meters, communication networks and data management systems that allows for two-way communication between meter endpoints and utilities. Unlike AMR, AMI doesn't require utility personnel to collect the data. Instead, the system automatically transmits the data directly to the utility at predetermined intervals.

Through discussions with City staff, converting the City's AMR system to an AMI system is a priority. If the City transitions to AMI, the City can expect many benefits, including real-time data monitoring, transparency with customers, improved leak detection in the distribution system, as well more time available for City staff.

It's recommended for the City to pursue grant funding to complete this effort. Specifically, this water metering project would be eligible under two grants administered by the Bureau of Reclamation under their WaterSMART program.

2.2.5 Water Storage and Pressure Zones

The City has two water towers (each 1 million gallons) and two ground storage reservoirs (each 1 million gallons) to store treated water. The stored water provides fire protection and maintains pressures throughout the distribution system. The water towers and ground storage reservoirs are in good condition, and therefore not recommended for improvement over the 10-year capital improvements planning horizon. The City also has four separate pressure zones. A map of the City's water storage facilities and the pressure zones is provided as **Figure 28**.



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North Dakota

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Figure 28. Map of Water Storage Facilities and Pressure Zones

Map Legend

- Ground Storage
- Water Tower
- Pressure Reducing Valve (PRV)
- MCWRD Existing Water Mains
- WAWSA Existing Water Mains

Pressure Zone

- East High Pressure
- Existing Low Pressure
- NW High Pressure
- SE Pressure Zone
- Watford City ETA

Miles
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2.2.6 *Existing Water System Summary and Recommendations*

Overall, the City's water system is in good condition, outside of some CIP water mains. The City's water loss is approximately 5%, which is significantly lower than the national average of 16%[4]. Most of the water system was installed over the last decade, which should last years into the future with minimal City involvement. However, it is recommended to instill proactive operations and maintenance practices to preserve the condition of the water system. **Table 13** provides recommendations for operating and maintaining a healthy water system.

Table 13. Water System – Recommended O&M Actions

Category	O&M Action
Water Mains	- Implement a condition assessment program to monitor the condition of critical water mains. Condition assessment methods vary from hydrostatic pressure testing, acoustic leak detection, acoustic velocity testing, electromagnetic testing, etc. There are benefits and drawbacks associated with varying condition assessment approaches, and each project should be approached specifically on a case-by-case basis.
Pressure Reducing Valves	- Complete annual visual inspections and valve exercising to ensure PRVs, isolation valves, and all other valve components within the vaults are in good condition and functioning appropriately. - Ensure that valve components are free from freezing and that vaults are watertight.
Hydrants	- Complete hydrant flushing on an annual basis to verify operation, reliability, and address repairs. At the same time of flushing, exercise isolation valve off the main to ensure proper operation. - Conduct flow testing every five years to verify capacity and marking of the hydrant.
Gate Valves	- Implement a valve exercising program where gate valves (and other isolation valves) throughout the system are exercised on a 5-year basis (exercise roughly 20% of the gate valves each year). - The City has intention of exercising valves every 3 – 4 years, but a 5-year cycle would be sufficient.
Curb Stops, Water Service Lines, and Water Meters	- Determine where lead service lines exist and develop a plan for replacing. - Identify and GPS all active curb stops. - Convert AMR system to AMI system.
Water Storage	- Conduct water tower visual inspections on an annual basis. - Closely monitor coatings to ensure coatings remain in good condition. - Monitor water tower operations utilizing the City's water distribution hydraulic model.
General	- Conduct updates to the City's water distribution hydraulic model, as needed, to ensure the City's model is kept up to date.

[4] EPA. Water Audits and Water Loss Control for Public Water Systems. July 2013.

2.3 Wastewater System

The City's wastewater system is comprised of a sanitary sewer collection system, consisting of collector sewers, trunk sewers, and interceptor sewers, as well as manholes, lift stations, and force mains. These wastewater system components are outlined in greater detail in forthcoming sections, where operational and maintenance recommendations are provided in Section 2.2.6.

The wastewater eventually is conveyed to the City's Water Resource Recovery Facility (WRRF) for treatment. Once the wastewater is treated at the WRRF, it is discharged to one of two ponds located at the WRRF's campus. Lastly, the water is discharged to Cherry Creek or to the Fox Hills Golf Course where it used for irrigation. There is more information regarding the golf course irrigation supply in Appendix C.

2.3.1 Sanitary Sewers

Watford City owns and maintains roughly 46 miles of sanitary sewer pipes, ranging in pipe diameter, pipe age, and pipe material. Table 14 provides a breakdown of the City's sanitary sewer pipe diameters. As shown in the table, most of the City's sanitary sewer system are 8-inch and 10-inch pipes, which make up roughly 82% of the system.

Table 14. Sanitary Sewer System - Pipe Diameters

Diameter	Length (ft)	Length (mi)	Distribution (%)
Unknown	1,979	0.4	0.8%
< 4"	2,042	0.4	0.9%
6"	2,801	0.5	1.2%
8"	150,010	28.4	62.5%
10"	46,707	8.8	19.4%
12"	9,346	1.8	3.9%
15"	16,654	3.2	6.9%
16"	1,215	0.2	0.5%
18"	8,154	1.5	3.4%
20"	40	0.0	0.02%
21"	1,095	0.2	0.5%
24"	110	0.0	0.05%
Total(s)	**240,154**	**45.5**	**100.0%**

Similar to the water system, many of the sanitary sewers that were installed decades ago have been replaced or improved, but the City still has some sanitary sewers in service since the late 1930s. Figure 29 below provides a graph showing the linear feet of sanitary sewer that remain in-service as well as the respective year the pipes were installed. The sanitary sewer system follows nearly an identical installation trend to the water main system, with a slight jump in sanitary sewer installation due to the oil boom in the early 1980s and another substantial jump in pipe installations from the most recent oil boom in the early and mid-2010s.

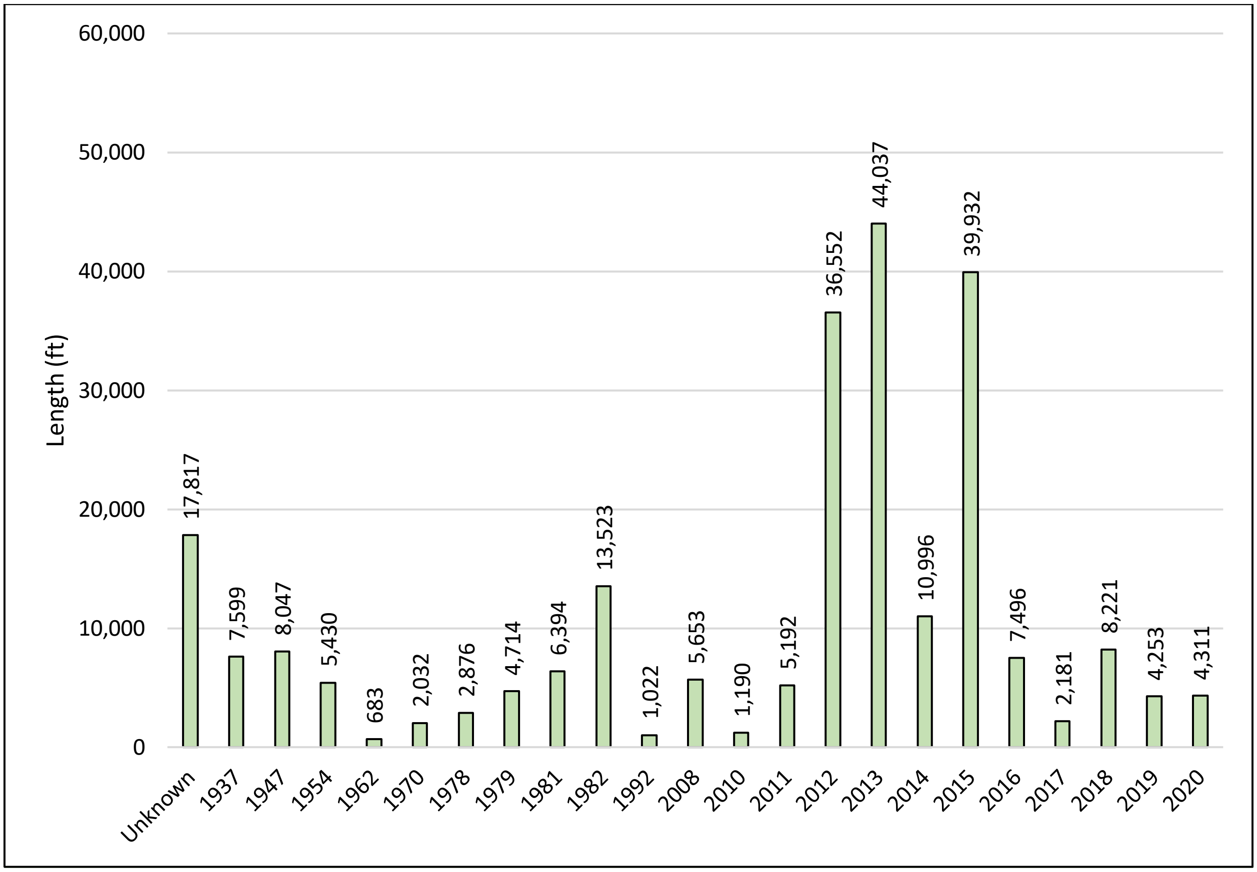

Figure 29. Sanitary Sewer System - Pipe Install Dates

Approximately 68% of the City's sanitary sewer system has an install date of 2010 or later. A map showing sanitary sewer age is provided on the following page as Figure 30. As provided in the map, most of the recent growth that occurred in Watford City is serviced by newer sanitary sewers, and much of Watford City's core area is serviced by older sanitary sewers.

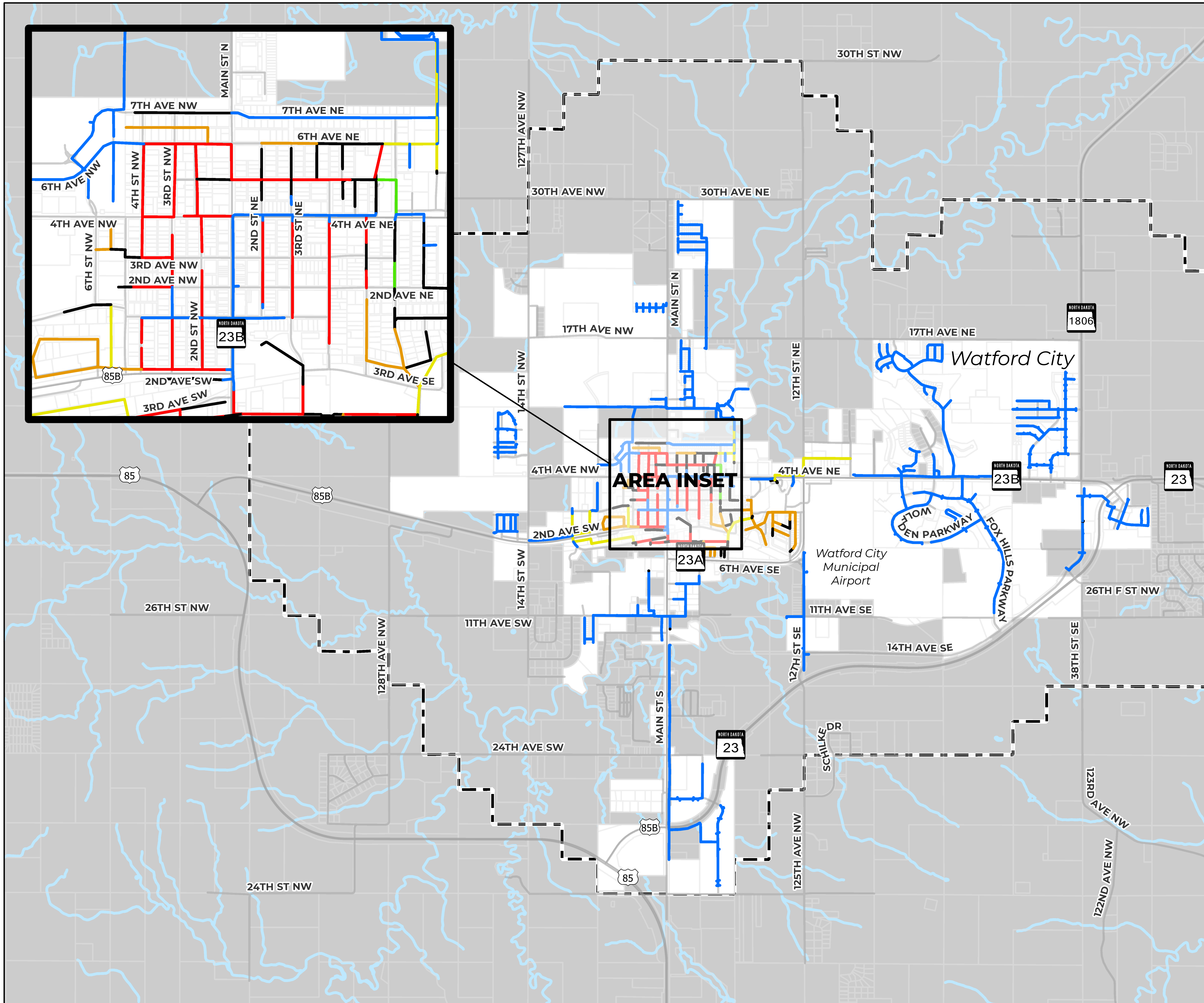

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Figure 30. Map of Sanitary Sewer Age

Map Legend

- 0 - 19 Years Old
- 20 - 29 Years Old
- 30 - 39 years Old
- 40 - 59 Years Old
- 60+ Years Old
- Unknown

Watford City ETA

Miles
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Figure 31 provides a graph showing the City's sanitary sewer system distribution of pipe materials. The City's sanitary sewer system is made up of PVC pipe, vitrified clay pipe (VCP), and CIP. As shown in the graph below, the overwhelming majority of the City's sanitary sewer system is PVC.

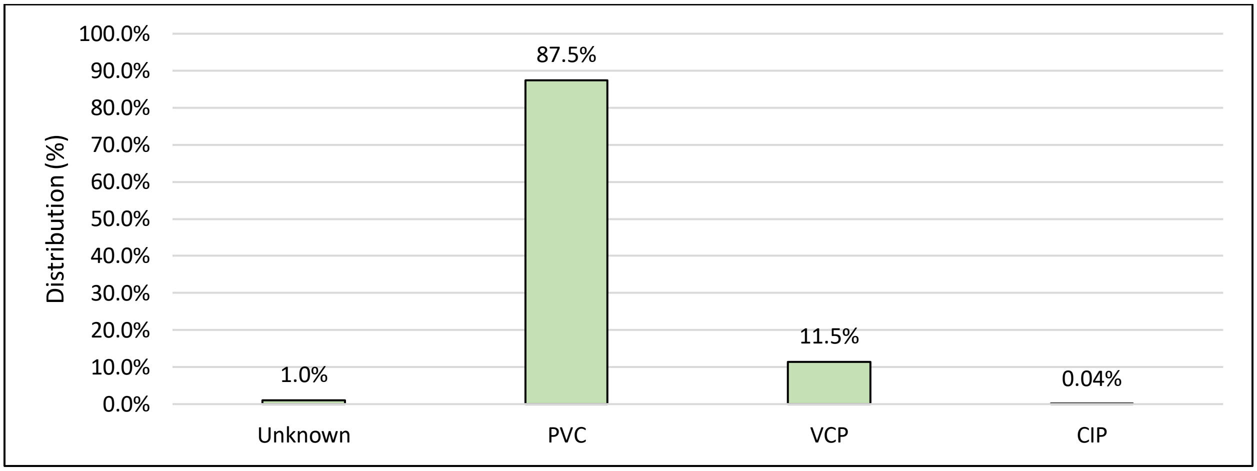


Figure 31. Sanitary Sewer System - Pipe Material

VCP pipe is still very much prevalent in sanitary sewer systems and continues to be installed today throughout the world. However, the pipe material is becoming more outdated and has drawbacks compared to PVC pipe, including: its heavier, has a shorter estimated lifespan, more cumbersome to cut and install, more susceptible to clogging, and it's more brittle which can lead to cracks, holes, and collapses, which can result in sinkholes. Example images VCP sewer defects (only examples; not Watford City) are provided in Figure 32.

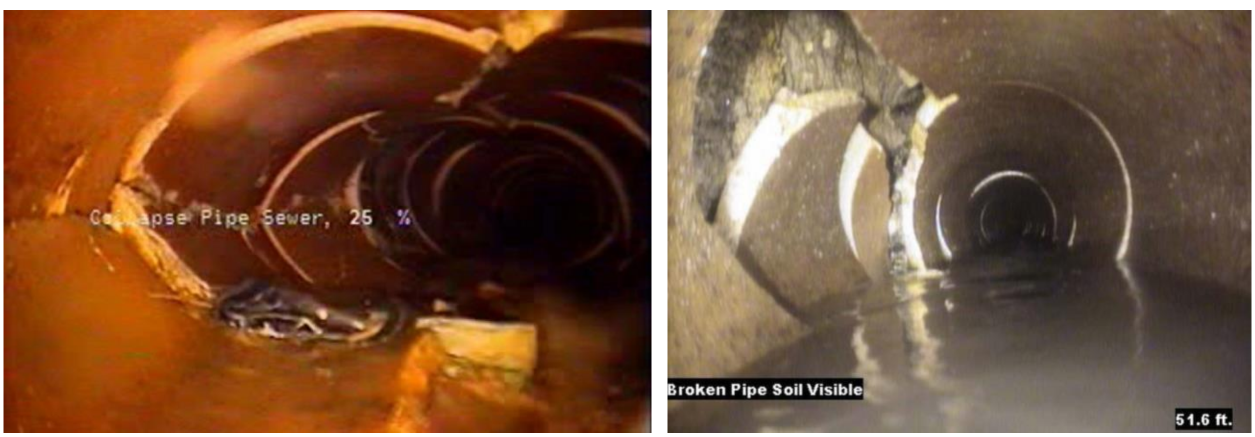


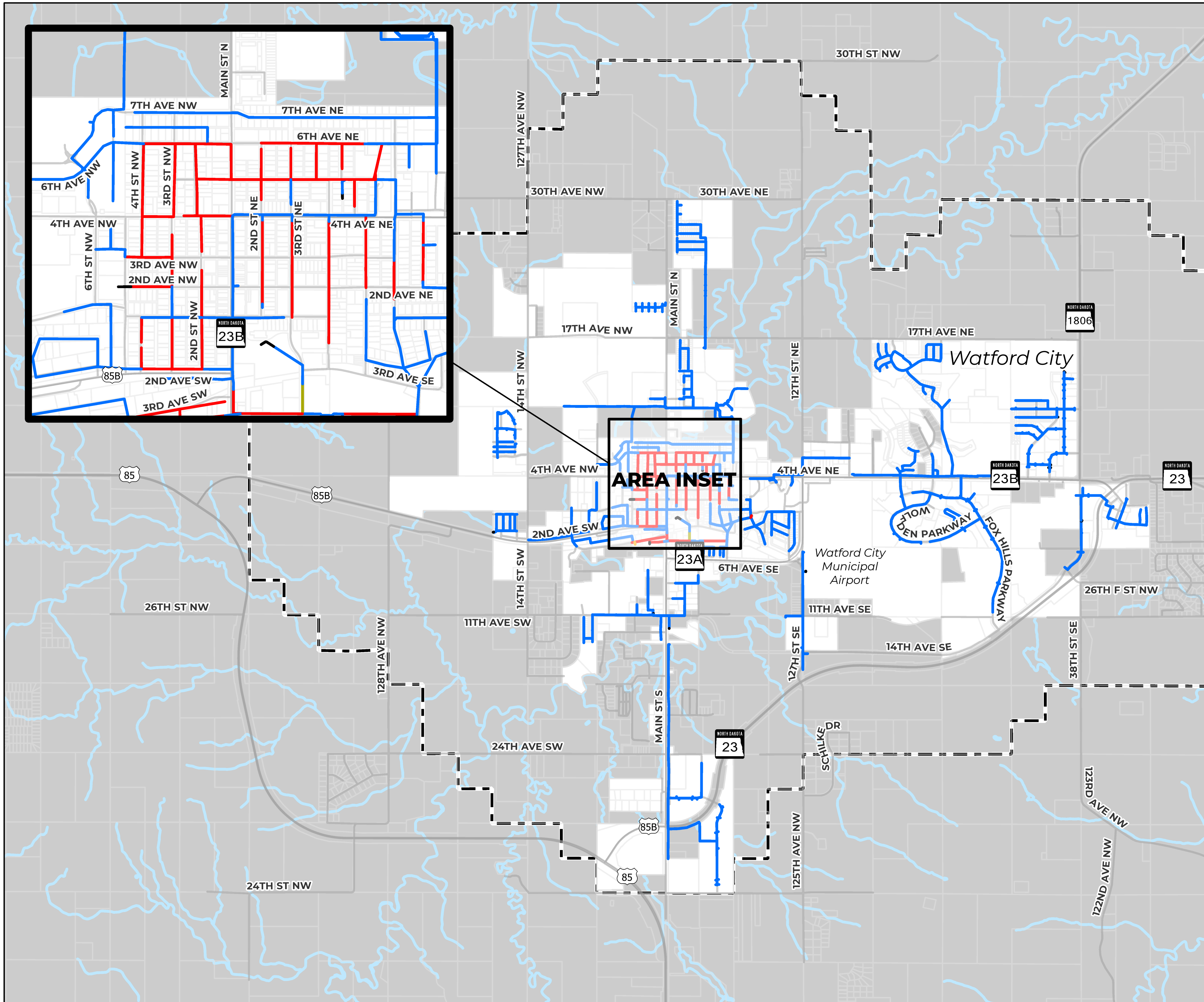
Figure 32. VCP Defect Examples (Left – Collapsed Sewer ; Right – Broken Pipe Soil Visible)

For the reasons and drawbacks stated above, more and more systems are striving to replace VCP throughout their systems because they are finding that sanitary sewer system issues are occurring in VCP sections. The CIP recommendations outlined in Chapter 7 will result in nearly all of the City's VCP being replaced.

The following page includes Figure 33, which shows the City's sanitary sewer materials displayed on a map.

Watford City 2040 Infrastructure Master Plan

Figure 33. Map of Sanitary Sewer Materials



Map Legend

- Cast Iron Pipe (CIP)
- Unknown
- Polyvinyl Chloride (PVC)
- Vitrified Clay Pipe (VCP)
- Orangeburg
- Watford City ETA

Miles
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2.3.2 Manholes

The City has 993 sanitary sewer manholes, ranging in depth, size, configuration, and condition. Within the dataset that was provided from the City, roughly 37% of the manholes had comments tied to them, which incorporated a variety of remarks. Some of the comments indicate condition of manhole, specific manhole deficiencies, survey data, odor issues, buildup issues, and flow observations. This is a good start, but it's recommended to further enhance the quality of data within the manhole data set. Over time, it's recommended to assess each manhole according to the NASSCO Manhole Assessment Certification Program (MACP).

2.3.3 Lift Stations and Force Mains

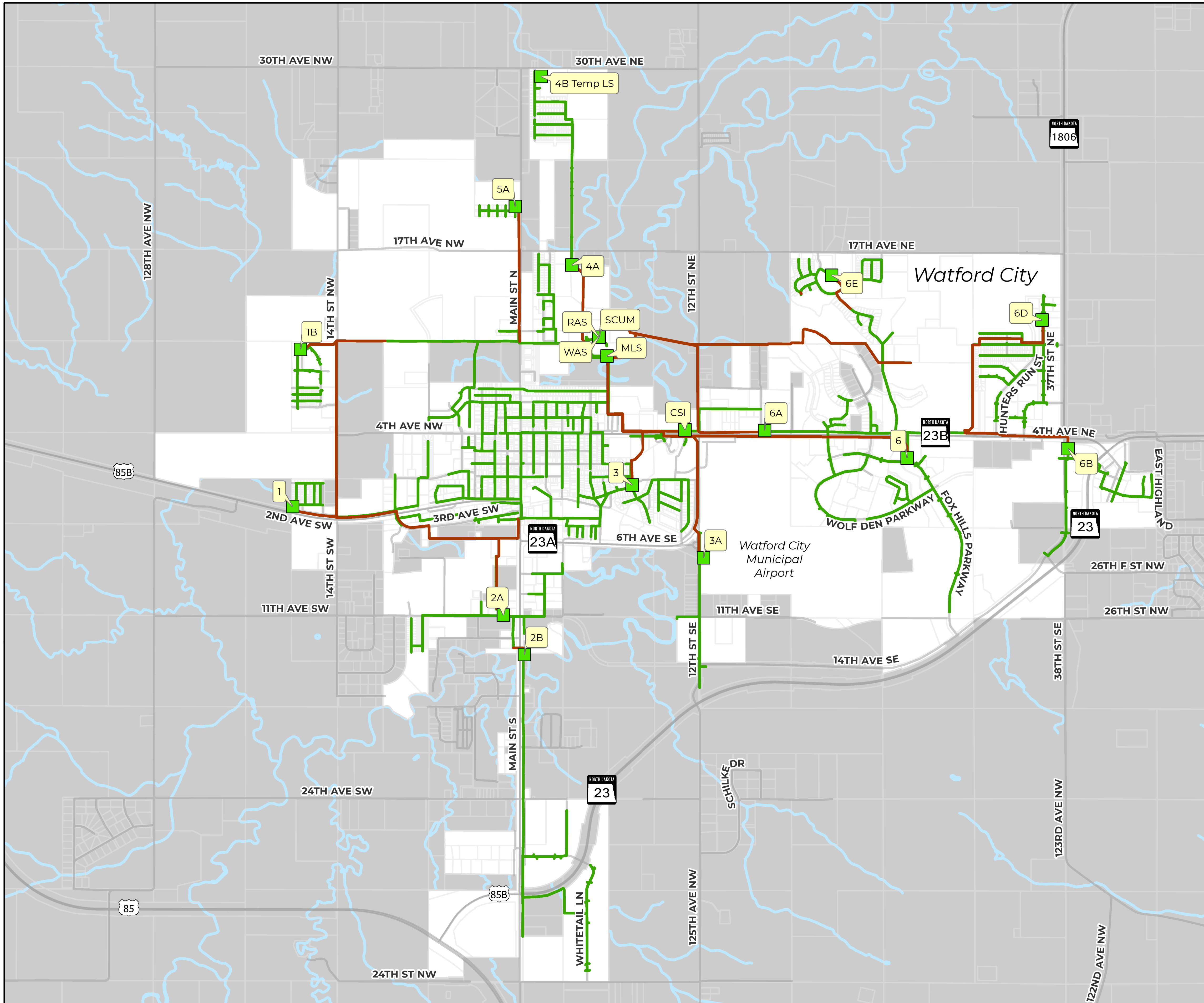
This section outlines the City's current lift station and force main systems.

2.3.3.1 Lift Stations

The City has 20 lift stations located throughout the City. These lift stations vary in capacity, configuration, age, and function. The lift stations were visually inspected and a desktop evaluation was conducted to help prioritize lift station improvements. **Table 15** below summarizes the City's lift stations and **Figure 34** provides the lift stations and force mains shown spatially on a map.

Table 15. Overview of Sanitary Sewer Lift Stations

Lift Station	Nearby Proximity (Location)	Subdivision / Neighborhood	Year Constructed/ Improved
1	2nd Avenue SW and Kennedy Street	Courtyard Addition	2011
1B	Emerald Ridge Road and 14th Street SW	Emerald Ridge	2013
2A	11th Avenue SW and Main Street	Unplatted	2011 / 2013
2B	Main Street and Cherry Creek	Unplatted	2013
3	8th Street SE and 2nd Avenue SE	Watford City 2nd Addition	1978 / 2011
3A	12th Street SE and 6th Avenue SE	Unplatted	2015
4A	E Pheasant Ridge Street and 17th Avenue NE	Dakota Ridge	2014
4BT	2nd Street NE and 29th Avenue NE	Dakota Ridge	2019
5A	Main Street and 19th Avenue NW	Stallion Meadows	2015
6	Fox Hills Parkway N	Fox Hills	2015
6A	4th Avenue NE and 16th Street NE	Legacy Commons	2013
6B	123rd Avenue NW and 4th Avenue NE	The Crossings	2013
6D	37th Street NE	Hunter's Run	2014
6E	17th Avenue NE	Stepping Stone	2018
CSI	4th Avenue NE and 11th Street NE	Watford City 2nd Addition	1981
MLS	WRRF	WRRF	2013
RAS	WRRF	WRRF	2013
SCUM	WRRF	WRRF	2013
WAS	WRRF	WRRF	2013
RBS	WRRF	WRRF	2013



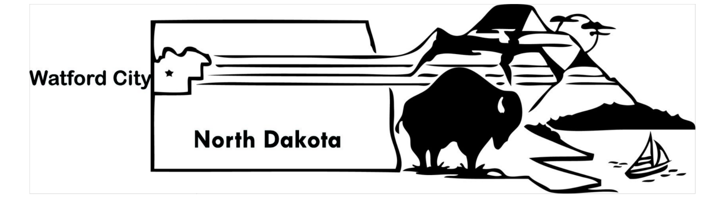


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Figure 34. Lift Stations and Force Mains

Map Legend

- Lift Station
- Force Main
- Sanitary Sewer

0 0.5 1 Miles

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In general, the lift stations are in good condition (average years since construction or last improvement is between 8 - 9 years), aside from Lift Station CSI (the City's oldest lift station is in need of improvement) and Lift Station 4BT (temporary lift station servicing the Dakota Ridge neighborhood needs to be replaced or improved to be a permanent lift station). These two lift stations are programmed for improvement in the CIP.

During the cursory visual inspections, the site, valve pit, and wet well were all inspected briefly at finished grade level. The valve pits and wet wells were not accessed, and submersible pumps were not pulled for inspection. Some example images from the visual inspection process are provided below in Figure 35 and Figure 36.

Site View | Valve Pit | Wet Well

Figure 35. Lift Station 3 Visual Inspection Photos

Site View | Valve Pit | Wet Well

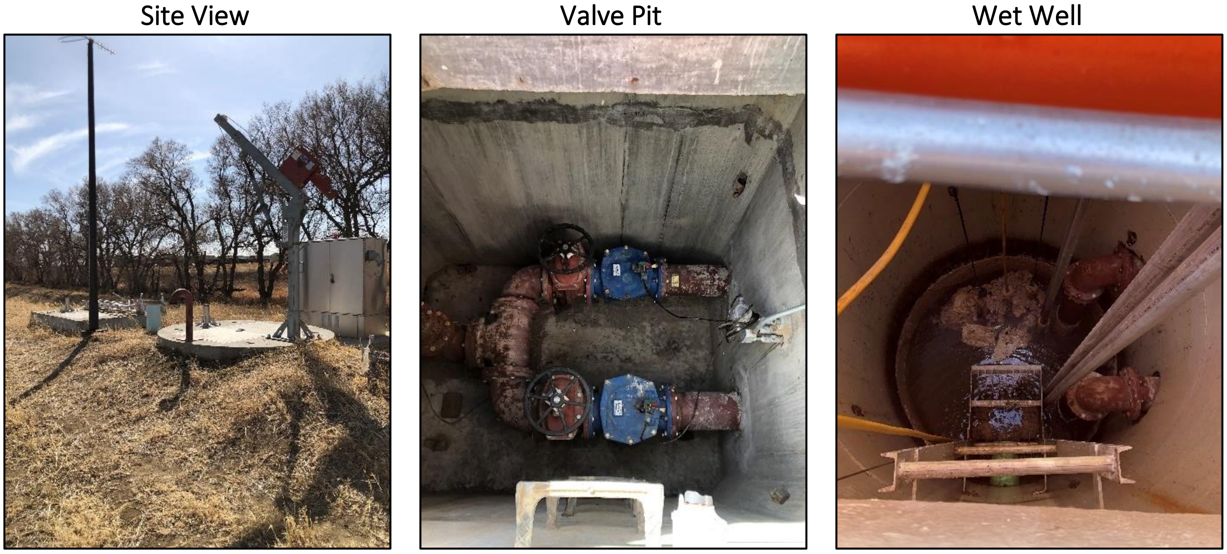


Figure 36. Lift Station 6D Visual Inspection Photos

As mentioned, in addition to the cursory visual lift station inspections, a desktop evaluation was performed to gain a comprehensive understanding of how each lift station compares to one another, in terms of likelihood of failure, consequence of failure, and overall risk of failure. More specific information regarding the desktop evaluation and lift station prioritization is provided later in this report in **Section 6.1.1.3.2**.

2.3.3.2 Force Mains

The City owns and maintains roughly 16 miles of force mains. These force mains convey wastewater from lift stations to gravity sewers or to other lift stations. **Table 16** provides the City's force mains categorized by pipe diameter, and **Figure 37** shows force mains categorized by install date. As shown in the previous figure, as well as the table and figure below, the City's force main system is predominately PVC (90% of the system), is between 6-inch and 12-inch in diameter (76% of the system), and is less than 10-years old (installed during or after 2011; 89%). Given that 90% of the system is PVC, 89% of the system was installed during or after 2011, and that the City has not experience significant force main failures, it is assumed that the City's force main system is in good condition and thus no infrastructure improvements are being recommended to the force main system.

Table 16. Force Main System - Pipe Diameters

Diameter	Length (ft)	Length (mi)	Distribution (%)
6"	9,982	1.9	12%
8"	15,594	3.0	19%
10"	10,481	2.0	13%
12"	26,953	5.1	32%
14"	8,560	1.6	10%
16"	6,551	1.2	8%
18"	4,780	0.9	6%
Unknown	62	0.0	0%
Total	**82,962**	**15.7**	**100%**

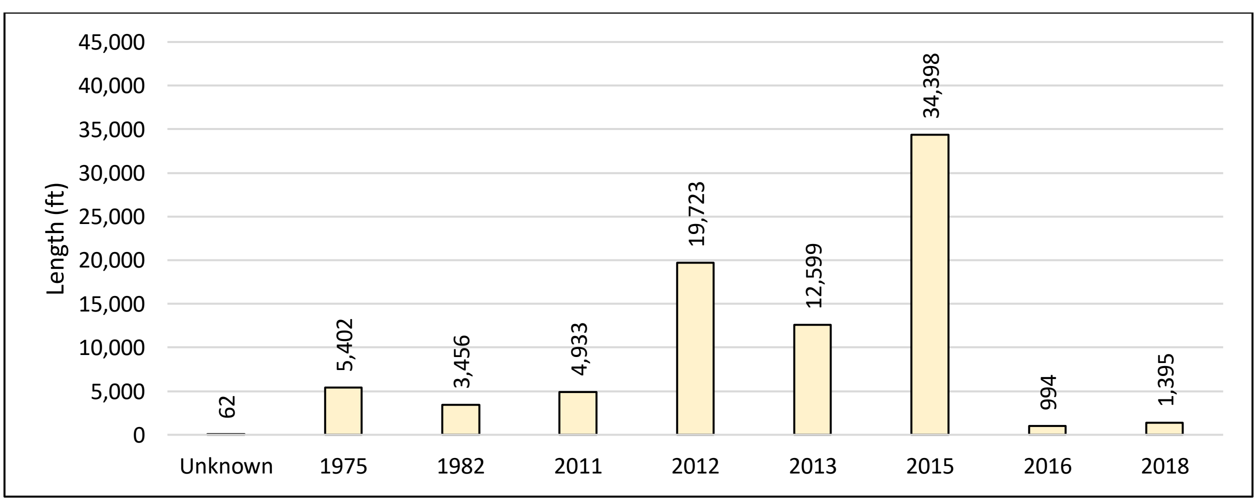


Figure 37. Force Main System - Pipe Install Dates

2.3.4 Water Resource Recovery Facility

First operational in 2016, Watford City's WRRF provides wastewater treatment services to the residents and businesses of Watford City. The WRRF's treatment process includes preliminary treatment (fine screening and grit removal), extended air oxidation ditch treatment, final clarification, disinfection, effluent aeration, and effluent pumping. The City's WRRF is unique in that it is the first wastewater treatment facility in North Dakota to have a continuous discharge permit to an intermittent stream (Cherry Creek). An aerial image of the WRRF is provided as **Figure 38**.

Figure 38. Water Resource Recovery Facility (WRRF) Aerial Image

The WRRF is designed to serve an estimated population of 15,000 people. Future planned phases at the current WRRF campus are estimated to provide treatment capacity to serve an estimated 25,000 people.

A walkthrough of the WRRF was conducted with City staff in early 2021 to review the facility and identify challenges and problems at a high-level, so projects could be developed and prioritized within the CIP. The following list of challenges and issues were identified as improvement priorities:

- Master Lift Station
  - A bypass line and sluice gate addition (or other means of isolation) to the Master Lift Station was identified as an improvement needed to provide greater operational flexibility and redundancy.
  - There is electrical wiring that is non-compliant at the Master Lift Station that should be corrected.
- Pretreatment Building
  - Odors are extremely prevalent in the pretreatment building due to HVAC system deficiencies and operational challenges associated with the air handling and ventilation systems. The heaters in the building are also experiencing issues. Improvements should be implemented to improve the HVAC system in its entirety.
- Existing Ponds
  - Fencing around existing ponds needs to be improved and replaced in various sections.
  - Existing ponds are showing signs of erosion, which will only continue to worsen. Erosion control measures should be implemented to remediate pond sidewalls and mitigate future sloughing.

These recommended improvements are included in the CIP as O&M projects at the WRRF.

2.3.5 Existing Wastewater System Summary and Recommendations

Overall, the City's wastewater system is in good condition, outside of some VCP sewers, two lift stations (Lift Station 4BT and CSI), and a few WRRF improvements (noted in Section 2.3.4). A summary of general recommendations for operating and maintaining a healthy wastewater system is provided in Table 17.

Table 17. Wastewater System – Recommended O&M Actions

Category	Action
Sanitary Sewers	- Implement an inspection program in accordance with NASSCO's Pipeline Assessment Certification Program (PACP). - Regularly jet and clean sewers, especially interceptor sewers and known problem areas. Sewers are currently cleaned on a 4-year cycle, which is sufficient. - Some 'problem sewers' (i.e. sewers with inadequate slope or sewers downstream of restaurants) may require more regular cleaning.
Lift Stations	- Complete annual visual inspections to ensure lift stations are in good condition and functioning appropriately. - Conduct drawdown testing on a recurring basis to monitor pump performance.
Force Mains	- Consider implementing condition assessment methods on critical force mains.
Manholes	- Implement an inspection program in accordance with NASSCO's Manhole Assessment Certification Program (MACP). - Implement a manhole lining program, where a percentage of manholes are lined on a routine basis to prolong the life of manholes. - Manholes should be jetted as part of the sewer cleaning cycle.
Wastewater Service Lines	- The wastewater service lines are the responsibility of the property owner, so no O&M action is required.
Water Resource Recovery Facility	- Complete and document monthly inspections to ensure wastewater treatment processes are in good condition and functioning appropriately.
General	- Develop and routinely update a collection system hydraulic model so the City can make more informed decisions about the collection system. - Deploying odor loggers to monitor odor levels should be considered in areas where odors become an issue.

2.4 Stormwater System

The stormwater system is comprised of the following core components:

- Approximately 27 miles of stormwater sewers
- 569 storm sewer inlets
- 452 storm sewer manholes
- 82 culverts (totaling approximately 7,100 feet)

The City relies on significant relief and elevation changes to aide with stormwater drainage. Throughout much of the City, as precipitation and stormwater accumulates, the stormwater overland flows in streets or ditches to either storm sewer catch basins and into the stormwater collection system, or directly into a stormwater outfall prior to discharging to a receiving waterbody. It is typical for stormwater sewer systems to be primarily made up of reinforced concrete pipe (RCP). Watford City shares this makeup, where 96% of its stormwater sewer system is RCP. Stormwater sewer systems are more challenging to *desktop assess* compared to water main and sanitary sewer systems for several reasons, including:

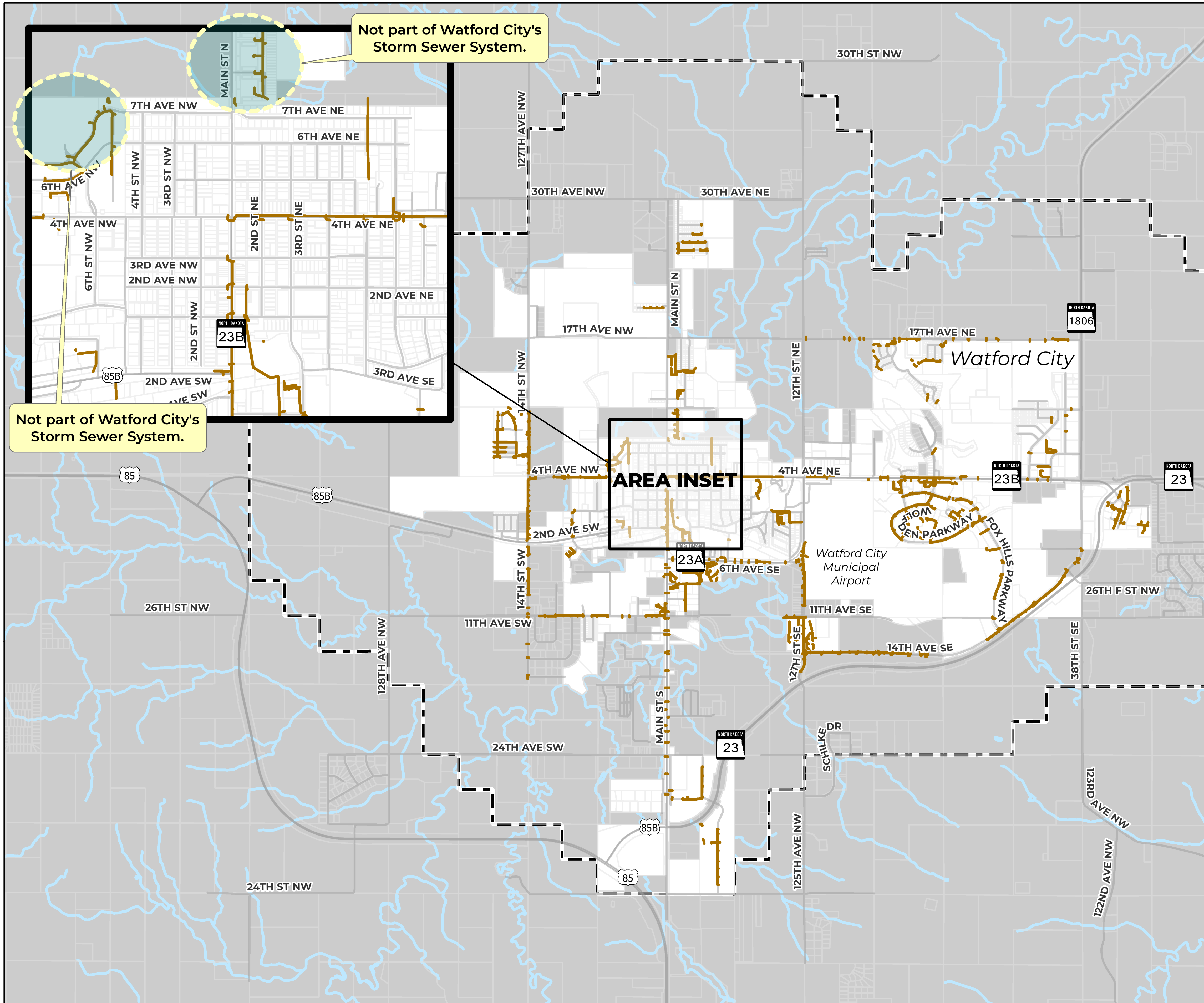
- Internal pipe corrosion is typically a non-factor
- No customer service connections
- Pipe diameter isn't indicative of actual flow volumes being carried through the pipe
- RCP is extremely resilient and doesn't have similar aging characteristics like cast iron pipe (for water) or vitrified clay pipe (for sanitary sewer)

The most appropriate method for evaluating stormwater system adequacy is through stormwater system hydraulic modeling, which was not included in the scope of this project. For these reasons, the stormwater system was not thoroughly assessed as part of this Master Plan; rather, discussions were facilitated with City staff to identify areas throughout the City that experience stormwater system challenges and drainage issues. These included the following:

- Hunter's Run Development
    - Drainage Issues Persistent Throughout Development
    - Incomplete Stormwater Ponds / Stormwater System
    - 11th Avenue NE doesn't have Catch Basins
    - Hydraulic Analysis is Recommended
- Emerald Ridge Development
    - No Pond Outlet was Installed
- Pheasant Ridge Development
    - Drainage and Erosion Issues Exist
    - Ditches are Filled in and Not Properly Contoured
- Dakota Ridge / Little Bison Development
    - Ponds were Not Completed per Plans
- Other
    - South Park Flood Study Needed
    - No Detention at County Courthouse
    - No Storm Sewer on 5th Street near the County Courthouse and Along 2nd Avenue
    - No Storm Sewer on 3rd Street NE near 2nd Avenue and 3rd Avenue

- No Storm Sewer on 3rd Avenue and 2nd Street near City Hall
- No Detention at School District Yard Across from the Swimming Pool on 3rd Street SE
- Undersized Storm Drain on 3rd Street and 4th Avenue SE near Old City Public Works Shop
- RV Park is Located within Floodplain – Floodplain Study Needed
- Cemetery Experiences Flooding – Build New Lift Station (ND DOT funded ; City Maintained)
- Several Alleys with Poor Drainage Results in Overland Drainage through Private Property
- Various Deficient Storm Drain Systems in "Old Watford City"
- Stormwater/Drainage Issues Along 3rd Avenue SW (will be address with planned project)

A map of the City's stormwater system is provided on the following page as Figure 39.



Watford City
North Dakota

Watford City 2040 Infrastructure Master Plan

Figure 39. Map of Storm Sewer System

Map Legend

Storm Sewer

Watford City ETA

0 0.5 1 Miles

N

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2.5 Facilities Review

The following facilities were included in the facility review (facility locations are also provided in Figure 40 on the following page):

- City Hall and Civic Center
- Old City Shops
- New City Shop
- Emergency Services Building
- Fire Hall
- Fox Hills Golf Course Clubhouse
- Rough Rider Center
- Veteran's Memorial Building
- Visitor's Center
- Wolf Pup Preschool
- Golf Course Maintenance Shop

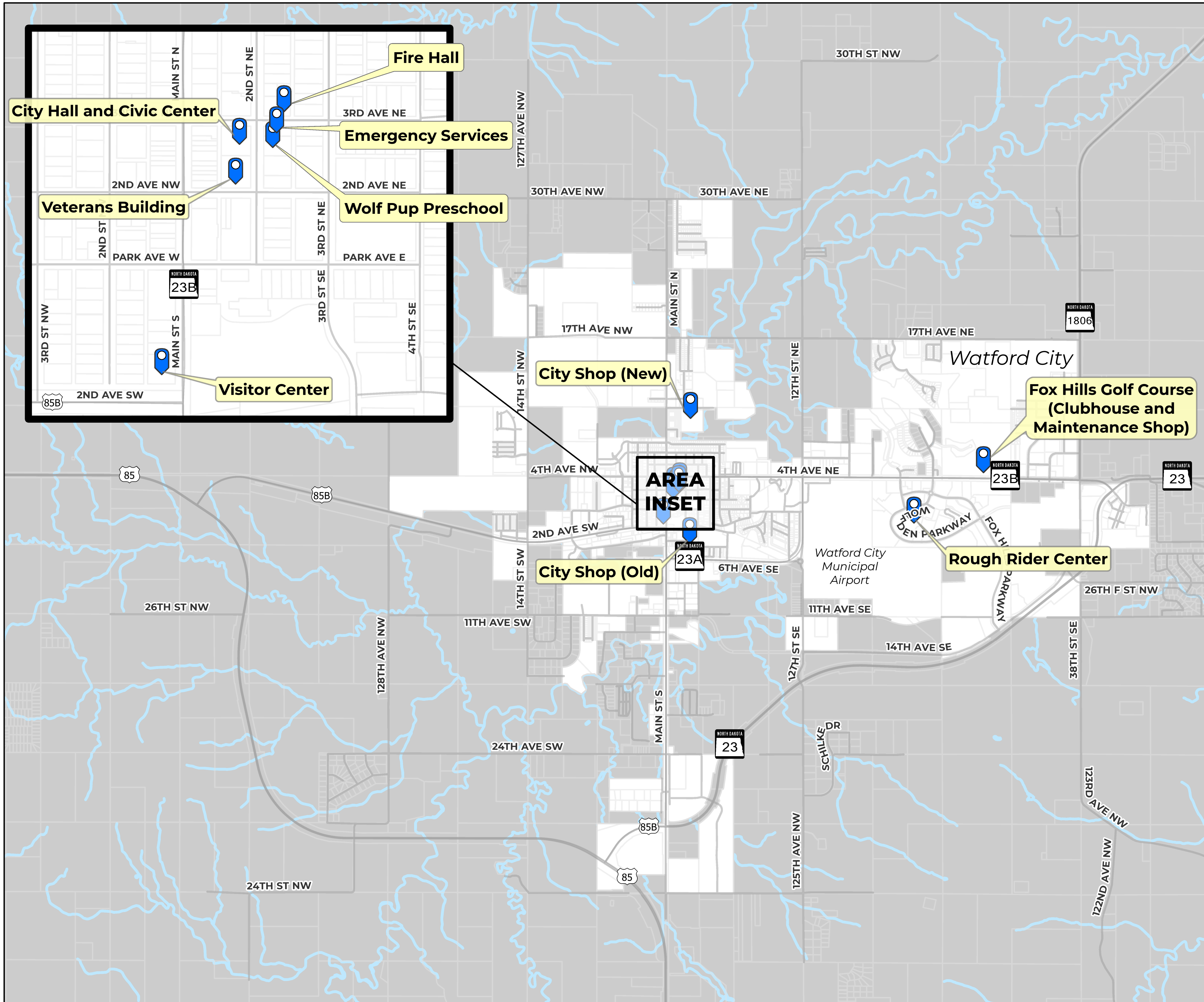
The project team utilized the following grading scale (provided in Table 18) to evaluate each of the City facilities included in the review.

Table 18. Facility Grading Scale

Grade	Condition	Purpose/Function Description
A	**Excellent Condition** Component showing no or very few signs of wear.	Everything meets intended purpose/function;
B	**Good Condition** Component showing some signs of wear.	Most meets intended purpose/function;
C	**Moderate Condition** Component showing moderate signs of wear.	Some meets intended purpose/function;
D	**Poor Condition** Component showing significant signs of wear.	Very little meets intended purpose/function;
F	**Extremely Poor Condition** Component needs to be replaced ASAP	Does not meet intended purpose/function;

A facilities walkthrough was performed in 2021 where each facility component was assigned a grade for its respective condition as well as purpose/function. Facility components were evaluated ranging from architectural and structural (which also included site conditions), to mechanical, electrical, and plumbing categories.

In addition, general facility notes and observations are included that the City can utilize to better understand some of the areas that may need to be addressed further.



Watford City North Dakota

Watford City 2040 Infrastructure Master Plan

Figure 40. Map of Facility Locations

Map Legend

City Facilities

Miles
0 0.5 1

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2.5.1 City Hall and Civic Center

The City Hall and Civic Center is a Glulam wood-framed and concrete masonry unit (CMU) building that was originally built in 1958. The Heritage Room was added in 1974, and City Hall was remodeled in 2013. The City Hall and Civic Center architectural and structural facility grades are provided in Table 19, and the mechanical and electrical grades are provided in Table 20.

Table 19. City Hall and Civic Center - Architectural and Structural Facility Component Grades

Architectural and Structural Facility Components	Condition Grade	Function Grade
Site Accessibility (Parking, Entry/Exit Points, Sidewalks)	A	A
Exterior Walls	A	A
Exterior Doors	A	B
Exterior Windows	A	A
Roof	C	A
Interior Flooring	B	A
Interior Walls	A	A
Interior Doors	A	A
General Circulation (Stairs / Elevators / Railings)	A	A
Compliance (ADA, Fire Escapes, etc.)	C	C

Table 20. City Hall and Civic Center - Mechanical and Electrical Facility Component Grades

Mechanical and Electrical Facility Components	Condition Grade	Function Grade
Lighting	B	B
Electrical Systems	B	C
Fire Suppression	N/A	N/A
Fire Alarm	B	A
Communications	C	D
HVAC Systems	A	A
Plumbing Systems	A	A

Specific facility observations identified on the City Hall and Civic Center facility walkthrough include the following:

- <u>General Notes</u>
  - A multimedia system in the Heritage Room to support sound and video for meetings and presentations should be installed as soon as possible.

- <u>Exterior Doors</u>
  - The Heritage room exit door requires egress hardware.

- <u>Roof</u>
  - The roof above Civic Center and Library area was improved in 2020.
  - The remaining roof areas that weren't improved in 2020 were last updated during the 2013 addition and remodel.

- <u>Interior Flooring</u>
  - The Heritage room was not updated during the 2013 remodel. The carpet in the Heritage Room will likely need replacement within the next 10 years. Typically, carpet needs updating every 10-15 years.
  - Unknown if asbestos removal occurred in existing buildings. Determine if an asbestos report exists. If not, conduct an asbestos assessment.

- <u>Compliance (ADA, Fire Escapes, etc.)</u>
  - The lower engineering level is not ADA accessible from main entry of building.
  - The restroom on lower level is not ADA accessible due to missing grab bars at toilet.

- <u>Lighting</u>
  - The business side of the facility utilizes energy efficient T5 fluorescent lamp type fixtures. Some decorative fixtures utilize halogen type incandescent lamps which have short lamp life.
  - It is estimated that the existing lighting in these areas have 10 – 15 years of remaining useful life.

- <u>Electrical</u>
  - The shared (City Hall & Veteran's Memorial Building) electrical service was recently upgraded, and the facility is backed up by a diesel generator. However, most of the existing branch panels in the facility are full, making adds/moves/changes challenging. The City should be aware that some future simple projects may incur additional costs associated with adding branch panels to the electrical system. Having said this, it is not prudent to add branch panels to the facility, until the need arises.

- <u>Fire Alarm</u>
  - The addressable fire alarm system incorporates pull stations at the exits and smoke detectors throughout the ceilings. Annunciation is accomplished with ADA compliant

audible/visible notification devices. It's estimated the system's remaining useful life is 15-20 years.

- <u>Network</u>
  - Cabling consists of Cat 5e telephone cables and Cat 6 data cables.
  - The main data rack is in the central mechanical room, which is not an ideal environment for computer servers and similar equipment. It is recommended to relocate/upgrade the network cabling system in the next 5 – 10 years.

- <u>Security</u>
  - The facility incorporates an adequate surveillance system.

- <u>HVAC Systems:</u>
  - The packaged rooftop units have an estimated remaining useful life of 12 years.
  - The furnace has an estimated remaining useful life of 15 years.
  - The boiler has an estimated remaining useful life of 20 years.

- <u>Plumbing:</u>
  - The water heater has an estimated remaining useful life of 8-10 years.

Images of key observations and potential improvement areas are provided in <u>Figure 41</u> and <u>Figure 42</u>.

Figure 41. City Hall and Civic Center - Interior Flooring in Need of Updates

Figure 42. City Hall and Civic Center - Lower Restroom Missing ADA Grab Bars

2.5.2 City Shops (Old)

The old City Shops are Pre-Engineered Metal Buildings that have been in service for decades. The architectural and structural facility grades are provided in **Table 21**, and the mechanical and electrical grades are provided in **Table 22**.

Table 21. City Shops (Old) - Architectural and Structural Facility Component Grades

Architectural and Structural Facility Components	Condition Grade	Function Grade
Site Accessibility (Parking, Entry/Exit Points, Sidewalks)	F	D
Exterior Walls	F	F
Exterior Doors	F	C
Exterior Windows	F	C
Roof	F	C
Interior Flooring	F	C
Interior Walls	F	F
Interior Doors	F	C
General Circulation (Stairs / Elevators / Railings)	N/A	N/A
Compliance (ADA, Fire Escapes, etc.)	F	F

Table 22. City Shops (Old) - Mechanical and Electrical Facility Component Grades

Mechanical and Electrical Facility Components	Condition Grade	Function Grade
Lighting	D	D
Electrical Systems	C	C
Fire Suppression	N/A	N/A
Fire Alarm	N/A	N/A
Communications	C	C
HVAC Systems	F	F
Plumbing Systems	D	C

Specific facility observations identified on the old City Shops facility walkthrough include the following:

- General Notes
  - Due to the overall condition old City Shops, it is recommended that this property be assessed for redevelopment. Construction of a new Public Works shop is programmed into the CIP.

- Site Accessibility (Parking, Entry/Exit Points, Sidewalks)
  - The location in proximity to daycare and elementary school is hazardous. The gravel lot does not meet the city requirement of paved parking lots, and it also forces vehicles to back out into the roadway.

- Exterior Doors
  - Overhead doors are old and have large gaps between doors and concrete slabs.

- Exterior Walls
  - The walls are damaged throughout the buildings with missing metal panels and damaged finishes.

- Compliance (ADA, Fire Escapes, etc.)
  - Buildings are not ADA compliant.

- Lighting
  - Lights consist of multiple different generations of florescent lighting with light fixtures somewhat randomly located in the buildings. All new LED lighting should be installed as soon as possible, if the buildings are not demolished in a timeline fashion.

- HVAC Systems
  - Ventilation is either non-existent or not functioning.
  - Heating equipment is generally old and in need of replacement.

- Plumbing
  - Water heaters are in good condition and have an estimated remaining useful life of 10 years.

Images of key observations and potential improvement areas are provided in Figure 43 through Figure 48.

Figure 43. City Shops (Old) - Exterior

Figure 44. City Shops (Old) - Large Gaps Under Aging Garage Doors

Figure 45. City Shops (Old) - Exterior Wall Condition

Figure 46. City Shops (Old) - Interior Step Showing Signs of Wear

Figure 47. City Shops (Old) - Ceiling Insulation

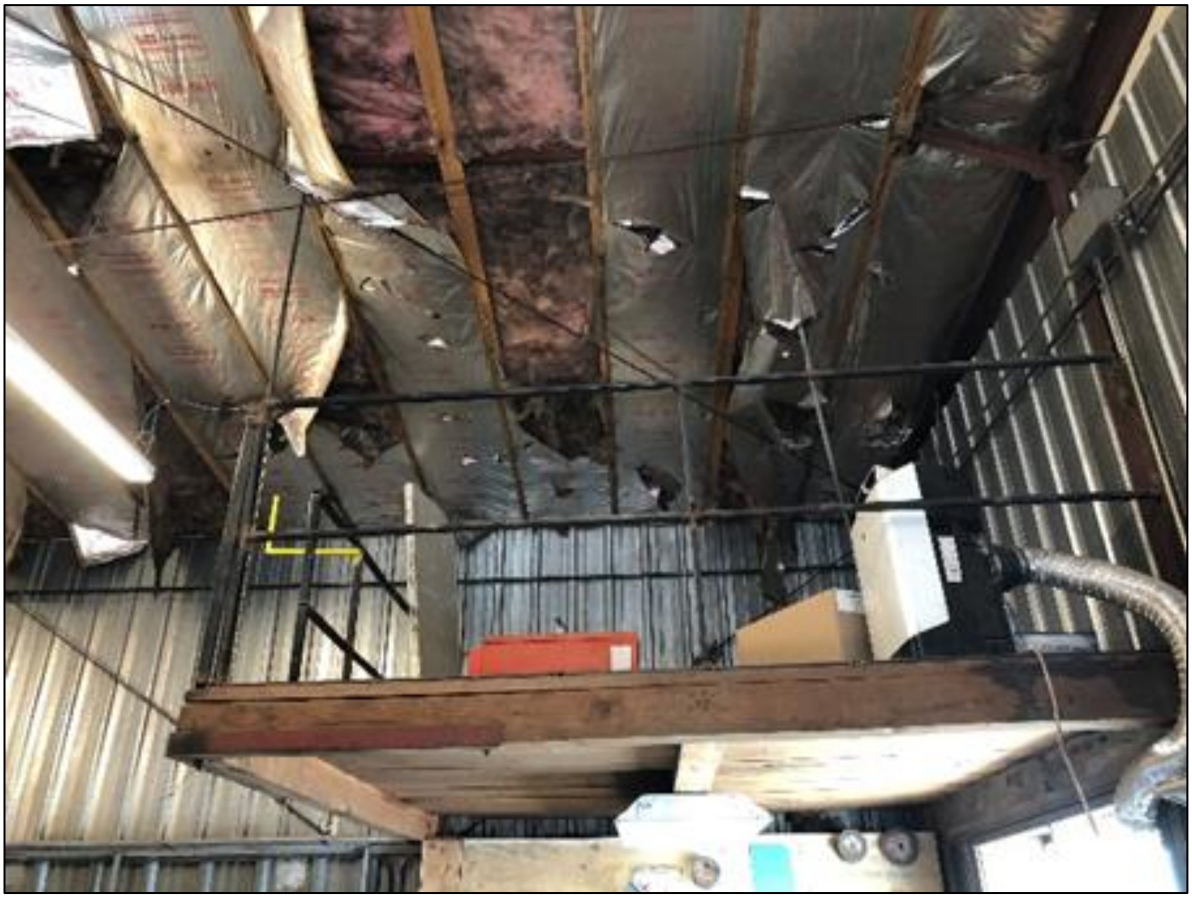

Figure 48. City Shops (Old) - Ceiling Insulation

2.5.3 City Shop (New)

The new City Shop is a Pre-Engineered Metal Building that was originally built in 2017. The architectural and structural facility grades are provided in Table 23, and the mechanical and electrical grades are provided in Table 24.

Table 23. City Shop (New) - Architectural and Structural Facility Component Grades

Architectural and Structural Facility Components	Condition Grade	Function Grade
Site Accessibility (Parking, Entry/Exit Points, Sidewalks)	A	A
Exterior Walls	A	A
Exterior Doors	A	A
Exterior Windows	A	A
Roof	A	A
Interior Flooring	A	A
Interior Walls	A	A
Interior Doors	A	A
General Circulation (Stairs / Elevators / Railings)	A	A
Compliance (ADA, Fire Escapes, etc.)	A	A

Table 24. City Shop (New) - Mechanical and Electrical Facility Component Grades

Mechanical and Electrical Facility Components	Condition Grade	Function Grade
Lighting	A	A
Electrical Systems	A	A
Fire Suppression	N/A	N/A
Fire Alarm	A	A
Communications	A	A
HVAC Systems	A	C
Plumbing Systems	A	A

Specific facility observations identified on the new City Shop facility walkthrough include the following:

- General Notes
    - All city shop functions will be relocated to this site.
- Lighting
    - The building consists of new LED type light fixtures. The estimated remaining useful life is 25-30 years.
- Electrical
    - The distribution system has provisions to attach a portable generator in the case of power outages. There is adequate space in the branch panels to support adds/moves/changes. The estimated remaining useful life is 25-30 years.
- Fire Alarm
    - The alarm incorporates a new addressable fire alarm panel with appropriate initiation and annunciation devices. The estimated remaining useful life is 20 years.
- Network
    - It's recommended to review the telephone and network cabling to ensure it's adequate.
- Security
    - The building incorporates a surveillance system with adequate coverage.
- HVAC system
    - The HVAC system is all new equipment. The heat is lacking on the makeup air unit, creating a risk of freezing temperatures in the shop.
    - The system features two boilers for the floor heat system in the shop. One of the boilers for floor heat had the cover removed at the time of the visit. The boilers are light commercial duty and have an estimated remaining useful life of 15-20 years.
- Plumbing
    - Systems are in good condition.

An image of key observations and potential improvement areas is provided in **Figure 49**.

Figure 49. City Shop (New) – New Shop Boiler Systems

2.5.4 Emergency Services Building

The Emergency Services Building is a wood-framed structure that was originally built in 2013. It currently houses the Watford City Volunteer Fire Department Fire and McKenzie County Ambulance. The architectural and structural facility grades are provided in Table 25, and the mechanical and electrical grades are provided in Table 26.

Table 25. Emergency Services Building - Architectural and Structural Facility Component Grades

Architectural and Structural Facility Components	Condition Grade	Function Grade
Site Accessibility (Parking, Entry/Exit Points, Sidewalks)	B	A
Exterior Walls	B	A
Exterior Doors	A	A
Exterior Windows	A	A
Roof	A	A
Interior Flooring	A	A
Interior Walls	A	A
Interior Doors	A	A
General Circulation (Stairs / Elevators / Railings)	A	A
Compliance (ADA, Fire Escapes, etc.)	A	A

Table 26. Emergency Services Building - Mechanical and Electrical Facility Component Grades

Mechanical and Electrical Facility Components	Condition Grade	Function Grade
Lighting	B	A
Electrical Systems	A	A
Fire Suppression	N/A	N/A
Fire Alarm	B	A
Communications	A	A
HVAC Systems	A	A
Plumbing Systems	B	A

Specific facility observations identified on the Emergency Services Building walkthrough include the following:

- Site Accessibility (Parking, Entry/Exit Points, Sidewalks)
  - The east apron and sidewalk heaving/settlement issue is causing a tripping hazard and water/ice damming issue.

- Exterior Walls
  - The sidings exposed fasteners were covered with a compound that was not color matched to the siding. This is probably not a maintenance issue but should be touched up with paint matching siding for aesthetic reasons.

- Lighting
  - The building utilizes energy efficient T5 fluorescent lamp type fixtures. The existing lighting has an estimated remaining useful life 10–15 years.

- Electrical
  - The system is backed up by natural gas generator. The system has an estimated remaining useful life 20–25 years.

- Fire Alarm
  - The system incorporates pull stations at the exits and smoke detectors throughout the ceilings. Annunciation is accomplished with ADA compliant audible/visible notification devices. The system has an estimated remaining useful life 15-20 years.

- Network
  - The building incorporates Cat 6 network cabling which has an estimated remaining useful life 15-20 years.

- HVAC Systems
  - Boiler is commercial duty and has an estimated remaining useful life of 20-25 years.
  - Gas furnaces are commercial duty and have an estimated remaining useful life of 15-20 years.

- Plumbing
  - The water heater appears to have a loose fitting and shows signs of past leaking from sediment buildup. It's recommended to further investigate what's causing the sediment buildup and consider potentially adding a water softener. No moisture was visible at the time of visit.

Images of key observations and potential improvement areas are provided in Figure 50 through Figure 51.

Figure 50. Emergency Services Building - Heaving Sidewalk in Building Front

Figure 51. Emergency Services Building - Sediment Buildup on Water Heater

2.5.5 Fire Hall

The Fire Hall is a Pre-cast concrete and CMU structure that was originally built in 1980's. The architectural and structural facility grades are provided in **Table 27,** and the mechanical and electrical grades are provided in **Table 28**.

Table 27. Fire Hall - Architectural and Structural Facility Component Grades

Architectural and Structural Facility Components	Condition Grade	Function Grade
Site Accessibility (Parking, Entry/Exit Points, Sidewalks)	C	F
Exterior Walls	B	A
Exterior Doors	D	B
Exterior Windows	C	A
Roof	D	A
Interior Flooring	C	A
Interior Walls	C	A
Interior Doors	C	D
General Circulation (Stairs / Elevators / Railings)	B	A
Compliance (ADA, Fire Escapes, etc.)	F	F

Table 28. Fire Hall - Mechanical and Electrical Facility Component Grades

Mechanical and Electrical Facility Components	Condition Grade	Function Grade
Lighting	C	B
Electrical Systems	B	C
Fire Suppression	N/A	N/A
Fire Alarm	F	C
Communications	C	A
HVAC Systems	A	C
Heating System	D	D
Plumbing Systems	B	B

Specific facility observations identified on the Fire Hall walkthrough include the following:

- General Notes
  - Due to the existing condition and function of various building components identified during the facility walkthrough, coupled with the true "high-level" nature of the facility walkthrough, it is recommended for the City to further analyze the Fire Hall and evaluate the alternatives of building new versus rehabilitating.
  - Construction of a new Fire Hall was programmed into the CIP. If this is determined to be the option that is in the City's best interest, and if it can be accomplished in a timely manner, some of the facility observations and recommendations provided below don't need to happen.

- Site Accessibility (Parking, Entry/Exit Points, Sidewalks)
  - The south apron has cracking in concrete that should be properly patched / repaired around fire hydrant.
  - There is very limited parking around the Fire Hall.

- Exterior Walls
  - A large crack above north door should be repaired.
  - Seals should be placed around pipe penetrations in the mechanical room.

- Exterior Doors
  - Overhead doors need new weather strip seals on exterior side. The doors are aging and have an estimated remaining useful life of 5 years.
  - All exterior doors need panic hardware.

- Exterior Windows
  - One of the windows in the lounge has broken glass that should be repaired.

- Roof
  - The roof is the original ballasted roof and needs repair. Due to age, replacement should be considered within 1-3 years.

- General Circulation (Stairs / Elevators / Railings)
  - North exterior railing needs to be replaced as it does not meet code. The openings between rails exceed the 4" max. which need to be met when landings are over 30" grade difference.
  - Concrete stairs at this location have cracking issues.

- Compliance (ADA, Fire Escapes, etc.)
  - Toilets do not comply with ADA requirements.
  - Building must have 2nd accessible exit.

- Fire Suppression
    - The current code where building has commercial vehicles stored and is over 5,000 SF requires the building be accommodated with fire suppression sprinklers.

- Lighting
    - The vehicle storage area has been updated to LED. The rest of the building utilizes T12 fluorescent lamp type fixtures (which are obsolete). These fluorescent fixtures should be replaced with energy efficient fixtures as soon as possible.

- Electrical
    - The system is backed up by a natural gas generator.
    - Circuit breakers are still readily available for this system; however, the existing branch panels in the facility are full, making adds/moves/changes a challenge.

- Fire Alarm
    - The existing analog type fire alarm system is obsolete. The panel, as well as all the existing initiation and annunciation, devices should be upgraded as soon as possible.
    - Smoke detector coverage in the building should be re-evaluated at that time, as some areas appear to be deficient.

- Networking
    - There is adequate phone/network cabling.

- HVAC System
    - The boilers and pumps are in problematic condition and should be replaced.
    - The garage ventilation system is approaching the end of its estimated remaining useful life and should be replaced in the next 5 years.

- Plumbing Systems
    - The water heater has an estimated remaining useful life of 10 years

Images of key observations and potential improvement areas are provided in Figure 52 through Figure 57.

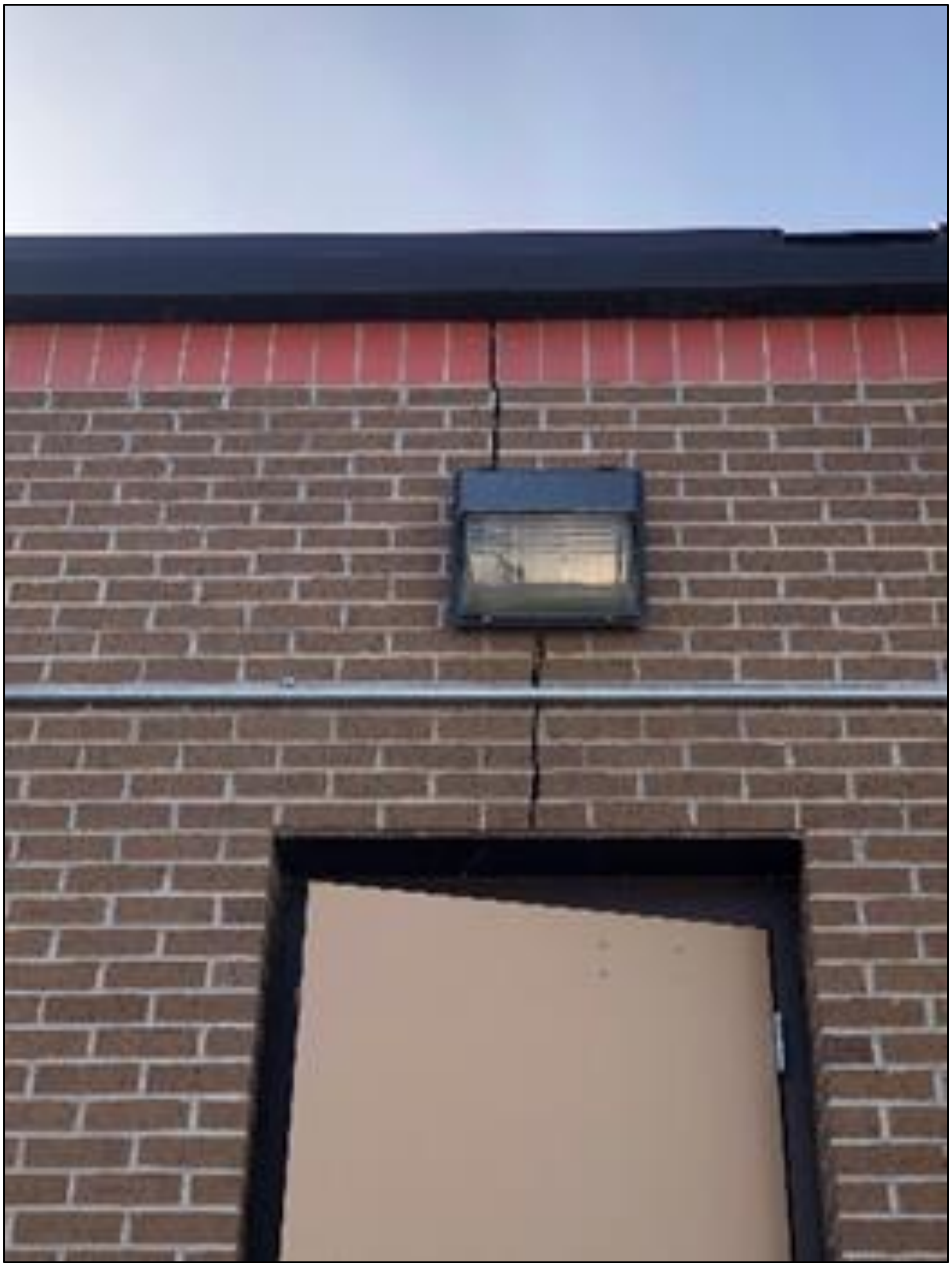

Figure 52. Fire Hall - Crack Above North Door

Figure 53. Fire Hall - Gap Between Mechanical Pipe and Exterior Wall

Figure 54. Fire Hall - Weatherstripping on Garage Doors

Figure 55. Fire Hall - Broken Exterior Window

Figure 56. Fire Hall - North Exterior Railing

Figure 57. Fire Hall - Broken Stairs on North Door Landing

2.5.6 *Fox Hills Golf Course Clubhouse*

The Fox Hills Golf Course Clubhouse has a wood-framed construction that was originally built in 2004 with and addition in 2012. The architectural and structural facility grades are provided in Table 29, and the mechanical and electrical grades are provided in Table 30.

