CITY OF CORCORAN

# Council Work Session Agenda
## February 11, 2021 - 5:30 pm

**Meeting Held Via Telephone/Other Electronic Means Call-in Instructions**

**Call**: +1 312 626 6799 US
**Enter Meeting ID:** 859 6218 2203 Press *9 to speak during the Public Comment Sections in the meeting.

**Video Link and Instructions:**
https://us02web.zoom.us/j/85962182203 visit http://www.zoom.us and enter
**Meeting ID:** 859 6218 2203

Participants can utilize the Raise Hand function to be recognized to speak during the Public Comment sections in the meeting. Participant video feeds will be muted.

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www.corcoranmn.gov

1. **Call to Order / Roll Call**
2. **Northeast Water Supply Planning***
3. **Unscheduled Items**
4. **Adjournment**

Due to the COVID-19 health pandemic, the City Council's regular meeting place is not available and is not open to the public. Pursuant to Minnesota Statute 13D.021 the one or more members of the City Council may participate by telephone or other electronic means.

***Includes Materials -** *Materials relating to these agenda items can be found in the house agenda packet book located by the Council Chambers entrance, or online at the City's website at www.corcoranmn.gov.*

# Technical Memo

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**To:** Kevin Mattson, PE, Public Works Director

**From:** Kent Torve, PE, City Engineer
Steve Hegland, PE

**Date:** February 5, 2021

**Subject:** NE Water Supply Work Session Summary

## 0.0 Purpose

The purpose of this memorandum is to provide a summary of work to date on establishing a water supply, treatment and distribution system in the NE portion of Corcoran. This memo frames the major topics for the presentation and subsequent discussion during the February 11th Council Work Session.

## 1.0 Background

The City of Corcoran has planned for sewer and water for urbanized development in accordance with the Metropolitan Council's planning process. The 2040 Comprehensive Plan for the Metropolitan Urban Service Area (MUSA) shows trunk facilities, routes, and sewer capacities on a city-wide basis which allows Met Council to plan for regional expansions along while managing growth rate and limitations on the system. The cities are responsible for planning of water infrastructure support, although Met Council is increasing their review efforts in this arena. As shown in the 2040 Comprehensive Plan (Attachment A), the Northeast portion of Corcoran is within the MUSA and is intended to be serviced via a proposed public water network.

### Regional

A joint (Quad City) study was funded by Met Council to look at the feasibility of a surface water supply (Mississippi River) for the four cities. Corcoran participated in the panel reviewing this study and Council directed staff to stay involved with the discussions. Corcoran is a later phase of the project, however the project would deliver treated water to the Corcoran/Rogers border after the treatment plant and infrastructure were constructed. A presentation was made by staff at the April 23, 2020 Council meeting.

### Regulatory

Water supply oversight from regional (Met Council) and State (Department of Natural Resources (DNR) and Minnesota Department of Health (MDH)) agencies has seen an increase in the past few years due to high profile surface water impacts in the east/northeast metro along with evolving public health concerns. The establishment of any water supply network within the Twin Cities will continue to be a heavily regulated process through these agencies.

## 2.0 Water Supply Agreement

The establishment of a water supply system for a community can be challenging. The timing and costs of creating a groundwater supply, identifying property, and constructing a distribution system are financially challenging for the "start-up" period. Individual developments can provide smaller wells and a pressure tank for household or small community use, but these are insufficient for fire flows and are temporary. Corcoran opted to work with Maple Grove, to gain access to a trunk water system and the communities negotiated an agreement in which Maple Grove would supply the Corcoran MUSA area adjacent to the two cities boundaries. A 30-year contract was formalized on December 4, 2012 that allowed for 5 million gallons a day (MGD) peak flow, which is 1.75 MGD average flow. A Residential Equivalent Unit (REU) was used to estimate the commercial portion of the total flows. The contract identifies 6,334 REUs for the 1.75/5.0 MGD supply.

## 3.0 Corcoran Areas

Water supply was initially started in SE Corcoran for the Ravinia development and the existing Downtown properties. As NE Corcoran developed a connection was made north of CSAH 30 along CR 101 to serve the Bellwether development. The original water contract was amended but limited the NE Corcoran connection to the Bellwether development at that time. The remainder of the original contract REUs would be fulfilled through SE Corcoran as development continued. Attachment B shows the updated infrastructure (June 2020) for the NE area.

## 4.0 Northeast Water Supply Investigation

As noted previously, the NE Maple Grove connection was contractually limited to the Bellwether development, however regional growth and I-94 improvements/interchange have increased development pressure and interest in the area. Therefore, the City initiated water supply planning for Northeast Corcoran and authorized Wenck to begin putting together a feasibility study on establishing a water supply system in NE Corcoran. A Draft copy of the feasibility study is also distributed for the Workshop. This process was paused last fall to ensure that the current Council review and set the timeline for improvements to the system.

The planning was initiated with more detailed information (Attachment B) for facilities, groundwater and infrastructure. Financial work included cost analysis for the Trunk Line Area Charge (TLAC), which was updated in 2020. This analysis reviewed the NE infrastructure needs, buildable acres and provided the TLAC per acre charge in the current fee schedule. The costs and buildable acres vary from NE to SE, therefore the TLAC fees are representative of those geographical separations. The implementation of this charge allows Corcoran to establish a viable method to fund the establishment of this system.

Water supply exploration began in a bedrock aquifer known to have adequate supply in the region. Property access was obtained and a test well (June 2020) was drilled. The production and water quality results were sufficient in order to identify the parcel as a location for Municipal Well No. 1, which is along CSAH 116 and Hunter Drive. Water storage volume is driven initially by fireflow requirements and can be accomplished in two ways, either an underground storage "tank" or a more common water tower. Both methods are utilized in the area and examples can be provided upon request. At this time an overhead tower is being studied. Two figures from the Draft Feasibility study are given in Attachment C, which also relate to the recent VanBlaricom concept submittal.

## 5.0 Current Status

The current status of NE Water Supply planning and investigation can be summarized as follows:

- A contractual limitation currently applies to Bellwether, which could be amended.
- Financial planning (TLAC) is in place for both a NE and SE Corcoran system.

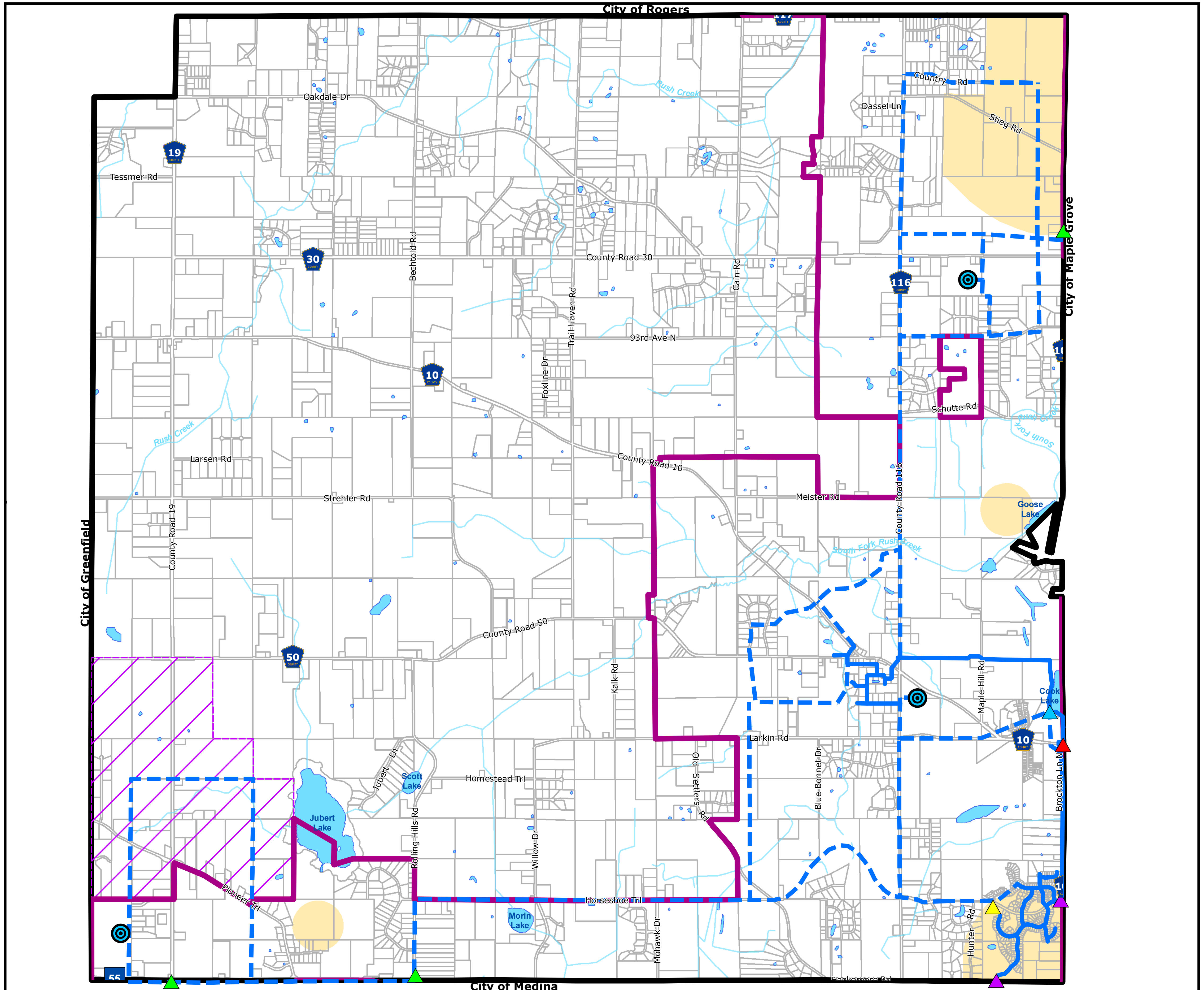
- A Draft Feasibility Study is complete.
- Pulte has provided a concept plan for continuing the Bellwether development on the VanBlaricom property.
- Other properties in NE Corcoran are receiving development interest. This is expected to continue based on the current economy and regional transportation (I94) scheduled improvements.
- A time frame for startup of a NE system is approximately 1.5 to 2 years based on 6 months of design, 12 months of construction and some contingency for property acquisition, startup, etc.
- Regulatory agencies are aware of Corcoran supply development to date.

## 6.0 Next Steps

The project is feasible from the technical and engineering perspective and as development continues a timeline will be important for land use acquisition, trunk system installation and supply and treatment planning. Therefore, the next steps include:

- Complete the acquisition on well and treatment plant site.
- Complete the Draft Feasibility Study.
- Update financial analysis.
- Discuss timeline to initiate construction of Municipal Well No. 1.
- Site the water tower and initiate tower site investigations
- Finalize trunk infrastructure loops, and easement needs
- Begin preliminary design for the 18-24 month process to supply water.

