WATER RESOURCES

WASTEWATER AND COMPREHENSIVE SEWER PLAN

I. POPULATIONS SERVED BY THE CITY WASTEWATER SYSTEMS & OTHERS

The following tables detail the forecasted households and employment forecasts in 10-year increments through 2040, based on the Met Council's forecasts, served by the City of Jordan. wastewater treatment system as well as a limited number of sewage treatment systems within the City limits.

TABLE 4-1
FORECASTS

Forecast Year	Population	Households	Employment
2010	5470	1871	1587
2020	6900	2500	2200
2030	9600	3600	2500
2040	12200	4700	2800

TABLE 4-2
METROPOLITAN DISPOSAL SYSTEM FORECAST

Forecast Year	Population	Households	Employment
2010	0	0	0
2020	0	0	0
2030	0	0	0
2040	0	0	0

TABLE 4-3
COMMUNITY AND SUBSURFACE SEWAGE TREATMENT SYSTEMS FORECAST

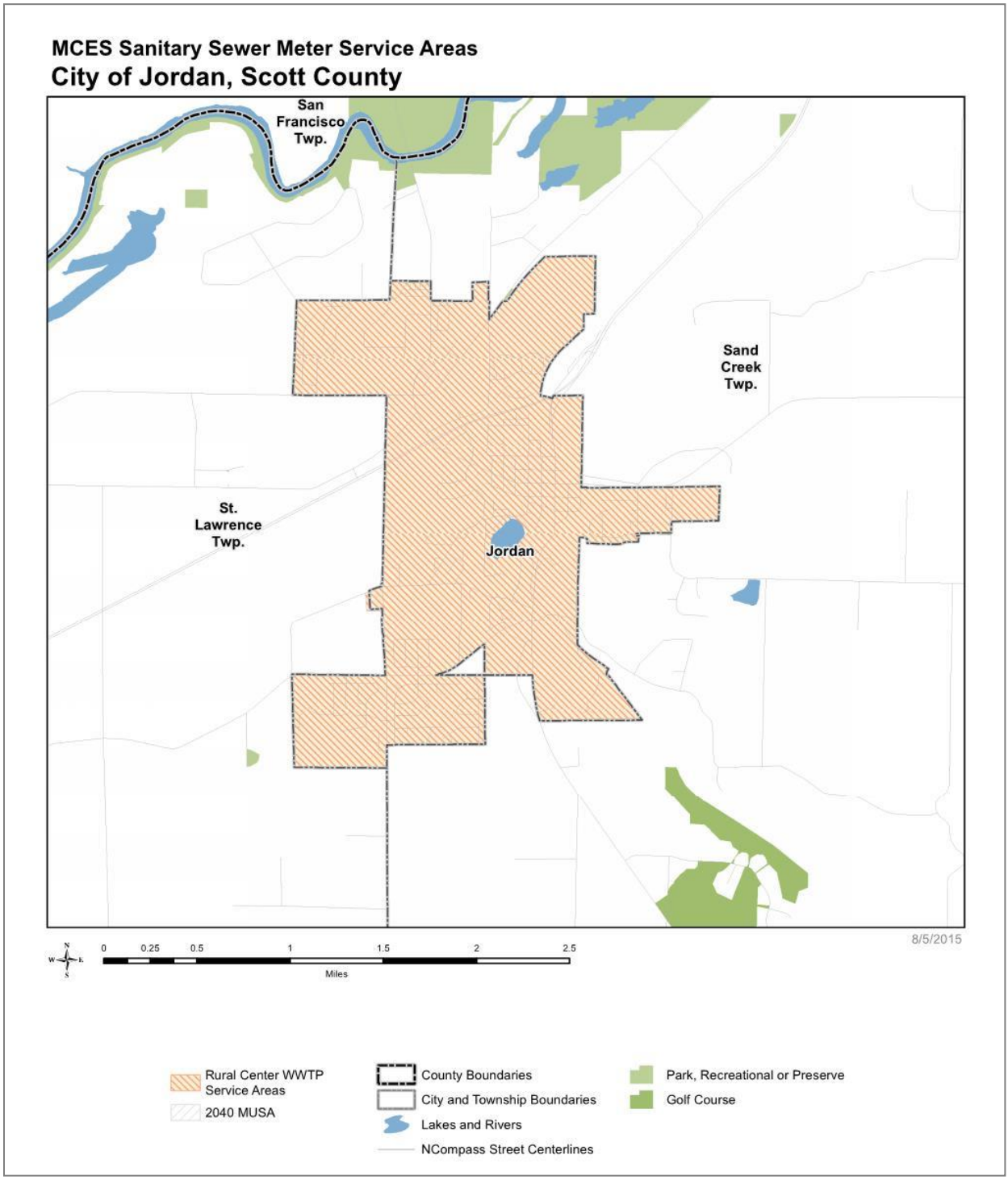
Forecast Year	Population	Households	Employment
2010	73	25	0
2020	58	20	0
2030	44	15	0
2040	29	10	0

TABLE 4-4
LOCALLY OWNED AND OPERATED TREATMENT SYSTEMS FORECAST

Forecast Year	Population	Households	Employment
2010	5397	1846	1587
2020	6842	2480	2200
2030	9556	3585	2500
2040	12171	4690	2800

Jordan provides its own wastewater treatment services through a municipally owned and operated facility. As such, the Metropolitan Council has no plans to provide regional wastewater services to the city.

MAP 4-1: MCES SANITARY SEWER METER SERVICE AREAS



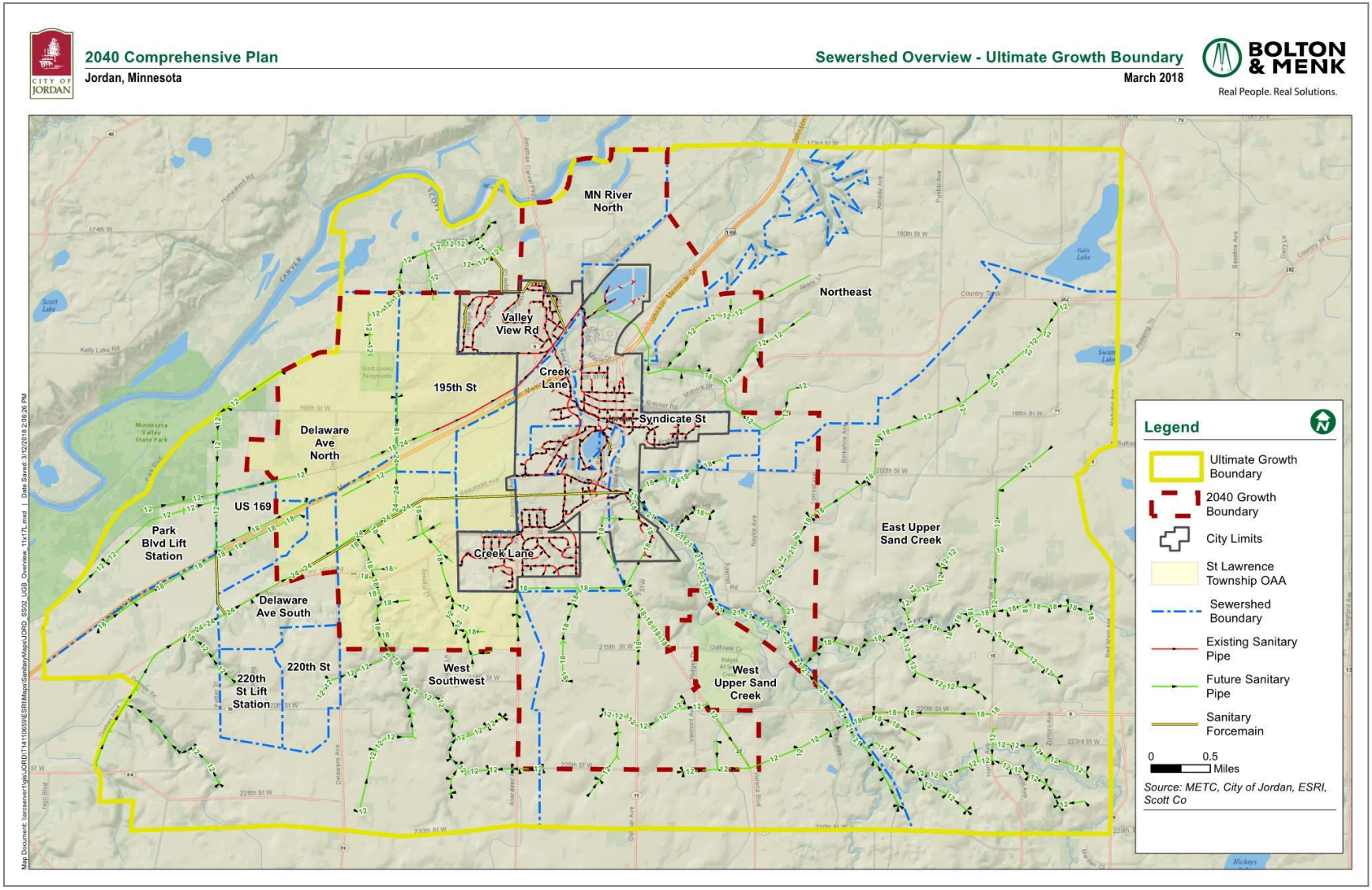
The City of Jordan sewage treatment facility and ponds were constructed in the 1970's. They were rebuilt in the 1980's and upgraded in 1993 but are currently largely unused. A portion of the pond system has been maintained to serve as a storage queue for wastewater when the mechanical plant is affected by inflow and infiltration (1&1). The City's wastewater treatment plant was constructed in 2001. The Jordan wastewater sewer system features a mechanical plant with a capacity of 1,298,000 gallons per day, a peak demand of 1,968,000 gallons per day, and an average demand of 580,000 gallons per day. As of March 2017, the City of Jordan provided service to approximately 1,833 accounts.

The City of Jordan believes the population and households will grow at a faster rate and therefore is planning for a population of 15,000 or 6,000 households. The City is not considering a potential connection to the Metropolitan Disposal System to serve its population prior to 2040, and therefore plans to continue to serve its 2040 population with its current wastewater treatment facility. From discussions with Met Council Staff, and investigations of the City's consultant, this connection is not likely for several decades and does not appear cost effective for the City until the Met Council's system is extended as a result of development north of Jordan. The closest metropolitan interceptor, at this time, is in Spring Lake Township, adjacent to the City of Prior Lake and Jackson Township adjacent to the City of Shakopee. The City is aware of the Metropolitan Council's conceptual plans to site a plant along the Minnesota River to serve the southwestern portions of Scott County, post 2040. One of the three sites historically in consideration was the Jordan wastewater treatment plant site, though significant considerations of an additional, future Met Council wastewater treatment facility along the Minnesota River have not been undertaken.

