CHAPTER 7: WATER SUPPLY

WATER SUPPLY INTRODUCTION

The goal of the water supply plan is to address the current and future water supply needs for Credit River. With the increasing population and a shift towards urban development, a community water supply will become more important to maintain a safe drinking water source for the residents of Credit River.

Increases in population, available undeveloped land, and expanding adjacent suburban communities indicate a shift from primarily rural development towards more urban development. Due to increasing population, development will need to be more dense placing increasing strain on aquifers potentially causing supply and environmental issues. With increased density a community water distribution system becomes more economical. Increases in development as well as environmental concerns drive a need for an effective water supply.

The first goal of the water supply plan is to plan for implementation of a feasible, affordable and effective water supply system that benefits the members of the community. This plan should minimize excess and unnecessary costs of public systems, evaluate the options to implement a water supply system, and promote a continuous future water supply through water conservation and efficient system operation.

The second goal is to maintain the safety and effectiveness of the existing water system. Working with the Metropolitan Council, Minnesota Department of Health, Minnesota Department of Natural Resources, and Scott County, will ensure individual and community water supplies are meeting regulations.

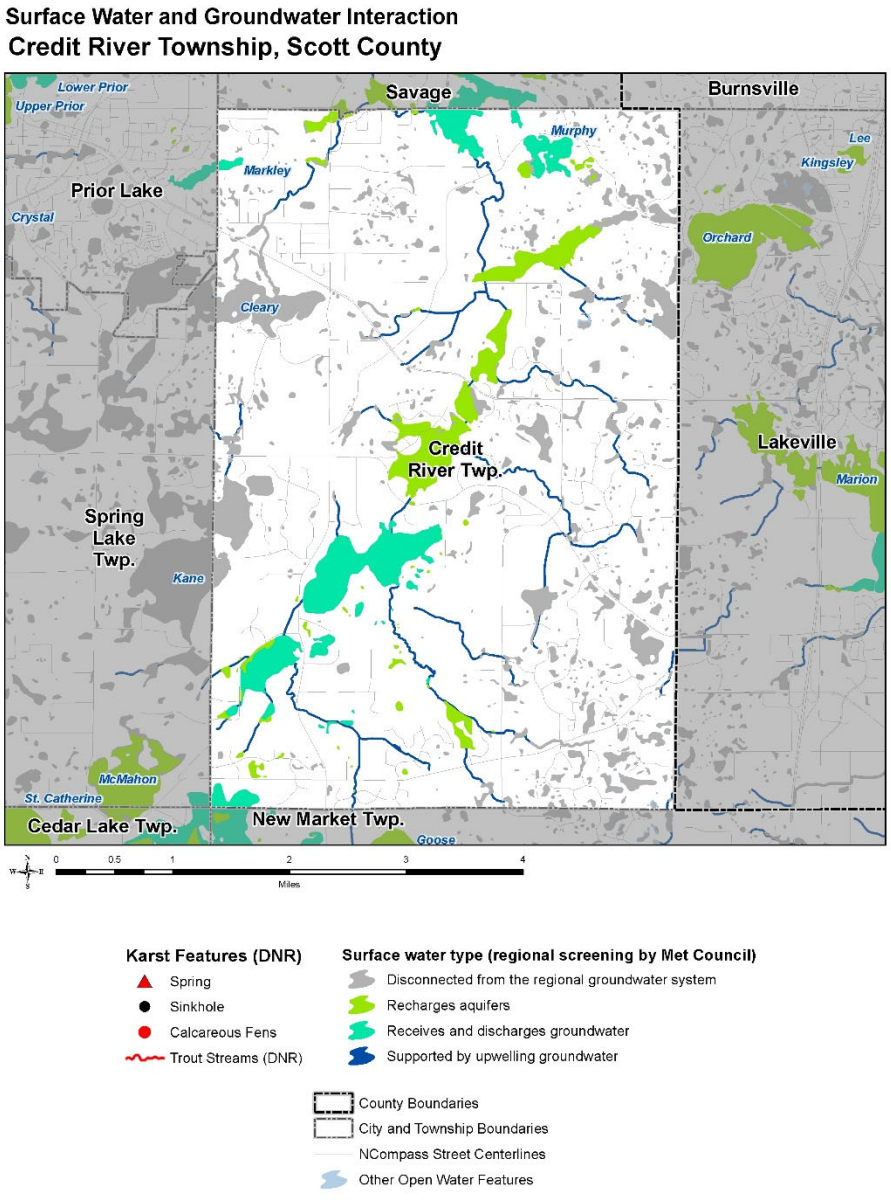
Existing Conditions

Credit River is boarded by the City of Savage to the north, the City of Lakeville to the east, New Market Township to the south, and to the west the City of Prior Lake and Spring Lake Township. The current plan is for development of services in the municipal supply area. The municipal supply area comprises of the low pressure zone and the high pressure zone as shown in Figure 7-5. County Road 21 corridor is the approximate boundary between the north and south section of town.