# Attachment A




# CITY OF CORCORAN

## 2040 COMPREHENSIVE PLAN

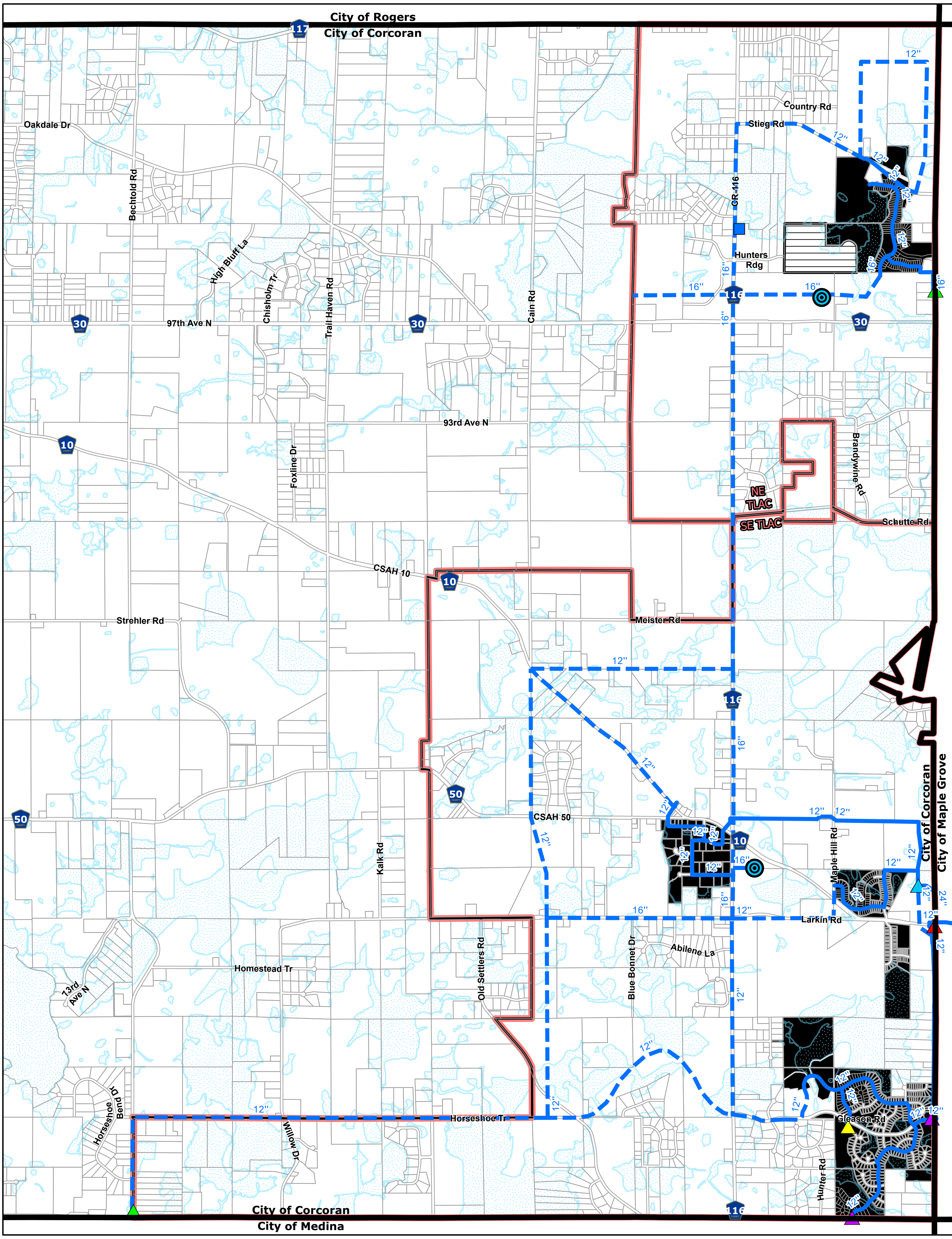
Map 9-2
Trunk Water System

- Existing Watermain
- Proposed Watermain
- Potential Water Tower Locations
- Existing Supply Connection with Neighboring Communities
- Proposed Supply Connection with Neighboring Communities
- Emergency Connection with Neighboring Communities (Normally Closed)
- Potential Water Storage
- Potential Booster Station
- Potential Future Well Exploration Areas
- Municipal Boundary
- 2040 MUSA
- Future MUSA Expansion Area
- Parcel Boundaries
- Streams
- Lake/Open Water

3,000 1,500 0 3,000
Feet
N

Path: L:\2294\100\2040CompPlan\Trunk Water System.mxd
Date: 1/15/2019 Time: 1:36:40 PM User: ShuJC0243

# Attachment B




## Legend

- Municipal Boundary
- Water TLAC Boundary
- Parcel Boundaries
- Existing Watermain
- Proposed Watermain
- Potential Water Tower Locations
- Well/Water Treatment Plant
- Potential Supply Connections with Neighboring Comm
- Existing Supply Connections with Neighboring Comm
- Emergency Supply Connections with Neighboring Comm
- Potential Booster Station
- Potential Water Storage
- Wetlands
- Bellweather Exception
- Recently Developed/ Platted (Removed from Analysis)

2,600 1,300 0 2,600 Feet

N

Path: L:\2294\Pro\TLAC\TLAC\TLAC.aprx
6/3/2020 10:53 AM shuic0243 Layout: Trunk Water System

CITY OF CORCORAN

Trunk Water System

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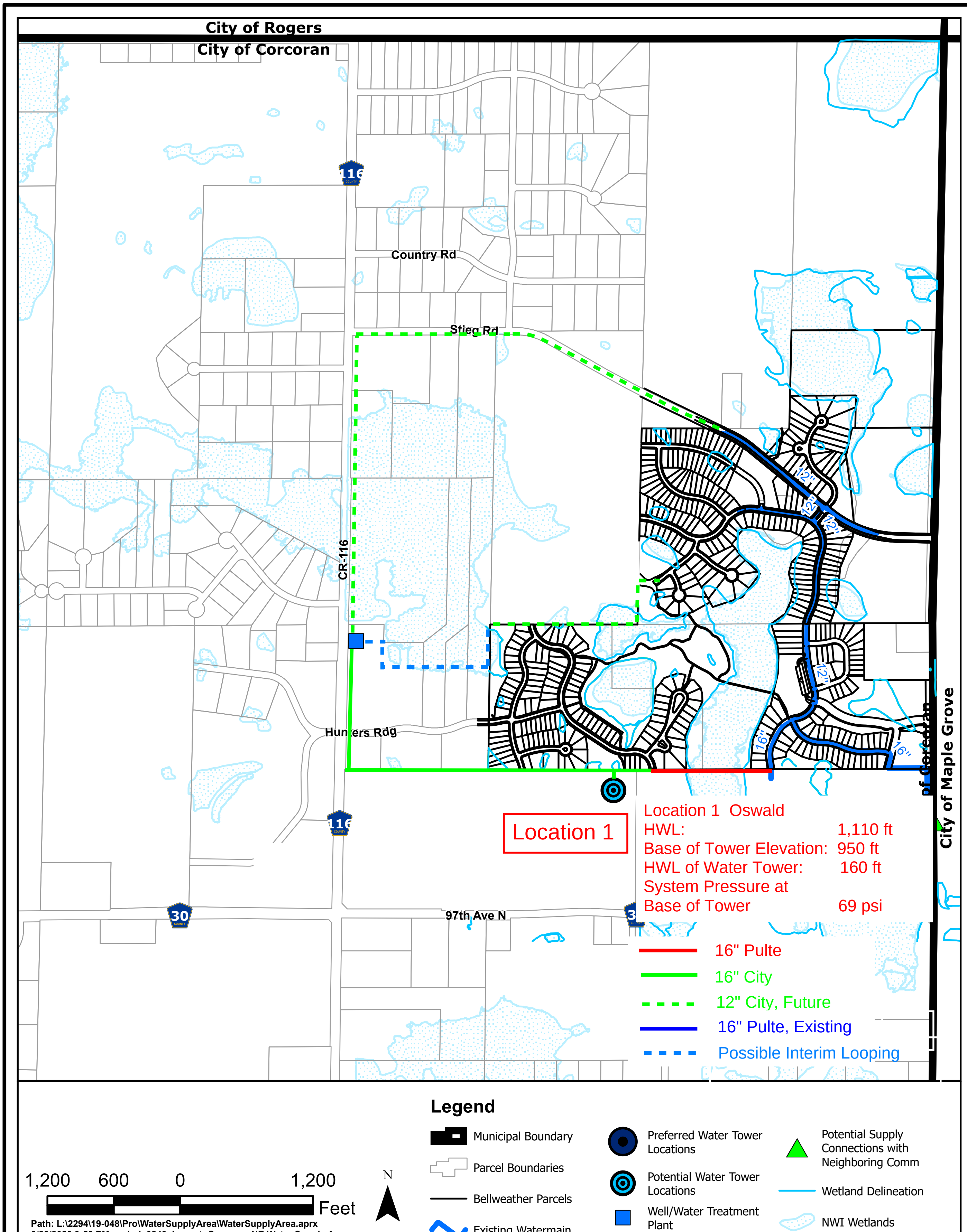
Figure 1

# Attachment C

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Corcoran NE Water Supply Area

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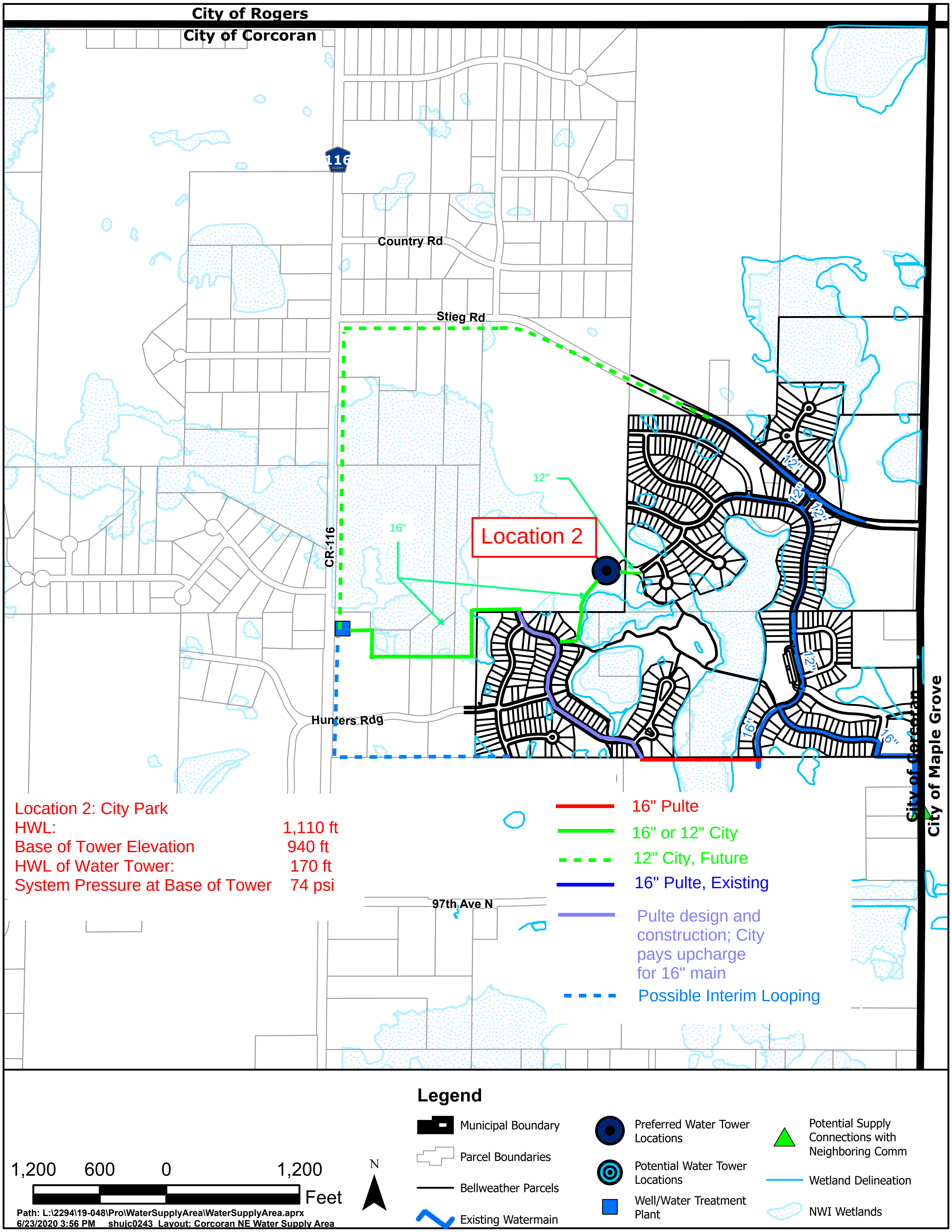
Figure 5-1a