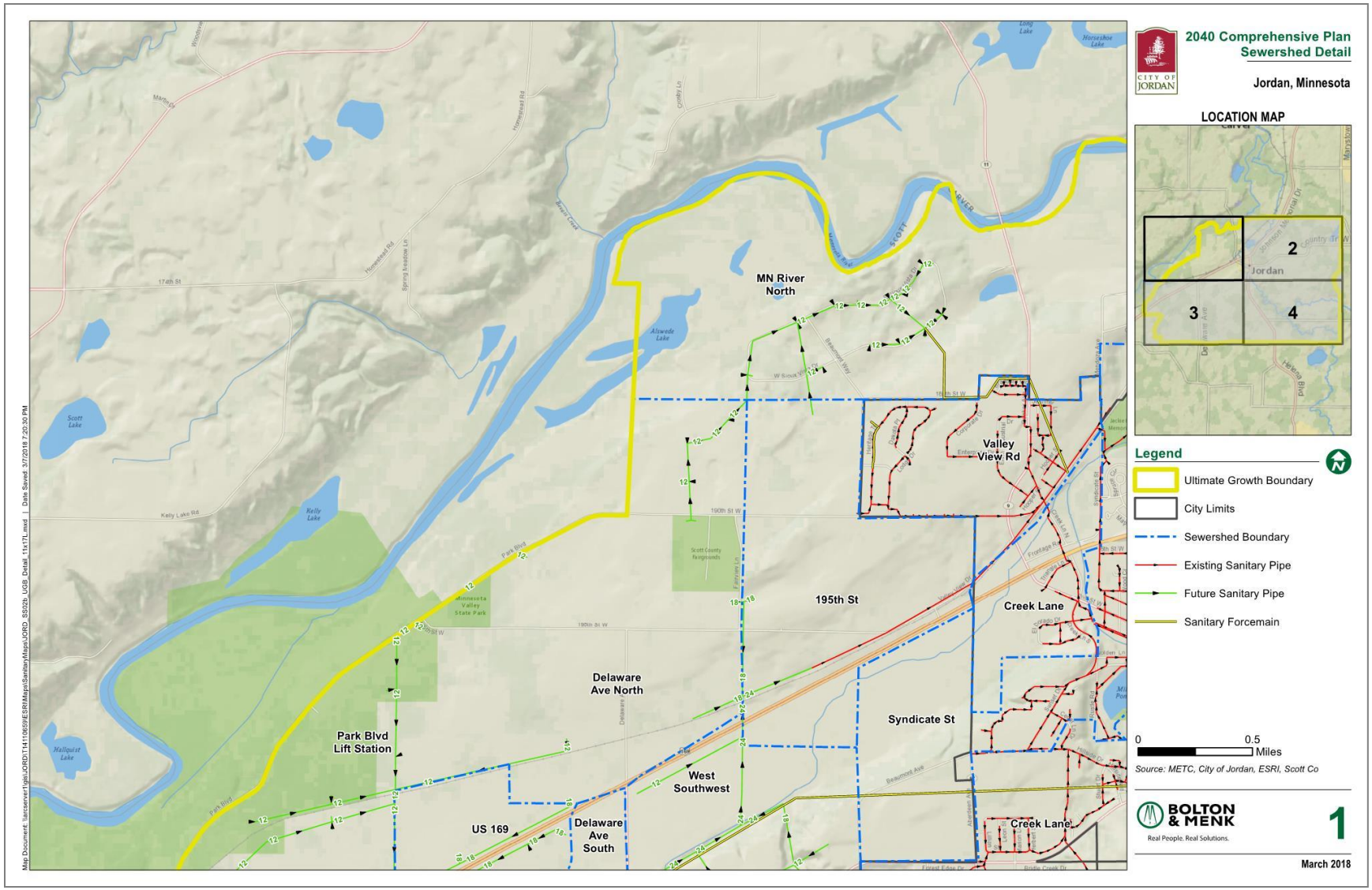
II. SANITARY SEWER COLLECTION FACILITIES

Map 4-2 illustrates the existing and future sanitary sewer collection system. **Maps 4-3 through 4-6** provide a more detailed view of the existing and future sanitary sewer system.

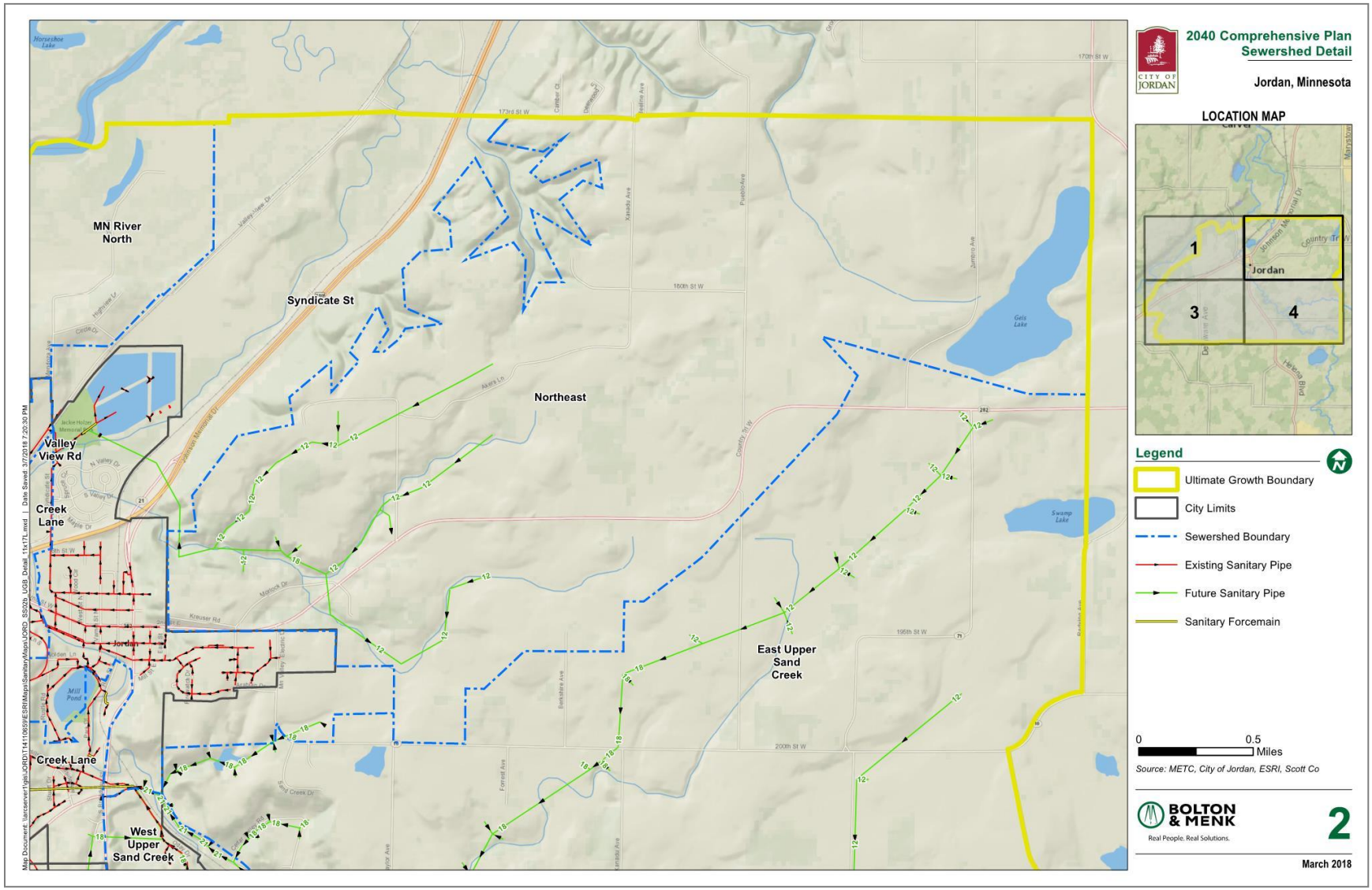
MAP 4-2: SEWERSHED OVERVIEW-ULTIMATE GROWTH BOUNDARY



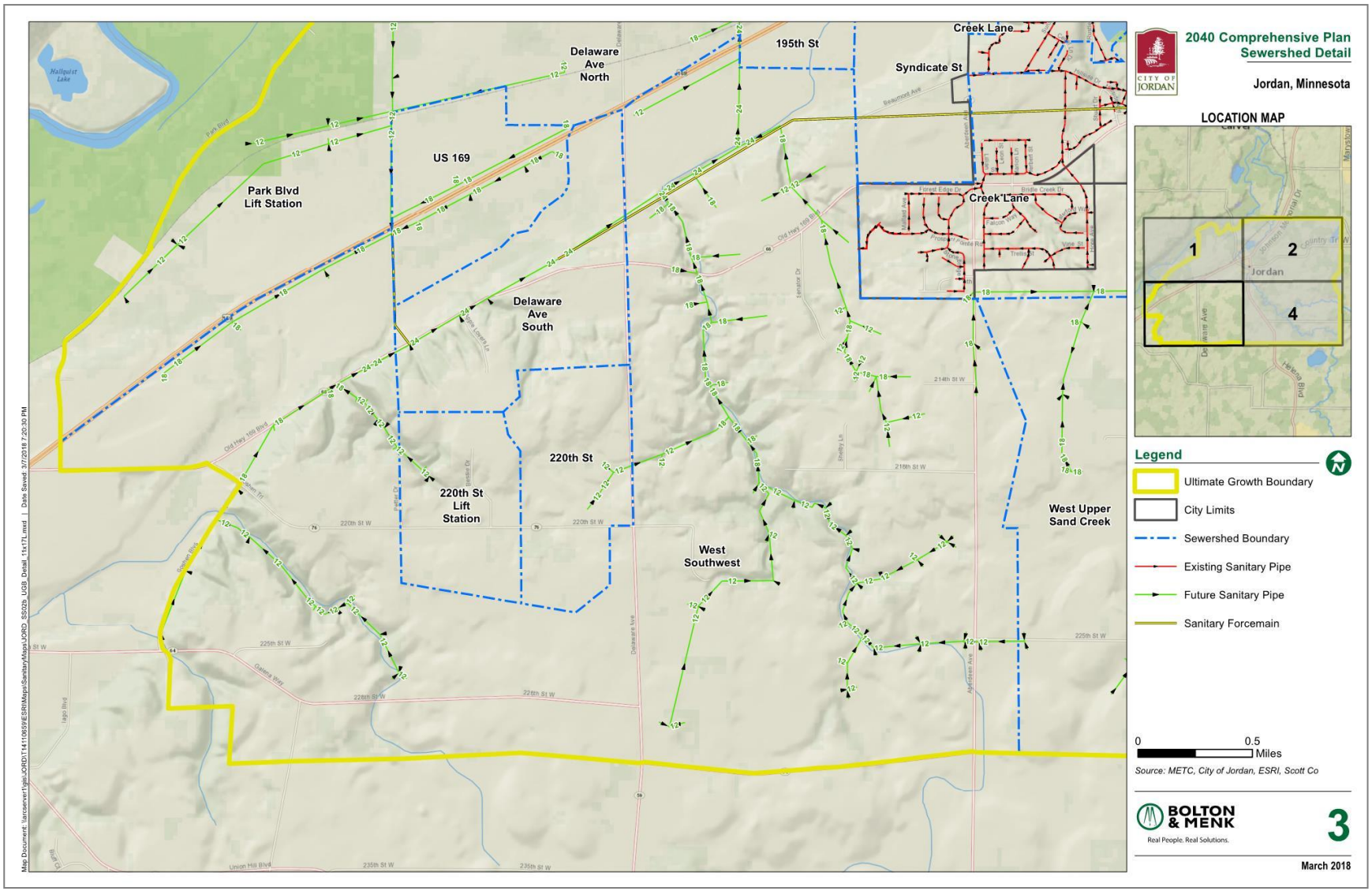
MAP 4-3: SEWERSHED DETAIL



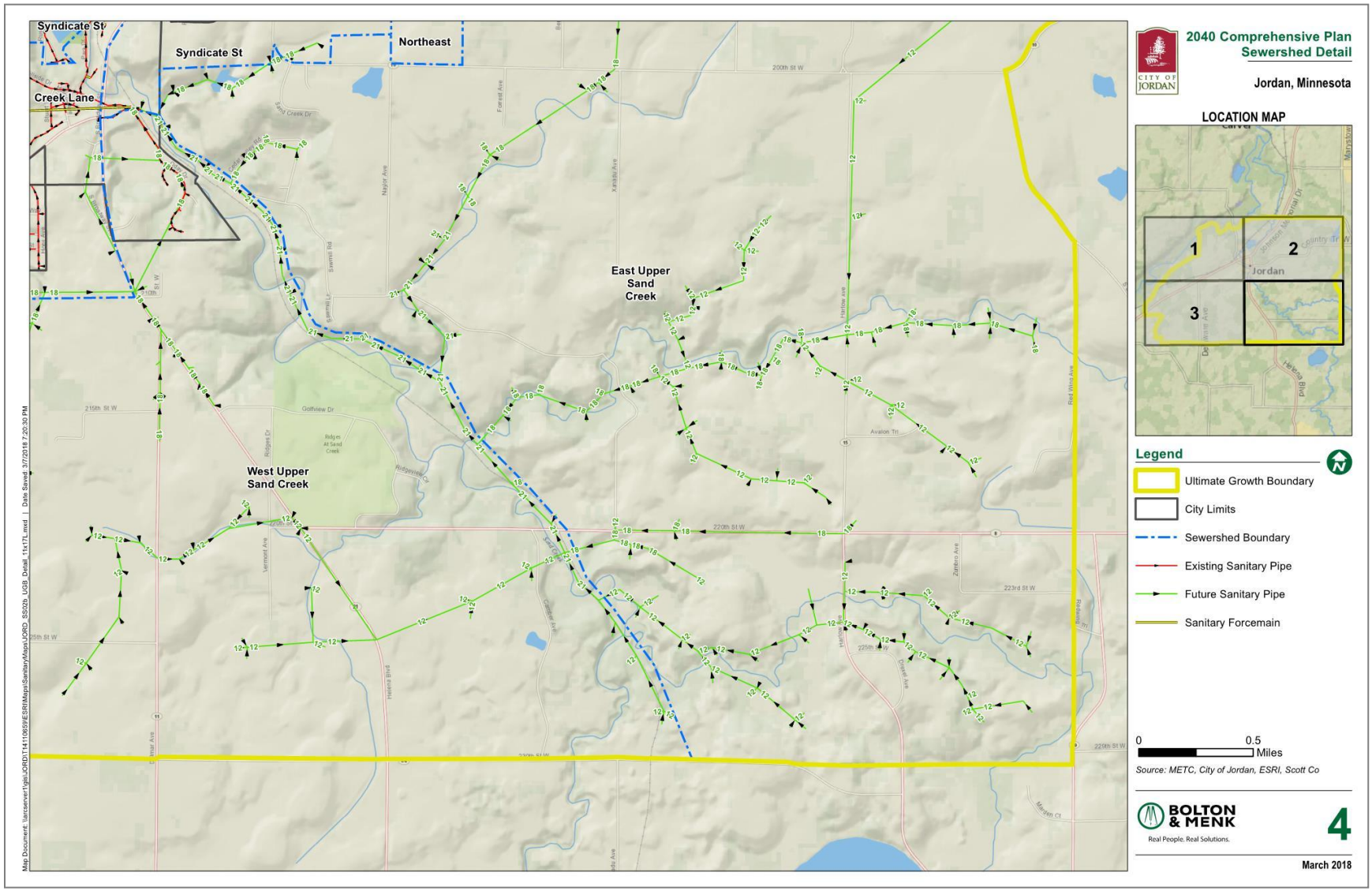
MAP 4-4: SEWERSHED DETAIL



MAP 4-5: SEWERSHED DETAIL



Map 4-6: SEWERSHED DETAIL



The existing wastewater collection system in the City of Jordan consists of a variety of sizes and types of pipe. Sanitary sewers range in size from 8 inches to 42 inches. Materials comprising the system include vitrified clay pipe (VCP), polyvinyl chloride (PVC) pipe, reinforced concrete pipe (RCP), and ductile iron pipe (DIP).