Credit River residents currently rely on private mostly individual wells for their supply of safe drinking water. These wells are constructed and maintained under regulations from The

Minnesota Department of Health. To monitor water quality Scott County Environmental Health Department provides water analysis and if necessary inspects contaminated wells. Credit River currently does not operate ground water level monitoring or aquifer testing. The ground water aquifers are recharged by infiltration of surface water. Figure 7-1 shows the interaction of surface water and ground water within Credit River.

Figure 7-1 - Surface Water and Ground Water Interaction Credit River Township



Land Use and Population

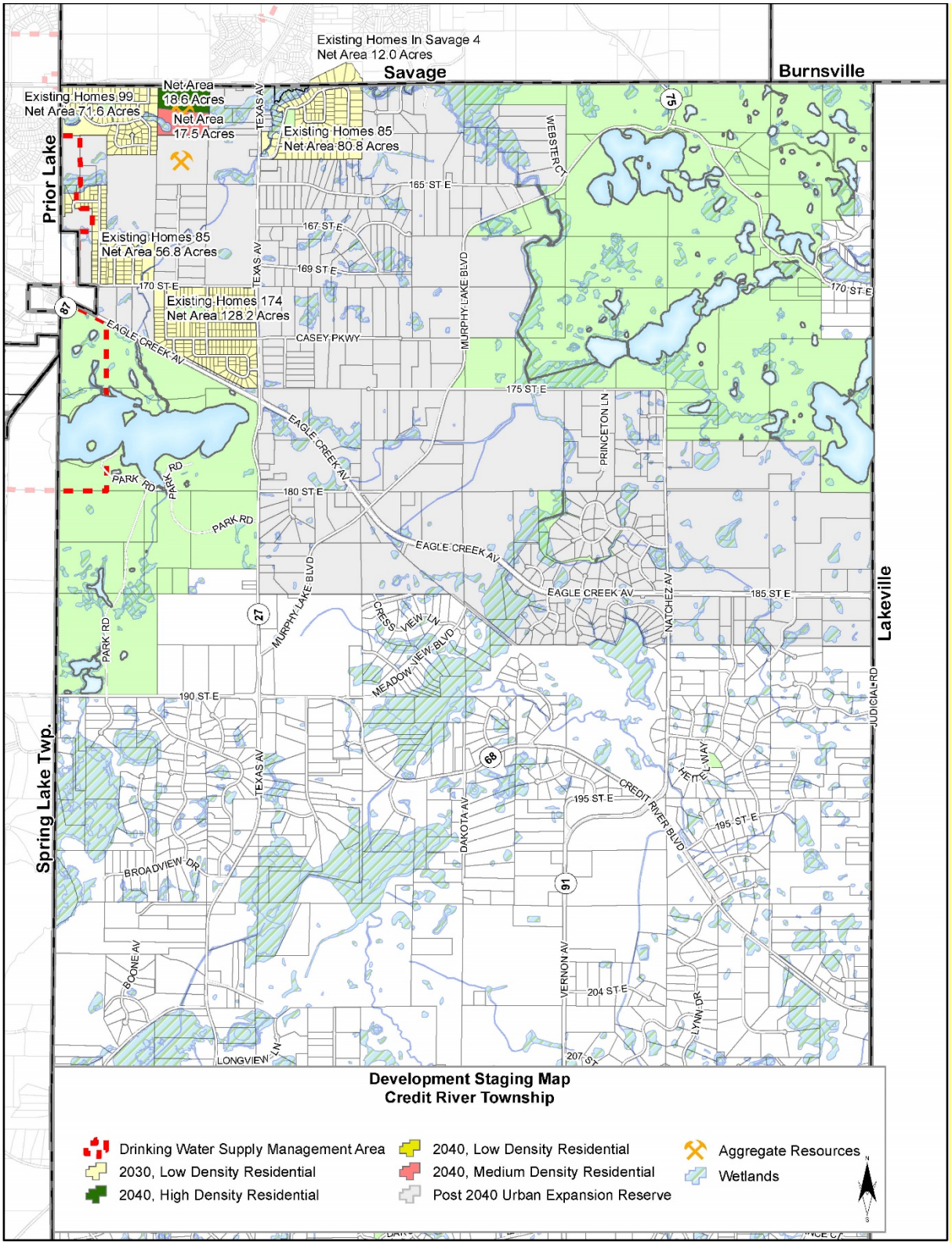
In the seven county Metropolitan Area, the central cities and first ring suburbs are generally served with water drawn from the Mississippi River. The remaining suburbs rely on groundwater aquifers. The northern half of the township is expected to see increased urban growth. With increased growth, the groundwater supply system Credit River will use, will continue to place more demand on the groundwater aquifer. Increased draw from an aquifer can potentially lead to removing more water than can be recharged, it also increases the vulnerability to contamination. Water conservation practices are the easiest way to reduce the impacts on an aquifer. With a community water system in place conservation practices can be pro-active and reactive. Pro-active conservation would be to utilize existing systems more efficiently and cutting out wasteful practices to ensure more supply in the future. Reactive conservation is typically done through regulation. During a shortage the community could enact sprinkling bans, water rationing, and other controls on non-essential water uses. Conservation practices not only ensure a stable water supply they also help save the community money.