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Corcoran NE Water Supply Area

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Figure 5-1b

WENCK File #2294-0048
November 2020

# 2020 Northeast Water System Feasibility Study



*Prepared for:*

City of Corcoran

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Corcoran
MN 55340

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*Prepared by:*

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Phone: 763-479-4200
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**TABLES**



**FIGURES**



**ATTACHMENTS**

# Executive Summary

Corcoran is a developing community in the northwest portion of Hennepin County. Drinking water for existing homes in this area is obtained through private wells and new development within the Municipal Utility Service Area (MUSA) is connected to Maple Grove. An amendment to Corcoran's water service contract with Maple Grove limiting northeast supply to the Bellwether development triggered the need for development and design of a Corcoran municipal water supply system.

This Water Supply Feasibility Study for NE Corcoran, as defined by the area from east of CR 116 to west of CR 101 and from north of CR 30 to south of CR 117, was performed to investigate water system demand, investigate water sources, evaluate treatment and storage system options, and costs. The key findings and recommendations are:

<u>Water Demand</u>
Water demand currently observed in NE Corcoran and the future projected community development was used to establish the near-term and long-term water demand through a 20-year planning period. Near-term water demand was projected for the completion of Bellwether development. Long-term water demand was projected for full build-out of the NE Quadrant. At buildout of the NE Quadrant, a system size of 800 gpm is justified.

> Recommendation - The proposed Corcoran water supply system should be designed to provide 250 gpm initially and expand to 1,000 gpm as development in the area progresses. This is equivalent to 0.36 million gallons per day (MGD) to 1.44 MGD.

<u>Water Source</u>
NE Corcoran is well-positioned to obtain groundwater as source of the water supply system. A test well exploration suggested a pumping capacity of at least 400 gpm can be achieved. Water quality analysis indicated the groundwater meets all the primary (health risk) drinking water standards, but exceeds a few of the secondary (taste, color, odor) drinking water standards. Test results indicate relatively high iron concentration, moderate manganese concentration, a small concentration of ammonia and high hardness.

> Recommendation - The proposed location for a municipal production well is favorable for obtaining the required water flow rate and water quality.

<u>Treatment Methods</u>
The primary outcome of a proposed water treatment system for NE Corcoran will be reducing the iron and manganese concentration present in the raw water. Sequestration, filtration, and softening options were evaluated. Preliminary sizing, concept layout, and staging plan for the water treatment system was analyzed in this report.

> Recommendations:
> A water treatment plant with pressure filters is recommended. The treatment plant will be able to provide to 500 gpm on Day 1, with the capability to expand to 1,000 gpm through a 30-year planning period. The plant site will have the capacity for further expansions. The recommended treatment process includes:
> - Horizontal pressure filters

- Pre-chlorination upstream of the filters
- Fluoride addition
- Chlorine disinfection
- Backwash water recovery returned to the head of the plant

Water Tower

Water storage and system pressure will be provided via an elevated water tower. The water tower will hold 750,000 gallons to provide a conservative storage volume while maintaining regular mixing of water within the tower for good water quality. The tower will be constructed on higher ground in the NE service area to minimize vertical construction cost and to ensure all connections are served from the tower without the need for booster pumps.

Recommendation - The recommended tower configurations are single pedestal style or composite style tower for aesthetic and maintenance advantages.

Cost and Schedule

It is recommended that the City budget $7,500,000 to $8,000,000 for the NE Quadrant water supply and distribution system construction. The cost includes construction of the production well, raw watermain, water treatment plant, watermain from plant to water tower, water tower, and engineering and administrative fees. Overall, this cost estimate is similar to the previous number provided for financial planning. The costs are itemized as follows:

| | |
|---|---:|
| Municipal Well | $350,000 |
| Water Treatment Plant | $2,700,000 |
| Watermain Extension from WTP to Tower | $800,000 |
| Water Tower | $3,000,000 |
| *Engineering, Legal, and Admin | $1,100,000 |
| Total | $7,950,000 |

Recommendations for Schedule:

- Municipal production well: Allow at least six months for, bidding and construction/testing. The design is currently 90% completed via the test well and permitting process.
- Water Treatment Plant: Allow six months to one year for design and permitting and one year for construction and startup activities. The water treatment plant would be operational in the fall of 2022 based on a January 2021 design kickoff.
- Water Tower: It is necessary to allow nine months for design and approximately one year for construction. Coordinate completion of the water tower with startup of the water treatment plant.

# 2.0 WATER DEMAND

Drinking water systems are designed to provide a community with high quality, safe water at all times, including during an extreme event such as a fire. A drinking water system includes the water source, treatment, storage and distribution. This section discusses future water demand predicted from community growth forecasts and historical water demand data. Future water demand projections are used to guide sizing of the new system. The water system will be designed to allow future expansion as the community grows.

## 2.1 WATER DEMAND PROJECTIONS

Previous planning for drinking water supply to the northeast quadrant of Corcoran (west of CR 116 and north of CR 30) established the near-term and long-term water demand through a 20-year planning period, based on available buildable acres and typical water demand per acre per land use type (in reference to Corcoran 2020 Comprehensive Plan). The proposed water system is necessary because water demand from development beyond Bellwether cannot be fulfilled by the existing water supply agreement with Maple Grove. Some developments could install private wells until the municipal supply is available (i.e. Nelson Trucking). However, this redundancy is not always financially feasible. Long-term water demand was projected for full build-out of NE Corcoran. Table 2-1 summarizes the water demand projections. The water system will be designed to provide 250 gpm initially and expand to 1,000 gpm as development in the area progresses.

**Table 2-1. NE Corcoran Water Demand Projections**

| Water Demand | Average (gpm*) | Peak Day (gpm) |
|---|---|---|
| Near-term (Bellwether) | 50 | 250** |
| Long-term (full build-out) | 333 | 800*** |

*Gallons per minute
** Small systems use a higher peak factor of 5.0
*** Long-term maximum day demand sets the design flow for the water supply and treatment systems.

For more details on development of these water demand projections, refer to the NE Water Supply FS Update prepared by Wenck (July 3, 2019).

# 3.0 WATER SOURCE INVESTIGATION

The July 2020 Test Well memo summarized that Corcoran is well positioned to obtain groundwater for its municipal water supply system. A 440 ft deep, 6" diameter test well (Unique Well Number: 840775) was constructed near the proposed municipal production well location. The well log (See Attachment A) confirms that the test well extends to the Tunnel City-Wonewoc (formerly known as the Franconia-Ironton-Galesville (FIG)) aquifer. Pumping tests confirmed that a production well in this location is likely to yield approximately 400 gpm or more. Water quality samples were collected from the test well to assist in selecting treatment techniques and equipment sizes.

## 3.1 TEST PUMPING

Two types of pumping tests (a step-drawdown test and a constant rate test) were performed on the test well to estimate the anticipated flow rate of the proposed municipal production well. The purpose of a step-drawdown test is to determine well performance characteristics such as water level drop as pumping rate increases. The step test incrementally increased the pumping rate from the well, beginning at 150 gpm and ending at 275 gpm over 5 hours. The static water level of this test well is 28 ft from top of casing. The change of water level in the well was recorded throughout the step pumping test (Figure 3-1). Each time the pumping rate was increased, the water level in the well decreased steeply and then leveled off, as expected.

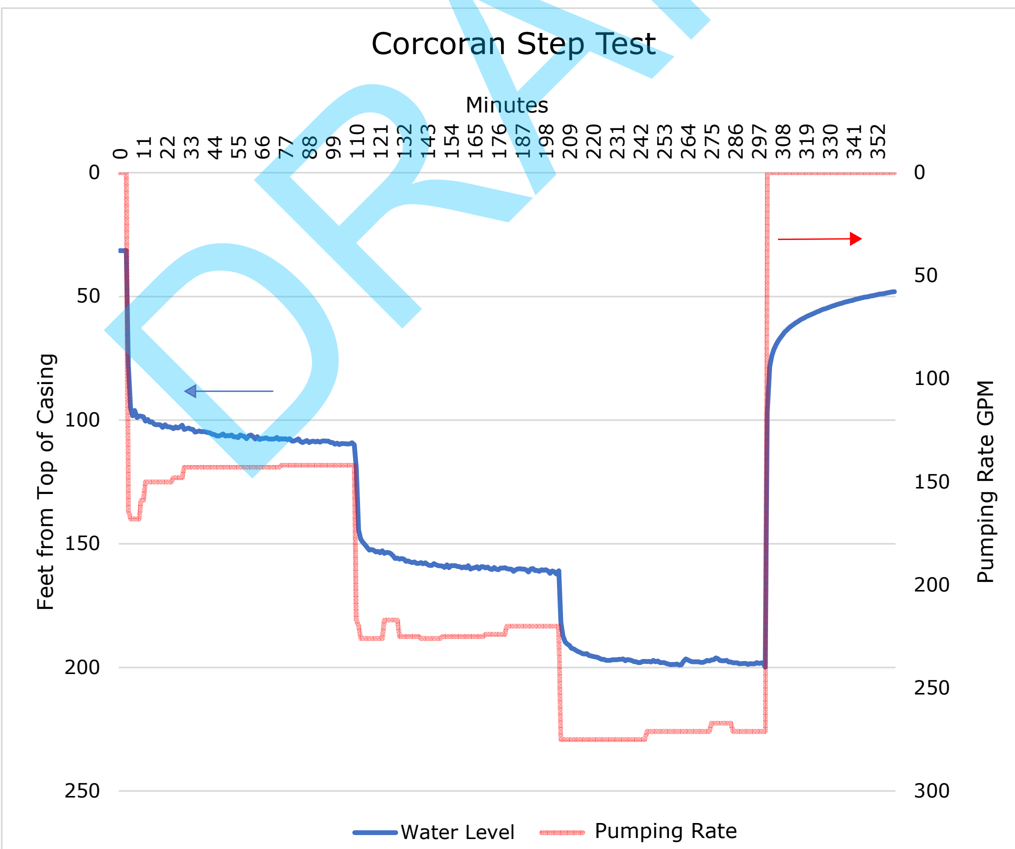



Figure 3-1 Water Level During Step-Drawdown Test

The second type of pumping test was a constant-rate test at approximately 250 gpm for 24 hours (Figure 3-2). The water level in the well was measure for the extent of the pumping period. After the pump was stopped the water level recovery was monitored for the next 24 hours.