Table 29. Fox Hill Clubhouse - Architectural and Structural Facility Component Grades

Architectural and Structural Facility Components	Condition Grade	Function Grade
Site Accessibility (Parking, Entry/Exit Points, Sidewalks)	D	C
Exterior Walls	D	B
Exterior Doors	C	B
Exterior Windows	B	A
Roof	B	A
Interior Flooring	A	A
Interior Walls	A	A
Interior Doors	A	A
General Circulation (Stairs / Elevators / Railings)	B	B
Compliance (ADA, Fire Escapes, etc.)	B	C

Table 30. Fox Hill Clubhouse - Mechanical and Electrical Facility Component Grades

Mechanical and Electrical Facility Components	Condition Grade	Function Grade
Lighting	C	B
Electrical Systems	A	A
Fire Suppression	N/A	N/A
Kitchen Fire Suppression	C	B
Fire Alarm	N/A	N/A
Communications	A	A
HVAC Systems	B	A
Kitchen HVAC System	C	D
Plumbing Systems	B	A

Specific facility observations identified on the Fox Hills Clubhouse walkthrough include the following:

- Site (Parking, Entry/Exit Points, Sidewalks)
    - The parking lot asphalt is in poor condition and lacks enough parking for 18-hole golf course. It is recommended that the parking configuration is redesigned to maximize parking count and lighting. A parking lot improvement project is programmed into the CIP.
    - A retaining wall is failing on the west side, and the wood deck needs to be refinished.

- Exterior Walls
    - The wood sidings vertical joint covers are missing throughout.
    - The horizontal joint between cultured stone and siding is poor with mesh exposed and possible water infiltration. This should be evaluated and either grouted or caulked depending on thickness (1/2" up to 3"). Wood "trim board" at grade is deteriorated and / or missing exposing rigid insulation at grade. A metal flashing should be provided to protect insulation and pest control. In a few areas cultured stone has fallen off exposing rigid insulation and a few spots show cracking. Recommend repairing immediately and replacing in 5-10 years.

- Exterior Doors
    - Exterior doors should be replaced with commercial grade doors and hardware.

- Exterior Windows
    - Exterior windows should be replaced with commercial grade windows.

- Interior Doors
    - Verify ADA compliance.

- General Circulation (Stairs / Elevators / Railings)
    - The stairs to basement require an additional handrail (one on each side).
    - The deck railing handrail is loose and needs to be repaired.

- Compliance (ADA, Fire Escapes, etc.)
    - The deck elevations do not match up - South deck with ADA ramp does not match up with the East side deck which takes you to main entries (½" is maximum allowed and this shows 2" +/- difference).
    - The ramp has a 36' long run which isn't allowed (public ramps have a maximum run of 30 feet before a rest or turn platform).
    - The railings on ramp are not graspable which does not comply, and handrails should be on both sides of ramp.
    - The bar counter does not have a lowered section for ADA seating or ordering.
    - Lower-level accessibility is difficult.

- General
    - Paper files and boxes stored in mechanical and garage area in basement are a fire hazard.

- Lighting
    - In most of the public areas, older downlights and track fixtures have been updated with LED lamps. These fixtures are generally in good condition and the LED lamps provide adequate and energy efficient light. The fluorescent fixtures in the kitchen, bathrooms, and other service areas are nearing their end of life and should be replaced with energy efficient LED light fixtures.
    - The parking lot is lit by wood pole mounted lights on the south side only. It is likely that this level of lighting is inadequate. New lighting that provides full coverage, utilizing aesthetically pleasing light fixtures should be installed in the parking lot.

- Electrical
    - The distribution equipment is in good condition and is adequate to support adds/moves/changes.
    - The receptacles in the Bar area should be updated to GFCI type.
    - Many of the weatherproof covers on the outdoor receptacles around the deck areas are broken. New "In-Use" type covers should be installed as soon as possible.

- Fire Suppression
    - According to the ND State Fire Marshall, buildings with a state liquor license, group A-2 (food and drink) that have an occupancy load of more than 300 is required to be fire sprinkled. Measurements were not completed during the facility review, but if the occupant areas total at least 4,500 SF (300 occupants x15sf), the lounge, dining, and gaming areas should have a fire suppression sprinkler system installed.
    - Kitchen fire suppression on the range hood is operational but reaching the end of its estimated remaining useful life. The system should be scheduled for replacement within the next 5 years.
    - Kitchen range hood exhaust duct is not properly connected to the hood.
        - Supply flex duct to kitchen range exhaust hood should not be exposed.
    - There is no humidity exhaust hood for the dishwasher.

- HVAC Systems
    - Electric and gas-fired furnaces have an estimated remaining useful life of 18 years. The furnaces in the original building appear to be reaching the end of their expected lifespan.

- Plumbing
    - Systems are functional. The water heaters in the original building may need to be replaced in 3-5 years. The water heater in the addition has an estimated remaining useful life of 7-10 years.

Images of key observations and potential improvement areas are provided in Figure 58 through Figure 63.

Figure 58. Fox Hills Clubhouse - Gaps in Wood Siding

Figure 59. Fox Hills Clubhouse - Exposed Insulation Due to Missing Cultured Stone

Figure 60. Fox Hills Clubhouse - Missing Handrail on Basement Stairs

Figure 61. Fox Hills Clubhouse - Elevation Difference Between South and East Deck

Figure 62. Fox Hills Clubhouse - Kitchen Fire Extinguisher System

Figure 63. Fox Hills Clubhouse - Aging Gas-Fired Furnace

2.5.7 Rough Rider Center

The Rough Rider Center is a pre-cast concrete and structural steel building that was built in 2016. The architectural and structural facility grades are provided in Table 31, and the mechanical and electrical grades are provided in Table 32.

Table 31. Rough Rider Center - Architectural and Structural Facility Component Grades

Architectural and Structural Facility Components	Condition Grade	Function Grade
Site Accessibility (Parking, Entry/Exit Points, Sidewalks)	A	A
Exterior Walls	A	A
Exterior Doors	A	B
Exterior Windows	A	B
Roof	A	A
Interior Flooring	A	A
Interior Walls	A	A
Interior Doors	A	B
General Circulation (Stairs / Elevators / Railings)	B	A
Compliance (ADA, Fire Escapes, etc.)	A	A

Table 32. Rough Rider Center - Mechanical and Electrical Facility Component Grades

Mechanical and Electrical Facility Components	Condition Grade	Function Grade
Lighting	A	A
Electrical Systems	A	A
Fire Suppression	A	A
Fire Alarm	A	A
Communications	A	B
Mechanical Equipment	A	B
HVAC Systems – Field House	A	C
HVAC Systems – Pool	A	A
HVAC Systems - Hockey	B	A
Plumbing Systems	B	A

Specific facility observations identified on the Rough Rider Center walkthrough include the following:

- Exterior Walls
  - On the east wall of the Mezzanine level off the hockey arena, there are a few precast panels with daylight visible through the joint indicating a caulking failure. This should be addressed immediately.
  - Condensation is building along the walls of the pool area along the roof causing streaks to travel down the walls. One possible cause could be that the precast walls are not insulated at the roof causing condensation to build up. The visible staining is likely rust from precast panel brackets or structure; however, further investigation should be taken to locate exact source.

- Exterior Windows
  - It has been reported that the windows on the north side are breaking periodically due to unknown causes and are very difficult to replace due to access.
  - One of the windowpanes on the south side vestibule is shattered and needs to be replaced.
  - Two areas, the west side gymnasium windows and the hockey arena, were identified as benefiting from a permanent blind system. A total blackout option should be evaluated for the gymnasium while a frosted film would remove the glare issues currently seen in the hockey arena.

- Exterior Doors
  - Door hardware should be adjusted to allow better west side and afterhours access.
  - Slab heaving outside of the west entrance is causing the doors to not seal correctly.
  - There is a need for more access other than main entrance as not all exterior doors have keys or latches to operate from exterior side. Example - access for door L5 for emergency personal and Door L6 for employee entrance.
  - The facility would like taller overhead doors to ice rinks for larger equipment shows in future.

- Roof
  - A 20-year warranty is currently in its 5^{th} year (as of 2021).

- General Circulation (Stairs / Elevators / Railings)
  - The intermediate horizontal rails are bending or easily popping out of their brackets from people standing or pulling on them. It is recommended that an alternative horizonal rail system is explored. The vertical posts appear to be standard, and the manufacture might have additional options available.
  - The bleachers in the main gymnasium mezzanine utilize a removable rail to block access when the seats are retracted. The rail is customed fabricated steel and is clunky, heavy, and hard to use. The facility operators are looking for a simpler solution of a gate or slider system.
  - The concrete stairs to the pool slide are corroding due to pool chemicals.

- Interior Doors
  - There are double doors that can be pulled open even when locked, leading to damaged locking mechanisms.
  - Interior doorways are required for functionality between certain spaces. Example - Man door between main ice rink and practice rink is required and between practice rink to field house

- General Notes
  - Storage is an issue throughout.
  - The ice rinks also need additional restrooms on the mezzanine level.
  - The facility would like to relocate the reception and coffee shop to make the coffee shop more accessible.

- Lighting
  - All lighting in this facility is LED. Most LED lighting is rated for 50,000 hours of operation. That will equate to 15 years life in some areas, and 25 or more in others. At that time, replacing components of the existing lights, may not be as cost effective as simply replacing the whole light fixture. Maintenance budgets should be set appropriately to anticipate these costs.

- Security
  - The surveillance system is missing coverage in some key areas. It is reported that approximately 20 additional cameras should be installed.

- HVAC Equipment
  - Facility should have maintenance contracts in place.
  - Pumps have an estimated remaining useful life of 15-20 years.
  - Chillers have an estimated remaining useful life of 23-25 years.
  - Boilers have an estimated remaining useful life of 25 years.

- HVAC Systems - Field House
  - Tends to introduce stratification in the gym areas. People on the upper decks can be too warm while people on the floor are too cold. The pear-type destratification fans produce a feeling of localized drafts with little apparent effect on destratification issues. It is recommended that an air return near the floor level is installed.

- HVAC Systems – Pool
  - Appears to be functioning well.
  - Pool Air Handler has an estimated remaining useful life of 15-20 years.

- HVAC Systems – Hockey
  - Appears to be functioning well.
  - The cooling tower for the ice system has an estimated remaining useful life of 10 years.

- Plumbing Systems
    - The system has shorter than normal lifespans due to water conditions. Faucets are being replaced on a regular basis.
    - Recommend adding water softener system.

Images of key observations and potential improvement areas are provided in Figure 64 through Figure 67.

Figure 64. Rough Rider Center - Gap Between Precast Panels in Hockey Arena

Figure 65. Rough Rider Center - Staining on Precast Walls

Figure 66. Rough Rider Center - Current Blind System on the West Gym Windows

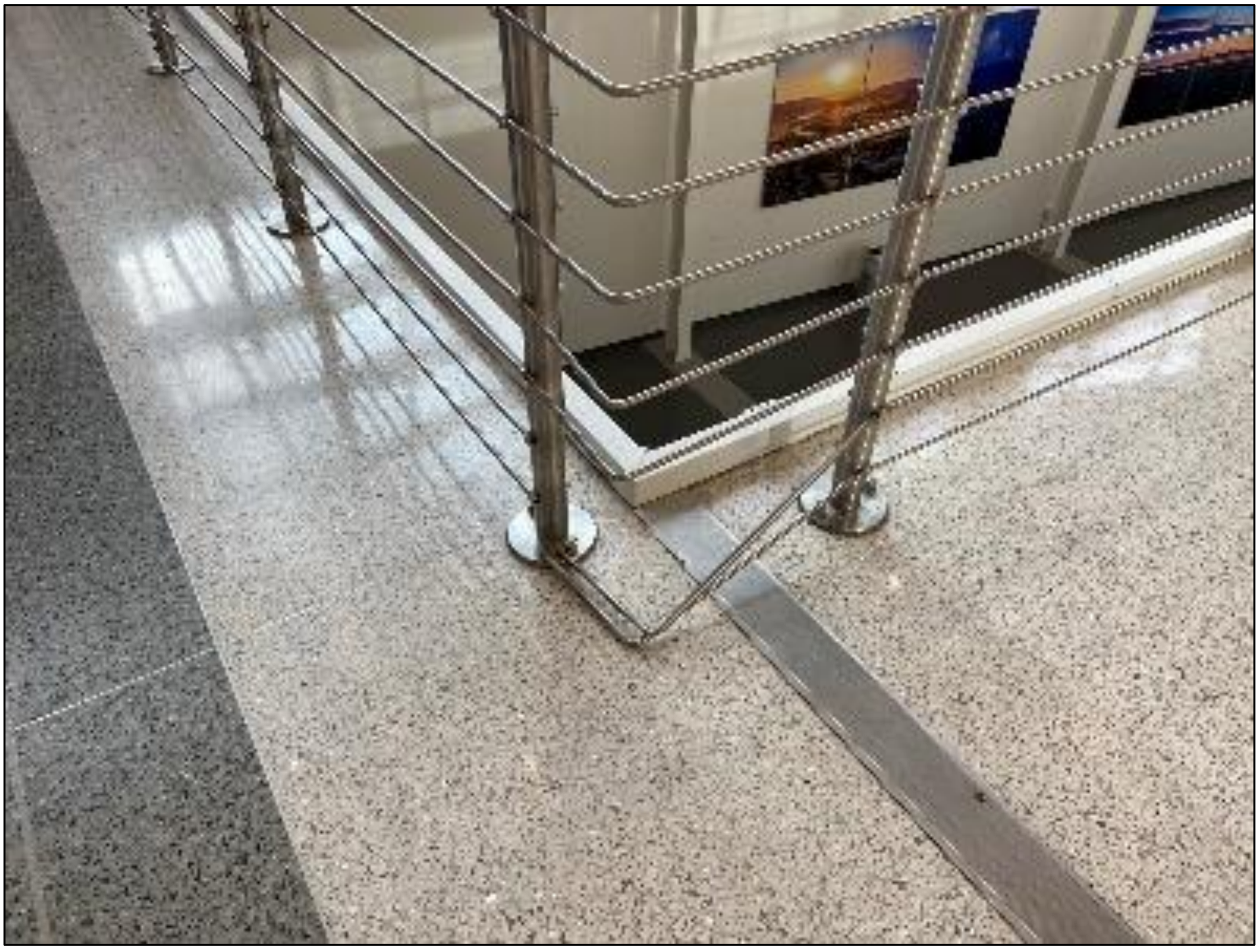

Figure 67. Rough Rider Center - Broken Horizontal Rails on Rough Rider Center Railings

2.5.8 Veteran's Memorial Building

The Veteran's Memorial Building is a structural steel framed and CMU structure that was built in 1995. The architectural and structural facility grades are provided in **Table 33**, and the mechanical and electrical grades are provided in **Table 34**.

Table 33. Veteran's Memorial Building - Architectural and Structural Facility Component Grades

Architectural and Structural Facility Components	Condition Grade	Function Grade
Site Accessibility (Parking, Entry/Exit Points, Sidewalks)	N/A	F
Exterior Walls	A	A
Exterior Doors	A	A
Exterior Windows	A	A
Roof	C	A
Interior Flooring	A	A
Interior Walls	A	A
Interior Doors	A	A
General Circulation (Stairs / Elevators / Railings)	A	A
Compliance (ADA, Fire Escapes, etc.)	A	C

Table 34. Veteran's Memorial Building - Mechanical and Electrical Facility Component Grades

Mechanical and Electrical Facility Components	Condition Grade	Function Grade
Lighting	C	C
Electrical Systems	B	C
Fire Suppression	N/A	N/A
Fire Alarm	B	A
Communications	C	C
HVAC Systems – Gym	C	B
HVAC Systems – VA	A	A
Plumbing Systems	A	A

Specific facility observations identified on the Veteran's Memorial Building walkthrough include the following:

- General Notes
    - The building is currently underutilized.
    - Flooring throughout the building is in good condition, except for the gym floor which is in need of improvement.

- Site Accessibility (Parking, Entry/Exit Points, Sidewalks)
    - No dedicated parking lot. However, the parking lot east of City Hall is available for parking when not being utilized by the Preschool.

- Roof
    - A roof improvement project was completed in 2020.

- Compliance (ADA, Fire Escapes, etc.)
    - Wheelchair lift is not practical and requires regular maintenance.

- Lighting
    - The events center side of the facility is predominately HID type lights (no instant on) and old T12 fluorescent lamp type fixtures. The gymnasium and south lobby should be considered for a lighting upgrade in future. Significant energy savings will be realized by replacing the HID lights with LED.

- Electrical
    - The shared (City Hall & Vets Center) electrical service was recently upgraded, and the facility is backed up by a diesel generator. However, most of the existing branch panels in the facility are full, making adds/moves/changes a challenge. The City should be aware that some future simple projects may incur additional costs associated with adding branch panels to the electrical system. On the other hand, it is not prudent to add branch panels to the facility, until the need arises.

- Fire Alarm
    - The City Hall fire alarm system extends into the gymnasium/vets building with similar coverage as described in City Hall narrative.

- Networking
    - City Hall networking is extended into the gymnasium/vets building with similar description to the City Hall narrative.

- HVAC System
    - The gym air handler is showing signs of age and has estimated remaining useful life of 5-7 years.
    - The furnace has an estimated remaining useful life of 15 years.

- The water heater has an estimated remaining useful life of 10 years.

Images of key observations and potential improvement areas are provided in **Figure 68** and **Figure 69**.

Figure 68. Veteran's Memorial Building - Wheelchair Lift

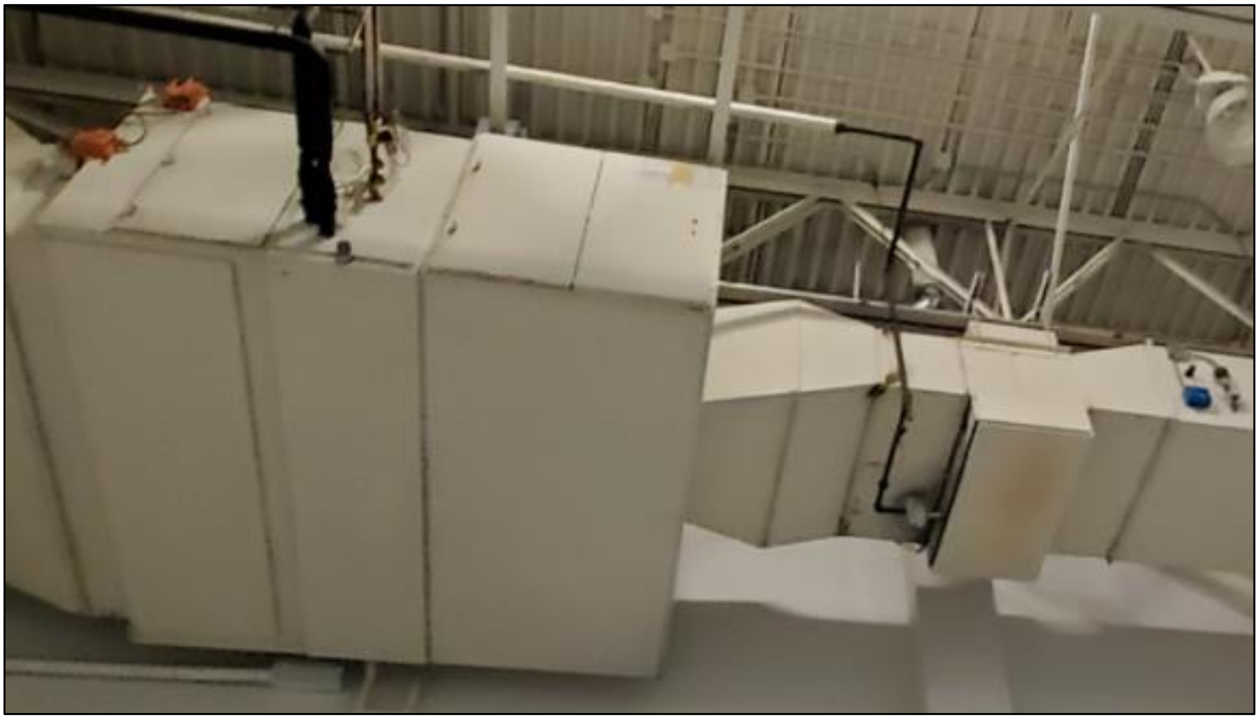

Figure 69. Veteran's Memorial Building - Gym Air Handling Unit

2.5.9 *Visitor Center*

The Visitor Center is a glulam wood framed structure that was built in 2006. The architectural and structural facility grades are provided in Table 35, and the mechanical and electrical grades are provided in Table 36.

Table 35. Visitor Center - Architectural and Structural Facility Component Grades

Architectural and Structural Facility Components	Condition Grade	Function Grade
Site Accessibility (Parking, Entry/Exit Points, Sidewalks)	C	D
Exterior Walls	B	A
Exterior Doors	A	A
Exterior Windows	A	A
Roof	A	A
Interior Flooring	A	A
Interior Walls	A	A
Interior Doors	A	A
General Circulation (Stairs / Elevators / Railings)	D	A
Compliance (ADA, Fire Escapes, etc.)	A	A

Table 36. Visitor Center - Mechanical and Electrical Facility Component Grades

Mechanical and Electrical Facility Components	Condition Grade	Function Grade
Lighting	B	A
Electrical Systems	B	B
Fire Suppression	F	F
Fire Alarm	N/A	F
Communications	C	B
HVAC Systems	C	B
Plumbing Systems	A	A

Specific facility observations identified on the Visitor Center Facility walkthrough include the following:

- General Notes
  - Humidity in basement is a concern, especially for a museum; sump pump was added due to ground water.
  - Pipe condensation / leaking in storage room.
  - The ceiling tiles in basement stained in various locations.

- Site Accessibility (Parking, Entry/Exit Points, Sidewalks)
  - Parking on Main Street is a problem.
  - Possible issues with retaining wall on west side that require further investigation. The corner of the drive thru is too tight causing drivers to either hit the retaining wall or cut the corner too short and hit the bollard or even transformer.

- Exterior Walls
  - A draft exists in the upper office and needs to be corrected where the roof and wall meet. The space behind the glulam beam is not sealed, and there is currently batt insulation stuffed in it.

- Roof
  - The roof is 17 years old with an original life expectancy of 20 years. It should be replaced in the next 5 years.

- General Circulation (Stairs / Elevators / Railings)
  - The deck boards need replacement.
  - The railing needs painting.
  - The east patio deck has deflection issues.
  - The ramp landing has failed boards.
  - It has been reported by staff that the elevator needs constant maintenance.

- Lighting
  - The building has been retrofitted with LED type lamps. Although the light fixtures are older, they are in acceptable condition and have an estimated remaining useful life of 10-15 years.

- Electrical
  - The electrical service is adequate. The branch panels have space available for adds/moves/changes. They system's estimated remaining useful life is 15-20 years.

- Fire Alarm
  - The building does not have a fire alarm system. By code, this building's occupancy classification does not require it to have a fire alarm system. However, based on the irreplaceable nature of the contents of the building, it is recommended to install a fire alarm system with full smoke detector coverage as soon as possible.

- Networking
    - Existing phone and data cabling is Cat 5e. This category cable is older technology and may not support the higher bandwidth requirements of some current equipment. It is recommended that the network cabling be upgraded to Cat 6 within the next 5 years.

- Security
    - The building incorporates a surveillance system with good coverage.

- Fire Suppression
    - There is no fire suppression in the facility.

- HVAC System
    - Furnaces have an estimated remaining useful life of 15 years.
    - Condensing units are showing signs of age.

Images of key observations and potential improvement areas are provided in Figure 70 through Figure 73.

Figure 70. Visitor Center - Exterior Parking

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Figure 71. Visitor Center - Deck Railing

Figure 72. Visitor Center - Basement Pipes

Figure 73. Visitor Center - Condensing Units

2.5.10 Wolf Pup Preschool

The Wolf Pup Preschool is a CMU building with an unknown original construction date. The architectural and structural facility grades are provided in Table 37, and the mechanical and electrical grades are provided in Table 38.

Table 37. Wolf Pup Preschool - Architectural and Structural Facility Component Grades

Architectural and Structural Facility Components	Condition Grade	Function Grade
Site Accessibility (Parking, Entry/Exit Points, Sidewalks)	C	F
Exterior Walls	F	A
Exterior Doors	A	A
Exterior Windows	B	A
Roof	B	A
Interior Flooring	A	A
Interior Walls	A	A
Interior Doors	A	A
General Circulation (Stairs / Elevators / Railings)	A	A
Compliance (ADA, Fire Escapes, etc.)	A	B

Table 38. Wolf Pup Preschool - Mechanical and Electrical Facility Component Grades

Mechanical and Electrical Facility Components	Condition Grade	Function Grade
Lighting	A	A
Electrical Systems	B	B
Fire Suppression	N/A	N/A
Fire Alarm	A	A
Communications	C	B
HVAC Systems	B	A
Plumbing Systems	A	A

Specific facility observations identified on the Wolf Pup Preschool walkthrough include the following:

- Site Accessibility (Parking, Entry/Exit Points, Sidewalks)
    - The asphalt parking lot possibly needs to be redone. There is no exterior playground or greenspace for kids. The fenced area is asphalt.

- Exterior Walls
    - The exterior insulation finishing system (EIFS) has multiple areas that need repair. Recommend removing EIFS down to CMU depending on future look of building that is trying to be achieved, or patch and repair. It appears that EIFS has exceeded its life expectancy.
    - The paint is peeling on the CMU of the back wall and needs to be repainted. Broken CMU needs to be repaired.

- Exterior Windows
    - It's recommended to update all windows in 5-10 years.

- Roof
    - The roof age is unknown. The roof should be further inspected to ensure it's functioning appropriately and has sufficient life remaining.

- Compliance (ADA, Fire Escapes, etc.)
    - There is a settlement issue with the top of ADA ramp and landing.
    - The rear ramp has no handrails.

- Lighting
    - The building consists of new LED type light fixtures with an estimated remaining useful life of 20 years.

- Electrical
    - Circuit breakers are still readily available for the electrical distribution system. The existing branch panel is almost full, making adds/moves/changes a challenge. The City should be aware that some future simple projects may incur additional costs associated with adding branch panels to the electrical system. On the other hand, it is not prudent to add branch panels to the facility, until the need arises.

- Fire Alarm
    - The facility incorporates a new addressable fire alarm panel with full smoke detector coverage. The estimated remaining useful life is 20 years.

- Networking
    - Existing phone and data cabling is Cat 5e. This category cable is older technology and may not support the higher bandwidth requirements of some current equipment. It is recommended that the network cabling be upgraded to Cat 6 within the next 5 years.

- Security
    - The building incorporates a surveillance system with good coverage.
- HVAC System
    - The furnaces have an estimated remaining useful life of 15 years.
- Plumbing
    - The water heater has an estimated remaining useful life of 10 years.

Images of key observations and potential improvement areas are provided in Figure 74 through Figure 76.

Figure 74. Wolf Pup Preschool - Existing Parking Lot and ADA Entrance Ramp

Figure 75. Wolf Pup Preschool - EIFS Needing Repair

Figure 76. Wolf Pup Preschool - Paint Peeling on CMU

2.5.11 Golf Course Maintenance Shop

The golf course maintenance shop was added for consideration after the facility reviews were conducted, so no formal facility walkthrough was performed. Based on discussions with City staff, the building needs improvement and lacks essential amenities including running water, bathrooms, and heating. It deemed necessary to program a project into the CIP to improve the golf course maintenance shop; this project is coupled with improving the golf course parking lot.

2.5.12 Facility Summary

The following tables provide a summary of the facility reviews based on the grading method provided throughout this Section.

- Table 39 – Provides a summary of the architectural / structural facility reviews.
- Table 40 – Provides a summary of the mechanical / electrical facility reviews.
- Table 41 – Provides a comprehensive summary of the facility reviews.

Table 39. Summary of Architectural and Structural Component Reviews

Facility	Condition GPA	Function GPA	Cumulative GPA	Overall Grade
City Shops - Old	0.0	1.2	0.6	F
Fire Hall	1.8	2.8	2.3	C-
Fox Hills Clubhouse	2.8	3.3	3.1	B
Wolf Pup Preschool	3.2	3.5	3.4	B+
Visitor Center	3.4	3.7	3.6	A-
Veterans Memorial Building	3.8	3.4	3.6	A-
City Hall and Civic Center	3.5	3.7	3.6	A
Rough Rider Center	3.9	3.7	3.8	A+
Emergency Services (Rural Fire and Ambulance)	3.8	4.0	3.9	A+
City Shop (2017)	4.0	4.0	4.0	A+
Golf Course Maintenance Shop	Not Reviewed	Not Reviewed	Not Reviewed	Not Reviewed

Table 40. Summary of Mechanical and Electrical Component Reviews

Facility	Condition GPA	Function GPA	Cumulative GPA	Overall Grade
City Shops - Old	1.2	1.4	1.3	F
Fire Hall	1.9	2.4	2.1	D+
Visitor Center	2.3	2.4	2.4	C-
Veterans Memorial Building	2.9	3.0	2.9	B-
Fox Hills Clubhouse	2.9	3.3	3.1	B
City Hall and Civic Center	3.2	3.0	3.1	B
Wolf Pup Preschool	3.3	3.7	3.5	A-
Rough Rider Center	3.8	3.6	3.7	A
Emergency Services (Rural Fire and Ambulance)	3.6	4.0	3.8	A+
City Shop (2017)	4.0	3.7	3.8	A+
Golf Course Maintenance Shop	Not Reviewed	Not Reviewed	Not Reviewed	Not Reviewed

Table 41. Comprehensive Facility Review Summary

Facility	Condition GPA	Function GPA	Cumulative GPA	Overall Grade
City Shops - Old	0.6	1.3	1.0	F
Fire Hall	1.8	2.6	2.2	C-
Visitor Center	2.9	3.1	3.0	B-
Fox Hills Clubhouse	2.8	3.3	3.1	B
Veterans Memorial Building	3.3	3.2	3.3	B+
City Hall and Civic Center	3.3	3.4	3.3	B+
Wolf Pup Preschool	3.3	3.6	3.4	A-
Rough Rider Center	3.9	3.7	3.8	A
Emergency Services (Rural Fire and Ambulance)	3.7	4.0	3.9	A+
City Shop (2017)	4.0	3.8	3.9	A+
Golf Course Maintenance Shop	Not Reviewed	Not Reviewed	Not Reviewed	Not Reviewed

The City's facilities are generally in good condition. However, some of the facilities, including the old City Shops and Fire Hall require significant near-term attention. These facilities have been programmed into the CIP for complete replacement.

Various O&M improvements are recommended, prioritized, and outlined in Section 6.1.1.4. It's highly recommended for the City to hire a Facilities Manager to oversee and manage the required O&M at each facility. It would also be beneficial to have a Facilities Manager on staff as the City takes on new projects or additional facilities.

Chapter 3. Future Conditions and Growth

This Chapter includes reviewing Watford City historical population data, population projections, and potential growth areas. It also considers reviewing growth-related projects from past planning efforts and newly identified projects included in this Master Plan.

3.1 Population Analysis

In this section, historical population data and previously developed population projections were reviewed and analyzed to develop new projections as the population growth basis for the Master Plan.

3.1.1 Historical Population

Historical population data was reviewed to understand how the City has grown over the past 20 years. The past populations for Watford City is presented in Figure 77 and is based on U.S. Census Bureau data since 2000 (census estimates shown in gray; actual census decennial populations are shown in red). Over the years and through times of oil and economic booms, the growth rate has experienced wide variations. For example, from 2000 to 2010, a time period where oil activity was very limited, the City experienced an average annual growth rate of 2.0%. More recently during the Bakken oil boom that occurred throughout the mid-2010s, the City grew from 1,744 in 2010 to 6,207 in 2020, an average annual growth rate of 13.5%.

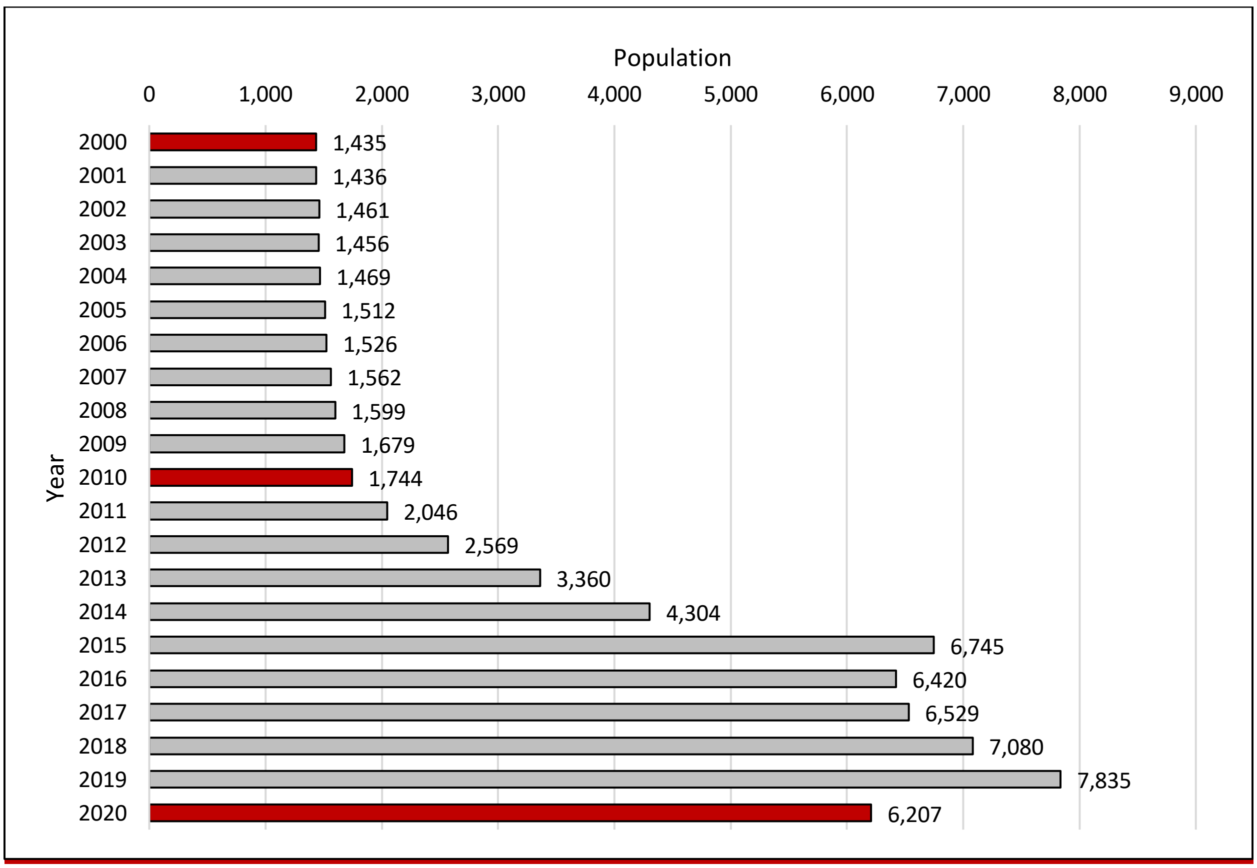


Figure 77. Watford City Historical Population

3.1.2 Population and Growth Scenario Development

Six previously developed population projections (from past planning and study efforts) were reviewed and evaluated. The previously developed population projections reviewed for this study are presented in Table 42, as well as displayed graphically in Figure 78.

Table 42. Population Growth Scenarios

Scenario	Growth Rate	Source	Year Conducted	Developed and Supported By
Scenario 1	3.94%	Watford City Enrollment Analysis	2021	RSP
Scenario 2	5.70%	Energy Impact Study – Watford City Projected Growth Rate	2017	Western Dakota Energy Association and AE2S
Scenario 3	2.60%	Energy Impact Study – McKenzie Projected County Growth Rate	2017	Western Dakota Energy Association and AE2S
Scenario 4	1.40%	Williston Basin Employment, Population, and Housing Forecasts – Low Growth Projection	2016	Vision West and NDSU
Scenario 5	2.00%	Williston Basin Employment, Population, and Housing Forecasts – Moderate Growth Projection	2016	Vision West and NDSU
Scenario 6	2.80%	Williston Basin Employment, Population, and Housing Forecasts – High Growth Projection	2016	Vision West and NDSU

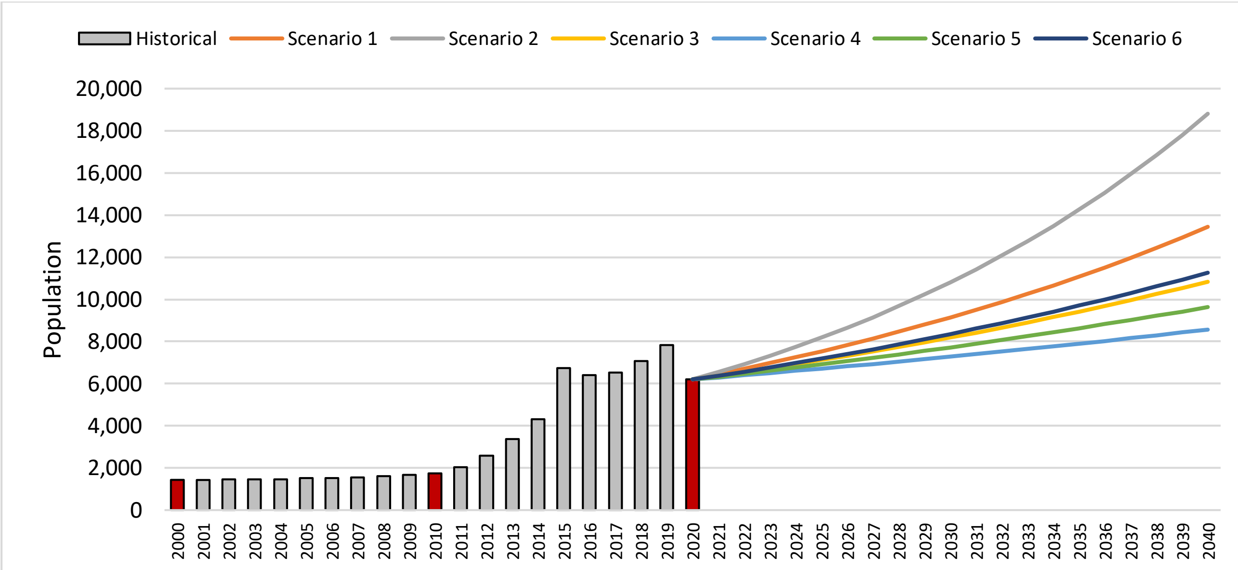


Figure 78. Population Growth Scenarios - Previously Developed Projections

Because six population projections provide a wide variety of outcomes, ranging from 8,600 people by 2040 on the low-end (Scenario 4) to 18,800 people by 2040 on the high-end (Scenario 2), two *modified* growth projection scenarios (defined as Scenario 7 and Scenario 8 below) within the range of the six population projections represented in **Figure 79**. Scenario 7 and Scenario 8 represent the 75th and 25th percentiles calculated from the population projection data shown in the figure above.

- Scenario 7 – Modified Growth Projection I
  - 3.7% Annual Growth Rate
- Scenario 8 – Modified Growth Projection II
  - 2.4% Annual Growth Rate

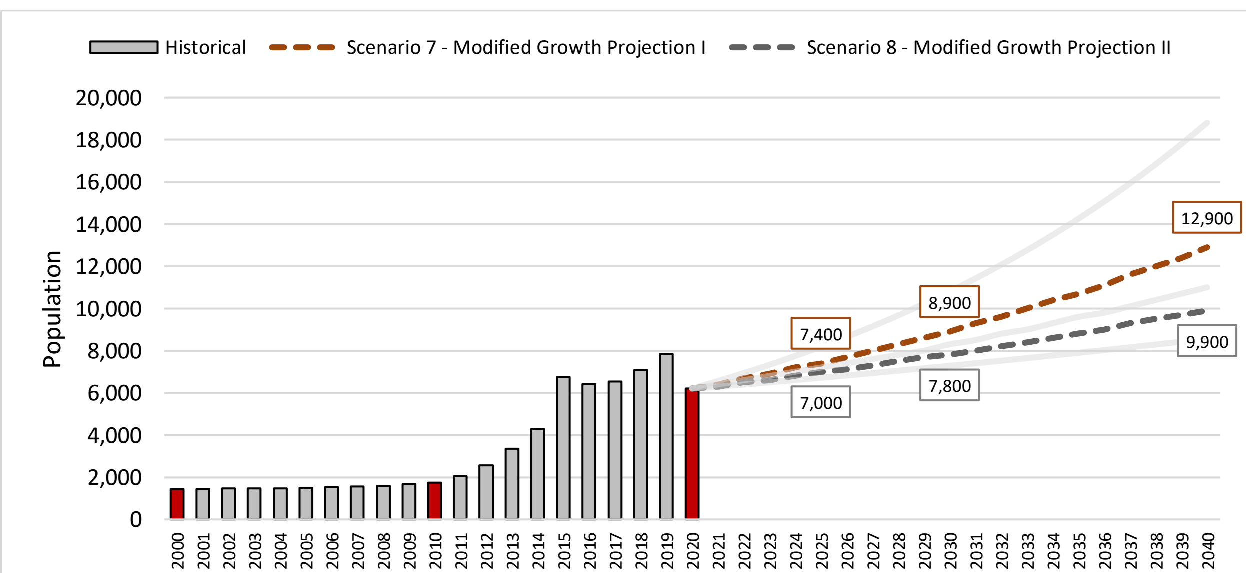


Figure 79. Population Projections

As shown, it's projected that Watford City will grow within the population ranges below at the following respective years:

- 2025 -> 7,000 to 7,400 people
- 2030 -> 7,800 and 8,900 people
- 2040 -> 9,900 and 12,900 people

Based on Watford City's existing City limit area of 5,750 acres and extra territorial area (ETA) of 18,650 acres and 2020 census population of 6,207 people, gross population densities could be calculated. Traditionally this exercise would only be conducted using the City limit area; however, ETA was utilized because some developed neighborhoods have not been annexed into the City limits at the time of this Master Plan. Once the gross population densities were calculated, those densities coupled with the population projections allowed for new development acres to be estimated. The findings from the population density analysis is provided in Table 43 below.

Table 43. Population Density Analysis and Estimated New Development Acreages

	Density Scenario	Area (acres)	Population Density (People per Acre)	Total New Development Acres by 2025	
				7,000 People	7,400 People
2025 Density Analysis	ETA Calculated Density	18,650	0.33	262	394
	City Limit Calculated Density	5,750	1.08	856	1,288
	Average of Total New Development Acres by 2025			560 to 850	
	Density Scenario	Area (acres)	Population Density (People per Acre)	Total New Development Acres by 2030	
				7,800 People	8,900 People
2030 Density Analysis	ETA Calculated Density	18,650	0.33	526	889
	City Limit Calculated Density	5,750	1.08	1,720	2,908
	Average of Total New Development Acres by 2030			1,130 to 1,900	
	Density Scenario	Area (acres)	Population Density (People per Acre)	Total New Development Acres by 2040	
				9,900 People	12,900 People
2040 Density Analysis	ETA Calculated Density	18,650	0.33	1,219	2,209
	City Limit Calculated Density	5,750	1.08	3,988	7,228
	Average of Total New Development Acres by 2040			2,610 to 4,720	

Some new population growth will be able to be accommodated through vacant residential units, but by looking at a range of densities and a range of population projections, the City can at least get an estimate of new development acres needed to accommodate population growth.

Even with development within the existing City limits (infill), new population growth will likely require new infrastructure. New development is hard to predict, because as funding becomes available for infrastructure, specifically major roads such as arterials and highways, greenfield development tends to follow. Previous planning efforts completed in 2017 and 2019 outlined various transportation, water, and wastewater projects driven by new growth. Those previously planned projects were reviewed carefully, omitted (if the project was completed or no longer relevant), and/or updated to reflect the current conditions of the City. Projects were also added to the respective lists of projects based on findings uncovered throughout this master planning process.

3.2 Future Infrastructure Needs and Drivers

This section is categorized into four subsections, where projects are organized by infrastructure system, including transportation system projects, water system projects, wastewater system projects, and facility projects. Additionally, the future growth projects have been associated with one of the following general areas, which are represented in Figure 80 below:

- Infill Growth
- Northwest Area Growth
- Northeast Area Growth
- Southeast Area Growth
- Southwest Area Growth

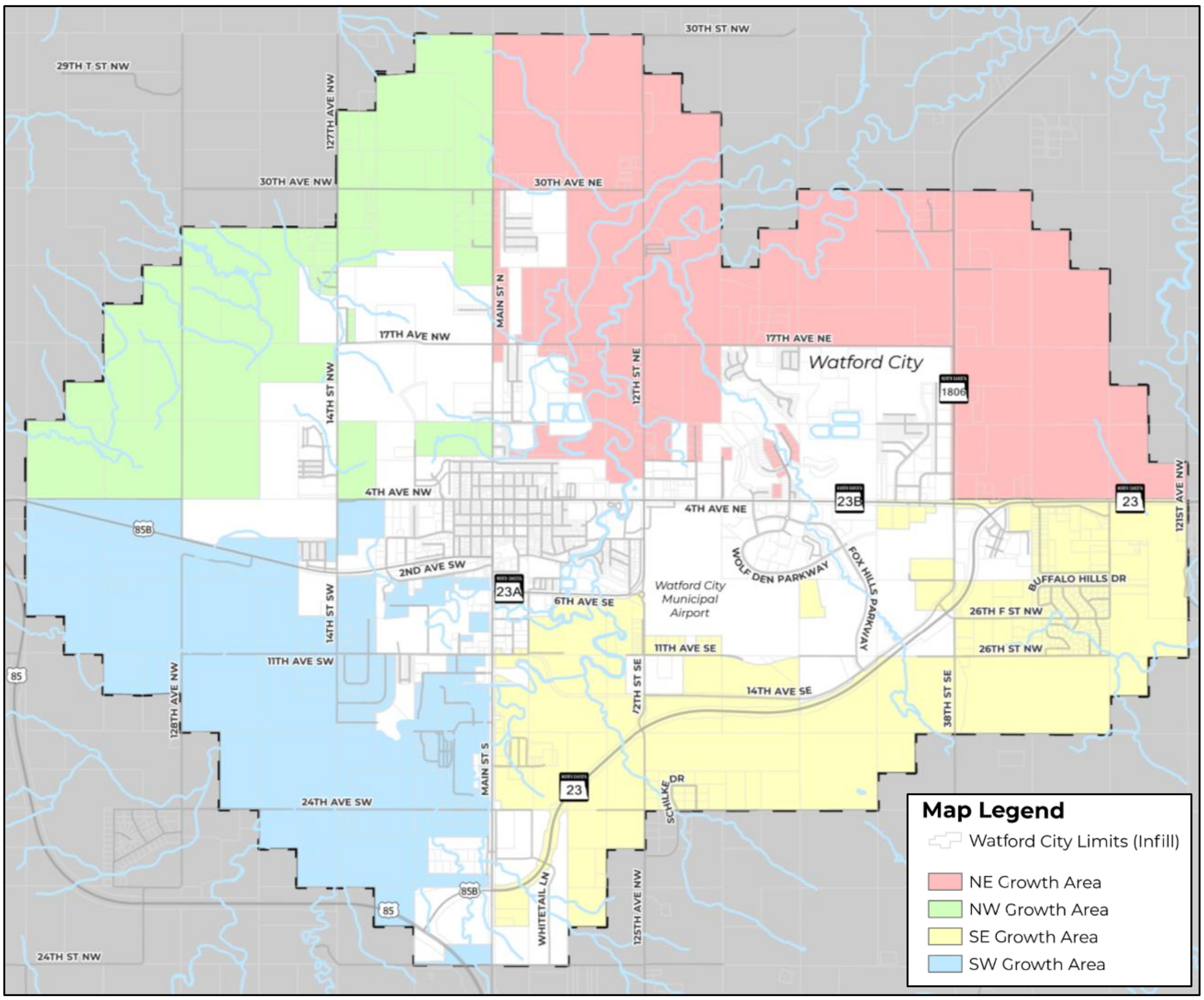


Figure 80. Growth Area Delineation

3.2.1 Future Growth Transportation System Projects

Future transportation system projects were identified through this Master Plan or from utilizing past planning efforts, including the Long-Range Transportation and Land Use Plan[5] and Capital Improvements Plan Update[6]. The future growth transportation system projects are provided in **Table 44**, along with their respective growth areas and estimated total project costs (2021 dollars). Additionally, the future transportation system projects are presented on a map in **Figure 81**.

The cost estimating process for future growth transportation system projects is as follows:

- Project cost estimates from projects carried forward from previous planning efforts were scaled to 2021 dollars utilizing the most recent Engineering News Record (ENR) Construction Cost Index (CCI). Detailed quantities were not provided for transportation system projects from past planning efforts.
- Projects that were identified through this Master Planning effort were cost estimated utilizing quantity takeoffs multiplied by unit costs, and then marked up with contingency and engineering, legal, and administrative fees.
- If a project cost estimate (after scaling to 2021 dollars) carried forward from a previous planning effort seemed inappropriate or off base, an assessment was done based on the proposed improvement and length of corridor to estimate project costs.

More information on how unit costs were applied to quantities and ultimately used to generate cost estimates is provided in **Section 6.3**, where the specific unit costs are provided in **Appendix E**.

[5] HDR. Watford City Long-Range Transportation and Land Use Plan. 2017.
[6] AE2S. Watford City Capital Improvements Plan Update. 2019.

Table 44. Future Growth Transportation System Projects and Associated Project Costs

Map ID[A]	Project Name	Existing Roadway? (Yes or No)	Existing Ownership	Growth Area	Total Estimated Project Costs (2021$)
1	2nd Avenue SW Shared Use Path (14th Street to Main Street)	No	State	Infill	$ 624,000[B]
2	ND 23 A (10th Street SW to Main Street)	No		Infill	$ 4,209,000
3	ND 23 A (14th Street SW to 10th Street SW)	No		Southwest	$ 2,094,000
4	11th Avenue S (Main Street to 12th Street SE)	No	City	Southeast	$ 4,193,000
5	24th Avenue SW (US 85 to 7th Street W)	Yes	County	Southwest	$ 15,224,000
6	14th Street SW (11th Avenue SW to 24th Avenue SW)	No		Southwest	$ 3,688,000
7	12th Street NE (17th Avenue NE to ND 23 B)	Yes	County	Northeast	$ 2,288,000
8	Extension of 6th Street NE (N of 6th Avenue NE to 17th Avenue NE)	No	City	Infill	$ 3,907,000
9	12th Street NE (17th Avenue NE to 30th Avenue NE)	Yes	County	Northeast	$ 9,344,000
10	6th Street NE (17th Avenue NE to 25th Avenue NE)	No	City	Northeast	$ 3,188,000
11	4th Avenue NW (28th Street NW to 14th Street NW)	No		Infill	$ 4,570,000
12	4th Avenue NW (40th Street NW to 28th Street NW)	No		Northwest	$ 4,933,000
13	11th Avenue SW (US 85 to 14th Street SW)	No		Southwest	$ 7,586,000
14	28th Street NW (4th Avenue NW to US 85)	Yes	County	Southwest	$ 914,000
15	28th Street SW (11th Avenue SW to 24th Avenue SW)	Yes	County	Southwest	$ 3,686,000
16	30th Avenue NE (CR 36 to ND 1806)	No		Northeast	$ 12,401,000
17	30th Avenue NE (Main Street to CR 36)	Yes	County	Northeast	$ 4,923,000
18	30th Avenue NE (CR 35 to Main Street)	Yes	County	Northwest	$ 5,080,000
19	24th Avenue SE (Main Street to CR 37)	Yes	County	Southeast	$ 18,518,000
20	17th Avenue NE (Main Street to 12th Street NE)	Yes	County	Northeast	$ 7,465,000
21	17th Avenue NW (14th Street NW to Main Street)	Yes	County	Infill	$ 3,711,000
22	CR 37 (ND 23 B to 5th Avenue SE)	Yes	County	Infill	$ 1,821,000
23	28th Street SW (US 85 to 11th Avenue SW)	Yes	County	Southwest	$ 2,752,000
Total Growth-Driven Transportation System Estimated Project Costs					**$ 127,119,000**

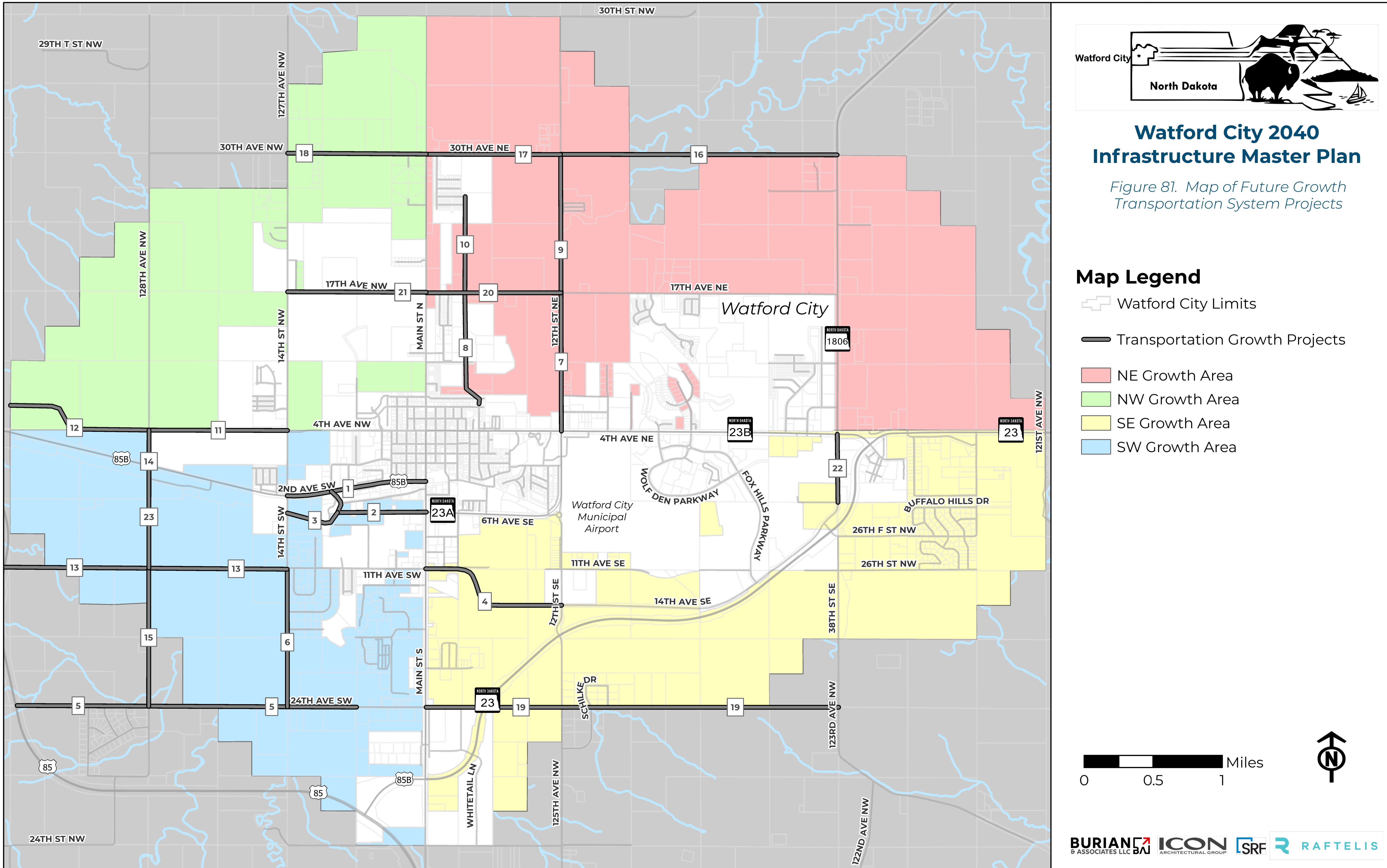
Notes:

A – Map ID does not correspond with project priority.
B – City's cost share is estimated to be $111,000.

Figure 8 (previously shown in Section 2.1.1.5) outlined a connectivity analysis, which identified several conceptual alignments that would improve system connectivity. The majority of the projects identified in the table above overlap with corridors outlined in the connectivity analysis.

Watford City 2040 Infrastructure Master Plan

Figure 81. Map of Future Growth Transportation System Projects



3.2.2 Future Growth Water System Projects

Future water system projects were identified through this Master Plan or from utilizing the previously developed Capital Improvements Plan Update[7]. The future growth water system projects are provided in Table 45, along with their respective growth areas and estimated total project costs (2021 dollars). Additionally, the future water system projects are presented on a map in Figure 82.

The cost estimating process for future growth water system projects is as follows:

- Detailed quantities were provided for water system projects from past planning efforts.
- Projects that were identified through this Master Planning effort or for projects that were carried forward from past planning efforts were cost estimated utilizing quantity takeoffs multiplied by unit costs, and then marked up with contingency and engineering, legal, and administrative fees.

More information on how unit costs were applied to quantities and ultimately used to generate cost estimates is provided in Section 6.3, where the specific unit costs are provided in Appendix E.

[7] AE2S. Watford City Capital Improvements Plan Update. 2019.

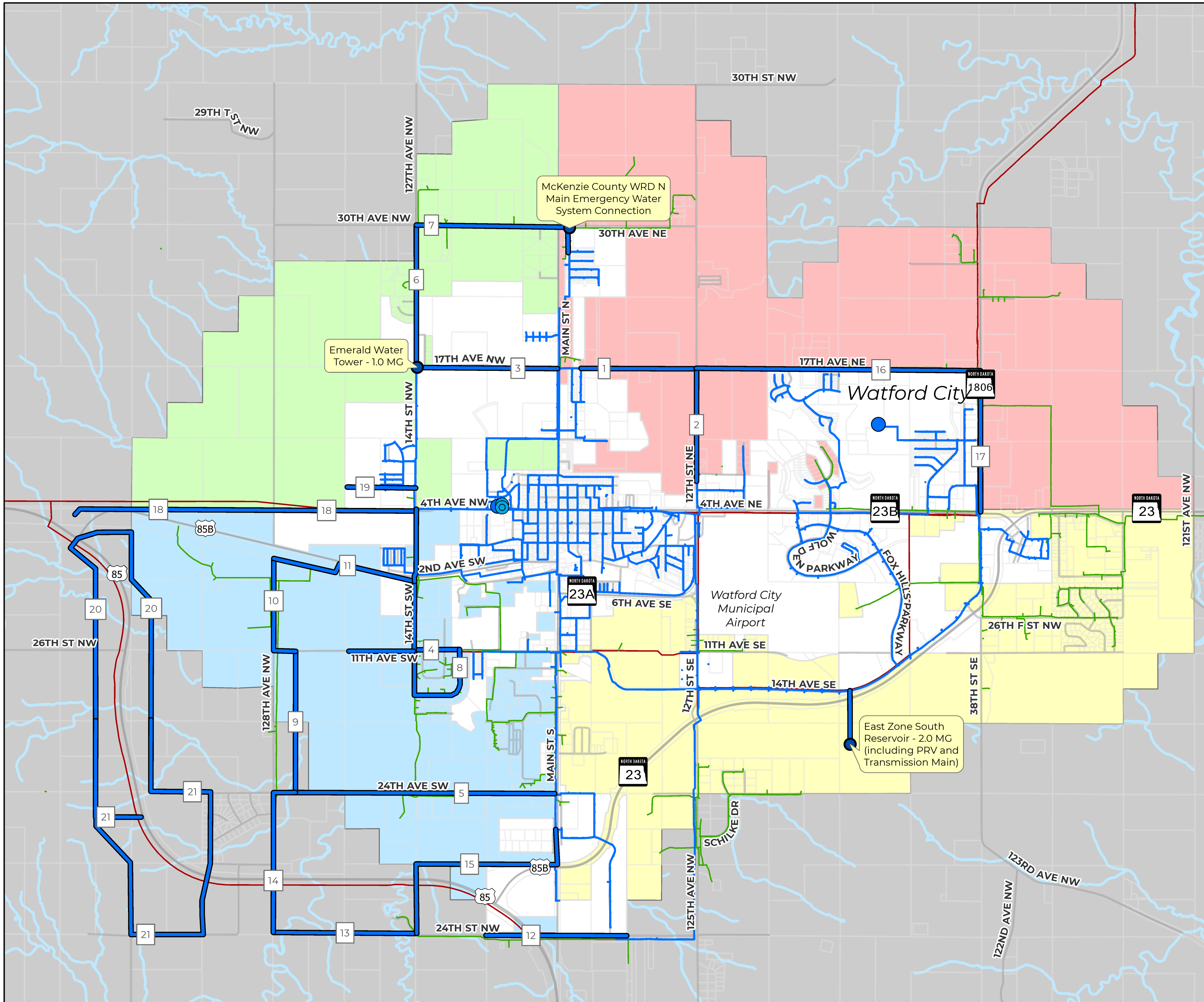
Table 45. Future Growth Water System Projects and Associated Project Costs

Map ID(A)	Project Name	Growth Area	Total Estimated Project Costs (2021$)
1	17th Avenue N (Between Pheasant Ridge and 12th Street NE)	Northeast	$ 1,103,000
2	12th Street NE (Between 6th Avenue N and 17th Avenue N)	Northeast	$ 1,065,000
3	17th Avenue N (Between Main Street and 14th Street W)	Infill	$ 803,000
4	11th Avenue SW (Between 11th Street SW and 14th Street SW)	Southwest	$ 769,000
5	24th Avenue SW (Between Main Street and 26th Street W)	Southwest	$ 2,497,000
6	14th Street NW (Between 17th Avenue NW and 30th Avenue NW)	Northwest	$ 1,344,000
7	30th Avenue NW (Between 14th Street NW and Main Street)	Northwest	$ 1,091,000
8	11th Street SW (South of 11th Avenue SW to 15th Avenue SW and up 14th Street SW)	Southwest	$ 550,000
9	26th Street SW (Between 11th Avenue SW and 24th Avenue SW)	Southwest	$ 1,319,000
10	28th Street SW (Between US 85 and 11th Avenue SW)	Southwest	$ 1,078,000
11	US 85 (Between 28th Street SW and 14th Street SW)	Southwest	$ 1,331,000
12	37th Avenue S (Between 7th Street SW and 6th Street SE)	Southwest/Southeast	$ 888,000
13	37th Avenue SW (Between 28th Street SW and 14th Street SW)	Southwest	$ 888,000
14	28th Street SW (Between 24th Avenue SW and 37th Avenue SW)	Southwest	$ 1,031,000
15	30th Avenue SW (Between 14th Street SW and Main Street; Including 14th Street SW south to 37th Avenue SW)	Southwest	$ 1,530,000
16	17th Avenue NE (between 12th Street NE and 37th Street NE)	Northeast	$ 1,792,000
17	ND 1806 (Between 17th Avenue NE and ND 23 B)	Northeast	$ 1,048,000
18	4th Avenue N (Between US 85 Bypass and 14th Street W; Include PRV)	Northeast/Southeast	$ 3,786,000
19	6th Avenue NW (West of 14th Street NW)	Infill	$ 546,000
20	US 85 Bypass West Loop (North Half)	Southwest	$ 1,864,000
21	US 85 Bypass West Loop (South Half)	Southwest	$ 2,751,000
N/A	McKenzie County WRD N Main Emergency Water System Connection	Infill	$ 85,000(B)
N/A	Emerald Water Tower - 1.0 MG	Infill	$ 4,713,000
N/A	East Zone South Reservoir - 2.0 MG (including PRV and Transmission Main)	Southeast	$ 5,688,000
	Total Growth-Driven Water System Estimated Project Costs		$ 39,560,000

Notes:

A – Map ID does not correspond with project priority.

B – City's cost share is estimated to be $21,111.



Watford City 2040 Infrastructure Master Plan

Figure 82. Map of Future Growth Water System Projects

Map Legend

- Watford City Limits
- Existing Ground Storage
- Existing Water Tower
- NE Growth Area
- NW Growth Area
- SE Growth Area
- SW Growth Area
- MCWRD Existing Water Mains
- WAWSA Existing Water Mains
- Watford City Existing Water Mains

3.2.3 Future Growth Wastewater System Projects

Similar to the water system, future wastewater system projects were identified through this Master Plan or from utilizing the previously developed Capital Improvements Plan Update[8]. The future growth wastewater system projects are provided in **Table 46**, along with their respective growth areas and total estimated project costs (2021 dollars). Additionally, the future wastewater system projects are presented on a map in **Figure 83**.

The cost estimating process for future growth wastewater system projects is as follows:

- Detailed quantities were provided for water system projects from past planning efforts.
- Projects that were identified through this Master Planning effort or for projects that were carried forward from past planning efforts were cost estimated utilizing quantity takeoffs multiplied by unit costs, and then marked up with contingency and engineering, legal, and administrative fees.

More information on how unit costs were applied to quantities and ultimately used to generate cost estimates is provided in **Section 6.3**, where the specific unit costs are provided in **Appendix E**.

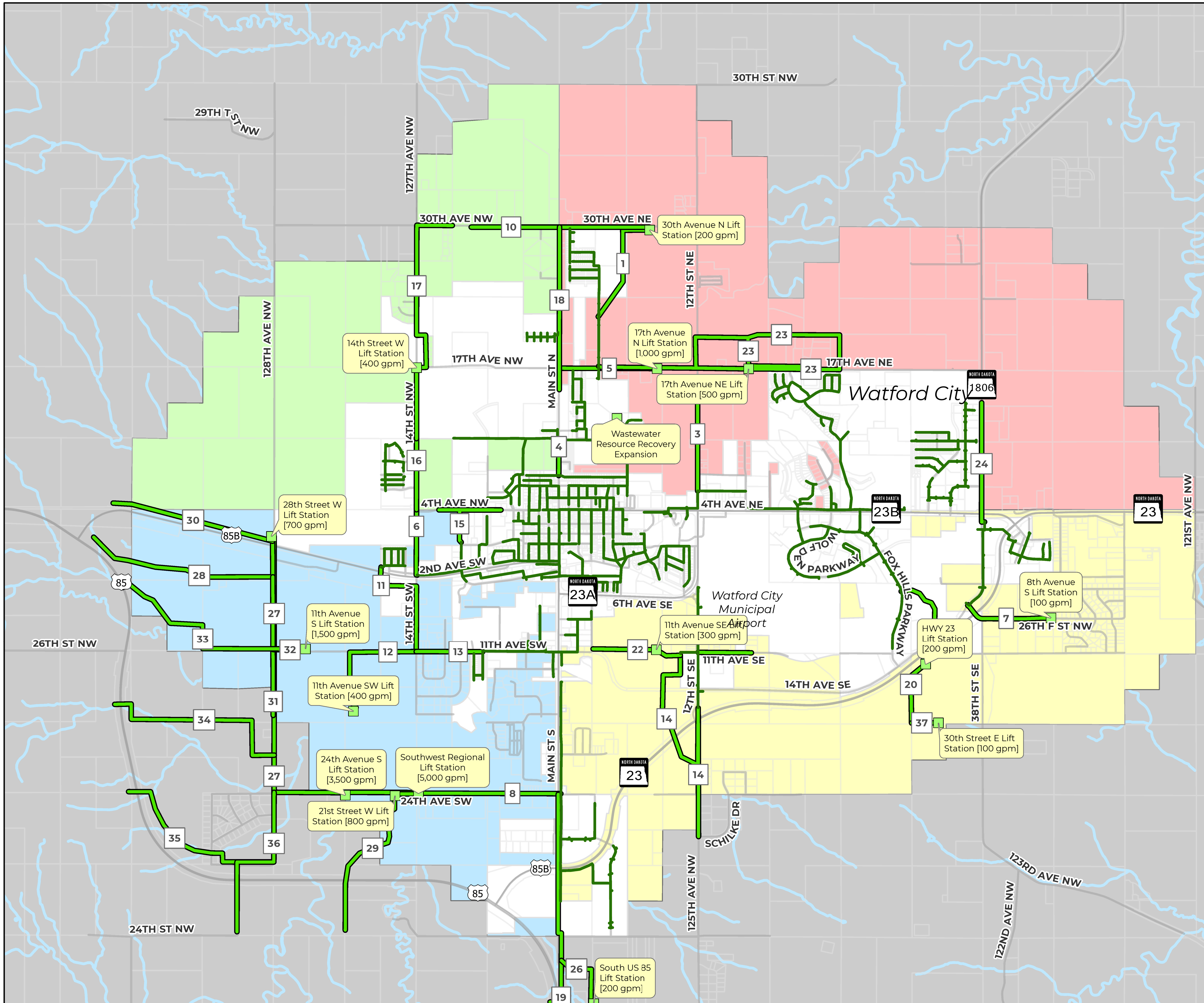
[8] AE2S. Watford City Capital Improvements Plan Update. 2019.

Table 46. Future Growth Wastewater System Projects and Associated Project Costs

Map ID	Project Name	Growth Area	Total Estimated Project Costs (2021$)
1	30th Avenue N Lift Station [200 gpm], Forcemain, and Gravity Sewer (to South)	Northeast/Infill	$ 806,000
2	11th Avenue S Gravity Sewer (East of 12th Street E)	Southeast/Infill	$ 821,500
3	12th Street E Gravity Sewer (just South of 17th Avenue N to 6th Avenue N)	Northeast	$ 294,500
4	Main Street Gravity Sewer (between 10th Avenue N to 7th Avenue N)	Infill	$ 186,000
5	17th Avenue N Gravity Sewer (between Main Street and 12th Street E), including Lift Station [1,000 gpm] and Forcemain)	Northeast	$ 2,852,000
6	14th Street W Gravity Sewer (between 4th Avenue N and US 85)	Southwest/Infill	$ 356,500
7	8th Avenue S Lift Station [100 gpm] and Forcemain	Southeast	$ 341,000
8	24th Avenue S Gravity Sewer (between SWRLS and Main Street)	Southwest	$ 1,410,500
9	Southwest Regional Lift Station [5,000 gpm] and Forcemain	Southwest	$ 10,664,000
10	30th Avenue N Gravity Sewer (just East of 14th Street W to Lift Station)	Northwest/Northeast	$ 1,209,000
11	14th Street W Gravity Sewer (between 11 Avenue S and North to US 85)	Southwest/Infill	$ 682,000
12	11th Avenue S Gravity Sewer (west of 14th Street W and South to Lift Station [400 gpm] and Forcemain)	Southwest	$ 3,007,000
13	11th Avenue S Gravity Sewer (between 7th Street W and 14th Street W)	Southwest/Infill	$ 372,000
14	12th Street SE Gravity Sewer (between 28th Avenue S [north branch and northwest branch] to Existing Gravity Sewer Connections)	Southeast	$ 2,340,500
15	4th Avenue N Gravity Sewer (between 7th Street W and 12th Street W)	Infill	$ 899,000
16	14th Street W Gravity Sewer (between 4th Avenue N and 10th Avenue N)	Infill	$ 372,000
17	14th Street W Gravity Sewer (Between 10th Avenue N and 30th Avenue N including Lift Station [400 gpm] and Forcemain)	Infill/Northwest	$ 2,139,000
18	Main Street Gravity Sewer (between 15th Avenue N and 30th Avenue N)	Infill	$ 868,000
19	South Main Street Gravity Sewer (43rd Avenue S to 24th Avenue S)	Infill	$ 1,581,000
20	HWY 23 Lift Station [200 gpm], Forcemain, and Sewer at 32nd Street E	Infill/Southeast	$ 945,500
21	Wastewater Treatment System Expansion (population to 15,000)	Infill	$ 15,500,000
22	11th Avenue S Gravity Sewer (between 4th Street E and 12th Street E including Lift Station [300 gpm] and Forcemain)	Southeast	$ 759,500
23	17th Avenue N Gravity Sewer (East of 12th Street E including Sewer to North, Lift Station [500 gpm], and Forcemain to the West)	Northeast	$ 3,208,500
24	HWY 1806 Gravity Sewer (between 12th Avenue N and Lift Station 6B)	Northeast/Infill	$ 682,000
25	24th Avenue S Gravity Sewer (between 28th Street W and SWRLS), including Lift Station [3,500 gpm] and Force Main	Southwest	$ 4,913,500
26	South HWY 85 Lift Station [200 gpm] and Forcemain (43rd Avenue S to Main Street)	Southeast (out of ETA)	$ 558,000
27	28th St W Lift Station [700 gpm], Forcemain, and Gravity Sewer (North End of 28th Street W and South to 24th Ave S)	Southwest	$ 2,976,000
28	4th Avenue S (HWY 85 Bypass East to 28th Street and North to Lift Station)	Southwest	$ 1,379,500
29	21st Street W Lift Station [800 gpm], Gravity Sewer, and Forcemain (between 37th Avenue S and 24th Avenue S)	Southwest	$ 2,790,000
30	US 85 North Gravity Sewer (42 Street W to 28th Street W)	Southwest	$ 1,116,000
31	28th Street W Gravity Sewer (between 17th Avenue S and 4th Avenue S)	Southwest	$ 790,500
32	11th Avenue S Lift Station [1,500 gpm] and Forcemain (26th Street W and 28th Street W and South to 17th Avenue S)	Southwest	$ 2,557,500
33	11th Avenue S Gravity Sewer (between US 85 Bypass and 28th Street W)	Southwest	$ 1,984,000
34	17th Avenue S Gravity Sewer (between US 85 Bypass and 28th Street W)	Southwest (out of ETA)	$ 1,302,000
35	South 85 Bypass Gravity Sewer (US 85 Bypass to 31st Street W)	Southwest (out of ETA)	$ 914,500
36	31st Street W Gravity Sewer (including 30th Avenue S and North to the Corner of 28th Street W and 24th Avenue S)	Southwest (out of ETA)	$ 1,550,000
37	30th Street E and 17th Avenue S Lift Station [100 gpm] and Forcemain	Southeast	$ 589,000
Total Growth-Driven Wastewater System Estimated Project Costs			$ 75,717,500

Notes:

A – Map ID does not correspond with project priority.