Water supply systems are often provided in conjunction with sanitary sewer systems. Plans are being made for sewer services to be extended to existing developments as well as being available to future developments of available land. Planning, designing, and constructing these systems at the same time is more economical than individually. Development staging has been identified that has existing users and large areas of undeveloped land. These areas represent a starting demand that will allow more efficient operation of a new system. Figure 7-3 shows existing developments and large parcels of undeveloped land that are planned for mostly low density residential with some medium and high density. Table 7-2 shows an estimated demand for the north service area if developed to targeted density.

Table 7-2 - Municipal Water Study Area Credit River Township

Ultimate Demand				
Land Use	Acres	Maximum REC Density	Maximum REC Units	Average Demand (MGD)
Commercial	192	6	1152	0.29
Low Density Residential	2782	3	8346	2.09
Medium Density Residential	423	6	2538	0.63
High Density Residential	157	12	1884	0.47
Light Industrial	48	6	288	0.07
Total	**3602**		**14208**	**3.55**

Figure 7-3 - Development Staging Credit River Township



WATER SUPPLY DESIGN CRITERIA

General

Credit River has been considering adding municipal services for over a decade. Barr Engineering Company prepared a Water Study dated October 2006. The results of the study and associated modeling have been updated and are summarized as follows:

The water source that was evaluated was the Jordan aquifer. If use of the Jordan aquifer is allowed then wells should be located as far to the south as is reasonable. This decision was made to minimize any impact to environmentally sensitive features such as the Savage Fen, Eagle Creek, and the Boiling Springs; all of which are located to the north, in the City of Savage. The Savage Fen is a calcareous wetland that is home to many rare and unique plants and is protected by state law. The Boiling Springs are a rare spring that feeds Eagle Creek, which is a trout stream, and is also protected by law. These features rely on springs at the base of the bluff near the Minnesota River which come from the Prairie du Chien (PDC) aquifer.

The PDC aquifer is underlain by the Jordan (JDN) aquifer. In most areas the two aquifers are hydraulically well connected and considered a single aquifer. Many communities use the PDC/JDN aquifer as a source of water. In the Credit River area, when water is appropriated from either the PDC or JDN aquifers, it can potentially have a negative impact on the Savage Fen and/or Eagle Creek and the Boiling Springs if careful consideration is not applied. The Minnesota Department of Natural Resources (DNR) does not allow community wells to draw from the underlying Mt. Simon-Hinckley aquifer.

Based on the above, modeling was performed assuming municipal wells being located a minimum of one mile south of the City of Savage border, in the Jordan aquifer. Placing the wells one mile south is assumed to have minimal impacts, and moving them even further south will result in even less impact on the environmentally sensitive features. The municipal water system should be constructed with a minimum of two wells so that if one fails there will be a backup well. System source needs are outlined in Table 7-4 . Once constructed, the first two wells should be adequate to meet the community's needs for 10 years. A third well would need to be added after approximately 10 years and a fourth well may need to be on line near the end of the planning period depending on development and population growth.