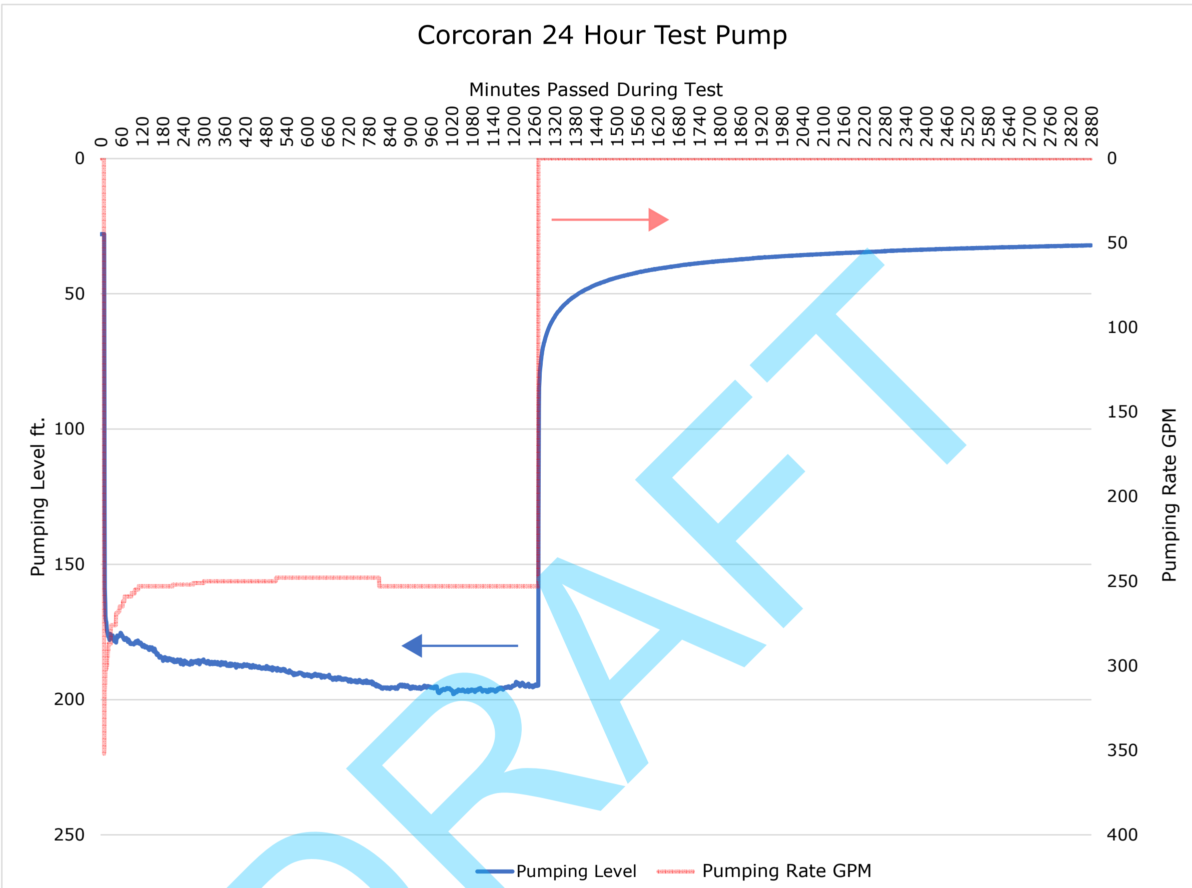



Figure 3-2 Water Level During Constant Rate Test

The soil and rock samples collected during development of the test well suggest that the Tunnel City-Wonewoc aquifer was present at the expected thickness and depth below the ground surface. These were analyzed by EH Renner and Sons well drilling company, Wenck geologist, and Minnesota Geological Society. The results of the test well pumping tests indicate that it is reasonable to expect Tunnel City-Wonewoc aquifer can provide the required supply of water, and a larger-diameter production well installed near the test well should meet the target production well capacity of at least 400 gpm. Production wells in this aquifer in surrounding communities typically produce 400 gpm or above.

## 3.2 WETLAND WATER LEVEL TESTING

As requested by the MN Department of Natural Resources (DNR), a wetland in the vicinity of the test well was monitored during pumping tests and for several days between pumping test runs. Figure 3-3 shows the observed water surface elevation during the two pumping tests. There was no evidence of the wetland water level significantly dropping due to test well pumping. The pump testing results suggest that the local wetland surface water levels are unlikely to be affected due to municipal well pumping. The DNR will require similar monitoring during the future pump testing that will be conducted on the proposed municipal well, which will be conducted at a higher pumping rate and for a longer time period (72-hour).

### 3.3 RAW WELL WATER QUALITY

Water samples were taken during the step pumping test and analyzed by Minnesota Valley Testing Laboratory (MVTL) for the parameters regulated by the EPA primary and secondary drinking water standards, as well as unregulated parameters such as hardness. The analysis indicated the well water meets all the primary (health risk) standards, but exceeds a few of the secondary standards, which are not health-based; rather, they are based on potential aesthetic concerns such as taste, color, odor, etc. Additional sampling was completed a few weeks later to confirm a few results from the first tests were anomalies. As is typical for this region, the results indicate relatively high iron concentration, moderate manganese concentration, a small concentration of ammonia and high hardness.

The concentrations of iron, manganese and ammonia detected in the raw water are not a health risk or design complication for treatment. Instead, iron and manganese contribute to poor taste and color at the tap if that raw water is not treated. Ammonia combines with chlorine disinfectant ions, requiring the facility to add more chlorine to maintain the required chlorine concentration in the distribution system.

**Table 3-1 Water Quality Parameters**

| Constituent | Concentration in test well (mg/L) | Secondary (aesthetic) Drinking Water Standard (EPA) (mg/L) | Concentration found in nearby municipal wells (TC-W aquifer) |
|---|---|---|---|
| Iron (Fe) | 1.7 | 0.3 | Loretto: 1.4 mg/L<br>Rogers: 1.3 – 1.6 mg/L<br>Dayton: 1 – 1.4 mg/L |
| Manganese (Mn) | 0.03 | 0.05 | Loretto: 0.05 mg/L<br>Dayton: 0.2 mg/L |
| Ammonia ($NH_3$) | 0.4 | N/A | No data available |

Water hardness is a common descriptor for the concentration of calcium and magnesium compounds dissolved in the water. Water with high hardness leaves mineral scale on plumbing fixtures and is generally less desirable for aesthetics. Groundwater in the Corcoran region is typically classified as “hard” or “very hard”. The test well water hardness is shown in the following table along with the water hardness scale.

**Table 3-2 Corcoran Water Hardness and Standard Hardness Scale***

| Water Type | Hardness | Hardness |
|---|---|---|
| | mg/L as $CaCO_3$ | grains/gallon |
| Corcoran Test Well | 326 | 19.1 |
| Soft | 0 - 60 | 0 – 3.5 |
| Moderately Hard | 60 – 120 | 3.5 – 7 |
| Hard | 120 - 180 | 7 – 10.5 |
| Very Hard | More than 180 | More than 10.5 |

*Water hardness scale adapted from Minnesota Pollution Control Agency webpage: www.pca.state.mn.us/skinny-water-softners

Two lab reports for the first and second samplings are provided in Attachment B. The full water quality data is summarized in Attachment C.

The implications of the water quality data are:

- No substances were detected that are problematic for commonly used water treatment methods.
- The test well water quality is similar to other wells in the Tunnel City-Wonewoc aquifer in this area.
- High iron (and possibly manganese if concentrations increase slightly) will cause aesthetic (taste, odor, and color) issues if no treatment is provided, but the concentrations are not a health concern.
- Ammonia, although natural and low concentration, may increase the amount of chlorine needed to maintain regulatory residual of chlorine in the distribution system.
- Water customers will still need to install home water softeners unless the water is softened at a municipal water treatment plant.

### 3.4 CONCLUSIONS FROM TEST WELL, COST, AND SCHEDULE

It is recommended that future municipal production well is drilled near the proposed location. The well is anticipated to be operational in December 2021. Since it takes about five months from advertising a municipal well for bid to finishing installation, testing and sampling. Design and regulatory review of the municipal well can normally be completed in about four months; however, this time period will be reduced because Wenck already obtained the initial permitting reviews from the DNR and MDH. Permit reviews were sought to ensure that the proposed well location/aquifer were acceptable prior to the City's investment in a test well. Therefore, it is recommended the City allow at least six to eight months for finalizing well design, bidding, and construction/testing of the municipal well. The estimated cost for construction of the municipal production well is approximately $275,000 to $ 300,000.

# 4.0 WATER TREATMENT OPTIONS

A water treatment system for NE Corcoran will reduce the iron and manganese concentrations present in the source water that would cause undesirable taste, odor and color in the water provided to customers. A more complex water treatment system could soften the water by removing much of the calcium and magnesium compounds. Fluoride will be added as required by the EPA to prevent tooth decay. Chlorine will also be added to prevent growth of pathogenic organisms in the distribution system. The proposed water treatment plant would be constructed within the same City-owned parcel as the proposed municipal well.

The breadth of water treatment options available to Corcoran are described in this section. This section also addresses sizing of the treatment plant based on the demand projections and source water quality data.

## 4.1 TREATMENT PLANT CAPACITY

As noted previously, the demand values show that at buildout of the NE Quadrant, a system size of 1,000 gpm is justified. The treatment capacity will be achieved by designing a system with two separate and similar 500 gpm treatment trains, with one being delayed and provided at the later phase when additional capacity is necessary.

## 4.2 TREATMENT PROCESSES

Treatment objectives for the proposed water treatment system are driven by EPA's National Drinking Water Standards and aesthetic concerns. Table 4-1 summarizes water quality constituents identified in the source water analysis that should be addressed by treatment, as well as optional approaches for removing the hardness in a treatment plant.

**Table 4-1 Treatment Techniques**

| Constituents | Approaches for Treatment |
|---|---|
| Iron and manganese (Low concentration) | Sequestration |
| Iron and manganese (High concentration) | Chlorination or aeration to oxidize metals, then filtration to remove |
| Ammonia | Chlorination |
| Pathogenic microorganisms (Coliforms) | Chlorination for disinfection |
| Hardness | Precipitation, ion exchange, or nanofiltration/reverse osmosis (NF/RO) |

### 4.2.1 Sequester Iron and Manganese

A common method of controlling iron and manganese oxidation and subsequent rusty or black deposits on water fixtures is to add polyphosphates upstream of any other chemical addition. The phosphate compounds combine with the metal ions, making them unavailable for reacting with oxygen and chlorine later in the treatment process.

Sequestration is typically recommended as a treatment option for raw water with less than 0.5 mg/L of iron. Ten States Standards, a commonly used engineering resource, state that sequestration by polyphosphates should not be used when the iron concentration exceeds 1 mg/L. The iron concentration in the water pumped from the proposed production well in

Corcoran is expected to have 1.7 mg/L of iron. Therefore, polyphosphate sequestration of iron and manganese is not a recommended treatment option for Corcoran's water system.