Watford City 2040 Infrastructure Master Plan

Figure 83. Map of Future Growth Wastewater System Projects

Map Legend

- Watford City Limits
- NE Growth Area
- NW Growth Area
- SE Growth Area
- SW Growth Area

Existing Wastewater System

- Sanitary Sewer

Future Growth Wastewater System

- Lift Station
- Force Mains and Sewer Corridors

Miles: 0, 0.5, 1

N

3.2.4 Future Growth Facility Projects

Future City facility projects are provided in Table 47, along with estimated total project costs. These projects were identified as part of this Master Plan and are not recommendations from previous planning efforts.

Cost estimates for the facilities were estimated utilizing engineering and architectural best judgement. The scale and magnitude of facility projects can vary drastically. Additionally, the projects identified below are considered conceptual and high-level. Therefore, it's strongly recommended that the facility project cost estimates be reviewed carefully prior to programming in the CIP.

Table 47. Future Growth Facility Projects and Associated Project Costs

Project	Total Estimated Project Costs (2021$)
Weight Room at Rough Rider Center	$ 697,500
Restroom in Hockey Area at Rough Rider Center	$ 310,000
Bathrooms at Golf Course	$ 155,000
ADA Ramp from Rough Rider Center to Football Field and Steps from Prairie Hills Road / Wolf Den	TBD
Parkway Intersection to Rough Rider Center / High School	TBD
Main Street Mixed Use Amenity P3 Project	TBD
Total Growth-Driven Facility Estimated Project Costs	**$ 1,162,500**

It should be noted that the following facility projects are currently programmed into the CIP:

- New Fire Hall (Total project cost estimate: $9,750,000)
- New Public Works (Total project cost estimate: $15,500,000)
- Golf Course Parking Lot and Shop Improvements (Total project cost estimate: $1,300,000)

These projects were identified through the Existing Conditions assessment because they are facilities that are currently used by the City, compared to facilities that do not exist.

3.3 Summary of Identified Future Growth Infrastructure Needs

In total, there are:

- 23 transportation projects totaling $127,119,000,
- 24 water system projects totaling $39,560,000,
- 37 wastewater system projects totaling $75,717,500, and
- 6 facility projects totaling $1,162,500 (many unknowns and TBD costs)

This brings the total growth-related investment to approximately $244 million dollars ($2021). With that said, there is a strong chance that some of these projects (1) don't happen due to changing plans and/or City wants and needs or (2) have strong outside participation or are funded (entirely or partially) by outside entities (private, County, State, etc.). Furthermore, because these future growth projects 'build out' much of the City's major infrastructure in the entire ETA area, some of these projects may not be needed for decades depending on future growth demands. Lastly, the most recent oil boom resulted in significant infrastructure to support elevated transportation, water, and sewer demands. Now that oil activity has tapered off slightly, many of the infrastructure systems have capacity to handle further growth with minimal improvements.

It was determined most appropriate to refer to these future growth projects as 'identified future growth infrastructure needs' rather than 'project recommendations'. As the City recognizes the need to pursue one of these Projects (which could be driven by a want [i.e. amenity project], a specific need [i.e. growth and development], or by available funding resource), that project can be added into the prioritization process, and ultimately programmed into the City's CIP.

It's recommended for the City to implement these future projects as needed, and in a methodical manner that is feasible and economical. Additionally, it's strongly encouraged for the City to keep the CIP updated on annual basis to ensure these Projects are carefully reviewed each year and prioritized and programmed accordingly.

Chapter 4. Economic Development Considerations

Infrastructure serves as the backbone for the social, environmental, and economic well-being of communities. Without reliable and resilient infrastructure systems, it's extremely difficult for communities to attract and retain people and businesses, and thus, successful economic development and infrastructure are closely aligned. It is also becoming widely recognized that people, and ultimately businesses, are attracted to special places and communities with a high quality of life. This connection further aligns economic development and infrastructure. Furthermore, these special places and a community's quality of life need to be marketed and communicated if a community desires vitality and growth by attracting people and businesses. This connection aligns economic development with promotional activities of the community such as tourism and events attraction, planning, and execution, which all indirectly require infrastructure including facilities.

As introduced in **Chapter 1**, the City of Watford City and the McKenzie County Job Development Authority (JDA) completed a Community Sustainability Plan in the summer of 2019. The vision for Watford City stemming from the Community Sustainability Plan included elements such as vibrancy, diverse economy, strategic growth, and high quality of life—all in line with the discussion above. The seven identified goals of the Community Sustainability Plan are listed below. Some of these goals have been actively addressed. Momentum from the Community Sustainability Plan, however, was hindered in large part by the COVID-19 pandemic.

1. Increase the availability and accessibility of affordable housing units in McKenzie County.
2. Expand the availability of childcare throughout McKenzie County.
3. Increase McKenzie County's workforce capabilities and availability.
4. Build the opportunity culture needed to cultivate the next generation of community advocates.
5. Provide additional resources and support services to the area's vulnerable populations.
6. Mitigate senior outmigration and assure that seniors are empowered and able to age in place.
7. Maintain and expand McKenzie County's high quality of life.

The City and/or McKenzie County JDA have made improvements to some of the above items through various programs. For example, the McKenzie County JDA has implemented two housing programs, and has also made strides regarding workforce development with planning of the Bakken Area Skills Center.

The purpose of including an economic development effort within this Master Plan is to serve as a catalyst for the City to move forward with past and future economic development initiatives. Collaboration was also included as an element of Watford City's vision. It is anticipated that successful economic development within Watford City will include collaboration with the County, School District, Parks and Recreation, and other stakeholders in the community.

4.1 Core Economic Development Team

As part of the scope of this Master Plan, a Core Economic Development Team was identified and invited to participate in a series of economic development focused meetings. The group that was identified and invited included City Council members, City staff members, McKenzie County Commission Members, McKenzie County JDA Board members and staff, Rough Rider Center staff, as well as local business owners and community leaders.

4.2 Needs and Challenges

Through recent past collaborative efforts, significant advancements were made at addressing workforce and quality of life challenges associated with limited day care and unaffordable housing. Current efforts are focused on building a skills center (Bakken Area Skills Center) for the community and region with support from the State of North Dakota. Additional needs and challenges were identified through a series of meetings with the Project's Core Economic Development Team. The needs and challenges are presented below, accompanied with questions which are intended to provoke internal dialogue for Watford City. The needs and challenges are categorized into four themes based on input received throughout meetings with the Core Economic Development Team. The four categories include (1) Economic Development/Workforce Development, (2) Marketing and Communications, (3) Tourism, and (4) Event Management. These four categories are also shown in the economic development organizational schematic provided later in this Chapter.

4.2.1 Economic Development/Workforce Development

- Defined Goals
  - What are the City's economic development goals and what are the necessary steps that will provide the City the opportunity to achieve the defined goals?
- Diversification
  - How can the City better diversify the local economy to supplement the oil and gas, agriculture, and tourism industries?
- Business Attraction
  - How can the City attract and retain new businesses in an environment of low unemployment and high wages?
- Responsibilities and Expectations
  - What are the responsibilities and expectations of people serving on the Council, committees, boards, and participating in economic development activities?
- Organizational Structure
  - What is the most effective organizational structure and communication protocol for helping the City achieve the defined goals? How is this structure coordinated with McKenzie County and other stakeholders?
- Personnel and Financial Resources
  - What are the City's staffing and financial needs required to achieve the defined goals and help the City progress forward?

- Optimization of Non-Profit Organizations
    - How can the City better utilize local non-profit organizations including the Economic Development Corporation, Chamber of Commerce, Downtown Development Association, Community Builders, etc.?

4.2.2 *Marketing and Communications*

- Strategy
    - What would a successful marketing strategy look like? What are the key messages? What platforms should be best used to communicate the messages, including social media?
- Organizational Structure
    - What is the most effective organizational structure and communication protocol for helping the City implement the marketing and communications strategy? How is this structure coordinated with McKenzie County and other stakeholders?
- Marketing and Communications Personnel
    - What are the City's staffing and financial needs to implement the marketing and communications strategy? The general consensus within the core economic development team was that a dedicated FTE focused on marketing and communications is needed.
- Work Space
    - Would it make sense for all marketing and communications staff for the City, County, and associated non-profits to be co-located to maximize collaboration and efficiencies?

4.2.3 *Tourism*

- Roles and Accountability
    - Who is responsible for representing the City regarding tourism, and what are the expectations for that person or team? How do they collaborate with the County staff and other stakeholders?
    - Who is responsible for event attraction, planning, and execution within the City, and what are the expectations of that person or team? How do they collaborate with the County staff and other stakeholders?
- Synergy
    - How are the tourism roles coordinated with marketing and communications within the City?
- Routine Updates with Existing County Structure and Staff
    - How often does the City staff check-in with the JDA and McKenzie County Tourism? Are the meetings effective and do they need to be more or less frequent?

4.2.4 *Event Management*

- Roles and Accountability
    - Who is responsible for representing the City regarding event management, and what are the expectations for that person or team? How do they collaborate with the County staff and other stakeholders?

  - If volunteers are utilized to manage events, how are volunteers identified?
- Synergy
  - How are the event management roles coordinated with marketing and communications within the City?

4.2.5 Other Considerations – Facility Management and Operations

The following considerations were identified regarding facility management and operations.

- Sustainability and Expansion
  - How can the initial successes of the Roughrider Center operations be sustained over time and expanded within the Roughrider Center and across the City?
- Lessons Learned
  - How can the lessons learned from operations of the Roughrider Center be extended to other stakeholders such as the County's planned new Fair Grounds and Ag Expo?
- Optimization and Coordination
  - How does the City optimize the utilization of its existing and planned facilities? How does the City coordinate with the County to optimize the use of existing and planned City and County facilities, while avoiding unhealthy competition?
- Personnel and Financial Resources
  - Will the City advertise and hire a facilities manager to oversee the operations and maintenance of all City facilities? It was the consensus of the Core Economic Development Team that a Facility Manager within the City is needed.

4.3 Economic Development Organizational Structure Concept Proposal

To help the City and associated stakeholders identify an effective organizational structure, the Core Economic Development Team brainstormed concepts for improving communication between various organizations and managing economic development, marketing and communications, tourism and events, and/or facilities management and operations. Figure 84 provides a collaborative organizational structure concept proposal based on feedback received throughout the economic development meetings. The organizational structure highlighted in Figure 84 is considered preliminary and not necessarily the recommendation. The conceptual structure was discussed and vetted with the Core Economic Development Team as a way to potentially improve communication and the effectiveness of various economic development initiatives undertaken by the City.

It was not concluded whether all of these groups could possibly be co-located and work together collaboratively supported financially by their respective organizations or whether some of the functions are unique enough to warrant two or more collaborative groups.

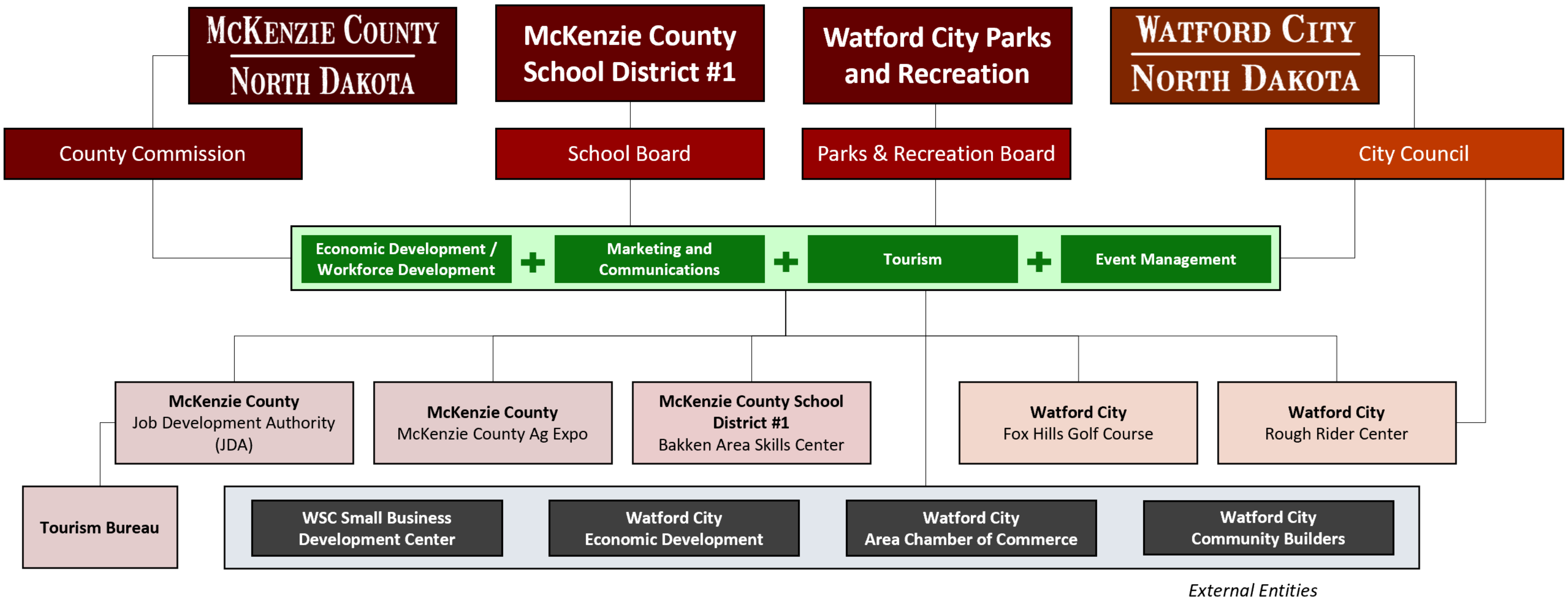


Figure 84. Economic Development Organizational Structure Concept Proposal

The figure above provides a collaborative organizational structure concept proposal based on feedback received throughout the economic development meetings. The organizational structure is considered preliminary and conceptual, and not necessarily the recommendation. The conceptual structure was discussed and vetted with the Core Economic Development Team as a way to potentially improve communication and the effectiveness of various economic development initiatives undertaken by the City.

4.4 Community Engagement Survey

It should also be noted that at the mid-point of the project, a community engagement open house was facilitated, which provided residents the opportunity to learn about the Master Plan, as well as provide input and feedback. Through the community engagement process, a digital survey was pushed out to local newspapers and published on the City's website and social media pages. There was impressive feedback provided by residents. Although infrastructure questions were the focus, many responses were related to economic development, business attraction and retainment, and workforce development. The anonymous responses from the survey have been preserved and are attached as Appendix D.

4.5 Improvement Areas, Recommendations, and Moving Forward

Throughout the series of meetings, the team members were engaged and indicated the discussion topics were very important to Watford City and the region. Below are some immediate improvement areas and recommendations, as well as plans for moving forward.

- Personnel Gaps
    - It is recommended to hire a Facilities Manager. Managing the City facilities will only become more challenging as the City and County add more facilities and as existing facilities require regular maintenance. Hiring a facilities manager would allow the City to operate and maintain the high-quality level of facilities that tourists and locals have come to appreciate.
    - It is recommended to hire a Marketing and Communications Specialist. Currently, marketing activities are undertaken by staff who already have other full time roles. It was identified that having a dedicated marketing and communications specialist focused on marketing community events, leading public outreach efforts, updating social media pages, etc. would be an asset to the City (and indirectly County).
- Organizational Structure and Communication
    - It is recommended to solidify an organizational structure that clearly defines key roles and responsibilities of the various departments, committees, organizations, and staff. The organizational structure should also provide recommendations for improving communication and minimizing the potential for 'missed information' caused by staff or organizations being left out of various planning and management activities.
- Economic Development Strategic Plan
    - It is recommended for the City to have some involvement (if possible) in the Economic Development Strategic Plan being led by the McKenzie County JDA, and to provide input and insight to the results of the plan utilizing the information identified in this Chapter.

Moving forward, the McKenzie County JDA will be working with the International Economic Development Council in 2022, with funding from the US Economic Development Administration for disaster effected counties, to develop an economic development strategic plan. The Core Economic Development Team concluded its final meeting by recognizing that the past work from the Community Sustainability Plan and dialogue from the team meetings as part of this Master Plan could serve as building blocks for the economic development strategic planning effort moving forward.

Chapter 5. Financial Analysis and Model Development

A key component of developing a successful infrastructure Master Plan is to ensure tools and processes are in place that can be aligned with the capital improvements plan. This Chapter outlines the financial analysis and the development of the City's financial model, which will be used to ensure planned capital and operational expenditures can be appropriately funded. There was also a Financial Policies Technical Memorandum and a Financial Model User Manual prepared as part of the Master Plan. Both documents are attached, respectively, as Appendix B and Appendix G.

5.1 Financial Analysis Approach

The following steps were taken to analyze the City's financial standing and financial ability to fund improvement projects:

1. Identify the beginning unrestricted cash available to pay for operating, debt, and capital related expenses within each fund included in the financial forecast.
2. Project the City's major revenues in each year of the forecast periods. Project all non-major revenues within each of the funds included in the forecast over each year of the forecast periods. Funds incorporated into the financial model include:
   a. General Fund
   b. Gross Production Tax (GPT) Fund
   c. Roads and Streets Fund
   d. Rough Rider Center Fund
   e. Rough Rider Sales Tax Fund
   f. Sales Tax Surplus Fund
   g. Special Improvement Fund
   h. Water Works Fund
   i. Sewer Fund
   j. Plus two additional 'unused funds' in the model to add additional funds
3. Add the projected revenues to the beginning cash balances with each fund to determine the total annual cash available to fund expenses.
4. Project operation expenses and existing debt service in each year of the forecast period within the included funds. Assume that transfers from the Gross Production Tax (GPT) fund to other funds will continue to occur at the current level in future years, if appropriate.
5. Incorporate the capital projects identified as part of this Master Plan into the forecast. Fund each project according to the capital project funding guidelines.
6. Adjust the water and sewer rates to fund the water and sewer related Master Plan projects.
7. Identify the additional funds needed to fully fund the non-water and sewer related Master Plan projects.

5.2 Revenues Considered

The revenue sources considered in the financial analysis as part of this Master Plan include:

- Property Taxes
- Sales Tax
- Water User Rates and Charges
- Sewer User Rates and Charges
- Highway Tax
- Gross Production Tax
- Other Miscellaneous Revenues

The intended use for each revenue source along with the forecast assumptions are outlined in the forthcoming subsections.

5.2.1 Property Taxes

Intended Use

Property tax revenues are used to fund general fund expenses.

Forecast Assumptions

Property tax revenues were budgeted to be approximately $1.3 million in FY 2021. In future years, the taxable assessed value of real property within the City was projected to increase by 2.0 percent per year, while the millage rate was assumed to remain unchanged as a baseline. This resulted in an assumed increase of 2.0 percent per year in property tax revenues within the General Fund.

5.2.2 Sales Tax

Intended Use

Sales tax revenues are currently used to fund the Sales Tax Surplus Fund, which pays for existing debt service on the 2015 Sales Tax Revenue Bond.

Forecast Assumptions

Sales tax revenues were budgeted to be $4.5 million in FY 2021. As a baseline, the sales tax rate is not expected to change from the current rate of 1.5 percent over the forecast period; however, it was assumed that taxable sales would increase by 2.0 percent per year, resulting in an increase of annual sales tax revenues of 2.0 percent per year over the forecast period.

5.2.3 Water User Rates and Charges

Intended Use

Water user rates and charges are used exclusively to fund the operating and capital costs of the water system.

Forecast Assumptions

Revenue from water user rates and charges was budgeted to be $1.7 million in FY 2021.

Without rate increases, these revenues were projected to remain unchanged in future years as a result of customer growth to provide a conservative estimate of water system revenues in future years.

5.2.4 Sewer User Rates and Charges

Intended Use

Sewer user rates and charges are used exclusively to fund the operating and capital costs of the sewer system.

Forecast Assumptions

Revenue from sewer user rates and charges was budgeted to be $1.4 million in FY 2021.

Without rate increases, these revenues were projected to remain unchanged in future years as a result of customer growth to provide a conservative estimate of water system revenues in future years.

5.2.5 Gross Production Tax

Intended Use

GPT revenue is used for a variety of purposes; current uses incorporated into the financial model include transfers to the General Fund, transfers to the Roads and Streets Fund, transfers to the Rough Rider Center Fund, and transfers to the Sewer Fund. GPT revenue is also utilized for existing debt service.

The GPT revenue source is currently instrumental in covering existing debt servicing and funding future infrastructure improvements. Because of the associated volatility, it’s recommended for the City to evaluate new methods for covering existing debt service and funding future infrastructure investments. This will help the City become financially resilient and provide better capabilities to mitigate burdening impacts of oil and gas industry downturns.

Forecast Assumptions

Gross production tax revenues were budgeted to be $21.0M in FY 2022. These revenues were projected to increase by 1.0 percent per year to provide a conservative estimate of GPT revenues in future years.

5.2.6 Highway Tax

Intended Use

Highway tax revenue is used exclusively to fund the Roads and Streets Fund.

Forecast Assumptions

Highway tax revenues were budgeted to be $437,000 in FY 2021. As a baseline, the highway tax rate is not expected to change from the current rate over the forecast period. Therefore, these revenues were projected to remain unchanged from this amount in all years of the forecast.

5.2.7 Miscellaneous Revenues

Intended Use

The City collects miscellaneous revenues from a number of different sources. Examples include monies generated from permits and fees, fines, as reimbursements, as amounts received as state aid, and for ancillary services provided as part of water and sewer operations.

Forecast Assumptions

As a baseline, revenues generated from fines, fees, and permits were projected to remain unchanged from their budgeted amounts over the forecast period, as the City does not have current plans to increase the fee amounts associated with these activities. Other miscellaneous revenues were projected to increase by between 1.0 to 3.0 percent per year over the forecast period.

5.3 Financial Forecast Primary Components

The primary components of the financial forecast are outlined below.

5.3.1 Beginning Cash

Ending cash balances were provided by the City for the applicable funds as of the end of FY 2020. Budgeted revenues were added to this amount, while budgeted expenses were subtracted, to determine estimated beginning cash balances as of the beginning of FY 2022.

5.3.2 Revenues

Except for revenues from property taxes, the City's share of GPT and highway taxes, and City sales taxes, all revenues within the funds included in the forecast were based on their adopted budget amount in FY 2021 and then escalated in future years based on the revenue type.

5.3.3 Expenses

Operating expenses within the funds included in the financial evaluation of the Master Plan were based on their adopted budget amount in FY 2021 and escalated in future years based on the expense type.

5.3.4 Debt Service

Debt is outlined in the two (existing and new) subsections below.

5.3.4.1 Existing Debt Service

The City's existing general fund debt is comprised of several issues of general obligation bonds and revenue bonds. Based on future repayment schedules provided by the City, annual principal and interest payments on these debt issues are approximately $10.8 million through FY 2026, before decreasing to roughly $8.9 million in FY 2027, and then to about $4.1 to $4.3 million per year through FY 2031. The decrease in existing debt service was primarily due to the 2019 Rough Rider Center Refunding bonds being repaid in FY 2027.

The City's existing debt related to its water system generally includes state revolving loans from the North Dakota Public Financing Authority. The City Council recently approved (early 2022) full repayment of existing Drinking Water State Revolving Fund (DWSRF) loans, so the City no longer has existing debt related to the City's water system.

The City's existing debt associated with its sewer system includes three state revolving loans from the North Dakota Public Financing Authority. Based on future repayment schedules provided by the City for these debt issues, annual principal and interest payments on these debt issues are approximately $1.6 million per year.

5.3.4.2 New Debt Service

New debt was assumed to be issued by the City to fund a portion of the capital projects included in the Master Plan. Within the water and sewer funds, the new debt was assumed to be revenue bonds. It was assumed that the City would use general obligation bonds to debt fund projects related to roads and streets or general government facilities.

Financing terms on general obligation bonds were assumed to include a 25-year repayment term, an annual interest rate of 2.25 percent to 3.25 percent, and issuance costs of 1.5 percent of the raw debt funding need. annual debt service payments were assumed over the repayment term, and one-half of the annual debt service payment was assumed in the year the debt was issued.

Financing terms on water and sewer revenue bonds were assumed to include a 25-year repayment term, an annual interest rate of 3.25 percent to 4.25 percent (3.25 percent in FY 2022, increasing to 4.25 percent in FY 2026 and thereafter), a debt service reserve funded with debt proceeds equal to one year of annual principal and interest payments, and issuance costs of 1.5 percent of the raw debt funding need. Level annual debt service payments were assumed over the repayment term, and one-half of the annual debt service payment was assumed in the year the debt was issued.

5.3.5 Cash-Funded Capital Spend

Master Plan projects were funded with debt, with cash from reserves, or current revenues based on the capital funding assumptions outlined in the section below.

5.4 Capital Funding Assumptions

Master Plan capital projects were funded with cash or debt based on the following guidelines:

- Programs for annually recurring operations and maintenance or repair and/or replacement work should be funded with cash from current revenues. Street repair and replacement work and other infrastructure projects should be funded with debt, when possible.
- If it is determined that excess cash reserves are available (excess cash is defined as cash above the minimum cash reserve target for the fund) over the forecast period. These monies will be used to fund capital project costs.
- When cash reserves are limited, or if cash funding projects would require a significant additional revenue need, projects should be debt funded.

Water Projects

- Cash versus debt rationale

Sewer Projects

- Cash versus debt rationale

General Government Projects

- Cash versus debt rationale

5.5 Other Potential Revenue Source Considerations

In November 2021, the United States Congress passed the Infrastructure Investment and Jobs Act, which includes $1.2 trillion in federal funding for infrastructure. Details regarding schedule and how funding will be available and distributed are not currently defined, but it's highly recommended for the City to stay informed on this matter as details emerge to better position the City to leverage federal infrastructure funding.

The following subsections outline potential revenue sources the City can utilize to help fund and subsidize infrastructure investments.

5.5.1 Grants and Low Interest Loans

Grants and low interest loans are popular means for funding critical infrastructure improvements. Some potential funding programs that offer either grants or low interest loans are outlined below.

5.5.1.1 State Programs

- North Dakota Department of Transportation (Various Programs)
    - https://www.dot.nd.gov/business/#funding-programs
- North Dakota Department of Water Resources
    - https://www.swc.nd.gov/project_development/cost_share.html
- North Dakota Public Finance Authority
    - https://www.pfa.nd.gov/capital-financing-program-cfp
- Bank of North Dakota Infrastructure Revolving Loan Fund
    - https://bnd.nd.gov/infrastructure/bnd-infrastructure-loan-fund/
- North Dakota Energy Conservation Grant
    - https://www.communityservices.nd.gov/renewableenergyprograms/EnergyConservationGrant/
- Community Development Block Grant
    - https://www.communityservices.nd.gov/communitydevelopment/Programs/CommunityDevelopmentBlockGrant/
- Renaissance Zone Program
    - https://www.communityservices.nd.gov/communitydevelopment/Programs/RenaissanceZoneProgram/
- Drinking Water State Revolving Fund
    - https://deq.nd.gov/MF/DWSRF/
- Clean Water State Revolving Fund
    - https://deq.nd.gov/MF/CWSRF/

5.5.1.2 Federal Programs

- US Department of Transportation
  - Rebuilding American Infrastructure with Sustainability and Equity (RAISE)
    - https://www.transportation.gov/RAISEgrants
  - Rural Opportunities to Use Transportation for Economic Success (ROUTES)
    - https://www.transportation.gov/rural
  - Infrastructure For Rebuilding America (INFRA)
    - https://www.transportation.gov/buildamerica/financing/infra-grants/infrastructure-rebuilding-america
- Bureau of Reclamation (WaterSMART)
  - WaterSMART Water and Energy Efficiency
    - https://www.usbr.gov/watersmart/weeg/index.html
  - WaterSMART Water Marketing Strategy
    - https://www.usbr.gov/watersmart/watermarketing/index.html
  - WaterSMART Small-Scale Water Efficiency
    - https://www.usbr.gov/watersmart/swep/index.html
- EPA
  - Water Infrastructure Finance and Innovation Act (WIFIA)
    - https://www.epa.gov/wifia/what-wifia
- FEMA
  - Hazard Mitigation Grant Program (HMGP)
    - https://www.fema.gov/grants/mitigation/hazard-mitigation
  - Building Resilient Infrastructure and Communities (BRIC)
    - https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities
  - Flood Mitigation Assistance Grant Program
    - https://www.fema.gov/grants/mitigation/floods
- USDA
  - Rural Economic Development Loan & Grant Program
    - https://www.rd.usda.gov/programs-services/rural-economic-development-loan-grant-program
  - Water & Waste Disposal Predevelopment Planning Grants
    - https://www.rd.usda.gov/programs-services/water-waste-disposal-predevelopment-planning-grants
  - Water & Waste Disposal Technical Assistance & Training Grants
    - https://www.rd.usda.gov/programs-services/water-waste-disposal-technical-assistance-training-grants
  - Water & Waste Disposal Loan & Grant Program
    - https://www.rd.usda.gov/programs-services/water-waste-disposal-loan-grant-program
  - Community Facilities Direct Loan & Grant Program
    - https://www.rd.usda.gov/programs-services/community-facilities-direct-loan-grant-program

5.5.2 New Utilities

Formation of new utilities are another effective way for funding various infrastructure investments. Like water and sewer utilities, residents are charged a monthly rate (either flat, variable, or combination of both) for the services the City provides. Some potential new utilities that could be formed in Watford City to help fund infrastructure improvements include a Street Utility, Street Light Utility, and Stormwater Utility. If formation of new utilities are explored and ultimately implemented in the future, it’s recommended that the revenues collected by each Utility be utilized to fund infrastructure specifically related to the Utility (i.e. Street Utility revenues are utilized solely for transportation specific costs). This helps ensure transparency between residents and City stakeholders.

5.5.3 Special Improvement Districts

Special Improvement (also commonly referred to as special assessment) Districts are a popular method for funding infrastructure improvements in areas that benefit nearby property owners. Generally, infrastructure costs (or a portion of infrastructure costs) are levied against property owners who will benefit from the project. Common factors included in a special assessment calculation include project type, benefit level, lot front footage, lot square footage, city share percentage, and additional funding sources. Although special improvement districts are an effective method for funding infrastructure, they are often controversial and disliked by City residents. It's extremely important to have a well-documented policy and procedures so residents and stakeholders are informed of how assessments are being calculated.

5.5.4 Tax Considerations

Publicly available North Dakota Tax Data was retrieved and evaluated to determine how Watford City compared to peer communities in North Dakota. Figure 85 below provides the top 13 largest communities by population in the State. Figure 86 and Figure 87 provide the property tax rates (2019) and sales tax rates (2019), respectively, for those same 13 communities.

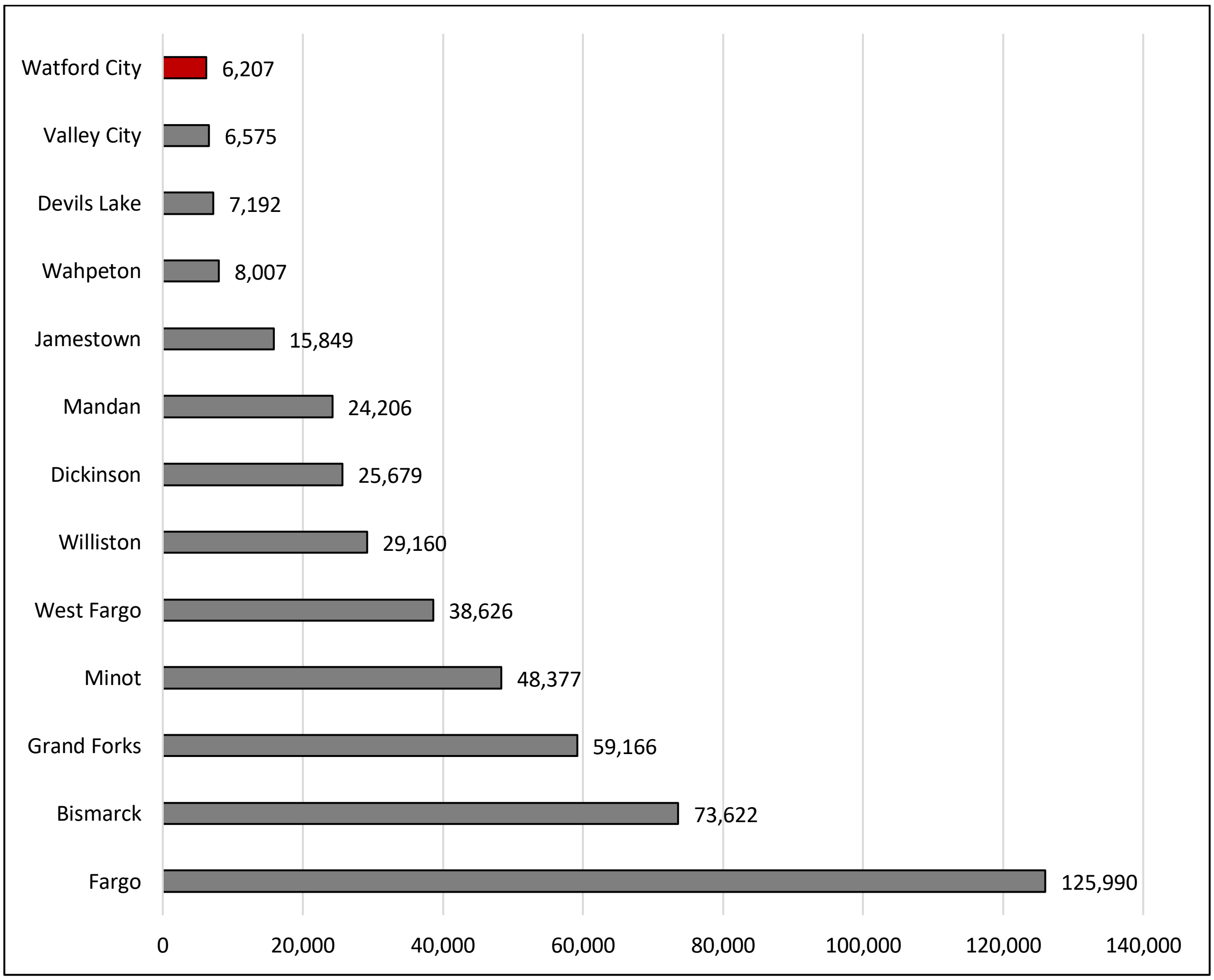


Figure 85. Largest Communities in North Dakota (2020 Census)

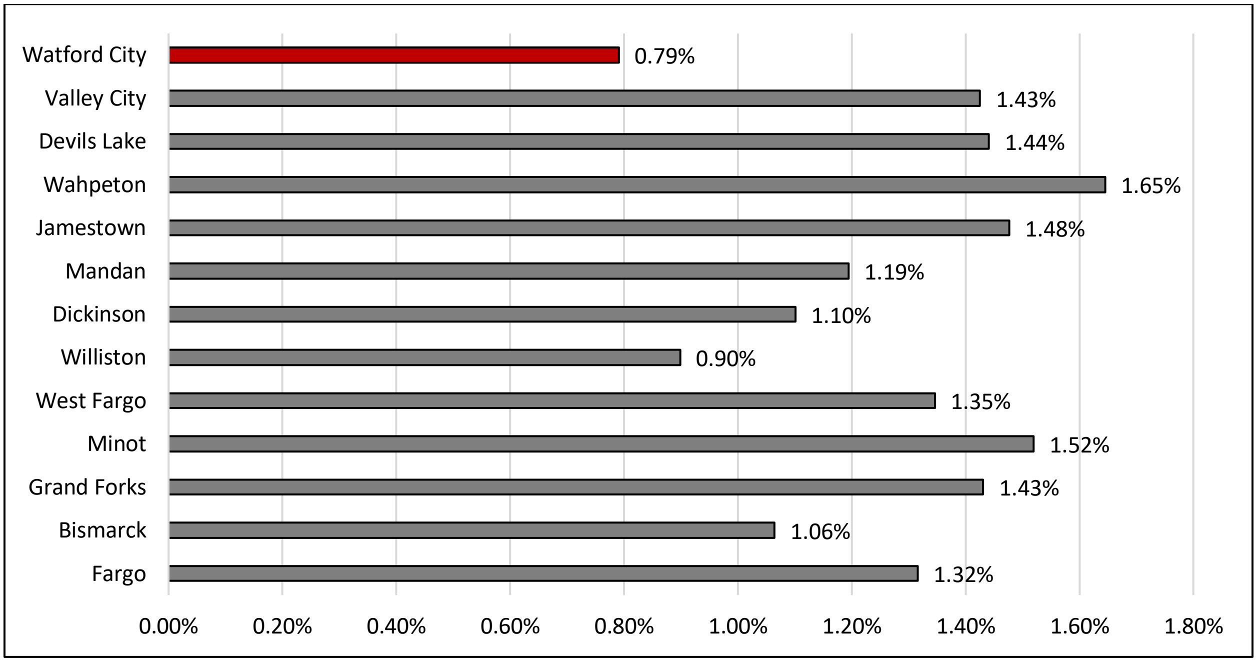


Figure 86. Property Tax Rates of Largest Communities in North Dakota

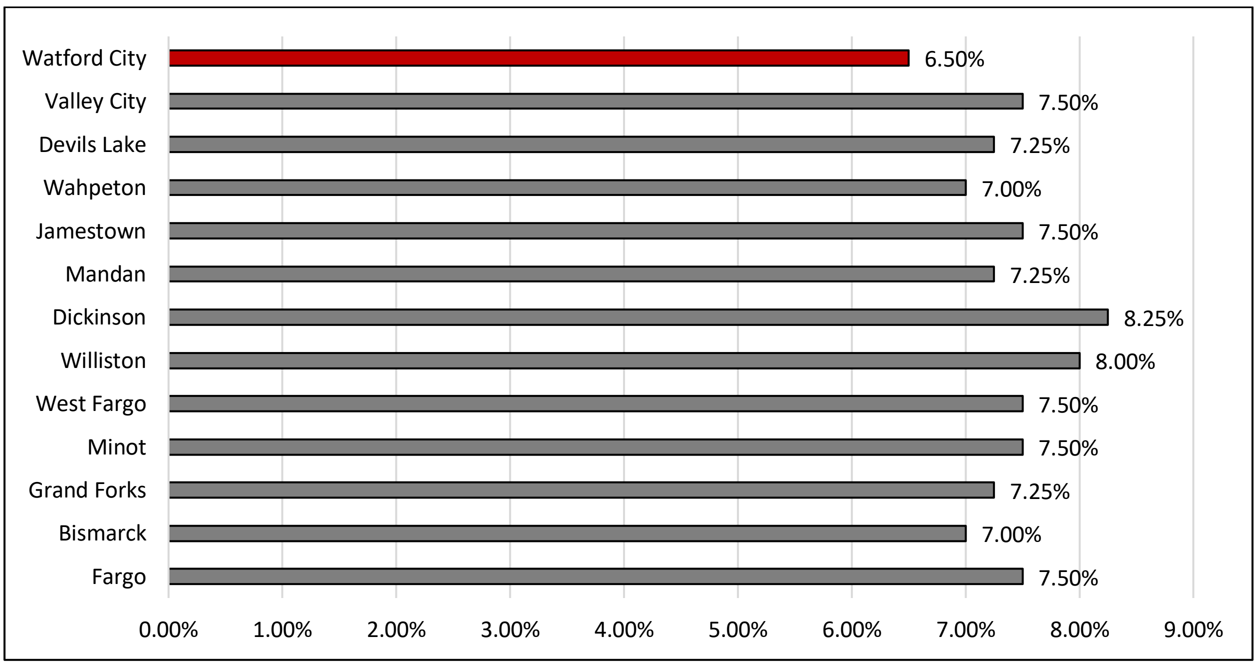


Figure 87. Sales Tax Rates of Largest Communities in North Dakota

As shown in the figures above, Watford City has the lowest property tax rate and sales tax rate when compared to peer communities in the State. One method to unlock additional City revenues would be to pursue increases to property and/or sales taxes. The public is generally more receptive to sales tax increases, as travelers, tourists, and workers that do not live in Watford City contribute to the local economy, rather than increasing property taxes which only effects property owners in McKenzie County.

Chapter 6. Project Prioritization and Cost Estimating

This Chapter includes information on how projects were identified, developed, prioritized, assigned cost estimates, and ultimately prioritized.

6.1 Project Prioritization

Project prioritization is a critical component of the Master Plan. The process allows the City to evaluate existing infrastructure in a relatively impartial manner, add-in infrastructure projects that are identified as future growth needs, and ultimately defensibly prioritize the two categories following an objective process. The project prioritization process utilized for this Master Plan can be summarized as follows:

1. Evaluate existing infrastructure systems independently to determine high priority infrastructure assets.
2. Where applicable, identify corridors with overlapping high priority infrastructure assets and develop improvement projects.
3. Screen improvement projects through project prioritization criteria.
    a. Prior to screening, add in City-identified existing conditions projects that are applicable.
    b. Prior to screening, add in future growth identified projects that are applicable.
4. Program projects into Capital Improvements Plan (CIP).

6.1.1 Individual Existing System Prioritization Criteria

The first step was to analyze existing infrastructure systems independently to determine which infrastructure assets were at the highest priority for improvement within each respective infrastructure system. It should be noted that even if something is deemed high priority, it doesn't mean that infrastructure asset is going to fail in the immediate future. It solely means that that infrastructure asset is at higher priority compared to lower priority assets.

6.1.1.1 Transportation System Assessment

The transportation system infrastructure components that were included in the transportation system assessment include streets, sidewalks, and paths/trails.

6.1.1.1.1 Streets Assessment

The list of transportation project recommendations was developed methodically. First, a pavement condition survey was completed to scope system needs. Using the pavement condition index, a list of potential construction projects was developed, along with general timeframes for construction. Each asphalt segment was identified for mill and overlay or reconstruction in the short term (0-5 years), middle term (6-10 years), and long term (10+ years). Concrete segments were similarly categorized.

Additional criteria were then introduced to refine the list of roadway system priorities. Each paved segment was scored across five metrics, each on a 1-5 scale. These prioritization metrics were weighted as shown in Table 48.

Table 48. Streets Assessment Criteria and Criteria Weights

Category / Criteria	Weight
Pavement Condition	35%
Road Classification	20%
Bike/Ped Connectivity	10%
Traffic Volume	5%
Safety	30%

Using this breakdown, a weighted average score was computed for each segment. Segments scoring at or above 3 were assigned the highest-priority ranking. Segments scoring between 2 and 3 were assigned as moderate priority, and all other segments receiving a score of 2 or lower were assigned as lower priority. This scoring system was used to further guide plan development. As the project list evolved and future work was assigned to each roadway segment, some minor ranking adjustments were made with discretion to achieve corridor consistency.

Pavement Condition

A pavement condition assessment was completed for all asphalt and concrete roads owned or maintained by Watford City. Approximately 44.1 miles of roadway were analyzed. Each segment was scored based on the distress observed on the surface of the pavement (i.e., transverse cracking, rutting, slab cracking, etc.) The pavement condition index (PCI) uses a 0-100 scale, where 100 is essentially a brand-new road. Table 49 summarizes the results of the pavement condition analysis and describes appropriate improvements for asphalt roads within each scoring range.

To help prioritize system needs, PCI scores were translated to 1-5 scale to (very good = 5, good = 4, etc.). This metric contributed 35% to overall scores.

Table 49. Pavement Condition Index (PCI) scores for Existing Roadways

Pavement Condition	PCI Range	Miles	Percent
Very Good	86-100	25.1	56.9%
Good	71-85	8.3	18.8%
Fair	56-70	5.8	13.2%
Poor	41-55	4.5	10.2%
Very Poor	40 and below	0.4	Less than 1.0%

Road Classification

Each road was scored according to its designated functional class. Minor Arterials were assigned a score of 5; Collectors were assigned a score of 3; and Local Roads were assigned a score of 1. This metric contributed 20% to the overall scores. It is generally correlated with traffic volumes and safety needs.

Bike/Ped Connectivity

Roads were also prioritized based on the degree of continuity in the sidewalk/trail network. To perform this analysis, existing sidewalks and trails were digitized in GIS. Data was confirmed using aerial imagery from Pictometry, which provides current, high-resolution imagery with full coverage for McKenzie County. Each street (e.g., 2nd Ave NW) was scored according to the approximate percentage of roadway length with a parallel sidewalk or trail (one or both sides). Coverage was estimated to be 20%, 40%, 60%, 80%, or 100%, with scores corresponding to the 1-5 scale. This metric contributed 10% to the overall scores.

Traffic Volume

Existing traffic volumes were analyzed using the travel demand model that was developed for McKenzie County's Capital Improvement Plan. The model utilized INRIX origin-destination data from 2019. Data were validated against available State highway counts to calibrate existing volumes (ADT – Average Daily Traffic) for the entire roadway system.

Road segments were scored as follows:

- 5,000 or more ADT = 5
- 2,000-4,999 ADT = 4
- 1,000-1,999 ADT = 3
- 500-999 ADT = 2
- Less than 500 ADT = 1

This metric contributed 5% to overall scores.

Safety

Roadway safety was evaluated using County-wide crash data for 2015-2019. Using GIS, crash data was overlaid on the City's centerline segments. Crashes were summed for each roadway segment. Each intersection-related crash was assigned to the nearest roadway segment to avoid double-counting. The final safety score was a composite of two variables including total segment crashes and crash severity.

Total crashes were scored as follows:

- 0-2 crashes = 1
- 3-4 crashes = 2
- 5-6 crashes = 3
- 7-9 crashes = 4
- 10-13 crashes = 5

Crash severity was evaluated based on occurrence of fatality or incapacitating injury. All segments with at least one fatal crash were assigned a score of 5. All segments with at least one crash resulting in a serious injury but no fatal crashes were assigned a score of 3. All other segments were assigned a score of 1.

The composite safety score was computed as the weighted average of the scores for total crashes and crash severity. This metric contributed 30% to overall scores.

Summary

This analysis incorporated several metrics, but system evaluation ultimately needs to be considered from the standpoint of pavement condition. Some segments with new pavement nonetheless scored high, due to higher traffic volumes, crashes, or other variables (4th Ave NW, 12th Street NE, and 14th Street NW/SW are some examples). Although not all Tier 1 segments will require pavement repairs within the horizon of this Plan, they should continue to be a focus of the City's ongoing pavement preservation strategy, given the significant role they play within the transportation system.

To develop the 2022-2031 Plan, the list of potential projects was filtered by PCI. The preliminary list of short-term projects focused on Tier 1 asphalt roads with poor or fair surface quality (PCI 41-70). Some segments with PCI in the 70s were also included, with the understanding that worsening pavement condition may warrant repair near the end of the planning horizon.

Interpretation of the PCI scale is different for concrete segments. Concrete wears longer than asphalt, and there are fewer potential preservation treatments. Concrete replacement can be delayed until PCI falls in the 40-50 range. With asphalt surface, a Mill and Overlay could be considered if PCI is approximately 56-70 ("fair"). Indeed, resurfacing roads in this range is the recommended approach for avoiding the "worst first" outcome – deferring maintenance to the point that operational life of the pavement is reduced and costly rehabilitation is the only viable treatment.

6.1.1.1.2 Sidewalks and Paths/Trails Assessment

The assessment process for sidewalks and paths/trails was similar as the roadway assessment process described above (criteria weights shown in Table 50). First, the existing system of sidewalks and trail facilities was digitized in GIS and system gaps were identified. Then, segments were scored across four prioritization metrics, each on the 1-5 scale. The scoring system accounts for local preference (10%), in addition to safety (50%), proximity to origins and/or destinations that produce or attract pedestrian traffic (30%), and project coordination (10%), which evaluated the potential to replace sidewalks as part of roadway reconstruction.

Table 50. Sidewalks and Paths/Trails Assessment Criteria and Criteria Weights

Category / Criteria	Weight
Safety	50%
Proximity to Generator	30%
Project Coordination	10%
Local Preference	10%

Safety

The safety metric developed for roadway system assessment was incorporated into the sidewalks/trails assessment, with each segment assigned a composite score for crash frequency and severity. This metric contributed 50% to overall scores.

Proximity to Generator

To account for sidewalk needs in active pedestrian areas, a locational analysis was performed in GIS. First, land uses that generate or attract pedestrian traffic were identified, including schools, parks, grocery stores, and apartments. Medical clinics and government buildings were also included, as it is important to provide equitable access and ADA facilities around these types of uses. A multi-ring buffer analysis was performed with distances of 1-quarter mile, 1-half mile, 1 mile, and 2 miles. (1-quarter mile is often used to define a "walk shed", as most people can comfortably walk this distance in 5 minutes.) Road segments were overlaid with buffer rings and scored as follows:

- Majority segment within 0.25-mile buffer ring = 5
- Majority segment with 0.50-mile buffer ring = 4
- Majority segment within 1.0-mile buffer ring = 3
- Majority segment within 2.0-mile buffer ring = 2
- Majority segment outside 2.0-mile buffer ring = 1

This metric contributed 30% to overall scores, and is represented in **Figure 88**.

Project Coordination

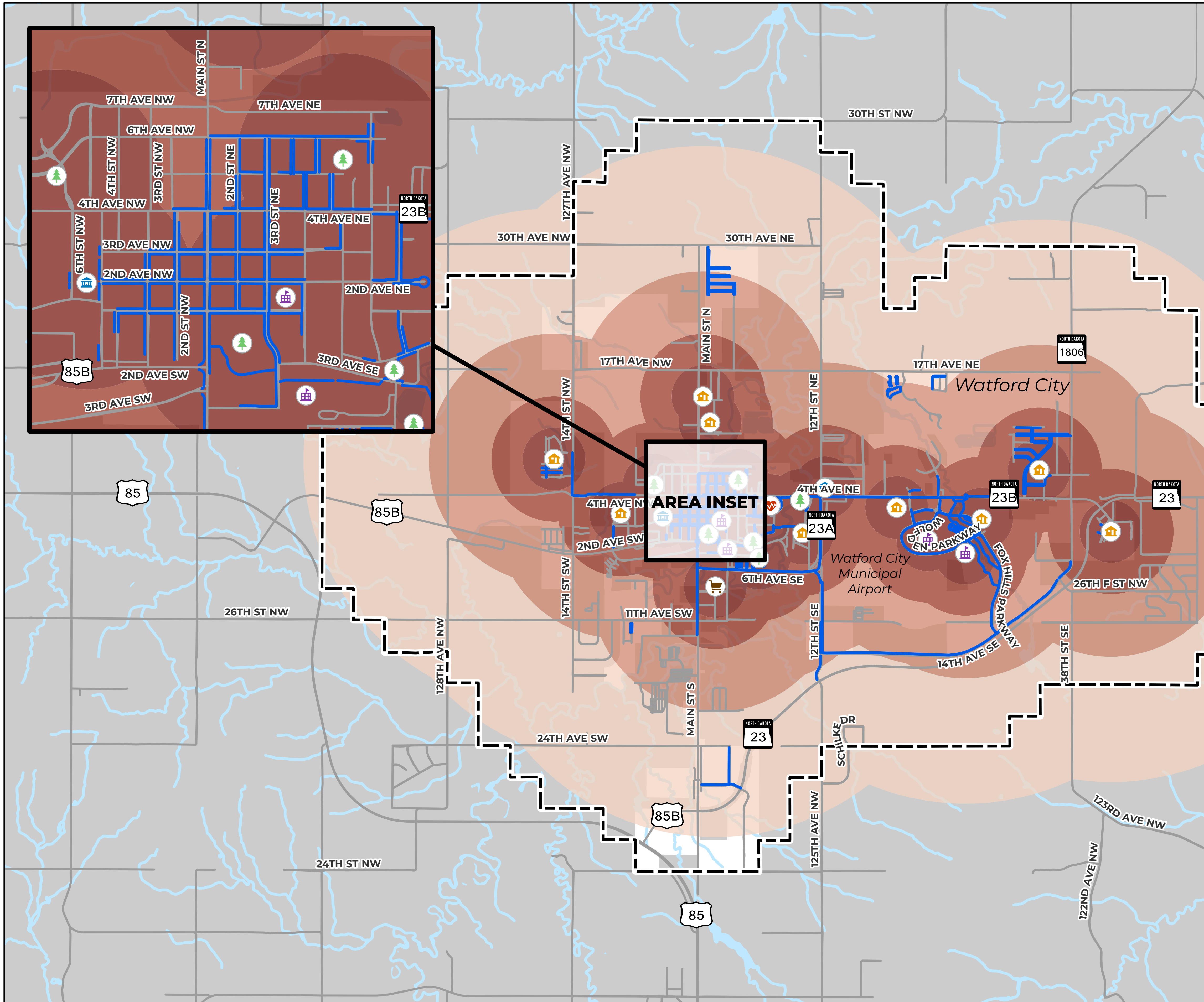
Roadway segments with a PCI of 70 or less were considered to be candidates for surface repairs during the CIP planning horizon. These roads received an additional 5 points given the potential to coordinate sidewalk gap improvements with a larger project. Generally, it is most efficient to complete sidewalk improvements with road reconstruction and/or wet infrastructure replacement. This metric contributed 10% to overall scores.

Preliminary ADA Assessment

In addition to prioritizing sidewalk/trail extensions or gap fill, intersection improvements are likely needed to ensure curb ramps are ADA-compliant. This Master Plan does not identify specific ADA improvements. An ADA Transition Plan is recommended to prioritize system needs. To scope further study, the number of existing sidewalk corners was tallied for each intersection. Then all intersections were summed. Approximately 230 corners include a sidewalk/trail facility. An intersection ADA map is provided as **Figure 89**.

Local Preference

At a public meeting in June of 2021, stakeholders identified local priorities for sidewalk and trail improvements. Stakeholder priorities received 5 additional points. **Figure 90** highlights these segments along with existing sidewalks and trails. The local preference metric contributed 10% to overall scores.



Watford City
North Dakota

Watford City 2040 Infrastructure Master Plan

Figure 88. Map of Proximities to Generator

Map Legend

Existing Sidewalk or Trail

Locations

- Apartments
- Grocery
- Medical
- Park
- Public
- School

Buffers

- 0.25 mile
- 0.50 mile
- 1.00 mile
- 2.00 miles
- Watford City ETA

0 1 2 Miles

N

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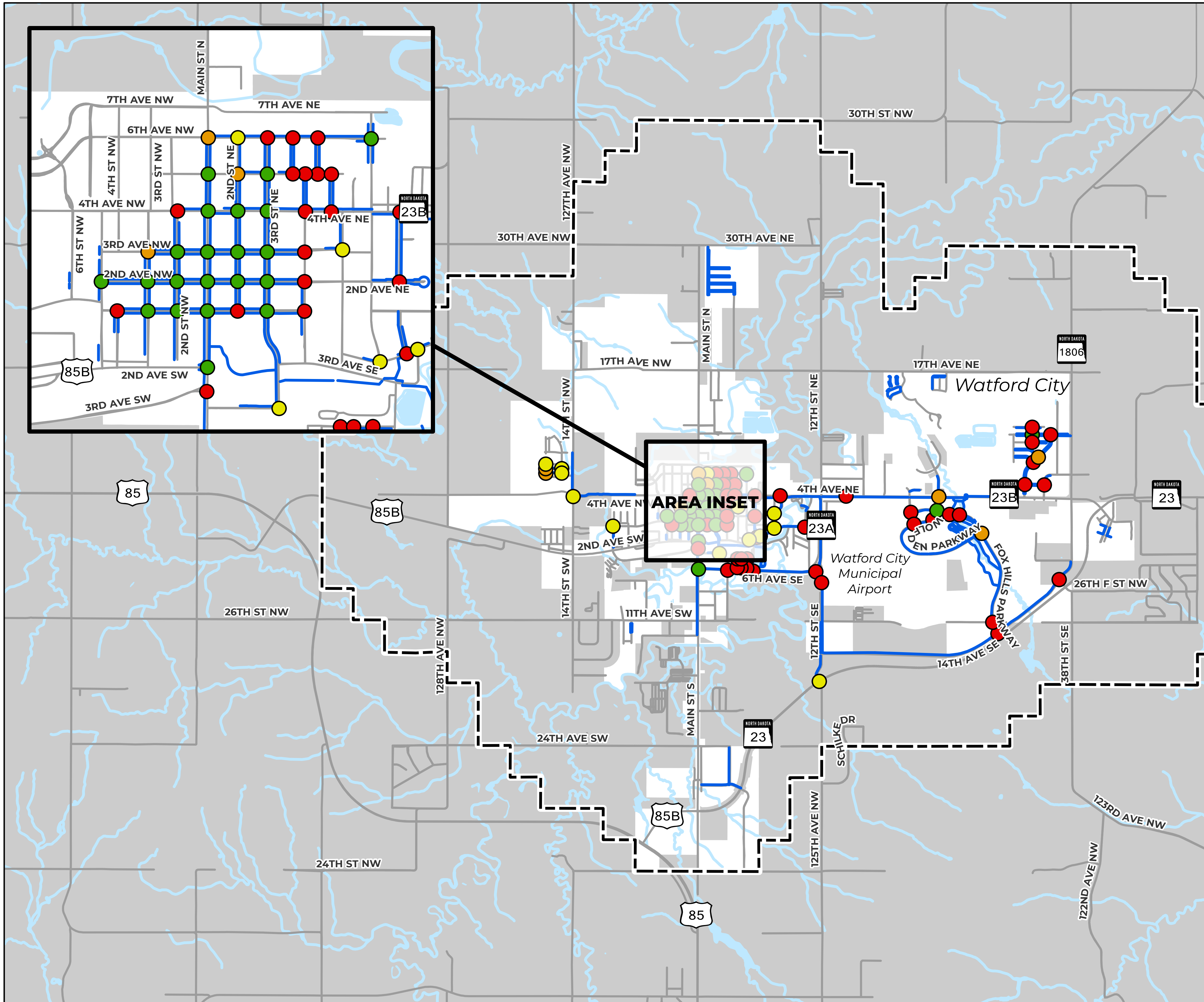

Watford City North Dakota

Watford City 2040 Infrastructure Master Plan

Figure 89. Intersection ADA Map

Map Legend

Existing Sidewalk or Trail

Sidewalk Intersections

- 1
- 2
- 3
- 4

Watford City ETA

0 1 2 Miles

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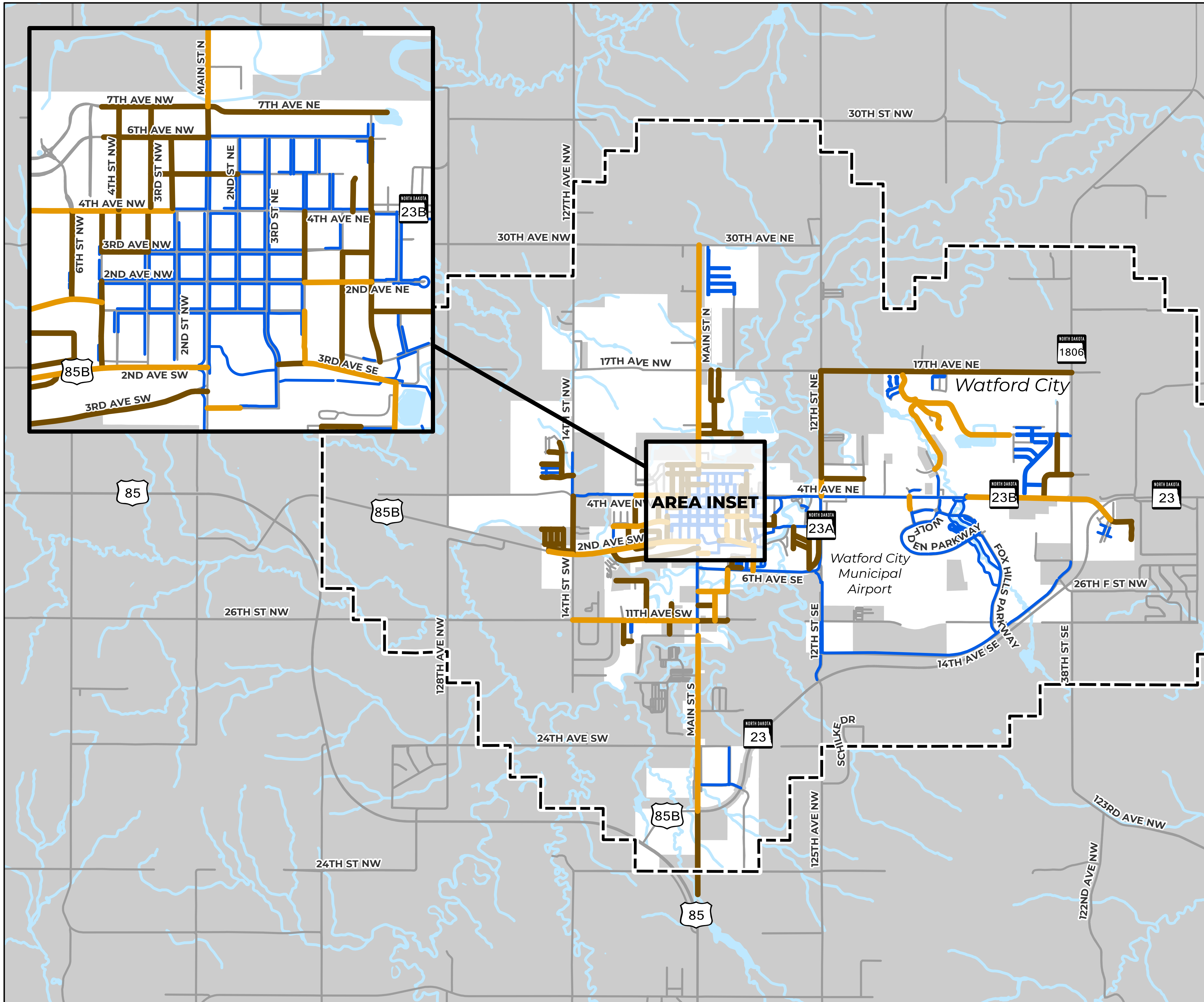

Watford City

North Dakota

Watford City 2040 Infrastructure Master Plan

Figure 90. Local Preference Input on Sidewalks and Paths

Map Legend

- Existing Sidewalk or Trail
- Priority Gap*
- Other Gap
- Watford City ETA

Includes NDDOT TAP grant examples and other gaps identified by community stakeholders.

Miles 0 1 2

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6.1.1.2 Water System Assessment

The water system assessment included evaluating and prioritizing existing water mains in Watford City. Other water system infrastructure, including water towers, supervisory control and data acquisition (SCADA) systems, and other ancillary components including isolation valves, PRVs, curb stops, pumps, etc., were considered for inclusion within the CIP (and outlined in **Section 2.2**), but were not included in the water system assessment. Assessments for these infrastructure components could be completed in the future if the City elects to expand the scope of their water system infrastructure assessment.

6.1.1.2.1 Water Main Assessment

The criteria and criteria weights provided in **Table 51** were used for the water main assessment. Each of the individual criteria are defined in greater detail throughout this section.

Table 51. Water Main Assessment Criteria and Criteria Weights

Category / Criteria	Weight
Consequence of Failure	45%
Pipe Diameter	70%
Count of Water Services	30%
Likelihood of Failure	55%
Pipe Age	40%
Pipe Material	40%
Soil Corrosivity	20%

Pipe Diameter

Each individual pipe was assigned a score based on the respective pipe diameter. In general, larger pipes carry more water compared to smaller pipes and can also act as transmission mains. Therefore, larger pipes received a higher score compared to smaller pipes. The scoring system utilized for pipe diameter is provided in **Table 52**.

Table 52. Water Main Pipe Diameter Scoring System

Pipe Diameter	Score
Unknown Diameter	2.5
Less than 4”	1.0
6” – 8”	2.0
10” – 12”	3.0
16” – 18”	4.0
Greater than 20”	5.0

Count of Water Services

A buffer distance of 80 feet was applied utilizing a trial-and-error approach. Through this approach, buffer distances of less than 80 feet were determined ineffective because many of the water services were not getting picked up from the buffer. The buffer works by drawing an 80 foot “cloud” around each pipe and counting the number of water services within each cloud. The scoring system utilized for count of water services is provided in Table 53.

Table 53. Count of Water Services Scoring System

Description	Score
0 Water Services	1.0
Count Between 1 and 5 Water Services	2.0
Count Between 6 and 10 Water Services	3.0
Count Between 11 and 19 Water Services	4.0
Count Greater than 20 Water Services	5.0

Pipe Age

It’s widely known that as water main pipes remain in service, the probability of pipe breaks and failures increases with time. Based on each pipe’s install date data and utilizing the current year, pipe age could be calculated. The scoring system utilized for pipe age is provided in Table 54.

Table 54. Pipe Age Scoring System

Pipe Age	Score
Unknown Age	5.0
0 – 19 Years Old	1.0
20 – 29 Years Old	2.0
30 – 39 Years Old	3.0
40 – 59 Years Old	4.0
60+ Years Old	5.0

Pipe Material

Certain water main pipe materials are known to be more resilient to failure compared to others. For example, although once customary, cast-iron pipe and asbestos cement pipe are no longer used during construction and improvement of public water distribution systems. These pipe materials are still very much prevalent and in-service throughout water distribution systems, but have been replaced by other more resilient pipe materials including polyvinyl chloride (PVC) pipe, high-density polyethylene (HDPE) pipe, and ductile iron pipe. For this reason, pipe material was utilized as one of the likelihood of failure criteria. The scoring system utilized for pipe material is provided in Table 55.

Table 55. Pipe Material Scoring System

Pipe Material	Score
Unknown Material	4.5
Polyvinyl Chloride (PVC)	1.0
High-Density Polyethylene (HDPE)	2.0
Fiberglass	3.0
Asbestos Cement Pipe (ACP)	4.0
Cast-Iron Pipe (CIP)	5.0

Soil Corrosivity

An Environmental Systems Research Institute (ESRI) managed spatial data set was evaluated to determine which pipes were located in areas that had higher susceptibility to soil corrosion. The data set displays the susceptibility of uncoated steel to corrosion when in contact with the soils. The data set includes classifying soil areas into three corrosion rates, including low, moderate, and high. This classification is based on the National Soil Survey Handbook.

Water mains were assigned a score based on which soil area the (majority of the) pipe was located within. The scoring system utilized for pipe corrosion is provided in Table 56.

Table 56. Soil Corrosivity Scoring System

Corrosion Level	Description	Score
Low Corrosion	Soil provides low corrosion potential	1.0
Moderate Corrosion	Soil provides moderate corrosion potential	3.0
High Corrosion	Soil provides high corrosion potential	5.0

Summary

Figure 91 outlines the water main priority levels by water main length, and Figure 92 shows the specific priorities of each water main in Watford City's existing distribution system.

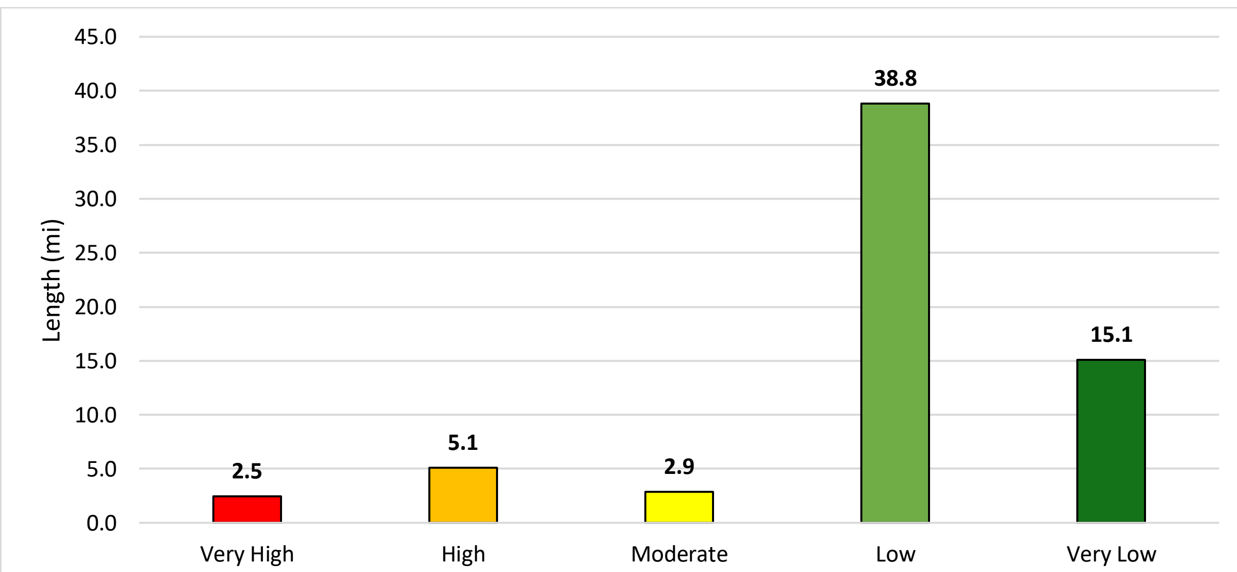
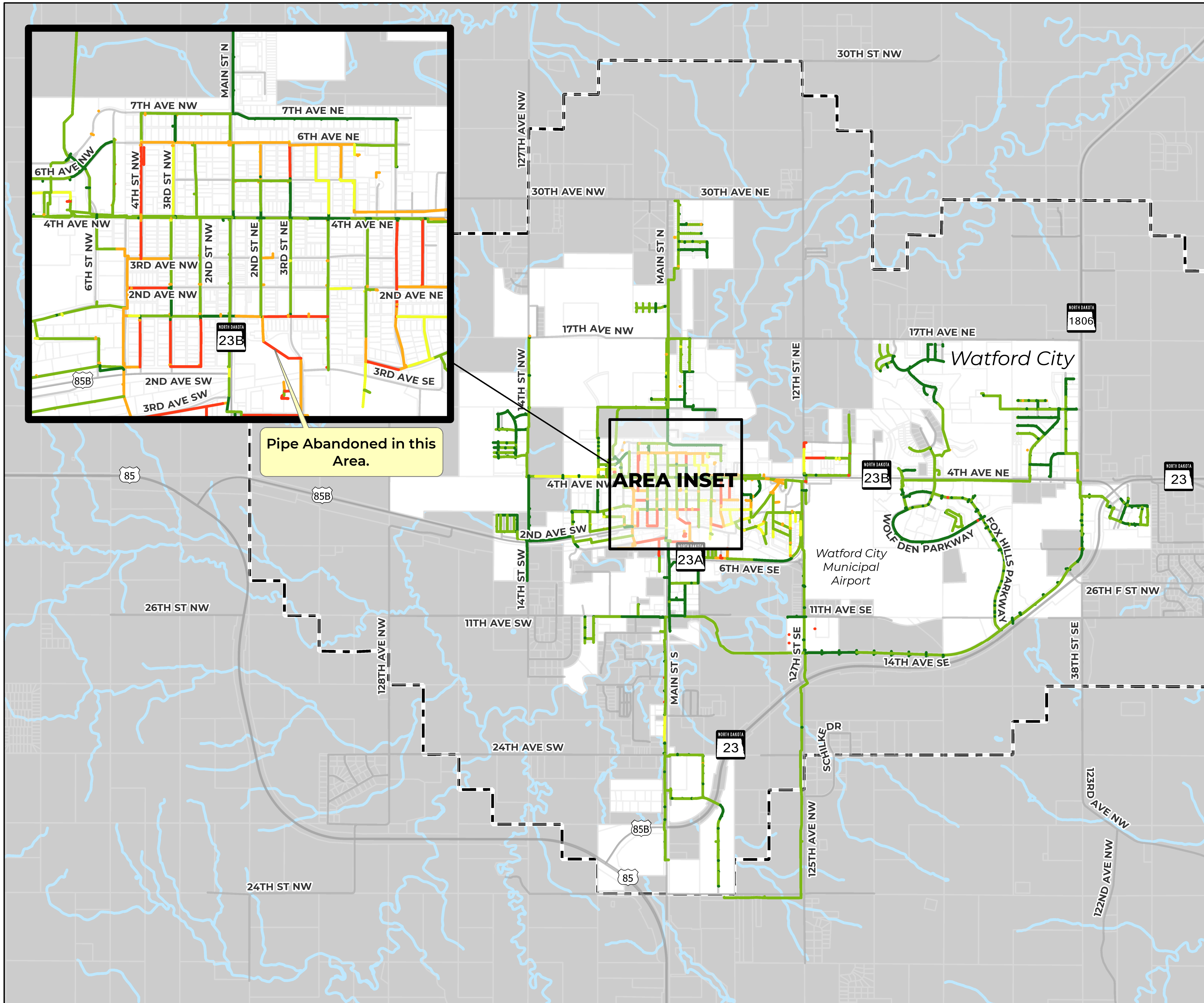


Figure 91. Water Main Priority Level (by Water Main Length)



Watford City North Dakota

Watford City 2040 Infrastructure Master Plan

Figure 92. Water Main Assessment Priorities

Map Legend

- Very High
- High
- Moderate
- Low
- Very Low

Watford City ETA

0 0.5 1 Miles

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6.1.1.3 Wastewater System Assessment

The wastewater system assessment included evaluating and prioritizing existing sanitary sewers and lift stations in Watford City. Other wastewater system infrastructure, including the lift stations, force mains, the Water Resource Recovery Facility (WRRF), manholes, and supervisory control and data acquisition (SCADA) systems were considered for inclusion within the CIP (and outlined in **Section 2.3**), but were not specifically included in the wastewater system assessment. Assessments for these infrastructure components could be completed in the future if the City elects to expand the scope of their wastewater system infrastructure assessment.