To determine if the groundwater source is capable of producing the desired pumping requirements, test wells will be necessary. Water test wells are used for two primary reasons. One is to test the performance and efficiency of the well being pumped, called the pumping test. Another purpose is to provide the water quality characteristics of the aquifer, called the aquifer test. The experience of a licensed well driller familiar with the planned area is generally used in locating a groundwater source.

Another key element in water system planning is the concept of firm capacity, which is used to

account for the possibility that a well may be out of service for maintenance or due to failure on a peak day. Firm capacity is the capacity that all wells can produce, assuming that the largest single producing well is out of service. Table 7-4 shows the population estimates with the peak usage and number of wells needed calculated. The existing estimates from Met Council are lower than our estimates. With large lots available and the shift towards urbanization population more growth is expected than current estimates.

Table 7-4 - Water Supply Source Needs Credit River Township

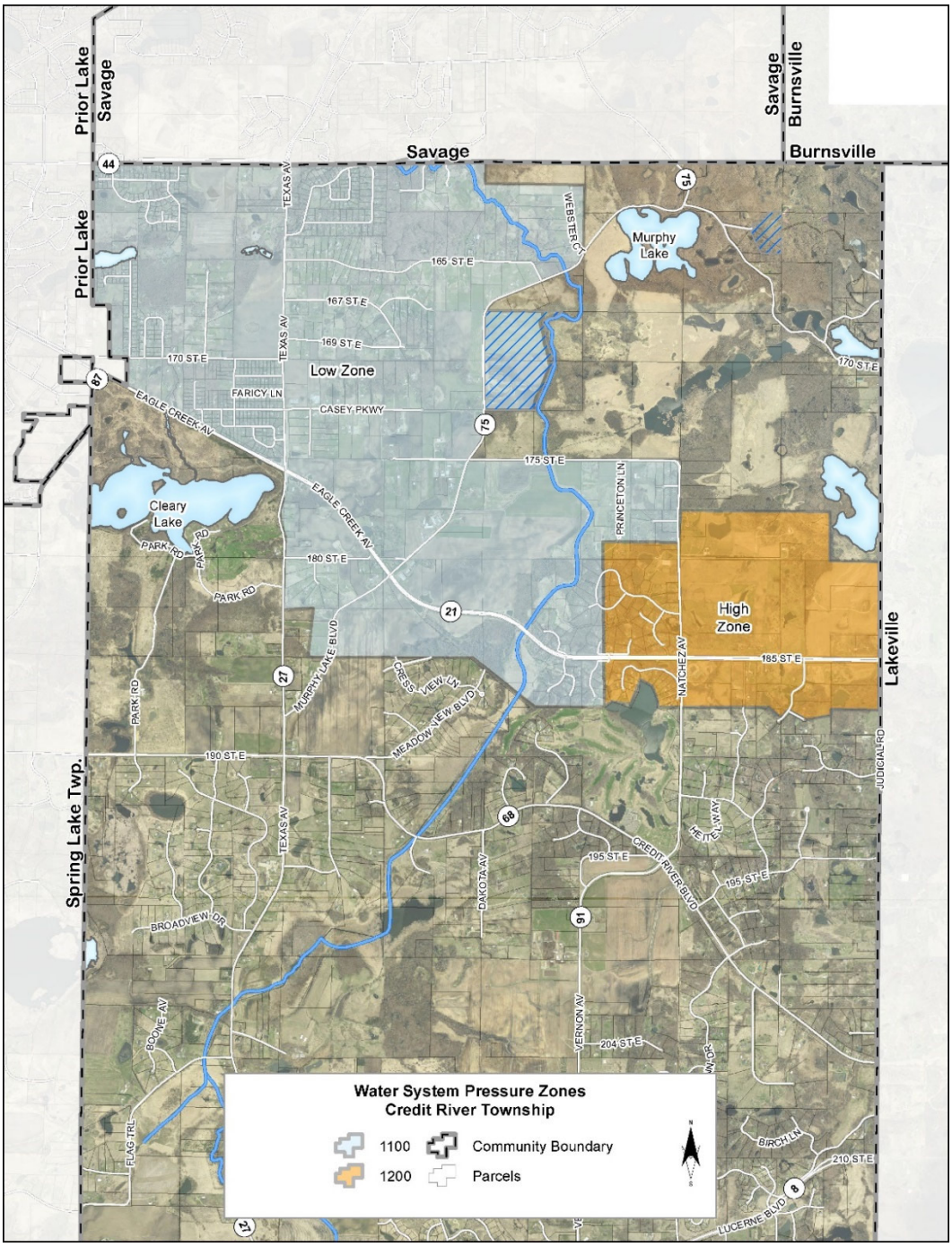
Year	Population	Avg Day MGD	Peak Day MGD	Peak Day GPM	Number of 1,200 GPM wells needed
2019	~~5678~~5639	0.~~57~~0	~~1.48~~0	~~10300~~	~~2~~0
2020	~~61065~~650	0~~.61~~	~~1.59~~0	~~11000~~	~~2~~0
2030	~~79155~~900	0.~~79~~11	~~2.05~~0.29	~~1420~~200	~~3~~1
2040	~~83036~~400	0.~~83~~19	~~2.16~~0.49	~~1500~~340	~~3~~1