### 4.2.2 Filtration

The media-based filtration systems are available to Corcoran include horizontal pressure filters, gravity filters, and biological filters. Filter media can be granular activated carbon (GAC), silica sand or greensand. Greensand is sand coated in manganese oxide to enhance iron and manganese removal. Each system was assumed to have a single-unit treatment flow rate of 500 gpm and a filter loading rate of 3 gpm/ft$^2$, with the option to add a second unit for treatment of up to 1,000 gpm at the same 3 gpm/ft$^2$ filter loading rate.

<u>Horizontal Pressure Filter</u>

Pressure filters are horizontal pressure vessels containing the filter media layers, underdrain and backwash trough inside the vessel (see Figure 4-1). Pressure is applied to the system by the well pump to push water through the filter media. Chlorine is added upstream of the pressure filter to oxidize iron and manganese, forming particles that can be filtered out of the water. In-line aeration is occasionally used to enhance the particle formation. A horizontal pressure filter vessel can be divided into multiple independent filter cells so that one or more cells can be depressurized and removed from service while the remaining cells operate.

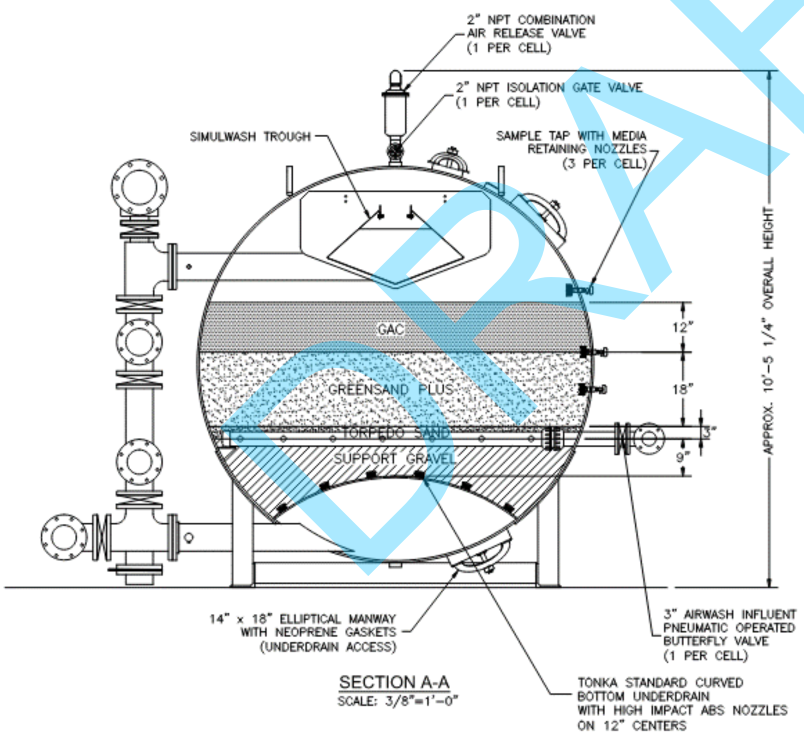



**Figure 4-1 Horizontal Pressure Filter Section View (courtesy of Tonka Water, filter media shown is not specific to Corcoran)**

Horizontal pressure filters have minor pressure drop across the filter media (less than 10 psi). This allows for a system in which the well pump can be sized to supply additional pressure to move water through the pressure filters and onward to elevated storage. The system eliminates the need for a clear well and a second high service pump system to pump finished water to the tower.

**Table 4-2 Pressure Filter Design Information**

| | |
|---|---|
| Footprint (per unit) | 8' diameter X 23' length |
| Treatment capacity (per unit) | 500 gpm, 3 gpm/$ft^2$ loading rate |
| Number of units | Initial construction: 1<br>NE quadrant build-out: 2<br>Expansion beyond NE quadrant: Add'l units can be added in parallel |
| Equipment cost, first unit | $350,000-$400,000 |
| Equipment cost, additional units | $300,000 each |
| Advantages | • No clear well or high service pumps required<br>• Filter cells within vessel operate independently, allowing one to backwash while others continue filtration<br>• Minimal operator supervision required<br>• Allows for filter media to be upgraded to greensand (silica sand is less expensive) |
| Disadvantages | • Does not remove hardness<br>• Filter media and internal equipment are not easily accessible |

Gravity Filter

Gravity filters are not pressurized. Water trickles through the filter bed by gravity instead of being pushed through the media under pressure. For Corcoran's water system, the water would be pumped from the well and aerated to allow formation of iron and manganese particles before flowing into the gravity filter. Filtered water would be collected in a clear well and pumped to the distribution system. A packaged gravity filter (Figure 4-2) combines aeration and gravity filtration into one unit. Gravity filters allow easier access to the filter media and components than pressure filtration and enable direct observation of the filtration and backwash process. However, gravity filters require one additional pumping step to lift the finished water to elevated storage.

**Table 4-3 Gravity Filter Information**

| | |
|---|---|
| Footprint (per unit) | 8' wide X 21' length X 12'-6" height |
| Treatment capacity (per unit) | 500 gpm, 3 gpm/$ft^2$ loading rate |
| Number of units | Initial construction: 1<br>NE quadrant build-out: 2<br>Expansion beyond NE quadrant: Add'l units can be added in parallel |
| Equipment cost, first unit | $375,000-$400,000 |
| Equipment cost, additional units | $350,000 each |
| Advantages | • Easy access to filter media and internal filter components<br>• Minimal operator supervision required<br>• Allows for filter media to be upgraded to Greensand |
| Disadvantages | • Does not remove hardness<br>• Clear well and high service pumps required<br>• Filter cells within unit operate are hydraulically connected, and entire unit must be removed from service during backwash |

**Figure 4-2 Gravity Filter (courtesy of Tonka Water)**

<u>Biological Filter</u>

Biological filtration is a third option for water treatment in Corcoran. The process involves a series of pressure or gravity filters designed to enhance growth of aerobic bacteria on the filter media. The bacteria remove ammonia by converting it to nitrite and nitrate. Enhancing the biological activity in filtration is a relatively new technique for water treatment, and the water community's understanding of the process is still developing. It is typically used when the ammonia concentration in raw water is high enough that maintaining the desired chlorine residual in the distribution system becomes difficult.

Base on the ammonia concentration in Corcoran's test well (0.45 mg/L) and the chemical stoichiometry, additional chlorine demand for Corcoran will be approximately 4.5 to 5.4 mg/L, to maintain a minimum free chlorine residual of 0.2- 0.5 mg/L. Chlorine gas is currently inexpensive, and increasing chlorine addition will be more economical and have less complexity than installing, operating, and maintaining a biological treatment module. Therefore, the biological filter option will not be pursued for Corcoran's system.

### 4.2.3 Softening

Hardness in the proposed source water is 326 mg/L as $CaCO_3$. For this hardness level, the City's options for in-plant softening are lime softening, ion exchange or nanofiltration membrane treatment. Discussions below are based on 500 gpm treatment capacity.

Lime Softening

Lime softening is accomplished by adding sufficient lime ($Ca(OH)_2$) to elevate the water pH above 10.3, at which point calcium hardness will precipitate as $CaCO_3$. Magnesium hardness can be removed by addition of soda ash ($Na_2CO_3$) and elevation of water pH to 11. Iron and manganese will co-precipitate with the calcium and magnesium compounds. The precipitated material is collected, dewatered and land applied, when possible, or disposed at a landfill. The softened water is filtered before additional chemicals are added.

Lime softening requires purchase and storage of lime, large settling basins, recarbonation (pH adjustment) basin and lime softening residuals collection, dewatering and disposal systems. Due to the complexity of the treatment process, lime softening is typically used in facilities that are much larger than Corcoran's proposed water treatment plant and was not considered further for Corcoran.

Ion Exchange

Calcium and magnesium compounds can be removed through a centralized ion exchange process. Similar to a home water softener, calcium and magnesium ions in the raw water replace sodium ions on an ion exchange media. The calcium and magnesium ions remain attached to the media until it is recharged with a salt solution.

For Corcoran, softening would be accomplished with three 6-ft diameter ion exchange vessels. With one vessel out of service, two vessels would treat approximately 347 gpm of raw water at a loading rate of 6.1 gpm/ft$^2$. The softened water would be combined with 153 gpm of bypass (unsoftened) water to provide 500 gpm of water at a blended hardness of approximately 100 mg/L of $CaCO_3$. This process does not remove iron or manganese. A separate oxidation and filtration process would be required upstream of the ion exchange process.

**Table 4-4 Ion Exchange Information**

| | |
|---|---|
| Footprint (per unit) | 6' diameter X 6' height |
| Treatment capacity (per unit) | 500 gpm (347 gpm raw water + 153 gpm bypass),<br>6.1 gpm/ft$^2$ loading rate |
| Number of 3-vessel systems: | Initial construction: 1<br>NE quadrant build-out: 2<br>Expansion beyond NE quadrant: Add'l units can be added in parallel |
| Equipment cost, initial installation | \$450,000-\$500,000 |
| Additional equipment cost, for full build-out | \$450,000-\$500,000 per 3-vessel system |
| Advantages | • Generates less sludge volume than lime softening<br>• Modular system can be added downstream of an iron and manganese removal filter system |
| Disadvantages | • Does not effectively remove iron or manganese, and pre-treatment for these constituents is needed<br>• Produces a high-chloride waste stream<br>• Larger footprint than membrane system |

Nanofiltration Membrane
Membrane filtration can be used to remove hardness compounds. Nanofiltration (NF) membranes have a pore size of 0.1 - 10 nm and allow some single-valent ions (like chloride) to pass through. A membrane system for Corcoran would consist of one 8-ft X 4-ft array membrane skid. Iron and manganese can cause membrane fouling, so a granular media filter, like the pressure filters described previously, should be installed upstream of the NF membranes. A portion of the NF membrane influent is used to carry away the material that cannot pass through the filter. Assuming 75% of the NF membrane influent passes through the membrane to become softened water, 380 gpm of membrane influent is needed to produce 285 gpm of cleaned, softened water (permeate). The permeate will be combined with 120 gpm of unsoftened (bypass) water to produce 405 gpm of clean, blended water with approximately 100 mg/L hardness as $CaCO_3$. The membrane system will require a separate clean-in-place system and several chemical systems to maintain the membranes.

**Table 4-5 Nanofiltration Information**

| | |
|---|---|
| Footprint (per skid) | 8' wide X 4' length X 6' height |
| Treatment capacity (per skid) | 500 gpm input, 405 gpm output (285 permeate + 120 gpm bypass) |
| Number of skids | Initial construction: 1<br>NE quadrant build-out: 2<br>Expansion beyond NE quadrant: Add'l skids can be added in parallel |
| Equipment cost, initial installation | $450,000 - $500,000 |
| Additional equipment cost, for full build-out | $450,000 - $500,000 each skid |
| Advantages | • Membrane waste does not contain high chloride concentrations<br>• Modular system can be added downstream of an iron and manganese removal filter system<br>• Smaller footprint than the ion exchange softening system |
| Disadvantages | • Iron and manganese need to be removed prior to membrane filtration to prevent fouling<br>• A separate clean-in-place skid and chemical feed systems for sodium bisulfite, anti-scalant and pH adjustment are required<br>• Generates 6 times more wastewater than ion exchange (however, it does not contain the high chlorides). |

#### 4.2.3.1 Softening Conclusion

The water softening options tend to be much more complex than the media-based filter options. They also cost more than the filter options and will involve more in-depth maintenance programs. For ion exchange and nanofiltration, pretreatment for iron and manganese is required, essentially creating the need to run two complete water treatment systems in a single plant. Water customers who want softened water can opt to install an in-home water softener. For these reasons, in-plant water softening is not recommended for Corcoran at this time.