6.1.1.3.1 Sanitary Sewer Assessment

The criteria and criteria weights provided in **Table 57** were used for the sanitary sewer assessment. Each of the individual criteria are defined in greater detail throughout this section.

Table 57. Sanitary Sewer Assessment Criteria and Criteria Weights

Category / Criteria	Weight
Consequence of Failure	45%
Pipe Diameter	70%
Count of Sewer Services	30%
Likelihood of Failure	55%
Pipe Age	40%
Pipe Material	40%
Soil Corrosivity	20%

Pipe Diameter

Each individual sanitary sewer gravity pipe was assigned a score based on the respective pipe diameter. For 'unknown' pipe diameters, a weighted average of 2.4 was calculated and used based on the length of other pipe diameters and their respective assigned scores.

In general, larger pipes carry more wastewater compared to smaller pipes; the largest sewer pipes in the collection system are typically interceptor pipes. Therefore, larger pipes received a higher score compared to smaller pipes. The scoring system utilized for pipe diameter is provided in **Table 58**.

Table 58. Sanitary Sewer Pipe Diameter Scoring System

Pipe Diameter	Score
Unknown Diameter	2.4
Less than 6”	1.0
8”	2.0
10” – 15”	3.0
16” – 18”	4.0
Greater than 20”	5.0

Count of Sanitary Sewer Services

A buffer distance of 80 feet was applied utilizing a trial-and-error approach. Through this approach, buffer distances of less than 80 feet were determined ineffective because many of the sanitary sewer services were not getting picked up from the buffer. The buffer works by drawing an 80 foot “cloud” around each pipe and counting the number of sanitary sewer services within each cloud. The scoring system utilized for count of sanitary sewer services is provided in Table 59.

Table 59. Count of Sanitary Sewer Scoring System

Description	Score
0 Sanitary Sewer Services	1.0
Count Between 1 and 5 Sanitary Sewer Services	2.0
Count Between 6 and 10 Sanitary Sewer Services	3.0
Count Between 11 and 19 Sanitary Sewer Services	4.0
Count Greater than 20 Sanitary Sewer Services	5.0

Pipe Age

It’s widely known that as sanitary sewer pipes remain in service, the probability of pipe breaks and failures increases with time. Based on each pipe’s install date data, and utilizing the current year, pipe age could be calculated. The scoring system utilized for pipe age is provided in Table 60.

Table 60. Pipe Age Scoring System

Pipe Age	Score
Unknown Age	5.0
0 – 19 Years Old	1.0
20 – 29 Years Old	2.0
30 – 39 Years Old	3.0
40 – 59 Years Old	4.0
60+ Years Old	5.0

Pipe Material

Certain sanitary sewer pipe materials are known to be more resilient to failure compared to others. For example, although once customary, vitrified clay pipe (VCP) is very seldom utilized during construction and improvement of sanitary sewer collection. VCP is still very much prevalent and in-service throughout municipal collection systems but has been replaced by other more resilient pipe materials such as polyvinyl chloride (PVC) pipe. For this reason, pipe material was utilized as one of the likelihood of failure criteria.

For 'unknown' pipe materials, a weighted average of 1.3 was calculated and used based on the length of other pipe materials and their respective assigned scores. The scoring system utilized for pipe material is provided in Table 61.

Table 61. Pipe Material Scoring System

Pipe Material	Score
Unknown Material	1.3
Polyvinyl Chloride (PVC)	1.0
Not Used	2.0
Not Used	3.0
Vitrified Clay Pipe (VCP)	4.0
Cast-Iron Pipe (CIP)	5.0

Soil Corrosivity

An Environmental Systems Research Institute (ESRI) managed spatial data set was evaluated to determine which pipes were located in areas that had higher susceptibility to soil corrosion. The data set displays the susceptibility of uncoated steel to corrosion when in contact with the soils. The data set includes classifying soil areas into three corrosion rates, including low, moderate, and high. This classification is based on the National Soil Survey Handbook.

Because corrosive soils affect ferrous metals and concrete (i.e. concrete manholes), soil corrosivity was considered for the sanitary sewer assessment. Sanitary sewers were assigned a score based on which soil area the (majority of the) pipe was located within. The scoring system utilized for pipe corrosion is provided in Table 62.

Table 62. Soil Corrosivity Scoring System

Corrosion Level	Description	Score
Low Corrosion	Soil provides low corrosion potential	1.0
Moderate Corrosion	Soil provides moderate corrosion potential	3.0
High Corrosion	Soil provides high corrosion potential	5.0

Summary

Figure 93 outlines the sanitary sewer priority levels by sanitary sewer length, and Figure 94 shows the specific priorities of each sanitary sewer in Watford City's existing collection system.

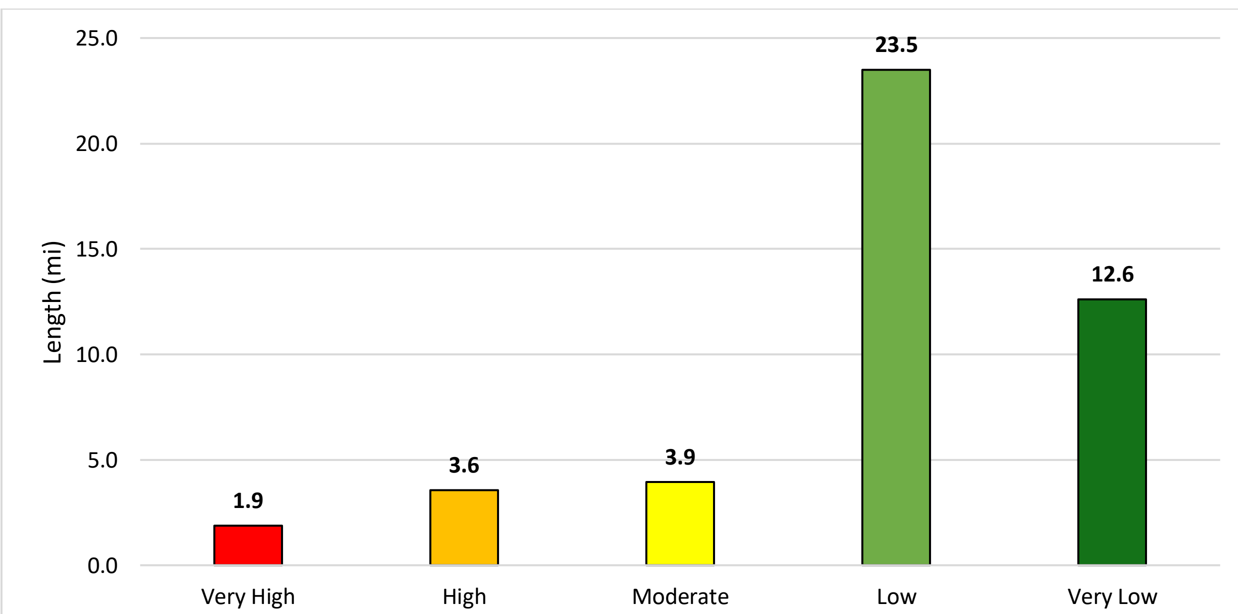
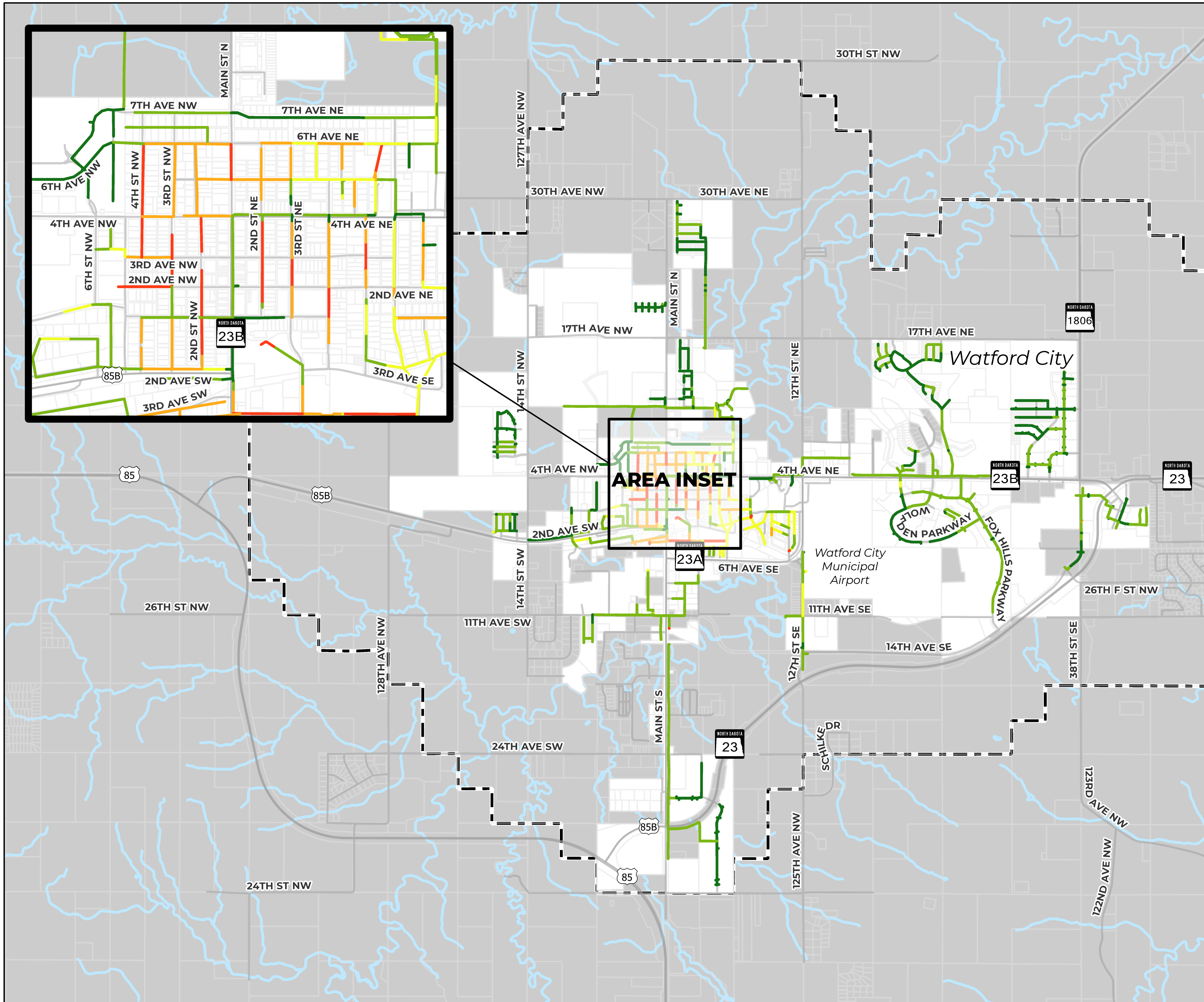


Figure 93. Sanitary Sewer Priority Level (by Sanitary Sewer Length)



Watford City 2040 Infrastructure Master Plan

Figure 94. Sanitary Sewer Assessment Priorities

Map Legend

- Very High
- High
- Moderate
- Low
- Very Low

Watford City ETA

Miles: 0, 0.5, 1

N

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6.1.1.3.2 Lift Station Assessment

The lift station assessment included evaluating each lift station based on the criteria provide in Table 63 below.

Table 63. Lift Station Assessment Criteria

Category / Criteria	Weight
Consequence of Failure	50%
Single Pump Pumping Capacity	30%
Backup Generation	15%
Bypass Capabilities	15%
SCADA	25%
Reliability	15%
Likelihood of Failure	50%
Lift Station Age	15%
Structural Condition	5%
Pump Condition	20%
Valve Condition	10%
Discharge Piping Condition	10%
Electrical Condition	20%
Performance	20%

A meeting was held with City staff to 'screen' each lift station through the above criteria. The scoring systems outlined in the forthcoming sections were utilized during the lift station screening process. Once completed, each lift station received a likelihood of failure score, a consequence of failure score, and ultimately a risk score. Lift Station improvements should be prioritized towards 'high risk' lift stations, and the City should strive to continuously lower the risk level of all the City's lift stations.

Single Pump Pumping Capacity

The single pump capacity was considered for each lift station. Typically, the larger the pumping capacity, the more critical the lift station. The scoring system utilized for lift station single pump capacity is provided in Table 64.

Table 64. Single Pump Capacity Scoring System

Single Pump Capacity (gpm)	Score
0 – 100 gpm	1.0
100 – 300 gpm	2.0
300 – 600 gpm	3.0
600+ gpm	4.0

Backup Generation

The backup generation criterion includes the back-up generation configuration. The scoring system utilized for lift station backup generation is provided in **Table 65**.

Table 65. Backup Generation Scoring System

Generation Capabilities	Score
Onsite Generator	1.0
Temp. Gen. - Easy	2.0
Temp. Gen. - Difficult	3.0
Temp. Gen. - Not Possible	4.0

Bypass Capabilities

The bypass capabilities criterion considers whether or not there is permanent, temporary, or no bypass capabilities installed. The scoring system utilized for lift station bypass capabilities is provided in **Table 66**.

Table 66. Bypass Capabilities Scoring System

Bypass Capabilities	Score
Permanent Bypass Installed	1.0
Temp. Bypass - Easy	2.0
Temp. Bypass - Difficult	3.0
Bypass Not Possible	4.0

SCADA

The supervisory control and data acquisition (SCADA) criterion considers the general reliability of the SCADA system. The scoring system utilized for lift station SCADA is provided in **Table 67**.

Table 67. SCADA Scoring System

SCADA Reliability	Score
Functions Great	1.0
Functions OK	2.0
Functions Poorly	3.0
No SCADA	4.0

Reliability

The reliability criterion considers how reliable (expressed in terms of problem frequency) a lift station has historically operated. The scoring system utilized for lift station SCADA is provided in **Table 68**.

Table 68. Reliability Scoring System

Condition	Score
No Problems	1.0
Minimal Problems	2.0
Some Problems	3.0
Frequent Problems	4.0

Lift Station Age

Lift station age was reviewed and utilized in the lift station assessment. The construction date, or if applicable, date of last improvement was used. From there, the lift station age was calculated by subtracting the install or last improvement date from the current year (2021). The calculated lift station ages were normalized on a scale of 1 to 4 to align with the other scales, 1 being the 'newest' lift station and 4 being the 'oldest' lift station. According to the data provided by the City, Lift Station CSI is the oldest lift station (1980; received a score of 4.0) and Lift Station 4B is the newest lift station (2019; received a score of 1.0). All other lift stations fell within the 1 to 4 range based on normalized scaling.

Structural Condition

Structural condition included reviewing the physical structure condition for each lift station. Defects such as cracks, intrusions, etc., as well as settlement and slumping issues were considered. The scoring system utilized for lift station structural condition is provided in **Table 69**.

Table 69. Structural Condition Scoring System

Condition	Score
Excellent Condition	1.0
Good Condition	2.0
Ok Condition	3.0
Poor Condition	4.0

Pump Condition

Pump condition included considerations for the pump discharge head, motor, impeller, volute, column, and floats, etc., located in the lift stations. The scoring system utilized for lift station pump condition is provided in **Table 70**.

Table 70. Pump Condition Scoring System

Condition	Score
Excellent Condition	1.0
Good Condition	2.0
Ok Condition	3.0
Poor Condition	4.0

Valve Condition

Valve condition included considerations for all valves in the lift station valve vaults, which may consist of isolation valves, check valves, and air release or air/vacuum valves, etc. The scoring system utilized for lift station valve condition is provided in **Table 71**.

Table 71. Valve Condition Scoring System

Condition	Score
Excellent Condition	1.0
Good Condition	2.0
Ok Condition	3.0
Poor Condition	4.0

Discharge Pipe Condition

Discharge pipe condition generally consists of lift station discharge piping located in and between the lift stations and the valve vaults. The scoring system utilized for lift station discharge pipe condition is provided in Table 72.

Table 72. Discharge Pipe Condition Scoring System

Condition	Score
Excellent Condition	1.0
Good Condition	2.0
Ok Condition	3.0
Poor Condition	4.0

Electrical Condition

Electrical condition included reviewing the lift station electrical equipment including but not limited to motor control centers (MCCs), variable frequency drives (VFDs), switchboards, wiring condition, etc. The scoring system utilized for lift station discharge pipe condition is provided in Table 73.

Table 73. Electrical Condition Scoring System

Condition	Score
Excellent Condition	1.0
Good Condition	2.0
Ok Condition	3.0
Poor Condition	4.0

Performance

The performance criterion included reviewing the performance level of each lift station. In many collection systems, lift stations perform differently based on configuration, design calculations, construction methods, typical wear, and other factors. Many variables can affect lift station performance, and newer lift stations don't always perform better than older lift stations. The scoring system utilized for lift station performance is provided in Table 74.

Table 74. Performance Scoring System

Performance	Score
Excellent Performance	1.0
Good Performance	2.0
Ok Performance	3.0
Poor Performance	4.0

Summary

The results from the lift station assessment process are displayed in Figure 95. Generally, lift station improvements should always be prioritized at higher risk assets. However, there will always be outlying defects that don't deem a lift station high risk. These outliers can likely be addressed through operational and maintenance related improvements, such as replacing a pump base, adding an isolation valve, waterproofing a vault, etc.

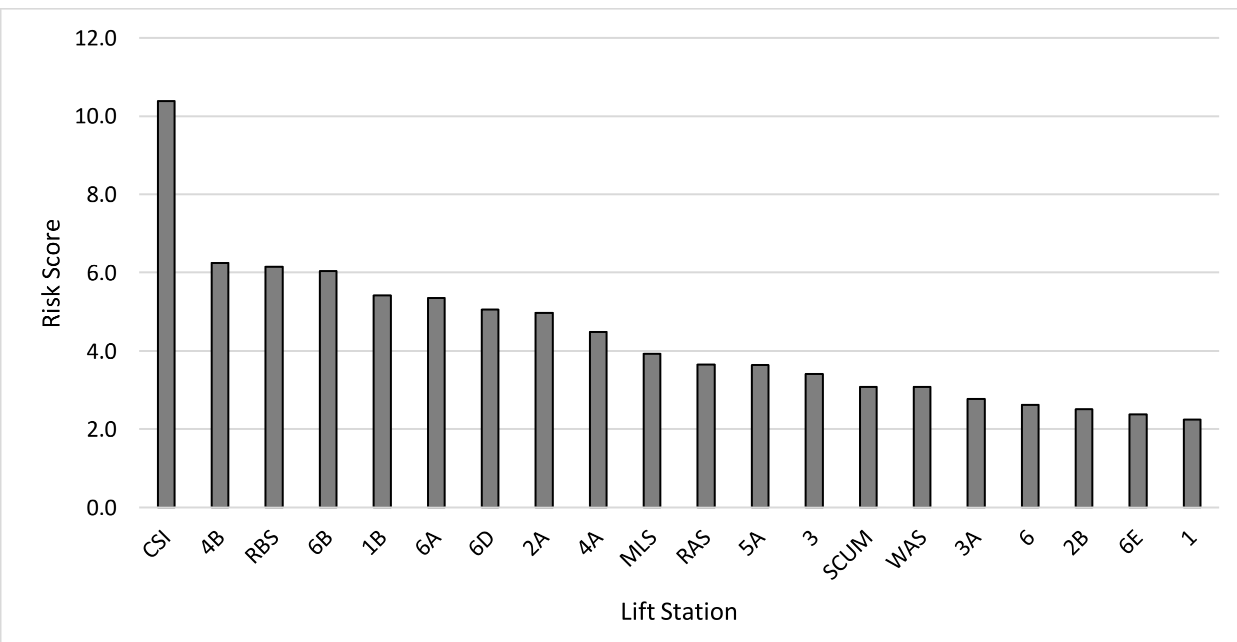


Figure 95. Lift Station Risk Scores and Associated Priorities

6.1.1.4 Facility Review

As previously outlined in Section 2.5, facility reviews were performed for each facility considered in this Master Plan. During each facility review, the facility review team assigned a consensus 'grade' to various structural and architectural components, as well as electrical and mechanical components. This exercise was done to try to understand, comprehensively (but still at a review level), the condition and function of each City facility. Additionally, various specific deficiencies and associated improvements were identified at each facility. These improvements (referred to as O&M Facility Improvements) were documented, cost estimates were developed, and ultimately prioritized into three priority time horizons, including 2022 – 2025 (most immediate need), 2026 – 2028, and 2029 – 2031. These improvements are provided in the forthcoming subsections.

6.1.1.4.1 2022 – 2025 O&M Facility Improvements

City Hall and Civic Center

Line Item	Estimated Costs (2021$)
Provide Egress Hardware for Heritage Room Exit Door	$2,200
Provide & Install Multimedia Systems in Heritage Room	$17,800
Total	**$20,000**

City Shops (Old)

N/A

City Shops (New)

N/A

Emergency Services Building

Line Item	Estimated Costs (2021$)
Provide Fire Suppression	$212,300
Replace Exterior Window	$2,400
Total	**$214,700**

Fire Hall

Line Item	Estimated Costs (2021$)
Repair Exterior Wall	$24,300
Replace Weatherstripping on all Overhead Doors	$5,900
Replace Fluorescent Fixtures with LED in Kitchen, Restrooms & Other Service Areas	$141,900
Update Fire Alarm System	$38,200
Replace Boilers & Pumps	$105,200
Total	**$315,500**

Fox Hills Golf Course Clubhouse

Line Item	Estimated Costs (2021$)
Provide Fire Suppression	$354,200
Fix Elevation Change Between Outdoor Decks	$12,500
Provide Handrails to Stairs	$1,700
Repair Deck Railing	$5,500
Re-Stain Deck	$19,500
Remove Paper Storage Boxes from Mechanical Space	$200
Update Receptacles to GFCI Type in Bar Area	$1,800
Reconnect Kitchen Range Hood Exhaust Duct Properly to the Hood	$17,800
Cover Exposed Kitchen Range Exhaust Hood Supply Flex Duct	$2,500
Total	**$415,700**

Rough Rider Center

Line Item	Estimated Costs (2021$)
Re-Caulk Precast Joints Where Gaps Exist	$80,900
Total	**$80,900**

Veteran's Memorial Building

N/A

Visitor Center

Line Item	Estimated Costs (2021$)
Repair Failed Boards on Deck By Ramp	$7,000
Total	**$7,000**

Wolf Pup Preschool

Line Item	Estimated Costs (2021$)
Repair Exterior CMU	$44,100
Replace EIFS	$96,000
Total	**$140,100**

6.1.1.4.2 2026 – 2028 O&M Facility Improvements

City Hall and Civic Center

Line Item	Estimated Costs (2021$)
Replace Carpet in Heritage Room	$11,300
Total	**$11,300**

City Shops (Old)

N/A

City Shops (New)

N/A

Emergency Services Building

N/A

Fire Hall

Line Item	Estimated Costs (2021$)
Repair Cracking South Concrete Apron	$60,700
Replace Roofing	$367,900
Repair Exit Door Stair Railings to Code & Cracking Concrete Stairs	$8,900
Replace Garage Ventilation System	$113,200
Total	**$550,700**

Fox Hills Golf Course Clubhouse

Line Item	Estimated Costs (2021$)
Repair Exterior Siding	$89,300
Update and Expand Parking Lot (Including Adequate LED Lighting)	$762,300
Replace ADA Ramp to Comply with Codes	$145,600
Replace Fluorescent Fixtures with LED in Kitchen, Restrooms & Other Service Areas	$36,400
Replace Kitchen Fire Suppression for Range Hood	$12,200
Provide Humidity Exhaust Hood for Dishwasher	$24,300
Replace Furnace Located in Original Building	$32,400
Replace Water Heater Located in Original Building	$4,100
Total	**$1,106,600**

Rough Rider Center

Line Item	Estimated Costs (2021$)
Remedy All Door Hardware Issues (Line-Up Door Hardware Consultant)	TBD
Repair Horizontal Members on Railings that are Coming Out (Consult Railing Manufacturer)	TBD
Provide a Water Softener System	$121,300
Total	**$121,300**

Veteran’s Memorial Building

Line Item	Estimated Costs (2021$)
Replace HID Lights with LED at Gym & South Entry	$404,300
Total	**$404,300**

Visitor Center

Line Item	Estimated Costs (2021$)
Replace Roofing Shingles	$283,000
Replace Deck Boards on East Side	$32,400
Replace Addressable Fire Alarm System & Full Smoke Detector Coverage	$51,000
Replace Condensing Units	$25,900
Total	**$392,300**

Wolf Pup Preschool

Line Item	Estimated Costs (2021$)
Provide Playground or Greenspace for Kids	$80,900
Update Network Cabling to Cat6	$52,600
Total	**$133,500**

6.1.1.4.3 2029 - 2031 O&M Facility Improvements

City Hall and Civic Center

Line Item	Estimated Costs (2021$)
Update & Relocate the Network Cabling System	$50,600
Total	**$50,600**

City Shops (Old)
N/A

City Shops (New)
N/A

Emergency Services Building
N/A

Fire Hall

Line Item	Estimated Costs (2021$)
Replace Water Heater	$8,100
Total	**$8,100**

Fox Hills Golf Course Clubhouse

Line Item	Estimated Costs (2021$)
Replace Exterior Siding	$258,100
Replace Roofing	$256,200
Replace Exterior Doors and Windows (Commercial Grade)	$145,600
Replace Water Heater Located in Addition	$4,100
Total	**$664,000**

Rough Rider Center

Line Item	Estimated Costs (2021$)
Provide a Condensation Study due to Streaking Down Precast; Verify No Major Issues	TBD
Replace Cooling Tower for the Ice System	$161,700
Total	**$161,700**

Veteran's Memorial Building

Line Item	Estimated Costs (2021$)
Replace Gym Air Handler	$291,100
Replace Water Heater	$8,100
Total	**$299,200**

Visitor Center

N/A

Wolf Pup Preschool

Line Item	Estimated Costs (2021$)
Replace Exterior Windows And Doors (Commercial Grade)	$141,500
Replace Water Heater	$8,100
Total	**$149,600**

6.1.1.4.4 O&M Facility Improvements Estimated Costs

Detailed estimates for each improvement were provided to the City in a spreadsheet. Table 75 below contains the total estimated costs to conduct all of the projects outlined above, categorized by facility as well as recommended improvement horizon. It should be noted that although facility improvements were identified beyond 2031, costs were not included in the Master Plan because it falls outside of the 10-year CIP planning horizon.

Table 75. O&M Facility Improvements Estimated Costs

Facility	Recommended Improvement Horizon			Total 10-Year Costs
	2022 – 2025	2026 – 2028	2029 – 2031	
City Hall and Civic Center	$ 20,000	$ 11,300	$ 50,600	$ 81,900
City Shops (Old)	$ -	$ -	$ -	$ -
City Shops (New)	$ -	$ -	$ -	$ -
Emergency Services Building	$ 214,700	$ -	$ -	$ 214,700
Fire Hall[1]	$ 315,500	$ 550,700	$ 8,100	$ 874,300
Fox Hills Golf Course Clubhouse	$ 415,700	$ 1,106,600	$ 664,000	$ 2,186,300
Rough Rider Center	$ 80,900	$ 121,300	$ 161,700	$ 363,900
Veteran's Memorial Building	$ -	$ 404,300	$ 299,200	$ 703,500
Visitor Center	$ 7,000	$ 392,300	$ -	$ 399,300
Wolf Pup Preschool	$ 140,100	$ 133,500	$ 149,600	$ 423,200
Total (Excluding Fire Hall)	$ 878,400	$ 2,169,300	$ 1,325,100	$ 4,372,800
Total Annual Cost Burden per Horizon	$ 219,600	$ 723,100	$ 441,700	$ 437,280

1 Because a new Fire Hall is programmed in the CIP, total O&M costs for the Fire Hall were excluded from the totals shown in the table above but included for reference.

6.2 Project Development and Project Categories

Once the individual infrastructure systems were assessed, high priority horizontal assets were overlayed to identify corridors in need of improvement. Based on the findings throughout this Master Plan, including the Existing Conditions Assessment (Chapter 2), the Future Conditions and Growth Assessment (Chapter 3), and this Chapter, projects were developed and categorized as follows:

Capital Projects

- Corridor Reconstruction
- New Roadway
- Wet Infrastructure
- New Facilities
- Other

O&M Projects

- Street Mill and Overlay Improvements
- Street Chip Seal Improvements
- Watermain and Sanitary Sewer Rehabilitation
- WRRF Improvements
- Facilities

Annual Programs

- Manhole Lining Annual Program
- Sidewalk Gap Infill Annual Program
- Sidewalk Repair and ADA Annual Program

6.3 Project Cost Estimating

To develop cost estimates for projects, a quantity takeoff was performed for each project that was identified as part of this Master Plan. For example, if a road reconstruction project was identified, the road length, road width, as well as underground water and sanitary sewer utility characteristics (pipe size, pipe length, and pipe material) were multiplied by an associated unit cost to calculate a subtotal. That calculated subtotal was then marked up with a 30% planning-level contingency to estimate the construction costs. Once the construction costs were estimated, a 25% engineering, legal, and administrative fee was applied to estimate the total project costs. The formulas below show, at a high-level, the cost estimating methodology utilized as part of this Master Plan. The unit costs utilized in this Master Plan are provided in Appendix E.

$$Estimated\ Quantities * Unit\ Costs * 1.30\ (Contingecy) = Estimated\ Construction\ Costs$$

$$Estimated\ Construction\ Costs * 1.25\ (ELA) = Estimated\ Project\ Costs$$

The project costs in the Capital Improvements Plan (CIP) are represented in 2021 dollars, where no inflation factor was applied for projects programmed into the future. The financial model developed as part of this Project has inflation factors built in, so inflation is accounted for as the City utilizes the financial model.

6.4 Project Prioritization Criteria

At the onset of this Master Plan, it was recognized that projects of various complexities, projects including various infrastructure systems, as well as projects to improve existing infrastructure and projects to add infrastructure, would be recommended from this effort (as noted above). To aide in prioritizing projects across a wide spectrum with varying project characteristics, prioritization criteria was developed to screen recommended projects. This process allows the City to invest and complete projects of the utmost priority. The project prioritization criteria utilized for this Master Plan is defined below in Table 76.

Table 76. Project Prioritization Criteria

Criterion	Description	Weight
Quality of Life	Degree to which the project will improve the quality of life of the City's residents.	15%
Health, Safety, and Regulatory Compliance	Degree to which the project will help minimize health risks, improve safety, and improve regulatory compliance capabilities.	25%
Infrastructure Condition	Degree to which the existing infrastructure condition is in need of improvement	25%
Infrastructure Overlap	Degree to which multiple infrastructure systems are captured within one project.	20%
Economic Development and Growth	Degree to which the project will support economic development initiatives and support smart growth	15%

Once the projects were developed and screened through the project prioritization criteria shown on the previous page, each project received a priority score and associated priority rank. Additionally, because each project had a cost estimate, a 'bang-for-buck' analysis was performed to higher prioritize projects that provided the most value at the least cost to the City. The project priority ranks for each project are provided within the CIP ledger shown in Appendix F.

Chapter 7. Capital Improvements Plan

Watford City's Capital Improvement Plan (CIP) provides a 10-year outlook of project recommendations from 2022 to 2031 to improve Watford City's infrastructure systems (CIP ledger provided as Appendix F). The CIP represents two equally split 5-year planning horizons. The near-term planning horizon includes recommended projects from 2022 through 2026, and the mid-term planning horizon includes recommended projects from 2027 through 2031. A detailed CIP spreadsheet was developed as part of this Master Plan and turned over to the City. Steps for utilizing and updating the spreadsheet are provided on the first tab in the spreadsheet.

7.1 Near-Term Planning Horizon (2022 – 2026)

Each project identified in the near-term planning horizon is accompanied by a project summary, which includes the project driver, project system, anticipated improvement years, total project cost estimate (shown with both construction and engineering, legal, administrative costs), project description, and project need and justification. All the project summaries for each project identified in the near-term planning horizon are provided in Section 7.1.1.

The CIP project recommendations for the near-term planning horizon (from years 2022 to 2026) are provided in Table 77 below. Additionally, the near-term planning horizon CIP expenditures are shown summarized in Figure 96 and represented by project category in Figure 97. The near-term project recommendations are shown spatially in Figure 98.

Table 77. Near-Term (2022 – 2026) CIP Projects

Project	Project Type	Total Project Costs	Project Year(s)	Other(s) Cost Share ($)	City Cost Share ($)
Capital Projects					
Main Street N Reconstruction (7th Avenue N to 4th Avenue N)	Capital - Corridor Reconstruction	$ 1,490,000	2022	$ 1,339,052	$ 150,948
McKenzie County WRD N Main Emergency Water System Connection	Capital - Wet Infrastructure	$ 85,000	2022	$ 63,889	$ 21,111
2nd Avenue Southwest Shared Use Path	Capital - Other	$ 624,000	2022	$ 513,000	$ 111,000
New Public Works Facility	Capital - New Facilities	$ 17,500,000	2022 - 2023	$ -	$ 17,500,000
3rd Avenue SW Reconstruction (Main Street S to 2nd Avenue SW)	Capital - Corridor Reconstruction	$ 3,779,000	2022 - 2023	$ -	$ 3,779,000
Golf Course Parking Lot and Shop Improvements	Capital - New Facilities	$ 1,300,000	2023	$ -	$ 1,300,000
New Fire Hall	Capital - New Facilities	$ 9,750,000	2022 - 2024	$ -	$ 9,750,000
Park Avenue E Reconstruction (Main Street S to 4th Street SE)	Capital - Corridor Reconstruction	$ 1,227,000	2023 - 2024	$ -	$ 1,227,000
10th Avenue NE Gravel to Urban Section (Main Street to WRRF)	Capital - New Roadway	$ 1,260,000	2023 - 2024	$ -	$ 1,260,000
6th Avenue NW Reconstruction (Main Street to 5th Street NW)	Capital - Corridor Reconstruction	$ 1,278,000	2023 - 2024	$ -	$ 1,046,000
4th Street SW Reconstruction (Park Avenue W to 2nd Avenue SW)	Capital - Corridor Reconstruction	$ 795,000	2023 - 2024	$ -	$ 795,000

Project	Project Type	Total Project Costs	Project Year(s)	Other(s) Cost Share ($)	City Cost Share ($)
2nd Avenue NW Reconstruction (5th Street NW to Main Street)	Capital - Corridor Reconstruction	$ 1,230,000	2024 - 2025	$ -	$ 1,230,000
3rd Street SW Reconstruction (Park Avenue W to 2nd Avenue SW)	Capital - Corridor Reconstruction	$ 1,243,000	2024 - 2025	$ -	$ 1,243,000
2nd Street SW Reconstruction (4th Avenue NW to 2nd Avenue SW)	Capital - Corridor Reconstruction	$ 1,990,000	2025 - 2026	$ -	$ 1,990,000
5th Street NE Reconstruction (6th Avenue NE to 5th Avenue NE)	Capital - Corridor Reconstruction	$ 514,000	2025 - 2026	$ -	$ 514,000
4th Street NE Reconstruction (6th Avenue NE to 5th Avenue NE)	Capital - Corridor Reconstruction	$ 514,000	2025 - 2026	$ -	$ 514,000
2nd Street NE Reconstruction (6th Avenue NE to 5th Avenue NE)	Capital - Corridor Reconstruction	$ 514,000	2025 - 2026	$ -	$ 514,000
3rd Street NE Reconstruction (6th Avenue NE to 5th Avenue NE)	Capital - Corridor Reconstruction	$ 518,000	2025 - 2026	$ -	$ 518,000
Operations and Maintenance Projects [Mill and Overlay]					
2024 Mill and Overlay Improvements	O&M - Mill and Overlay	$ 566,000	2023 - 2024	$ -	$ 566,000
Operations and Maintenance Projects [Chip Seal]					
2022 City Wide Chip Seal Improvements	O&M - Chip Seal	$ 1,247,000	2022	$ -	$ 1,247,000
2025 City Wide Chip Seal Improvements	O&M - Chip Seal	$ 887,000	2025	$ -	$ 887,000
Operations and Maintenance Projects [Watermain and Sanitary Sewer Rehabilitation]					
2025 Sanitary Sewer Rehabilitation	O&M - Watermain and Sanitary Rehabilitation	$ 798,000	2025	$ -	$ 798,000
Operations and Maintenance Projects [Facilities]					
2023 City Facility Improvements	O&M - Facilities	$ 620,000	2023	$ -	$ 620,000
Operations and Maintenance Projects [WRRF]					
WRRF Improvements - Phase I (Bypass Pumping Upgrades and Electrical Distribution Repairs)	O&M - WRRF	$ 300,000	2022	$ -	$ 300,000
WRRF Improvements - Phase II (PTB Improvements)	O&M - WRRF	$ 200,000	2022	$ -	$ 200,000
WRRF Improvements - Phase III (Sludge Removal)	O&M - WRRF	$ 150,000	2026	$ -	$ 150,000
Annual Improvement Programs					
Manhole Lining Annual Program[1]	Annual Programs	$ 20,000	Annual	$ -	$ 20,000
Sidewalk Gap Infill Annual Program[2]	Annual Programs	$ 35,000	Annual	$ -	$ 35,000
Sidewalk Repair and ADA Annual Program[3]	Annual Programs	$ 75,000	Annual	$ -	$ 75,000

1 - $20,000 per year ($200,000 total over the 10-year CIP planning horizon)
2 - $35,000 per year ($350,000 total over the 10-year CIP planning horizon)
3 - $75,000 per year ($750,000 total over the 10-year CIP planning horizon)

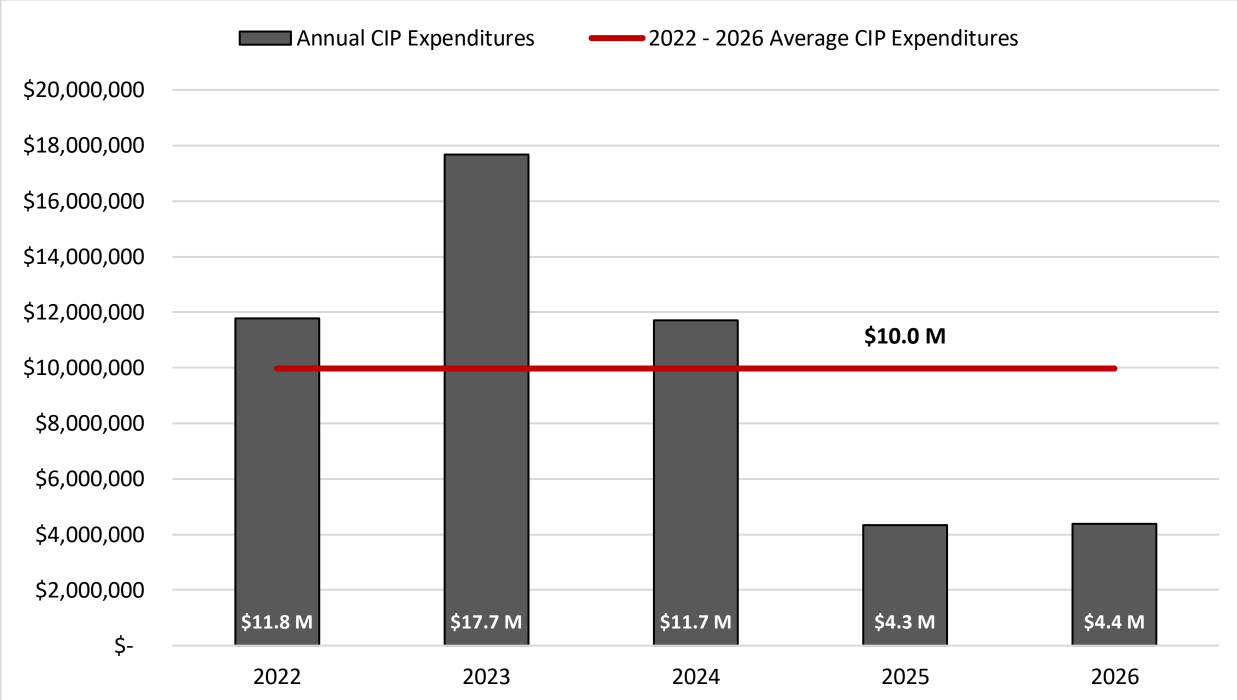


Figure 96. Near-Term (2022 – 2026) CIP Expenditures

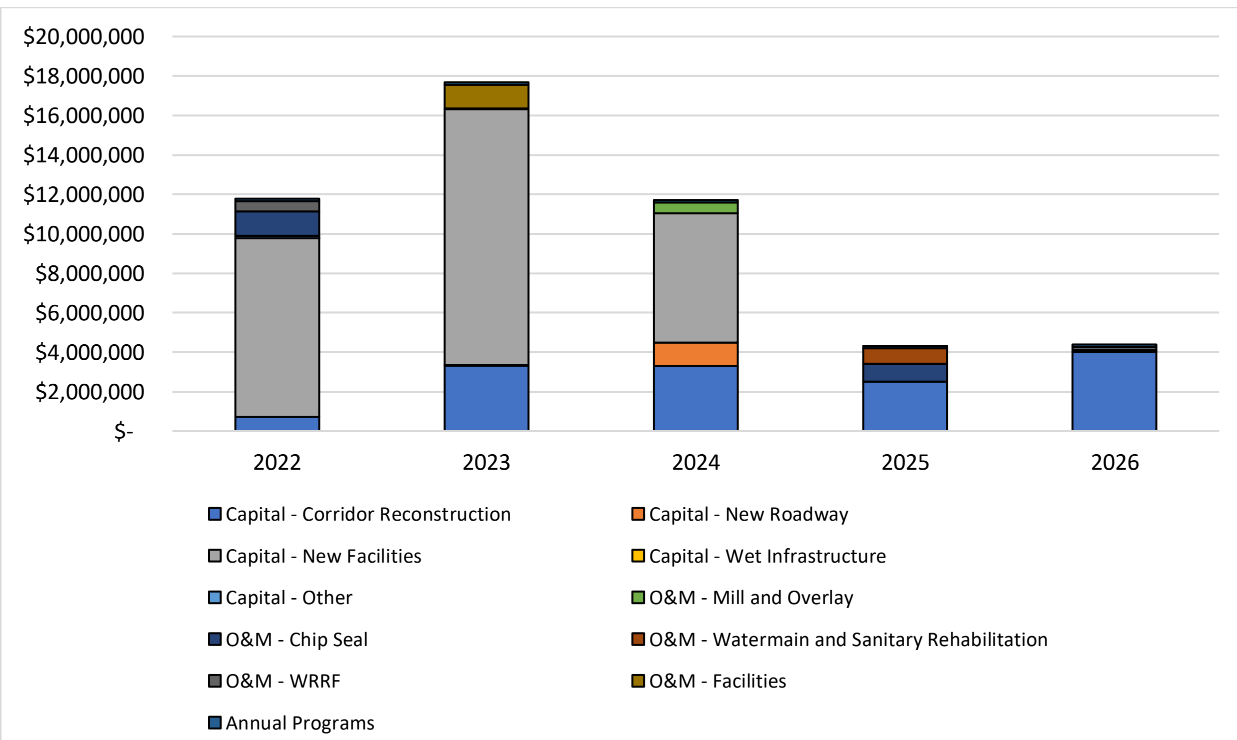
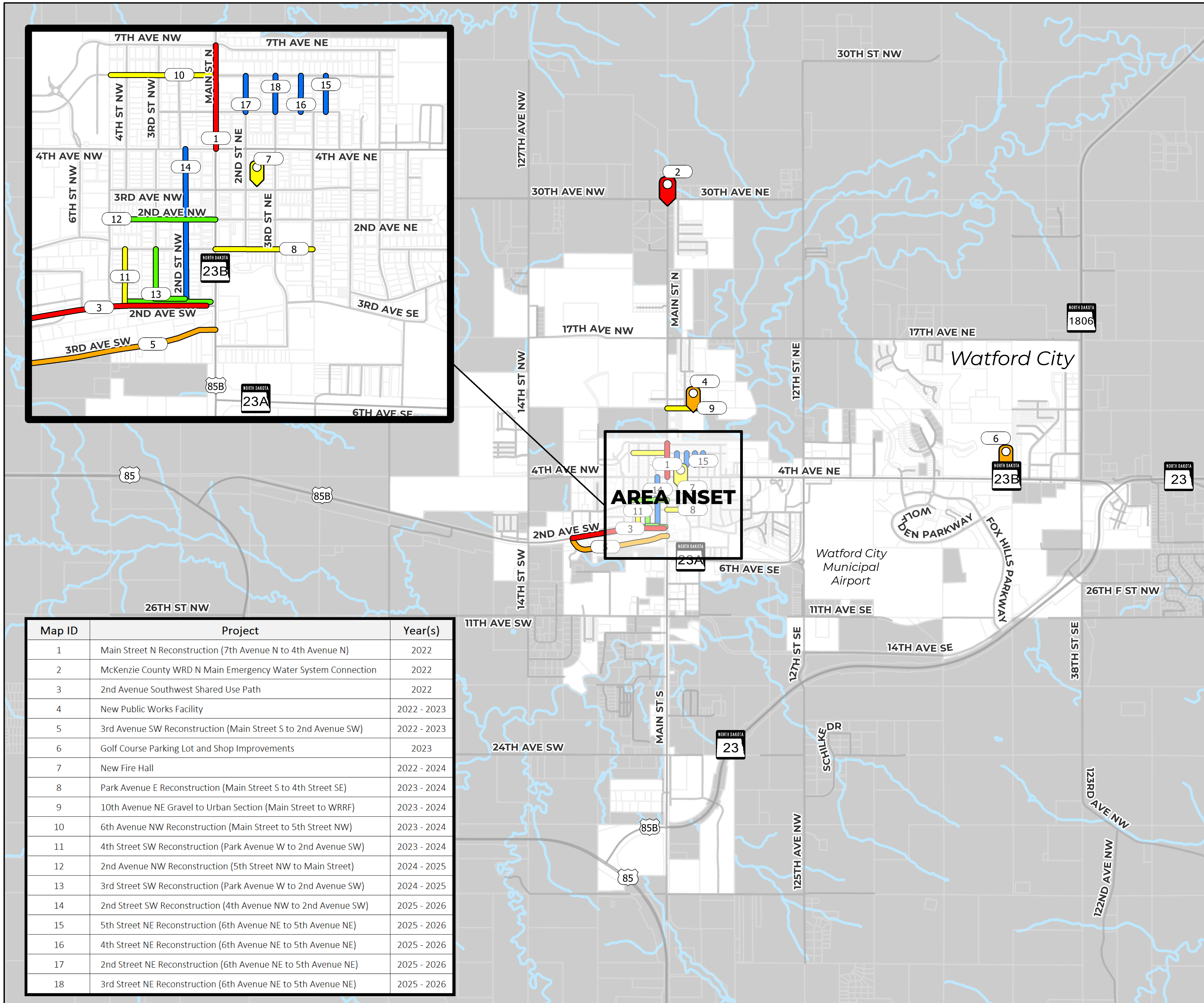


Figure 97. Near-Term (2022 – 2026) CIP Expenditures (by Project Type)

Watford City 2040 Infrastructure Master Plan

Figure 98. Map of Near-Term (2022-2026) CIP Projects



Map ID	Project	Year(s)
1	Main Street N Reconstruction (7th Avenue N to 4th Avenue N)	2022
2	McKenzie County WRD N Main Emergency Water System Connection	2022
3	2nd Avenue Southwest Shared Use Path	2022
4	New Public Works Facility	2022 - 2023
5	3rd Avenue SW Reconstruction (Main Street S to 2nd Avenue SW)	2022 - 2023
6	Golf Course Parking Lot and Shop Improvements	2023
7	New Fire Hall	2022 - 2024
8	Park Avenue E Reconstruction (Main Street S to 4th Street SE)	2023 - 2024
9	10th Avenue NE Gravel to Urban Section (Main Street to WRRF)	2023 - 2024
10	6th Avenue NW Reconstruction (Main Street to 5th Street NW)	2023 - 2024
11	4th Street SW Reconstruction (Park Avenue W to 2nd Avenue SW)	2023 - 2024
12	2nd Avenue NW Reconstruction (5th Street NW to Main Street)	2024 - 2025
13	3rd Street SW Reconstruction (Park Avenue W to 2nd Avenue SW)	2024 - 2025
14	2nd Street SW Reconstruction (4th Avenue NW to 2nd Avenue SW)	2025 - 2026
15	5th Street NE Reconstruction (6th Avenue NE to 5th Avenue NE)	2025 - 2026
16	4th Street NE Reconstruction (6th Avenue NE to 5th Avenue NE)	2025 - 2026
17	2nd Street NE Reconstruction (6th Avenue NE to 5th Avenue NE)	2025 - 2026
18	3rd Street NE Reconstruction (6th Avenue NE to 5th Avenue NE)	2025 - 2026

Map Legend

Near-Term Capital Improvements

- 2022
- 2023
- 2024
- 2022
- 2023
- 2024
- 2025
- 2026

Note: Only Capital Projects are displayed on the map. Separate maps outlining the programmed O&M Improvements (i.e. Chip Seals, Mill & Overlays, Water and Sanitary Sewer Rehabilitation) are provided in Figure 99 through Figure 101.

Miles
0 0.5 1

7.1.1 Near-Term Planning Horizon Project Summaries

The summaries for projects recommended within the near-term planning horizon are provided within this Section. Each project summary includes the following information:

- Project Name
- Project Category
- Priority Rank
- Project Driver(s)
  - Participation:
    Project includes cost-share participation with Watford City.
  - Growth:
    Project is required to meet the City's growing needs.
  - Improve:
    Project will enhance existing infrastructure through replacement or rehabilitation.
  - Preserve:
    Project will preserve existing infrastructure through standard maintenance practices.
  - Regulatory:
    Project is needed to comply with regulatory requirements.
  - Redundancy:
    Project will provide much needed infrastructure redundancies.
  - Safety:
    Project will greatly improve safety.
- Project System
  - *Transportation, Water, Wastewater, Facilities*
- Project Description
- Need/Justification
- Improvement Years
- Total Project Cost Estimate
- Estimated Local Cost Share

7.1.1.1 Main Street N Reconstruction (7th Avenue N to 4th Avenue N)

CAPITAL - CORRIDOR RECONSTRUCTION

Main Street N Reconstruction
7th Avenue N to 4th Avenue N

PRIORITY RANK
1

PROJECT DRIVER(S)	INFRASTRUCTURE SYSTEM(S)	IMPROVEMENT YEAR(S)	TOTAL PROJECT COST ESTIMATE
PARTICIPATION **IMPROVE**	**TRANSPORTATION** **WASTEWATER**	**2022**	**$1.49M** (2021 $) **CONSTRUCTION** $916,600 **CONTINGENCY (30%)** $275,000 **ELA (25%)** $298,000

PROJECT DESCRIPTION	ESTIMATED LOCAL COST SHARE
The proposed 2022 reconstruction of Main Street N would replace the arterial road from 7th Avenue N to 4th Avenue N. This project includes replacement of the road surface as well as an estimated 710' of 8" sanitary sewer pipe. McKenzie County is funding the transportation costs of this Project; The City's cost share of $151,000 funds the sewer replacement and sidewalk replacement.	**$151,000**

NEED / JUSTIFICATION
Another project (led by McKenzie County) is being conducted on Main Street N from 7th Avenue N to 30th Avenue N. This corridor will tie into that project and will enhance the existing infrastructure.

7.1.1.2 McKenzie County WRD N Main Emergency Water System Connection

CAPITAL - WET INFRASTRUCTURE

McKenzie County Water Resource District
North Main Emergency Water System Connection

PRIORITY RANK
13

PROJECT DRIVER(S)	PROJECT SYSTEM(S)	IMPROVEMENT YEAR(S)	TOTAL PROJECT COST ESTIMATE
PARTICIPATION **REDUNDANCY**	**WATER**	**2022**	**$85,000** (2021 $) **CONSTRUCTION** $85,000 **CONTINGENCY (0%)** $0 **ELA (0%)** $0

PROJECT DESCRIPTION	ESTIMATED LOCAL COST SHARE
This project will provide an emergency water connection (near 30th Avenue N and Main Street) from the MCWRD water distribution system to Watford City's water distribution system.	**$21,100**

NEED / JUSTIFICATION
This project is being led and primarily funded by McKenzie County Water Resource District (WRD). The water system connection will provide an emergency connection the City's distribution system, providing much needed redundancy.

7.1.1.3 2nd Avenue SW Shared Use Path

CAPITAL - OTHER				
2nd Avenue Southwest Shared Use Path				PRIORITY RANK: 18
PROJECT DRIVER(S)	PROJECT SYSTEM(S)	IMPROVEMENT YEAR(S)	TOTAL PROJECT COST ESTIMATE	
PARTICIPATION SAFETY	**TRANSPORTATION**	**2022**	**$624,000** (2021 $) **CONSTRUCTION $520,000** **CONTINGENCY (0%) $0** **ELA (20%) $103,500**	
PROJECT DESCRIPTION			ESTIMATED LOCAL COST SHARE	
This project will provide a shared use path along 2nd Avenue SW from the intersection of 10th Street / 3rd Avenue SW and 2nd Avenue SW to Main Street.			**$111,000**	
NEED / JUSTIFICATION				
The City has two grants for this effort, including a $200,000 grant from the ND Department of Transportation and a $287,000 grant from the Outdoor Heritage Fund, which is a driver behind this project. It will also greatly improve pedestrian safety.				

7.1.1.4 New Public Works Facility

CAPITAL - NEW FACILITIES				
New Public Works Facility				PRIORITY RANK: 19
PROJECT DRIVER(S)	PROJECT SYSTEM(S)	IMPROVEMENT YEAR(S)	TOTAL PROJECT COST ESTIMATE	
IMPROVE GROWTH	**FACILITY**	**2022 - 2023**	**$17.5M** (2021 $) **CONSTRUCTION $12,240,000** **CONTINGENCY (30%) $3,670,000** **ELA (10%) $1,590,000**	
PROJECT DESCRIPTION			ESTIMATED LOCAL COST SHARE	
The new Public Works Facility would provide an updated and expanded facility to help meet the existing and future needs of the City.			**$17.5M**	
NEED / JUSTIFICATION				
The existing public works old City shops are outdated and in need of improvement.				

7.1.1.5 3rd Avenue SW Reconstruction (Main Street S to 2nd Avenue SW)

CAPITAL - CORRIDOR RECONSTRUCTION

3rd Avenue Southwest Reconstruction
Main Street S to 2nd Avenue SW

PRIORITY RANK
2

PROJECT DRIVER(S)	PROJECT SYSTEM(S)	IMPROVEMENT YEAR(S)	TOTAL PROJECT COST ESTIMATE
IMPROVE REDUNDANCY	**TRANSPORTATION WATER WASTEWATER**	**2022-2023**	**$3.78M** (2021 $) CONSTRUCTION $2,325,000 CONTINGENCY (30%) $698,000 ELA (25%) $756,000

PROJECT DESCRIPTION	ESTIMATED LOCAL COST SHARE
The collector roadway 3rd Avenue SW will be reconstructed in 2022-2023 from Main Street S to 2nd Avenue SW. This project includes replacement of the existing road surface, as well as an estimated 2,240 feet of 6” watermain, and 580’ of 10” and 1,420’ of 8” sewer pipe, respectively, at a total construction price of $3.78 million.	**$3.78M**

NEED / JUSTIFICATION
This project will result in another connection from US 85 to Main Street, providing transportation system redundancy. Additionally, this project will greatly improve the infrastructure in this corridor, which includes VCP sewer pipe and CI water main.

7.1.1.6 Golf Course Parking Lot and Shop Improvements

CAPITAL - NEW FACILITIES

Golf Course Parking Lot and Shop Improvements

PRIORITY RANK
5

PROJECT DRIVER(S)	PROJECT SYSTEM(S)	IMPROVEMENT YEAR(S)	TOTAL PROJECT COST ESTIMATE
IMPROVE GROWTH	**FACILITY**	**2023**	**$1.30M** (2021 $) CONSTRUCTION $800,000 CONTINGENCY (30%) $240,000 ELA (25%) $260,000

PROJECT DESCRIPTION	ESTIMATED LOCAL COST SHARE
The proposed project would expand and replace the existing parking lot to meet the needs of an 18-hole golf course. Additionally, the Course’s shop would be updated to meet the golf course existing and future growing O&M needs.	**$1.30M**

NEED / JUSTIFICATION
The golf course parking lot is a paved surface and undersized for an 18-hole golf course. Additionally, the existing shops at the golf course need immediate upgrades (the most cost effective solution is likely demolition and construction of a new shop).

7.1.1.7 New Fire Hall

CAPITAL - NEW FACILITIES				
New Fire Hall				PRIORITY RANK: 12
PROJECT DRIVER(S)	PROJECT SYSTEM(S)	IMPROVEMENT YEAR(S)	TOTAL PROJECT COST ESTIMATE	
IMPROVE GROWTH	**FACILITY**	**2022-2024**	**$9.75M** (2021 $) CONSTRUCTION $6,818,000 CONTINGENCY (30%) $2,045,000 ELA (10%) $886,000	
PROJECT DESCRIPTION			ESTIMATED LOCAL COST SHARE	
The proposed project would build a new Fire Hall to replace the existing facility.			**$9.75M**	
NEED / JUSTIFICATION				
The existing fire hall is outdated and in need of improvement.				

7.1.1.8 Park Avenue E Reconstruction (Main Street S to 4th Street SE)

CAPITAL - CORRIDOR RECONSTRUCTION				
Park Avenue East Reconstruction ***Main Street S to 4th Street SE***				PRIORITY RANK: 3
PROJECT DRIVER(S)	PROJECT SYSTEM(S)	IMPROVEMENT YEAR(S)	TOTAL PROJECT COST ESTIMATE	
IMPROVE	**TRANSPORTATION WATER WASTEWATER**	**2023-2024**	**$1.23M** (2021 $) CONSTRUCTION $755,000 CONTINGENCY (30%) $226,000 ELA (25%) $245,000	
PROJECT DESCRIPTION			ESTIMATED LOCAL COST SHARE	
This project includes reconstruction of Park Avenue E and would improve the residential road from Main Street to 4th Street SE. This project includes replacement of the existing road surface, 840' of 8" cast iron pipe water main, and 600' of 8" sanitary sewer (it's recommended the sanitary sewer be televised prior to replacing to check condition).			**$1.23M**	
NEED / JUSTIFICATION				
This pavement condition for this corridor is poor and the water main is cast iron, thus driving a corridor reconstruction.				

7.1.1.9 10th Avenue NE Gravel to Urban Section (Main Street to WRRF)

CAPITAL - NEW ROADWAY

10TH Avenue Northeast
Main Street N to Water Resources Recovery Facility (WRRRF)

PRIORITY RANK
4

PROJECT DRIVER(S)	PROJECT SYSTEM(S)	IMPROVEMENT YEAR(S)	TOTAL PROJECT COST ESTIMATE
REGULATORY IMPROVE GROWTH	**TRANSPORTATION**	**2023-2024**	**$1.26M (2021 $)** **CONSTRUCTION** **$775,000** **CONTINGENCY (30%)** **$233,000** **ELA (25%)** **$252,000**

PROJECT DESCRIPTION	ESTIMATED LOCAL COST SHARE
This project results in construction of 10th Avenue NE, which would convert a rural gravel section to urban section from Main Street N west to the WRRF. This project should be constructed once the new public works facility is built.	**$1.26M**

NEED / JUSTIFICATION

10th Avenue NE is currently gravel. Once the new public works facility is built, it's important that this corridor can handle the increase in anticipated traffic. This will also be required by Planning and Zoning.

7.1.1.10 6th Avenue NW Reconstruction (Main Street to 5th Street NW)

CAPITAL - CORRIDOR RECONSTRUCTION

6th Avenue Northwest Reconstruction
Main Street to 5th Street NW

PRIORITY RANK
6

PROJECT DRIVER(S)	PROJECT SYSTEM(S)	IMPROVEMENT YEAR(S)	TOTAL PROJECT COST ESTIMATE
IMPROVE	**TRANSPORTATION WASTEWATER**	**2023-2024**	**$1.28M (2021 $)** **CONSTRUCTION** **$786,000** **CONTINGENCY (30%)** **$236,000** **ELA (25%)** **$255,000**

PROJECT DESCRIPTION	ESTIMATED LOCAL COST SHARE
This project includes reconstruction of 6th Avenue NW from Main Street to 5th Street NW. This project includes replacement of approximately a quarter mile of road surface and approximately 1,100' of 8" vitrified clay pipe sanitary sewer.	**$1.28M**

NEED / JUSTIFICATION

The pavement in this corridor is in poor to fair condition in various sections. Additionally, this corridor has vitrified clay pipe sanitary sewer that was installed in the 1940s, which is past its estimated useful life.

7.1.1.11 4th Street SW Reconstruction (Park Avenue W to 2nd Avenue SW)

CAPITAL - CORRIDOR RECONSTRUCTION

4th Street Southwest Reconstruction
Park Avenue W to 2nd Avenue SW

PRIORITY RANK
8

PROJECT DRIVER(S)	PROJECT SYSTEM(S)	IMPROVEMENT YEAR(S)	TOTAL PROJECT COST ESTIMATE
IMPROVE	**TRANSPORTATION** **WATER** **WASTEWATER**	**2023-2024**	**$795,000** (2021 $) **CONSTRUCTION** $489,000 **CONTINGENCY (30%)** $147,000 **ELA (25%)** $159,000

PROJECT DESCRIPTION	ESTIMATED LOCAL COST SHARE
This project includes reconstruction of the residential road along 4th Street SW from Park Avenue W to 2nd Avenue SW. Additionally, this project includes replacement of 700' of 6" cast iron water main and 700' of 8" vitrified clay pipe sanitary sewer.	**$795,000**

NEED / JUSTIFICATION

The road, cast iron water main, and vitrified clay pipe sanitary sewer are all known or estimated to be in poor condition and therefore require improvement.

7.1.1.12 2nd Avenue NW Reconstruction (5th Street NW to Main Street)

CAPITAL - CORRIDOR RECONSTRUCTION

2nd Avenue Northwest Reconstruction
5th Street NW to Main Street

PRIORITY RANK
9

PROJECT DRIVER(S)	PROJECT SYSTEM(S)	IMPROVEMENT YEAR(S)	TOTAL PROJECT COST ESTIMATE
IMPROVE	**TRANSPORTATION** **WATER** **WASTEWATER**	**2024-2025**	**$1.23M** (2021 $) **CONSTRUCTION** $756,000 **CONTINGENCY (30%)** $227,000 **ELA (25%)** $246,000

PROJECT DESCRIPTION	ESTIMATED LOCAL COST SHARE
This project includes reconstruction of 2nd Avenue NW from 5th Street NW to Main Street. Additionally, this project will replace 580' of 6" cast iron water main and 580' of 8" vitrified clay pipe sanitary sewer.	**$1.23M**

NEED / JUSTIFICATION

The road, cast iron water main, and vitrified clay pipe sanitary sewer are all known or estimated to be in poor condition and therefore require improvement.

7.1.1.13 3rd Street SW Reconstruction (Park Avenue W to 2nd Avenue SW)

CAPITAL - CORRIDOR RECONSTRUCTION

3rd Street Southwest Reconstruction
Park Avenue W to 2nd Avenue SW

PRIORITY RANK
10

PROJECT DRIVER(S)	PROJECT SYSTEM(S)	IMPROVEMENT YEAR(S)	TOTAL PROJECT COST ESTIMATE
IMPROVE	**TRANSPORTATION** **WATER** **WASTEWATER**	**2024-2025**	**$1.24M** (2021 $) **CONSTRUCTION** $765,000 **CONTINGENCY (30%)** $229,000 **ELA (25%)** $249,000

PROJECT DESCRIPTION	ESTIMATED LOCAL COST SHARE
This project includes reconstruction of 3rd Street SW from Park Ave W to 2nd Ave SW. Additionally, this project includes replacement of 1,000' of 6" cast iron water main and 1,000' of 8" vitrified clay pipe sanitary sewer.	**$1.24M**

NEED / JUSTIFICATION

The road, cast iron water main, and vitrified clay pipe sanitary sewer are all known or estimated to be in poor condition and therefore require improvement.

7.1.1.14 2nd Street SW Reconstruction (4th Avenue NW to 2nd Avenue SW)

CAPITAL - CORRIDOR RECONSTRUCTION

2nd Street Southwest Reconstruction
4th Avenue NW to 2nd Avenue SW

PRIORITY RANK
11

PROJECT DRIVER(S)	PROJECT SYSTEM(S)	IMPROVEMENT YEAR(S)	TOTAL PROJECT COST ESTIMATE
IMPROVE	**TRANSPORTATION** **WATER** **WASTEWATER**	**2025-2026**	**$1.99M** (2021 $) **CONSTRUCTION** $1,224,000 **CONTINGENCY (30%)** $367,000 **ELA (25%)** $398,000

PROJECT DESCRIPTION	ESTIMATED LOCAL COST SHARE
This project includes reconstruction of 2nd Street SW from 4th Avenue NW to 2nd Avenue SW. Additionally, this project includes approximately 580' of 6" cast iron water main and 1,900' of 8" vitrified clay pipe sanitary sewer. It is not recommended to replace the PVC water main on the north sections of this corridor.	**$1.99M**

NEED / JUSTIFICATION

The road, cast iron water main, and vitrified clay pipe sanitary sewer are all known or estimated to be in poor condition and therefore require improvement.

7.1.1.15 5th Street NE Reconstruction (6th Avenue NE to 5th Avenue NE)

CAPITAL - CORRIDOR RECONSTRUCTION				
5th Street Northeast Reconstruction *6th Avenue NE to 5th Avenue NE*				PRIORITY RANK: T-14
PROJECT DRIVER(S)	PROJECT SYSTEM(S)	IMPROVEMENT YEAR(S)	TOTAL PROJECT COST ESTIMATE	
IMPROVE	**TRANSPORTATION WATER WASTEWATER**	**2025-2026**	**$514,000** (2021 $) CONSTRUCTION $316,000 CONTINGENCY (30%) $95,000 ELA (25%) $103,000	
PROJECT DESCRIPTION			ESTIMATED LOCAL COST SHARE	
This project includes reconstruction of 5th Street NE from 6th Avenue NE to 5th Avenue NE. Additionally, this project includes replacement of 460' of 6" cast iron watermain and 460' of 8" vitrified clay pipe sanitary sewer.			**$514,000**	
NEED / JUSTIFICATION				
The road, cast iron water main, and vitrified clay pipe sanitary sewer are all known or estimated to be in poor condition and therefore require improvement.				

7.1.1.16 4th Street NE Reconstruction (6th Avenue NE to 5th Avenue NE)

CAPITAL - CORRIDOR RECONSTRUCTION				
4th Street Northeast Reconstruction *6th Avenue NE to 5th Avenue NE*				PRIORITY RANK: T-14
PROJECT DRIVER(S)	PROJECT SYSTEM(S)	IMPROVEMENT YEAR(S)	TOTAL PROJECT COST ESTIMATE	
IMPROVE	**TRANSPORTATION WATER WASTEWATER**	**2025-2026**	**$514,000** (2021 $) CONSTRUCTION $316,000 CONTINGENCY (30%) $95,000 ELA (25%) $103,000	
PROJECT DESCRIPTION			ESTIMATED LOCAL COST SHARE	
This project includes reconstruction of 4th Street NE from 6th Avenue NE to 5th Avenue NE. Additionally, this project includes replacement of 460' of 6" cast iron pipe water main and 460' of 8" vitrified clay pipe sanitary sewer.			**$514,000**	
NEED / JUSTIFICATION				
The road, cast iron water main, and vitrified clay pipe sanitary sewer are all known or estimated to be in poor condition and therefore require improvement.				

7.1.1.17 2nd Street NE Reconstruction (6th Avenue NE to 5th Avenue NE)

CAPITAL - CORRIDOR RECONSTRUCTION

2nd Street Northeast Reconstruction
6th Avenue NE to 5th Avenue NE

PRIORITY RANK
T-14

PROJECT DRIVER(S)	PROJECT SYSTEM(S)	IMPROVEMENT YEAR(S)	TOTAL PROJECT COST ESTIMATE
IMPROVE	**TRANSPORTATION** **WATER** **WASTEWATER**	**2025-2026**	**$514,000** (2021 $) **CONSTRUCTION $316,000** **CONTINGENCY (30%) $95,000** **ELA (25%) $103,000**

PROJECT DESCRIPTION	ESTIMATED LOCAL COST SHARE
This project includes reconstruction of 2nd Street NE from 6th Avenue NE to 5th Avenue NE. Additionally, this project includes 460' of 6" cast iron water main and 460' of 8" vitrified clay pipe sanitary sewer.	**$514,000**

NEED / JUSTIFICATION

The road, cast iron water main, and vitrified clay pipe sanitary sewer are all known or estimated to be in poor condition and therefore require improvement.

7.1.1.18 3rd Street NE Reconstruction (6th Avenue NE to 5th Avenue NE)

CAPITAL - CORRIDOR RECONSTRUCTION

3rd Street Northeast Reconstruction
6th Avenue NE to 5th Avenue NE

PRIORITY RANK
17

PROJECT DRIVER(S)	PROJECT SYSTEM(S)	IMPROVEMENT YEAR(S)	TOTAL PROJECT COST ESTIMATE
IMPROVE	**TRANSPORTATION** **WATER** **WASTEWATER**	**2025-2026**	**$518,000** (2021 $) **CONSTRUCTION $318,000** **CONTINGENCY (30%) $97,000** **ELA (25%) $103,000**

PROJECT DESCRIPTION	ESTIMATED LOCAL COST SHARE
This project includes reconstruction of 3rd Street NE from 6th Avenue NE to 5th Avenue NE. Additionally, this project includes 460' of 6" cast iron water main and 460' of 8" vitrified clay pipe sanitary sewer.	**$518,000**

NEED / JUSTIFICATION

The road, cast iron water main, and vitrified clay pipe sanitary sewer are all known or estimated to be in poor condition and therefore require improvement.

7.1.1.19 Mill and Overlay Improvements (O&M)

OPERATIONS AND MAINTENANCE

Mill and Overlay Improvements
Operations and Maintenance Recommendations

PRIORITY RANK
NA

PROJECT DRIVER(S)	PROJECT SYSTEM(S)	IMPROVEMENT YEAR(S)	TOTAL PROJECT COST ESTIMATE
PRESERVE	**TRANSPORTATION**	**2024**	**$566,000** (2021 $) CONSTRUCTION $452,800 CONTINGENCY (20%) $113,200 ELA (0%) $NA

PROJECT DESCRIPTION	ESTIMATED LOCAL COST SHARE
This project includes a city-wide mill and overlay project for specific corridors throughout the City (see associated mill and overlay map). The mileage is as follows: - 2024: 1.9 miles	**$566,000**

NEED / JUSTIFICATION
Pavement overlays are integral projects to preserve and maintain pavement systems. As such, it's necessary for the City to conduct these projects in order to prolong the lifespans of roads and mitigate costly reconstruction projects.