The City of Jordan has five existing sanitary sewer lift stations:

1. The wastewater treatment facility is fed from the Wastewater Treatment Facility (WWTF) lift station, which is located directly in front of the facility under its parking lot. The existing lift station pumps wastewater from the 42" trunk interceptor to the treatment facility. All flows in the City of Jordan travel through the WWTF lift station, which is effectively a component of the WWTF itself.
2. Sanitary sewer is collected in a gravity pipe in the rear yards of the Helena Street homes, discharging into the Helena Street lift station. The Helena Street lift station serves four properties, three of which are developed, and pumps its flow under Sand Creek to the gravity sanitary sewer main in Park Drive.
3. The South Broadway Street lift station, similar to the Helena St system, collects sewer from a gravity main in the rear yards of five properties. Once flow is collected the South Broadway lift station pumps its flow under Sand Creek to a manhole in the Mini Met parking lot, which flows by gravity to the Park Drive sanitary sewer main.
4. The Timberline lift station collects flow from approximately 110 properties in the north half of the Timberline neighborhood. The flow is pumped to the south to another sanitary sewer main in the Timberline neighborhood, which then flows to the 190th St interceptor.
5. The Bridle Creek lift station is a temporary sanitary sewer lift station that was installed in 2008 to serve the Bridle Creek 7th and 8th additions. The lift station will continue to serve these homes, as well as subsequent Bridle Creek additions, until the SW Interceptor is constructed in (estimated) year 2021. Upon completion of the SW interceptor, the influent gravity sanitary sewer pipe serving Bridle Creek 7th, 8th, and future additions will be directly connected to the interceptor and will freely flow by gravity to the City's WWTF.

The collection system utilizes two inverted siphons to transfer wastewater flow under Sand Creek from south to north:

1. The Creek Lane Interceptor siphon is a 15" pipe located near the Sunset Booster Station, located just east of (below) Nolden Lane and just north of Sunset Drive.
2. The Syndicate Street Interceptor siphon is a 15" pipe located just west of the Varner Street Bridge.

The inverted siphons transfer flow through a conversion of gravity flow, to pressurized flow under the creek, and back to gravity flow. On occasion in the past when segments of the siphons under the creek have been damaged, large amounts of creek water have directly entered the wastewater treatment system. After crossing Sand Creek, both sewers flow west down First Street (paralleling each other) and then flow north down Creek Lane and Syndicate street, respectively. It is recommended the City periodically meter the flow both upstream and downstream of its inverted siphons to determine whether any flow is leaking or whether any I&I is entering the siphon.

As part of the Comprehensive Planning process coupled with past analyses, the capacities of existing individual collector sewers were determined and compared to the design capacity required to serve the tributary area. Peaking factors were calculated based on an equivalent population using the Recommended Standards for Wastewater Treatment Facilities Ten States Standards (2014 p. 10-6). The assumed per capita wastewater flow to calculate an equivalent population given total wastewater flow including industrial and commercial contributions in 100 gpcd. This comparison was completed to identify the 'weakest link in the chain' in terms of sanitary

sewer capacity versus demand, thereby identifying areas of potential need or areas that should avoid receiving additional new flows/demands.

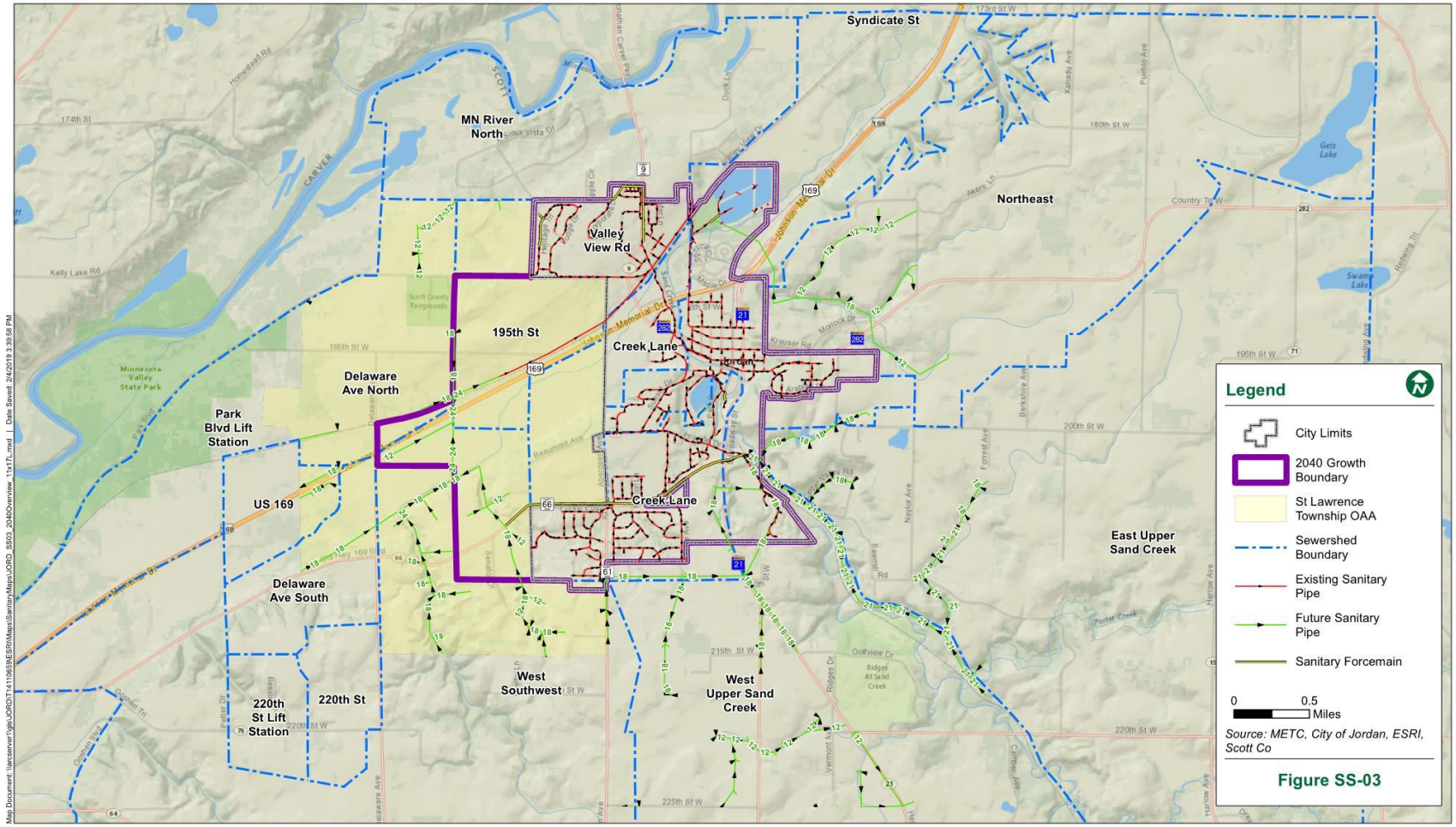
The flow at the City wastewater treatment plant is monitored daily. Over the last 5 years the average flow rate at the plant was 0.407 MGD. Future flow rates were also determined by using typical flow rates for each land usage by parcel within city limits. The future average daily and peak daily flow rates to the wastewater treatment plant were also calculated by land usage via both the 2040 growth boundary and 2040 population forecast. The 2040 growth boundary average daily and peak daily flow rates are 6.20 MGD and 15.8 MGD respectively. These 2040 calculations were made assuming full buildout of the 2040 boundary at prescribed densities and assuming a 1,500 gal/acre/day usage rate for commercial/industrial uses. Using the 2040 population forecast and assuming land uses similar to the existing distribution, the 2040 average daily and peak flow rates are 0.75 MGD and 2.27 MGD, respectively.

Finally, acknowledging lifespan of sanitary sewers far exceed the 22 year analysis time period ending in 2040, the resulting flow from a fully developed ultimate growth boundary was also quantified to provide some reference for large downstream sanitary sewer pipe sizing as well as allow for concept level planning of future sewer extensions in multiple directions. It should be understood the ultimate growth boundary will take many decades, perhaps well in excess of 100 years, to reach in full at any reasonable growth rate. It is also feasible however, that growth focuses on one direction (i.e. southwest or northeast) faster than other directions and approaches the ultimate growth boundary in that direction sooner and within the lifespan of a sanitary sewer pipe. Therefore, the full conceptual layout of the ultimate system also aids in the consideration of development staging constraints and benefits. The ultimate growth boundary has average daily and peak daily flow rates of 19.76 MGD and 26.41 MGD respectively. Relative to Jordan's sewer system these figures are quite large, though they are effectively theoretical in nature as the ultimate growth boundary is not anticipated to be reached for many, many decades. Therefore, the function of these estimated flow numbers can largely be ignored in a practical perspective but the conceptual ultimate service area sewer system layout is of value.