Sites for Water System Components

The logical location for a water treatment facility would be next to the wells. The water towers do not need to be placed next to wells or a treatment facility. However, a centrally located position or positions within the plan area does help with distributing fire flow protection.

Based on the elevation differences, Credit River should consider different pressure zones. Most of the northern part of the planning area could be served by water towers with overflow elevations of approximately 1,100 feet. This is called the Credit River Low Zone. Note that a second pressure zone run on towers with overflows at elevation of approximately 1,200 feet would be needed for two other areas shown in Figure 7-5. This is called the Credit River High Zone. The Low Zone would border on the City of Savage and allow for easy transfer of water between communities.

Figure 7-5 - Water System Pressure Zones Credit River Township



An important element in a water distribution system is water storage. Storage of water enables the system to equalize demands on supply sources and treatment facilities. System flows and pressures are improved and stabilized to better meet variable demands. Additionally, reserve supplies are provided in the distribution system for emergencies such as firefighting and power outages. Two common storage methods include elevated storage, and mechanical pressure tanks.

1. Elevated Storage Facility – Elevated storage facilities provide the most suitable and versatile operation. Properly sized, elevated storage maintains system pressure throughout the distribution system and reliably provides dedicated fire storage. Operating by gravity, fire flow demands and pressures can be maintained during power outages.

2. Mechanical Pressure Systems – Mechanical pressure systems are the most practical storage units for domestic and commercial needs. Compressed air in the tank provides the required pressure for the system. Mechanical systems such as hydro-pneumatic tanks are subject to power failures and mechanical breakdowns. Typically, when water needs are sufficiently large, elevated storage provides the best, most reliable and most useful form of storage, particularly for fire suppression. Only when calculated storage requirements are much less than 100,000 gallons should separate, mechanical pressure systems be considered. Therefore, this option will be given no further consideration.

Storage facilities should have sufficient capacity to meet domestic demands, and fire flow demands. It is common practice to provide for the average day demand in storage in a water system. Water demand projections can be found in tables above. A large tower constructed early on in this system, will result in stale water, or low chlorine. However, if Credit River constructs a small tower now, it runs the risk of having too little storage within a few years. A combination of ground and elevated storage can be used to limit water quality degradation. In 2006, Barr Engineering Company recommended a 0.5 million-gallon ground storage reservoir built in conjunction with the new water treatment plant and a 0.5 million-gallon elevated reservoir to maintain system pressure and provide firefighting reserve. These would all need to be constructed simultaneously to get the system up and running.

In addition, the area that is in the higher-pressure zone may utilize a small tank to maintain system pressure. A 250,000-gallon elevated reservoir will be sufficient since the area that is served is smaller. Interim systems that run on booster pumps and/or hydro pneumatic tanks may be able to be used in this area before significant development occurs.

Water Distribution

A detailed distribution system will need to be designed so that an adequate supply of water is available to the consumer for potable water usage and fire protection at all times and at a minimum of cost. In addition, sufficient planning should be considered in the design so that the system may be readily extended to serve the entire service area.

The main distribution system would consist of the trunk water mains needed to convey water from the wells to the water treatment facility (raw water lines) and from the water treatment facility to the storage tank and the consumer distribution system. The community has specific criteria and standards related to pipes, valves, construction practices and system operation. In addition, Credit River will use the City Engineers Association of Minnesota (CEAM) Standard

Utilities Specifications (with modifications) to document the design standards and procedures for development of the water system.

The details of the Credit River distribution system are almost entirely dependent upon where the main development occurs. In general, Credit River will need to deliver peak day demands into its system from its wells and treatment plants. Assuming that all four wells will feed to a single treatment plant then a system of 20-inch and 16-inch diameter mains will be needed to distribute peak day and firefighting supply into the Credit River Township system.