7.1.1.20 Chip Seal Improvements (O&M)

OPERATIONS AND MAINTENANCE

Chip Seal Improvements
Operations and Maintenance Recommendations

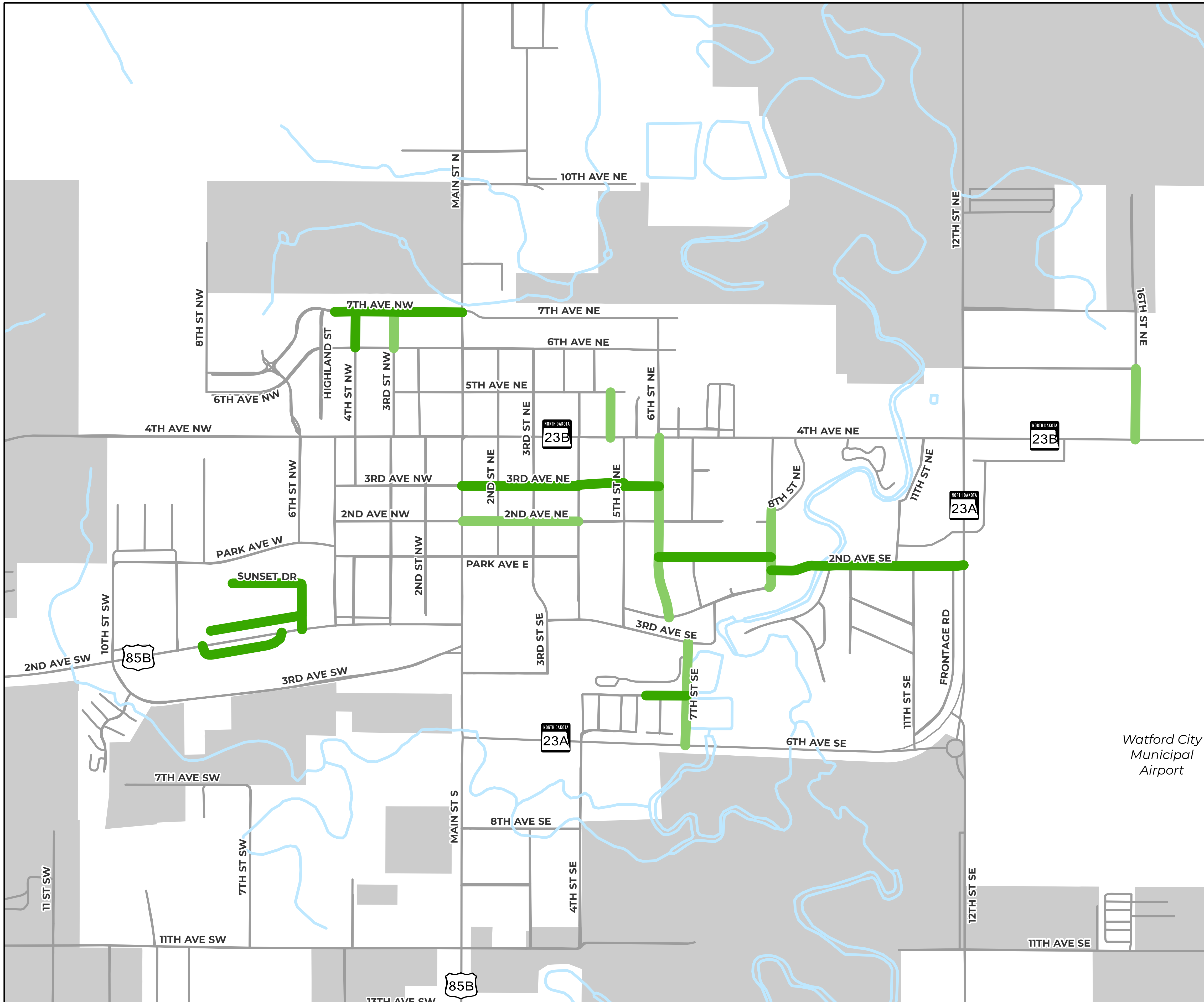
PRIORITY RANK
NA

PROJECT DRIVER(S)	PROJECT SYSTEM(S)	IMPROVEMENT YEAR(S)	TOTAL PROJECT COST ESTIMATE
PRESERVE	**TRANSPORTATION**	**2022 ; 2025**	**$2.13M** (2021 $) CONSTRUCTION $1,707,000 CONTINGENCY (20%) $427,000 ELA (0%) $NA

PROJECT DESCRIPTION	ESTIMATED LOCAL COST SHARE
This project includes a city-wide chip seal project for specific corridors throughout the City (see associated map). The mileage is as follows: - 2022: 20.1 miles - $1,247,000 - 2025: 14.3 miles - $887,000	**$2.13M**

NEED / JUSTIFICATION
Chip seals and seal coats are integral projects to preserve and maintain pavement systems. As such, it's necessary for the City to conduct these projects in order to prolong the lifespans of roads and mitigate costly reconstruction projects.

Maps for both recommended mill and overlay projects and chip seal projects are provided in Figure 99 and Figure 100, respectively. Recommendations for corridors included in the Mid-Term Planning Horizon are also provided in the figures.



Watford City
North Dakota

Watford City 2040 Infrastructure Master Plan

Figure 99. Recommended Mill & Overlay Projects

Map Legend

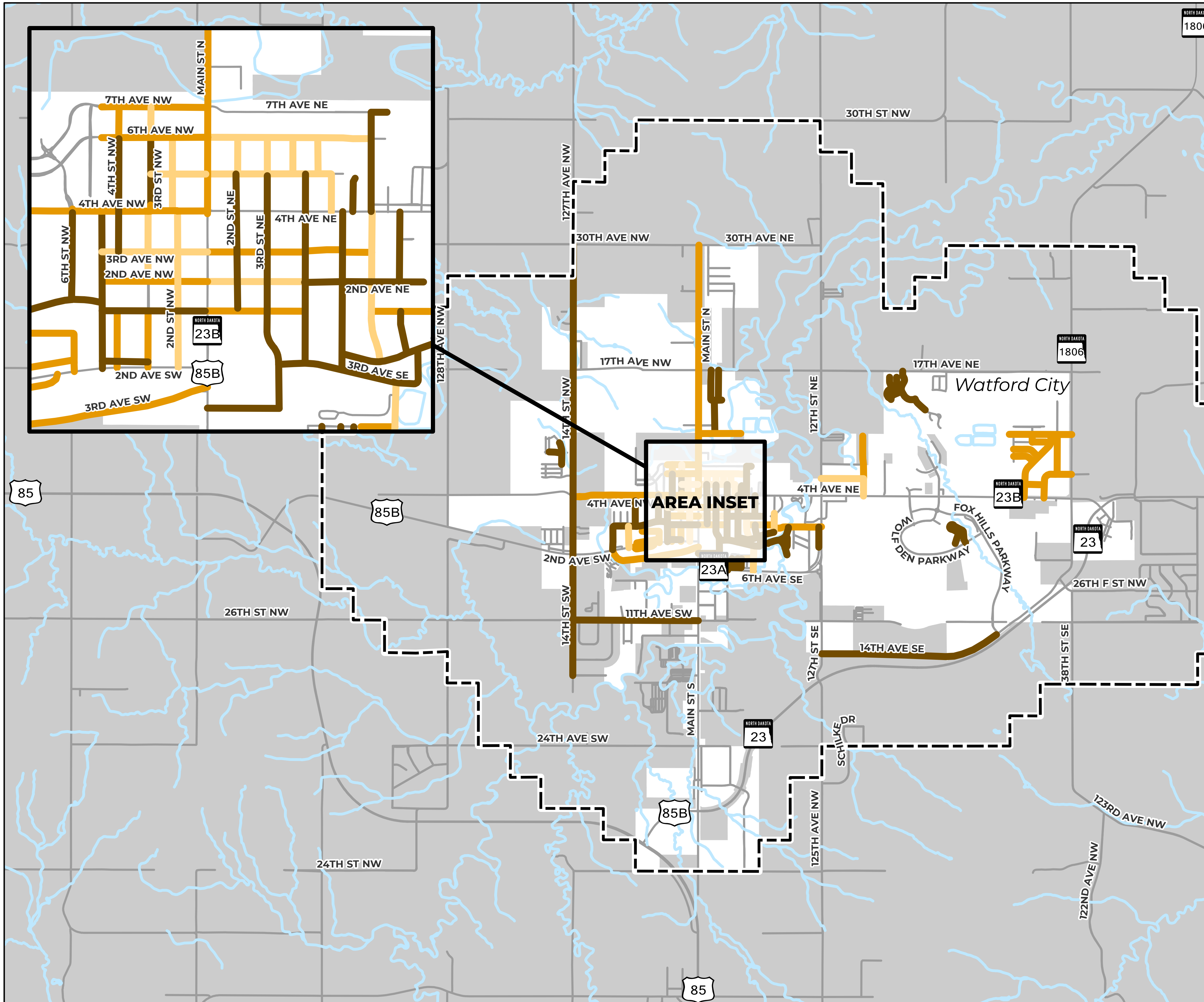
Mill and Overlay (Year)

- 2024
- 2028
- Watford City ETA

0 0.25 0.5 Miles

N

BURIAN & ASSOCIATES LLC ICON ARCHITECTURAL GROUP SRF RAFTELIS



Watford City North Dakota

Watford City 2040 Infrastructure Master Plan

Figure 100. Recommended Chip Seal Projects

Map Legend

Next Seal Coat (Year)

- 2022-2023
- 2025-2026
- 2029-2030
- Watford City ETA

0 1 2 Miles

N

BURIAN & ASSOCIATES LLC ICON ARCHITECTURAL GROUP SRF RAFTELIS

7.1.1.21 Sanitary Sewer Rehabilitation (O&M)

OPERATIONS AND MAINTENANCE

Sanitary Sewer Rehabilitation
Operations and Maintenance Recommendations

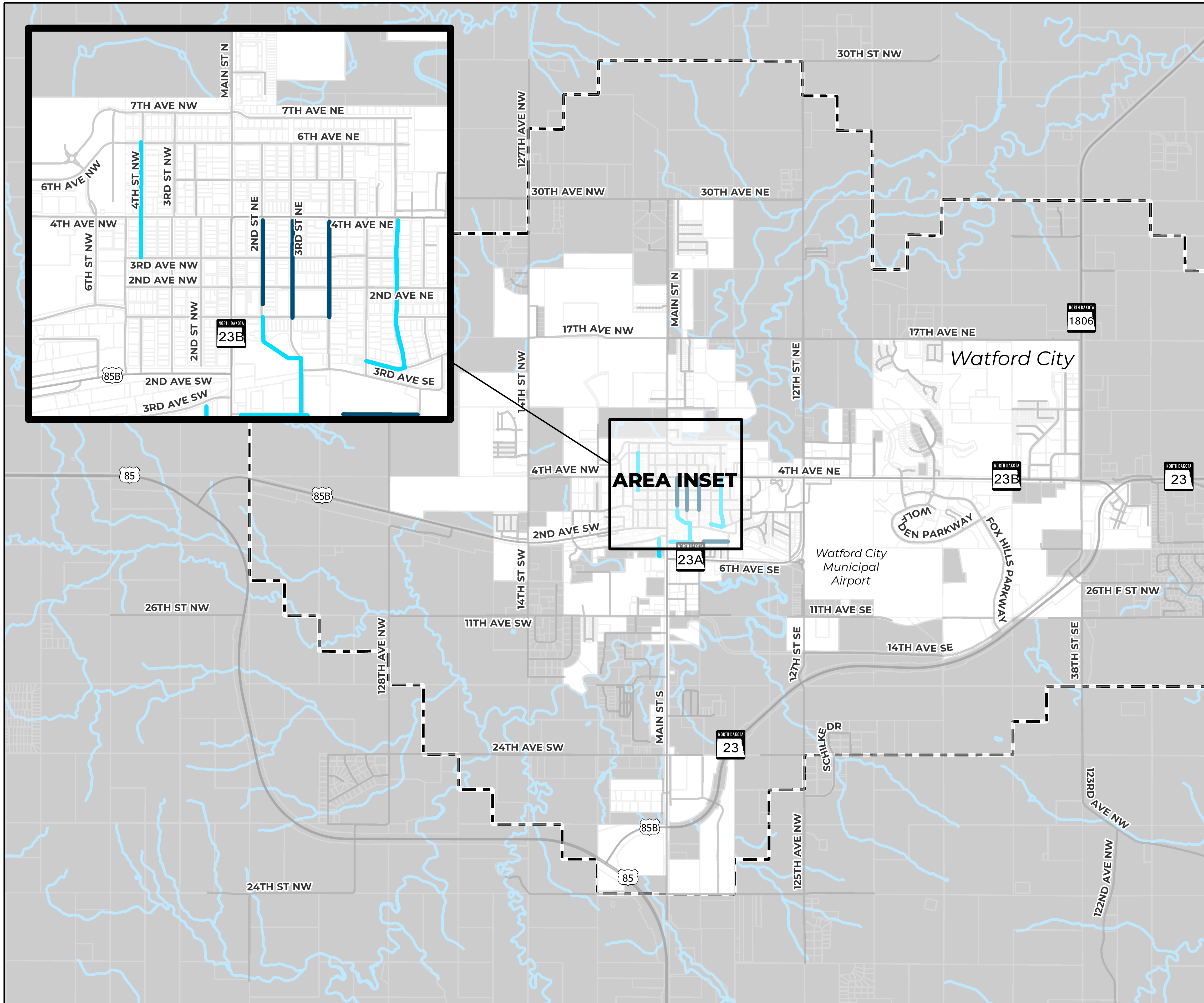
PROJECT DRIVER(S)	PROJECT SYSTEM(S)	IMPROVEMENT YEAR(S)	TOTAL PROJECT COST ESTIMATE
PRESERVE **IMPROVE**	**WASTEWATER**	**2025**	**$798,000** (2021 $) CONSTRUCTION $491,000 CONTINGENCY (30%) $148,000 ELA (25%) $159,000

PRIORITY RANK
NA

PROJECT DESCRIPTION	ESTIMATED LOCAL COST SHARE
This project includes rehabilitating approximately 3,425' of vitrified clay pipe (VCP) sanitary sewer sections located in the following corridors: - 2nd Street NE - 3rd Street NE - 4th Street NE	**$798,000**

NEED / JUSTIFICATION
These corridors include PVC water main in good condition (replaced in last 10 years), but the sanitary sewer is VCP dating back to the late 1930s, which also have known defects and deficiencies.

Figure 101 provides a map of the Sanitary Sewer Rehabilitation Project recommended for 2025, as well as Watermain and Sanitary Sewer Rehabilitation Project recommended for 2030.



Watford City
North Dakota

Watford City 2040 Infrastructure Master Plan

Figure 101. Recommended Water and Sanitary Sewer Rehabilitation Projects

Map Legend

- 2025 Sanitary Sewer Rehabilitation
- 2030 Watermain and Sanitary Sewer Rehabilitation
- Watford City ETA

Miles
0 0.5 1

BURIAN & ASSOCIATES LLC | ICON ARCHITECTURAL GROUP | SRF | RAFTELIS

7.1.1.22 City Facility Improvements (O&M)

OPERATIONS AND MAINTENANCE

2023 City Facility Improvements
Operations and Maintenance Recommendations

PRIORITY RANK
NA

PROJECT DRIVER(S)	PROJECT SYSTEM(S)	IMPROVEMENT YEAR(S)	TOTAL PROJECT COST ESTIMATE
PRESERVE	**FACILITY**	**2023**	**$1.25M** (2021 $) **CONSTRUCTION** **$872,900** **CONTINGENCY (30%)** **$374,100** **ELA (0%)** **$NA**

PROJECT DESCRIPTION	ESTIMATED LOCAL COST SHARE
This project includes important improvements at several of the City's buildings including City Hall and the Civic Center, Emergency Services, Fox Hills Golf Course Clubhouse, Rough Rider Center, the Visitor Center, and Wolf Pup Preschool.	**$1.25M**

NEED / JUSTIFICATION

This project will result in improving many deficient areas at the various facilities referenced above. Specific improvements are provided in Section 6.1.1.4.1.

7.1.1.23 WRRF Improvements (O&M)

OPERATIONS AND MAINTENANCE

Water Resources Recovery Facility (WRRF)
Operations and Maintenance Recommendations

PRIORITY RANK
NA

PROJECT DRIVER(S)	PROJECT SYSTEM(S)	IMPROVEMENT YEAR(S)	TOTAL PROJECT COST ESTIMATE
PRESERVE	**WASTEWATER**	**2022-2026**	**$1.06M** (2021 $) **CONSTRUCTION** **$650,000** **CONTINGENCY (30%)** **$195,000** **ELA (25%)** **$211,250**

PROJECT DESCRIPTION	ESTIMATED LOCAL COST SHARE
The phased improvement plan for the WRFF includes: - Phase I Bypass Pumping Upgrades and Electrical Distribution Repairs (2022) - Phase II PTB Improvements (2022) - Phase III Sludge Removal (2026)	**$1.06M**

NEED / JUSTIFICATION

This project will result in many important upgrades needed at the WRRF.

7.2 Mid-Term Planning Horizon (2027 – 2031)

The CIP project recommendations for the mid-term planning horizon (from years 2027 to 2031) are presented in Table 78 below. Additionally, the near-term planning horizon CIP expenditures are shown summarized in Figure 102, and represented by project category in Figure 103. The near-term project recommendations are shown spatially in Figure 104.

Table 78. Mid-Term (2027 – 2031) CIP Projects

Project	Project Type	Total Project Costs	Project Year(s)	Other(s) Cost Share ($)	City Cost Share ($)
Capital Projects					
5th Street W Reconstruction (4th Avenue NW to 2nd Avenue SW)	Capital - Corridor Reconstruction	$ 2,511,000	2026 - 2027	$ -	$ 2,511,000
New Lift Station CSI	Capital - Wet Infrastructure	$ 1,040,000	2026 - 2027	$ -	$ 1,040,000
Lift Station 4BT Reconstruction	Capital - Wet Infrastructure	$ 1,219,000	2026 - 2027	$ -	$ 1,219,000
6th Avenue NE Gravel to Urban Section (12th Street NE to 16th Street NE)	Capital - New Roadway	$ 1,262,000	2026 - 2027	$ -	$ 1,262,000
5th Avenue NE Reconstruction (Main Street N to 5th Street NE)	Capital - Corridor Reconstruction	$ 1,216,000	2027 - 2028	$ -	$ 1,216,000
3rd Avenue NW Reconstruction (5th Street NW to Main Street N)	Capital - Corridor Reconstruction	$ 1,230,000	2027 - 2028	$ -	$ 1,230,000
6th Avenue NE Reconstruction (Main Street to 6th Street NE)	Capital - Corridor Reconstruction	$ 2,029,000	2027 - 2028	$ -	$ 2,029,000
9th Street SW Gravel to Urban Section (12th Street NE to 16th Street NE)	Capital - New Roadway	$ 638,000	2027 - 2028	$ -	$ 638,000
3rd Street NW Reconstruction (4th Avenue NW to 2nd Avenue NW)	Capital - Corridor Reconstruction	$ 1,125,000	2028 - 2029	$ -	$ 1,125,000
5th Avenue NW Reconstruction (3rd Street NW to Main Street N)	Capital - Corridor Reconstruction	$ 661,000	2028 - 2029	$ -	$ 661,000
2nd Street NW Reconstruction (6th Avenue NW to 4th Avenue NW)	Capital - Corridor Reconstruction	$ 917,000	2028 - 2029	$ -	$ 917,000
Golf Course Water Supply Improvements	Capital - Wet Infrastructure	$ 975,000	2028 - 2029	$ -	$ 975,000
Bathrooms at Golf Course	Capital - New Facilities	$ 163,000	2028 - 2029	$ -	$ 163,000
Restroom in Hockey Area at Rough Rider Center	Capital - New Facilities	$ 325,000	2029 - 2030	$ -	$ 325,000
2nd Avenue NE Reconstruction (6th Street NE to Culdesac)	Capital - Corridor Reconstruction	$ 597,000	2029 - 2030	$ -	$ 597,000
5th Avenue SE Gravel to Urban Section (Connection to 6th Avenue SE)	Capital - New Roadway	$ 850,000	2030 - 2031	$ -	$ 850,000
5th Street NE/5th Street SE Reconstruction (3rd Avenue NE to 3rd Avenue SE)	Capital - Corridor Reconstruction	$ 1,793,000	2030 - 2031	$ -	$ 1,793,000
3rd Street NW Reconstruction (6th Avenue NW to 4th Avenue NW)	Capital - Corridor Reconstruction	$ 925,000	2030 - 2031	$ -	$ 925,000
7th Street NE Reconstruction (4th Avenue NW to 2nd Avenue NE)	Capital - Corridor Reconstruction	$ 958,000	2030 - 2031	$ -	$ 958,000
Operations and Maintenance Projects [Mill and Overlay]					
2028 Mill and Overlay Improvements	O&M - Mill and Overlay	$ 452,000	2027 - 2028	$ -	$ 452,000

Project	Project Type	Total Project Costs	Project Year(s)	Other(s) Cost Share ($)	City Cost Share ($)
Operations and Maintenance Projects [Chip Seal]					
2029 City Wide Chip Seal Improvements	O&M - Chip Seal	$ 689,000	2029	$ -	$ 689,000
Operations and Maintenance Projects [Watermain and Sanitary Sewer Rehabilitation]					
2030 Watermain and Sanitary Sewer Rehabilitation	O&M - Watermain and Sanitary Rehabilitation	$ 2,096,000	2030	$ -	$ 2,096,000
Operations and Maintenance Projects [Facilities]					
2027 City Facility Improvements	O&M - Facilities	$ 2,191,000	2027	$ -	$ 2,191,000
2031 City Facility Improvements	O&M - Facilities	$ 1,327,000	2031	$ -	$ 1,327,000
Operations and Maintenance Projects [WRRF]					
WRRF Improvements - Phase III (Cell Maintenance)	O&M - WRRF	$ 150,000	2027	$ -	$ 150,000
Annual Improvement Programs					
Manhole Lining Annual Program[1]	Annual Programs	$ 20,000	Annual	$ -	$ 20,000
Sidewalk Gap Infill Annual Program[2]	Annual Programs	$ 35,000	Annual	$ -	$ 35,000
Sidewalk Repair and ADA Annual Program[3]	Annual Programs	$ 75,000	Annual	$ -	$ 75,000

1 - $20,000 per year ($200,000 total over the 10-year CIP planning horizon)
2 - $35,000 per year ($350,000 total over the 10-year CIP planning horizon)
3 - $75,000 per year ($750,000 total over the 10-year CIP planning horizon)

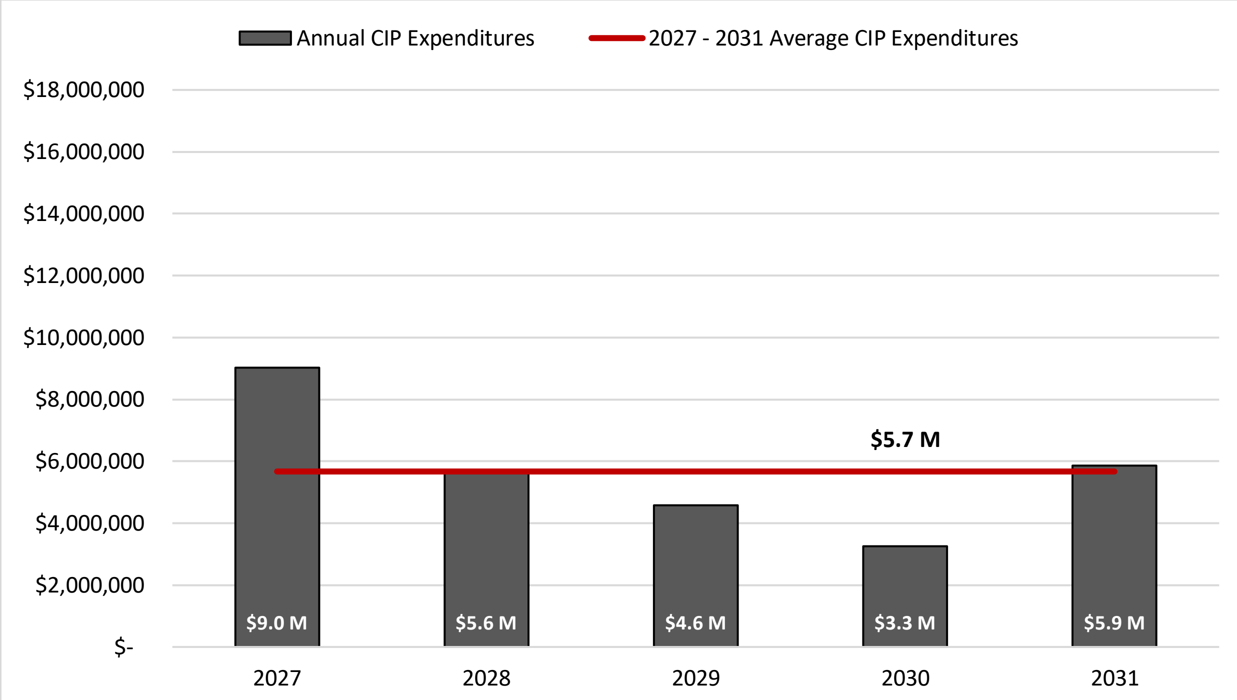


Figure 102. Mid-Term (2027 – 2031) CIP Expenditures

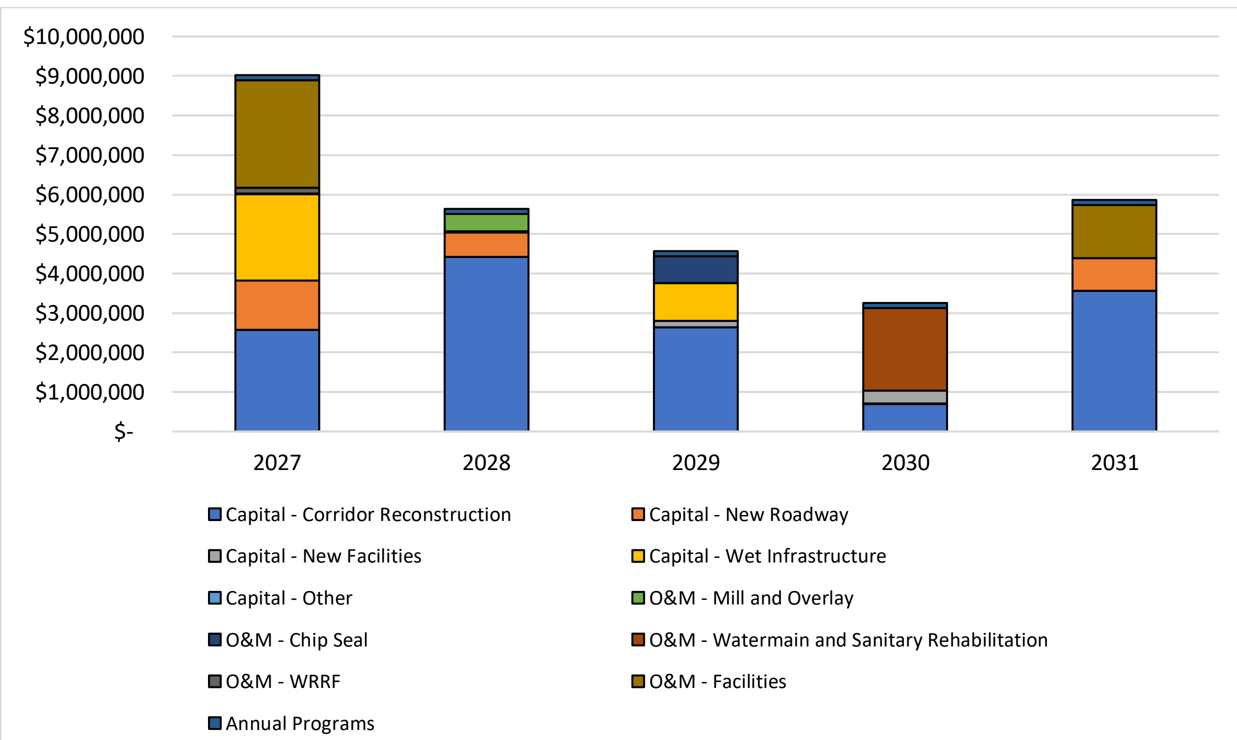
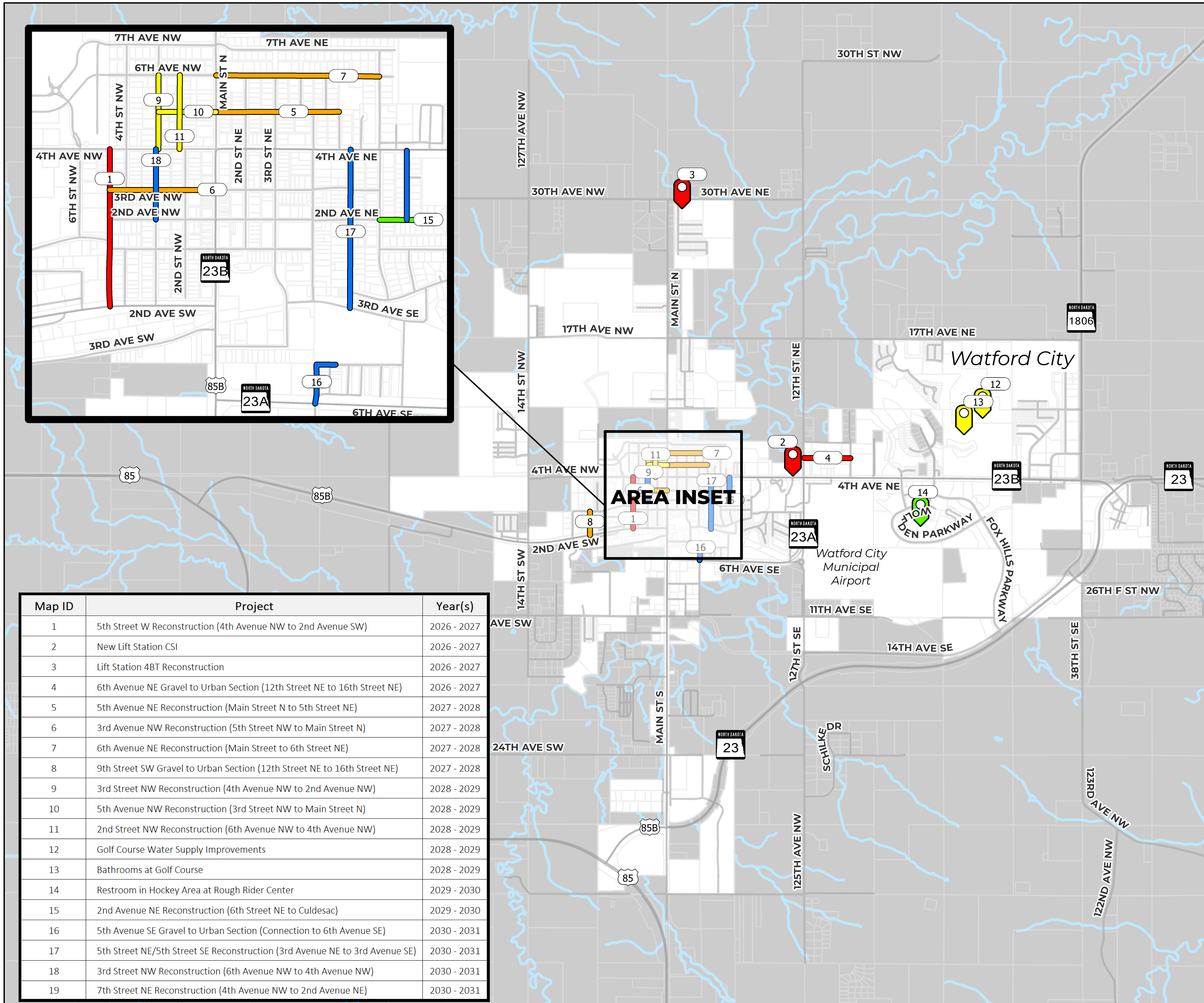


Figure 103. Mid-Term (2027 – 2031) CIP Expenditures (by Project Type)

Watford City 2040 Infrastructure Master Plan

Figure 104. Map of Mid-Term (2027-2031) CIP Projects



Map ID	Project	Year(s)
1	5th Street W Reconstruction (4th Avenue NW to 2nd Avenue SW)	2026 - 2027
2	New Lift Station CSI	2026 - 2027
3	Lift Station 4BT Reconstruction	2026 - 2027
4	6th Avenue NE Gravel to Urban Section (12th Street NE to 16th Street NE)	2026 - 2027
5	5th Avenue NE Reconstruction (Main Street N to 5th Street NE)	2027 - 2028
6	3rd Avenue NW Reconstruction (5th Street NW to Main Street N)	2027 - 2028
7	6th Avenue NE Reconstruction (Main Street to 6th Street NE)	2027 - 2028
8	9th Street SW Gravel to Urban Section (12th Street NE to 16th Street NE)	2027 - 2028
9	3rd Street NW Reconstruction (4th Avenue NW to 2nd Avenue NW)	2028 - 2029
10	5th Avenue NW Reconstruction (3rd Street NW to Main Street N)	2028 - 2029
11	2nd Street NW Reconstruction (6th Avenue NW to 4th Avenue NW)	2028 - 2029
12	Golf Course Water Supply Improvements	2028 - 2029
13	Bathrooms at Golf Course	2028 - 2029
14	Restroom in Hockey Area at Rough Rider Center	2029 - 2030
15	2nd Avenue NE Reconstruction (6th Street NE to Culdesac)	2029 - 2030
16	5th Avenue SE Gravel to Urban Section (Connection to 6th Avenue SE)	2030 - 2031
17	5th Street NE/5th Street SE Reconstruction (3rd Avenue NE to 3rd Avenue SE)	2030 - 2031
18	3rd Street NW Reconstruction (6th Avenue NW to 4th Avenue NW)	2030 - 2031
19	7th Street NE Reconstruction (4th Avenue NW to 2nd Avenue NE)	2030 - 2031

Map Legend

Mid-Term Capital Improvements

- 2027 (point)
- 2029 (point)
- 2030 (point)
- 2027
- 2028
- 2029
- 2030
- 2031

Note: Only Capital Projects are displayed on the map. Separate maps outlining the programmed O&M Improvements (i.e. Chip Seals, Mill & Overlays, Water and Sanitary Sewer Rehabilitation) are provided in Figure 99 through Figure 101.

Miles 0 0.5 1

Chapter 8. Resiliency Plan

Another component of this Master Plan included looking beyond the 10-year capital improvements timeline to identify methods, concepts, and processes for the City to employ in order to remain resilient. Infrastructure resiliency is defined as the ability of a community to prevent, withstand, adapt to, and recover from infrastructure disruptions. This Chapter outlines the Resiliency Plan, which aims to provide Watford City with recommendations on how to own and operate resilient infrastructure systems today, and for years to come. The Resiliency Plan is categorized into the following primary sections:

- General Resiliency Recommendations
- Levels of Service
- Water Main and Sanitary Sewer Rehab and Replacement Cost Projections

8.1 General Resiliency Recommendations

The following general resiliency recommendations were identified for the City to consider. The general resiliency recommendations are categorized as follows:

- Cybersecurity, Technology, Data
- Natural Disasters
- Condition Assessment and Monitoring
- Performance Assessment and Monitoring
- Asset Management and Proactive Maintenance

<u>Cybersecurity, Technology, and Data</u>

- Implement processes and systems to minimize the possibility of cyberattacks. Some examples include:
    - Ensure that the City's AWIA Risk and Resiliency Plan and Emergency Response Plan are up to date and being followed.
    - Utilize antivirus, antispyware programs, and firewalls to ensure computer systems are protected.
    - Provide education to staff on various cyber and digital threats (hackers, scammers, phishing correspondence).
- Be receptive to utilizing new technology to leverage existing data to make better decisions in both managerial and operational settings.

<u>Natural Disasters</u>

- Implement redundant infrastructure systems to ensure that natural disasters such as droughts or tornadoes do not cause major service disruptions, safety hazards, or increase potential loss of life.

<u>Condition Assessment and Monitoring</u>

- Implement condition assessment and monitoring programs for critical infrastructure systems. A few examples of this include:

  - Conduct PCI surveys on a routine basis (every 3 to 5 years) to monitor the condition and pavement degradation of the City's roadway network.
  - Utilize condition assessment technologies on crucial water mains (i.e. transmission main without redundancy) to ensure that the failure probability remains low.
  - For infrastructure that is visible, consider conducting visual inspections on a routine basis. The optimal frequency will vary from asset to asset.

Performance Assessment and Monitoring

- Implement performance assessment and monitoring programs for critical infrastructure systems. Some examples include.
  - Develop and/or update simulated models (traffic models, hydraulic models, etc.).
  - Test infrastructure (i.e. exercise valves, run pumps, operate hydrants, etc.) on a routine basis.

Asset Management and Proactive Maintenance

- Utilize the findings and information from this Master Plan to start developing an asset management program.
- Continue to invest in existing infrastructure, even if it is in good condition. Generally, large-dollar improvement projects can either be delayed or mitigated by investing in proactive maintenance practices. The goal should be to maximize the useful life of functioning assets that are sufficiently meeting levels of service targets.

8.2 Levels of Service

Levels of service were developed based on City input for this Master Plan. Levels of service can be defined as ***characteristics or attributes of a service that describe its required level of performance***. These characteristics typically describe, ***how much***, ***to what degree***, and ***how frequently*** about the service. A few examples of levels of service and their respective key performance indicators (means for measuring service performance) that were developed as part of this Master Plan include:

- Number of Sewer Main Failures per Year: Less than 2
- Number of Complaints per Year Related to Missed Garbage Can Pick Ups: Less than 50
- Number of Traffic Accidents (Vehicle Collisions; both Non-Fatal and Fatal): Less than 15

Understanding the City's required "sustainable" levels of service can help establish the guiding principles for maintaining a resilient network of infrastructure systems. Levels of service allow the City monitor how services are being delivered, and whether or not those services are being delivered exceptionally, or those services need attention. By having levels of service in place, the City can better communicate to stakeholders and citizens its plan for continuing the delivery of exceptional city-provided services. Appendix A contains a technical memorandum focused solely on Watford City's proposed levels of service that were developed throughout this Master Plan. The levels of service identified from this project are separated into the following categories:

- Financial
- Water

- Wastewater
- Stormwater
- Solid Waste
- Transportation
- Fleet
- Police Department
- Fire Department
- Facilities

Recommendations for implementing and monitoring the levels of service recommendations are also outlined in Appendix A.

8.3 Water Main and Sanitary Sewer Rehab and Replacement Cost Projections

Another component of evaluating and recommending methods to improve infrastructure resiliencies, specifically for the water distribution and sanitary sewer systems, involved estimating long-term renewal and replacement needs and the associated cost burden. This process involved analyzing the pipe install dates, pipe materials, and estimated lifespans associated with each respective pipe material. Table 79 shows the water main and sanitary sewer assumed lifespans associated with each pipe material.

Table 79. Assumed Estimated Water Main and Sanitary Sewer Lifespans

Water Main Material	Estimated Lifespan	Sanitary Sewer Material	Estimated Lifespan
ACP	70	Unknown	70
PVC	70	PVC	70
Unknown	70	VCP	70
CIP	100	CIP	100
Fiberglass	70	Not Used	n/a
HDPE	70	Not Used	n/a

Utilizing these assumed pipe lifespans, an 'improvement date' could be estimated, and the associated investment need could be calculated. Figure 105 and Figure 106 shows the estimated existing water main improvement needs in linear feet and 2021 dollars, respectively. Similar to the water mains, Figure 107 and Figure 108 provides the estimated existing sanitary sewer improvement needs in linear feet and 2021 dollars, respectively.

The purpose of this exercise was to better understand the estimated future investment needs associated with the water main and sanitary sewer systems.

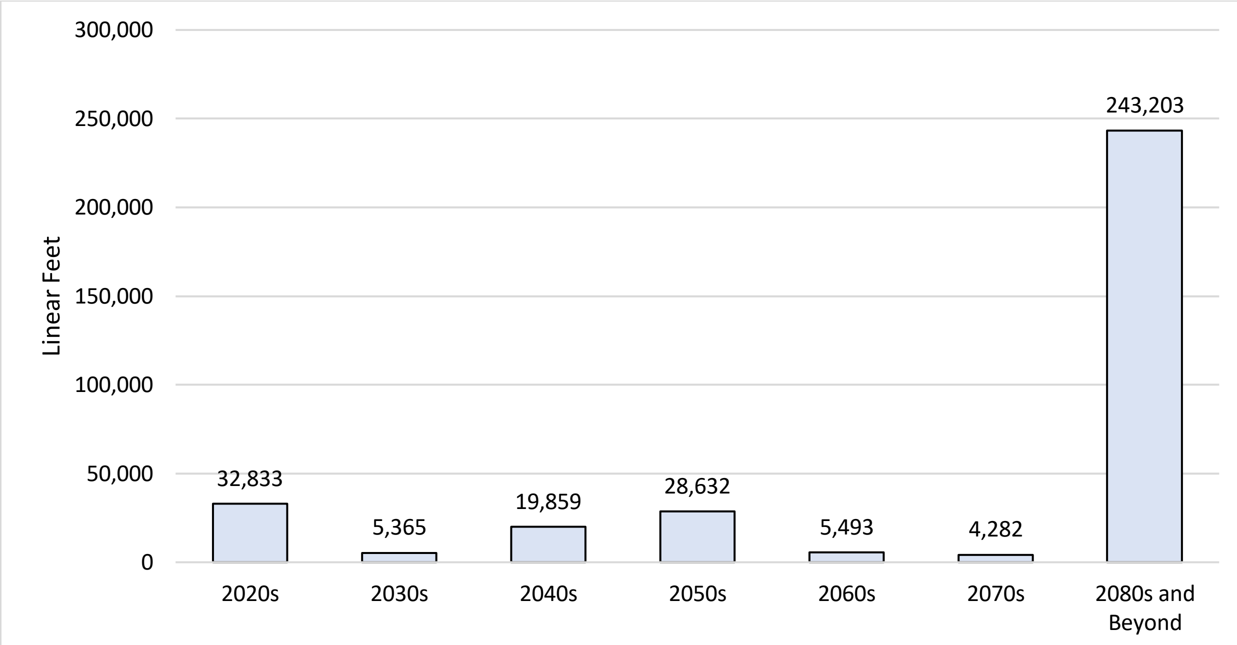


Figure 105. Existing Water Main Estimated Improvement Needs [Expressed in Linear Feet]

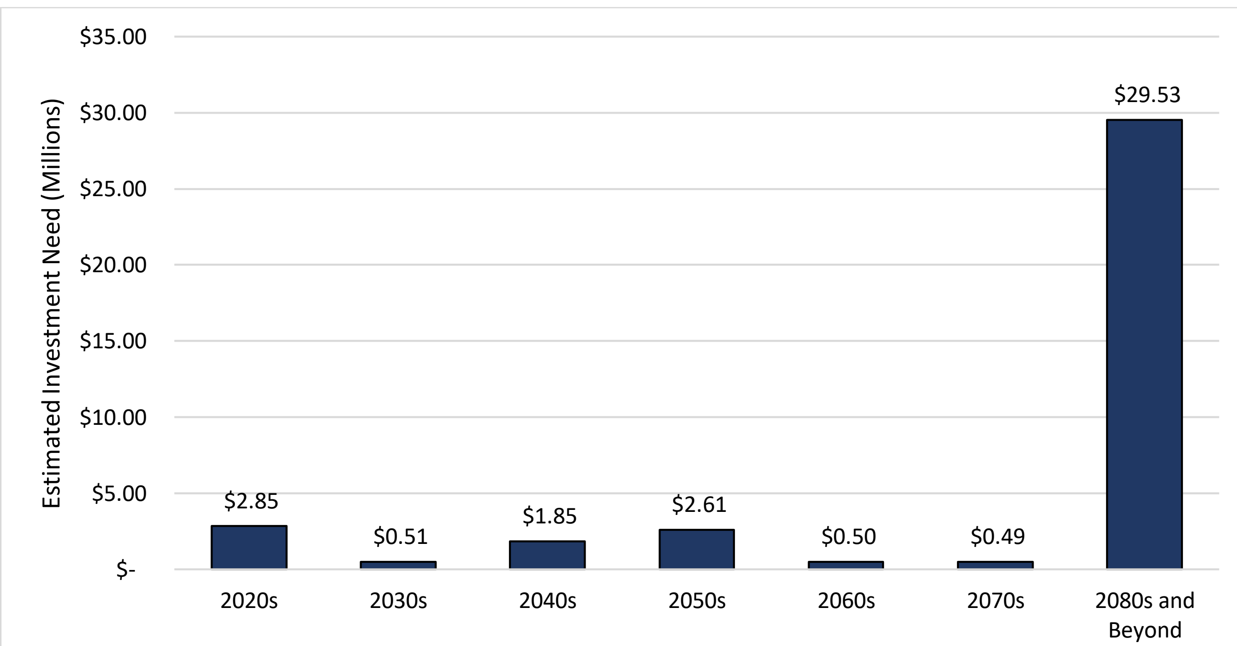


Figure 106. Existing Water Main Estimated Improvement Needs [Expressed in 2021$]

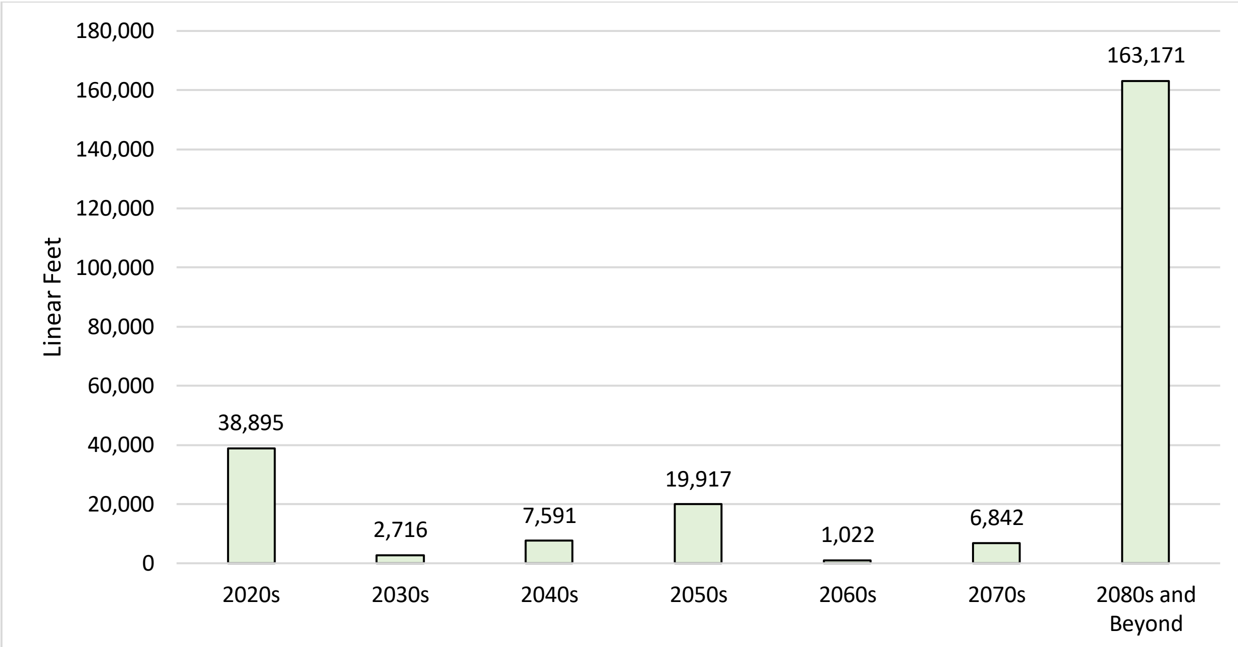


Figure 107. Existing Sanitary Sewer Estimated Improvement Needs [Expressed in Linear Feet]

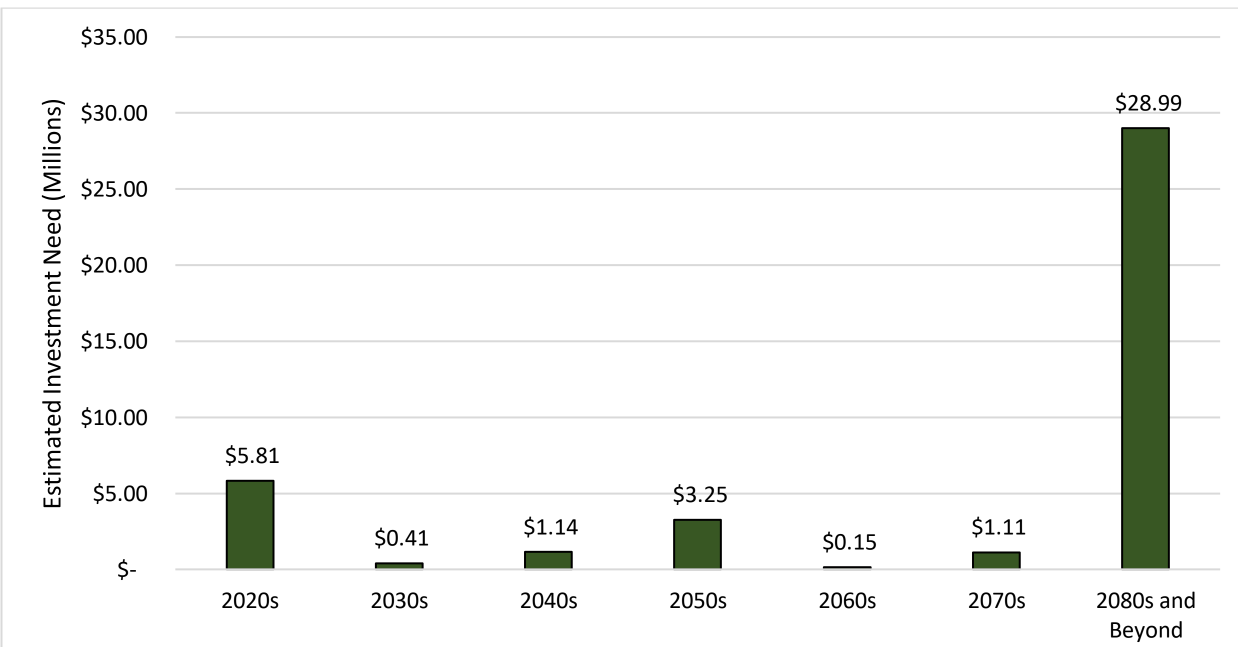


Figure 108. Existing Sanitary Sewer Estimated Improvement Needs [Expressed in 2021$]

8.4 Roadway Improvement Cost Projections

Conducting a similar exercise for the roadway system is more challenging and was not planned as part of the scope of this Project. However, with proper maintenance, asphalt and concrete roads should last approximately 50 years. Below outlines the recommended best pavement management practices (at a high level) for maintaining asphalt and concrete roads, as well as the estimated costs (shown in $2021) per centerline mile and per linear foot.

<u>Asphalt Roads</u>

- Over a new asphalt road's approximate 50 year lifespan:
  - Chip Seals should be performed roughly every 2-3 years.
    - Estimated Chip Seal Cost per Centerline Mile: $40,000
  - Mill and Overlays should be performed roughly every 15-20 years.
    - Estimated Mill and Overlay Cost per Centerline Mile: $300,000 - $320,000

<u>Concrete Roads</u>

- Over a new concrete road's approximate 50-year lifespan:
  - A preventative joint seal should be performed within the first 10-years of a new concrete roadway construction.
    - Estimated Joint Seal Cost per Linear Foot: $3.00 - $5.00
  - Minor and Major Concrete Pavement Repairs should be performed around year 15 and year 25 after original installation, respectively.
    - The costs for concrete repairs vary greatly depending on what improvement is needed.

More information on the City's current pavement condition as well as pavement preservation techniques are provided previously in Section 2.1.2.

8.5 Process for Utilizing the Master Plan

This section outlines the recommended process for utilizing the Master Plan on an annual basis. For this process to work effectively, it's imperative for Watford City to maintain up-to-date GIS files. As projects are completed, infrastructure is decommissioned, or new information or data becomes available, the GIS files should be updated prior to conducting the steps below. Additionally, it is critically important to keep the financial model current with accurate financial data.

- At fiscal year end, update the levels of service tracking spreadsheet to ensure target levels of service are being achieved.
  - If a target level of service isn't being achieved, either reconsider the target, or make investments to help the City achieve the target.
  - If a target level is being achieved, continue to function as usual or consider scaling back investments in that system.
- Prior to budgeting for forthcoming years:
  - Re-run the individual infrastructure system assessments. Ensure that assets calculated as high priority are captured within a project in the CIP spreadsheet. If a high priority asset is not included within a project, create a project.
  - Once all the projects (both existing infrastructure as well as applicable growth projects) are loaded in the CIP spreadsheet, conduct the project prioritization.
  - After the project prioritization, review projects that are programmed into the CIP to ensure they are still applicable. Shift projects from year-to-year accordingly.
  - After programming projects into the CIP, conduct a final review with applicable committees and City Commissions for approval. In unison with this step, the CIP projects should be extracted from the CIP and input into the financial model.
  - Once the CIP and financial model are in sync, and the financial model reveals that the City can sufficiently fund the upcoming projects, finalize the CIP for the upcoming year.
- Repeat this process on an annual basis.

Although significant effort was put into development of this Master Plan, it's recommended for the City to strive for continuous improvement. As more data becomes available and the City evolves over time, the process should be refined, as needed, to ensure that the City is utilizing all sources of information to make informed and defensible decisions.

Chapter 9. Appendices

Appendix A

TM1 – Levels of Service Technical Memorandum

Appendix B

TM2 – Financial Policies Technical Memorandum

Appendix C

TM3 – Golf Course Irrigation Supply Technical Memorandum

Appendix D

TM4 – Digital Survey Responses

Appendix E

Unit Costs (2021$)

Appendix F

Capital Improvements Plan (CIP) Ledger

Appendix G

Financial Model User Manual

Appendix H

Bridge Inspections Report

Watford City 2040 Infrastructure Master Plan

APPENDIX A

TM1 - Levels of Service Technical Memorandum

TECHNICAL MEMORANDUM

To:	City of Watford City, ND		
Attn:	Grace Demars, PE City Engineer	Laura Dokken Finance Director	Justin Smith Public Works Director
From:	Burian & Associates, LLC Steve L. Burian, PE		
Re:	Watford City 2040 Infrastructure Master Plan – Levels of Service Memorandum		
Date:	December 2021		

Introduction

As part of the 2040 Infrastructure Master Plan project being completed for Watford City (City), the Project team was tasked with supporting the development of levels of service (LOS) for the City to help ensure effective and affordable delivery of City services to residents.

This Technical Memorandum contains the initial LOS established as part of the Master Plan and recommendations for implementation and monitoring of the LOS, as well as the Watford City's community vision and Master Plan mission statement. This Technical Memorandum is comprised of the following sections:

- Introduction
- Community Vision
- Master Plan Mission Statement
- Levels of Service
- Implementation and Monitoring Recommendations
- Conclusion

Community Vision

The following is an excerpt from the 2020 – 2024 Community Sustainability Plan:

> In the summer of 2019, the City of Watford City and the McKenzie County Job Development Authority engaged with *Strengthen ND* to develop a five-year Community Sustainability Plan. Through a community survey, community roundtable sessions, and a leadership-driven planning session, data was able to be collected on the current state of Watford City and McKenzie County as well as what could be future priorities. Laid out in the sustainability plan are the details of the community planning process, relevant outcomes, and the distilled goals and strategies to guide future growth and development of Watford City and the broader McKenzie County area.
>
> With the results of the electronic survey and roundtable sessions, the leadership of Watford City and McKenzie County came together to focus and strategize on drafting a vision, goals, and strategies for the future.[i] The vision for Watford City is summarized in a vision statement and provided below.

Watford City will be a vibrant and inclusive community:

- *Where a diverse economy is fostered;*
- *Where residents enjoy a high quality of life and a strong sense of belonging*
- *Where collaboration and strategic growth are prioritized; and*
- *Where people are proud to call McKenzie County "home".*

This vision statement was reviewed and considered when developing a mission statement for the Master Plan, which is provided in the next section.

Master Plan Mission Statement

The City developed the following Master Plan Mission Statement for the Project:

The Watford City 2040 Infrastructure Master Plan is an overarching policy document which is intended to guide decision making related to the City's infrastructure assets and financials to ensure decisions move the City towards the community's vision.

Levels of Service

Levels of service (LOS) can be defined as ***characteristics or attributes of a service that describe its required level of performance***. These characteristics typically describe, ***how much***, ***to what degree***, and ***how frequently*** about the service. Some questions to consider when establishing LOS include:

- **What is the demand for services by stakeholders?**
  - Example: Our stakeholders expect roads, sidewalks, and paths it safe and functional condition.
- **What do regulators require?**
  - Example: We are required to treat wastewater to meet established regulatory requirements.
- **What is the target and actual performance?**
  - Example: We want to have less than 5 watermain failures per year – how many failures occurred?

Developing and understanding the City's required "sustainable" LOS will establish the guiding principles for maintaining a resilient network of infrastructure systems. Having LOS in place will help the City communicate to stakeholders and citizens its plan for continuing the delivery of exceptional City-provided services.

The LOS established as part of this Master Plan are provided in the forthcoming sections.

Financial

A summary of the established LOS for the City finances is provided below in Table 1.

Table 1. Financial Levels of Service

LOS Description	LOS Measure	Target
Budget to Actual Levels	Percent Differentiation Between Budgeted and Actual	% TBD
Billable Work Submission	Time (in Hours from Job Completion) to Submit All Billable Work Detail Submitted to Accounting	< 24 HRS
Rate Increases During Economic Contraction	Cumulative Amount of Rate Increases During Economic Contraction	$0.00
Water Rate Increases	Maximum Percent Increase of Water Rates	< 3%
Sewer Rate Increases	Maximum Percent Increase of Sewer Rates	< 3%
Solid Waste Rate Increases	Maximum Percent Increase of Solid Waste Rates	< 3%
Reinvestment Rate	5-year Running Average of Capital Reinvestment to Replacement Value	$ TBD
Reserve Fund Size	Percent of Reserve Fund Relative to System Replacement Value	% TBD

Water

A summary of the established LOS for the Water System is provided below in Table 2.

Table 2. Water System Levels of Service

LOS Description	LOS Measure	Target
Customer Complaints - Water Delivery	Number of Customer Complaints Related to Taste, Odor, Color, Pressure, Outages, Missed Appointments, etc.	< 5
Unplanned Water Outages - Frequency	Number of Unplanned Water Outages	0
Watermain Failures - Frequency	Number of Watermain Failures	< 5
Valve Failures - Frequency	Number of Valve Failures	< 2
Meter Performance	Maximum Number of "No Reads" Per Month	< 5
Water Quality Compliance Rate	Water Quality Compliance Rate	100%
Number of Reporting Violations	Number of Water System Regulatory Violations	0
Preventative Maintenance to Reactive Maintenance	Ratio of Preventative (Planned) Maintenance Costs to Reactive (Unplanned) Maintenance Costs	75 : 25

Wastewater

A summary of the established LOS for the Wastewater System is provided below in Table 3.

Table 3. Wastewater System Levels of Service

LOS Description	LOS Measure	Target
Customer Complaints - Odor	Number of Customer Complaints Related to Odor	0
Customer Complaints - Residential Overflows Due to Jetting	Number of Customer Complaints Related to Jetting (Toilet Overflows, Dry Traps, etc.)	< 3
Sewer Backup - Frequency	Number of Sewer Backups in Customer Homes	0
Manhole Failures - Frequency	Number of Manhole Failures	0
Sewer Main Failures - Frequency	Number of Sewer Main Failures	< 2
Reporting Violations Frequency	Number of Wastewater System Regulatory Violations	0
Preventative Maintenance to Reactive Maintenance	Ratio of Preventative (Planned) Maintenance Costs to Reactive (Unplanned) Maintenance Costs	75 : 25

Stormwater

A summary of the established LOS for the Stormwater System is provided below in Table 4.

Table 4. Stormwater System Levels of Service

LOS Description	LOS Measure	Target
Customer Complaints - Blocked/Frozen Culverts and Drains	Number of Customer Complaints Related to Blocked/Frozen Culverts and Drains	< 2
Storm Sewer Failures	Average Response Time (Years) to Damaged Drain System Components	< 1 Years
Private Development SWPPP Compliance	NDDEQ SWPPP Compliance Rate	100%
Removal of Temporary BMPs After Development	Temporary BMP Removal Rate	100%
Clean Up and Repair of Erosion	Average Response Time (Days) to Erosion in Streets, Ditches, Ponds, etc.	< 8 Days
Inundation After Storm Event	Determined by Stormwater Model. Degree of Inundation After 10-Year Storm Event	TBD
Catch Basin Cleaning	Percent of Catch Basins Cleaned and Jetted per Year	TBD

Solid Waste

A summary of the established LOS for the Solid Waste System is provided below in Table 5.

Table 5. Solid Waste Levels of Service

LOS Description	LOS Measure	Target
Customer Complaints - Missed Pick Ups	Number of Customer Complaints Related to Missed Pick Up	50
Rejected Loads - Frequency	Number of Rejected Loads	0
Extra Pick Up Completion	Average Response Time (Days) to Complete an Extra Pick Up	<5

Transportation

A summary of the established LOS for the Transportation System is provided below in Table 6.

Table 6. Transportation Levels of Service

LOS Description	LOS Measure	Target
Citizen Complaints - Traffic and Street Lights	Average Response Time to Traffic and Street Light Complaints	<5
Total Traffic Accident Frequency	Number of Traffic (Vehicle Collisions; both Non-Fatal and Fatal) Accidents	< 15
Total Pedestrian Accident Frequency	Number of Traffic (Pedestrian Collisions; both Non-Fatal and Fatal) Accidents	0
Street Sweeping Date	Complete Street Sweeping by Target Date	June 1
Snow Plowing Date	Complete Snow Plowing withing Target Time after Snowfall	< 60 HRS
Preventative Maintenance to Reactive Maintenance	Ratio of Preventative (Planned) Maintenance Costs to Reactive (Unplanned) Maintenance	75 : 25
ADA Compliant Curb Ramps	Percent of Non-ADA Compliance Curb Ramps Replaced Yearly	10%
MUTCD Compliance	Percent of Traffic Control MUTCD Compliance for City and Contractor Work in ROW	100%

Fleet

A summary of the established LOS for the City-owned Fleet is provided below in Table 7.

Table 7. Fleet Levels of Service

LOS Description	LOS Measure	Target
Equipment Downtime - Duration	Total Hours of Equipment Downtime	< 1000
Unplanned Equipment Repairs - Duration	Total Hours Spent on Unplanned Repairs	< 500

Police Department

A summary of the established LOS for the Police Department is provided below in Table 8.

Table 8. Police Department Levels of Service

LOS Description	LOS Measure	Target
Staffing - Patrol	Ensure members available to adequately protect and serve community	TBD
Staffing - Investigations	Ensure members are available and trained to conduct thorough investigations	TBD
Staffing - Administration (non-sworn)	Ensure members are available and trained to conduct department operations	TBD
Staffing - Community Service Officer(s)	Ensure members are available to conduct code enforcement	TBD
Budget	Ensure budget encompasses current and projected needs for fiscal year	TBD
Recruiting	Effectively recruit candidates to fill vacant position(s)	TBD
Retention	Effectively retain members using traditional and non-traditional incentives	TBD
Ballistic Vests for All Uniform Members	Each member has properly fitted, current warranty ballistic vest	TBD
Medical Kits Including AED in Squads	Provide Medical Kits and AEDs IAW Department best practices	TBD
Lock Out Kits in Squads	Ensure each squad has lock out kit, members trained in use	TBD
Inclement Weather Footwear - Yaktraxs	Ensure each member has foul weather footwear traction device(s)	TBD
Ensure Sufficient Vehicles Available for Shifts Admin	Purchase, upfit, maintain vehicles IAW Department best practices	TBD
Phase Out of Ford Expeditions	IAW WCPD Fleet maintenance plan	TBD
Purchase of Vehicles	Replace obsolete vehicles IAW Fleet maintenance plan	TBD
Sale / Disposition of Obsolete Vehicle(s)	Sell obsolete vehicle(s) at impound auction(s)	TBD
In-house Maintenance	Perform simple repairs/maintenance IAW Fleet maintenance plan	TBD
Local Maintenance / Service	Perform simple/moderate repairs with City shop, local vendors	TBD
Factory Service	Coordinate major repairs with factory shops in region	TBD

ND POST Peace Officer Licenses	Renewed as directed by POST	100%
ND POST Methods of Instruction Certifications	Renewed as directed by POST	100%
Grant Use Validation	As required by grant administrating entity	100%
ND POST Firearms Qualification Requirement	Required annually	100%
SIRN 20/20	Purchase, upgrade, replace portable and vehicle radios IAW SIRN 20/20	TBD
LEC	Review use of WCPD and joint use spaces on regular basis	TBD
Future Facility Needs	Expansion and/or displacement from McKenzie County LEC	TBD

Fire Department

The City requested that LOS be developed for the Fire Department; however, this was not included in the scope of this Project. A placeholder table is provided below in Table 9 that the City can utilize to update Fire Department LOS in the future.

Table 9. Fire Department Levels of Service

LOS Description	LOS Measure	Target
To be completed from Fire Dept.		
To be completed from Fire Dept.		
To be completed from Fire Dept.		

Facilities

A summary of the established LOS for City Facilities is below in Table 10 and Table 11, where Table 10 includes general levels of service that apply to all City Facilities, and Table 11 includes LOS pertaining to specific City Facilities.

Table 10. City Facility Levels of Service - General

LOS Description	LOS Measure	Target
Snow and Ice Removal	Number of Days to Clear Snow and Ice from Parking Lots, Sidewalks, and Entries	1
Gutter and Downspout Cleaning	Frequency of Gutter and Downspout Cleaning	Annually
Specialty Landscaping	Frequency of Tree and Shrub Trimming	Annually
HVAC and Electrical Systems Inspection	Frequency to Inspect HVAC and Electrical Systems	Annually

Table 11. City Facility Levels of Service - Specific

LOS Description	LOS Measure	Target(s)						
		Civic Center / Vet's Building	Visitor Center	Rough Rider Center	Golf Course	Public Works Buildings	Law Enforcement Center	Wolf Pup Preschool
Customer Complaints - General Complaints	Number of Customer Complaints Related to Cleanliness, Broken Doors, etc.	3	3	3	3	3	n/a	n/a
ADA System Operation	ADA System Operation During Operating Hours Rate	99%	99%	99%	90%	99%	n/a	n/a

Implementation and Monitoring Recommendations

The following steps are recommended for establishing, implementing, monitoring LOS:

1) When establishing and implementing new LOS, consider the difficulty for monitoring that LOS.
   a. If a LOS needs to be monitored more frequently (i.e. once per month), it will be more difficult to monitor progress.
   b. If a LOS needs to be monitored less frequently (i.e. once per year), it will be easier to monitor progress.
   c. **Recommendation: Establish LOS that need to be monitored and updated annually. This process and frequency of monitoring and updating LOS could be performed prior to budgeting, which could help influence important budgeting decisions.**
2) When establishing and implementing new LOS, consider the number of LOS that are being monitored and the value that monitoring specific LOS will bring to each department and the City.
   a. If too many LOS are established, it will be much more difficult to monitor progress.
   b. If too few LOS are established, it will be much easier to monitor progress, but value realized will be limited as less data is being collected.
   c. **Recommendation: Establish enough LOS to be valuable and meaningful, but not too many to the point it becomes cumbersome to monitor progress.**
3) When monitoring LOS, it's recommended to do the following:
   a. **Maintain an-overarching single master spreadsheet to monitor LOS. The master spreadsheet will utilize input data from each respective departments' spreadsheet.**
   b. **Each department to maintain a single spreadsheet to monitor LOS respective to that department.**
   c. **Appoint one person (for each department at the department level) to manage the LOS pertaining to that department or system.**
   d. **Appoint one person (at the City level) to ensure that the LOS are being updated on an annual basis and that the master spreadsheet is updated.**
   e. **Review the LOS progress internally and consider showing the City Council how each department is actually doing versus the targets set.**
   f. **Review the LOS and compare with other similar communities and industry research to determine if the City is performing in-line with peer cities and industry trends.**
   g. **Add, omit, and modify LOS as deemed necessary and progress is made towards achieving departmental and City goals.**
   h. **If the City elects to utilize a maintenance management system (or other computer software for monitoring operations, maintenance, compliance, etc.) for certain departments, integrate the established LOS within the system.**
   i. **Routinely review the process and strive to make improvements.**

[i] Watford City and McKenzie County. 2020-2024 Community Sustainability Plan. 2019.

Watford City 2040
Infrastructure Master Plan

APPENDIX B

TM2 - Financial Policies Technical Memorandum

TECHNICAL MEMORANDUM

To:	**City of Watford City, ND**	
Attn:	Grace Demars, PE City Engineer	Laura Dokken Finance Director
From:	**Burian & Associates, LLC** Steve L. Burian, PE	**Raftelis** John Mastracchio, CFA
Re:	**Watford City 2040 Infrastructure Master Plan – Financial Policies Memorandum**	
Date:	December 2021	

Introduction

As part of the 2040 Infrastructure Master Plan project being completed for Watford City (City), Burian & Associates, LLC. and subconsultant, Raftelis, are tasked with preparing a long-term financial plan and model for the City to help ensure that the capital plan developed through the master planning effort is affordable and implementable, and to provide a tool to enable the City to maintain a strong financial position into the future while managing revenue risk to the greatest extent possible. This financial policies memorandum was prepared to help achieve these goals.

Raftelis reviewed the City's existing fiscal policies and financial targets to ensure that the financial plan being developed for the City is in compliance with these policies, and to support a financially sustainable financial plan for the City. At the time that this memorandum was prepared, the City's fiscal policies and targets were primarily informal and not specifically documented or approved by City Council. Therefore, a review of government sector policy guidelines was completed and discussions with City finance staff were held to develop policy recommendations that would ensure a sound financial position for the City.

Policy Recommendations

The following sections outline a summary of the fiscal policy and financial target recommendations that were reviewed with City finance staff. An overview of the policy recommendations is included as Table 1 on the following page.

Table 1. Overview of Policy Recommendations

Policy Recommendations
Fixed Asset(s)
Capital Improvement Plan (CIP)
Capital Improvement Plan (CIP) Appropriations
Municipal Indebtedness
Fund Balance Reserves
Budget Stabilization

Fixed Asset

It is recommended that the City develop a policy that provides guidelines for safeguarding and managing assets of the City. This policy should provide rules that ensure compliance, accountability, responsibility, safekeeping, and adequate control of assets. A proposed draft policy statement is provided below:

The City will maintain its assets at a level adequate to comply with all regulatory requirements and to minimize future replacement and maintenance costs. The City's asset management process will be coordinated as part of its annual capital improvement planning process.

Capital Improvement Plan

It is recommended that the City develop a policy that provides guidance on how the City's Capital Improvement Plan is followed and implemented. A proposed draft policy statement is provided below:

The City's Capital Improvement Plan (CIP) will be carefully planned, generally as part of an infrastructure and facilities planning process, to enable decision makers to evaluate each capital project based on complete and accurate information. The City will annually update and re-adopt its five-year capital improvements program, identifying and describing each capital project along with the estimated cost and funding source.

Capital Improvement Plan Appropriations

It is recommended that the City develop a policy that provides guidelines on how the City's capital projects can be funded and financed. A proposed draft policy statement is provided below:

The City will determine the least costly funding method for its capital projects and will obtain grants, contributions, and low-cost state or federal loans whenever possible and advantageous to do so.

The City will utilize "pay-as-you-go" funding for capital improvement expenditures considered recurring, operating or maintenance in nature. The City may also utilize "pay-as-you-go" funding for capital improvements when current revenues and adequate fund balances are available, when issuing debt would unduly affect the City's credit rating, or when market conditions are unstable or suggest difficulties in marketing a debt.

The City will consider the use of debt financing for capital projects under the following circumstances:

a. When the project's expected useful life is sufficient to warrant long-term debt financing.
b. When projected annual revenues are deemed sufficient and reliable to service the long-term debt.
c. When market conditions present favorable interest rates for City financing.
d. When the issuance of debt will not unduly affect the City's credit rating.
e. When current revenues or fund balances are insufficient to pay project costs.

Municipal Indebtedness

It is recommended that the City develop a policy that provides guidelines on how the City's existing debt will be managed. A proposed draft policy statement is provided below:

General Fund Debt. The City will comply with all statutory debt limitations imposed by North Dakota (Century Code) Statutes, including the following.

a. The City's outstanding indebtedness shall not exceed 5% of the asset value of taxable property, except by referendum (as specified in Section 21-03-04 of the Century Code).
b. No bonds run for a longer period than 20 years from their date of issue (as per Section 21-03-08 of the Century Code).

The City will comply with all bond covenants, arbitrage requirements, disclosure requirements, and other requirements as specified by contract and by law.

Enterprise Fund Debt. The City will meet North Dakota Public Financing Authority's State Revolving Loan Fund Program requirements when it has SRF loans outstanding that are backed by revenue bonds. The program requires the borrower to charge fees that will generate net revenues that are at least equal to 1.2 times the annual debt service. The City's policy is to achieve this debt service coverage ratio in each year that the City has outstanding SRF loans and strive to improve its Enterprise Fund financial position such that beginning in 2026, the City's Enterprise Funds shall maintain a management target for debt service coverage that is more restrictive than its bond and loan requirements of at least 1.35 times.

Fund Balance Reserves

It is recommended that the City develop a policy that addresses the importance of maintaining self-sufficiency regarding liquidity. A proposed draft policy statement is provided below:

The City will maintain unrestricted fund balances to provide the City with sufficient working capital and a comfortable margin of safety to address emergencies and unexpected declines in revenue without the need for borrowing. The City will maintain sufficient contingency and reserves in each fund for the ability to:

a. Mitigate short-term volatility in revenues and makeup the temporary shortfall in revenue.
b. Mitigate short-term economic downturns (2 years or less).
c. Absorb unanticipated operating needs that arise during the fiscal year, but were not anticipated during the budget process.
d. Sustain City services in the event of an emergency.

e. Meet operating cash flow requirements before the collection of property taxes, grant proceeds, or other operating revenues.
f. Absorb minor claim or litigation settlements.
g. Purchase vehicles and equipment without the need to finance such purchases.
h. Meet routine facility and equipment repair needs.
i. Meet requirements for debt service reserves.
j. Maintain good standing with rating agencies.

General Fund Reserves – The City shall improve or maintain its General Fund financial position such that beginning in 2026 it shall maintain General fund unassigned reserves of at least 16% or 2 months of the operating budget of the General Fund. Funding of the General Fund reserve will generally come from excess revenues over expenditures or one-time revenues. Ending reserve levels will be evaluated annually and undesignated reserve balances in excess of the target will be dedicated to improving the condition of the City's facilities, streets, sidewalks, and paths, as well as the water, wastewater, and stormwater systems.

Water and Sewer Reserves – The City shall improve or maintain its Water and Sewer Enterprise Funds financial positions such that beginning in 2026 it shall maintain an undesignated Operating Reserve of at least 25% (or 3 months) of the operating budget for its water and sewer utility funds. In addition, the City shall build a Rate Stabilization Reserve in the water and sewer funds over a seven-year period such that the rate stabilization funds are maintained at no less than an additional 25% or 3 months of the operating budget to protect against volatility of revenues or unexpected, one-time capital expenditure needs. The City will also meet North Dakota Public Financing Authority's State Revolving Loan Fund Program requirements of maintaining a Debt Service Reserve equal to the lesser of (1) 10% of the par amount of the SRF loan, (2) maximum annual principal and interest payment associated with the loan, or (3) 125 percent of the average annual principal and interest payments.