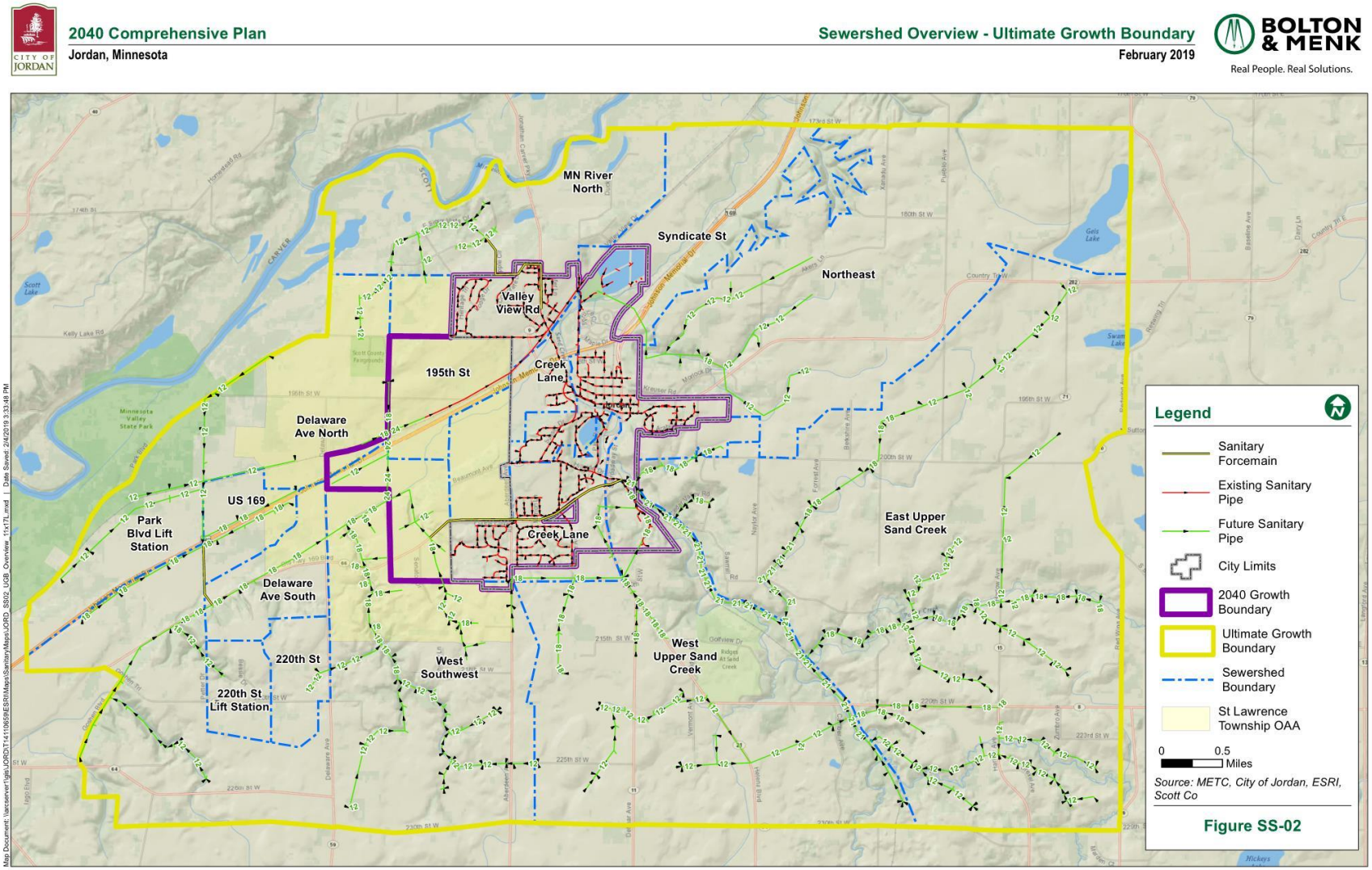
III. EVALUATION OF FUTURE SANITARY SEWER COLLECTION FACILITIES

Maps 4-7 through 4-9 illustrate current and future sanitary sewersheds (geographic service areas) within the city limits, the 2040 boundary, and the ultimate growth boundary.

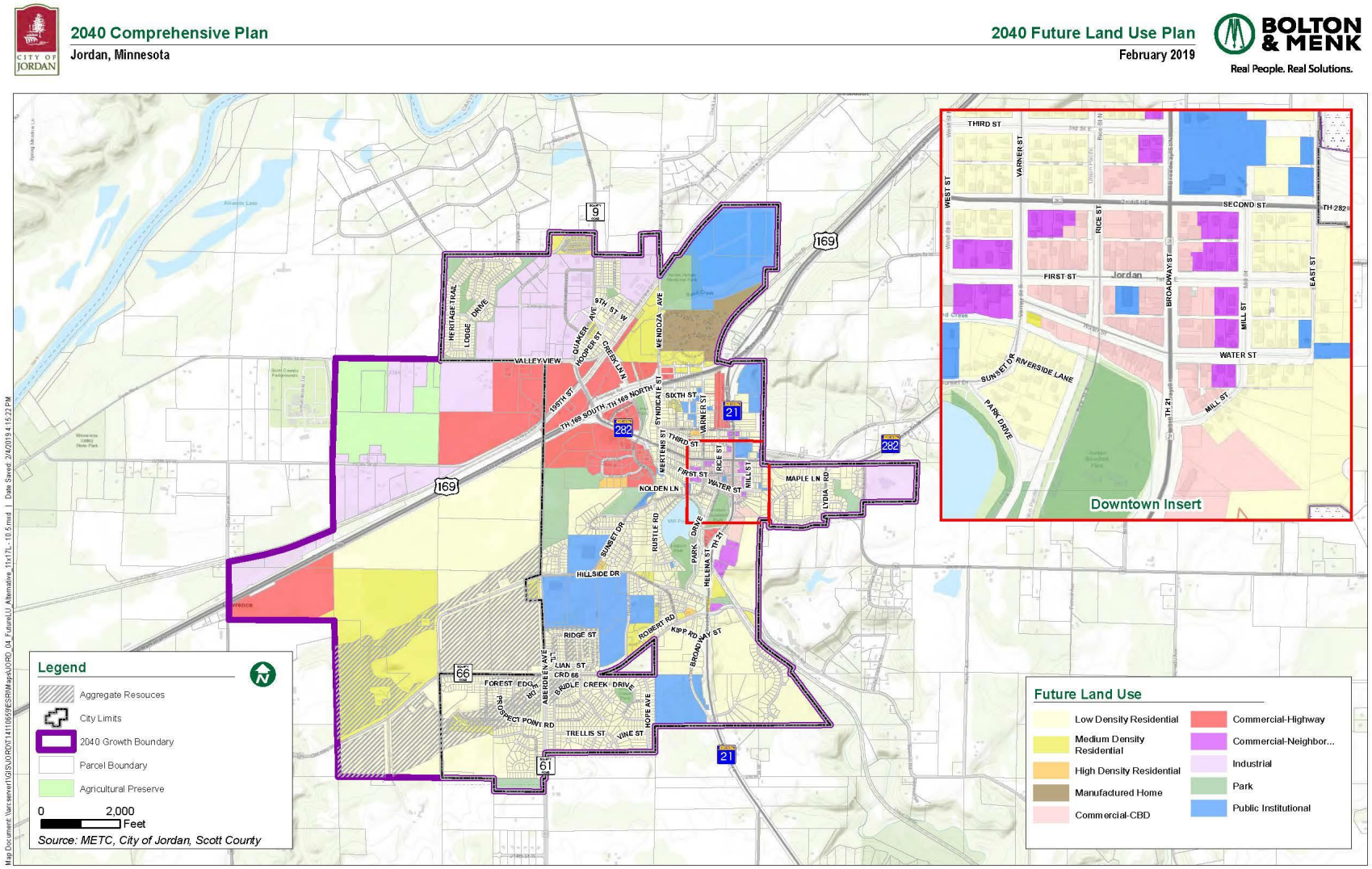
MAP 4-7: SEWERSHED OVERVIEW – 2040 GROWTH BOUNDARY



MAP 4-8: ULTIMATE GROWTH – FUTURE LAND USE AND DENSITY



MAP 4-9: FUTURE LAND USE – 2040 BOUNDARY



In late 2017 the City signed an orderly annexation agreement with St Lawrence Township to the west and southwest, and is nearing agreement with Sand Creek Township to the east. In early 2018 the City has received final plat submittals for 60 lots (doubling the Met Council forecasted growth rate) and estimates at least an additional 50-100 lots to be platted in 2019 as a result of development pressure. The growth of the community is inevitable as result of this development pressure and orderly annexation agreements. Effective management of the growth of the community will be achieved through proper planning of sanitary sewer infrastructure. The development of sewersheds enables downstream piping with a lifespan exceeding 100 years to be sized effectively for the forecasted 2040 population, which is anticipated to arrive only 22 years from the drafting of this plan, and beyond given.

The sewersheds have been named based on their location or based on the location of the downstream sanitary sewer pipe from which they are served:

1. Syndicate Street sewershed and existing interceptor
2. Creek Lane sewer shed and existing interceptor
3. Valley View Drive sewershed and existing interceptor
4. 195th Street sewershed and existing interceptor
5. Upper Sand Creek sewer shed and (partial) existing interceptor
6. West/Southwest sewershed and (partial) existing interceptor
7. Minnesota River Area sewershed (future)
8. Northeast sewershed (future)
9. Park Boulevard sewershed (future)
10. West US 169 sewershed (future)
11. Delaware Avenue N sewershed (future)
12. Delaware Avenue S sewershed (future)
13. 220th St sewershed (future)
14. Far West South of US 169 sewershed (future)
15. Far West North of US 169 sewershed (future)

Wastewater Treatment Facility

The City of Jordan mechanical treatment facility was constructed and placed online in October 2001. The mechanical facility consists of flow equalization, pretreatment, extended aeration activated sludge with biological phosphorous removal, final clarification, disinfection, aerobic digestion, and biosolids storage.

The wastewater treatment facility continues to use two of the stabilization ponds from the earlier facility for flow equalization. A third stabilization pond existed until it was decommissioned in 2008. The mechanical treatment facility is designed to treat an average wet weather flow of 1.289 million gallons per day (mgd) with a 5-day biochemical oxygen demand (BOD) of 1,045 pounds per day. The treatment facility discharges on a continuous basis to Sand Creek with the following limits: 15 mg/l Biochemical Oxygen Demand (BOD); 30 mg/l- Total Suspended Solids (TSS); 1.0 to 7.7 mg/l- Ammonia, Nitrogen (limit changes seasonally); and 1 mg/l- Total Phosphorous.

Currently the treatment facility is meeting all limits and treating approximately 0.400 mgd.

Evaluation of Treatment Facilities:

The wastewater treatment facility processes were evaluated using the criteria from the "Recommended Standards for Wastewater Facilities" or more commonly called "Ten State Standards". Using these standards and the population and flow estimates from above, each process was evaluated on when its capacity might be exceeded. Mechanical wastewater treatment facilities include two separate processes combined to form an integrated

treatment system. The processes are commonly referred to the "liquid stream" and the "solids stream." The liquid stream combines various treatment components to convert the wastewater into natural byproducts of biological stabilization and the capabilities of the liquid stream determine the quality of the effluent produced by the facility. The solids stream combines treatment components to stabilize, thicken and store the solids byproducts produced by the liquid stream for eventual incorporation into the soil. Some processes are evaluated on average wastewater flows whereas others are evaluated on peak flows. Results are tabulated in the following tables along with a brief description.

A Peaking Factor of 2.78 and a per capita wastewater flow rate of 85 gpcd were calculated based on historical data from the City's wastewater treatment facility and were used to project future flow rates based on population estimates.

Pretreatment facilities are provided to remove sticks, rags, grit and other materials to ensure that they do not interfere with subsequent wastewater processes. The pretreatment process consists of a mechanical fine screen, back-up manual screen and a grit removal system.

TABLE 4-5
WASTEWATER TREATMENT PLANT PRETREATMENT COMPONENTS

Equipment	Capacity, Peak (mgd)	Capacity (Year/Population)
Fine Screen	2.0	2028/8,805
Grit Removal	2.5	2036/10,916

As noted above, the pretreatment facilities were evaluated on peak flows and the fine screen is the limiting factor and additional pretreatment facilities would be required in 2028. Although the system has adequate capacity, the existing equipment is located in a corrosive environment and may need equipment replacements prior to 2028.

Aeration Basins

The City of Jordan operates an extended aeration activated sludge process. The major benefit of operating this type of process is the long retention times that allows for effective and efficient operation even when flows and strengths vary widely. Additionally, the activated sludge system is designed for biological phosphorous removal that occurs in two basins preceding the aeration basins. The City has two, 27-foot wide by 90-foot long and 16-feet deep aeration basins and an anaerobic and anoxic basin prior to the aeration basins for phosphorous removal. As shown below organic loading is the limiting factor for the activated sludge process with additional capacity required in 2024.

TABLE 4-6
WASTEWATER TREATMENT PLANT AERATION BASINS

Description	Design Requirement	Capacity (Year/Population)
Hydraulic Retention Time	18 Hours	2032/9,700
Organic Loading Rate	15 lb BOD/day	2024/7,953

Final Clarifiers

Activated sludge final clarifiers are designed to meet thickening as well as solids separation requirements. Scum collection and removal facilities are provided as well. The City of Jordan has two, 35-foot diameter clarifiers that operate at a 14-foot water level. Two clarifiers are required to meet the Ten State Standard criteria; however, in determining the Surface Overflow Rate, only one clarifier is used. As shown below the surface overflow rate governs with new clarifier(s) required in 2027.

TABLE 4-7
WASTEWATER TREATMENT PLANT FINAL CLARIFIER

Description	Design Requirement	Capacity (Year/Population)
Surface Overflow Rate	900 gpd/ sq. ft.	2027/8,658
Solids Loading Rate	35 lb/day/sq. ft.	2042/12,890
Weir Loading Rate	30,000 gpd/lin. ft.	>2060/29,220

Disinfection
A disinfection system is required to disinfect the treated wastewater prior to entering the receiving stream. As per the City's NPDES permit, they must disinfect and dechlorinate the treated wastewater for the months of April through October. The City of Jordan uses sodium hypochlorite to disinfect and sodium bisulfite to dechlorinate. The disinfection basin is a rectangular basin with interior walls to create a serpentine flow pattern and provide the proper detention time. According to Ten State Standards, disinfection systems must be designed to handle the peak flows, however, since the Jordan wastewater facility is designed for flow equalization, the average flows will be used for evaluation.