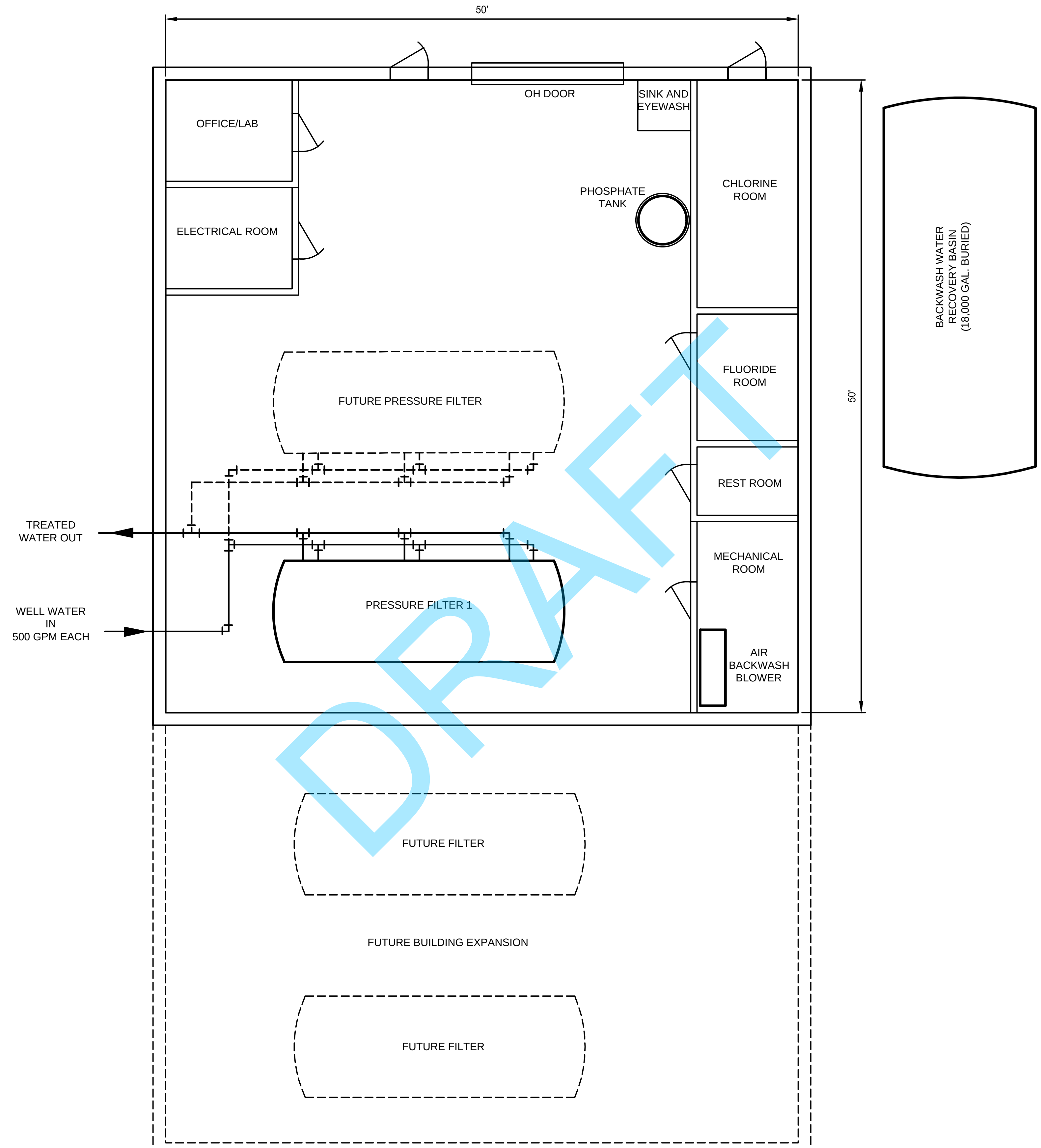
### 4.2.4 Treatment Recommendation

The treatment objectives of the proposed Corcoran Water Treatment Plant are:

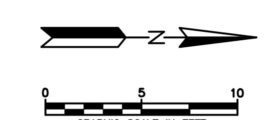
- Consistent production of drinking water that meets all EPA National Drinking Water Standards with good taste and aesthetics
- Simple operation
- Expandable
- Economical

The pressure and gravity filter options are typical for city water treatment systems, simple to operate, expandable and economical. The pressure filters offer the advantage of being able to backwash one filter cell while filtration continues in the other cell. The pressure filter system does not require an additional pumping step to move the finished water to the distribution system. This provides a small cost savings at initial construction and lower power and maintenance costs over time. For these reasons, the recommended filter for the treatment process is the horizontal pressure filter.

A complete water treatment process with horizontal pressure filters will include pre-chlorination upstream of the filters, filtration, fluoride addition and chlorine disinfection. A backwash water recovery basin can be added to return most of the backwash water to the head of the plant rather than wasting all of it to the sanitary sewer. Chlorine and fluoride systems will be installed within individual chemical rooms. An electrical equipment room and restroom will also be included. Figure 4-3 illustrates the conceptual layout the Corcoran water treatment plant.



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CLIENT:
CITY OF CORCORAN
8200 COUNTY ROAD 116
CORCORAN , MN 55340

# CITY OF CORCORAN NORTHEAST WATER SUPPLY

8200 COUNTY ROAD 116
CORCORAN, MN 55340

CERTIFICATION:
NOT FOR CONSTRUCTION

| | |
|---|---|
| PROJECT NO.: | 2294-0048 |
| DWN BY: JVB | CHK'D BY: JMB / APP'D BY: JMB |
| ISSUE DATE: | 08/12/2020 |
| ISSUE NO.: | 1 |

SHEET TITLE:
EXAMPLE FILTRATION PLANT FLOOR PLAN

FIGURE 4-3

M:\2294\0048 - NE Water Supply\3_DESIGN\CAD\2 EXHIBITS\Figure 1 Water Supply Schematic.dwg
10/5/2020 8:34:17 AM

The proposed plant layout is based on 1,000 gpm treatment capacity, with space to expand the plant to the east to add additional vessels. The proposed site plan for the water treatment plant, test well and production well is shown in Figure 4-4.

## WARNING:

THE CONTRACTOR SHALL BE RESPONSIBLE FOR CALLING FOR LOCATIONS OF ALL EXISTING UTILITIES. THEY SHALL COOPERATE WITH ALL UTILITY COMPANIES IN MAINTAINING THEIR SERVICE AND/OR RELOCATION OF LINES.

THE CONTRACTOR SHALL CONTACT GOPHER STATE ONE CALL AT 651-454-0002 AT LEAST 48 HOURS IN ADVANCE FOR THE LOCATIONS OF ALL UNDERGROUND WIRES, CABLES, CONDUITS, PIPES, MANHOLES, VALVES OR OTHER BURIED STRUCTURES BEFORE DIGGING. THE CONTRACTOR SHALL REPAIR OR REPLACE THE ABOVE WHEN DAMAGED DURING CONSTRUCTION AT NO COST TO THE OWNER.

CALL BEFORE YOU DIG

GOPHER STATE ONE CALL

TWIN CITY AREA: 651-454-0002
TOLL FREE 1-800-252-1166

## SITE LEGEND

FUTURE CITY PROPERTY (PURCHASE IN PROGRESS)

9XX EXISTING CONTOUR

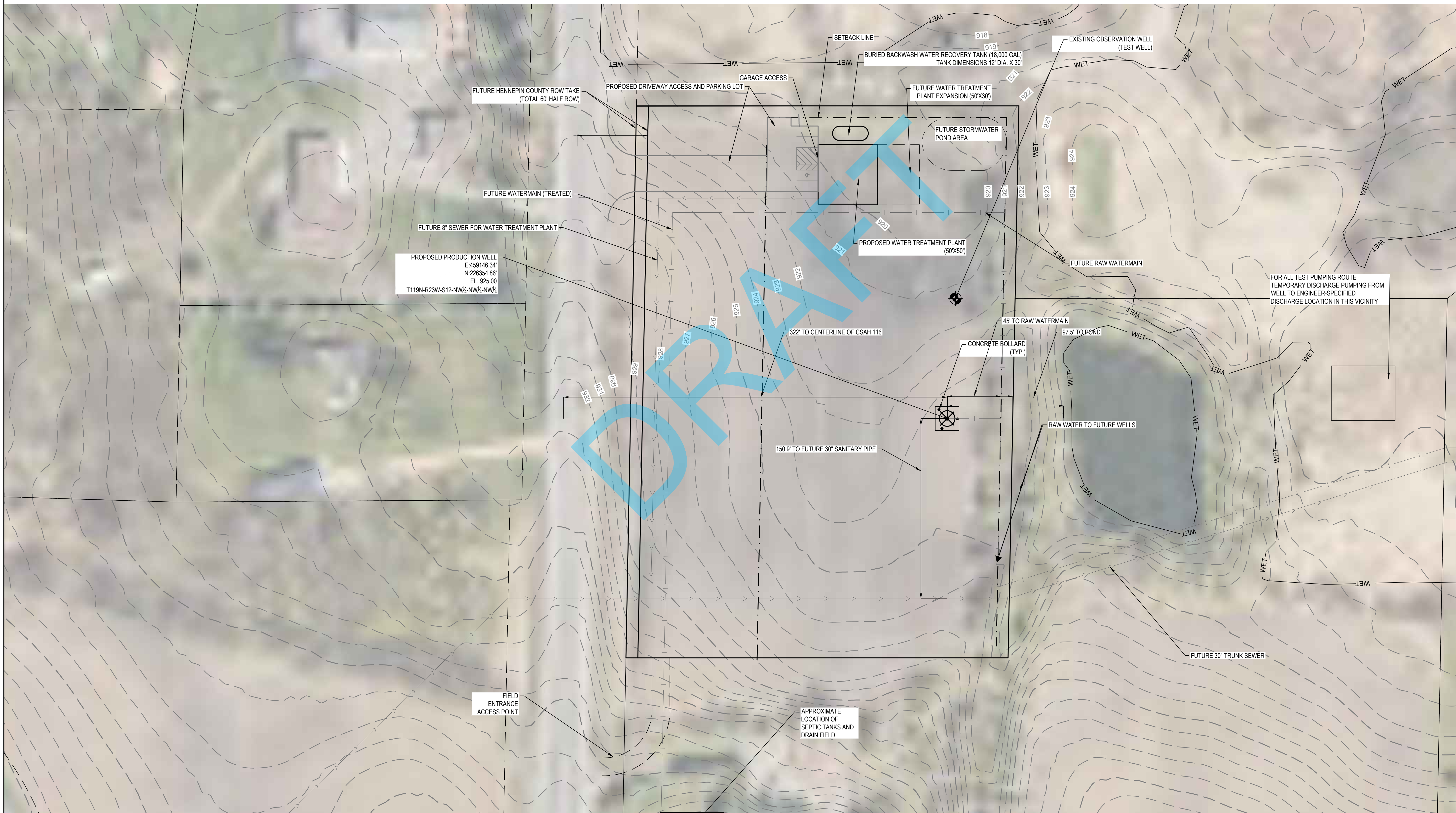
PROPERTY LINE

## HORIZONTAL/VERTICAL CONTROL NOTES

1. THE HORIZONTAL CONTROL FOR THIS PLAN IS NAD83(2011) HENNEPIN COUNTY COORDINATES SYSTEM US FOOT
2. THE VERTICAL CONTROL FOR THIS PLAN IS NAVD88

N

0 40 80
GRAPHIC SCALE IN FEET

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CLIENT:

CITY OF CORCORAN
8200 COUNTY ROAD 116
CORCORAN , MN 55340

CITY OF CORCORAN NORTHEAST WATER SUPPLY
8200 COUNTY ROAD 116
CORCORAN, MN 55340

CERTIFICATION:

NOT FOR CONSTRUCTION

| | |
|---|---|
| PROJECT NO.: | 2294-0048 |
| DWN BY: JVB | CHK'D BY: JMB / APP'D BY: JMB |
| ISSUE DATE: | 08/12/2020 |
| ISSUE NO.: | 1 |

SHEET TITLE:
SITE IMPROVEMENTS PLAN

SHEET NO.:
FIGURE 4-4

## 4.3 CONCEPTUAL TREATMENT COST

For water treatment plant construction, it is recommended that the City budget $2,700,000. Engineering, legal and administrative costs are estimated to be $400,000, or roughly 15% of the construction cost. For operation and maintenance activities, it is recommended to budget $200,000 per year for the initial treatment capacity. Annual O&M cost is subject to future treatment capacity expansion. The detailed conceptual cost estimate is presented in Section 6.2.