The City will use reserves on a one-time or temporary basis for the purposes described above. In the event that reserve funds decrease to levels below the levels established by this policy, the City will develop a plan to restore reserves to the required levels. If feasible, the minimum reserve balances shall be replenished in the following year of use, but no longer than within five years.

Budget Stabilization

It is recommended that the City develop a policy that provides guidelines on how the City can best close short to moderate cash flow gaps in municipal spending when revenues have decreased below budgeted levels. A proposed draft policy statement is provided below:

The City will deposit a portion (determined by City staff) of Gross Production Tax (GPT) revenues into the fund on a monthly basis. GPT in the amount of up to $100,000 per month may be deposited into the Budget Stabilization Fund.

Adopted Policies

After reviewing policy recommendations with City staff, the following financial policies (shown in Table 2 and defined below) were defined and adopted by the City in November of 2021.

Table 2. Overview of Policy Recommendations

Adopted Policies
Fixed Asset/Capital Asset Policy
Capital Improvement Plan Policy
Capital Improvement Plan Appropriation
Municipal Indebtedness
Fund Balance Reserves
Budget Stabilization Fund

Fixed Asset/Capital Asset Policy

The following subsections outline the fixed asset/capital asset financial policy.

Scope/Purpose

Assets that have a useful life of more than one fiscal year are considered fixed assets. The term fixed assets (also referred to as capital assets) will be identified through the capital improvement planning process. The objectives of asset planning are to enhance the accuracy and reliability of City financial statements, amortize the cost of long-term assets over their useful lives and strategically plan systematic replacement of capital investments. Fixed asset accounting is required under compliance with Government Accounting Standards Board (GASB). Application of the fixed asset policy must adhere to GASB, North Dakota Century Code (NDCC) and the ordinances of the City of Watford City Council.

Fixed Asset Process

The capital improvements planning process will provide the necessary information to identify long term fixed assets. Assets and depreciation expenses will be assigned to specific funds.

Designation as an Asset

The City of Watford City has determined that an asset of significant value shall be defined as an item with an acquisition cost of $5,000 or greater and buildings, structures, and capital leases with a value of at least $50,000.

Capital assets are major assets that are used in governmental operations and that benefit more than a single fiscal period. These assets are not intentionally acquired for resale, nor are they readily converted to cash. The identifying characteristics of a capital asset are “significant value” and “useful life.”

Capital Asset Classification

The maintenance of accurate records and effective capital improvement planning depends on precise definitions of each capital asset category. Capital assets are categorized into several major classes. These classes provide the structure for the capital asset accounts and define processing requirements for the different types of assets.

Major asset classes include:

- Land and land improvements
- Buildings and building improvements
- Machinery and equipment, including
  - Vehicles
  - Off-road equipment
  - Office equipment
  - Computer equipment (in most cases hardware only)
  - Furniture and fixtures
- Infrastructure
- Construction work in progress
- Capital leases

Asset Depreciation

All capital assets are depreciated over their useful lives on a straight-line basis. The City has established the following useful lives:

- Buildings & Infrastructure: 20-50 years
- Machinery and equipment: 5-15 years
- Improvements other than buildings: 15-40 years

Asset Disposition

The disposition of fixed assets will be determined by the department head responsible for assigned assets. Asset disposition must be reported to the Finance Director with the explanation of the disposition (obsolescence, trade, sale, destruction, theft)

Capital Improvement Plan Policy

The following subsections outline the capital improvement plan financial policy.

Scope/Purpose

To provide policy and procedures for the development and approval of the City of Watford City five (5) year plan for Capital Improvements, known as the Capital Improvement Plan (CIP). The CIP serves as a guide for the efficient and effective provisions of public facilities, outlining a timeline and appropriation schedule. A capital improvement project for consideration in the plan has a final projected cost of at least $5,000 and an estimated useful life of more than one year. Projects over $200,000 will be publicly bid according to North Dakota Century Code 48-01.2.

CIP Process

Annually a CIP development calendar will be followed. The yearly CIP process will be coordinated and administered by a CIP Team consisting of the City Engineer, City Public Works Administrator and Finance

Director. The Team will utilize the previous year's approved CIP as a base for developing recommended additions, deletions, or changes for incorporation in the updated CIP for the ensuing year. Requests will be initiated to City Department heads for updates, revisions, and new projects/equipment for the five-year Capital Improvement Plan. Department Heads will utilize the CIP Application form provided to submit new projects/equipment or propose revisions to existing projects. All new projects will include a comprehensive estimate of the impact of the new project on the City's annual operating budget which includes salaries, benefits, utilities, fuel and maintenance requirements, etc.

The City Administrator, City Auditor, City Public Works Superintendent, City Finance Director and City Engineer will prioritize the submitted projects via an approved matrix/weighting system. The Ways, Means & Finance Committee will review the prioritized list and recommend final adoption of the five-year CIP to the full City Council for approval. The CIP will be presented at an open public meeting of the City Council. Upon approval, the Finance Director will integrate the CIP into the upcoming Annual Budget. The CIP may be amended upon approval of the City Council. Amendments examples include cost increases for approved projects, the acceleration of projects to the appliable budget year from a future year, and the addition of projects not previously included in the CIP.

Capital Improvement Plan Appropriations

The following subsections outline the capital improvement plan appropriations financial policy.

Scope/Purpose

To identify and allocate resources necessary for the timely acquisition of public assets as identified in the capital improvement plan.

Policy

The capital improvements fund is intended for the acquisition of assets required in the delivery of municipal services to the community as a whole. Capital project funds will be used for assets acquired for the benefit of a specifically defined area, for the acquisition of major enterprise fund assets and for the accumulation of costs associated with acquisition of major public infrastructure.

Capital Improvements Requests

Requests will be prepared and reviewed by the Capital Improvements Team and submitted to City Council for final approval. See the Capital Improvement Plan Policy.

Preliminary Budget

To preserve adequate reserves in the capital improvements fund, project funding will be presented in a balanced budget equation; expenditures exceeding fund revenue shall be clearly identified as pending additional financing.

Final Budget

Presentation of the final capital improvements budget will be presented to the council for approval. Appropriation will be for the ensuing fiscal period and is not to be carried over unless specifically identified as a multi-year appropriation.

Revenue

The capital improvements fund may receive revenue from taxes, licenses, permits, fees, interest income, grant proceeds, intergovernmental allocations and fund balance surpluses according to the Home Rule Charter of the City of Watford City.

Disbursements

Capital improvement purchases are approved in the CIP process; expenses of the capital improvements funds are subject to all laws and ordinances applicable to the acquisition of public property. Expenses are not to exceed the appropriated amount without prior approval and documentation from city council. Unexpended appropriations will remain in the capital improvements fund balance reserve.

Municipal Indebtedness

The following subsections outline the municipal indebtedness financial policy.

Scope/Purpose

To strategically balance the use of debt financing to provide City services, meet community needs and attain objectives as designated by City Council.

Policy

Debt financing will only be utilized for projects that are permanent in nature and have an estimated useful life that exceeds the terms of indebtedness. Projects will be evaluated for necessity by the City Council and staff. Viable revenue sources for debt service shall be included in each project proposal. Municipal Indebtedness will be compliant with statutory debt levels as designated by NDCC 21-03-04.

Financing alternatives will be evaluated to ensure the City maintains the highest possible bond rating and minimizes the costs of borrowed money with targeted payback amortizations.

Evaluation of debt financing alternatives will designate the project financing as special assessment, enterprise/sales tax revenue, tax increment or general obligation debt.

Fund Balance Reserves

The following subsections outline the fund balance reserves financial policy.

Scope/Purpose

To maintain equity and provide adequate reserves for operations, fund liabilities, unforeseen events and cyclical changes in fund revenues.

Policy

This policy will ensure that the City maintains adequate fund balances and reserves in order to:

1. Provide sufficient cash flow for daily financial needs;
2. Secure and maintain investment grade bond ratings;
3. Offset significant economic downturns or revenue shortfalls;
4. Provide funds for unforeseen expenditures related to emergencies.

The City shall retain fund balances equal to approximately 6 months of operating expenses in the General, Road, Water, Sewer & Garbage funds. Shall the City Council direct appropriations from the fund balance reserves a plan and time frame not to exceed 36 months will be included in the budget process to restore the established 6-month operating fund requirement. The City will also meet North Dakota Public Financing Authority's State Revolving Loan Fund Program requirements of maintaining a Debt Service Reserve.

Budget Stabilization Fund

The following subsections outline the budget stabilization fund financial policy.

Scope/Purpose

The City of Watford City's Budget Stabilization Fund is dedicated to closing short to moderate cash flow gaps in municipal spending when revenues have decreased below budgeted levels.

Policy

Gross Production Tax (GPT) revenues may be deposited into the fund monthly as recommended by City staff. GPT in the amount of up to $100,000 per month may be deposited into the Budget Stabilization Fund.

Fund Uses

The City of Watford City may only use the funds by vote of the City Council. Uses of the funds may only be for payroll and other General Fund, Road Fund or Enterprise Fund(s) operating expenses. Funds may also be used for debt service required payments in sinking funds. Budget Stabilization funds may not be used for capital improvement projects.

Fund Cap

The Fund will have a cap of $4,000,000.

Watford City 2040 Infrastructure Master Plan

APPENDIX C

TM3 - Golf Course Irrigation Supply Technical Memorandum

TECHNICAL MEMORANDUM

To: City of Watford City, ND

Attn:

Grace Demars, PE City Engineer	Laura Dokken Finance Director	Justin Smith Public Works Director

From: Burian & Associates, LLC
Steve Burian, PE

Re: Watford City 2040 Infrastructure Master Plan – Golf Course Irrigation Supply Assessment

Date: December 2021

Introduction

The Watford City Fox Hills Golf Course is a state-of-the-art 18-hole golf course that provides recreational activity for McKenzie County citizens in addition to scenic views for residents living in the Stepping Stone and Fox Hills neighborhoods. Originally established in 1930 as a nine-hole course, the Fox Hills Golf Course was expanded in 2020 to include nine additional holes and a driving range. Today, the total course length is 6,980 yards and covers approximately 180 acres, although a portion of this acreage is residential development. Due to decreased source water for irrigation, the City requested that additional golf course irrigation options be evaluated as part of this Master Plan so that a supplement irrigation option could be identified.

Existing System Overview

The Fox Hills Golf Course currently irrigates an estimated 80 acres. Prior to the construction of the Water Resource Recovery Facility (WRRF) in 2015, the City utilized groundwater to irrigate the golf course. In addition to groundwater, the City holds active surface water appropriations on Cherry Creek. Due to sustainability concerns regarding utilizing surface water from Cherry Creek as a long-term irrigation solution, in addition to groundwater quality concerns, the City elected to utilize reclaimed effluent from the WRRF as their primary irrigation supply source.

After the wastewater goes through the treatment process at the WRRF, the wastewater is stored in two ponds on the WRRF campus. Wastewater from the ponds can be discharged to Cherry Creek or to the booster station wet well for irrigation supply. The booster station pumps to a force main, which discharges to a storage pond located at the golf course. Water is then pumped from the golf course storage pond and used for irrigation. In recent years, the City has noticed a reduction in wastewater flows at the headworks of the WRRF. This reduction in wastewater flows limits the amount of reclaimed effluent the City can provide as irrigation water to the golf course.

Overviews of the data described in the paragraph above are provided in the following tables:

- WRRF Secondary Pond Storage Data [Table 1]
- WRRF Booster Station Data [Table 2]
- Force Main Data [Table 3]
- Golf Course Onsite Storage Data [Table 4]

Table 1. WRRF Secondary Pond Data

Parameter	Value
Existing North Secondary Pond #3	
Perimeter	2,480-feet
Surface Area	256,000 square feet (5.88 acres)
Estimated Pond Depth	7-feet
Estimated Sludge Depth	1-feet
Estimated Freeboard	2-feet
Estimated Useable Storage Depth	4-feet
Estimated Storage Volume	**23.5 acre-feet**
Existing SE Secondary Pond #2	
Perimeter	1,950-feet
Surface Area	270,000 square feet (6.20 acres)
Estimated Pond Depth	7-feet
Estimated Sludge Depth	1-feet
Estimated Freeboard	2-feet
Estimated Useable Storage Depth	4-feet
Estimated Storage Volume	**24.8 acre-feet**
Total Existing WRRF Secondary Storage Volume	48.3 acre-feet (15.7 MG)

Table 2. WRRF Booster Station Data

Parameter	Value
Booster Station	
Year Constructed	2013
Number of Pumps	Two (2)
Estimated Firm Pumping Capacity	520 gallons per minute
Pump Control	Variable Frequency Drives
Wet Well Diameter	96-inch
Wet Well Depth	16.2-feet
Influent Pipe Diameter	12-inch
Low Water Alarm	2043.00’
High Water Level	2052.00’
Operating Band	9-feet

Table 3. Force Main Data

Parameter	Value
Force Main	
Pipe Material	PVC
Pipe Diameter	8-inch
Pipe Length	4,300-feet
Valves	Four (4) Air Release Valves
Flow Rate (at 3 feet per second)	470 gpm
Flow Rate (at 5 feet per second)	780 gpm
Flow Rate (at 7 feet per second)	1,100 gpm

Table 4. Golf Course Onsite Storage Data

Parameter	Value
Golf Course Onsite Storage Pond	
Perimeter	1,800-feet
Surface Area	223,000 square feet (5.88 acres)
Estimated Pond Depth	6-feet
Estimated Sludge Depth	0-feet
Estimated Freeboard	2-feet
Estimated Useable Storage Depth	4-feet
Estimated Storage Volume	**20.5 acre-feet (6.7 MG)**

Estimated Irrigation Demand

The Environmental Institute of Golf developed Volume II of a Golf Course Environmental Profile in 2009 focused on water use and conservation practices on US golf courses. According to that study, it's estimated that golf courses located in the upper / west mountain region (the region where Watford City is located) needs 2.9 acre-feet (35 inches) of water (per irrigated turfgrass acre annually).[i] Since the golf course irrigates approximately 80 acres, the total estimated irrigation demand is 232 acre-feet (75.6 million gallons) of water per year. A summary of the estimated irrigation is provided in Table 5.

Table 5. Estimated Golf Course Irrigation Demand

Parameter	Value
Annual Irrigation Demand	
Estimated Annual Water Demand per Acre	2.9 acre-feet
Irrigated Acres	80 acres
Total Estimated Annual Water Demand	**232 acre-feet (75.6 MG)**
Average Daily Irrigation Demand	
Irrigation Start Date	May 1st
Irrigation End Date	October 15th
Irrigation Days	167 days
Daily Irrigation Water Demand	1.39 acre-feet per day
Daily Irrigation Water Demand	0.45 MGD
Daily Irrigation Water Demand	452,680 GPD

Based on 20-year historical rainfall data observed at a National Weather Service Williston rain gauge, it's estimated that the region receives anywhere between 8-inches and 21-inches of rainfall per year, and the average rainfall over that time span is estimated to be approximately 14-inches per year. If Watford City, specifically the Fox Hills Golf Course, receives the historical average of 14-inches of rainfall (1.16 acre-feet), the total estimated annual irrigation demand is approximately 139 acre-feet, or 45.3 MG. To summarize, an extremely dry year (similar to what was experienced in 2021) results in **75.6 MG** of irrigation water needed, and a typical average rainfall year results in **45.3 MG** needed.

Supplemental Irrigation Options

The following options were considered for this effort:

- Baseline Option – Do Nothing
- Option 1 – Supplement with Cherry Creek Water
- Option 2 – Supplement with Groundwater
- Option 3 – Supplement with City Water
- Option 4 – Construct Additional Pond at WRRF
- Option 5 – Improve Existing Pond at Golf Course
- Option 6 – Hybrid A – Supplement with Cherry Creek and City Water
- Option 7 – Hybrid B – Supplement with City Water and Groundwater

Options 1 through 5 are shown visually in Figure 1.

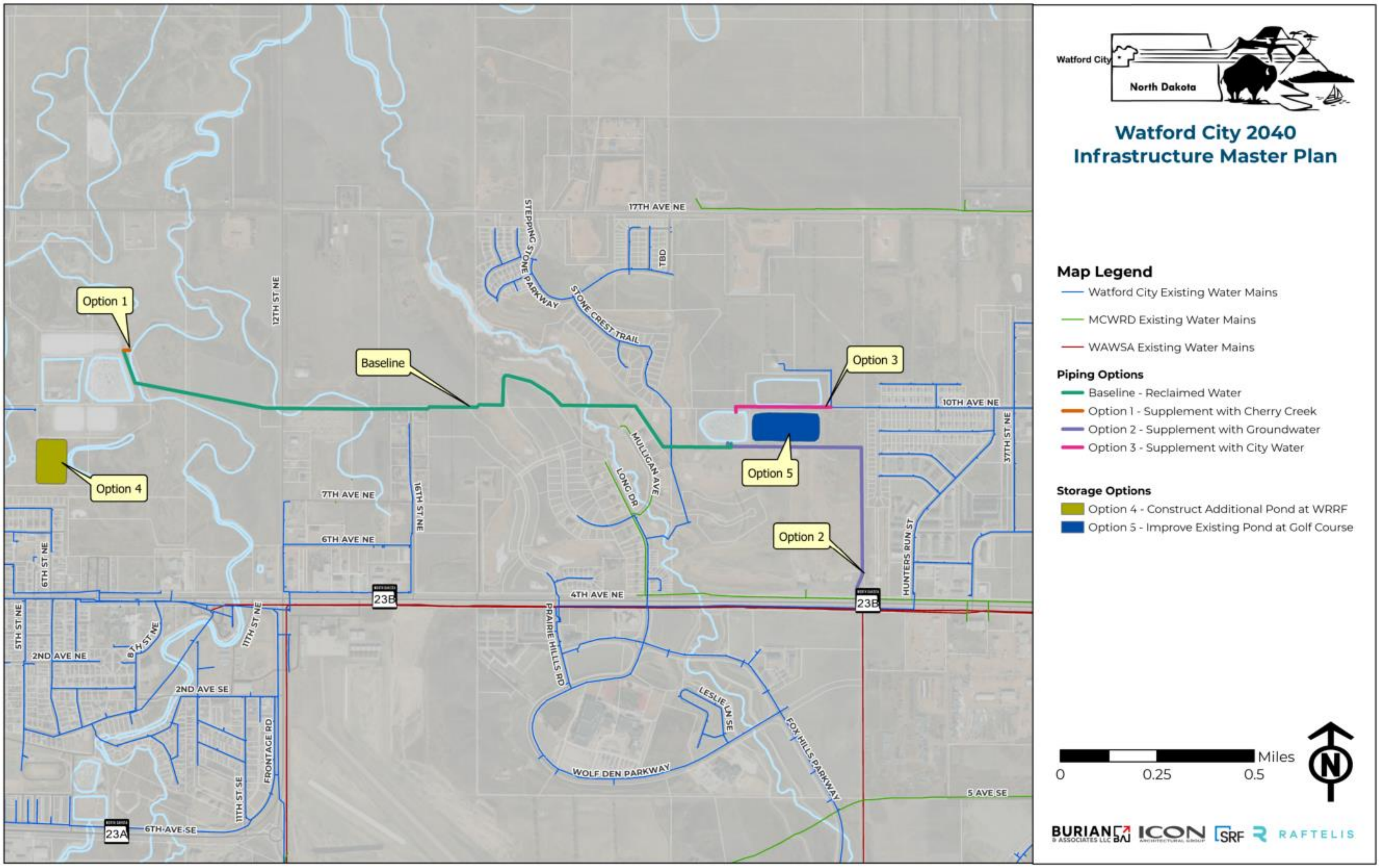


Figure 1. Golf Course Supplemental Irrigation Water Supply Options

Baseline Option – Do Nothing

The Baseline Option was considered in the event the City elects not to implement any changes to their existing golf course irrigation supply system. For all the options considered in this study, it's estimated that the City will continue to utilize the baseline option at an estimated flow rate of 384,780 gpd. This is calculated by multiplying a pumping rate of 500 gpm (slightly less than the firm capacity) by an assumed operating percentage of 53% (roughly 12.8 hours average per day run-time). The City currently batch operates the booster station due to lack of telemetry, meaning the booster station runs continuously for an extended period of time (roughly two weeks) until the onsite storage pond at the golf course is filled, and then is turned off for a period of time until more water is needed. The difference between the maximum baseline flow and the total daily irrigation demand of 452,680 gpd is 67,900 gpd. The difference could be made up if the City runs the booster station more often than the assumption of 53% (operating duration throughout the irrigation period) stated above.

Option 1 – Supplement with Cherry Creek Water

Option 1 involves utilizing raw water from Cherry Creek to supplement the Baseline Option. The preliminary concept includes installing approximately 40 feet of pipe from Cherry Creek to the existing booster station. Under Option 1, the existing force main system would be utilized for conveying water from the WRRF booster station to the onsite storage pond located at the golf course.

The City has an existing perfected surface water permit (1 of 2 existing irrigation permits Watford City holds) for irrigating the golf course. Permit #4765 includes a permit allocation of 25 acre-feet with a priority date of February 17, 1995. The City hasn't utilized this permit allocation since 2015. Upon securing the permit through 2015, the City utilized an annual average of 14 acre-feet from this appropriated volume.

Option 2 – Supplement with Groundwater

Option 2 involves utilizing groundwater from the City's groundwater wells to supplement the Baseline Option. The preliminary concept includes tying into a WAWSA-owned water line on the south side of 4th Avenue NE and installing approximately 1,860-feet of pipe from the tie-point to the onsite storage pond located at the golf course.

The second irrigation permit the City has (2 of 2 existing irrigation permits) is Permit #4085, which is a perfected groundwater permit which includes 82.6 acre-feet with a priority date of April 7, 1989. Similar to the other permit, the City hasn't utilized this permit allocation since 2015.

Option 3 – Supplement with City Water

Option 3 involves utilizing treated City water via a connection point on 10th Avenue NE to supplement the baseline option. The preliminary concept includes tying into the City's distribution system, installing a reduced pressure zone (RPZ) backflow preventer valve, and installing approximately 620 feet of pipe from the tie-point to the onsite storage pond.

Option 4 – Construct Additional Pond at the WRRF

Option 4 involves purchasing land nearby the WRRF and constructing an additional six acre pond, capable of holding an estimated 22.5 acre-feet, or 7.3 MG. The preliminary concept includes constructing an additional pond, onsite piping from the new pond to upstream of the booster station, and utilizing the existing booster station and force main to convey the water to the golf course. Option 4 wouldn't modify the water quality from the Baseline Option; however, water quantity would be improved through additional storage capacity.

Option 5 – Improve Existing South Pond at the Golf Course

Option 5 involves making improvements to one of the two existing ponds located at the Golf Course that are not currently being utilized. The south pond is slightly larger than the north pond, at it's closer to the pond that the golf course utilizes for onsite storage, so that pond was selected for improvement for the purpose of this study. The south pond is approximately 340,000 square feet, and has an estimated usable storage depth of 4-feet, resulting in an estimated storage volume of 31.2 acre-feet (10.2 MG). Both of the existing ponds at the golf course (owned by First International Bank and Trust), so improvements would need to be coordinated or the land would need to be purchased by the City.

The scale and details of the required improvements were not studied in depth as part of this Project, but it's estimated that earthwork, piping modifications, and installation and/or repair of the existing clay liner would be needed.

Option 6 – Hybrid A – Supplement with Cherry Creek and City Water

Option 6 is a hybrid option which combines Options 1 and 3.

Option 7 – Hybrid B – Supplement with City Water and Groundwater

Option 7 is a hybrid option which combines Options 1 and 2.

Analysis of Irrigation Options

Water Quantity

Due to the high-level nature of this assessment, and because data on river stream flows and groundwater aquifer levels were not readily available, a scoring method was implemented for quickly evaluating the sustainability and reliability of the options.

Water Quantity Scoring Evaluation

The scoring criteria utilized is as follows:

1 – Water Quantity Reduced

2 – No Change in Water Quantity

3 – Water Quantity Improved – Unreliable Supply

4 – Water Quantity Improved – Moderately Reliable Supply

5 – Water Quantity Improved – Very Reliable Supply

Table 6 below provides the results from the water quantity evaluation.

Table 6 Water Quantity Scoring Results

Options	Score	Description
Baseline Option	2	No change in Water Quantity
Option 1 Supplement with Cherry Creek	3	Water Quantity Improved – Unreliable Supply
Option 2 Supplement with Groundwater	4	Water Quantity Improved – Moderately Reliable Supply
Option 3 Supplement with City Water	5	Water Quantity Improved – Very Reliable Supply
Option 4 Construct Additional Pond at WRRF	4	Water Quantity Improved – Moderately Reliable Supply
Option 5 Improve Existing Pond at Golf Course	4	Water Quantity Improved – Moderately Reliable Supply
Option 6 Supplement with Cherry Creek + City Water	5	Water Quantity Improved – Very Reliable Supply
Option 7 Supplement with Groundwater + City Water	5	Water Quantity Improved – Very Reliable Supply

The justification for the scoring assignments is provided below:

- The Baseline Option was scored a **2** because there would be no change in water quantity.

- Option 1 was scored a **3** because Cherry Creek is an intermittent stream which can experience times of extremely low or no flow during extended periods of dry weather and drought. Additionally, the existing permit allocation for Cherry Creek is 25 acre-feet, which is not enough to meet the estimated total demand. However, Option 1 assumes that the City pursues and is granted additional appropriations on Cherry Creek. The source makeup for Option 1 includes:
  - Baseline (reclaimed effluent) – 384,780 gpd [85%]
  - Cherry Creek – 67,900 gpd [15%]
  - Total – 452,680 gpd [100%]

- Option 2 was scored a **4** because the groundwater aquifer is estimated to be more reliable than Cherry Creek from a quantity standpoint (because droughts groundwater aquifers are more resilient compared to surface waters during drought), but less reliable than a connection the City's distribution system. Additionally, the City's existing groundwater appropriations adequately make up the difference in needed demand. The source makeup for Option 2 includes:
  - Baseline (reclaimed effluent) – 384,780 gpd [85%]
  - Groundwater – 67,900 gpd [15%]
  - Total – 452,680 gpd [100%]

- Option 3 was scored a **5** because a connection with City water provides an extremely reliable source given the capacity of the Missouri River and the Missouri River's resistance to drought.
  - Baseline (reclaimed effluent) – 384,780 gpd [85%]
  - Cherry Creek – 67,900 gpd [15%]
  - Total – 452,680 gpd [100%]

- Option 4 and Option 5 were scored a **4** because they would provide additional holding storage, but wouldn't provide quite the level of reliability and sustainability as a City connection. The source makeup for Option 4 and Option 5 include 100% reclaimed effluent.

- Option 6 and Option 7 were both scored a **5** because they include a connection to the City's distribution system, in addition to other water supply improvements.
  - The source makeup of Option 5 includes:
    - Baseline (reclaimed effluent) – 384,780 gpd [85%]
    - Cherry Creek – 38,480 gpd [8.5%]
    - City Water – 29,420 gpd [6.5%]
    - Total – 452,680 gpd [100%]
  - The source makeup of Option 6 includes:
    - Baseline (reclaimed effluent) – 384,780 gpd [85%]
    - Groundwater – 38,480 gpd [8.5%]
    - City Water – 29,420 gpd [6.5%]
    - Total – 452,680 gpd [100%]

Water Quality

Prior to evaluating water quality data, the desired ranges for optimal turf growth were researched and are presented below in Table 7.

Table 7.Desired Water Quality Ranges for Optimal Turf Growth

Parameter	Desired Range	Recommended Limit
pH	6.0 – 7.0	N/A
Residual Sodium Carbonate (RSC)[1]	< 0	2.5
Total Dissolved Solids (TDS)[2]	300 – 1,200	2,000
Sodium (Na)[2]	< 50	75
Calcium (Ca)[2]	20 – 65	80
Magnesium (Mg)[2]	10 – 25	35
Sodium Absorption Ratio (SAR)	< 4	10

1 Represented in meq/L
2 Represented in mg/L

Water quality data was gathered for this study in order to analyze the sources being considered. Table 8 provides the water quality of the sources based on data obtained from the City.

Table 8. Source Water Quality Data

Parameter	Reclaimed Effluent	Cherry Creek	Groundwater	Potable City Water
pH	7.85	7.77	7.71	7.47
Residual Sodium Carbonate (RSC)[1]	-0.2	-0.6	2.2	-2.2
Total Dissolved Solids (TDS)[2]	1,064	1,342	2,233	350
Sodium (Na)[2]	226	376	683	71
Calcium (Ca)[2]	62	58	101	72
Magnesium (Mg)[2]	30	47	63	38
Sodium Absorption Ratio (SAR)	5.9	8.8	13.1	1.7

Table Notes

- For the pH, RSC, and TDS parameters, green values indicate a value within the desired range, and red values indicate a value outside of the desired range.
- For the Na, Ca, Mg, and SAR parameters, green values indicate a value below the recommended limit, where red values indicate above the recommended limit.

As shown in Table 8, the reclaimed effluent and potable City water sources offer the best water quality for optimal turf growth.

Water Quality Analysis

Table 9 provides blend ratios and the estimated water qualities for each of the options after blending occurs. In the table, underneath 'estimated irrigation water quality', a green value indicates that the water quality was improved from the baseline, a red value indicates that the water quality was worsened from the baseline, and a black value indicates no change in water quality.

Table 9. Water Quality Analysis Results

Water Source / Parameter	Baseline	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
Water Supply Flow Rates by Source (represented in Gallons per Day)								
Reclaimed Effluent	384,780	384,780	384,780	384,780	384,780	384,780	384,780	384,780
Cherry Creek	0	67,900[(A)]	0	0	0	0	38,480[(B)]	0
Groundwater	0	0	67,900	0	0	0	0	38,480[(C)]
City Water	0	0	0	67,900	0	0	29,420	29,420
Total Irrigation Supply Provided	**384,780**	**452,680**	**452,680**	**452,680**	**384,780**	**384,780**	**452,680**	**452,680**
Estimated Irrigation Water Quality								
pH	7.9	N/A[1]	N/A[1]	N/A[1]	7.9	7.9	N/A[1]	N/A[1]
RSC[2]	-0.2	-0.3	0.2	-0.5	-0.2	-0.2	-0.4	-0.1
TDS[3]	1,064	1,106	1,241	956	1,064	1,064	1,041	1,118
Na[3]	226	249	295	203	226	226	229	255
Ca[3]	62	61	68	64	62	62	62	66
Mg[3]	30	33	35	31	30	30	32	33
SAR[3]	5.9	6.4	7.2	5.2	5.9	5.9	5.9	6.4

(A) 67,900 gpd for the entire season equates to approximately 35 acre-feet of water for the season, which exceeds the current permit appropriation of 25 acre-feet. Therefore, the City would need to pursue additional appropriations on Cherry Creek to meet the full demand.

(B) 38,480 gpd for the entire season (167 days) equates to approximately 20 acre-feet (5 acre-feet less than permitted appropriation).

(C) Under Option 7, it's assumed that the City will utilize the same source split as Option 6, except with groundwater instead of water from Cherry Creek.

1 Blended pH is estimated to be between 7.4 – 7.9
2 Represented in meq/L
3 Represented in mg/L

Water Quality Scoring Evaluation

The scoring criteria utilized is as follows:

1 – Water Quality Worsened Significantly

2 – Water Quality Worsened Slightly

3 – No Change in Water Quality

4 – Water Quality Improved Slightly

5 – Water Quality Improved Significantly

Table 10 below provides the results from the water quality analysis.

Table 10. Water Quality Scoring Results

Options	Score	Description
Baseline Option	3	No Change in Water Quality
Option 1 Supplement with Cherry Creek	2	Water Quality Worsened Slightly
Option 2 Supplement with Groundwater	1	Water Quality Worsened Significantly
Option 3 Supplement with City Water	4	Water Quality Improved Slightly
Option 4 Construct Additional Pond at WRRF	3	No Change in Water Quality
Option 5 Improve Existing Pond at Golf Course	3	No Change in Water Quality
Option 6 Supplement with Cherry Creek + City Water	4	Water Quality Improved Slightly
Option 7 Supplement with Groundwater + City Water	1	Water Quality Worsened Significantly

The justification for the scoring assignments is provided below:

- The Baseline Option was scored a 3 because there would be no change in water quantity.

- Option 1 was scored a 2 because raw water from Cherry Creek has slightly worse water quality than reclaimed effluent. Therefore, blending with Cherry Creek will slightly worsen the water quality. However, the water quality change will be minimal and likely unnoticeable for irrigation water.

- Option 2 was scored a 1 because the groundwater is significantly worse quality than the reclaimed effluent. Therefore, blending with groundwater will significantly worsen the water quality.

- Option 3 was scored a 4 because City water is better water quality than reclaimed effluent. Therefore, blending with City water will slightly improve the water quality.

- Option 4 and Option 5 was scored a 3 because there would be no change in water quality.

- Option 6 was scored a 4 because City water is better water quality than reclaimed effluent, and blending with Cherry Creek is only slightly worse than reclaimed effluent. Therefore, blending with City water and Cherry Creek will slightly improve the water quality.

- Option 7 was scored a 1 because the groundwater is significantly worse quality than the reclaimed effluent. Even with the addition of City water, the water quality will still be worse than only utilizing reclaimed effluent. Therefore, blending with groundwater and City water will significantly worsen the water quality.

Cost Considerations

Capital costs as well as annual operating costs were calculated to estimate the cost burden associated with each option.

Capital Costs

Preliminary capital cost estimates (CCE) were prepared based on historical bid data review, online research, and engineering judgement. The capital cost estimates are provided in Table 11 through Table 15.

Table 11. CCE for Option 1 - Supplement with Cherry Creek

Item	Quantity	Unit	Unit Cost	Extended Cost
6" PVC	60	LF	$ 60.00	$ 3,600.00
6" Gate Valve	1	EA	$ 2,500.00	$ 2,500.00
Wetwell Modifications	1	LS	$ 20,000.00	$ 20,000.00
Intake Screen and Rip Rap	1	EA	$ 25,000.00	$ 25,000.00
Subtotal				**$ 51,100.00**
Markup (Contingencies, Mobilization, ELA) [50%]				$ 25,550.00
Estimated Total Project Costs				**$ 76,650.00**

Table 12. CCE for Option 2 - Supplement with Groundwater

Item	Quantity	Unit	Unit Cost	Extended Cost
Existing Watermain Connection	1	EA	$ 5,000.00	$ 5,000.00
6" PVC	1,810	LF	$ 60.00	$ 108,600.00
6" PVC Road Bore	50	LF	$ 80.00	$ 4,000.00
Gate Valve	3	EA	$ 2,500.00	$ 7,500.00
Flow Meter	1	EA	$ 7,000.00	$ 7,000.00
Outfall Structure and Rip Rap	1	EA	$ 25,000.00	$ 25,000.00
Subtotal				**$ 157,100.00**
Markup (Contingencies, Mobilization, ELA) [50%]				$ 78,550.00
Estimated Total Project Costs				**$ 235,650.00**

Table 13. CCE for Option 3 - Supplement with City Water

Item	Quantity	Unit	Unit Cost	Extended Cost
Existing Watermain Connection	1	EA	$ 2,000.00	$ 2,000.00
6" PVC	630	LF	$ 60.00	$ 37,800.00
Gate Valve	1	EA	$ 2,500.00	$ 2,500.00
RPZ and Enclosure	1	EA	$ 15,000.00	$ 15,000.00
Flow Meter	1	EA	$ 7,000.00	$ 7,000.00
Outfall Structure and Rip Rap	1	EA	$ 25,000.00	$ 25,000.00
Subtotal				**$ 89,300.00**
Markup (Contingencies, Mobilization, ELA) [50%]				$ 44,650.00
Total				**$ 133,950.00**

Table 14. CCE for Option 4 – Construct Additional Pond at WRRF

Item	Quantity	Unit	Unit Cost	Extended Cost
Excavation	27,222	CY	$ 4.50	$ 122,499.00
Placement	15,840	CY	$ 4.50	$ 71,280.00
Compaction	43,062	CY	$ 1.00	$ 43,062.00
Clay Liner (1' thickness)	11,343	CY	$ 7.00	$ 79,401.00
Miscellaneous Site Piping	1	LS	$ 100,000.00	$ 100,000.00
Geological Investigation	5.6	AC	$ 5,000.00	$ 28,000.00
Disked, Seeded, Mulched	5.6	AC	$ 1,500.00	$ 8,400.00
Subtotal				**$ 452,642.00**
Markup (Contingencies, Mobilization, ELA) [50%]				$ 226,321.00
Total [1]				**$ 678,963.00**

[1] Total cost estimate for Option 4 does not include the purchase of additional land required to build pond

Table 15. CCE for Option 5 – Improve Existing South Pond at the Golf Course

Item	Quantity	Unit	Unit Cost	Extended Cost
Excavation	10,890	CY	$ 4.50	$ 49,005.00
Placement	6,336	CY	$ 4.50	$ 28,512.00
Compaction	17,226	CY	$ 1.00	$ 17,226.00
Clay Liner (1' thickness)	11,343	CY	$ 7.00	$ 79,401.00
Miscellaneous Site Piping	1	LS	$ 50,000.00	$ 50,000.00
Geological Investigation	7.8	AC	$ 5,000.00	$ 39,000.00
Disked, Seeded, Mulched	7.8	AC	$ 1,500.00	$ 11,700.00
Subtotal				**$ 274,844.00**
Markup (Contingencies, Mobilization, ELA) [50%]				$ 137,422.00
Total [1]				**$ 412,266.00**

[1] Total cost estimate for Option 4 does not include the purchase of additional land required to build pond

Option 6 and Option 7 (hybrid options) CCE are calculated based on adding Option 1 with Option 3, and Option 2 and Option 3, respectively:

- Option 5 – Hybrid A – Supplement with Cherry Creek and City Water
  - $210,600
- Option 6 – Hybrid B – Supplement with Groundwater and City Water
  - $369,600

Operational Costs

Operational costs were estimated to determine the annual cost burden associated with operating each option. The operational costs utilized for this evaluation include the following:

- Electrical Costs
  - Electrical costs were estimated from multiplying $0.062/kWh by the daily energy usage.
- Chemical Costs
  - Chemical costs were estimated from multiplying $0.51/kgal by the daily water demand.
    - $0.51/kgal was calculated based on sequestering 4.0 mg/L of Iron (Fe) and Manganese (Mn) utilizing a proprietary chemical blend (AQ-7015) from AQUA-PURE.
    - This information was obtained based on a recent water quality and groundwater irrigation study Burian & Associates conducted for the City of Mandan Parks and Recreation Department.
- Purchase Water Costs
  - Purchase water costs were estimated based on Watford City's residential water rates. The purchase water rate utilize in this study is $8.965/kgal.

The operational cost components and estimated annual operating costs for each of the options are presented below in Table 16.

Table 16. Operational Cost Components and Estimated Annual Operating Costs

Cost Component	Option 1	Option 2	Option 3	Options 4 & 5	Option 6	Option 7
	None	Electrical Costs Chemical Costs	Purchase Water Costs	None	Purchase Water Costs	Electrical Costs Chemical Costs Purchase Water Costs
Electrical Costs	$0.00	$581.43	$0.00	$0.00	$0.00	$330.37
Chemical Costs	$0.00	$7,376.56	$0.00	$0.00	$0.00	$4,191.36
Purchase Water Costs	$0.00	$0.00	$128,560.76	$0.00	$55,499.54	$55,499.54
Total Annual Operating Costs	**$0.00**	**$7,957.99**	**$128,560.76**	**$0.00**	**$55,499.54**	**$60,021.27**

Once the annual operating costs were estimated, the costs were multiplied by 10 to get a 10-year operational cost estimate. The 10-year estimated annual operating costs were then added to the estimated capital costs to get a comprehensive 10-year cost estimate. Lastly, the total 10-year costs were normalized to get the costs into the exact scale utilized for the quantity and quality analyses. This information is provided in Table 17 below.

Table 17. Cost Considerations for Each Option

Option	Capital Costs	10-Year Operating Costs	Total Costs	Total Cost Score(N)
Option 1 - Supplement with Cherry Creek	$ 76,650.00	$ -	$ 76,650.00	5.00
Option 2 - Supplement with Groundwater	$ 235,650.00	$ 79,579.90	$ 315,229.90	4.29
Option 3 - Supplement with City Water	$ 133,950.00	$ 1,285,605.60	$ 1,419,555.60	1.00
Option 4 - Construct Additional Pond at WRRF	$ 678,963.00	$ -	$ 678,963.00	3.21
Option 5 – Improve Existing Pond at the Golf Course	$ 412,266.00	$ -	$ 412,266.00	4.00
Option 6 - Supplement with Cherry Creek + City Water	$ 210,600.00	$ 554,995.40	$ 765,595.40	2.95
Option 7 - Supplement with Groundwater + City Water	$ 369,600.00	$ 600,212.70	$ 969,812.70	2.34

(N) – Normalized costs

Analysis Findings

Once the water quantity, water quality, and estimated costs were evaluated, a final analysis was performed to objectively evaluate the options. The quantity score, quality score, and cost score were each weighted 33%, and a comprehensive score was calculated for each option. This is provided in Table 18.

Table 18. Irrigation Option Analysis

Option	Quantity Score	Quality Score	Cost Score	Option Score
	33%	*33%*	*33%*	*100%*
Option 1 - Supplement with Cherry Creek	3.0	2.0	5.0	3.33
Option 2 - Supplement with Groundwater	4.0	1.0	4.3	3.10
Option 3 - Supplement with City Water	5.0	4.0	1.0	3.33
Option 4 - Construct Additional Pond at WRRF	4.0	3.0	3.2	3.40
Option 5 – Improve Existing Pond at the Golf Course	4.0	3.0	4.0	3.67
Option 6 – Supplement with Cherry Creek + City Water	5.0	2.0	2.9	3.32
Option 7 - Supplement with Groundwater + City Water	5.0	1.0	2.3	2.78

As shown in the table, Option 5 receives the best overall score analysis when considering water quantity, water quality, capital costs, and operational costs.

Recommendations

The purpose of this study was to evaluate supplemental irrigation water supply options for the Golf Course. Based on the results from analyzing water quantity improvements, water quality improvements, as well as capital and operational costs, it's recommended for the City to pursue Option 5, which includes improving the existing unused storage ponds at the Golf Course. This will provide additional water storage, at relatively low capital costs and essentially zero operational costs (aside from maintenance) compared to the other options.

However, because adding storage volume doesn't introduce another supply source, adding an additional source could be beneficial to the City, as it would further drought-proof the Golf Course and make the irrigation water supply system more resilient. If the City wishes to pursue an additional source, it's recommended that Option 1 (Supplement with Cherry Creek Water) or Option 3 (Supplement with City Water) be implemented. These options have their respective strengths and drawbacks – Utilizing Cherry Creek water is going to be more affordable compared to using City water; however, City water offers better water quality and a more reliable source, given that Cherry Creek is an intermittent stream and can sometimes experience periods of low flow.

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[i] *Golf Course Environmental Profile, Volume 2.* The Environmental Institute of Golf & The Toro Foundation, 2009.

Watford City 2040
Infrastructure Master Plan

APPENDIX D

TM4 - Digital Survey Responses

TECHNICAL MEMORANDUM

To:	City of Watford City, ND		
Attn:	Grace Demars, PE City Engineer	Laura Dokken Finance Director	Justin Smith Public Works Director
From:	Burian & Associates, LLC		
Re:	Watford City 2040 Infrastructure Master Plan - Digital Community Survey Responses		
Date:	December 2021		

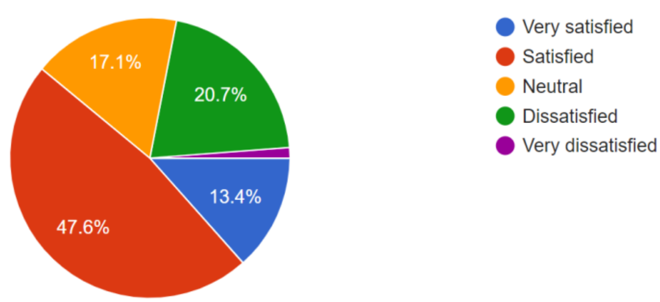
Introduction

To support the community engagement open-house at the mid-point of the Project, a digital community survey was prepared and outreach efforts were initiated. The survey responses were considered when developing projects and programming projects into the Capital Improvements Plan.

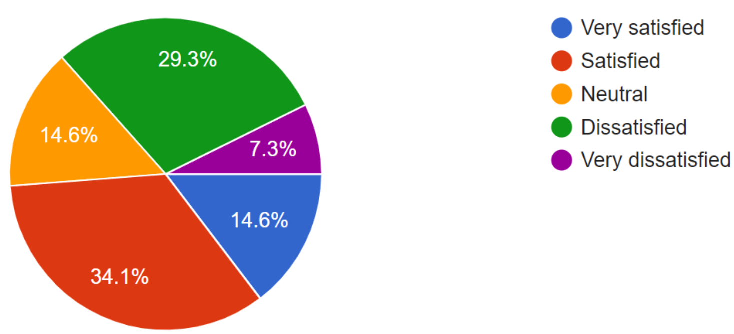
Survey Questions and Responses

There were 18 questions included in the digital survey. The questions and survey responses are provided below. The survey responses were not edited in any way prior to incorporating into this Technical Memorandum.

1. To what degree are you satisfied with the roads and streets throughout Watford City? (82 responses)



2. To what degree are you satisfied with the sidewalks, paths, and trails throughout Watford City? (82 responses)



3. What road, sidewalk, and path improvements would you like to see over the next ten years? (61 responses)
   a. Fix the broken sidewalks
   b. The gravel road/streets out to be paved for all the housing that live north of town. (I don't know what the developments are called) but all three of those roads north of the Catholic Church need to be paved. Also, I feel the side streets from the law enforcement center area to the "Garmen Hill" area should be built. More running/walking paths are always huge for quality of life.
   c. A walking path connecting Hunters Run development to the sidewalk that ends at the golf course.
   d. Walking, Biking and Pet exercise paths.

e. Take out the turning cement by kum& go so you can turn into elevator/stock yards from the south. & turn left (north) when leaving
f. Paved and sidewalk extensions
g. I feel there are many many sidewalks throughout our city are in dire need of being redone! Specifically sidewalks that run adjacent to the streets …. The berms? Many are cracked/crumbling and need to be replaced ! I feel some are even a danger for people walking !
h. To connect all trails already in place. There is a lot of voids.
i. Having another walking path north of town like the one by the high school
j. Bike trail to the North unit
k. Investment into old Watford. This has not occurred for at least the past 10 years, besides a few blocks of utility replacement here and there and the Park Avenue project which was good.
l. curb and gutter along 5th St. SW from Park Ave to the south where 5th intersect with Hwy85/100; and also curb and gutter to the west along Park Ave West where it intersects with with 5th Ave SW. I'd also like to see alignment of Park Ave West where it intersects with 5th Ave SW straightened out pavement for 6th Ave NE behind the post office all the way to where it intersects with 16th St NE. that could be a nice commercial corridor back there but it needs to be cleaned up overlay on 16th St NE from the highway north to its ending point. its a good road that unfortunately wasn't designed for the heavy loads it receives on the south end 7th Ave NE needs some help. its a dirt road that used to be maintained by the county. now its not maintained at all. it needs to be bladed and some surface material put down but more importantly it needs fill where it intersects with 16th St NE. the intersection is eroding on the west side and is compromising the edge of the pavement on 16th St NE which runs north/south. also, it would be nice if the city could coordinate with the State for a bicycle or wheelchair access point on the south side of Hwy23 across from 16th St NE onto the bike/walking path. currently there is no access unless you jump the curb or take the hwy down to the approach across from Stenehjems access road to the east or to the airport access road to the west. i'm sure it would take an act of god working with DOT but it would be nice to have convenient bike access to the bike path off of 16th St NE last, it would be nice to extend the walking path to the McKenzie County Athletic Complex SW of town. a big project perhaps but it would be nice if we could tie that into the city in some way for walking and biking access
m. More bike/running/walking paved paths. Longer paths. Also plant trees along paths so there is shade!
n. More walking / hiking paths, a bike path, paving the streets by Creekside Cottages would be great. :D
o. More roundabouts.
p. Streets need to be smoothed and chip sealed properly, Not the way they are doing crack sealing with chips the streets are unreasonably rough.

q. Neighborhoods/developments should NOT be approved without sidewalks as part of the design. Stop value engineering sidewalks out of street projects. A plan should be developed as to how to fund - whether private, public or combination, etc - the rebuilding or installation of sidewalks in the older parts of watford city. Go back through the list of projects that were supposed to have sidewalks, and build them. North Main Street. Park Avenue and Connect the bike path by the heritage park to SOMETHING along 2nd Avenue SW.
r. More sidewalks
s. Truly I think more roundabouts would be a great thing and more walking paths that are wide enough for two way traffic.
t. All residential streets need to be planned and resurfaced and same goes for the side walks. With a lot of sidewalks cracked and uneven tehy need to be removed and repaired. Adding to the sidewalk talk there's a lot of places in town that there's no access because there's no sidewalks at all and working lighting of sidewalks would be appreciated for safety.
u. Need sidewalks everywhere
v. fishing pond
w. More on the south end of town by smiling moose and up hill.
x. Curbs are in bad condition. Trip hazards
y. Bike path system that reaches neighborhoods just outside city limits.
z. The harsh uneven transition from asphalt to concrete
aa. More sidewalks added throughout the town as well as more bike paths or lanes.
bb. the gravel surface road around hospital should be paved including south and west of the horizon and assisted living area. there is a lot of traffic on those two roads
cc. Sidewalks throughout the neighborhoods are in sad shape or don't exist at all.
dd. Watford City has made numerous annexations that are not connected to the rest of the town by roads, and even those with road connections lack a safe walking connection. Some parts of town have a very good walking path, but sidewalks throughout town are unusable and many parts of town have no sidewalk connection at all.
ee. More walking paths
ff. Sidewalks added on residential streets.
gg. I would like every house to have a sidewalk so your not walking on the road especially near the schools
hh. Pave county roads
ii. 17 st north side of town. North main
jj. Out to the fairgrounds and 30th Ave NW
kk. 5th Street SW from old 85 past the courthouse needs to be curb and gutter all the way; there is a lot of traffic on that road and some of it is heavy. 2nd Ave from the Courthouse to Main Street needs to be redone, preferable with concrete. Sidewalks along both those streets need to be built or replaced. Then there is Park Ave. Curb and gutter should have continued past the old Rick Jore house. It needs to be connected to

the Park Ave so it is 1 intersection and not two. And Brent Sanford's stop sign onPark Ave. going down the hill from 5th ST SW can go - it is not needed. Elevators past Outsiders needs to be paved. Lot of heavy traffic there as well. Main Street going north past the Catholic Church needs paving, curb and gutter and sidewalk/walking path Something needs to be done with the diagonal parking in that hobgoblin "strip mall" north of the Catholic church. It is a safety hazard. Now having said where I think the main areas are needed for improvement, the new streets and redoing main are fantastic. And the 4 way at Main and 4th Ave. NE greatly improved traffic flow and safety! Good job.

ll. Stop signs at all intersections. Main street sidewalks need to be fixed

mm. Please pave the small section of road east of Nuverra. It is terrible to run into fresh slime there. I have seen many do illegal turns because of it too.

nn. Paving the dirt road going to Boulder ridge apartments. Putting in more curb/gutter. Sidewalks throughout the city so that kids/adults are not having to walk in the street. The newer parts of the city are great but we need help in the older area.

oo. Need cross country skiing on paths by school in the wintertime. If snow.

pp. Replace older sidewalks and curbs. Add sidewalks to streets that do not have them.

qq. I’ve noticed a lot of people using the golf course cart paths for exercising, biking, walking dogs, etc, which is dangerous, so maybe develop scenic trail routes on the edge of town. The demand seems to be there.

rr. Repair some of the older roads in town, add sidewalks in areas that don’t yet have them

ss. Long X Visitor Center to the west

tt. Sidewalks around middle school and Badlands elem school

uu. The sidewalks need a lot of improvements! Residential areas need attention

vv. Complete sidewalks in older neighborhoods connecting to newer neighborhoods

ww. bike lanes would be nice to be added. It would also be good to see a side walk along 2nd Ave SW.

xx. For all streets to have curbs and sidewalks and for curb cuts to be installed where they are not currently existing, at street corners.

yy. Continuing the addition of sidewalks and networking them together throughout town. I would LOVE to see the Cashwise, Teddy’s, Smiling Moose parts of town connected with sidewalk access on from Main Street going south to the Forest Service and new ballparks.

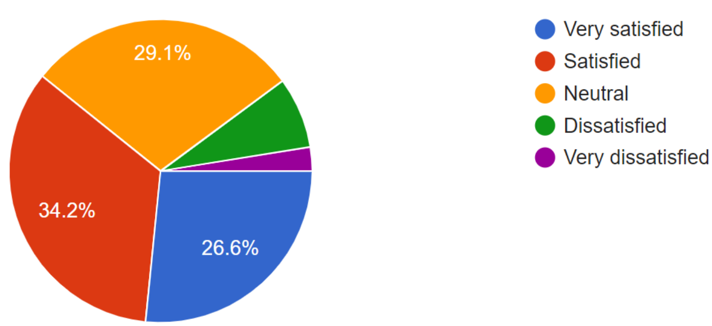
zz. More sidewalks extending on north Main Street.

aaa. Sidewalks on both sides of the roads for pedestrians and bikes! (If bike paths aren’t an option) More walking paths would be great too! Some timely road repairs would be helpful too.

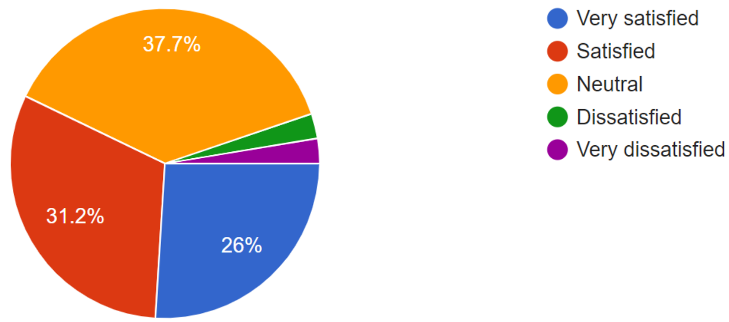
bbb. A sidewalk (or pedestrian light) from the Fox Hills Estates (across from Main Stay) development to the bike path across the street. Many kids in that neighborhood cross that busy intersection.

ccc. more path roads, sidewalks not just in town but the surrounding area to help keep kids off the street
ddd. Fix the pot holes and I finished roads, like the unfinished roads in Hunters Run.
eee. There are some side streets that need improvement but overall pretty good.
fff. Would like to see 17th ave NE paved
ggg. Page all of the dirt or travel streets that are still within city limits.
hhh. Fix sidewalks on main at minimum
iii. With the large amount of housing developments outside of downtown, I would like to see more connectivity between these developments. Shared use paths should be considered more frequently rather than 5' sidewalks when a road project is being completed. Roadways within Watford City are in adequate condition, however, more effective maintenance should be completed on the asphalt roadways. Proper joint sealing would provide smoother ride quality rather than the current method of sealing asphalt joints with oil and chips. There are many areas within Watford on concrete roadways where concrete panels have received significant cracking/settling. A plan to remedy this in the short term would likely delay full reconstruction for majority of the roadways. More up to date City standards and specifications with relation to NDDOT Standard Drawings would be desired to prevent large amounts of settlement/cracking on roadways.

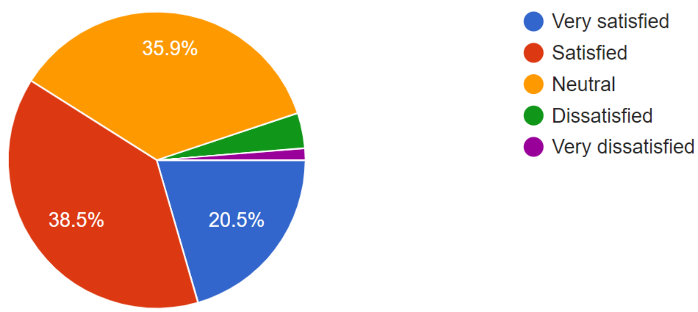
4. To what degree are you satisfied with the water service you are provided? (79 responses)



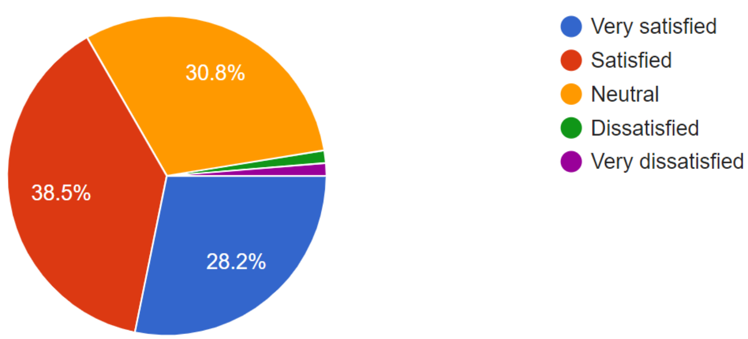
5. To what degree are you satisfied with the wastewater service you are provided? (77 responses)



6. To what degree are you satisfied with stormwater management and drainage throughout Watford City? (78 responses)



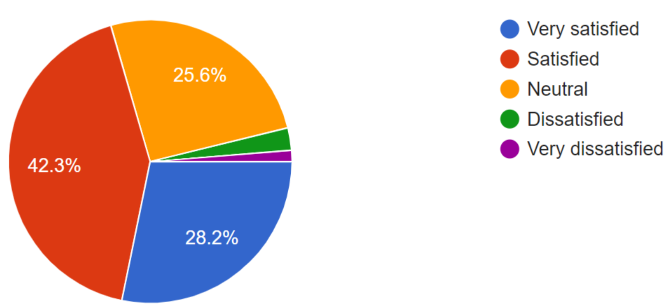
7. To what degree are you satisfied with the solid waste service you are provided? (78 responses)



8. **Do you have any issues or concerns you would like to express with the services provided by the City (water, wastewater, garbage)? (29 responses)**
   a. No
   b. No issues
   c. As an owner of home in AZ, I find that our water is extremely more cost wise … I am not unhappy with quality but it seems quality is great in AZ for example as is here but we pay so much more
   d. My alley continues to deteriorate after every rain. This has been brought up to the city for several years. Also from the other alley and from down the street I get all the silt and dirt right in front of my house.
   e. Would prefer options to recycle cans, bottles, newspaper and cardboard
   f. On my one and only walk around the WWTP last summer the gate was left unlocked and wide open at one or two spots, creates an opportunity for curious kids, vandalism, etc. On water why could we not pump our irrigation water from shallow point wells instead of buying Rural Water to save on costs? Fox Hills linear park could be like this, also supplemental water for the golf course? The city is surrounded by an endless supply of shallow groundwater on the west, north, east and south sides. Jimmy Pittsley is the man! Other city stewards can learn a lot of good values from him. Garbage service in Watford City is way better than any other place I've ever lived.
   g. there is a drainage issue off of Park Ave West south of the Courthouse. there is a storm water sewer line on our property with manhole but i'll be darned if i can figure out whether its in use and if so where it is taking storm water from. there is a culvert that runs under Park Ave West at the West end of the Gray Building Partnership that daylights on to Gray Building property and is causing an erosion issue and safety hazard. it seems like that water perhaps could be routed to the foregoing line if and when the city straightens out Park Ave as mentioned above last, i am hopeful the city will consider a summer rate for residences and commercial businesses that are interested in watering their lawns. it gets pretty pricey to try and keep a property looking nice in the summer months; and i feel like we should incentivize property owners do what we can to keep the our yards and therefore the community looking good without punishing the pocketbook so to speak. a delicate balance i am certain.
   h. Stormwater - the drive over curb (in a driveway) is one of the most irritating parts of my day. If given a choice i would never pick this, and wouls choose a neighborhood with 'real' curbs and driveway cuts. Water - while softer than years past, our water is still hard or seems to be. Waste - specialized collection could be considered at particular times of the year - electronics, fall/spring clean up…. And when are we going to figure out what it takes to offer recycling? Hopefully that is on someones radar.
   i. Water prices are too high, you want people yards to look nice, but the cost or watering the lawns is through the roof.
   j. I live in the country so most of these do not pertain to me.
   k. Better pressure
   l. N/A

m. Storm water management is a little to be desire in the alley ways. Most of the alleys need touch up.
n. The water pressure is terrible and the chemical taste to our water is awful.
o. There are a number of places that curb gutter and storm water system needs to be improved in "old Watford".
p. Should be separate bills
q. The water in Watford city is damaging to faucets and the like. What is the pH that you strive for? Is there something that could be done to make it more neutral?
r. Please keep the garbage services the way they are. Picking up odd sized items is a great help
s. 2 yrs ago the city water line going into my house froze and once they thawed out the line, I had to leave my sink running for over a month to stop it from freezing again.
t. There are some older water systems in town that probably should be replaced. The only issue with garbage collection is the time it takes in our neighborhood; more staff is needed!
u. I believe they are doing a fine job
v. I have zero complaints about the trash collection, would be nice to have recycling someday if it made sense
w. None
x. No issues
y. Price seems to continue to go up which is not ideal.
z. Water prices are too high. Waste water should also be calculated on the amount sent to the sewer, like water used to water a lawn shouldn't be counted as waste water.
aa. Not at this time
bb. All older homes should be inspected to make sure the water main valve is useable. If thy are bad,then who's responsibility is it to pay for it.
cc. None

9. To what degree are you satisfied with the public buildings throughout Watford City? (78 responses)



10. What existing City buildings and facilities would you like to see improved over the next ten years? (34 responses)

a. None
b. City Shop should be moved to a better location
c. Civic Center. They should put a batting cage in there. The floor should get redone and then that building can be utilized more.
d. Empty log on main. Either a building or develop esthetic lot
e. Civic center upgraded.
f. I feel that with all the new facilities we have it will be important to keep them maintained! I am so proud of what we have but sometimes the challenge is to keep them looking nice ! Inside and outside are equally important! Curb appeal is important !
g. Old hospital. Take it town or renovate it
h. The veterans building more useable
i. Public Works obviously
j. the old shop by the badlands elementary needs to go; and that area can become something else like parking and/or a transition alley to the property to the south if the City picks that up and develops it into something would also like the storm water drainage issues addressed along 6th Ave NE , 7th Ave behind the post office; and over along Park Ave West and 5th St SW
k. the library could be expanded!
l. A new Fire Hall needs to be Built
m. City workers and staff should be specifically asked what they feel is needed for them to continue providing services to us….in addition to the general publics requests. In general, a plan for downtown and revitalizing old/shabby neighborhoods….take a bigger and more active stance in blighted buildings and lots, lots and buildings that sit empty throughout our downtown 'neighborhood'.
n. Gym added to Rough Rider center like ever other city had done.
o. Town hall and library , update movie theater
p. Seem good to me
q. Possibly a larger library.
r. i would like to see the fox hills club house and golf course improved. that course has tons of potential if we can get it to fill in and maintain it. the traffic their should spill over to the hospitality industry and retail for a public/private sector win win
s. The library
t. None. Stop overbuilding city buildings when it is not needed. Focus on making it easy for businesses to come here.
u. I would like to see some decommissioned. Or, sold to private industry if they are not needed.
v. Movie theater
w. Bigger library!!
x. Expand the pool and water park. Add locker rooms and training room for figure skaters at the rough rider center
y. Old hospital

z. Existing buildings/facilities that will/are starting to see the wear of time. Very important to keep these buildings in top form with possible upgrade if needed
aa. Vets gym
bb. Outdoor Pool
cc. Library is not city but would love to see a new library in the next 5-10 years
dd. The Vets building needs to find a new identity. It seems under utilized. Also the old hospital needs aggressive intervention to get either remodeled or torn down. Also we need a day care badly!!
ee. Golf course maintenance building
ff. Not one in particular. But parking is horrible.
gg. Fair grounds
hh. Parks Department to receive a better site along with continuing improvement at the City Shop site.

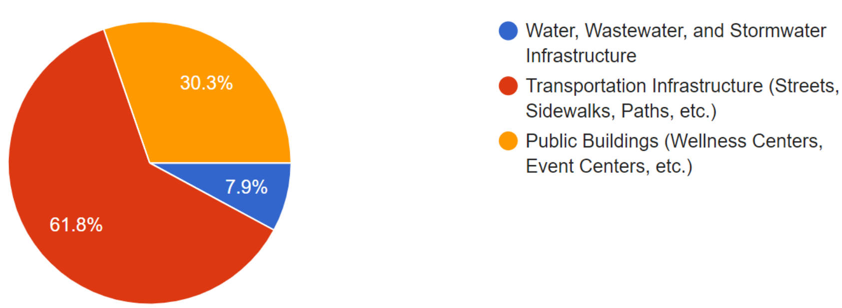
11. What buildings, facilities, and amenities do you feel Watford City is currently missing? (51 responses)

a. Bowling alley
b. Domestic abuse housing
c. I would like to continue to see progression and interesting improvements made to Main Street in Watford to make it unique and different those other small towns. Close off a part of Main Street in the summer months to walking only??? A bike path to the north unit park should be a priority. It is one of our hidden gems. It would bring tourism dollars.
d. Bowling Alley, Mini Golf Course, an always free splash pad not connected to the pool, an art studio place were art classes can be held and it can be open throughout the day for people to come paint clay items and such.
e. Dog park, Fast Food options, facilities for young person (teenagers) to hang out at, year around options.
f. Ma pa restaurant on Main Street
g. We need a store like Walmart or target.
h. Soccer field
i. Dry cleaners, bowling alley public transportation
j. Transparency w/ Operations and Maintenance of newer buildings like RRC and Wolf Pup Daycare.
k. seem like we are missing indoor winter activities entertainment for families and individuals. maybe the time honored bowling alley concept that never gains traction. the bigger issue seems to be how do you motivate people to use what we have, so they can appreciate what we have. it seems we like to build be lose site of generating continuing interest and often time the long term cost of maintenance i know some people call for wellness centers. we already have a wellness center.
l. Indoor activities for during the winter. Like indoor parks & waterpark (rough rider too small/not a lot of public time because of classes and sports)

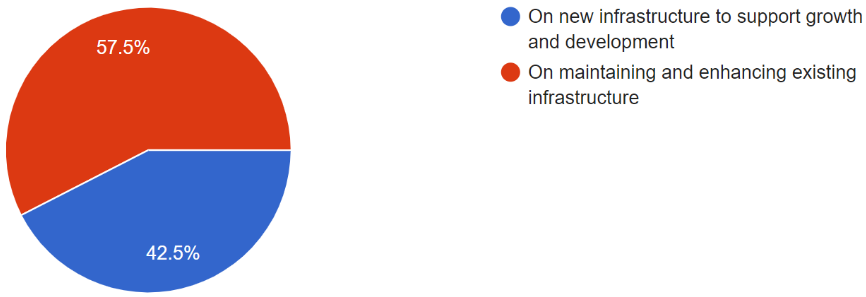
m. More entertainment for families such as roller skating, bowling, lazer tag, etc.!!
n. Fitness facilities, additional restaurants
o. Recycling. A way to hear/read timely news/information about our community that doesnt have to be on facebook. Digital Community information boards? daily newspaper or radio are common options elsewhere but recognize that may not be feasible here. A training or secondary option for our kids after high school.
p. Fast food restaurants
q. Something for families to do, bowling, axe throwing, arcade, etc. You could put up a family friendly place that has most of these items in it. The winters are long and not everyone goes to the lake in the summer. We need something here to draw people in and keep the families that are here already spending their money here in town.
r. Bowling Hall ,Walmart ,Target and restaurants not owned by Shooters LLC... Quality of food is horrible and over priced.
s. bird watching locations
t. Teenage hang out, bowling alley,
u. Restaurants and arcade / game are for kids
v. More entertainment, particularly for families. A LARGE park dedicated to outdoor recreation such as disk golf.
w. A Bowling Alley that serves alcohol and a light menu!!
x. there should be a remote bathroom facility out at fox hills. i think the city could design build and pick up some private money contributed as corporate sponsorhip to get it completed. it could be used as restroom / snack shack / watering hole for tournaments, scrambles and on days with heavy play
y. Shopping
z. Entertainment for youth/teens
aa. More daycares
bb. A gym at the RRC
cc. Large scale shopping, bowling, entertainment, chain restaurants, retail, recreation.
dd. There are good parks for children and adult use in the that area lying east of Main Street. However in "old Watford" west of main street have nearly no parks. Areas should be identified and pursued for green space and parks. It's too late but the new ball diamonds are too far for youth to use without adult involvement. They are going to require a complete build up of facilities, including restrooms, etc., that will be at great tax payor expense; and they are remote which provides more opportunity for vandalism. You are going to have to account for all of that. The problems this remote area selection has brought with it will require tax payor money on an annual and increasing basis.
ee. Bowling alley. Walmart. Sam's. Costco. Wendys. Red lobster. Texas road house. Lonestar. Hand car wash.
ff. Drive thru store
gg. Kids activities that aren't parks!!
hh. BOWLING. BOWLING.

ii. It will have them when the new fair grounds is complete. Stay out of their planing. Take care of the city.
jj. We need more trees planted in the new parks.
kk. Better skatepark
ll. Main Street court yard for bands and craft beer nights
mm. True recreation center with gym amenities
nn. Family Based Activity Zone. We have the rough rider but it is mainly one or the other who gets benefited. We need something aside from the theatre/pool that an entire family can go to and just enjoy and relax. We need a fun zone, a bowling alley and more.
oo. A downtown splash pad type park in summer.
pp. Day care.
qq. Someplace for teenagers to hang out during the day and evening hours. For example an arcade, bowling alley, or family fun center would be nice
rr. Full mail delivery service to all properties in town More fast food options Bowling/activities for teenagers and young adults besides just bars
ss. Golf course maintenance building and bathrooms on the golf course
tt. more option for fast food, no all purpose store, a hardware/lumber yard that carries something.
uu. Entertainment and food options
vv. Something more for the teenage students.
ww. Family entertainment. Possibly a bowling alley. Furniture store. Larger retail once population allows.
xx. Maybe more places such as A bowling alley in town. As well maybe a therapist or alike profession to be here. Maybe lastly like a sauna spa or alike at some point to.
yy. Recycling facilities

12. Please choose which category you feel Watford City should emphasize infrastructure spending. (76 responses)



13. How do you feel infrastructure spending should be prioritized? (73 responses)



14. Are there any infrastructure problems that you feel the City needs to correct and prioritize? (30 responses)
    a. Paved roads that are currently gravel in and around the city.
    b. Internet
    c. I stated earlier that I feel it is important to have safe walking paths/sidewalks, etc….. our existing facilities are all very new but it will be important to maintain them to keep them looking inviting! Our city sidewalks in many areas need much much improving! It is so important in my mind that when people are looking to relocate here, driving around and seeing things looking upgraded is inviting and makes people want to move/stay here!
    d. Public Works Building Expansion
    e. yes. i have touch on them above.
    f. Need to start planting more trees. It's just sad how little trees get planted in public areas.
    g. The City should have not annexed in the amount of area they did. Need to fill in small areas at a time to save on unused infrastructure that is a burden on taxes.
    h. Youve cleary focused on new infrastructure - we cant continue down that path without looking at areas that have been neglected.
    i. 14th st sw sewer
    j. The apartments that were built like crap should just come down or be fixed.
    k. Streets and Sidewalks
    l. Parking for downtown
    m. Cleaning up areas of temporary housing
    n. Traffic light at 4th & Main.
    o. The lack of a safe way to walk or bicycle between neighborhoods that have been annexed and the lack of accessible (in every sense) sidewalks within the town are a problem that jumps out at anyone who has lived in a walkable city anywhere in the world. Not everyone wants to drive between businesses located 2 blocks apart, but it is necessary here because of the lack of safe and accessible walking and bicycling options.
    p. Sidewalks
    q. The water pressure and the treatment of our drinking water

r. Stop building extravagant buildings with tax money to make Stenejehems richer.
s. Previously identified.
t. Aren't we getting big enough to have public transportation??
u. Adding trees throughout the newer parts of the city.
v. I think WC needs to improve old infrastructure & work on the new
w. Yes, the roads, side walks, lanes.
x. Sidewalks
y. Yes.
z. Flooding in the cemetery after the winter
aa. Some street and road repairs
bb. Roads and snow removal
cc. No
dd. Some concrete pavement repairs such as 8th Ave SE (Cashwise), 3rd St SE (Cashwise), 4th St SE (Cashwise) and 9th Ave SE (Teddy's). Asphalt pavement repair areas such as Hunter's Run development. Completing a wider roadway on N main Street from 7th Ave to 30th Ave, 17th Ave NE from Main to 12th St NE, 12th St NE from ND 23 to 30th Ave NE, and 30th Ave NE from County ROute 35 to County Route 36.