TABLE 4-8
WASTEWATER TREATMENT PLAN DISINFECTION

Description	Design Requirement	Capacity (Year/Population)
Disinfection	15 minutes	2046/14,530
Dechlorination	0.5 minutes	2048/15,133

Biosolids Processing
Wastewater biosolids consists of solids from raw wastewater and biological solids generated in the treatment process. The City of Jordan treats biosolids using an aerobic digester and then stores the treated biosolids in a storage tank. The City land applies the biosolids on a semi-annual basis. The biosolids system was designed to hold and treat the biosolids for 180-days at the original design population of 5,803 persons. The system can treat the biosolids for an approximate population of 6,000 persons. Currently the City is testing the use of biosolids bags to dewater the solids and create more storage on site. The City has yet to land apply dewatered solids from the bags and the feasibility of this as a biosolids treatment option will be further evaluated following the first land application of dewatered solids. If the dewatering bag method does not meet the City's goals, other alternatives the City may evaluate include adding additional storage, adding additional treatment processes, or implementing a regional treatment solution.

Future Wastewater Treatment Facility Considerations
Based upon the above discussion, estimates can be made for future expansion needs of the wastewater treatment facility. These estimates can be helpful for capital improvement budgeting, future project planning, and determination of Sewer Area Charges (SAC development fees). The treatment facility liquid portion is limited by the aeration basins and will require upgrading in approximately 2024 or a population of nearly 8,000 persons. The final clarifiers and pretreatment facility are forecasted require additional capacity in 2033 respectively. The solids portion, or biosolids treatment, has been nearing capacity and the City is currently utilizing biosolids bags to dewater the solids and create additional storage. The City has yet to land apply dewatered solids from the bags and the feasibility of this as a biosolids treatment option will be further evaluated following the first land application of dewatered solids. Since many of the liquid processes will be at capacity at nearly the same time, it is recommended to upgrade the pretreatment, activated sludge process and final clarification at the same time. The treatment facility was originally designed to add on additional aeration basins and final clarifiers, which will facilitate the integration of the new processes. Additional

pretreatment facilities could be added adjacent to the existing pretreatment facility. Any upgrade would also require additional piping, blowers, pumps, mechanical, and electrical systems. By adding additional processes, the operation and maintenance costs would also increase. When the time comes for expansion in the future, there is ample room for expansion on the plant site.

The expansion of the wastewater treatment facility's liquid portion is not anticipated for 15 years based upon assumptions made to develop **Tables 4-5** through **4-8**. While expansion of the City's wastewater treatment facility is not anticipated until 2024. This may change however depending upon:

1. The type/volume of commercial/industrial users which locate within the community. An industry which uses high levels of water could consume a large portion of the city's capacity. For planning purposes, **Tables 4-5** through **4-8** were developed assuming 1500 gallons per acre per day for commercial/industrial properties. Industrial growth, as well as actual population growth, should be monitored and sewer capacity plans be made accordingly. The City has a "Premature Subdivision" section in its Subdivision Ordinance, which allows for the denial of plats if the City is unable to service the area with municipal sewer, among other services. The City should carefully monitor capacity, and if needed, implement and exercise a premature subdivision clause if capacity becomes limited before an expansion can be completed.

2. Any changes in wastewater permitted discharge limits to Sand Creek, which could result from either changes in state/federal law or the state's classification of the facility. If the state were to classify the facility in a different 'bracket', it is possible the City would be required to immediately or phase in additional treatment processes.

3. Population growth rates, if different from the Met Council forecasts given to the City. The City is of the opinion the growth forecasts are relatively low, as evidenced by the 2018 and 2019 planned residential expansions, which would imply expansion of the plant may be required sooner than illustrated in **Tables 4-5** through **4-8**.

Future Wastewater Collection System Improvements

Development within the 2040 Boundary will occur in stages over the upcoming 22-year period. For the planning purposes and to aid decision makers in understanding potential growth patterns, a development staging plan has been created to predict the order of development. This may be valuable for decision maker understanding, however it should be understood the actual development in the City of Jordan will occur based on: the timing of completion of the SW interceptor, ease of installation (by relative cost) of sanitary sewer system expansions, and location of recent development requests and inquiries received by the City. These factors were primary considerations in creation of the development staging estimate.

Syndicate Street Service Area (Existing Service Area)

The Syndicate Street Interceptor's current service areas are completely within the 2040 Planning Boundary. The sewers were extended to serve the bluff areas to the west and the area south of TH 282, to the east. The Syndicate Street district has a gravity sewer service boundary that includes some growth areas near the top of the bluff, just south of the existing Cedar Ridge and Heritage Hills developments. The existing Syndicate Street interceptor sewer does have adequate capacity to accept flow from these areas with the extension of 8" sanitary sewers. The Syndicate Street interceptor has historically been broken down into three sub-districts:

1. First / Syndicate Sub-District - From WWTF to the intersection of First & Varner - This is the major interceptor which accepts flow from the other trunk lines in this district. The graph

above includes full development of the tributary areas and the actual capacities generally exceed the necessary capacities, represented by the red line.

2. MN Valley Electric Sub-District - From First & Varner to MN Valley Electric - This sub-district of First and Syndicate collects the flow from the east leg of the Syndicate Street interceptor, along the south side of TH 282. The large 'actual' capacities are caused by the sewers that have increased slopes along the side of the escarpment. This sewer is already extended to its maximum gravity service area and its design and actual capacities are shown in the graph above.
3. Timber Ridge Sub-District - From First & Varner upstream to Aberdeen & Sunset, this collector runs around the north end of Mill Pond to serve the area along and above the bluff around Sunset Drive. The Syndicate Street interceptor is at its maximum service area. The Creek Lane district to the south prohibits any further expansion in that direction and the valley to the north makes expansion in that direction unnecessary. The conclusion is that the Syndicate Street interceptor is adequate to accommodate its district boundaries shown and development to "infill" the district at the designated densities can be permitted with little or no risk of overtaxing the collection system.

Creek Lane Service Area (Existing Service Area)

The Creek Lane Interceptor extends from the SW interceptor (at the intersection of Creek Lane and Valley View Drive), across Sand Creek just west of Varner Street, along Park Drive to the intersection of Hillside Drive where it forks into two significant subdistricts: a) to its upstream end at the Sawmill Woods Dog Park and b) to the new early 2000s development areas including Bridle Creek, River Ridge, Arborview, and Stonebridge. Between 2003 and 2006 the City approved preliminary plats in the Bridle Creek and Stonebridge area, which are continuing to expand in 2018, as well as areas south of the Sawmill Woods development. These areas greatly taxed the capacity of on the Creek Lane interceptor.

Until the SW interceptor is completed, future development will be somewhat limited by the capacity of the Creek Lane Interceptor. The Creek Lane interceptor appears to have sufficient capacity to manage growing flow rates and the current rate of development, but the Creek Lane interceptor is currently vulnerable to excess flow conditions during heavy rain events which will be more pressing as additional development flow areas are added.

Prior to construction of the Sawmill Woods 1st addition in 2004, the City constructed a special manhole to function as a future diversion chamber on the upstream end of the Creek Lane Interceptor located in what is now the Sawmill Woods Dog Park. Currently, this structure allows flow to travel by gravity under TH 21 to Hillside Drive (and then down Park Drive). In the future, this diversion chamber is intended to collect flow from Sawmill Woods and 'Upper Sand Creek' subdistricts located upstream. The structure will potentially allow a portion to continue to flow along its existing route by gravity but allow the excess to flow into a future lift station. This future lift station will pump flow through a future forcemain along Sawmill Road, west along CR 66, ultimately discharging into the SW interceptor pipe. Construction of the lift station and forcemain will not be necessary until continued expansion to the southeast overtaxes the existing Creek Lane (located downstream).

Three major and one minor sub-districts are tributary to Creek Lane, in addition to local connections. They are: Bridle Creek / Hillside Drive / Hope Avenue subdistrict, the Broadway South (minor) subdistrict, the Upper Sand Creek – West Side, and the Upper Sand Creek - East Side.

Sanitary sewers often follow ravines and waterbodies as a strategy to remain lower than the adjacent service areas. The East and West Upper Sand Creek subdistricts are formed along

the upstream areas of Sand Creek, located in the southeast corner of the City, on the east and west bluffs along Sand Creek. These are extensive, future/long term expansion areas for the City. Existing sanitary sewer is stubbed out of the Sawmill diversion manhole to the east, creating the start of the East Upper Sand Creek Subdistrict. By installing the East and West Upper Sand Creek interceptor pipes at the toe of bluff slope and keeping the invert above the floodplain, the sewers could then have a low enough elevation to serve required areas but most likely not require rock excavation. One or two inverted siphons may still be required to cross the Creek, especially in the more upstream area.

East Upper Sand Creek Subdistrict (Future Service Area)

In the period 2005 through 2007, the City reportedly committed to provide sanitary sewer service to Sawmill Woods 1, 2, & 3, Lloyd (PID 090350020), Ames (PIDs 099290310 & 229300020) and Mullin (PID 099290282) properties through plats or concept plans. Approval of these preliminary plats have since expired, therefore the consideration of any such preliminary plats contributing to the Creek Lane interceptor should be critiqued with respect to downstream capacity. Extensions further up Sand Creek, along Aberdeen Avenue, or County Road 66, could ultimately result in backups in the Creek Lane interceptor along First Street near West Street. Flow metering in June 2014 showed a clear relationship between Sand Creek flood stage and flow in the Creek Lane interceptor. These leads to three considerations:

1. It is recommended the City continue to periodically meter flow in the Creek Lane interceptor, particularly during the spring rainy season, to gauge the remaining capacity of the interceptor at critical points along its length. The two most critical points observed historically were at First Street/West Street, along Park Drive, and along CR 66 near Hope Avenue.
2. Capacity relief to the Creek Lane interceptor can be accomplished by diverting additional flow to the SW interceptor. With the planned completion of the SW interceptor to Bridle Creek in 2021, the diversion of some existing flows and much of the future flow will be diverted west. If metered flows indicate the Creek Lane interceptor is still continuing to trend toward its full capacity, it is recommended the City explore solutions to prevent inflows and infiltration by identifying potential sources and eliminating them. This could be accomplished through sanitary sewer pipe and manhole lining rehabilitation efforts.
3. If inflow and infiltration relief efforts are not cost effective or cannot sufficiently address the continued rising flows, the City will need to divert the Upper Sand Creek flow districts to the SW interceptor.

The areas to the southwest are tributaries of the Creek Lane interceptor through the Bridle Creek subdistrict. The Bridle Creek subdistrict is comprised of several developments, including Bridle Creek 1-7, River Ridge, Stonebridge, Arborview, the area north of CR 66 and west of Aberdeen Avenue, and (temporarily) Bridle Creek 8th and beyond. If this area becomes fully developed prior to completion of the SW interceptor, it is possible the sewers along CR 66 between Herbert Street and Hope Avenue would require upsizing to avoid backups. Given the anticipated schedule of the SW interceptor project, this would be a poor investment strategy. It is recommended the 48-acre tributary area (SW-3A) at the northwest corner of Aberdeen and Old 169, which is not yet developed or preliminarily platted, be guided toward the SW interceptor for sanitary sewer flow. The Timber Ridge interceptor will ideally not accept any additional area and if this area were directed to the SW interceptor when constructed, it would alleviate the problem between Herbert Street and Hope Avenue. Depending on the layout of the development in this area, it could require a small lift station to serve the 48 acres until it is fully built out – either to temporarily allow it to pump back toward Hope Avenue temporarily, or to permanently pump to the SW interceptor. In the long term, mechanical lift

stations are almost always more expensive to the public. Therefore, it is recommended development be guided to result in a permanent gravity flow toward the SW interceptor.

West Upper Sand Creek Service Area (Existing/Future Service Area)

The existing sanitary sewer into Sawmill Woods, along O'Day Drive to Wood Ridge Court are the beginning of the West Upper Sand Creek Subdistrict. Ultimately, the Upper Sand Creek Subdistrict sanitary sewer will be extended to serve future development areas toward the Ridge at Sand Creek Golf Course.

The southernmost portion of this service area is a long-range consideration, beyond what is anticipated to be served prior to 2040. The north frontage east of TH 21 is the Ridges at Sand Creek Golf Club has limited potential for the generation of wastewater. With such low flows, the most efficient way to service the SE-10B and SW-6C districts will be to construct a small lift station near TH 21 and County Road 8. A forcemain along TH 21 would carry the wastewater flow northward to near the northwest corner of the Golf Club where it can discharge into the SW-9B collector. Since the properties along Golfview Drive are already developed, the area may best be served with a pressurized sewer system.