## 4.4 SCHEDULE

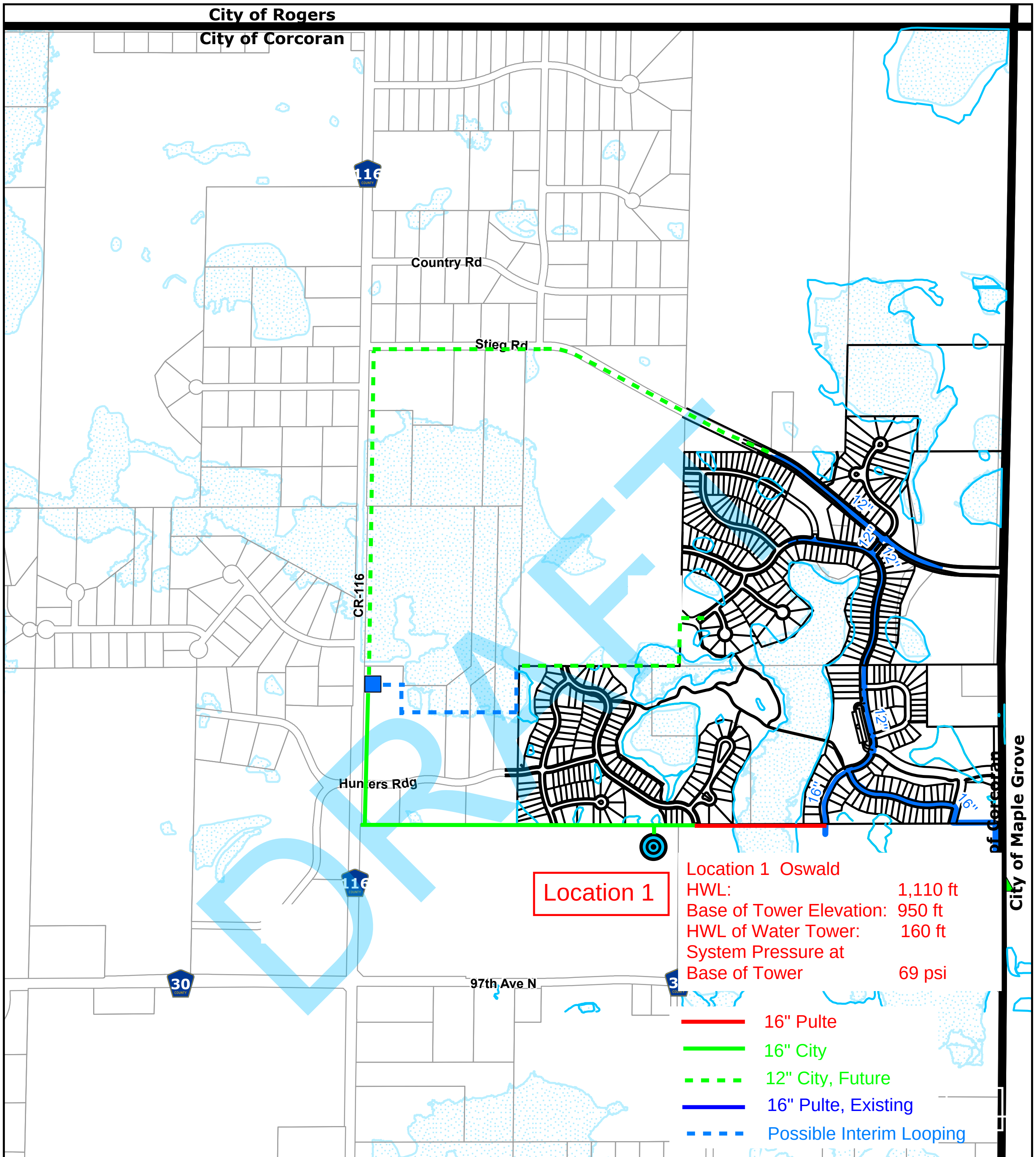
The water treatment plant would be operational in 2022/2023 based on January 2021 design start. The design and permitting period for a water treatment plant of this size typically lasts about 1 year, followed by another year for construction and startup activities.

# 5.0 WATER STORAGE

As documented in the NE Water Supply FS Update (July 2019), the minimum water storage volume for the NE Quadrant system is 650,000 gallons, which is based on fire flow requirements when municipal demand is low, such as in Corcoran. Because 650,000 gallon is not a standard water tower size, the recommended standard size of the elevated water tower is 750,000 gallons to provide additional storage volume. The tower will be constructed on higher ground of the NE service area to minimize vertical construction cost and to ensure all connections are served from the tower without the need for booster pumps. This section discussed site alternatives and tower configuration options.

## 5.1 WATER TOWER SITE ALTERNATIVES

Two general locations have been discussed as potentially favorable for construction of a water tower. Selection of the two water tower locations was based on topography and reasonable proximity to the proposed water treatment plant location. The two potential locations and proposed trunk systems are shown on Figure 5-1.




## Legend

- Municipal Boundary
- Parcel Boundaries
- Bellweather Parcels
- Existing Watermain
- Preferred Water Tower Locations
- Potential Water Tower Locations
- Well/Water Treatment Plant
- Potential Supply Connections with Neighboring Comm
- Wetland Delineation
- NWI Wetlands

1,200 600 0 1,200 Feet

N

Path: L:\2294\19-048\Pro\WaterSupplyArea\WaterSupplyArea.aprx
6/23/2020 3:56 PM shujc0243 Layout: Corcoran NE Water Supply Area

CITY OF CORCORAN

Corcoran NE Water Supply Area

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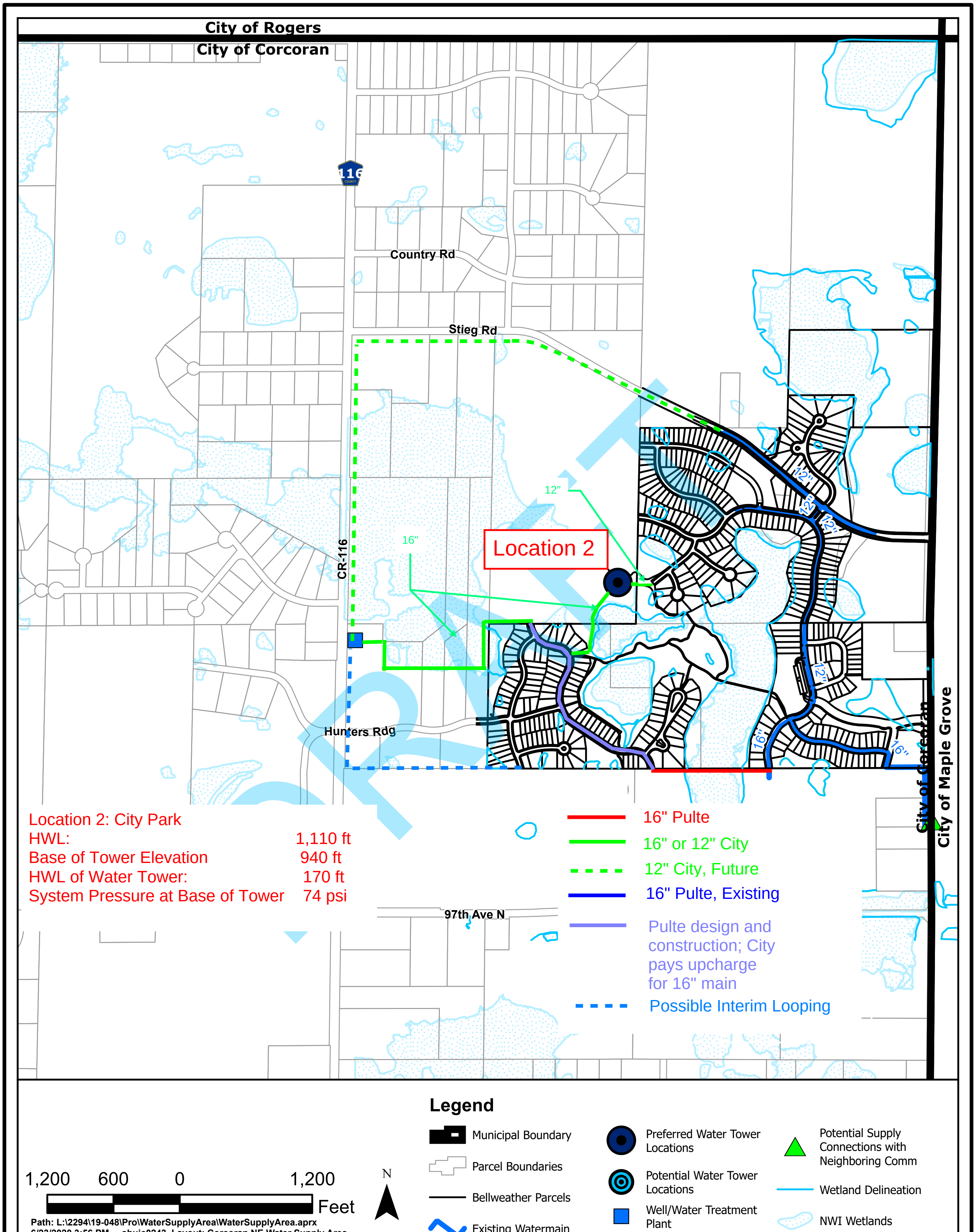
Figure 5-1a




CITY OF CORCORAN

Corcoran NE Water Supply Area

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JUN 2020

Figure 5-1b

Location 1 (Oswald) is southeast of the WTP (CR 116) and Location 2 (City Park) is east of the WTP. Location 2, being park land, will be City-owned. Location 1 (Oswald), which is not currently under development, will require land acquisition. Table 5-1 summarizes comparisons of the two sites.