15. What challenges affecting Watford City concern you the most? (40 responses)

a. Cost of living
b. Concerned city spends too much
c. Labor shortage.
d. Places for young persons to hang out in positive environments have a safe space to socialize.
e. Expensive current infrastructure making it almost impossible for any small business to afford to start up. Many opportunities missed with discouraging fees
f. The challenge of building new neighborhoods from start to finish! When driving around other states that have growth happening, it seems that the streets, curbs, open space areas are all finished before lots are built on! This is most appealing to me ! As I realized our growth happened to very quickly, things have slowed so it is important to do things in a very right way
g. The cities willingness to work with people to get different building projects going. I keep hearing that people that are willing to build say that the city is the worst to work with out of every other city they have dealt with.
h. Perception of our anti-business climate and anti-growth regulations and permit costs etc. We need to get back to identifying a need such as a new business or an existing business expansion, and collaborating with all parties involved to make it happy, I'll dub it the Gene Veeder effect, need to bring that back into the picture.
i. balancing existing infrastructural needs with growth and development that spreads us out which in turn over the long haul costs tax payers more money to maintain, police etc

j. Lack of access/things to do.. ie super small grocery stores, no activities for people/kids during winter. Super small water park for summer (town is large enough that we need a much larger water park!)
k. cost of living
l. Employee expenses Too Many employees not working. Too many Law officers.
m. Odd thing to say, but out current tax structure/reliance on gpt doesnt support our community into the future.
n. Keeping money spent here instead of Williston, Bismarck, etc. We need things that no one else has.... Stuff that will pull people in, spend the weekend or even a week here. Family type things, stuff for tweens, teens to do.
o. Maintaining a population to cover future costs and spending so taxes won't be raised when oil prices go down ,it solely relies on the oil field. It has to diversify and have other options for income and work for everyone.
p. hiring public employees
q. All the apartment buildings that are going to be run down in about 15 years making town look dumpy.
r. Access to better healthcare
s. The town is dominated by a few core families, don't get me wrong they do good things for the town however if a business my compete with those core families that have control over the town they are not allowed to come in. It's not welcoming to new businesses unless it won't take money away from the monopoly.
t. The sidewalk conditions
u. Overspending and overcommitting future funding on unnecessary projects will make it impossible to maintain necessary facilities. We should not build the town in such a way that, in 2040, it consists mostly of many miles of cracked streets and rundown events centers.
v. Revenue
w. Limited housing options
x. Steve Stenejehem and his cronies using public funds as their piggy bank.
y. Paying for the improvements, maintaining the improvements, and keeping the taxes and fees at a level that makes Watford City an attractive place to build, buy and live rather than outside of the city limits.
z. Other people should be able to expand their dreams of business ownership..
aa. Lack of different indoor things for kids. RRC isn't great for everyone!
bb. Affordable single family housing shortage.
cc. Growing our permanent population
dd. High cost of living
ee. Lack of business coming in which means businesses are slow and that affects work. No work, no employees, no pay, no tax back to the city.
ff. Not having enough money to maintain facilities and infrastructure
gg. Maintaining the current population, retaining people to live here and work here. Finding people for the unskilled positions in town.

hh. High costs of commercial and residential properties preventing startup businesses
ii. lack of options
jj. Cost of water
kk. Affordable housing, not everyone makes oilfield money.
ll. Being a single economy town. It needs more industry then just oil & gas
mm. Declining population
nn. Budgeting concerns me the most and how to spend that money. There are some areas where there has been construction completed 10 years ago where it appears proper methods were not followed. Prioritizing these repair areas while still promoting new construction will be a difficult challenge.

16. What do you feel are Watford City's largest needs? (47 responses)

a. Domestic abuse, psychological services and dialysis treatment
b. We need to do something great and fun for the general public with the old fairgrounds property.
c. Safe places for young persons to hang out and socialize.
d. Retail
e. Cheaper food and cloth options.
f. I feel that all needs as I think about this are met! We have very nice schools, a beautiful hospital, nursing home, assisted living, pool, public library, restaurants and outdoor areas that are great! However, as I stated earlier, the challenge is maintaining! Which bring to mind the one need we have and that is employees! We need to be able to draw people here to sustain our restaurants, hospitals, nursing homes, etc…… we need employable people that want to work!
g. Businesses
h. Public transportation
i. Tax Base Growth (Maybe too vague of an answer)
j. the basics - roads, sewer and water; especially on the west side near the courthouse and down by the post office
k. Trees, Grocery stores, indoor activists for families
l. affordable housing
m. Competitive eating establishments, main street businesses
n. A volatile funding source, and developing alternative strategies.
o. franchise food choices
p. More consistent dining options
q. Something for tweens and teens and families to do, especially in the winter.
r. 24hr Supermarket
s. family friendly sites
t. Updating the town past Cashwise. Making side walks and bike paths on this side of town.
u. Utilizing the Healthcare facility to its fullest potential

v. More family friendly entertainment offered year around; cater more to families rather than just oilfield men, more variety of stores, meaningful employment that provides a livable wage for the disabled & SIDEWALKS.
w. A bowling alley which offers games for kids and serves adult beverages and pizza, burgers example: Willistons bowling alley
x. Long-term planning with an eye to the best future for the town, even if it means saying "no" to projects that seem shiny and exciting but turn into albatrosses around the town's neck.
y. More housing for families
z. Intelligent public officials
aa. Lumber yard
bb. Entertainment - bowling alley, etc
cc. To listen to the people that live here and not the architects, engineers, contractors and others that make their living by the city spending money on projects and infrastructure that burden the tax base of the city. You need to employ people that live in the city limits so their loyalty is to city improvement and affordability and not outside influences. Council needs to run drive train on the advancement of the city not employees or third party contractors.
dd. Indoor recreation for FAMILIES WITH CHILDREN.
ee. Drive-through convenient store
ff. Streets to be repaved, bigger library and more accessible
gg. It is nearly impossible for anyone, that doesn't have extremely deep pockets, to build or improve a building here. I cannot even tell you how many people have told me that they have gone elsewhere to build or have just given up. They were tired of fighting with the city over the tremendous amount of money it takes to meet the requirements for permits, landscaping, and streets with curb and gutter. If these are city streets and businesses or developments that will improve the city, I think the city should pitch in to make it feesable for folks to move forward. I get that we want our city to be pretty and function well, but many of these businesses would improve the city. There is nothing welcoming for people to build a business here. When I did the research before the boom, on which town I wanted to move to. I ended up here because we felt needed and wanted. People were excited to have a building improved, not only did we not get hit with an enormous bill for permits and building requirements, there were grants and other help to get us going. This must have changed to protect the city during the boom. I think it was an over compensation and the requirements and permit fees need to be revisited.
hh. Affordable singe family housing
ii. Updating curbs and sidewalks repaying streets
jj. Affordable housing
kk. We need to address the parking problems in the downtown area. Businesses need to provide their own parking so we can park in front of our own houses.
ll. Business to come back

mm. Workforce. Hands down.
nn. More things for teenagers to do
oo. Activities for young adults
pp. Not a softball complex
qq. Some type of public transportation
rr. Affordable housing. NOT apartments, condos and townhouses. Actual stick built homes that are affordable and reasonably sized for a family. Nothing fancy, but a descent yard would be nice.
ss. Bowling alley
tt. More manufacturing or alike type jobs to eventually. Make a blend of oilfield type economy and traditional type of economy as well.
uu. Now that may of these large buildings have been completed and large connections of roadways have been completed, constructing proper pedestrian facilities along with maintaining existing infrastructure should be prioritized.

17. Is there anything else you would like to share regarding Watford City's infrastructure? (14 responses)

a. Need to fill ETA before extending ETA boundaries
b. Great shape compared to our peers, but obviously more can be done. Think of the amount of infrastructure that could of been built with a 100 milllion dollars.
c. We look forward to the information and knowledge the city will gain from this process
d. Offer more commercial store fronts so people can offer the town more options, there's nothing here or available.
e. Really need teenage hangout to keep them out of trouble. More fast food restaurants.
f. N/A
g. What we have built in the last 10 years is fantastic. Better than cities 5 times or greater than our size. But don't be like my wife - just because there is room in the closet and budget for more shoes - do you really need to fill the closet up with shoes?
h. Stop letting people monopolize the area.
i. Welcome Signage
j. no
k. I would love to know when mosquito spraying happens on which streets. Same for snow removal and for street sweeping.
l. The Shovel Ready program was awesome.
m. Overall ran pretty well. Difficult times when a city grows like this.
n. I would recommend that there would be more regional detention ponds rather than each site development being required to develop a detention pond. This would allow for better Vector control and ensure that detention facilities are being properly constructed and properly maintained.

18. In your opinion, what is the best thing about living in Watford City? (51 responses)

a. The people in the community & the services we have

b. The people.
c. the community
d. The people
e. Sense of a caring community
f. Rough Rider Center, restaurants for small town, running paths, golf course, proximity to lake
g. A small town and friendly place.
h. Very progressive. Getting past the growing pains.
i. Being able to have a short commute.
j. For me the best thing is my family and friends! Everything else is gravy! I love this community! I have lived here since 1976 and through 2 oil booms…. I believe that any growth in population brings good and bad…. But I like to look for the good things it all brings! I feel proud of what our governing men and women have done to bring us to where we are right now! Right today! Watford city/McKenzie county has alway been respected for our excellence in progressing! We have been looked up to ! That makes me very proud!
k. The sense of community
l. Define "best". Economically good, I can walk to work. Its safe. It has good values and has always had great people. I think its good for my kids, haven't quite decided that one yet. Learned its a great place to be during a pandemic thats for sure, and there are many opportunities by living here.
m. first, quality of life. second, i feel like we are lucky to have young, progressive, sharp minded folks loaded with talent in our camp. that is a huge PLUS for this community that others dont have
n. The people/ community vibes
o. It still has the small town appeal
p. very nice facilities and community events
q. The town itself is great, great people, looks great, beautiful country.
r. Thats there's hope for real growth and expansion
s. the school system
t. Small town fill. Everyone will to help someone else out when in need. Love this town.
u. Small town with many nice amenities
v. Small town
w. The amount of money that is spent to make improvements on the town. We know that our dollars are going back to the community to make improvements.
x. The people!!!
y. Small town atmosphere with some city amenities.
z. Quiet and friendly
aa. The community events and support
bb. Nobody else wants to live here.
cc. Small community values
dd. In regard to infrastructure? It is access to city council members who will at least listen.

ee. Not much crime.
ff. The community
gg. I have lived here all of my life. Family and good people and a great educational system.
hh. It's people. The forward thing of the city fathers. We have a wonderful community
ii. The community
jj. Small town atmosphere with nice amenities like the RR center, school, golf course and very close to the lake
kk. People. Watford still has the small town feel even with the growth which points to the people.
ll. I was born & raised here & I think it's a great place to live!
mm. The people. Community minded, down to earth. Also, historically have had good leadership that has known how to get things done and has their finger on the pulse of the community.
nn. RRC, the variety of restaurants, Lake Sakakawea
oo. Even though it is growing it still has the small town feel
pp. Income
qq. The people
rr. All the parks and walking paths
ss. poeple
tt. Big boys toys
uu. Community, the people. Small town atmosphere.
vv. Small town feel. Generous people. Fantastic library
ww. Awesome for families
xx. Good scenery and generally the people to.
yy. The best thing about living in Watford City has been the way that the locals have welcomed and encouraged people to move and stay in this town. Many issues that arose 5 to 10 years ago have been successfully remedied to improve the quality of life for all ages

Watford City 2040 Infrastructure Master Plan

APPENDIX E

Unit Costs (2021$)

UNIT COSTS

Notes:

- Unit costs are meant to reflect "Contractor Pricing" (Materials + Labor)
- Project cost estimates include a markup for incidentals.
- Project cost estimates include a markup for contingencies.
- Project cost estimates include a markup for ELA.

Line Item	Unit	Unit Cost
Transportation Unit Costs		
Aggregate Base	TON	$ 23.00
Bike Path	SY	$ 45.00
Common Excavation	CY	$ 9.00
Cover Coat Material	SY	$ 0.45
Curb & Gutter	LF	$ 35.00
Emulsified Asphalt	GAL	$ 2.50
Full Depth Reclamation	SY	$ 2.00
Geosynthetic Type R1	SY	$ 2.00
Lighting	EA	$ 9,090.00
Milling Pavement Surface	SY	$ 1.00
Path	SY	$ 45.00
Pavement	TON	$ 100.00
Removal of Curb and Gutter	LF	$ 10.00
Remove Aggregate Base and Surfacing	TON	$ 10.00
Sidewalk	SY	$ 45.00
Subgrade Preparation Type A	STA	$ 500.00
Water System Costs		
4" PVC Watermain	LF	$ 40.00
6" PVC Watermain	LF	$ 60.00
8" PVC Watermain	LF	$ 80.00
10" PVC Watermain	LF	$ 100.00
12" PVC Watermain	LF	$ 120.00
16" PVC Watermain	LF	$ 140.00
20" PVC Watermain	LF	$ 180.00
24" PVC Watermain	LF	$ 220.00
4" Watermain Rehabilitation	LF	$ 46.00
6" Watermain Rehabilitation	LF	$ 69.00
8" Watermain Rehabilitation	LF	$ 92.00
10" Watermain Rehabilitation	LF	$ 115.00
12" Watermain Rehabilitation	LF	$ 138.00
16" Watermain Rehabilitation	LF	$ 161.00
20" Watermain Rehabilitation	LF	$ 207.00
24" Watermain Rehabilitation	LF	$ 253.00
4" Gate Valve	EA	$ 500.00
6" Gate Valve	EA	$ 1,500.00
8" Gate Valve	EA	$ 2,500.00
10" Gate Valve	EA	$ 3,500.00
12" Gate Valve	EA	$ 4,500.00
16" Gate Valve	EA	$ 5,500.00
20" Gate Valve	EA	$ 6,500.00
24" Gate Valve	EA	$ 7,500.00
Water Service Connection	EA	$ 500.00
Fire Hydrant Assembly	EA	$ 4,000.00
Wastewater System Costs		
4" PVC Gravity Sewer	LF	$ 60.00
6" PVC Gravity Sewer	LF	$ 80.00
8" PVC Gravity Sewer	LF	$ 100.00
10" PVC Gravity Sewer	LF	$ 120.00
12" PVC Gravity Sewer	LF	$ 140.00
15" PVC Gravity Sewer	LF	$ 170.00
18" PVC Gravity Sewer	LF	$ 190.00
21" PVC Gravity Sewer	LF	$ 220.00
24" PVC Gravity Sewer	LF	$ 240.00
4" PVC Gravity Sewer Rehabilitation	LF	$ 66.00
6" PVC Gravity Sewer Rehabilitation	LF	$ 88.00
8" PVC Gravity Sewer Rehabilitation	LF	$ 110.00
10" PVC Gravity Sewer Rehabilitation	LF	$ 132.00
12" PVC Gravity Sewer Rehabilitation	LF	$ 154.00
15" PVC Gravity Sewer Rehabilitation	LF	$ 187.00
18" PVC Gravity Sewer Rehabilitation	LF	$ 209.00
21" PVC Gravity Sewer Rehabilitation	LF	$ 242.00
24" PVC Gravity Sewer Rehabilitation	LF	$ 264.00

Manhole Dia. 48" (4')	EA	$ 3,500.00
Manhole Dia. 60" (5')	EA	$ 6,000.00
Manhole Dia. 72" (6')	EA	$ 8,000.00
Manhole Dia. 84" (7')	EA	$ 9,500.00
Manhole Dia. 96" (8')	EA	$ 12,000.00
Lift Station Pumping Capacity (100 gpm)	EA	$ 100,000.00
Lift Station Pumping Capacity (200 gpm)	EA	$ 150,000.00
Lift Station Pumping Capacity (300 gpm)	EA	$ 200,000.00
Lift Station Pumping Capacity (400 gpm)	EA	$ 250,000.00
Lift Station Pumping Capacity (500 gpm)	EA	$ 300,000.00
Lift Station Pumping Capacity (600 gpm)	EA	$ 500,000.00
Lift Station Pumping Capacity (700 gpm)	EA	$ 750,000.00
Lift Station Pumping Capacity (800 gpm)	EA	$ 900,000.00
Lift Station Pumping Capacity (900 gpm)	EA	$ 1,100,000.00
Lift Station Pumping Capacity (1000 gpm)	EA	$ 1,300,000.00
Lift Station Pumping Capacity (1500 gpm)	EA	$ 1,500,000.00
Lift Station Pumping Capacity (2000 gpm)	EA	$ 1,600,000.00
Lift Station Pumping Capacity (2500 gpm)	EA	$ 1,700,000.00
Lift Station Pumping Capacity (3000 gpm)	EA	$ 1,850,000.00
Lift Station Pumping Capacity (3500 gpm)	EA	$ 2,000,000.00
Lift Station Pumping Capacity (4000 gpm)	EA	$ 2,300,000.00
Lift Station Pumping Capacity (4500 gpm)	EA	$ 2,700,000.00
Lift Station Pumping Capacity (5000 gpm)	EA	$ 3,100,000.00
Lift Station Pumping Capacity (5500 gpm)	EA	$ 3,500,000.00
Lift Station Pumping Capacity (6000 gpm)	EA	$ 4,000,000.00
4" PVC SS Forcemain	LF	$ 40.00
6" PVC SS Forcemain	LF	$ 60.00
8" PVC SS Forcemain	LF	$ 80.00
10" PVC SS Forcemain	LF	$ 100.00
12" PVC SS Forcemain	LF	$ 120.00
16" PVC SS Forcemain	LF	$ 140.00
20" PVC SS Forcemain	LF	$ 180.00
24" PVC SS Forcemain	LF	$ 220.00

TRANSPORTATION COSTS

Local Residential Summary Table - Cost per Centerline Mile		
Improvement Type	**Local Residential (Asphalt)**	**Local Residential (Concrete)**
New Roadway	$ 2,830,000	$ 2,930,000
Reconstruction	$ 2,590,000	$ 2,680,000
Full Depth Reclamation	$ 1,930,000	$ 2,220,000
Convert Rural Gravel to Urban Section	$ 2,300,000	$ 2,570,000
Mill and Overlay	$ 300,000	
Chip Seal	$ 40,000	
Bike Path		
Sidewalk	$ 460,000	$ 460,000

Local Commercial Summary Table - Cost per Centerline Mile		
Improvement Type	**Local Commercial (Asphalt)**	**Local Commercial (Concrete)**
New Roadway	$ 3,140,000	$ 3,050,000
Reconstruction	$ 2,870,000	$ 2,790,000
Full Depth Reclamation	$ 2,130,000	$ 2,280,000
Convert Rural Gravel to Urban Section	$ 2,610,000	$ 2,690,000
Mill and Overlay	$ 320,000	
Chip Seal	$ 40,000	
Bike Path		
Sidewalk	$ 460,000	$ 460,000

Collectors Summary Table - Cost per Centerline Mile		
Improvement Type	**Collectors (Asphalt)**	**Collectors (Concrete)**
New Roadway	$ 2,810,000	$ 3,290,000
Reconstruction	$ 2,550,000	$ 2,970,000
Full Depth Reclamation	$ 1,790,000	$ 2,450,000
Convert Rural Gravel to Urban Section	$ 2,280,000	$ 2,930,000
Mill and Overlay	$ 320,000	
Chip Seal	$ 40,000	
Bike Path	$ 820,000	$ 820,000
Sidewalk	$ 480,000	$ 480,000

Arterials Summary Table - Cost per Centerline Mile		
Improvement Type	**Arterials (Asphalt)**	**Arterials (Concrete)**
New Roadway	$ 3,820,000	$ 3,950,000
Reconstruction	$ 3,390,000	$ 3,510,000
Full Depth Reclamation	$ 2,420,000	$ 2,880,000
Convert Rural Gravel to Urban Section	$ 3,120,000	$ 3,500,000
Mill and Overlay	$ 310,000	
Chip Seal	$ 40,000	
Bike Path	$ 860,000	$ 860,000
Sidewalk	$ 520,000	$ 520,000

Watford City 2040 Infrastructure Master Plan
Appendix E – Unit Costs (2021$)

Local Residential – Asphalt

WATFORD CITY COST ESTIMATES - RESIDENTIAL (BITUMINOUS)
Assumes Watford city Typical DWG No. 3.1 "Local Residential without alley"

Description	Value	Unit
Pavement Depth	4	Inches
Pavement Width	36	Feet
Aggregate Depth	12	Inches
Aggregate Width	39	Feet
Max ROW	69	Feet
Embankment Depth	2	Feet

NEW ROADWAY

Item	Unit	Qty	Unit Price	Cost	Assumptions
Pavement	TON	4,700	$ 100.00	$ 470,000.00	4" depth (33' pavement top)
Aggregate Base	TON	16,020	$ 23.00	$ 368,460.00	12" depth for pavement and 4" depth for sidewalk and paths
Geosynthetic Type R1	SY	22,880	$ 2.00	$ 45,760.00	
Subgrade Preparation Type A	STA	10	$ 500.00	$ 5,000.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Common Excavation	CY	26,990	$ 9.00	$ 242,910.00	Assume 2' fill for 69' ROW width
Sidewalk	SY	5,870	$ 45.00	$ 264,150.00	4" of concrete, 5' wide sidewalk both sides
Storm Sewer	LS	1	$ 491,465.00	$ 491,465.00	25% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 368,598.75	$ 368,598.75	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 2,825,923.75	

RECONSTRUCTION

Item	Unit	Qty	Unit Price	Cost	Assumptions
Remove Aggegate Base and Surfacing	TON	21,340	$ 10.00	$ 213,400.00	assumes 6" existing bituminous on 12" aggregate base
Removal of Curb and Gutter	LF	10,560	$ 10.00	$ 105,600.00	
Pavement	TON	4,700	$ 100.00	$ 470,000.00	4" depth (33' pavement top)
Aggregate Base	TON	16,020	$ 23.00	$ 368,460.00	12" depth for pavement and 4" depth for sidewalk and paths
Geosynthetic Type R1	SY	22,880	$ 2.00	$ 45,760.00	
Subgrade Preparation Type A	STA	10	$ 500.00	$ 5,000.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Sidewalk	SY	5,870	$ 45.00	$ 264,150.00	4" of concrete, 5' wide sidewalk both sides
Storm Sewer	LS	1	$ 204,195.00	$ 204,195.00	10% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 336,921.75	$ 336,921.75	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 2,583,066.75	

FULL DEPTH RECLAIM RECONSTRUCTION

Item	Unit	Qty	Unit Price	Cost	Assumptions
Removal of Curb and Gutter	LF	10,560	$ 10.00	$ 105,600.00	
Pavement	TON	4,700	$ 100.00	$ 470,000.00	4" depth (33' pavement top)
Milling Pavement Surface	SY	21,120	$ 1.00	$ 21,120.00	Mill prior to Reclamation
Full Depth Reclamation	SY	21,120	$ 2.00	$ 42,240.00	12" depth for pavement and 4" depth for sidewalk and paths
Geosynthetic Type R1	SY	22,880	$ 2.00	$ 45,760.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Sidewalk	SY	5,870	$ 45.00	$ 264,150.00	4" of concrete, 5' wide sidewalk both sides
Storm Sewer	LS	1	$ 151,845.00	$ 151,845.00	10% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 250,544.25	$ 250,544.25	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 1,920,839.25	

CONVERT RURAL GRAVEL ROAD TO URBAN SECTION

Item	Unit	Qty	Unit Price	Cost	Assumptions
Pavement	TON	4,700	$ 100.00	$ 470,000.00	4" depth (33' pavement top)
Aggregate Base	TON	5,750	$ 23.00	$ 132,250.00	12" depth for pavement and 4" depth for sidewalk and paths. Use uxisting gravel bed as base (assume 28')
Geosynthetic Type R1	SY	6,460	$ 2.00	$ 12,920.00	
Subgrade Preparation Type A	STA	10	$ 500.00	$ 5,000.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Common Excavation	CY	16,040	$ 9.00	$ 144,360.00	Assume 2' fill for 69' ROW width. Use existing road grading
Sidewalk	SY	5,870	$ 45.00	$ 264,150.00	4" of concrete, 5' wide sidewalk both sides
Storm Sewer	LS	1	$ 399,565.00	$ 399,565.00	25% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 299,673.75	$ 299,673.75	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 2,297,498.75	

MILL AND OVERLAY

Item	Unit	Qty	Unit Price	Cost	Assumptions
Pavement	TON	2,350	$ 100.00	$ 235,000.00	2" depth (33' pavement top)
Milling Pavement Surface	SY	21,120	$ 1.00	$ 21,120.00	Mill 2" depth
Incidentals	LS	1	$ 38,418.00	$ 38,418.00	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 294,538.00	

SEAL COAT/CHIP SEAL

Item	Unit	Qty	Unit Price	Cost	Assumptions
Emulsified Ashpalt	GAL	8,660	$ 2.50	$ 21,650.00	Assme .41 Gal/SY
Cover Coat Material	SY	21,120	$ 0.45	$ 9,504.00	25 lbs/SY
Incidentals	LS	1	$ 3,247.50	$ 3,247.50	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 34,401.50	

SIDEWALK

Item	Unit	Qty	Unit Price	Cost	Assumptions
Aggregate Base	TON	1,720	$ 23.00	$ 39,560.00	4" depth for sidewalk both sides of road
Common Excavation	CY	10,560	$ 9.00	$ 95,040.00	Assume 2' fill under sidewalk
Sidewalk	SY	5,870	$ 45.00	$ 264,150.00	4" of concrete, 5' wide sidewalk both sides
Incidentals	LS	1	$ 59,812.50	$ 59,812.50	Signage, traffic control, mobilization, etc. (about 15%)
			TOTAL	$ 458,562.50	

Local Residential – Concrete

WATFORD CITY COST ESTIMATES - RESIDENTIAL (CONCRETE)
Assumes Watford city Typical DWG No. 3.1 "Local Residential without alley"

Description	Value	Unit
Pavement Depth	6	Inches
Pavement Width	36	Feet
Aggregate Depth	6	Inches
Aggregate Width	39	Feet
Max ROW	69	Feet
Embankment Depth	2	Feet

NEW ROADWAY

Item	Unit	Qty	Unit Price	Cost	Assumptions
Pavement	TON	7,040	$ 100.00	$ 704,000.00	6" depth (33' pavement top)
Aggregate Base	TON	8,870	$ 23.00	$ 204,010.00	6" depth for pavement and 4" depth for sidewalk and paths
Geosynthetic Type R1	SY	22,880	$ 2.00	$ 45,760.00	
Subgrade Preparation Type A	STA	10	$ 500.00	$ 5,000.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Common Excavation	CY	26,990	$ 9.00	$ 242,910.00	Assume 2' fill for 69' ROW width
Sidewalk	SY	5,870	$ 45.00	$ 264,150.00	4" of concrete, 5' wide sidewalk both sides
Storm Sewer	LS	1	$ 508,852.50	$ 508,852.50	25% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 381,639.38	$ 381,639.38	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 2,925,901.88	

RECONSTRUCTION

Item	Unit	Qty	Unit Price	Cost	Assumptions
Remove Aggegate Base and Surfacing	TON	21,340	$ 10.00	$ 213,400.00	assumes 6" existing bituminous on 12" aggregate base
Removal of Curb and Gutter	LF	10,560	$ 10.00	$ 105,600.00	
Pavement	TON	7,040	$ 100.00	$ 704,000.00	6" depth (33' pavement top)
Aggregate Base	TON	8,870	$ 23.00	$ 204,010.00	6" depth for pavement and 4" depth for sidewalk and paths
Geosynthetic Type R1	SY	22,880	$ 2.00	$ 45,760.00	
Subgrade Preparation Type A	STA	10	$ 500.00	$ 5,000.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Sidewalk	SY	5,870	$ 45.00	$ 264,150.00	4" of concrete, 5' wide sidewalk both sides
Storm Sewer	LS	1	$ 211,150.00	$ 211,150.00	10% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 348,397.50	$ 348,397.50	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 2,671,047.50	

FULL DEPTH RECLAIM RECONSTRUCTION

Item	Unit	Qty	Unit Price	Cost	Assumptions
Removal of Curb and Gutter	LF	10,560	$ 10.00	$ 105,600.00	
Pavement	TON	7,040	$ 100.00	$ 704,000.00	6" depth (33' pavement top)
Milling Pavement Surface	SY	21,120	$ 1.00	$ 21,120.00	Mill prior to Reclamation
Full Depth Reclamation	SY	21,120	$ 2.00	$ 42,240.00	6" depth for pavement and 4" depth for sidewalk and paths
Geosynthetic Type R1	SY	22,880	$ 2.00	$ 45,760.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Sidewalk	SY	5,870	$ 45.00	$ 264,150.00	4" of concrete, 5' wide sidewalk both sides
Storm Sewer	LS	1	$ 175,245.00	$ 175,245.00	10% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 289,154.25	$ 289,154.25	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 2,216,849.25	

CONVERT RURAL GRAVEL ROAD TO URBAN SECTION

Item	Unit	Qty	Unit Price	Cost	Assumptions
Pavement	TON	7,040	$ 100.00	$ 704,000.00	6" depth (33' pavement top)
Aggregate Base	TON	3,730	$ 23.00	$ 85,790.00	6" depth for pavement and 4" depth for sidewalk and paths. Use uxisting gravel bed as base (assume 28')
Geosynthetic Type R1	SY	6,460	$ 2.00	$ 12,920.00	
Subgrade Preparation Type A	STA	10	$ 500.00	$ 5,000.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Common Excavation	CY	16,040	$ 9.00	$ 144,360.00	Assume 2' fill for 69' ROW width. Use existing road grading
Sidewalk	SY	5,870	$ 45.00	$ 264,150.00	4" of concrete, 5' wide sidewalk both sides
Storm Sewer	LS	1	$ 446,450.00	$ 446,450.00	25% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 334,837.50	$ 334,837.50	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 2,567,087.50	

SIDEWALK

Item	Unit	Qty	Unit Price	Cost	Assumptions
Aggregate Base	TON	1,720	$ 23.00	$ 39,560.00	4" depth for sidewalk both sides of road
Common Excavation	CY	10,560	$ 9.00	$ 95,040.00	Assume 2' fill under sidewalk
Sidewalk	SY	5,870	$ 45.00	$ 264,150.00	4" of concrete, 5' wide sidewalk both sides
Incidentals	LS	1	$ 59,812.50	$ 59,812.50	Signage, traffic control, mobilization, etc. (about 15%)
			TOTAL	$ 458,562.50	

Local Commercial - Asphalt

WATFORD CITY COST ESTIMATES - COMMERCIAL (BITUMINOUS)

Assumes Watford city Typical DWG No. 3.2 "Local Commercial"

Description	Value	Unit
Pavement Depth	5	Inches
Pavement Width	38	Feet
Aggregate Depth	12	Inches
Aggregate Width	44	Feet
Max ROW	74	Feet
Embankment Depth	2	Feet

NEW ROADWAY

Item	Unit	Qty	Unit Price	Cost	Assumptions
Pavement	TON	6,200	$ 100.00	$ 620,000.00	5" depth (38' pavement top)
Aggregate Base	TON	17,850	$ 23.00	$ 410,550.00	12" depth for pavement and 4" depth for sidewalk and paths
Geosynthetic Type R1	SY	25,820	$ 2.00	$ 51,640.00	
Subgrade Preparation Type A	STA	10	$ 500.00	$ 5,000.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Common Excavation	CY	28,950	$ 9.00	$ 260,550.00	Assume 2' fill for 74' ROW width
Sidewalk	SY	5,870	$ 45.00	$ 264,150.00	4" of concrete, 5' wide sidewalk both sides
Storm Sewer	LS	1	$ 545,367.50	$ 545,367.50	25% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 409,025.63	$ 409,025.63	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 3,135,863.13	

RECONSTRUCTION

Item	Unit	Qty	Unit Price	Cost	Assumptions
Remove Aggegate Base and Surfacing	TON	23,570	$ 10.00	$ 235,700.00	assumes 6" existing bituminous on 12" aggregate base
Removal of Curb and Gutter	LF	10,560	$ 10.00	$ 105,600.00	
Pavement	TON	6,200	$ 100.00	$ 620,000.00	5" depth (38' pavement top)
Aggregate Base	TON	17,850	$ 23.00	$ 410,550.00	12" depth for pavement and 4" depth for sidewalk and paths
Geosynthetic Type R1	SY	25,820	$ 2.00	$ 51,640.00	
Subgrade Preparation Type A	STA	10	$ 500.00	$ 5,000.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Sidewalk	SY	5,870	$ 45.00	$ 264,150.00	4" of concrete, 5' wide sidewalk both sides
Storm Sewer	LS	1	$ 226,222.00	$ 226,222.00	10% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 373,266.30	$ 373,266.30	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 2,861,708.30	

FULL DEPTH RECLAIM RECONSTRUCTION

Item	Unit	Qty	Unit Price	Cost	Assumptions
Removal of Curb and Gutter	LF	10,560	$ 10.00	$ 105,600.00	
Pavement	TON	6,200	$ 100.00	$ 620,000.00	5" depth (38' pavement top)
Milling Pavement Surface	SY	22,300	$ 1.00	$ 22,300.00	Mill prior to Reclamation
Full Depth Reclamation	SY	22,300	$ 2.00	$ 44,600.00	12" depth for pavement and 4" depth for sidewalk and paths
Geosynthetic Type R1	SY	25,820	$ 2.00	$ 51,640.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Sidewalk	SY	5,870	$ 45.00	$ 264,150.00	4" of concrete, 5' wide sidewalk both sides
Storm Sewer	LS	1	$ 167,787.00	$ 167,787.00	10% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 276,848.55	$ 276,848.55	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 2,122,505.55	

CONVERT RURAL GRAVEL ROAD TO URBAN SECTION

Item	Unit	Qty	Unit Price	Cost	Assumptions
Pavement	TON	6,200	$ 100.00	$ 620,000.00	5" depth (38' pavement top)
Aggregate Base	TON	7,580	$ 23.00	$ 174,340.00	12" depth for pavement and 4" depth for sidewalk and paths. Use uxisting gravel bed as base (assume 28')
Geosynthetic Type R1	SY	9,390	$ 2.00	$ 18,780.00	
Subgrade Preparation Type A	STA	10	$ 500.00	$ 5,000.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Common Excavation	CY	18,000	$ 9.00	$ 162,000.00	Assume 2' fill for 74' ROW width. Use existing road grading
Sidewalk	SY	5,870	$ 45.00	$ 264,150.00	4" of concrete, 5' wide sidewalk both sides
Storm Sewer	LS	1	$ 453,462.50	$ 453,462.50	25% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 340,096.88	$ 340,096.88	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 2,607,409.38	

MILL AND OVERLAY

Item	Unit	Qty	Unit Price	Cost	Assumptions
Pavement	TON	2,480	$ 100.00	$ 248,000.00	2" depth (38' pavement top)
Milling Pavement Surface	SY	22,300	$ 1.00	$ 22,300.00	Mill 2" depth
Incidentals	LS	1	$ 40,545.00	$ 40,545.00	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 310,845.00	

SEAL COAT/CHIP SEAL

Item	Unit	Qty	Unit Price	Cost	Assumptions
Emulsified Ashpalt	GAL	9,150	$ 2.50	$ 22,875.00	Assme .41 Gal/SY
Cover Coat Material	SY	22,300	$ 0.45	$ 10,035.00	25 lbs/SY
Incidentals	LS	1	$ 3,431.25	$ 3,431.25	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 36,341.25	

SIDEWALK

Item	Unit	Qty	Unit Price	Cost	Assumptions
Aggregate Base	TON	1,720	$ 23.00	$ 39,560.00	4" depth for sidewalk both sides of road
Common Excavation	CY	10,560	$ 9.00	$ 95,040.00	Assume 2' fill under sidewalk
Sidewalk	SY	5,870	$ 45.00	$ 264,150.00	4" of concrete, 5' wide sidewalk both sides
Incidentals	LS	1	$ 59,812.50	$ 59,812.50	Signage, traffic control, mobilization, etc. (about 15%)
			TOTAL	$ 458,562.50	

Local Commercial – Concrete

WATFORD CITY COST ESTIMATES - COMMERCIAL (CONCRETE)

Assumes Watford city Typical DWG No. 3.2 "Local Commercial"

Description	Value	Unit
Pavement Depth	6	Inches
Pavement Width	38	Feet
Aggregate Depth	6	Inches
Aggregate Width	44	Feet
Max ROW	74	Feet
Embankment Depth	2	Feet

NEW ROADWAY

Item	Unit	Qty	Unit Price	Cost	Assumptions
Pavement	TON	7,440	$ 100.00	$ 744,000.00	6" depth (38' pavement top)
Aggregate Base	TON	9,780	$ 23.00	$ 224,940.00	6" depth for pavement and 4" depth for sidewalk and paths
Geosynthetic Type R1	SY	25,820	$ 2.00	$ 51,640.00	
Subgrade Preparation Type A	STA	10	$ 500.00	$ 5,000.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Common Excavation	CY	28,950	$ 9.00	$ 260,550.00	Assume 2' fill for 69' ROW width
Sidewalk	SY	5,870	$ 45.00	$ 264,150.00	4" of concrete, 5' wide sidewalk both sides
Storm Sewer	LS	1	$ 529,965.00	$ 529,965.00	25% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 397,473.75	$ 397,473.75	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 3,047,298.75	

RECONSTRUCTION

Item	Unit	Qty	Unit Price	Cost	Assumptions
Remove Aggegate Base and Surfacing	TON	23,570	$ 10.00	$ 235,700.00	assumes 6" existing bituminous on 12" aggregate base
Removal of Curb and Gutter	LF	10,560	$ 10.00	$ 105,600.00	
Pavement	TON	7,440	$ 100.00	$ 744,000.00	6" depth (38' pavement top)
Aggregate Base	TON	9,780	$ 23.00	$ 224,940.00	6" depth for pavement and 4" depth for sidewalk and paths
Geosynthetic Type R1	SY	25,820	$ 2.00	$ 51,640.00	
Subgrade Preparation Type A	STA	10	$ 500.00	$ 5,000.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Sidewalk	SY	5,870	$ 45.00	$ 264,150.00	4" of concrete, 5' wide sidewalk both sides
Storm Sewer	LS	1	$ 220,061.00	$ 220,061.00	10% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 363,100.65	$ 363,100.65	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 2,783,771.65	

FULL DEPTH RECLAIM RECONSTRUCTION

Item	Unit	Qty	Unit Price	Cost	Assumptions
Removal of Curb and Gutter	LF	10,560	$ 10.00	$ 105,600.00	
Pavement	TON	7,440	$ 100.00	$ 744,000.00	6" depth (38' pavement top)
Milling Pavement Surface	SY	22,300	$ 1.00	$ 22,300.00	Mill prior to Reclamation
Full Depth Reclamation	SY	22,300	$ 2.00	$ 44,600.00	6" depth for pavement and 4" depth for sidewalk and paths
Geosynthetic Type R1	SY	25,820	$ 2.00	$ 51,640.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Sidewalk	SY	5,870	$ 45.00	$ 264,150.00	4" of concrete, 5' wide sidewalk both sides
Storm Sewer	LS	1	$ 180,187.00	$ 180,187.00	10% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 297,308.55	$ 297,308.55	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 2,279,365.55	

CONVERT RURAL GRAVEL ROAD TO URBAN SECTION

Item	Unit	Qty	Unit Price	Cost	Assumptions
Pavement	TON	7,440	$ 100.00	$ 744,000.00	6" depth (38' pavement top)
Aggregate Base	TON	4,650	$ 23.00	$ 106,950.00	6" depth for pavement and 4" depth for sidewalk and paths. Use uxisting gravel bed as base (assume 28')
Geosynthetic Type R1	SY	9,390	$ 2.00	$ 18,780.00	
Subgrade Preparation Type A	STA	10	$ 500.00	$ 5,000.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Common Excavation	CY	18,000	$ 9.00	$ 162,000.00	Assume 2' fill for 69' ROW width. Use existing road grading
Sidewalk	SY	5,870	$ 45.00	$ 264,150.00	4" of concrete, 5' wide sidewalk both sides
Storm Sewer	LS	1	$ 467,615.00	$ 467,615.00	25% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 350,711.25	$ 350,711.25	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 2,688,786.25	

SIDEWALK

Item	Unit	Qty	Unit Price	Cost	Assumptions
Aggregate Base	TON	1,720	$ 23.00	$ 39,560.00	4" depth for sidewalk both sides of road
Common Excavation	CY	10,560	$ 9.00	$ 95,040.00	Assume 2' fill under sidewalk
Sidewalk	SY	5,870	$ 45.00	$ 264,150.00	4" of concrete, 5' wide sidewalk both sides
Incidentals	LS	1	$ 59,812.50	$ 59,812.50	Signage, traffic control, mobilization, etc. (about 15%)
			TOTAL	$ 458,562.50	

Watford City 2040 Infrastructure Master Plan
Appendix E – Unit Costs (2021$)

Collectors – Asphalt

WATFORD CITY COST ESTIMATES - COLLECTORS (BITUMINOUS)

Assumes Watford city Typical DWG No. 3.3 "Collector"

Description	Value	Unit
Pavement Depth	5	Inches
Pavement Width	38	Feet
Aggregate Depth	12	Inches
Aggregate Width	44	Feet
Max ROW	79	Feet
Embankment Depth	2	Feet

NEW ROADWAY

Item	Unit	Qty	Unit Price	Cost	Assumptions
Pavement	TON	6,200	$ 100.00	$ 620,000.00	5" depth (38' pavement top)
Aggregate Base	TON	18,460	$ 23.00	$ 424,580.00	12" depth for pavement and 4" depth for sidewalk and paths
Geosynthetic Type R1	SY	25,820	$ 2.00	$ 51,640.00	
Subgrade Preparation Type A	STA	10	$ 500.00	$ 5,000.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Common Excavation	CY	30,900	$ 9.00	$ 278,100.00	Assume 2' fill for 79' ROW width
Sidewalk	SY	0	$ 45.00	$ -	Assume no sidewalk on standard collectors
Storm Sewer	LS	1	$ 487,225.00	$ 487,225.00	25% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 365,418.75	$ 365,418.75	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 2,801,543.75	

RECONSTRUCTION

Item	Unit	Qty	Unit Price	Cost	Assumptions
Remove Aggegate Base and Surfacing	TON	23,570	$ 10.00	$ 235,700.00	assumes 6" existing bituminous on 12" aggregate base
Removal of Curb and Gutter	LF	10,560	$ 10.00	$ 105,600.00	
Pavement	TON	6,200	$ 100.00	$ 620,000.00	5" depth (38' pavement top)
Aggregate Base	TON	18,460	$ 23.00	$ 424,580.00	12" depth for pavement and 4" depth for sidewalk and paths
Geosynthetic Type R1	SY	25,820	$ 2.00	$ 51,640.00	
Subgrade Preparation Type A	STA	10	$ 500.00	$ 5,000.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Sidewalk	SY	0	$ 45.00	$ -	Assume no sidewalk on standard collectors
Storm Sewer	LS	1	$ 201,210.00	$ 201,210.00	10% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 331,996.50	$ 331,996.50	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 2,545,306.50	

FULL DEPTH RECLAIM RECONSTRUCTION

Item	Unit	Qty	Unit Price	Cost	Assumptions
Removal of Curb and Gutter	LF	10,560	$ 10.00	$ 105,600.00	
Pavement	TON	6,200	$ 100.00	$ 620,000.00	5" depth (38' pavement top)
Milling Pavement Surface	SY	22,300	$ 1.00	$ 22,300.00	Mill prior to Reclamation
Full Depth Reclamation	SY	22,300	$ 2.00	$ 44,600.00	12" depth for pavement and 4" depth for sidewalk and paths
Geosynthetic Type R1	SY	25,820	$ 2.00	$ 51,640.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Sidewalk	SY	0	$ 45.00	$ -	Assume no sidewalk on standard collectors
Storm Sewer	LS	1	$ 141,372.00	$ 141,372.00	10% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 233,263.80	$ 233,263.80	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 1,788,355.80	

CONVERT RURAL GRAVEL ROAD TO URBAN SECTION

Item	Unit	Qty	Unit Price	Cost	Assumptions
Pavement	TON	6,200	$ 100.00	$ 620,000.00	5" depth (38' pavement top)
Aggregate Base	TON	8,190	$ 23.00	$ 188,370.00	12" depth for pavement and 4" depth for sidewalk and paths. Use uxisting gravel bed as base (assume 28')
Geosynthetic Type R1	SY	9,390	$ 2.00	$ 18,780.00	
Subgrade Preparation Type A	STA	10	$ 500.00	$ 5,000.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Common Excavation	CY	19,950	$ 9.00	$ 179,550.00	Assume 2' fill for 79' ROW width. Use existing road grading
Sidewalk	SY	0	$ 45.00	$ -	Assume no sidewalk on standard collectors
Storm Sewer	LS	1	$ 395,320.00	$ 395,320.00	25% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 296,490.00	$ 296,490.00	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 2,273,090.00	

MILL AND OVERLAY

Item	Unit	Qty	Unit Price	Cost	Assumptions
Pavement	TON	2,480	$ 100.00	$ 248,000.00	2" depth (38' pavement top)
Milling Pavement Surface	SY	22,300	$ 1.00	$ 22,300.00	Mill 2" depth
Incidentals	LS	1	$ 40,545.00	$ 40,545.00	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 310,845.00	

SEAL COAT/CHIP SEAL

Item	Unit	Qty	Unit Price	Cost	Assumptions
Emulsified Ashpalt	GAL	9,150	$ 2.50	$ 22,875.00	Assme .41 Gal/SY
Cover Coat Material	SY	22,300	$ 0.45	$ 10,035.00	25 lbs/SY
Incidentals	LS	1	$ 3,431.25	$ 3,431.25	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 36,341.25	

BIKE PATH

Item	Unit	Qty	Unit Price	Cost	Assumptions
Aggregate Base	TON	2940	$ 23.00	$ 67,620.00	4" depth for paths both sides of road
Common Excavation	CY	12520	$ 9.00	$ 112,680.00	Assume 2' fill under path
Bike Path	SY	11740	$ 45.00	$ 528,300.00	4" of concrete, 10' wide trail both sides
Incidentals	LS	1	$ 106,290.00	$ 106,290.00	Signage, traffic control, mobilization, etc. (about 15%)
			TOTAL	$ 814,890.00	

SIDEWALK

Item	Unit	Qty	Unit Price	Cost	Assumptions
Aggregate Base	TON	1,720	$ 23.00	$ 39,560.00	4" depth for sidewalk both sides of road
Common Excavation	CY	12,520	$ 9.00	$ 112,680.00	Assume 2' fill under sidewalk
Sidewalk	SY	5,870	$ 45.00	$ 264,150.00	4" of concrete, 5' wide sidewalk both sides
Incidentals	LS	1	$ 62,458.50	$ 62,458.50	Signage, traffic control, mobilization, etc. (about 15%)
			TOTAL	$ 478,848.50	

Collectors – Concrete

WATFORD CITY COST ESTIMATES - COLLECTORS (CONCRETE)

Assumes Watford city Typical DWG No. 3.3 "Collector"

Description	Value	Unit
Pavement Depth	6	Inches
Pavement Width	38	Feet
Aggregate Depth	6	Inches
Aggregate Width	44	Feet
Max ROW	79	Feet
Embankment Depth	2	Feet

NEW ROADWAY

Item	Unit	Qty	Unit Price	Cost	Assumptions
Pavement	TON	7,440	$ 100.00	$ 744,000.00	6" depth (38' pavement top)
Aggregate Base	TON	10,390	$ 23.00	$ 238,970.00	6" depth for pavement and 4" depth for sidewalk and paths
Geosynthetic Type R1	SY	25,820	$ 2.00	$ 51,640.00	
Subgrade Preparation Type A	STA	10	$ 500.00	$ 5,000.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Common Excavation	CY	30,900	$ 9.00	$ 278,100.00	Assume 2' fill for 79' ROW width
Path	SY	8,800	$ 45.00	$ 396,000.00	4" of concrete, 10' wide trail and 5' wide sidewalk
Storm Sewer	LS	1	$ 570,822.50	$ 570,822.50	25% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 428,116.88	$ 428,116.88	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 3,282,229.38	

RECONSTRUCTION

Item	Unit	Qty	Unit Price	Cost	Assumptions
Remove Aggegate Base and Surfacing	TON	23,570	$ 10.00	$ 235,700.00	assumes 6" existing bituminous on 12" aggregate base
Removal of Curb and Gutter	LF	10,560	$ 10.00	$ 105,600.00	
Pavement	TON	7,440	$ 100.00	$ 744,000.00	6" depth (38' pavement top)
Aggregate Base	TON	10,390	$ 23.00	$ 238,970.00	6" depth for pavement and 4" depth for sidewalk and paths
Geosynthetic Type R1	SY	25,820	$ 2.00	$ 51,640.00	
Subgrade Preparation Type A	STA	10	$ 500.00	$ 5,000.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Path	SY	8,800	$ 45.00	$ 396,000.00	4" of concrete, 10' wide trail and 5' wide sidewalk
Storm Sewer	LS	1	$ 234,649.00	$ 234,649.00	10% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 387,170.85	$ 387,170.85	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 2,968,309.85	

FULL DEPTH RECLAIM RECONSTRUCTION

Item	Unit	Qty	Unit Price	Cost	Assumptions
Removal of Curb and Gutter	LF	10,560	$ 10.00	$ 105,600.00	
Pavement	TON	7,440	$ 100.00	$ 744,000.00	6" depth (38' pavement top)
Milling Pavement Surface	SY	22,300	$ 1.00	$ 22,300.00	Mill prior to Reclamation
Full Depth Reclamation	SY	22,300	$ 2.00	$ 44,600.00	6" depth for pavement and 4" depth for sidewalk and paths
Geosynthetic Type R1	SY	25,820	$ 2.00	$ 51,640.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Path	SY	8,800	$ 45.00	$ 396,000.00	4" of concrete, 10' wide trail and 5' wide sidewalk
Storm Sewer	LS	1	$ 193,372.00	$ 193,372.00	10% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 319,063.80	$ 319,063.80	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 2,446,155.80	

CONVERT RURAL GRAVEL ROAD TO URBAN SECTION

Item	Unit	Qty	Unit Price	Cost	Assumptions
Pavement	TON	7,440	$ 100.00	$ 744,000.00	6" depth (38' pavement top)
Aggregate Base	TON	5,260	$ 23.00	$ 120,980.00	12" depth for pavement and 4" depth for sidewalk and paths. Use uxisting gravel bed as base (assume 28')
Geosynthetic Type R1	SY	9,390	$ 2.00	$ 18,780.00	
Subgrade Preparation Type A	STA	10	$ 500.00	$ 5,000.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Common Excavation	CY	19,950	$ 9.00	$ 179,550.00	Assume 2' fill for 79' ROW width. Use existing road grading
Path	SY	8,800	$ 45.00	$ 396,000.00	4" of concrete, 10' wide trail and 5' wide sidewalk
Storm Sewer	LS	1	$ 508,472.50	$ 508,472.50	25% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 381,354.38	$ 381,354.38	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 2,923,716.88	

BIKE PATH

Item	Unit	Qty	Unit Price	Cost	Assumptions
Aggregate Base	TON	2,940	$ 23.00	$ 67,620.00	4" depth for paths both sides of road
Common Excavation	CY	12,520	$ 9.00	$ 112,680.00	Assume 2' fill under path
Bike Path	SY	11,740	$ 45.00	$ 528,300.00	4" of concrete, 10' wide trail both sides
Incidentals	LS	1	$ 106,290.00	$ 106,290.00	Signage, traffic control, mobilization, etc. (about 15%)
			TOTAL	$ 814,890.00	

SIDEWALK

Item	Unit	Qty	Unit Price	Cost	Assumptions
Aggregate Base	TON	1,720	$ 23.00	$ 39,560.00	4" depth for sidewalk both sides of road
Common Excavation	CY	12,520	$ 9.00	$ 112,680.00	Assume 2' fill under sidewalk
Sidewalk	SY	5,870	$ 45.00	$ 264,150.00	4" of concrete, 5' wide sidewalk both sides
Incidentals	LS	1	$ 62,458.50	$ 62,458.50	Signage, traffic control, mobilization, etc. (about 15%)
			TOTAL	$ 478,848.50	

Watford City 2040 Infrastructure Master Plan
Appendix E – Unit Costs (2021$)

Arterials – Asphalt

WATFORD CITY COST ESTIMATES - ARTERIALS (BITUMINOUS)

Assumes Watford city Typical DWG No. 3.3 "Minor Arterial"

Description	Value	Unit
Pavement Depth	6	Inches
Pavement Width	37	Feet
Aggregate Depth	18	Inches
Aggregate Width	43	Feet
Max ROW	88	Feet
Embankment Depth	2	Feet

NEW ROADWAY

Item	Unit	Qty	Unit Price	Cost	Assumptions
Pavement	TON	7,240	$ 100.00	$ 724,000.00	6" depth (37' pavement top)
Aggregate Base	TON	25,980	$ 23.00	$ 597,540.00	18" depth for pavement and 4" depth for sidewalk and paths
Geosynthetic Type R1	SY	25,230	$ 2.00	$ 50,460.00	
Subgrade Preparation Type A	STA	10	$ 500.00	$ 5,000.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Common Excavation	CY	34,420	$ 9.00	$ 309,780.00	Assume 2' fill for 88' ROW width
Path	SY	8,800	$ 45.00	$ 396,000.00	4" of concrete, 10' wide trail and 5' wide sidewalk
Storm Sewer	LS	1	$ 663,090.00	$ 663,090.00	25% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 497,317.50	$ 497,317.50	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 3,812,767.50	

RECONSTRUCTION

Item	Unit	Qty	Unit Price	Cost	Assumptions
Remove Aggegate Base and Surfacing	TON	23,010	$ 10.00	$ 230,100.00	assumes 6" existing bituminous on 12" aggregate base
Removal of Curb and Gutter	LF	10,560	$ 10.00	$ 105,600.00	
Pavement	TON	7,240	$ 100.00	$ 724,000.00	6" depth (37' pavement top)
Aggregate Base	TON	25,980	$ 23.00	$ 597,540.00	18" depth for pavement and 4" depth for sidewalk and paths
Geosynthetic Type R1	SY	25,230	$ 2.00	$ 50,460.00	
Subgrade Preparation Type A	STA	10	$ 500.00	$ 5,000.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Path	SY	8,800	$ 45.00	$ 396,000.00	4" of concrete, 10' wide trail and 5' wide sidewalk
Storm Sewer	LS	1	$ 267,828.00	$ 267,828.00	10% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 441,916.20	$ 441,916.20	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 3,388,024.20	

FULL DEPTH RECLAIM RECONSTRUCTION

Item	Unit	Qty	Unit Price	Cost	Assumptions
Removal of Curb and Gutter	LF	10,560	$ 10.00	$ 105,600.00	
Pavement	TON	7,240	$ 100.00	$ 724,000.00	6" depth (37' pavement top)
Milling Pavement Surface	SY	21,710	$ 1.00	$ 21,710.00	Mill prior to Reclamation
Full Depth Reclamation	SY	21,710	$ 2.00	$ 43,420.00	18" depth for pavement and 4" depth for sidewalk and paths
Geosynthetic Type R1	SY	25,230	$ 2.00	$ 50,460.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Path	SY	8,800	$ 45.00	$ 396,000.00	4" of concrete, 10' wide trail and 5' wide sidewalk
Storm Sewer	LS	1	$ 191,077.00	$ 191,077.00	10% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 315,277.05	$ 315,277.05	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 2,417,124.05	

CONVERT RURAL GRAVEL ROAD TO URBAN SECTION

Item	Unit	Qty	Unit Price	Cost	Assumptions
Pavement	TON	7,240	$ 100.00	$ 724,000.00	6" depth (37' pavement top)
Aggregate Base	TON	10,580	$ 23.00	$ 243,340.00	18" depth for pavement and 4" depth for sidewalk and paths. Use uxisting gravel bed as base (assume 28')
Geosynthetic Type R1	SY	8,800	$ 2.00	$ 17,600.00	
Subgrade Preparation Type A	STA	10	$ 500.00	$ 5,000.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Common Excavation	CY	23,470	$ 9.00	$ 211,230.00	Assume 2' fill for 88' ROW width. Use existing road grading
Path	SY	8,800	$ 45.00	$ 396,000.00	4" of concrete, 10' wide trail and 5' wide sidewalk
Storm Sewer	LS	1	$ 541,687.50	$ 541,687.50	25% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 406,265.63	$ 406,265.63	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 3,114,703.13	

MILL AND OVERLAY

Item	Unit	Qty	Unit Price	Cost	Assumptions
Pavement	TON	2,420	$ 100.00	$ 242,000.00	2" depth (37' pavement top)
Milling Pavement Surface	SY	21,710	$ 1.00	$ 21,710.00	Mill 2" depth
Incidentals	LS	1	$ 39,556.50	$ 39,556.50	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 303,266.50	

SEAL COAT/CHIP SEAL

Item	Unit	Qty	Unit Price	Cost	Assumptions
Emulsified Ashpalt	GAL	8,900	$ 2.50	$ 22,250.00	Assme .41 Gal/SY
Cover Coat Material	SY	21,710	$ 0.45	$ 9,769.50	25 lbs/SY
Incidentals	LS	1	$ 3,337.50	$ 3,337.50	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 35,357.00	

BIKE PATH

Item	Unit	Qty	Unit Price	Cost	Assumptions
Aggregate Base	TON	2,940	$ 23.00	$ 67,620.00	4" depth for paths both sides of road
Common Excavation	CY	16,430	$ 9.00	$ 147,870.00	Assume 2' fill under path
Bike Path	SY	11,740	$ 45.00	$ 528,300.00	4" of concrete, 10' wide trail both sides
Incidentals	LS	1	$ 111,568.50	$ 111,568.50	Signage, traffic control, mobilization, etc. (about 15%)
			TOTAL	$ 855,358.50	

SIDEWALK

Item	Unit	Qty	Unit Price	Cost	Assumptions
Aggregate Base	TON	1,720	$ 23.00	$ 39,560.00	4" depth for sidewalk both sides of road
Common Excavation	CY	16,430	$ 9.00	$ 147,870.00	Assume 2' fill under sidewalk
Sidewalk	SY	5,870	$ 45.00	$ 264,150.00	4" of concrete, 5' wide sidewalk both sides
Incidentals	LS	1	$ 67,737.00	$ 67,737.00	Signage, traffic control, mobilization, etc. (about 15%)
			TOTAL	$ 519,317.00	

Arterials – Concrete

WATFORD CITY COST ESTIMATES - ARTERIALS (CONCRETE)

Assumes Watford city Typical DWG No. 3.3 "Minor Arterial"

Description	Value	Unit
Pavement Depth	9	Inches
Pavement Width	37	Feet
Aggregate Depth	9	Inches
Aggregate Width	43	Feet
Max ROW	88	Feet
Embankment Depth	2	Feet

NEW ROADWAY

Item	Unit	Qty	Unit Price	Cost	Assumptions
Pavement	TON	10,860	$ 100.00	$ 1,086,000.00	9" depth (37' pavement top)
Aggregate Base	TON	14,150	$ 23.00	$ 325,450.00	9" depth for pavement and 4" depth for sidewalk and paths
Geosynthetic Type R1	SY	25,230	$ 2.00	$ 50,460.00	
Subgrade Preparation Type A	STA	10	$ 500.00	$ 5,000.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Common Excavation	CY	34,420	$ 9.00	$ 309,780.00	Assume 2' fill for 88' ROW width
Path	SY	8,800	$ 45.00	$ 396,000.00	4" of concrete, 10' wide trail and 5' wide sidewalk
Storm Sewer	LS	1	$ 685,567.50	$ 685,567.50	25% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 514,175.63	$ 514,175.63	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 3,942,013.13	

RECONSTRUCTION

Item	Unit	Qty	Unit Price	Cost	Assumptions
Remove Aggegate Base and Surfacing	TON	23,010	$ 10.00	$ 230,100.00	assumes 6" existing bituminous on 12" aggregate base
Removal of Curb and Gutter	LF	10,560	$ 10.00	$ 105,600.00	
Pavement	TON	10,860	$ 100.00	$ 1,086,000.00	9" depth (37' pavement top)
Aggregate Base	TON	14,150	$ 23.00	$ 325,450.00	9" depth for pavement and 4" depth for sidewalk and paths
Geosynthetic Type R1	SY	25,230	$ 2.00	$ 50,460.00	
Subgrade Preparation Type A	STA	10	$ 500.00	$ 5,000.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Path	SY	8,800	$ 45.00	$ 396,000.00	4" of concrete, 10' wide trail and 5' wide sidewalk
Storm Sewer	LS	1	$ 276,819.00	$ 276,819.00	10% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 456,751.35	$ 456,751.35	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 3,501,760.35	

FULL DEPTH RECLAIM RECONSTRUCTION

Item	Unit	Qty	Unit Price	Cost	Assumptions
Removal of Curb and Gutter	LF	10,560	$ 10.00	$ 105,600.00	
Pavement	TON	10,860	$ 100.00	$ 1,086,000.00	9" depth (37' pavement top)
Milling Pavement Surface	SY	21,710	$ 1.00	$ 21,710.00	Mill prior to Reclamation
Full Depth Reclamation	SY	21,710	$ 2.00	$ 43,420.00	9" depth for pavement and 4" depth for sidewalk and paths
Geosynthetic Type R1	SY	25,230	$ 2.00	$ 50,460.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Path	SY	8,800	$ 45.00	$ 396,000.00	4" of concrete, 10' wide trail and 5' wide sidewalk
Storm Sewer	LS	1	$ 227,277.00	$ 227,277.00	10% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 375,007.05	$ 375,007.05	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 2,875,054.05	

CONVERT RURAL GRAVEL ROAD TO URBAN SECTION

Item	Unit	Qty	Unit Price	Cost	Assumptions
Pavement	TON	10,860	$ 100.00	$ 1,086,000.00	9" depth (37' pavement top)
Aggregate Base	TON	6,450	$ 23.00	$ 148,350.00	9" depth for pavement and 4" depth for sidewalk and paths. Use uxisting gravel bed as base (assume 28')
Geosynthetic Type R1	SY	8,800	$ 2.00	$ 17,600.00	
Subgrade Preparation Type A	STA	10	$ 500.00	$ 5,000.00	
Curb & Gutter	LF	10,560	$ 35.00	$ 369,600.00	NDDOT Type 1
Common Excavation	CY	23,470	$ 9.00	$ 211,230.00	Assume 2' fill for 88' ROW width. Use existing road grading
Path	SY	8,800	$ 45.00	$ 396,000.00	4" of concrete, 10' wide trail and 5' wide sidewalk
Storm Sewer	LS	1	$ 608,440.00	$ 608,440.00	25% of total cost (excluding incidentals)
Lighting	EA	22	$ 9,090.00	$ 199,980.00	Staggered 250ft, no sidewalk/trail lighting, inc. conduit etc
Incidentals	LS	1	$ 456,330.00	$ 456,330.00	Signage, traffic control, striping, mobilization, etc. (about 15%)
			TOTAL	$ 3,498,530.00	

BIKE PATH

Item	Unit	Qty	Unit Price	Cost	Assumptions
Aggregate Base	TON	2,940	$ 23.00	$ 67,620.00	4" depth for paths both sides of road
Common Excavation	CY	16,430	$ 9.00	$ 147,870.00	Assume 2' fill under path
Bike Path	SY	11,740	$ 45.00	$ 528,300.00	4" of concrete, 10' wide trail both sides
Incidentals	LS	1	$ 111,568.50	$ 111,568.50	Signage, traffic control, mobilization, etc. (about 15%)
			TOTAL	$ 855,358.50	

SIDEWALK

Item	Unit	Qty	Unit Price	Cost	Assumptions
Aggregate Base	TON	1,720	$ 23.00	$ 39,560.00	4" depth for sidewalk both sides of road
Common Excavation	CY	16,430	$ 9.00	$ 147,870.00	Assume 2' fill under sidewalk
Sidewalk	SY	5,870	$ 45.00	$ 264,150.00	4" of concrete, 5' wide sidewalk both sides
Incidentals	LS	1	$ 67,737.00	$ 67,737.00	Signage, traffic control, mobilization, etc. (about 15%)
			TOTAL	$ 519,317.00	

Watford City 2040 Infrastructure Master Plan

APPENDIX F

Capital Improvements Plan (CIP) Ledger

Project: **WATFORD CITY 2040 IMP**
Sheet: **Sheet1**
Date: **3/18/2022**

Project	Project Type	Priority Rank	Total Project Costs	Project Year(s)	Other(s) Cost Share ($)	City Cost Share ($)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	Total 5-Year Costs	Total 10-Year Costs
Capital Projects																		
Main Street N Reconstruction (7th Avenue N to 4th Avenue N)	Capital - Corridor Reconstruction	1	$ 1,490,000	2022	$ 1,339,052	$ 150,948	$ 150,948	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 150,947.71	$ 150,947.71
McKenzie County WRD N Main Emergency Water System Connection	Capital - Wet Infrastructure	13	$ 85,000	2022	$ 63,889	$ 21,111	$ 21,111	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 21,111.00	$ 21,111.00
2nd Avenue Southwest Shared Use Path	Capital - Other	18	$ 624,000	2022	$ 513,000	$ 111,000	$ 111,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 111,000.00	$ 111,000.00
New Public Works Facility	Capital - New Facilities	20	$ 17,500,000	2022 - 2023	$ -	$ 17,500,000	$ 8,750,000	$ 8,750,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 17,500,000.00	$ 17,500,000.00
3rd Avenue SW Reconstruction (Main Street S to 2nd Avenue SW)	Capital - Corridor Reconstruction	2	$ 3,779,000	2022 - 2023	$ -	$ 3,779,000	$ 566,850	$ 3,212,150	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,779,000.00	$ 3,779,000.00
Golf Course Parking Lot and Shop Improvements	Capital - New Facilities	5	$ 1,300,000	2023	$ -	$ 1,300,000	$ -	$ 1,300,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,300,000.00	$ 1,300,000.00
New Fire Hall	Capital - New Facilities	12	$ 9,750,000	2022 - 2024	$ -	$ 9,750,000	$ 292,500	$ 2,925,000	$ 6,532,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 9,750,000.00	$ 9,750,000.00
Park Avenue E Reconstruction (Main Street S to 4th Street SE)	Capital - Corridor Reconstruction	3	$ 1,227,000	2023 - 2024	$ -	$ 1,227,000	$ -	$ 36,810	$ 1,190,190	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,227,000.00	$ 1,227,000.00
10th Avenue NE Gravel to Urban Section (Main Street to WRRF)	Capital - New Roadway	4	$ 1,260,000	2023 - 2024	$ -	$ 1,260,000	$ -	$ 37,800	$ 1,222,200	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,260,000.00	$ 1,260,000.00
6th Avenue NW Reconstruction (Main Street to 5th Street NW)	Capital - Corridor Reconstruction	6	$ 1,278,000	2023 - 2024	$ -	$ 1,278,000	$ -	$ 38,340	$ 1,239,660	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,278,000.00	$ 1,278,000.00
4th Street SW Reconstruction (Park Avenue W to 2nd Avenue SW)	Capital - Corridor Reconstruction	8	$ 795,000	2023 - 2024	$ -	$ 795,000	$ -	$ 23,850	$ 771,150	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 795,000.00	$ 795,000.00
2nd Avenue NW Reconstruction (5th Street NW to Main Street)	Capital - Corridor Reconstruction	9	$ 1,230,000	2024 - 2025	$ -	$ 1,230,000	$ -	$ -	$ 36,900	$ 1,193,100	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,230,000.00	$ 1,230,000.00
3rd Street SW Reconstruction (Park Avenue W to 2nd Avenue SW)	Capital - Corridor Reconstruction	10	$ 1,243,000	2024 - 2025	$ -	$ 1,243,000	$ -	$ -	$ 37,290	$ 1,205,710	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,243,000.00	$ 1,243,000.00
2nd Street SW Reconstruction (4th Avenue NW to 2nd Avenue SW)	Capital - Corridor Reconstruction	11	$ 1,990,000	2025 - 2026	$ -	$ 1,990,000	$ -	$ -	$ -	$ 59,700	$ 1,930,300	$ -	$ -	$ -	$ -	$ -	$ 1,990,000.00	$ 1,990,000.00
5th Street NE Reconstruction (6th Avenue NE to 5th Avenue NE)	Capital - Corridor Reconstruction	14	$ 514,000	2025 - 2026	$ -	$ 514,000	$ -	$ -	$ -	$ 15,420	$ 498,580	$ -	$ -	$ -	$ -	$ -	$ 514,000.00	$ 514,000.00
4th Street NE Reconstruction (6th Avenue NE to 5th Avenue NE)	Capital - Corridor Reconstruction	14	$ 514,000	2025 - 2026	$ -	$ 514,000	$ -	$ -	$ -	$ 15,420	$ 498,580	$ -	$ -	$ -	$ -	$ -	$ 514,000.00	$ 514,000.00
2nd Street NE Reconstruction (6th Avenue NE to 5th Avenue NE)	Capital - Corridor Reconstruction	14	$ 514,000	2025 - 2026	$ -	$ 514,000	$ -	$ -	$ -	$ 15,420	$ 498,580	$ -	$ -	$ -	$ -	$ -	$ 514,000.00	$ 514,000.00
3rd Street NE Reconstruction (6th Avenue NE to 5th Avenue NE)	Capital - Corridor Reconstruction	17	$ 518,000	2025 - 2026	$ -	$ 518,000	$ -	$ -	$ -	$ 15,540	$ 502,460	$ -	$ -	$ -	$ -	$ -	$ 518,000.00	$ 518,000.00
5th Street W Reconstruction (4th Avenue NW to 2nd Avenue SW)	Capital - Corridor Reconstruction	19	$ 2,511,000	2026 - 2027	$ -	$ 2,511,000	$ -	$ -	$ -	$ -	$ 75,330	$ 2,435,670	$ -	$ -	$ -	$ -	$ 75,330.00	$ 2,511,000.00
New Lift Station CSI	Capital - Wet Infrastructure	21	$ 1,040,000	2026 - 2027	$ -	$ 1,040,000	$ -	$ -	$ -	$ -	$ 31,200	$ 1,008,800	$ -	$ -	$ -	$ -	$ 31,200.00	$ 1,040,000.00
Lift Station 4BT Reconstruction	Capital - Wet Infrastructure	22	$ 1,219,000	2026 - 2027	$ -	$ 1,219,000	$ -	$ -	$ -	$ -	$ 36,570	$ 1,182,430	$ -	$ -	$ -	$ -	$ 36,570.00	$ 1,219,000.00
6th Avenue NE Gravel to Urban Section (12th Street NE to 16th Street NE)	Capital - New Roadway	23	$ 1,262,000	2026 - 2027	$ -	$ 1,262,000	$ -	$ -	$ -	$ -	$ 37,860	$ 1,224,140	$ -	$ -	$ -	$ -	$ 37,860.00	$ 1,262,000.00
5th Avenue NE Reconstruction (Main Street N to 5th Street NE)	Capital - Corridor Reconstruction	24	$ 1,216,000	2027 - 2028	$ -	$ 1,216,000	$ -	$ -	$ -	$ -	$ -	$ 36,480	$ 1,179,520	$ -	$ -	$ -	$ -	$ 1,216,000.00
3rd Avenue NW Reconstruction (5th Street NW to Main Street N)	Capital - Corridor Reconstruction	25	$ 1,230,000	2027 - 2028	$ -	$ 1,230,000	$ -	$ -	$ -	$ -	$ -	$ 36,900	$ 1,193,100	$ -	$ -	$ -	$ -	$ 1,230,000.00
6th Avenue NE Reconstruction (Main Street to 6th Street NE)	Capital - Corridor Reconstruction	28	$ 2,029,000	2027 - 2028	$ -	$ 2,029,000	$ -	$ -	$ -	$ -	$ -	$ 60,870	$ 1,968,130	$ -	$ -	$ -	$ -	$ 2,029,000.00
9th Street SW Gravel to Urban Section (12th Street NE to 16th Street NE)	Capital - New Roadway	29	$ 638,000	2027 - 2028	$ -	$ 638,000	$ -	$ -	$ -	$ -	$ -	$ 19,140	$ 618,860	$ -	$ -	$ -	$ -	$ 638,000.00
3rd Street NW Reconstruction (4th Avenue NW to 2nd Avenue NW)	Capital - Corridor Reconstruction	30	$ 1,125,000	2028 - 2029	$ -	$ 1,125,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 33,750	$ 1,091,250	$ -	$ -	$ -	$ 1,125,000.00
5th Avenue NW Reconstruction (3rd Street NW to Main Street N)	Capital - Corridor Reconstruction	31	$ 661,000	2028 - 2029	$ -	$ 661,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 19,830	$ 641,170	$ -	$ -	$ -	$ 661,000.00
2nd Street NW Reconstruction (6th Avenue NW to 4th Avenue NW)	Capital - Corridor Reconstruction	32	$ 917,000	2028 - 2029	$ -	$ 917,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 27,510	$ 889,490	$ -	$ -	$ -	$ 917,000.00
Golf Course Water Supply Improvements	Capital - Wet Infrastructure	33	$ 975,000	2028 - 2029	$ -	$ 975,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 29,250	$ 945,750	$ -	$ -	$ -	$ 975,000.00
Bathrooms at Golf Course	Capital - New Facilities	34	$ 163,000	2028 - 2029	$ -	$ 163,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,890	$ 158,110	$ -	$ -	$ -	$ 163,000.00
Restroom in Hockey Area at Rough Rider Center	Capital - New Facilities	35	$ 325,000	2029 - 2030	$ -	$ 325,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 9,750	$ 315,250	$ -	$ -	$ 325,000.00
2nd Avenue NE Reconstruction (6th Street NE to Culdesac)	Capital - Corridor Reconstruction	37	$ 597,000	2029 - 2030	$ -	$ 597,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 17,910	$ 579,090	$ -	$ -	$ 597,000.00
5th Avenue SE Gravel to Urban Section (Connection to 6th Avenue SE)	Capital - New Roadway	38	$ 850,000	2030 - 2031	$ -	$ 850,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 25,500	$ 824,500	$ -	$ 850,000.00
5th Street NE/5th Street SE Reconstruction (3rd Avenue NE to 3rd Avenue SE)	Capital - Corridor Reconstruction	39	$ 1,793,000	2030 - 2031	$ -	$ 1,793,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 53,790	$ 1,739,210	$ -	$ 1,793,000.00
3rd Street NW Reconstruction (6th Avenue NW to 4th Avenue NW)	Capital - Corridor Reconstruction	48	$ 925,000	2030 - 2031	$ -	$ 925,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 27,750	$ 897,250	$ -	$ 925,000.00
7th Street NE Reconstruction (4th Avenue NW to 2nd Avenue NE)	Capital - Corridor Reconstruction	53	$ 958,000	2030 - 2031	$ -	$ 958,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 28,740	$ 929,260	$ -	$ 958,000.00
Operations and Maintenance Projects [Mill and Overlay]																		
2024 Mill and Overlay Improvements	O&M - Mill and Overlay	NA	$ 566,000	2023 - 2024	$ -	$ 566,000	$ -	$ 16,980	$ 549,020	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 566,000.00	$ 566,000.00
2028 Mill and Overlay Improvements	O&M - Mill and Overlay	NA	$ 452,000	2027 - 2028	$ -	$ 452,000	$ -	$ -	$ -	$ -	$ -	$ 13,560	$ 438,440	$ -	$ -	$ -	$ -	$ 452,000.00
Operations and Maintenance Projects [Chip Seal]																		
2022 City Wide Chip Seal Improvements	O&M - Chip Seal	NA	$ 1,247,000	2022	$ -	$ 1,247,000	$ 1,247,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,247,000.00	$ 1,247,000.00
2025 City Wide Chip Seal Improvements	O&M - Chip Seal	NA	$ 887,000	2025	$ -	$ 887,000	$ -	$ -	$ -	$ 887,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 887,000.00	$ 887,000.00
2029 City Wide Chip Seal Improvements	O&M - Chip Seal	NA	$ 689,000	2029	$ -	$ 689,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 689,000	$ -	$ -	$ -	$ 689,000.00
Operations and Maintenance Projects [Watermain and Sanitary Sewer Rehabilitation]																		
2025 Sanitary Sewer Rehabilitation	O&M - Watermain and Sanitary Rehabilitation	NA	$ 798,000	2025	$ -	$ 798,000	$ -	$ -	$ -	$ 798,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 798,000.00	$ 798,000.00
2030 Watermain and Sanitary Sewer Rehabilitation	O&M - Watermain and Sanitary Rehabilitation	NA	$ 2,096,000	2030	$ -	$ 2,096,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,096,000	$ -	$ -	$ 2,096,000.00
Operations and Maintenance Projects [Facilities]																		
2023 City Facility Improvements	O&M - Facilities	NA	$ 878,400	2023	$ -	$ 1,196,000	$ -	$ 1,196,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,196,000.00	$ 1,196,000.00
2027 City Facility Improvements	O&M - Facilities	NA	$ 2,169,300	2027	$ -	$ 2,724,000	$ -	$ -	$ -	$ -	$ -	$ 2,724,000	$ -	$ -	$ -	$ -	$ -	$ 2,724,000.00
2031 City Facility Improvements	O&M - Facilities	NA	$ 1,325,100	2031	$ -	$ 1,336,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,336,000	$ -	$ 1,336,000.00
Operations and Maintenance Projects [WRRF]																		
WRRF Improvements - Phase I (Bypass Pumping Upgrades and Electrical Distribution Repairs)	O&M - WRRF	NA	$ 300,000	2022	$ -	$ 300,000	$ 300,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 300,000.00	$ 300,000.00
WRRF Improvements - Phase II (PTB Improvements)	O&M - WRRF	NA	$ 200,000	2022	$ -	$ 200,000	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 200,000.00	$ 200,000.00
WRRF Improvements - Phase III (Sludge Removal)	O&M - WRRF	NA	$ 150,000	2026	$ -	$ 150,000	$ -	$ -	$ -	$ -	$ 150,000	$ -	$ -	$ -	$ -	$ -	$ 150,000.00	$ 150,000.00
WRRF Improvements - Phase III (Cell Maintenance)	O&M - WRRF	NA	$ 150,000	2027	$ -	$ 150,000	$ -	$ -	$ -	$ -	$ -	$ 150,000	$ -	$ -	$ -	$ -	$ -	$ 150,000.00
Annual Improvement Programs																		
Manhole Lining Annual Program	Annual Programs	NA	$ 200,000	Annual	$ -	$ 200,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 100,000.00	$ 200,000.00
Sidewalk Gap Infill Annual Program	Annual Programs	NA	$ 350,000	Annual	$ -	$ 350,000	$ 35,000	$ 35,000	$ 35,000	$ 35,000	$ 35,000	$ 35,000	$ 35,000	$ 35,000	$ 35,000	$ 35,000	$ 175,000.00	$ 350,000.00
Sidewalk Repair and ADA Annual Program	Annual Programs	NA	$ 750,000	Annual	$ -	$ 750,000	$ 75,000	$ 75,000	$ 75,000	$ 75,000	$ 75,000	$ 75,000	$ 75,000	$ 75,000	$ 75,000	$ 75,000	$ 375,000.00	$ 750,000.00
				TOTALS	**$ 1,915,941**	**$ 78,220,059**	**$ 11,769,409**	**$ 17,666,930**	**$ 11,708,910**	**$ 4,335,310**	**$ 4,389,460**	**$ 9,021,990**	**$ 5,643,280**	**$ 4,572,430**	**$ 3,256,120**	**$ 5,856,220**	**$ 49,870,019**	**$ 78,220,059**

Watford City 2040 Infrastructure Master Plan

APPENDIX G

Financial Model User Manual

INTRODUCTION.