Pressures in most water systems are best kept between 40 and 100 psi, though complaints can occasionally occur for pressures outside the range of 50 to 80 psi.

Water Treatment

The source of the raw water supply and the finished water quality objectives form the basis for selecting treatment process alternatives. Maximum contaminant levels (MCL) are the primary standards for drinking water and must be adhered to. The MCL limits are enforceable by the Minnesota Department of Health. Secondary standards represent recommended limits for aesthetics based on characteristics that render a drinking water less desirable for use.

In review of the secondary standards for aesthetics, three parameters exist in objectionable concentrations – namely total hardness, iron, and manganese. Hardness in water is caused by the presence of calcium and magnesium ions and is largely the result of geological formations of the water source. Hardness presents objectionable scale in heated water lines and vessels and consumes excessive amounts of soap. Fixtures and dishes often are left with a spotty appearance.

Public acceptance of hardness varies from community to community, the consumer sensitivity being related to the degree to which he or she is accustomed. The American Water Works Quality Goals recommend a range of 80-100 mg/l as desirable both for aesthetics and corrosion control. Total hardness up to 150 mg/l may be acceptable.

Treatment processes that provide softening may be accomplished either by chemical precipitation or by ion exchange. Chemical precipitation involves additions of lime soda ash and results in sludge precipitate that requires storage, dewatering, handling and disposal facilities. Ion exchange is most often completed through a pressure filter and takes up minimal space.

High concentrations of iron and manganese are considered objectionable in drinking water because they affect color and taste of edibles, and stain plumbing fixtures and laundry. Treatment for iron and manganese should be implemented to reduce the combined concentration to meet Secondary Drinking Water Standards.

Based on water quality of neighboring communities, a treatment facility appears to be necessary and would provide for the removal of iron and manganese and provide chemical addition for

fluoridation, disinfection (typically chlorination), and water softening. Treatment processes that will be required include filtration for softening and removal of iron and manganese.

Under the EPA's Safe Drinking Water Act, other contaminants have recently become regulated and/or will be regulated in the near future. These contaminates include arsenic, copper, radon, radium, etc. Treatment options will be determined after the well test to reduce the presence of these and other contaminants if necessary.

Overall, treatment will be determined by the quality of water encountered in the wells and the quality of water it desires to deliver to its customers. A minimum level of treatment recommended is fluoridation, chlorination, and sequestering of iron and manganese. Radium is occasionally encountered in Jordan water and if it is, then significant, additional treatment may be needed at great cost. If normal greensand filtration does not remove the radium then the addition of hydrous manganese oxides followed by greensand filtration may be needed. Note that greensand filtration will eliminate the need to sequester.

Interim Water Supply from Adjacent Communities

It may be desirable to initially purchase finished water from adjacent communities to allow the establishment of an initial user base. If the adjoining communities are agreeable to providing water, this would allow for initial urban development with a modest investment in infrastructure. Credit River then could take the steps necessary to construct the wells, water storage tanks, and water treatment plants. The water distribution pipes that would be initially utilized could also be used for the final system, therefore there would be no wasted infrastructure.

It is common practice for adjoining municipalities to provide water system interconnects. A meter could be installed on the line(s) to measure the amount of water utilized. The City of Savage, the City of Prior Lake, and the City of Lakeville would all be feasible for negotiating water system interconnects, although it is likely that the development will occur near the City of Savage border first.

Ground Water Protection

Credit River recognizes the sensitivity of the aquifers and will establish all necessary environmental protection policies that will enhance the protection of the groundwater. Credit River will do this through implementation of its MS4 stormwater program, Surface Water Management Plan, and establishment of a wellhead protection plan.

Regulatory Controls

Prior to establishing a municipal water system, it will be necessary for Credit River to prepare and adopt ordinances regulating the use and protection of groundwater.

Capital Improvements

Credit River prepares, revises and adopts a Capital Improvement Plan on an annual basis. The purpose of the Capital Improvement Program (CIP) is to identify, prioritize, and address community needs through careful long-term planning and balanced public investment in preserving the Town's infrastructure.

The CIP has been prepared as a strategic planning tool to assist the Town Board in identifying proposed road maintenance and capital improvement projects over the proceeding time period. The Town Board annually prepares and approves this document acknowledging that it is subject to the dynamics of community growth, political leadership and financial constraints. A copy of the DRAFT 2019 – 2029 CIP is included as Appendix A.