**Table 5-1 Details of Proposed Water Tower Locations**

| | Base of Tower Elev. | HWL of Water Tower | System Pressure | Approximate Watermain Extension* | Considerations |
|---|---|---|---|---|---|
| | ft. | ft. | psi | ft. | |
| Location 1 (Oswald) | 950 | 160 | 69 | 3,800 | Land must be purchased for this location |
| Location 2 (City Park) | 940 | 170 | 74 | 3,000 | Location requires upsizing a watermain in Bellwether, as shown in Figure 5-1<br><br>Lower site elevation requires a 10-foot taller tower |

*Proposed trunk watermain from WTP to water tower

The soil conditions at the proposed water tower locations are not currently known. Geotechnical borings should be completed at each location before the preferred site is selected. Geotechnical analysis can verify whether any extensive site improvements are needed to support the tower.

## 5.2 WATER TOWER CONFIGURATION OPTIONS

Water tower configurations for a 750,000-gallon water tower include composite, single pedestal, and multi-column configurations. A multi-column tower is not recommended for Corcoran because:

- Multi-column towers are often recommended when good seismic performance is needed, but Minnesota is not recognized seismic zone.
- Cost, material, and labor for reconditioning of multi-column tower is high compared to other tower configurations.
- Aesthetically, multi-column towers appear less modern; Corcoran's tower will be near new housing developments.

It is recommended that the City consider a composite or a single pedestal tower configuration. The features of the two configurations are:

**Figure 5-2 Composite Water Tower (courtesy of KLM Engineering)**

<u>Composite</u>

- Concrete pedestal, steel bowl (see Figure 5-2)
- Strong support for water tower higher than 150 ft
- Storage area at bottom of tower
- Dripping ring around bowl to prevent mold on lower portion of bowl

- Minor maintenance to concrete
- Higher cost on construction

**Figure 5-3 Single Pedestal Water Tower (courtesy of KLM Engineering)**

Single pedestal

- Steel pedestal and bowl (see Figure 5-3)
- Smooth transition and symmetrical
- Smaller footprint at tower bottom
- Prone to condensation and mold growth on bottom half
- Cost for reconditioning is typically more than composite because all interior needs coating

## 5.3 CONCEPTUAL COST

For tower construction, it is recommended that the City budget $2,500,000 to $3,000,000. The construction cost will vary with different tower configurations, additional site-specific items and costs associated with watermain extension. Major maintenance includes tower cleaning and repainting, expected to occur every 15 years at a cost of approximately $300,000 for a full recondition. A conceptual construction cost estimate is presented in Section 6.0.

## 5.4 SCHEDULE

For a 750,000-gallon water tower, a six-month to nine-month period for design and approximately 1-year construction period should be anticipated. In order to coordinate startup of the water treatment plant and with completion of the water tower. Section 6.4 discusses a preliminary schedule.

# 6.0 CONCEPTUAL COSTS & SCHEDULE

## 6.1 CONSTRUCTION COST ESTIMATES FOR MUNICIPAL PRODUCTION WELL

| Description | Cost |
|---|---|
| Construction* | $ 275,000-$300,000 |
| Contingency (15% of Construction) | $ 41,250-$45,000 |
| Total Construction Cost | $ 320,000-$350,000 |

*Includes mobilization, contractor overhead, site work, utilities, well drilling, development, testing and logging

Detailed cost estimate is attached as Attachment D.

## 6.2 COST ESTIMATES FOR WATER TREATMENT PLANT USING HORIZONTAL PRESSURE FILTER

| Description | Cost |
|---|---|
| Construction* | $ 2,300,000 |
| Contingency (15% of construction) | $ 350,000 |
| Total Construction Cost | $ 2,700,000 |
| Total Annual OM&R** | $ 200,000 |

*Includes mobilization, contractor overhead, site work, utilities, architectural, structural, process, mechanical, electrical and controls. Engineering, legal and admin fees will add $400,000 to the total cost.
**The budget is for the initial treatment capacity. Annual O&M cost is subject to future treatment capacity expansion.

Detailed cost estimate is attached as Attachment E.

## 6.3 CONSTRUCTION COST ESTIMATES FOR WATERMAIN EXTENSION FROM WTP TO WATER TOWER SITE

| Description | Location 1 (Oswald) | Location 2 (City Park) |
|---|---|---|
| Watermain Extension in undeveloped area-16” | $ 690,000 | $ 520,000 |
| Watermain Extension in undeveloped area-12” | - | $ 23,000 |
| Upsizing Watermain in New Development-8” to 16” | - | $ 51,000 |

| Description | Location 1 (Oswald) | Location 2 (City Park) |
|---|---|---|
| Contingency | $ 110,100 | $ 89,000 |
| Total | $ 800,000 | $ 700,000 |

*Land and easement acquisition cost will be added to the cost analysis when the information is available

Detailed cost estimate is attached as Attachment F.

## 6.4 CONSTRUCTION COST ESTIMATES FOR WATER TOWER

| | 160' Tower (Location 1, Oswald) | | 170' Tower (Location 2, City Park) | |
|---|---|---|---|---|
| Description | Low Estimate | High Estimate | Low Estimate | High Estimate |
| Construction* | $2,600,000 | $3,000,000 | $2,800,000 | $3,000,000 |

*Includes site work, site utilities, foundation improvement, control and electrical improvement, and contingency (15% of construction).
**Land and easement acquisition cost will be added to the cost analysis when the information is available

Detailed cost estimate is attached as Attachment G.

## 6.5 BUDGET RECOMMENDATION

It is recommended that the City budget $ 7,500,000 to $8,000,000 for the NE Quadrant water supply and distribution system construction and engineering, legal and administrative fees. The construction budget on the high-end breakdown is shown below.

| | |
|---|---|
| Municipal Well | $350,000 |
| Water Treatment Plant | $2,700,000 |
| Watermain Extension from WTP to Tower | $800,000 |
| Water Tower | $3,000,000 |
| *Engineering, Legal, and Admin | $1,100,000 |
| Total | $7,950,000 |

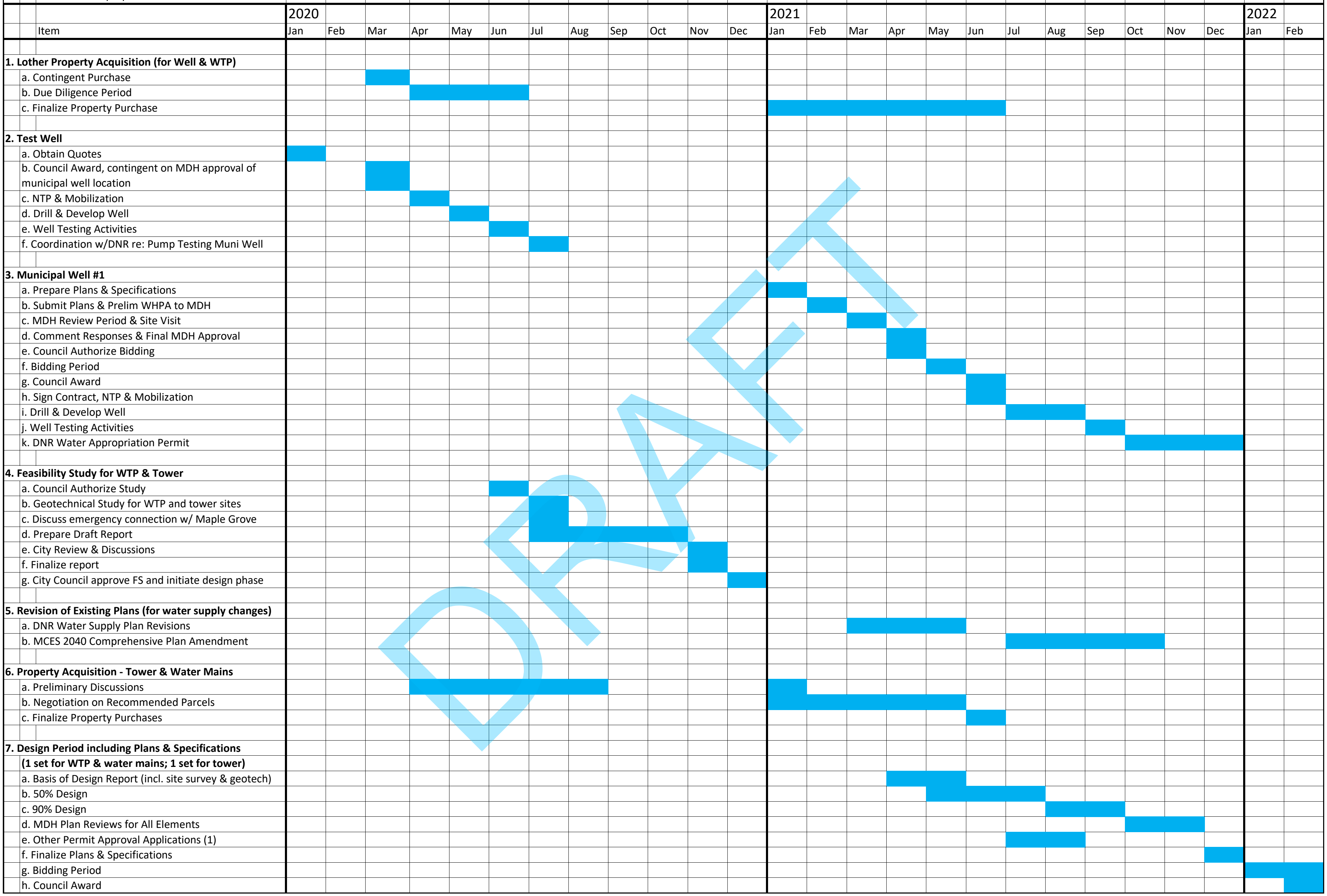
*15% of total capital cost

## 6.6 SCHEDULE FOR CRITICAL DECISIONS

The following schedule was developed to help the City to identify the major components of the project and critical decision-making milestones.

# NORTHEAST WATER SUPPLY

Revised on: 11/09/20



**NORTHEAST WATER SUPPLY**

Revised on: 10/30/20

| | 2022 | | | | | | | | | | | | 2023 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Item | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| **8. Construction - WTP, Tower, & Water Mains** | | | | | | | | | | | | | | | | | | | | | | | | |
| a. Sign Contract, NTP & Mobilization | | | | | | | | | | | | | | | | | | | | | | | | |
| b. Construction | | | | | | | | | | | | | | | | | | | | | | | | |
| c. Start-Up | | | | | | | | | | | | | | | | | | | | | | | | |
| **9. Wellhead Protection Plan (MDH)** | | | | | | | | | | | | | | | | | | | | | | | | |
| a. Start of 4-Year Process | | | | | | | | | | | | | | | | | | | | | | | | |
| **10. Sanitary Sewer Extension (30")** | | | | | | | | | | | | | | | | | | | | | | | | |
| *(Details TBD - Need to be in service by WTP start-up)* | | | | | | | | | | | | | | | | | | | | | | | | |
| **11. Preliminary work for Well #2** | | | | | | | | | | | | | | | | | | | | | | | | |
| *(Planning should begin in 2021)* | | | | | | | | | | | | | | | | | | | | | | | | |
| **Notes** | | | | | | | | | | | | | | | | | | | | | | | | |
| (1) Permit applications include: wetlands, Department of Labor and Industry, building, county/utility ROW and MnDOT/FAA for tower | | | | | | | | | | | | | | | | | | | | | | | | |

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