Southwest Interceptor (W/SW) Service Area (Existing/Future Service Area)

In 2017 the City constructed the first phase of the SW interceptor from the WWTF toward Delaware Ave (CR 59), a total distance of about 2 miles. In 2018 the City is taking an opportunity created by a MnDOT construction project to open trench a casing across Highway 169 about 2000 feet east of Delaware Avenue. In 2021 the City plans to construct the remaining phase of the interceptor, starting from where it left off in phase 1, through the 2018 casing, adjacent to the westerly edge of the large Highway 169 wetland complex, and up a ravine in the bluff to connect to the west end of the Bridle Creek subdivision.

The SW interceptor is the critical backbone pipeline of the sanitary sewer system through which all current and future sewer flow is conveyed, with exception only to the future Northeast interceptor and service area. It will also serve as the gravity discharge point for a handful of other future areas discussed elsewhere in this document. In order, from downstream to upstream, the SW interceptor currently serves (or will serve) the following service areas / interceptors:

1. Syndicate Street (at the intersection with Syndicate Street)
2. MN River North (at the intersection of Valley View / Syndicate Street)
3. Creek Lane (at the intersection with Creek Lane)
4. Valley View / 190th St (just west of the intersection of Valley View Drive / Creek Lane)
5. 195th Street (future connections, but now available due to 2017 interceptor install)
6. Delaware Ave North (future) and Park Blvd Lift Station Area (future, beyond 2040)
7. US 169 Lift Station Area (future near Delaware Ave, 2040+)
8. Delaware Ave South (future near Delaware Ave south of 169, straddling 2040 boundary)
9. West Southwest Area (future direct connections and tributary spurs, immediately available upon installation of interceptor phase 2 in 2021)
10. 220th St, 220th St Lift Station (future connections 1 mile SW of existing City limits, 2040+)
11. Upper Sand Creek (straddling 2040 boundary)
12. Creek Lane (existing or near-term development areas to be routed west along CR 66)

The completion of phase 1 has immediately opened the previously unsewered area between 190th Street and Highway 169 for development. The completion of phase 2 will open additional area both north and south of Highway 169, just east of Delaware Ave. It will also facilitate continued development in the southwest part of the City without negative downstream

capacity issues that would have been created without the SW interceptor. Eventually in the long term, as significant development occurs in the southeast quadrant of Jordan's 2040 and ultimate growth boundary, this area will also serve the Upper Sand Creek subdistricts through the lift station to be constructed on Sawmill Rd near O'Day Dr and the forcemains along CR 66.

Until the SW interceptor is completed, future development will be somewhat limited by the capacity of the Creek Lane Interceptor. The Creek Lane interceptor appears to have sufficient capacity to manage growing flow rates and the current rate of development, but the Creek Lane interceptor is currently vulnerable to excess flow conditions during heavy rain events which will be more pressing as additional development flow areas are added. Phase 2 of the interceptor project will require acquisition of easements across private property and potentially significant, temporary wetland impacts. It is recommended some construction of the SW interceptor phase 2 be implemented during winter months when permitting of temporary wetland impacts is more readily received. It is recommended preliminary design and the land acquisition process be initiated 18 months prior to the intended award of a construction contract, or about 20 months prior to desired start of construction.

As development interests move beyond the current Bridle Creek / Stonebridge / Pieper property undeveloped areas, heading further west/southwest on top of the bluff line, another tributary spur from the SW interceptor can be extended at the toe of the bluff to a ravine west of Delaware Avenue. Trunk collector sewers may then be extended up the ravines to serve future development in the area.

195th Street Service Area (Existing Service Area)

The 195th Street area recently became sewered as a result of the 2017 SW interceptor extension. Manholes spaced at approximately 400-foot-frequency allow connection points for sewer tributaries to be extended north into undeveloped area. Land uses are projected to be a combination of commercial / industrial and residential as shown in the future land use maps found elsewhere in the Comprehensive Plan. Most notably, this area is a unique area of developable land available for creation of new commercial/industrial opportunities for which there are limited opportunities elsewhere in the current City limits.

Valley View Drive Service Area (Existing Service Area)

This existing service area is heavily subdivided and is currently serviced through the CSAH 9 collector sewer. The current density is relatively low, and the area is surrounded by other service areas in this study therefore it will not be expanded. Valley View Drive is the primary access route to the WWTF using the SW interceptor. Continued development within this area, such as at the Pearson property (PID 229130010) or Hauer property (PID 220920020) will enjoy direct, immediately available connection to the Valley View Drive Interceptor along 190th Street without any capacity constraint. No future major collector or interceptor sewers are required within this existing service area.

Northeast Service Area (Future Service Area)

The northeast service area straddles the 2040 boundary and is currently an unsewered area requiring a new interceptor sewer route to wastewater treatment plant (WWTF). The planned path would follow the ravine at the southeast corner of TH 21 and US 169. From that point, trunk collector sewers may be extended up the various ravines to the top of the bluff. These extensions will be capable of directly serving the gravity service portion of the area. The far northeast most portion of the Northeast service area more difficult to be served directly by the gravity collection system due to topography. Either another interceptor along US 169 or a lift station with forcemain would be required to pump flow back to the main, northeast

interceptor. Evaluation of this routine should be investigated prior to development of a northeast interceptor project. Properties located in this area may be best served with pressurized sewers.

The installation of new trunk interceptors such as the northeast interceptor are an expensive investment. The City's recent investment in the SW interceptor and its installation in 2017-2021 make development pressure more likely to be met in the southwest and southeast quadrants of the community, prior to the northeast quadrant atop the bluff.

Minnesota River North Service (Future Service Area)

This area lies on the side-slope of the Minnesota River, north of the city and will be served in two directions. In previous reports, the Sioux Vista area and areas downstream (NE) were discussed as requiring construction of a new interceptor sewer from near the intersection of Valley View Drive and Syndicate Street. This was originally presented in the Northwest Quadrant Growth Study Report completed in the early 1990s. Near the intersection of Valley View Dr and Syndicate Street the MN River North sewer interceptor will discharge into the Southwest Interceptor and flow south to the WWTF. Significant portions of Sioux Vista have been developed as unsewered hobby farms. For long term planning, it should be acknowledged that future redevelopment and lot splits may occur, and the density could increase. However, the ultimate density will always be relatively light. The 740 MSL contour generally defines the limit of areas within Sioux Vista that can be serviced directly by gravity flow to the WWTF. The properties located between the 740 contour and the floodplain boundary of the Minnesota River must be serviced with on-site systems, pressurized sewers or a small lift station. The area to the west and further upstream from Sioux Vista along Park Boulevard will be served by the construction of an approximately 1,427-gpm lift station. The Sioux Vista area itself could be served in either of these directions depending on timing and detailed design of the system.

Before extension of sewer to these areas, it is recommended a feasibility study be completed to quantify the costs of sanitary sewer extension. Identified costs should be compared to the benefit of adding this lightly developed area to the City. It may be prudent to plan to accept only portions of the MN River North service area, such only that area which will be developed in a denser pattern thereby making sanitary sewer extension more cost effective for sewer rate payers.

West US 169 Service Area (Future Service Area, 2040+)

The area on either side of US 169 from ½ mile to 1 mile west of Delaware Avenue will require the installation of a 3,200-gpm lift station on the south side of US 169. The lift station will serve everything in the west and southwest portions of the Ultimate Service Area. The 220th and 228th Street service areas will discharge through the ravine east of Delaware and flow north to 169 where they can connect to the 169 Interceptor. The forcemain from the lift station will discharge to the gravity sewer installed to serve the frontage road businesses. The discharge manhole should be near Suzette's Restaurant.

Delaware Avenue North Service Area (Future Service Area)

Portions of the Delaware Avenue Service area will be served via the SW interceptor trunk sewer which can be partially extended northward in Delaware Avenue from US 169 to serve this area. This trunk will also receive the flow from the Park Boulevard lift station, which serves the upstream (westerly) portion of the Minnesota River service area. Other portions of the Delaware Avenue North Service area will be fed via the future Sioux Vista service area which will also be pumped back to the gravity sections of the Delaware North Service Area's main and ultimately discharged to the SW interceptor.

Delaware Avenue South Service Area (Future Service Area, 2035 - 2040+)
Service to the bluffs on the south side of US 169 will be provided by the extension of a trunk sewer south in Delaware Avenue from US 169. Generally, it will be constructed near the bottom of the bluff and individual collectors will be extended up the ravines to the south.

220th Street Service Areas (Future Service Area, 2040+)
The area on the north side of 220th Street W is broken into two service areas. The westerly portion (SW-7C&D) will be served by a 346 gpm lift station. The forcemain will extend easterly, as shown, and discharge into the second service area (SW-7B). Ultimately, the flow from the 220th Street W service areas will flow across Delaware Avenue to the northeast and down the ravine to the north. Eventually, it will connect to the Southwest interceptor along US 169.

220th Street Lift Station (Future Service Area, 2040+)
On the most western portion of this area, gravel mining has historically been performed on some specific sites. Therefore, it is recognized that the topography will be changing. The northwesterly portion of the area can be served with straight forward connections across 220th Street. The southwest corner will require a pump station to accommodate the 316 acres. The flow from this area will be to the east to the first ravine east of Delaware and then north to US 169.

220th Street, west of Delaware Street (Future, 2040+)
In the very southwest corner of the Ultimate Service Area is a comparatively small district that must be served by its own 600 gpm lift station. The discharge will be to the east in District SW-5I and flow into the collector in the first ravine east of Delaware.

Park Boulevard Lift Station Area (Future, 2040+)
This area is within the ultimate growth boundary along Park Blvd and US Hwy 169, about 1 mile west of Delaware Ave. This area will utilize gravity sewers to collect flow and route flow via a lift station back to the SW interceptor.

Upper Sand Creek Lift Station / Force Main
This will require a dual forcemain (14" & 10") to reach the West / Southwest Interceptor. Initially, there will be insufficient flow to operate a large diameter main; therefore, the smaller one is required. But in the future, as the area develops a single smaller diameter forcemain would be inadequate to carry the flow. The City has constructed the lift station diversion chamber with the Sawmill Road project in 2005. The design of the diversion chamber allows the installation of control gates in the future. By automatic monitoring the flow in the downstream Creek Lane interceptor, the gates will be capable of allowing gravity flow into Creek Lane when it is capable of accepting it. This will permit limiting operation of the lift station to times that the flow demands it. The interceptor and arterial sewers within the Southwest service area will require over sizing to accept the capacity of the pump station.

Service Area Collector Sewers
Other, less critical, interceptor and trunk collectors are necessary throughout the study area to deliver the wastewater to the WWTF. Specific reaches of these sewer routes may extend through areas in which the sewer can directly service neighboring properties; however, for the purposes of this study, it was assumed that no portion of the cost would be directly assessable. The approximate routes and sizes are shown on individual maps for each of the service areas.

Estimated Costs and Recommendations

Basis of Cost Analysis - For the purpose of estimating cost, it is assumed that there will be no easement or right-of-way costs involved with any of the proposed improvements.