This Financial Planning Model ("Model") and User Guide were developed by Raftelis Financial Consultants, Inc ("Raftelis") and customized for the City of Watford City ("City"). The Model was designed to evaluate and provide transparency to the estimated financial impact of the City's 2040 Infrastructure Master Plan by including customized dashboard screens summarizing key outputs and financial metrics requested by the City.

The Model is Excel-based and requires the input of certain financial data and calibration of various assumptions to achieve optimal results. The Model was designed to be simple, while being inclusive of the functionality requested by the City. Input and assumption tabs have been programmed to make future updates or scenario analyses quick and easy to perform. However, this User Guide contains information that should be helpful to the user as the user updates and utilizes the Model. While many aspects of the Model may seem intuitive, it is recommended that users review the User Guide in its entirety to ensure that the Model is being used as intended, and to ensure the most efficient use and accurate results.

We appreciate the opportunity to design a customized Financial Planning Model for Watford City and trust that it will serve as an effective tool in helping to address its financial planning needs as part of the City's 2040 Infrastructure Master Planning effort.

WHAT TO KNOW.

While this User Guide contains an in-depth discussion on how to setup and use the Model, some basic information about the Model that may be helpful to the user is included below. Please note, Raftelis recommends that the User Guide be read in its entirety prior to using the Model.

The Model contains input, output, and calculation tabs. The main input and output tabs are as follows:

<u>Main Input Tabs:</u>

- Setup_General
- Setup_Funding
- Assumptions
- Revenue
- Funds
- CIP

<u>Main Output Tabs:</u>

- G Dashboard
- W Dashboard
- S Dashboard
- Fin Forecast

Within the Model, input cells contain a light blue fill and a blue text. This helps the user identify where inputs may be made on the various input tabs. Calculation or output cells contain a light gray or white fill and black text. This helps the user identify where calculations are located, or outputs provided, and that the user <u>should not</u> make any changes to these cells.

Detailed Model calculations have been programmed into the Model_Calc tab. Detailed calculations related to debt service coverage have been programmed separately and are included on the Coverage tab. These are calculation tabs. The user <u>should not</u> make any inputs or changes here but may wish to view data contained within the tabs for informational purposes.

For simplicity, this Model relies on the user's inputs for capital project funding decisions. In other words, for the capital projects that has been inputted, the user must setup funding options (cash or debt type) to fully fund each year's capital project expenditures. The Model will automatically calculate required rate revenue increases in response to user inputted capital funding rules for the Water Works and Sewer Funds.

Note that within the Water Works and Sewer Funds, interest revenues are not available to fund operating and capital costs or to help meet Model constraints for minimum operating cash reserves or debt service coverage in the year in which they are generated. This is because no iterative loops or circular references were programmed into the Model.

Several tabs are currently hidden in the Model. These include the Dashboard_Data tabs and they may be unhidden at any time, if necessary. In addition, any tabs currently visible can also be hidden by the user at any time.

DASHBOARD TABS.

The Model includes three separate dashboard tabs:

- General Government Dashboard
- Water Works Fund Dashboard
- Sewer Fund Dashboard

The dashboard tabs summarize the key outputs of the Model. For example, the charts included on the dashboards include the following information for each year of the 20-year forecast period:

- Projected User Rate/Charge Increase (Water Works and Sewer Fund Dashboards only)
- Ending Unrestricted Cash and Minimum Target
- Capital Project Expenditures
- Capital Funding Sources
- Debt Service Coverage
- Main Revenue Sources (General Government Dashboard only)

In addition, there are some key inputs included on the Dashboard tabs which can be used to (1) override Model calculated rate revenue adjustments (Water Works and Sewer Funds only) and (2) adjust the years shown in the charts. The section of the Dashboard tabs that contain these inputs is shown in Exhibit 1.

Exhibit 1.

Water Works and Sewer Fund Dashboards:

Year	1	2	3	4	5
	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025
Rate Increase Override					
Senior Lien DSC	120%	120%	120%	120%	120%
All-In DSC	120%	120%	120%	120%	120%
First Year of Charts	1				
Number of Years in Charts	20				

All Dashboards:

First Year of Charts	1
# of Years in Charts	20

Rate Increase Overrides (Water Works and Sewer Funds):

Based on the inputs and assumptions programmed into the Model on the Assumptions, Revenue, Funds, and CIP tabs, the Model will automatically calculate an annual rate revenue adjustment to meet the requirements of the Model's constraints (set by the user) for minimum cash reserves and debt service coverage for the Water Works and the Sewer Funds. However, as shown in Exhibit 1, the user can also program manual rate revenue adjustments, called *Rate Revenue Increase Overrides,* for these funds into the Model. This is done on the *Rate Revenue Increase Override* line and can be entered for each year included in the Model. Revenue adjustments for the General Government Funds are made on the Revenue tab.

Years Shown in Dashboard Charts:

The user can adjust the years shown in the Dashboard charts. For example, if the base year of the Model is fiscal year ("FY") 2021, the user can adjust the first year shown in the charts by changing the dropdown selection for *First Year of Charts* from 1 to 2. The Model will then show FY 2022 as the initial year in the charts. Furthermore, the user can adjust the number of years shown in the charts by changing the dropdown selection for *Number of Years in Charts* from 20 to 10, if the user wishes to see only ten fiscal years in the chart. Any number of years, up to the total number of years analyzed by the Model, can be shown in the charts.

RAFTELIS TIP…

When entering manual rate revenue adjustments on the Rate Increase Override line within the Water Works and Sewer Fund Dashboards, the user should be sure that minimum requirements for ending cash and debt service coverage, as inputted on the Assumptions tab, are met in each year of the forecast.

Special Features of the General Government Dashboard Tab.

The General Government tab contains a special feature under the Ending Pooled Unrestricted Cash and Minimum Target and Pooled Debt Service Coverage charts. The table titled *Ending Cash Analysis by Fund* allows the user to ensure that there are no negative ending cash balances within the general government funds in each year of the 20-year forecast period. If the alert for a specific fund reads 'Cash Ok!', then ending cash balances for the fund over the forecast period are all $0 or greater. If the alert reads 'Check Cash!', then ending cash balances for the fund over the forecast period are less than $0 for at least one year. This table is shown in Exhibit 2.

The table titled *Debt Service Coverage Analysis by Fund* allows the user to ensure that debt service coverage is at least 1.0x within the general government funds during each year of the 20-year forecast period. If the alert for a specific fund reads 'DSC Ok!', then debt service coverage levels for the fund over the forecast period are all at least 1.0x. If the alert reads 'Check DSC!", then debt service coverage for the fund over the forecast period is less than 1.0x for at least one year. This table is also shown as part of Exhibit 2.

Exhibit 2.

Special Features of General Government Dashboard:

ENDING CASH ANALYSIS BY FUND:			
General Fund	Check Cash!	*Sales Tax Surplus Fund*	Cash Ok!
Gross Production Tax Fund	Check Cash!	*Special Improvement Fund*	Cash Ok!
Roads & Streets Fund	Check Cash!	*Unused 8*	Cash Ok!
Rough Rider Center Fund	Cash Ok!	*Unused 9*	Cash Ok!
Rough Rider Sales Tax Fund	Cash Ok!	*Unused 10*	Cash Ok!

DEBT SERVICE COVERAGE ANALYSIS BY FUND:			
General Fund	DSC Ok!	*Sales Tax Surplus Fund*	DSC Ok!
Gross Production Tax Fund	Check DSC!	*Special Improvement Fund*	DSC Ok!
Roads & Streets Fund	DSC Ok!	*Unused 8*	DSC Ok!
Rough Rider Center Fund	DSC Ok!	*Unused 9*	DSC Ok!
Rough Rider Sales Tax Fund	DSC Ok!	*Unused 10*	DSC Ok!

SETUP GENERAL TAB.

The Model's basic setup inputs are contained on the Setup General tab. Users may adjust inputs on this tab to perform the following actions:

- Document the funds to be modeled and the main revenue source associated with each fund.
- Identify the major miscellaneous revenue types, their coding, and whether each revenue type should be included in the debt service coverage calculation.
- Identify the major expense types, their coding, and whether each expense type should be included in the debt service coverage calculation.
- Identify the funding sources to be used to fund capital project costs within each fund.
- Associate names with the different capital project scenarios (up to 5) within the model.
- Setup the interfund transfers within the Model, including which fund the transfer originates from and where monies are transferred to, the dollar amount of the transfer, and a brief description documenting the purpose of the transfer.

RAFTELIS TIP…

Associating a modeled revenue with a particular fund allows the user to setup a more detailed projection of these future revenues within the Revenue tab. Other miscellaneous/non-modeled revenue sources are projected using only an annual escalation factor within the Funds tab.

SETUP FUNDING TAB.

The Setup Funding tab is used to assign the debt service requirement resulting from new general government debt issues and its pay-as-you-go ("PAYGO") funding requirement to individual general government funds. For each general government debt type that may be issued (setup by the user on the Setup General tab), the user selects which fund(s) the debt service should be assigned to and paid out of. The same inputs are required by the user to assign the PAYGO funding need.

ASSUMPTIONS TAB.

General Model Assumptions:

The Assumptions tab includes a set of general model assumptions, which include:

- The Base Year of the Model.
- The interest earnings rate on the average annual cash balance of each fund.
- Annual cost inflation factors for future capital project costs entered on the CIP tab.
- The active capital project schedule and funding scenario.
- The active revenue projection scenarios for Gross Production Tax and City Sales Tax revenues.

The *Base Year of the Model* is the first year the Model will analyze data and provide results. Budgeted or actual financial information can be inputted for this year and the Model is formatted to provide projections for 20-years beyond the selected Base Year.

The *Interest Earnings Rate* contains the rate at which annual interest revenues will be calculated based on the average annual cash balance in the fund. As the Model does not include circular references or iterative calculations, the revenues generated from interest are not available to fund operating or capital related costs in the year they are generated.

Capital project costs entered on the CIP tab may be inputted in current year dollars. If current year dollars are assumed, the user may elect to escalate these costs to future year dollars using assumed annual cost escalation factors, which are inputted on the *Escalation of Capital Project Costs* line.

The CIP tab allows users to enter five separate capital project schedules and funding scenarios. The active scenario is selected on the *Capital Project Scenario* line.

Best, Worst, and Most-Likely revenue projections have been setup on the Revenue tab for Gross Production Tax and City Sales Tax revenues. The user is able to select the active revenue projection scenario for these revenues on the *Gross Production Tax Revenue Scenario* and the *City Sales Tax Revenue Scenario* lines.

Exhibit 3.

General Assumptions:

Description	Year 1 FY 2021	2 FY 2022	3 FY 2023
General Assumptions			
Base Year of Model	2021		
Interest Earnings Rate	0.25%	0.25%	0.25%
Escalation of Capital Project Costs	0.0%	2.5%	2.5%
Capital Project Scenario	1		
Gross Production Tax Revenue Scenario	Most-Likely	3	
City Sales Tax Revenue Scenario	Most-Likely	3	

Utility System Customer Growth:

Future revenues generated by the City's water and sewer user rates and charges may be impacted by customer growth within the service area. The user can input the estimated overall impact of customer growth on the future water and sewer user rate and charge revenues on the *Water System Customer Growth Impact* and *Sewer System Customer Growth Impact* lines, as shown in Exhibit 4.

Exhibit 4.

Impact of Customer Growth on Utility Revenues:

Description	Year 1 FY 2021	2 FY 2022	3 FY 2023
Utility System Customer Growth			
Water System Customer Growth Impact	0.0%	1.0%	1.0%
Sewer System Customer Growth Impact	0.0%	1.0%	1.0%

Minimum Cash Reserves and Debt Service Coverage – General Government Funds:

The user is required to enter minimum targets for ending operating cash reserves and debt service coverage for the general government funds, as shown in Exhibit 5; however, the Model will not automatically adjust general government revenues to meet the minimum targets in any year. Therefore, once all inputs and assumptions have been inputted, the user should switch back to the G Dashboard tab to determine if ending operating cash and debt service coverage meet their minimum targets within the government funds. Note that these metrics are analyzed on a combined basis, for all general government funds, within the charts on the G Dashboard tab.

Exhibit 5.

Model Constraints for General Government Funds:

Description	Year 1 FY 2021	2 FY 2022	3 FY 2023
Minimum Targets - Gen Govt Funds			
Minimum Operating Cash Reserve Target			
Months	0.0	1.0	1.0
Minimum Debt Service Coverage Target			
All Debt	110%	110%	110%

Model Constraints for Cash Reserves and Debt Service Coverage – Water Works and Sewer Funds:

The model constraints for the Water Works and Sewer Funds are the rules for which the Model will automatically calculate annual rate revenue adjustments. In other words, to ensure there is a minimum amount of cash available at the end of the year and that net revenues exceed the annual debt service requirement by at least the specified margin, the Model will increase the system's user rates and charges by the required dollar amount. These assumptions are shown in Exhibit 6.

There are two inputs for the minimum level of debt service coverage. The first pertains to principal and interest on debt classified as having a senior claim to system net revenues, while the second is related to the debt service related to all outstanding debt of the system.

Exhibit 6.

Model Constraints for Water Works and Sewer Funds:

Description	Year 1 FY 2021	2 FY 2022	3 FY 2023
Model Constraints - Water Works Fund			
Minimum Operating Cash Reserve Target			
Months	0.0	1.0	1.0
Minimum Debt Service Coverage Target			
Senior Lien Debt	120%	120%	120%
All-In Coverage	110%	110%	110%
Model Constraints - Sewer Fund			
Minimum Operating Cash Reserve Target			
Months	0.0	1.0	1.0
Minimum Debt Service Coverage Target			
Senior Lien Debt	120%	120%	120%
All-In Coverage	110%	110%	110%

Capital Project Financing:

This section of the Assumptions tab contains capital project financing assumptions that can be entered for each debt type. The inputs include term, interest rate, issuance costs, debt service reserve amount, and percent of annual debt service due in the year of issuance.

Three different debt types may be entered for the general government funds. Three separate debt types may be entered for the Water Works and Sewer Funds. The debt types entered by the user for the Water Works and Sewer Funds require the user to input the debt type's claim on system net revenues (see *Revenue Claim* line). If the user selects 'Senior' from the dropdown menu, the debt will be issued as senior debt and the resulting debt service will be subject to the minimum coverage target for senior lien debt service coverage. If the user selects 'Subordinate' from the dropdown menu, the debt will be issued as having a subordinate claim to system net revenues and will only be included in the test to ensure the minimum target for all-in debt service coverage is met.

An example of the inputs required for debt types within the Water Works and Sewer Funds is included in Exhibit 7.

Exhibit 7.

Debt Assumptions:

Description	Year 1 FY 2021	2 FY 2022	3 FY 2023
Capital Project Financing - WW / S Funds			
Revenue Bonds			
Term (Years)	25	25	25
Rate	3.25%	3.25%	3.75%
Issuance Costs	1.5%	1.5%	1.5%
Debt Service Reserve (Years DS)	1	1	1
Percent of Debt Service in Year 1	50%	50%	50%
Revenue Claim	Senior	Senior	Senior

Miscellaneous Revenue and Operating Cost Escalation Factors:

Users can enter specific escalation factors for various subcategories of miscellaneous revenues and operating expenses. To do so, the user must enter in the name of the miscellaneous revenue or expense subcategory on the appropriate line and then enter in annual escalation percentages in the appropriate year(s). Up to 10 unique revenue subcategories can be incorporated into the miscellaneous revenue projections. Up to 15 unique expense subcategories can be incorporated into the expense projections. The section of the Assumptions tab containing the revenue and expense escalation assumptions is shown in Exhibit 8.

RAFTELIS TIP…

Remember to account for customer growth impacts when escalating water and/or sewer system expenses that are variable, in that they change based on the amount of water sold or sewer flows received.

Exhibit 8.

Miscellaneous Revenue and Operating Expense Escalation Factors

Description	Year 1 FY 2021	2 FY 2022	3 FY 2023
Non-Rate Revenue Escalation Factors			
Misc 1	n/a	1.0%	1.0%
Misc 2	n/a	2.0%	2.0%
Misc 3	n/a	3.0%	3.0%
Fees/Fines	n/a	0.0%	0.0%
Licenses	n/a	0.0%	0.0%
Constant	n/a	0.0%	0.0%
WAWSA	n/a	2.4%	2.4%
Access	n/a	1.0%	1.0%
General	n/a	2.0%	2.0%
<Unused>	n/a	0.0%	0.0%
Operating Cost Escalation Factors			
Salaries	n/a	2.0%	2.0%
Benefits	n/a	3.5%	3.5%
Utilities	n/a	5.0%	5.0%
Prof Svcs	n/a	3.5%	3.5%
Contract	n/a	2.5%	2.5%
Chemicals	n/a	5.0%	5.0%
General	n/a	2.0%	2.0%
Purch W	n/a	5.0%	5.0%
Constant	n/a	0.0%	0.0%
Minor Constr	n/a	2.5%	2.5%
Taxes	n/a	1.5%	1.5%
<Unused>	n/a	0.0%	0.0%
<Unused>	n/a	0.0%	0.0%
<Unused>	n/a	0.0%	0.0%

REVENUE TAB.

The Revenue tab allows users to setup a more detailed projection of the major revenue sources within each general government fund. The user may elect to add-in further detail to the projection of the major revenue types within these funds, as long as the total annual revenue cell for each revenue source remains properly linked to other sheets within the Model.

The Gross Production Tax and the Rough Rider Sales Tax revenue sources were setup to include Best, Worst, and Most-Likely scenarios for their respective projected annual revenues. The user must select the active scenario for these revenue sources on the Assumptions tab.

Note that while User Rate and Charge revenues within the Water Works and the Sewer Funds are calculated on this tab, only their beginning/baseline annual revenue amounts are inputted on this tab. The user may input growth related assumptions for these revenues on the Assumptions tab. Annual increases to these revenues are calculated automatically by the model unless the user enters in annual adjustments for these revenues on the Rate Increase Override line on the Water Works and Sewer Funds' dashboards.

FUNDS TAB.

Inputs for beginning cash balances, miscellaneous (or non-modeled) revenues, expenses and transfers, and debt service payments for each of the funds entered by the user on the Setup General tab are located within the Funds tab.

<u>Beginning Cash Balances:</u>

The inputs on the Funds tab for each fund begin with an input for the fund's beginning cash balance. There is no need for the user to input beginning balances in any year other than Year 1. The section of the Fund 1 tab containing this input is shown in Exhibit 9.

Exhibit 9.

<u>Beginning Cash Balance Input:</u>

Type		Escalation	Description	Year 1 Budget FY 2021
General Fund Inputs				
<u>Beginning Balance:</u>				
			Fund 1 Beginning Balance	$ 9,806,513

<u>Miscellaneous Revenues:</u>

Miscellaneous revenues are entered on the following section of the Funds tab, as shown in Exhibit 10. For each miscellaneous revenue line item, the user is required to enter the following information:

Type. The user must select the miscellaneous revenue type based on the types inputted on the Setup General Tab.

Escalation. The user must select a revenue escalation option based on the escalation options setup on the Assumptions tab. If the user elects not to use an escalation option, the user must input individual miscellaneous revenue amounts in the appropriate years for the revenue line item.

Description. The user should enter a name and/or description for each revenue line item.

Budget FY 2021. The user is required to enter a budgeted dollar amount in this column. Based on the escalation option selected, the Model will automatically project future revenues associated with the line item in all future years. No inputs need to be made by the user in years beyond the initial year. The Model contains formula driven projections within these columns. However, manual inputs may be made by the user in any year, independent of the escalation factors, if desired.

Exhibit 10.

Miscellaneous Revenue Inputs:

Type		Escalation	Description	Year 1 Budget FY 2021	2 FY 2022	3 FY 2023
Miscellaneous Revenues				VLOOKUP REF	3	4
			Revenue Details:			
OR	320000	Licenses	320211 Beer and Liqour Licenses	$ 42,000	$ 42,000	$ 42,000
OR	320000	Licenses	320215 Taxi Licenses	1,500	1,500	1,500
OR	320000	Fees/Fines	320220 Animal Impound Fees	3,000	3,000	3,000

Expenses and Transfers:

Operating expenses and transfers are entered in the following section of the Funds tab, as shown in Exhibit 11. For each expense or transfer line item, the user is required to enter the following information:

Type. The user must select the expense type based on the types inputted on the Setup General tab.

Escalation. The user must select an expense escalation option based on the escalation options setup on the Assumptions tab. If the user elects not to use an escalation option, the user must input individual expense amounts in the appropriate years for the expense line item.

Description. The user should enter a name and/or description for each expense line item.

Budget FY 2021. The user is required to enter a budgeted dollar amount in this column. Based on the escalation option selected, the Model will automatically project future expenses associated with the line item in all future years. Again, no inputs need to be made by the user in years beyond the initial year. The Model contains formula driven projections within these columns. However, manual inputs may be made by the user in any year, independent of the escalation factors, if desired.

Exhibit 11.

Operating Expense Inputs:

Type		Escalation	Description	Year 1 Budget FY 2021	2 FY 2022	3 FY 2023
Expenses/Transfers:				VLOOKUP REF	3	4
			Governing Board:			
OE	411000	Salaries	100 Salaries & Wages	$ 72,000	$ 73,440	$ 74,909
OE	411000	General	340 Travel Expense	100	102	104
OE	411000	General	370 Dues, Memberships, Registration	100	102	104

Existing Debt Service:

Future debt service payments associated with individual currently outstanding debt issues are entered in the following section of the Funds tab, as shown in Exhibit 12. Note that future debt service payments associated with new debt issues are not to be inputted on this tab. The Model calculates these amounts automatically and incorporates them into the appropriate fund based on user inputs on the Setup Funding tab. For each currently outstanding debt issue, users are required to enter the following information:

Type. The user must identify the debt type based on the debt types inputted on the Setup General tab.

Description. The user should enter the loan or debt issue name and/or description.

Budget FY 2021 (and all other fiscal years). The user must manually input all future debt service payments associated with each issue.

RAFTELIS TIP…

The Funds tab also includes columns for previous year revenue and expense dollar amounts. These can be hidden or viewed using Excel's grouping function at the top of the spreadsheet. The user can input historical actual miscellaneous revenues, expenses, and annual debt service payments in these columns to compare historical financial information to projected figures on a line item basis.

Exhibit 12.

Existing Debt Service Inputs:

Type	Escalation	Description	Year 1 Budget FY 2021	2 FY 2022	3 FY 2023
Existing Debt Service:					
REV		2015 Sales Tax Revenue Bond - $35,550,000	$ 2,273,100	$ 2,268,550	$ 2,269,550

CIP TAB.

The CIP tab is where the user can enter future capital project costs into the Model. Inputs of capital project costs will require the user to setup capital funding inputs, which are also included on this tab. Users may enter up to five different capital project/funding scenarios. The scenario actively incorporated into the Model is selected on the Assumptions tab.

Inputs are made within a scenario in two separate areas.

Part I. Input of Capital Project Costs:

Inputs on the CIP tab begin with the user adding individual future projects under the column labeled *Project Description*, as shown in Exhibit 13. Future costs associated with each project are then entered in the fiscal year in which the project expenditures are anticipated to occur.

Exhibit 13.

Capital Project Input Section:

Scenario 1

General Government Capital Projects

Project Description	FY 2021	FY 2022	FY 2023
Capital Project 1	$ -	$ -	$ -
Capital Project 2	-	-	-
Capital Project 3	-	-	-
Capital Project 4	-	-	-
Capital Project 5	-	-	-
	-	-	-
	-	-	-
	-	-	-
	-	-	-
	-	-	-
Total	$ -	$ -	$ -

Part II. Input of Capital Funding Sources:

The second part involves the user identifying the sources of funding for the inputted capital project costs.

When Cash is Selected as a Funding Source-

When cash is used to fund project costs, the user should complete the following steps:

1. Enter Cash as a line item under the *Funding Name* column.
2. Select Cash from the dropdown menu of funding types under the *Funding Type* column.
3. Enter the annual cash amounts that will be made available in future years to fund project costs.
4. Leave the input cell under the *Year Issued* column blank.

When Debt is Selected as a Funding Source-

When debt is used as a funding source, the user should complete the following steps:

1. Enter the name or a description of the debt type under the *Funding Name* column.
2. Select the debt type from the dropdown menu of funding types under the *Funding Type* column.
3. Enter the dollar amounts under the year(s) that the proceeds will be used to provide funding.
4. Select the year in which the debt will be issued and will begin amortizing.

After completing these steps, the user should verify that the total funding provided in each year is equal to the total project costs to be expended. If the total is equal, the user will see the check for the year read as 'Funding Ok!'. If the totals are not equal, the check for the year will read as 'Check Funding!'. If the totals do not equal, the Model will not be able to provide accurate results for the scenario. Note that multiple funding sources may be used during a single year.

Exhibit 14.

Capital Project Funding Input Section:

General Government Funding Inputs

Funding Type	Year Issued	Funding Name	FY 2021	FY 2022	FY 2023
		Cash	$ -	$ -	$ -
		Funding Type 1	-	-	-
		Funding Type 2	-	-	-
		Funding Type 3	-	-	-
		Funding Type 4	-	-	-
		Funding Type 5	-	-	-
			-	-	-
			-	-	-
			-	-	-
			-	-	-
		Total	$ -	$ -	$ -
			Funding Ok!	Funding Ok!	Funding Ok!

RAFTELIS TIP…

Project costs can be entered in current year dollars. The Model will automatically account for future cost inflation based on the inputted assumption for capital project cost inflation entered by the user on the Assumptions tab.

NEW DEBT TAB.

This tab contains calculations related to the projection of debt service resulting from automatically issued (as opposed to manually inputted by the user) new debt. The calculations are performed by debt type and are driven by the inputs made on the Setup General, Assumptions, and CIP tabs. The user should not make any inputs or changes to this tab.

COVERAGE TAB.

This tab contains calculations related to debt service coverage. The user should not make any inputs or changes to this tab.

MODEL CALC TAB.

This tab is the main calculation tab of the Model and contains calculations related to the sufficiency of ending cash balances and debt service coverage levels for each of the funds analyzed within the Model. The user should not make any inputs or changes to this tab.

FIN FORECAST TAB.

The Proforma tab provides a detailed projection of cash revenues and expenses for each year analyzed by the Model. The projection also includes the annual surplus or deficit, as well as information related to each fund's cash position. Information on debt service coverage is also shown.

This tab is for informational purposes only. The user should not make any inputs or changes to this tab unless it is necessary, based on inputs made within the Funds tab. The user may elect to hide or unhide columns on this tab depending on their preference for the number of fiscal years to be shown.

Watford City 2040
Infrastructure Master Plan

APPENDIX H

Bridge Inspections Report

CITY OF WATFORD CITY

Bridge Inventory - Structure Inventory And Appraisal Sheet SEC 409

Structure Number: 2ND AVE SE PEDESTRIAN BRIDGE

200 System Designation	4 - Urban
201 Status	Not Deficient
202 Sufficiency Rating	N/A

Identification

02 Highway District	Williston District
03 County	McKenzie
04 City	WATFORD CITY
05 Inventory Route	Route on Structure
8 Other 0 None of	00000 0 N/A (NBI)
06 Feats Intersect	CHERRY CREEK
09 Location	2ND AVE SE WATFORD CITY
11 Milepoint	N/A
13 LRS Inv Route. Subroute	-1 -1
16 Latitude	47d 48' 04.05"
17 Longitude	103d 16' 05.19"
GPS Coordinates XY	2065892.1 17374140.8
98 Border Bridge	Not Applicable 0.00%
99 Border Bridge Struct No.	-

Structure Type and Material

43 Main Struct Type	Steel Stringer
44 Approach Struct Type	Unknown (NBI) Unknown (P)
45 No. Spans in Main Unit	1
46 No. Approach Spans	0
107 Deck Struct Type	8 Wood or Timber
108 Wearing Surface	7 Wood or Timber
Membrane	0 None
Dk Protect	0 None
208 Dk Overburden N	Not Applicable

Age and Service

27 Yr Built	1997 106 Yr Reconstructed
42 Type of Service	3 Pedestrian - bicycle - On 5 Waterway - Under
28 Lanes on Structure	1
29 ADT 1	30 Year of ADT 2020
109 Average Daily Truck Traffic	0
19 Bypass, Detour Length	0 Miles

Geometric Data

10 Min Vert Clearance	99 Ft. 12 In.
32 Approach Roadway Width	10 Ft.
33 Bridge Median	0 No median
34 Skew	0
35 Structure Flared	0 No flare
47 Total Horizontal Clearance	10.0 Ft.
48 Length of Max Span	109.04 Ft.
49 Structure Length	110.04 Ft.
50 Curb/Sidewalk Widths	0.0 Ft Rt-Side 0.0 Ft Lt-Side
51 Bridge Rdwy Width - Curb to Curb	10.0 Ft.
52 Deck Width	10.0 Ft.
53 Min Vert Clear. Over Bridge	99 Ft. 12 In.
54 Min Vert Underclearance	0 Ft. 0 In. N Feature not hwy or RR
55 Min Lateral UnderClear. - Rt	99.9 Ft. N Feature not hwy or RR
56 Min Lateral UnderClear. - Lt	0.0 Ft.
210 Culvert / 211 Description	

Classification

12 Base Highway Network	Not on Base Network
20 Toll	3 On free road
21 Maint Responsibility	City/Municipal Hwy Agenc
22 Owner	City/Municipal Hwy Agenc
26 Functional	Urban, Local
37 Historical Significance	4 Hist sign not determin
100 Defense Highway Designation	0 Not a STRAHNET hwy
101 Parallel Structure Designation	No ll bridge exists
102 Direction of Traffic	0 Highway traffic not carried
103 Temporary Structure Designation	Not Applicable (P)
104 Highway System of Inventory Rte	0 Not on NHS
105 Federal Lands Highways	Not applicable
110 Designated National Network	0 Not part of natl netwo
112 NBIS Bridge Length	Yes

Condition

58 Deck	8 Very Good
59 Superstructure	6 Satisfactory
60 Substructure	6 Satisfactory
61 Chan. & Chan. Protection	8 Protected
62 Culvert and Retaining Walls	N N/A (NBI)

Load Rating and Posting

31 Design Load	Unknown
41 Structure Open, Closed or Posted	A Open, no restriction
63 Operating Rating Method	1 LF Load Factor
64 Oper. Rating H2.2	2.2 Tons
65 Inventory Rating Method	1 LF Load Factor
66 Inv. Rating H1.6	1.6 Tons
70 Bridge Posting	0>39.9% below
209 Posted in "Tons"	Tons

Appraisal

67 Structural Condition	6 Equal Min Criteria
68 Deck Geometry	N Not applicable (NBI)
69 Underclear. Vert & Horiz	N Not applicable (NBI)
71 Waterway Adequacy	9 Above Desirable
72 App. Rdwy. Alignment	7 Above Min Criteria
36 Traffic Safety Features	0 N N N
113 Scour Critical	U Unknown Scour

Inspections

90 Date of Last Inspection	May 13, 2020
91 Designated Inspection Frequency	24 Months
92 Critical Feature Inspected / 93 Critical Feature Last Inspection Dt	
Fracture Critical	N
Underwater	N
Other Special	N
218 Channel Profile	N
Chaining Date	None
207 Transporter Erector Routes and Sites	
212 Structure Load Rated	06/19/2020
213 Federal Aid Project Number	
214 Delayed Inspection	Not Applicable
216 Inspector	Rykowsky, Nelson

Navigation Data

38 Navigation Control	Permit Not Required
39 Navigation Vertical Clearance	0.0 Ft.
40 Navigation Horizontal Clearance	0.0 Ft.
111 Pier or Abutment Protection	Unknown (NBI)
116 Minimum Navigation Vertical Clearance	Ft.

Bridge #2ND AVE SE PEDESTRIAN BRIDGE

LOCATION: 2ND AVE SE WATFORD CITY

Team Lead: Ryan Rykowsky **Inspection Date:** May 13, 2020

Inspection Comments

Bridge is inventoried from West to East. Substructure units are numbered Abutment 1 (West) and Abutment 2 (East). Girders and piles are numbered North to South.

[05/13/2020] Pedestrian railing is substandard in strength with loose posts and fabric present. Rough ride at bridge end transition to approaches.

Deck Notes

[05/13/2020] Longitudinal timber deck plank wearing course present. Wearing course plank rotting 25ft from East end. Loose wearing course planks 25ft from West end and 38ft from East end. Light mold present on the underside of the deck prevalent throughout.

Superstructure Notes

[05/13/2020] Coating limited in effectiveness with significant loss of pigment, numerous scrape marks and large areas of light surface rust present with no measurable section loss. Several damaged angle iron cross bracing members present. Steel girders embedded in soil at bridge ends.

Substructure Notes

[05/13/2020] Uniform surface rust present on steel caps with no measurable section loss. At Abutment 2 (East), Pile 1N - Steel cap top flange distortion measuring 18in L x 1-1/4in W. Steel caps embedded in soil.

Maintenance Needs

[05/13/2020] Repair damaged cross bracing. Grade bridge end slopes to uncover steel cap and girder ends. Update pedestrian guard to meet the strength requirements of AASHTO.

July 14, 2020

CITY OF WATFORD CITY

Bridge Inventory - Structure Inventory And Appraisal Sheet SEC 409

Structure Number: TOURIST PARK PEDESTRIAN BRIDGE

200 System Designation 4 - Urban
201 Status Not Deficient
202 Sufficiency Rating N/A

Identification

02 Highway District Williston District
03 County McKenzie
04 City WATFORD CITY
05 Inventory Route Route on Structure
8 Other 0 None of 00000 0 N/A (NBI)
06 Feats Intersect CHERRY CREEK
09 Location 11TH ST NE WATFORD CITY
11 Milepoint N/A
13 LRS Inv Route. Subroute -1 -1
16 Latitude 47d 48' 12.12"
17 Longitude 103d 15' 52.59"
GPS Coordinates XY 2066733.6 17374977.4
98 Border Bridge Not Applicable 0.00%
99 Border Bridge Struct No. -

Structure Type and Material

43 Main Struct Type Steel
Stringer
44 Approach Struct Type Unknown (NBI)
Unknown (P)
45 No. Spans in Main Unit 1
46 No. Approach Spans 0
107 Deck Struct Type 8 Wood or Timber
108 Wearing Surface 0 None
Membrane 0 None
Dk Protect 0 None
208 Dk Overburden N Not Applicable

Age and Service

27 Yr Built 1997 106 Yr Reconstructed
42 Type of Service 3 Pedestrian - bicycle - On
5 Waterway - Under
28 Lanes on Structure 1
29 ADT 1 30 Year of ADT 2020
109 Average Daily Truck Traffic 0
19 Bypass, Detour Length 0 Miles

Geometric Data

10 Min Vert Clearance 99 Ft. 12 In.
32 Approach Roadway Width 10 Ft.
33 Bridge Median 0 No median
34 Skew 0
35 Structure Flared 0 No flare
47 Total Horizontal Clearance 8.0 Ft.
48 Length of Max Span 76.00 Ft.
49 Structure Length 78.92 Ft.
50 Curb/Sidewalk Widths 0.0 Ft Rt-Side
0.0 Ft Lt-Side
51 Bridge Rdwy Width - Curb to Curb
8.0 Ft.
52 Deck Width 8.0 Ft.
53 Min Vert Clear. Over Bridge 99 Ft. 12 In.
54 Min Vert Underclearance 0 Ft. 0 In.
N Feature not hwy or RR
55 Min Lateral UnderClear. - Rt 99.9 Ft.
N Feature not hwy or RR
56 Min Lateral UnderClear. - Lt 0.0 Ft.
210 Culvert / 211 Description

Classification

12 Base Highway Network Not on Base Network
20 Toll 3 On free road
21 Maint Responsibility City/Municipal Hwy Agenc
22 Owner City/Municipal Hwy Agenc
26 Functional Urban, Local
37 Historical Significance 4 Hist sign not determin
100 Defense Highway Designation 0 Not a STRAHNET hwy
101 Parallel Structure Designation No ll bridge exists
102 Direction of Traffic 0 Highway traffic not carried
103 Temporary Structure Designation Not Applicable (P)
104 Highway System of Inventory Rte 0 Not on NHS
105 Federal Lands Highways Not applicable
110 Designated National Network 0 Not part of natl netwo
112 NBIS Bridge Length Yes

Condition

58 Deck 8 Very Good
59 Superstructure 6 Satisfactory
60 Substructure 6 Satisfactory
61 Chan. & Chan. Protection 8 Protected
62 Culvert and Retaining Walls N N/A (NBI)

Load Rating and Posting

31 Design Load
Unknown
41 Structure Open, Closed or Posted A Open, no restriction
63 Operating Rating Method 1 LF Load Factor
64 Oper. Rating H2.7 2.7 Tons
65 Inventory Rating Method 1 LF Load Factor
66 Inv. Rating H2.0 2.0 Tons
70 Bridge Posting 0>39.9% below
209 Posted in "Tons" Tons

Appraisal

67 Structural Condition 6 Equal Min Criteria
68 Deck Geometry N Not applicable (NBI)
69 Underclear. Vert & Horiz N Not applicable (NBI)
71 Waterway Adequacy 9 Above Desirable
72 App. Rdwy. Alignment 7 Above Min Criteria
36 Traffic Safety Features 1 N N N
113 Scour Critical U Unknown Scour

Inspections

90 Date of Last Inspection May 13, 2020
91 Designated Inspection Frequency 24 Months
92 Critical Feature Inspected / 93 Critical Feature Last Inspection Dt
Fracture Critical N
Underwater N
Other Special N
218 Channel Profile N
Chaining Date None
207 Transporter Erector Routes and Sites
212 Structure Load Rated 06/19/2020
213 Federal Aid Project Number
214 Delayed Inspection Not Applicable
216 Inspector Rykowsky, Nelson

Navigation Data

38 Navigation Control Permit Not Required
39 Navigation Vertical Clearance 0.0 Ft.
40 Navigation Horizontal Clearance 0.0 Ft.
111 Pier or Abutment Protection Unknown (NBI)
116 Minimum Navigation Vertical Clearance Ft.

Bridge #11TH ST NE BRIDGE

LOCATION: 11TH ST NE BRIDGE WATFORD CITY

Team Lead: Ryan Rykowsky **Inspection Date:** May 13, 2020

Inspection Comments
Bridge alignment is on a North 112deg azimuth. For simplicity, the Northwest Abutment will be referred to as Abutment 1 (West) and the Southeast Abutment will be referred to as Abutment 2 (East). Bridge is inventoried from West to East. Substructure units are numbered Abutment 1 (West) and Abutment 2 (East). Girders and piles are numbered North to South.

Superstructure Notes
[05/13/2020] Coating limited in effectiveness with significant loss of pigment, peeling, numerous scrape marks and large areas of light surface rust present with no measurable section loss. Steel girders embedded in soil at Abutment 2 (East).

Substructure Notes
[05/13/2020] Uniform surface rust present on steel caps with no measurable section loss. At Abutment 1 (West) top timber plank is gone with soil infiltration present. Steel cap embedded in soil at Abutment 2 (East).

Maintenance Needs
[05/13/2020] Grade bridge end slopes to uncover steel cap and girder ends. Replace missing timber plank at Abutment 1 (West).

July 14, 2020

CITY OF WATFORD CITY

Bridge Inventory - Structure Inventory And Appraisal Sheet SEC 409

Structure Number: 17TH AVE NE (SITE 1)

200 System Designation	4 - Urban
201 Status	Not Deficient
202 Sufficiency Rating	98.30
Identification	
02 Highway District	Williston District
03 County	McKenzie
04 City	WATFORD CITY
05 Inventory Route	Route on Structure
5 City Street 1 Mainline 00000	0 N/A (NBI)
06 Feats Intersect	CREEK
09 Location	17TH AVE NE WATFORD CITY
11 Milepoint	N/A
13 LRS Inv Route. Subroute	-1 -1
16 Latitude	47d 49' 08.61"
17 Longitude	103d 15' 13.35"
GPS Coordinates XY 2069281.9	17380759.2
98 Border Bridge Not Applicable	0.00%
99 Border Bridge Struct No.	-
Structure Type and Material	
43 Main Struct Type	Concrete Culvert (includes frame culverts)
44 Approach Struct Type	Unknown (NBI) Unknown (P)
45 No. Spans in Main Unit	1
46 No. Approach Spans	0
107 Deck Struct Type	N N/A (NBI)
108 Wearing Surface	N N/A (no deck (NBI))
Membrane	N N/A (no deck (NBI))
Dk Protect	N N/A (no deck (NBI))
208 Dk Overburden N	Not Applicable
Age and Service	
27 Yr Built 2014	106 Yr Reconstructed
42 Type of Service	1 Highway - On 5 Waterway - Under
28 Lanes on Structure	3
29 ADT 500 30 Year of ADT	2020
109 Average Daily Truck Traffic	185
19 Bypass, Detour Length	2 Miles
Geometric Data	
10 Min Vert Clearance	99 Ft. 12 In.
32 Approach Roadway Width	41 Ft.
33 Bridge Median	0 No median
34 Skew	20.00
35 Structure Flared	0 No flare
47 Total Horizontal Clearance	41.0 Ft.
48 Length of Max Span	14.89 Ft.
49 Structure Length	14.89 Ft.
50 Curb/Sidewalk Widths	0.0 Ft Rt-Side 0.0 Ft Lt-Side
51 Bridge Rdwy Width - Curb to Curb	0.0 Ft.
52 Deck Width	0.0 Ft.
53 Min Vert Clear. Over Bridge	99 Ft. 12 In.
54 Min Vert Underclearance	0 Ft. 0 In. N Feature not hwy or RR
55 Min Lateral UnderClear. - Rt	99.9 Ft. N Feature not hwy or RR
56 Min Lateral UnderClear. - Lt	0.0 Ft.
210 Culvert / 211 Description	SINGLE 14X5X131' PRECAST RCB

Classification	
12 Base Highway Network	Not on Base Network
20 Toll	3 On free road
21 Maint Responsibility	City/Municipal Hwy Agenc
22 Owner	City/Municipal Hwy Agenc
26 Functional	Urban, Local
37 Historical Significance	4 Hist sign not determin
100 Defense Highway Designation	0 Not a STRAHNET hwy
101 Parallel Structure Designation	No ll bridge exists
102 Direction of Traffic	2 2-way traffic
103 Temporary Structure Designation	Not Applicable (P)
104 Highway System of Inventory Rte	0 Not on NHS
105 Federal Lands Highways	Not applicable
110 Designated National Network	0 Not part of natl netwo
112 NBIS Bridge Length	No
Condition	
58 Deck	N N/A (NBI)
59 Superstructure	N N/A (NBI)
60 Substructure	N N/A (NBI)
61 Chan. & Chan. Protection	8 Protected
62 Culvert and Retaining Walls	6 Deterioration
Load Rating and Posting	
31 Design Load	HL93 (AASHTO LRFD HL 93 design live load)
41 Structure Open, Closed or Posted	A Open, no restriction
63 Operating Rating Method	1 LF Load Factor
64 Oper. Rating HS42	75 Tons
65 Inventory Rating Method	1 LF Load Factor
66 Inv. Rating HS25	45 Tons
70 Bridge Posting	5 At/Above Legal Loads
209 Posted in "Tons"	Tons
Appraisal	
67 Structural Condition	6 Equal Min Criteria
68 Deck Geometry	N Not applicable (NBI)
69 Underclear. Vert & Horiz	N Not applicable (NBI)
71 Waterway Adequacy	9 Above Desirable
72 App. Rdwy. Alignment	8 Equal Desirable Crit
36 Traffic Safety Features	N N N N
113 Scour Critical	8 Stable Above Footing
Inspections	
90 Date of Last Inspection	May 13, 2020
91 Designated Inspection Frequency	48 Months
92 Critical Feature Inspected / 93 Critical Feature Last Inspection Dt	
Fracture Critical	N
Underwater	N
Other Special	N
218 Channel Profile	N
Chaining Date	None
207 Transporter Erector Routes and Sites	
212 Structure Load Rated	06/22/2020
213 Federal Aid Project Number	
214 Delayed Inspection	Not Applicable
216 Inspector	Rykowsky, Nelson
Navigation Data	
38 Navigation Control	Permit Not Required
39 Navigation Vertical Clearance	0.0 Ft.
40 Navigation Horizontal Clearance	0.0 Ft.
111 Pier or Abutment Protection	Unknown (NBI)
116 Minimum Navigation Vertical Clearance	Ft.

Bridge #17TH AVE NE (SITE 1)

LOCATION: 17TH AVE NE WATFORD CITY

Team Lead: Ryan Rykowsky **Inspection Date:** May 13, 2020

Inspection Comments
[05/13/2020] 2ft of standing water in box.

Culvert Notes
[05/13/2020] Spalling at roof joints with exposed reinforcing typical throughout (likely occurred at time of install). Worst case spall 3ft from South end of box measures 2ft L x 6in W x 3in D with exposed reinforcing. Joints are open 2in at (3) locations near the North end.

Maintenance Needs
[05/13/2020] Repair spall areas with exposed reinforcing by saw cutting 1/2in D around the perimeter of repair areas, remove unsound concrete, clean reinforcing steel and patch area with a non-shrink epoxy/grout.

July 14, 2020

CITY OF WATFORD CITY

Bridge Inventory - Structure Inventory And Appraisal Sheet SEC 409

Structure Number: 17TH AVE NE (SITE 2)

200 System Designation	4 - Urban
201 Status	Not Deficient
202 Sufficiency Rating	98.30

Identification

02 Highway District	Williston District
03 County	McKenzie
04 City	WATFORD CITY
05 Inventory Route	Route on Structure
5 City Street 1 Mainline 00000	0 N/A (NBI)
06 Feats Intersect	CREEK
09 Location	17TH AVE NE WATFORD CITY
11 Milepoint	N/A
13 LRS Inv Route. Subroute	-1 -1
16 Latitude	47d 49' 08.39"
17 Longitude	103d 14' 12.02"
GPS Coordinates XY 2073466.2	17380831.9
98 Border Bridge Not Applicable	0.00%
99 Border Bridge Struct No.	-

Structure Type and Material

43 Main Struct Type	Concrete Culvert (includes frame culverts)
44 Approach Struct Type	Unknown (NBI) Unknown (P)
45 No. Spans in Main Unit	1
46 No. Approach Spans	0
107 Deck Struct Type	N N/A (NBI)
108 Wearing Surface	N N/A (no deck (NBI))
Membrane	N N/A (no deck (NBI))
Dk Protect	N N/A (no deck (NBI))
208 Dk Overburden N	Not Applicable

Age and Service

27 Yr Built 2014 106 Yr Reconstructed	
42 Type of Service	1 Highway - On 5 Waterway - Under
28 Lanes on Structure	2
29 ADT 500 30 Year of ADT	2020
109 Average Daily Truck Traffic	185
19 Bypass, Detour Length	2 Miles

Geometric Data

10 Min Vert Clearance	99 Ft. 12 In.
32 Approach Roadway Width	41 Ft.
33 Bridge Median	0 No median
34 Skew	27.00
35 Structure Flared	0 No flare
47 Total Horizontal Clearance	41.0 Ft.
48 Length of Max Span	8.98 Ft.
49 Structure Length	8.98 Ft.
50 Curb/Sidewalk Widths	0.0 Ft Rt-Side 0.0 Ft Lt-Side
51 Bridge Rdwy Width - Curb to Curb	0.0 Ft.
52 Deck Width	0.0 Ft.
53 Min Vert Clear. Over Bridge	99 Ft. 12 In.
54 Min Vert Underclearance	0 Ft. 0 In. N Feature not hwy or RR
55 Min Lateral UnderClear. - Rt	99.9 Ft. N Feature not hwy or RR
56 Min Lateral UnderClear. - Lt	0.0 Ft.
210 Culvert / 211 Description	SINGLE 8X4X118' PRECAST RCB

Classification

12 Base Highway Network	Not on Base Network
20 Toll	3 On free road
21 Maint Responsibility	City/Municipal Hwy Agenc
22 Owner	City/Municipal Hwy Agenc
26 Functional	Urban, Local
37 Historical Significance	4 Hist sign not determin
100 Defense Highway Designation	0 Not a STRAHNET hwy
101 Parallel Structure Designation	No ‖ bridge exists
102 Direction of Traffic	2 2-way traffic
103 Temporary Structure Designation	Not Applicable (P)
104 Highway System of Inventory Rte	0 Not on NHS
105 Federal Lands Highways	Not applicable
110 Designated National Network	0 Not part of natl netwo
112 NBIS Bridge Length	No

Condition

58 Deck	N N/A (NBI)
59 Superstructure	N N/A (NBI)
60 Substructure	N N/A (NBI)
61 Chan. & Chan. Protection	8 Protected
62 Culvert and Retaining Walls	7 Minor Deterioration

Load Rating and Posting

31 Design Load	HL93 (AASHTO LRFD HL 93 design live load)
41 Structure Open, Closed or Posted	A Open, no restriction
63 Operating Rating Method	1 LF Load Factor
64 Oper. Rating HS49	89 Tons
65 Inventory Rating Method	1 LF Load Factor
66 Inv. Rating HS30	53 Tons
70 Bridge Posting	5 At/Above Legal Loads
209 Posted in "Tons"	Tons

Appraisal

67 Structural Condition	7 Above Min Criteria
68 Deck Geometry	N Not applicable (NBI)
69 Underclear. Vert & Horiz	N Not applicable (NBI)
71 Waterway Adequacy	9 Above Desirable
72 App. Rdwy. Alignment	8 Equal Desirable Crit
36 Traffic Safety Features	N N N N
113 Scour Critical	8 Stable Above Footing

Inspections

90 Date of Last Inspection	May 13, 2020
91 Designated Inspection Frequency	48 Months

92 Critical Feature Inspected / 93 Critical Feature Last Inspection Dt

Fracture Critical	N
Underwater	N
Other Special	N
218 Channel Profile	N
Chaining Date	None
207 Transporter Erector Routes and Sites	
212 Structure Load Rated	06/22/2020
213 Federal Aid Project Number	
214 Delayed Inspection	Not Applicable
216 Inspector	Rykowsky, Nelson

Navigation Data

38 Navigation Control	Permit Not Required
39 Navigation Vertical Clearance	0.0 Ft.
40 Navigation Horizontal Clearance	0.0 Ft.
111 Pier or Abutment Protection	Unknown (NBI)
116 Minimum Navigation Vertical Clearance	Ft.

Bridge #17TH AVE NE (SITE 2)

LOCATION: 17TH AVE NE WATFORD CITY

Team Lead: Ryan Rykowsky **Inspection Date:** May 13, 2020

Culvert Notes

[05/13/2020] Spalling at roof joint just South of North end measuring 8in L x 2-1/2in W x 2in D with exposed reinforcing. Loose concrete with exposed reinforcing at storm drain entrances into box. Minor honeycombing, lower East haunch at several segments near North end.

Maintenance Needs

[05/13/2020] Repair spall areas with exposed reinforcing by saw cutting 1/2in D around the perimeter of repair areas, remove unsound concrete, clean reinforcing steel and patch area with a non-shrink epoxy/grout.

July 14, 2020

CITY OF WATFORD CITY

Bridge Inventory - Structure Inventory And Appraisal Sheet SEC 409

Structure Number: 17th Ave NE Site 3

200 System Designation	4 - Urban
201 Status	Not Deficient
202 Sufficiency Rating	98.30

Identification

02 Highway District	Williston District
03 County	McKenzie
04 City	WATFORD CITY
05 Inventory Route	Route on Structure
5 City Street 1 Mainline 00000	0 N/A (NBI)
06 Feats Intersect	CREEK
09 Location	17TH AVE NE WATFORD CITY
11 Milepoint	N/A
13 LRS Inv Route. Subroute	-1 -1
16 Latitude	47d 49' 08.27"
17 Longitude	103d 13' 23.38"
GPS Coordinates XY 2076784.5	17380895.8
98 Border Bridge Not Applicable	0.00%
99 Border Bridge Struct No.	-

Structure Type and Material

43 Main Struct Type	Concrete Culvert (includes frame culverts)
44 Approach Struct Type	Unknown (NBI) Unknown (P)
45 No. Spans in Main Unit	1
46 No. Approach Spans	0
107 Deck Struct Type	N N/A (NBI)
108 Wearing Surface	N N/A (no deck (NBI))
Membrane	N N/A (no deck (NBI))
Dk Protect	N N/A (no deck (NBI))
208 Dk Overburden N	Not Applicable

Age and Service

27 Yr Built 2014	106 Yr Reconstructed
42 Type of Service	1 Highway - On 5 Waterway - Under
28 Lanes on Structure	3
29 ADT 500 30 Year of ADT	2020
109 Average Daily Truck Traffic	185
19 Bypass, Detour Length	2 Miles

Geometric Data

10 Min Vert Clearance	99 Ft. 12 In.
32 Approach Roadway Width	41 Ft.
33 Bridge Median	0 No median
34 Skew	0.00
35 Structure Flared	0 No flare
47 Total Horizontal Clearance	41.0 Ft.
48 Length of Max Span	8.00 Ft.
49 Structure Length	8.00 Ft.
50 Curb/Sidewalk Widths	0.0 Ft Rt-Side 0.0 Ft Lt-Side
51 Bridge Rdwy Width - Curb to Curb	0.0 Ft.
52 Deck Width	0.0 Ft.
53 Min Vert Clear. Over Bridge	99 Ft. 12 In.
54 Min Vert Underclearance	0 Ft. 0 In. N Feature not hwy or RR
55 Min Lateral UnderClear. - Rt	99.9 Ft. N Feature not hwy or RR
56 Min Lateral UnderClear. - Lt	0.0 Ft.
210 Culvert / 211 Description	SINGLE 8X4X100' PRECAST RCB

Classification

12 Base Highway Network	Not on Base Network
20 Toll	3 On free road
21 Maint Responsibility	City/Municipal Hwy Agenc
22 Owner	City/Municipal Hwy Agenc
26 Functional	Urban, Local
37 Historical Significance	4 Hist sign not determin
100 Defense Highway Designation	0 Not a STRAHNET hwy
101 Parallel Structure Designation	No ll bridge exists
102 Direction of Traffic	2 2-way traffic
103 Temporary Structure Designation	Not Applicable (P)
104 Highway System of Inventory Rte	0 Not on NHS
105 Federal Lands Highways	Not applicable
110 Designated National Network	0 Not part of natl netwo
112 NBIS Bridge Length	No

Condition

58 Deck	N N/A (NBI)
59 Superstructure	N N/A (NBI)
60 Substructure	N N/A (NBI)
61 Chan. & Chan. Protection	8 Protected
62 Culvert and Retaining Walls	8 No Major Problem

Load Rating and Posting

31 Design Load	HL93 (AASHTO LRFD HL 93 design live load)
41 Structure Open, Closed or Posted	A Open, no restriction
63 Operating Rating Method	1 LF Load Factor
64 Oper. Rating HS34	61 Tons
65 Inventory Rating Method	1 LF Load Factor
66 Inv. Rating HS20	36 Tons
70 Bridge Posting	5 At/Above Legal Loads
209 Posted in "Tons"	Tons

Appraisal

67 Structural Condition	8 Equal Desirable Crit
68 Deck Geometry	N Not applicable (NBI)
69 Underclear. Vert & Horiz	N Not applicable (NBI)
71 Waterway Adequacy	9 Above Desirable
72 App. Rdwy. Alignment	8 Equal Desirable Crit
36 Traffic Safety Features	N N N N
113 Scour Critical	8 Stable Above Footing

Inspections

90 Date of Last Inspection	May 14, 2020
91 Designated Inspection Frequency	48 Months
92 Critical Feature Inspected / 93 Critical Feature Last Inspection Dt	
Fracture Critical	N
Underwater	N
Other Special	N
218 Channel Profile	N
Chaining Date	None
207 Transporter Erector Routes and Sites	
212 Structure Load Rated	06/22/2020
213 Federal Aid Project Number	
214 Delayed Inspection	Not Applicable
216 Inspector	Rykowsky, Nelson

Navigation Data

38 Navigation Control	Permit Not Required
39 Navigation Vertical Clearance	0.0 Ft.
40 Navigation Horizontal Clearance	0.0 Ft.
111 Pier or Abutment Protection	Unknown (NBI)
116 Minimum Navigation Vertical Clearance	Ft.

Bridge #17TH AVE NE (SITE 3)

LOCATION: 17TH AVE NE WATFORD CITY

Team Lead: Ryan Rykowsky **Inspection Date:** May 14, 2020

Inspection Comments
[05/14/2020] 4in of silt throughout.

Maintenance Needs
[05/14/2020] Remove tree in close proximity to the Southeast corner of box. Remove silt and debris from box culvert floor.

CITY OF WATFORD CITY

Bridge Inventory - Structure Inventory And Appraisal Sheet SEC 409

Structure Number: FOX HILLS GOLF COURSE BRIDGE (SITE 1)

200 System Designation	4 - Urban
201 Status	Not Deficient
202 Sufficiency Rating	N/A

Identification

02 Highway District	Williston District
03 County	McKenzie
04 City	WATFORD CITY
05 Inventory Route	Route on Structure
8 Other 0 None of	00000 0 N/A (NBI)
06 Feats Intersect	CREEK
09 Location	FOX HILLS GOLF COURSE
11 Milepoint	N/A
13 LRS Inv Route. Subroute	-1 -1
16 Latitude	47d 48' 39.14"
17 Longitude	103d 14' 38.32"
GPS Coordinates XY 2071739.4	17377828.5
98 Border Bridge Not Applicable	0.00%
99 Border Bridge Struct No.	-

Structure Type and Material

43 Main Struct Type Stringer	Timber
44 Approach Struct Type	Unknown (NBI) Unknown (P)
45 No. Spans in Main Unit	8
46 No. Approach Spans	0
107 Deck Struct Type	8 Wood or Timber
108 Wearing Surface	0 None
Membrane	0 None
Dk Protect	0 None
208 Dk Overburden N	Not Applicable

Age and Service

27 Yr Built 2017	106 Yr Reconstructed
42 Type of Service	3 Pedestrian - bicycle - On 5 Waterway - Under
28 Lanes on Structure	1
29 ADT 50 30 Year of ADT	2017
109 Average Daily Truck Traffic	0
19 Bypass, Detour Length	0 Miles

Geometric Data

10 Min Vert Clearance	99 Ft. 12 In.
32 Approach Roadway Width	10 Ft.
33 Bridge Median	0 No median
34 Skew	0.00
35 Structure Flared	0 No flare
47 Total Horizontal Clearance	9.0 Ft.
48 Length of Max Span	10.00 Ft.
49 Structure Length	74.83 Ft.
50 Curb/Sidewalk Widths	0.0 Ft Rt-Side 0.0 Ft Lt-Side
51 Bridge Rdwy Width - Curb to Curb	9.0 Ft.
52 Deck Width	9.9 Ft.
53 Min Vert Clear. Over Bridge	99 Ft. 12 In.
54 Min Vert Underclearance	0 Ft. 0 In. N Feature not hwy or RR
55 Min Lateral UnderClear. - Rt	99.9 Ft. N Feature not hwy or RR
56 Min Lateral UnderClear. - Lt	0.0 Ft.
210 Culvert / 211 Description	

Classification

12 Base Highway Network	Not on Base Network
20 Toll	3 On free road
21 Maint Responsibility	City/Municipal Hwy Agenc
22 Owner	City/Municipal Hwy Agenc
26 Functional	Urban, Local
37 Historical Significance	4 Hist sign not determin
100 Defense Highway Designation	0 Not a STRAHNET hwy
101 Parallel Structure Designation	No ǁ bridge exists
102 Direction of Traffic	0 Highway traffic not carried
103 Temporary Structure Designation	Not Applicable (P)
104 Highway System of Inventory Rte	0 Not on NHS
105 Federal Lands Highways	Not applicable
110 Designated National Network	0 Not part of natl netwo
112 NBIS Bridge Length	Yes

Condition

58 Deck	8 Very Good
59 Superstructure	9 Excellent
60 Substructure	9 Excellent
61 Chan. & Chan. Protection	8 Protected
62 Culvert and Retaining Walls	N N/A (NBI)

Load Rating and Posting

31 Design Load	Pedestrian (live load for which structure was designated)
41 Structure Open, Closed or Posted	A Open, no restriction
63 Operating Rating Method	1 LF Load Factor
64 Oper. Rating H5.4	5.4 Tons
65 Inventory Rating Method	1 LF Load Factor
66 Inv. Rating H4.1	4.1 Tons
70 Bridge Posting	5 At/Above Legal Loads
209 Posted in "Tons"	Tons

Appraisal

67 Structural Condition	9 Above Desirable Crit
68 Deck Geometry	N Not applicable (NBI)
69 Underclear. Vert & Horiz	N Not applicable (NBI)
71 Waterway Adequacy	9 Above Desirable
72 App. Rdwy. Alignment	7 Above Min Criteria
36 Traffic Safety Features	0 N N N
113 Scour Critical	U Unknown Scour

Inspections

90 Date of Last Inspection	May 14, 2020
91 Designated Inspection Frequency	24 Months
92 Critical Feature Inspected / 93 Critical Feature Last Inspection Dt	
Fracture Critical	N
Underwater	N
Other Special	N
218 Channel Profile	N
Chaining Date	None
207 Transporter Erector Routes and Sites	
212 Structure Load Rated	06/19/2020
213 Federal Aid Project Number	
214 Delayed Inspection	Not Applicable
216 Inspector	Rykowsky, Nelson

Navigation Data

38 Navigation Control	Permit Not Required
39 Navigation Vertical Clearance	0.0 Ft.
40 Navigation Horizontal Clearance	0.0 Ft.
111 Pier or Abutment Protection	Unknown (NBI)
116 Minimum Navigation Vertical Clearance	Ft.

Bridge #FOX HILLS GOLF COURSE BRIDGE (SITE 1)

LOCATION: #FOX HILLS GOLF COURSE BRIDGE (SITE 1)

Team Lead: Ryan Rykowsky **Inspection Date:** May 14, 2020

Inspection Comments

Bridge is inventoried from West to East. Substructure units are numbered Abutment 1 (West) and Abutment 2 (East). Girders and piles are numbered North to South.

[05/14/2020] Rough ride at Abutment 1 (West) bridge end transition to concrete approach: Northwest corner - 2in vertical gap from bottom of cover plate to concrete approach surface. Southwest corner - 1/2in vertical gap.

Deck Notes

[05/14/2020] Minor section loss on plank 11ft from East end.

Maintenance Needs

[05/14/2020] Mudjack concrete approaches after settlement has stopped to improve ride at bridge ends.

July 6, 2020

CITY OF WATFORD CITY

Bridge Inventory - Structure Inventory And Appraisal Sheet SEC 409

Structure Number: FOX HILLS GOLF COURSE BRIDGE (SITE 2)

200 System Designation	4 - Urban
201 Status	Not Deficient
202 Sufficiency Rating	N/A
Identification	
02 Highway District	Williston District
03 County	McKenzie
04 City	WATFORD CITY
05 Inventory Route	Route on Structure
8 Other 0 None of 00000	0 N/A (NBI)
06 Feats Intersect	CREEK
09 Location	FOX HILLS GOLF COURSE
11 Milepoint	N/A
13 LRS Inv Route. Subroute	-1 -1
16 Latitude	47d 48' 33.22"
17 Longitude	103d 14' 33.79"
GPS Coordinates XY 2072062.1	17377236.0
98 Border Bridge Not Applicable	0.00%
99 Border Bridge Struct No.	-
Structure Type and Material	
43 Main Struct Type Stringer	Timber
44 Approach Struct Type	Unknown (NBI) Unknown (P)
45 No. Spans in Main Unit	11
46 No. Approach Spans	0
107 Deck Struct Type	8 Wood or Timber
108 Wearing Surface	0 None
Membrane	0 None
Dk Protect	0 None
208 Dk Overburden N	Not Applicable
Age and Service	
27 Yr Built 2017 106 Yr Reconstructed	
42 Type of Service	3 Pedestrian - bicycle - On 5 Waterway - Under
28 Lanes on Structure	1
29 ADT 50 30 Year of ADT	2017
109 Average Daily Truck Traffic	0
19 Bypass, Detour Length	0 Miles
Geometric Data	
10 Min Vert Clearance	99 Ft. 12 In.
32 Approach Roadway Width	10 Ft.
33 Bridge Median	0 No median
34 Skew	0.00
35 Structure Flared	0 No flare
47 Total Horizontal Clearance	9.0 Ft.
48 Length of Max Span	11.50 Ft.
49 Structure Length	110.33 Ft.
50 Curb/Sidewalk Widths	0.0 Ft Rt-Side 0.0 Ft Lt-Side
51 Bridge Rdwy Width - Curb to Curb	9.0 Ft.
52 Deck Width	9.9 Ft.
53 Min Vert Clear. Over Bridge	99 Ft. 12 In.
54 Min Vert Underclearance	0 Ft. 0 In. N Feature not hwy or RR
55 Min Lateral UnderClear. - Rt	99.9 Ft. N Feature not hwy or RR
56 Min Lateral UnderClear. - Lt	0.0 Ft.
210 Culvert / 211 Description	

Classification	
12 Base Highway Network	Not on Base Network
20 Toll	3 On free road
21 Maint Responsibility	City/Municipal Hwy Agenc
22 Owner	City/Municipal Hwy Agenc
26 Functional	Urban, Local
37 Historical Significance	4 Hist sign not determin
100 Defense Highway Designation	0 Not a STRAHNET hwy
101 Parallel Structure Designation	No ǁ bridge exists
102 Direction of Traffic	0 Highway traffic not carried
103 Temporary Structure Designation	Not Applicable (P)
104 Highway System of Inventory Rte	0 Not on NHS
105 Federal Lands Highways	Not applicable
110 Designated National Network	0 Not part of natl netwo
112 NBIS Bridge Length	Yes
Condition	
58 Deck	8 Very Good
59 Superstructure	9 Excellent
60 Substructure	9 Excellent
61 Chan. & Chan. Protection	8 Protected
62 Culvert and Retaining Walls	N N/A (NBI)
Load Rating and Posting	
31 Design Load	Pedestrian (live load for which structure was designated)
41 Structure Open, Closed or Posted	A Open, no restriction
63 Operating Rating Method	1 LF Load Factor
64 Oper. Rating H5.4	5.4 Tons
65 Inventory Rating Method	1 LF Load Factor
66 Inv. Rating H4.1	4.1 Tons
70 Bridge Posting	5 At/Above Legal Loads
209 Posted in "Tons"	Tons
Appraisal	
67 Structural Condition	9 Above Desirable Crit
68 Deck Geometry	N Not applicable (NBI)
69 Underclear. Vert & Horiz	N Not applicable (NBI)
71 Waterway Adequacy	9 Above Desirable
72 App. Rdwy. Alignment	7 Above Min Criteria
36 Traffic Safety Features	0 N N N
113 Scour Critical	U Unknown Scour
Inspections	
90 Date of Last Inspection	May 14, 2020
91 Designated Inspection Frequency	24 Months
92 Critical Feature Inspected / 93 Critical Feature Last Inspection Dt	
Fracture Critical	N
Underwater	N
Other Special	N
218 Channel Profile	N
Chaining Date	None
207 Transporter Erector Routes and Sites	
212 Structure Load Rated	06/19/2020
213 Federal Aid Project Number	
214 Delayed Inspection	Not Applicable
216 Inspector	Rykowsky, Nelson
Navigation Data	
38 Navigation Control	Permit Not Required
39 Navigation Vertical Clearance	0.0 Ft.
40 Navigation Horizontal Clearance	0.0 Ft.
111 Pier or Abutment Protection	Unknown (NBI)
116 Minimum Navigation Vertical Clearance	Ft.

Bridge #FOX HILLS GOLF COURSE BRIDGE (SITE 2)

LOCATION: #FOX HILLS GOLF COURSE BRIDGE (SITE 2)

Team Lead: Ryan Rykowsky **Inspection Date:** May 14, 2020

Inspection Comments
Bridge alignment is on a North 38deg azimuth. For simplicity, the Southwest Abutment will be referred to as Abutment 1 (West) and the Northeast Abutment will be referred to as Abutment 2 (East). Bridge is inventoried from West to East. Substructure units are numbered Abutment 1 (West) and Abutment 2 (East). Girders and piles are numbered North to South.

[05/14/2020] Rough ride at Abutment 1 (West) bridge end transition to concrete approach with 1in vertical gap from bottom of cover plate to concrete approach surface. South side of bridge, 3rd rail segment from the East is slightly out of alignment.

Maintenance Needs
[05/14/2020] Mudjack concrete approaches after settlement has stopped to improve ride at bridge ends.

Produced By:

Burian & Associates, LLC

In Conjunction With:

SRF Consulting Group

ICON Architectural Group

Raftelis