TABLE 4-9
NEWLY SERVED SANITARY SEWERED AREAS WITHIN 2040 BOUNDARY

Service Areas Within 2040 Planning Boundary	New Area Served (Acre)	
	Residential	Commercial
Syndicate Street Service Area Extension	277	30
Southeast 10 Collector (C.R. 8 extended westerly)	278	28
Southeast 9-b Collector	232	0
Southeast 9-a Collector	358	0
Upper Sand Creek – West Side (Directly Tributary)	86	0
Broadway Interceptor – South – SE – Taken to Sand Creek	30	0
Bridle Cr / Hillside Dr / Hope Ave Interceptor	344	0
West and Southwest Interceptor	1776	283
195th St Collector	0	172
Valley View Service Area	30	0
MN River Interceptor	857	0
Approximate New Acreage Served Within the 2040 Planning Boundary	4268	513

TABLE 4-10
NEWLY SERVED SANITARY SEWERED AREAS WITHIN UGB AREA

Service Areas Between the 2040 Planning Boundary and the Ultimate Growth Boundary	New Area Served (Acre)	
	Residential	Commercial
Northeast Growth Area – TH 282 Interceptor	992	107
Northeast Growth Area – US 169 Interceptor	369	0
Upper Sand Creek – East Side (Directly Tributary)	399	0
Southeast 2 – Sawmill Rd	109	0
Southeast 7 Collector	861	0
Southeast 8 Collector	337	0
Park Boulevard Service Area	627	27
Delaware Avenue North Service Area	82	369
West US 169 Service Area	238	91
Delaware Avenue South Service Area	259	113
220th Street Service Area	378	0
Approximate New Acreage Served Between the 2040 Planning Boundary and the Ultimate Growth Boundary	4651	734

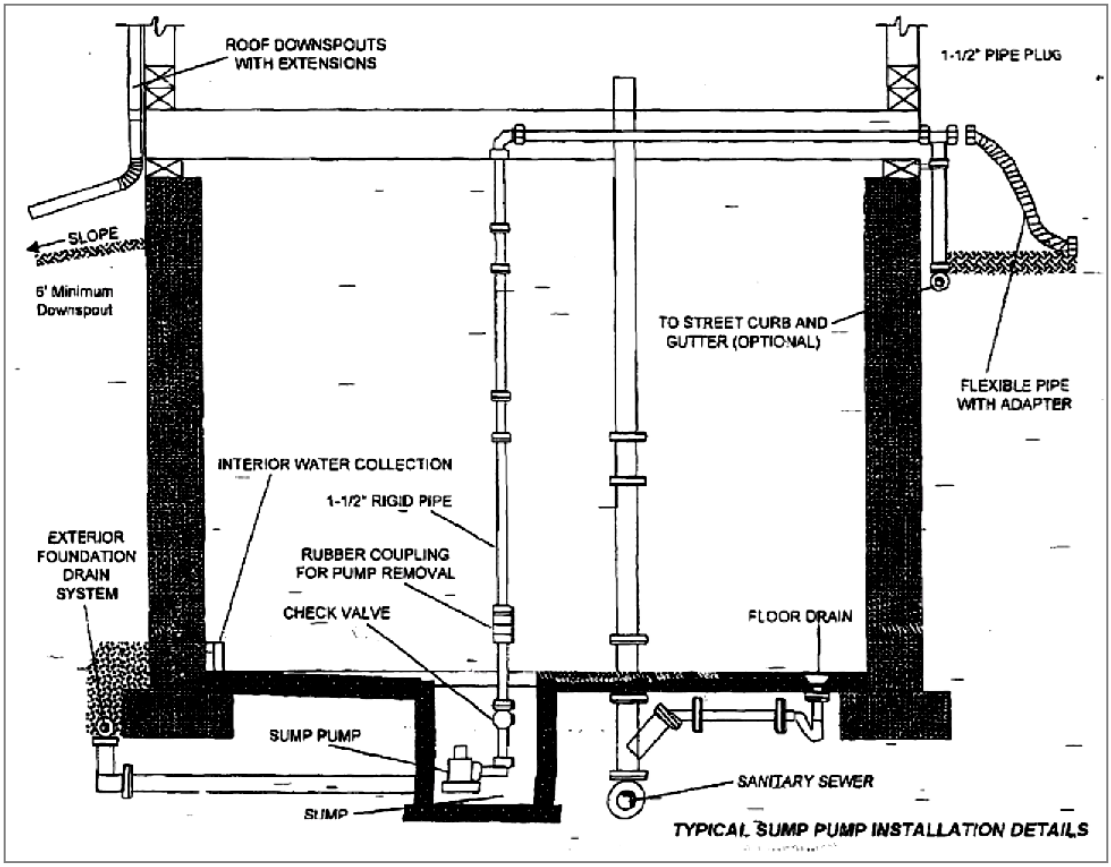
TABLE 4-11
COST ESTIMATE OF PROPOSAL SANITARY SYSTEM 2040 EXPANSION

Service Area	Estimated Cost
Southwest Interceptor Phase 2	$3,423,000
Old US 169 Forcemain	$1,570,000
Sawmill Lift Station	$490,000
Sawmill Interceptor Extension	$3,130,000
Upper Sand Creek Interceptor	$6,470,000
Northeast Interceptor Phase 1	$3,040,000
Southwest Interceptor Phase 3	$3,600,000
Delaware Interceptor and Forcemain	$3,690,000
Delaware Lift Station	$490,000
Oversizing Costs – Individual Developments	$2,400,000
Total Estimated Cost	$28,320,000

Cost Analysis
Assuming the City pursues these recommendations, the estimated total cost of the collection system is $ 28,320,000. Given the approximate new area served, the City's current single family residential fee per acre of $5,862.52 is appropriate to cover the City's participation for the construction, right-of-way acquisition, financing, etc. Attempts were made in this study to limit the tributary area calculations to developable property and omitting the escarpments, floodplains, ravines, etc. If the gross areas were included in the design, the capacities of the sewers would have been inflated which would have inflated the cost projections. The current City policy applies the Sewer Area / Capital Charge to the gross area of each property. As development expands into less efficient topographic areas, the City may want to consider limiting charges to the "net" area of a development. This could only exclude areas prohibited from development by existing ordinances, i.e., the escarpments, floodplains, wetlands, etc.

Management of Inflow & Infiltration to Reduce Infrastructure Expansion Needs
The City of Jordan Public Works Department monitors flows at the municipal wastewater treatment plant for any unusual activity which may be associated with infiltration. Additionally, the City owns and its City Engineer operates two flow meters used each spring for strategic metering of sanitary sewer flows. The goals of the City's flow metering efforts are twofold; 1) to identify areas where sewer flow is nearing capacity and 2) to compare base flows to peak flows so as to identify the proportion of sewer flow due to inflow/infiltration. Currently the City's WWTF is capable of managing its peak flows, and pipe size is the first constraint at some points in its system. Prior to implementation of future expansions of the system, the City will consider implementation of strategic sewer pipe and manhole lining improvements with benefit of this data. As part of the construction contract for the 2017 SW interceptor project, the City's Public Works Department took ownership of a sanitary sewer televising system to enable it to inspect potential sources of inflow/infiltration throughout the community without the need to hire outside contractors.

Section 52.05 (D) of the City Code restricts connection of sump pumps to the sanitary sewer system, stating, "No sump pumps or tiles around perimeters can be allowed to drain into the sanitary sewer." The City Code notes failure to comply may result in penalties including charges of a misdemeanor. The City Code also illustrates the required plumbing of a sump pump, as depicted in the following image:



Facility Planning

Currently there are not any existing facility planning reports for the wastewater treatment plant. The City is currently awaiting approval of their new NPDES permit and will likely develop a facility plan based on any new requirements in the new NPDES permit.

National Pollutant Discharge Elimination System (NPDES) Permit

A copy of the most current NPDES permit for the Jordan Wastewater Treatment Facility is included in the appendix.

IV. COMMUNITY AND SUBSURFACE TREATMENT SYSTEMS

As of January 2017, there were twenty-five (25) residential units and businesses in the city limits serviced by individual sewage treatment systems (ISTS). Minnesota Rules Chapter 7080 governs construction and abandonment of ISTSs. The City has contracted with Scott County Environmental Services office to implement MN Rules 7080 locally. Scott County requires ISTS's be pumped every three years by a licensed company. A list of sites with ISTS's follows, with a map of sites attached (Map 10-4). A copy of the Ordinance is attached as Appendix to this Plan. The City also regulates ISTSs in the City Code, Section 3.04, Rules and Regulations Relating to Municipal Utilities. There are no known non-compliant ISTS systems within the City at the time this Plan was drafted.

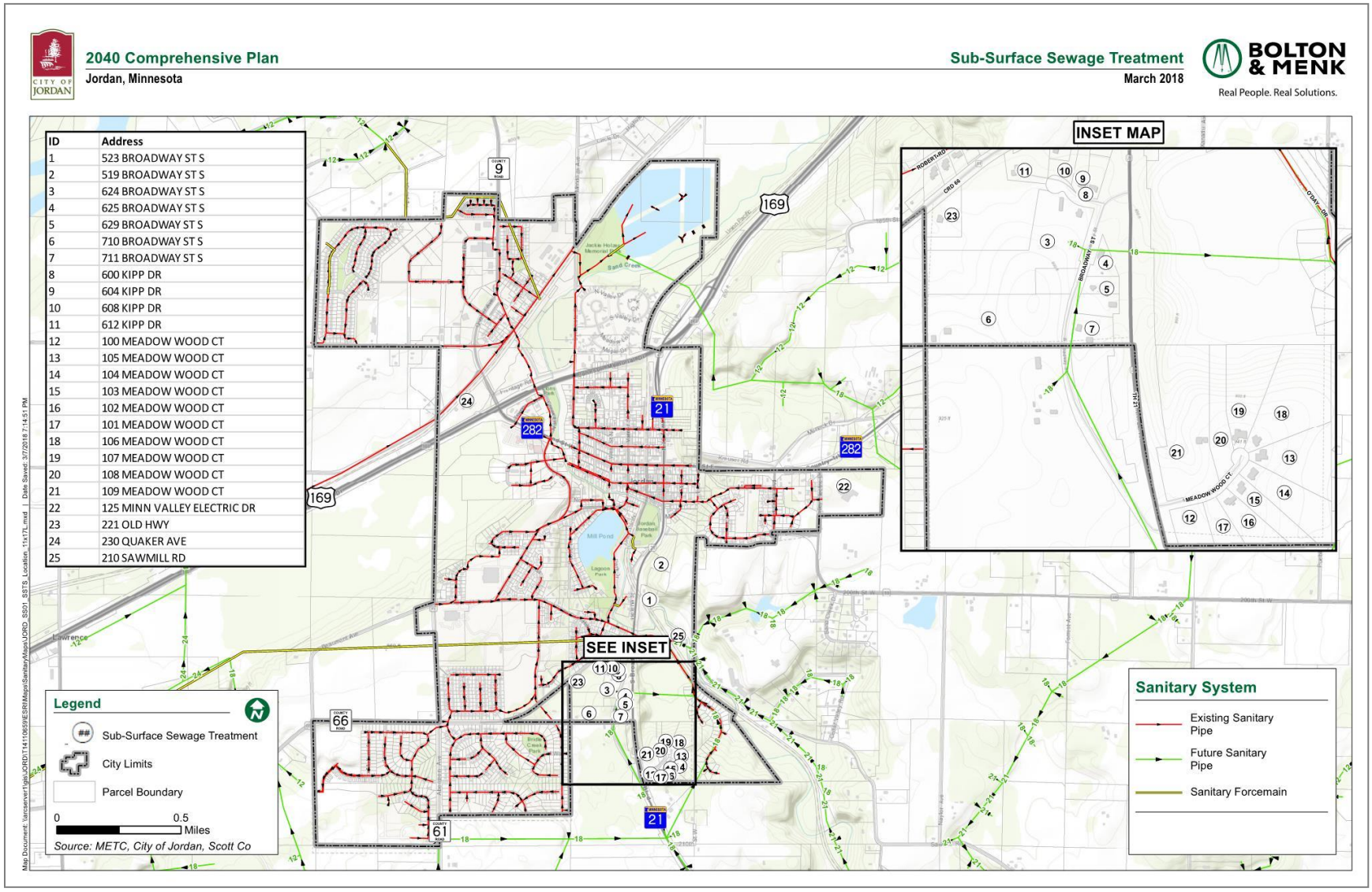
TABLE 4-12
INDIVIDUAL SEWAGE TREATMENT SYSTEMS IN CITY LIMITS

Address	Install Date
519 BROADWAY ST S	8/19/1989
523 BROADWAY ST S	1/1/1950
624 BROADWAY ST S	10/16/1981
625 BROADWAY ST S	1/1/1950
629 BROADWAY ST S	1/1/1950
710 BROADWAY ST S	1/1/1981
711 BROADWAY ST S	1/1/1950
600 KIPP DR	6/3/1994
604 KIPP DR	8/20/1992
608 KIPP DR	6/15/1995
612 KIPP DR	7/1/2010
100 MEADOW WOOD CT	10/25/2000
101 MEADOW WOOD CT	7/24/2001
102 MEADOW WOOD CT	1/1/1993
103 MEADOW WOOD CT	1/1/1997
104 MEADOW WOOD CT	10/26/1993
105 MEADOW WOOD CT	11/9/2010
106 MEADOW WOOD CT	1/1/1996
107 MEADOW WOOD CT	5/19/1995
108 MEADOW WOOD CT	10/6/2015
109 MEADOW WOOD CT	7/22/2003
125 MINN VALLEY ELECTRIC DR	5/15/2003
221 OLD HWY 169 BLVD	1/1/1990
230 QUAKER AVE	1/1/1974
201 SAWMILL RD	1/1/1950

Source: Scott County Environmental Services (January 2017)

There are no private treatment systems in the City of Jordan. All systems are either public or private sub-surface sewage treatment systems. Known sub-surface sewage treatment systems are shown on **Map 4-10**. The City of Jordan would not consider the approval of private sewer treatment plants or cluster systems for industries or manufactured home parks, as this would not be consistent with the City's long-range sewer plan.

MAP 4-10: SUBSURFACE SEWAGE TREATMENT



V. AREAS SERVED BY THE REGIONAL SYSTEM

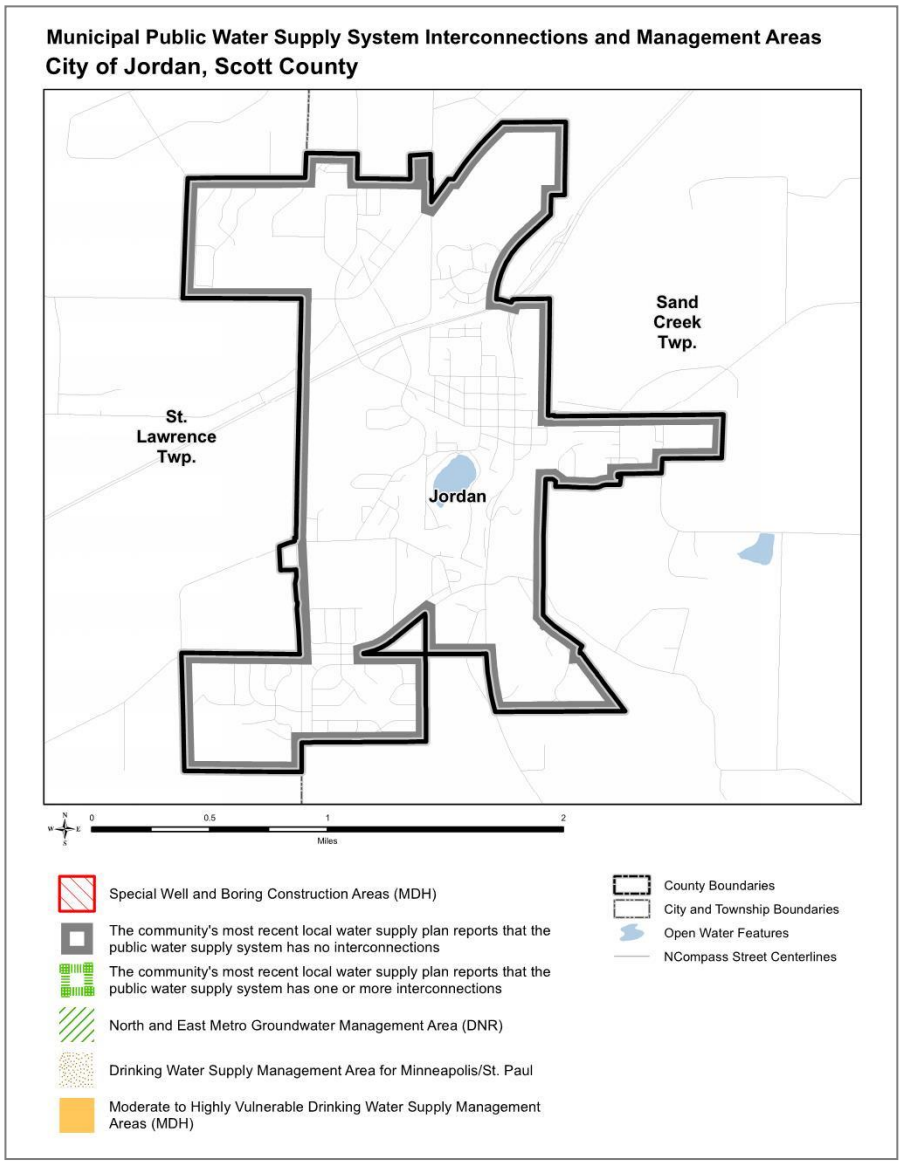
The City of Jordan owns and operates its own wastewater facility. It is not a part of the Metropolitan Council's wastewater treatment system; therefore, a number of requirements for the 2040 Comprehensive Plan relating to the sewer chapter (e.g. maps of connection points to the Metropolitan Disposal System) are not applicable and therefore, not included in this document.

WATER SUPPLY PLAN

I. AREAS SERVED BY LOCAL WATER SUPPLY SYSTEMS

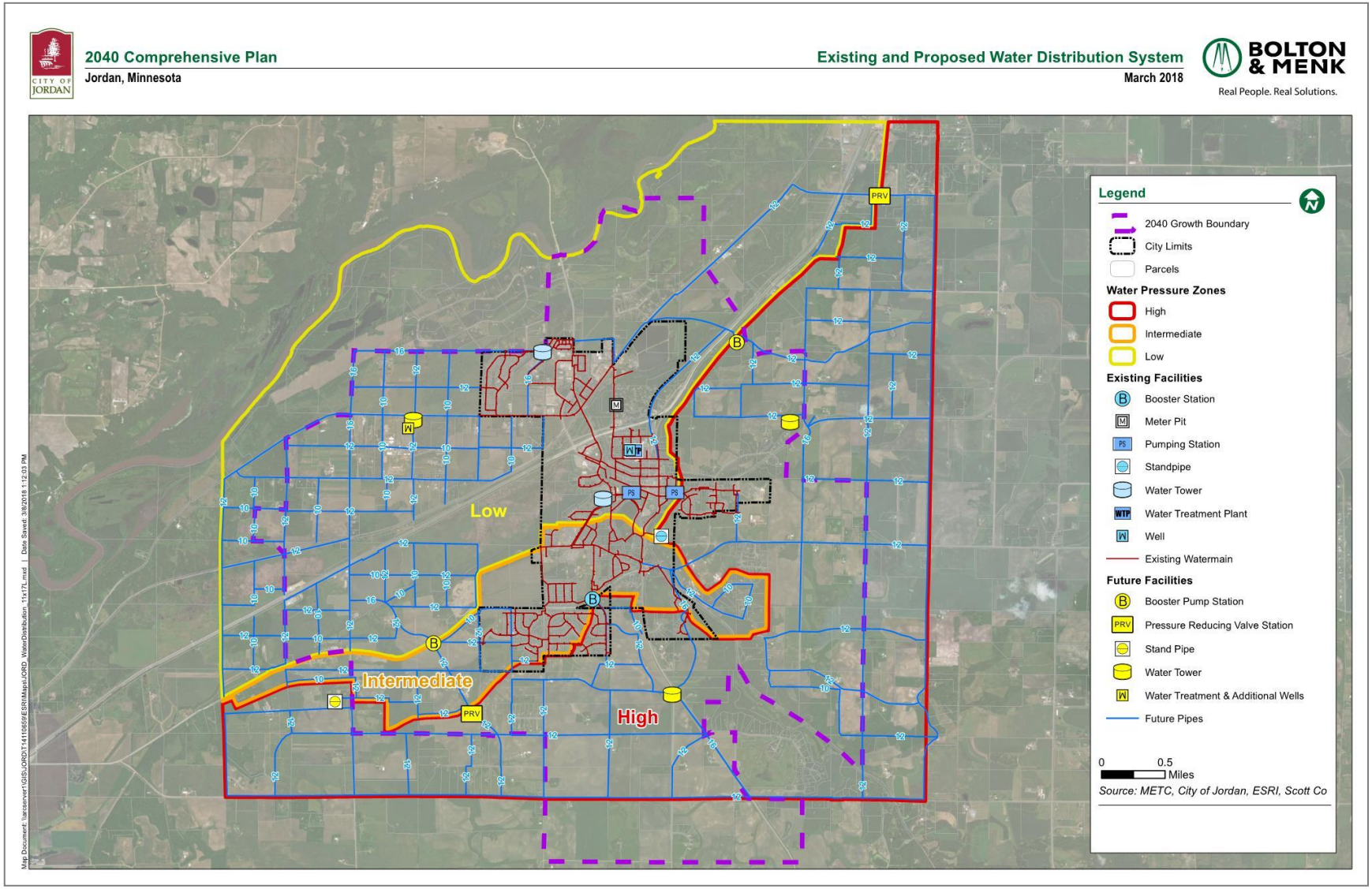
The City of Jordan completed its 3rd generation Water Supply Plan in 2017 and the following data has been taken from that plan. The full Water Supply Plan can be found in the appendix. This report contains a summary of water demand, water storage and treatment, source water condition, water conservation, emergency preparedness, and the Capital Improvement Plan (CIP). As shown below, there are no interconnections.

MAP 4-11: WATER SUPPLY SYSTEMS INTERCONNECTIONS



Map 4-12 illustrates the existing and future layout of Jordan's water distribution network and water supply infrastructure.

MAP 4-12: EXISTING AND PROPOSED WATER DISTRIBUTION SYSTEM



II. WATER DEMAND

The historic water demand in the City of Jordan is shown in **Table 4-13.**

TABLE 4-13
HISTORIC WATER DEMAND

Year	Avg. Day (MGD)*	Estimated Population	Avg. Day per Capita (GPCD)**	Max Day (MGD)*	Peaking Factor (Max. Day / Avg. Day)
2005	0.417	4750	87.7	1.04	2.50
2006	0.477	5000	95.4	1.10	2.31
2007	NA	5040	NA	1.40	NA
2008	NA	5316	NA	1.10	NA
2009	NA	5350	NA	1.10	NA
2010	0.458	5470	83.6	0.85	1.85
2011	0.493	6253	78.9	0.89	1.80
2012	0.499	6255	79.7	1.20	2.41
2013	0.477	5873	81.2	1.00	2.10
2014	0.463	5970	77.6	1.04	2.25
2015	0.611	6150	99.3	1.20	1.96
Avg. 2010-2015	0.500	5955	83.4	1.03	2.06

**MGD – million gallons per day*
***GPCD – gallons per capita per day*

Anywhere that NA is listed in **Table 4-13**, data was not available for that year. In 2015 the water demand spiked well above previous years. Since completion of the Water Supply Plan, the City is investigated the cause of the apparent increase in water demand (usage) and found it was the result of a metering issue at the water treatment plant which was incorrectly outputting data (i.e. water demand was actually not increasing in 2015). In general, the average water use per day has remained consistent even though the population has increased. Average water use per capita has decreased.

Current population projections indicate that the City of Jordan will grow from a population of 6,357 to an estimated 12,200 by the year 2040. Water use trends from the past can be used to forecast future water demands. Demand projections associated with the population growth projections indicated the following 2040 Design Water Demands: Average Day Demand: 0.82 MGD and Peak Day Demand: 1.83 MGD.

TABLE 4-14
FUTURE WATER DEMAND PROJECTIONS

Year	Projected Total Population	Projected Population Served	Projected Total Per Capita Water Demand (GPCD)	Projected Average Daily Demand (MGD)	Projected Maximum Daily Demand (MGD)
2016	6,357	6,357	83	0.53	1.18
2017	6,493	6,363	83	0.53	1.20
2018	6,629	6,496	83	0.54	1.22
2019	6,765	6,630	83	0.55	1.25
2020	6,900	6,762	83	0.56	1.28
2021	7,170	7,027	83	0.59	1.30
2022	7,440	7,291	83	0.61	1.33
2023	7,710	7,556	83	0.63	1.36
2024	7,980	7,820	83	0.65	1.38
2025	8,250	8,085	83	0.67	1.41
2030	9,600	9,600	83	0.80	1.77
2040	12,200	12,200	83	1.02	2.25

III. WATER STORAGE AND TREATMENT

The City of Jordan must be able to provide treatment and storage to meet future water demands. Water treatment is done to ensure that water quality standards are met. Storage is important for a few reasons:

- Elevated storage provides pressure for the water distribution system.
- Additional storage aids in meeting peak water demands.
- An emergency supply of water is stored in case of something like a power outage.

The tables below show the characteristics and capacity of the water treatment plant and water storage facilities.

TABLE 4-15
WATER TREATMENT

Treatment Site ID	Year Constructed	Treatment Capacity (gallons per day)	Treatment Method	Treatment Type
WTP No. 1	Originally built in 1991 and updated in 2008	3,456,000	Gravity filtration	Fe/MN and Radium removal

TABLE 4-16
WATER STORAGE

Structure Name	Type of Storage Structure	Year Constructed	Primary Material	Storage Capacity (Gallons)
CORP Tower	Elevated Storage (Pedestal)	2005	Steel	500,000
Sunset Tower	Elevated Storage (Pedestal)	1971	Steel	300,000
Broadway Tower	Other – Standpipe	1991	Steel	500,000
Total				1,300,000

The average daily demand projection for 2040 is 1.02 MGD. Both the treatment plant, capacity of 3.5 MGD, and water towers, combined capacity of 1.3 MGD, have sufficient capacity for the projected population growth.

IV. ASSESSING AND PROTECTING SOURCE WATER

Supplying water to a distribution system, requires drawing water from a source like groundwater, surface water, or interconnections with other water suppliers. The City of Jordan has four wells that provide water to the City. Data about these wells is shown in the table below:

TABLE 4-17
WATER SOURCE DATA

Resource Type	Resource Name	Year Installed	Capacity (Gallons per Minute)	Well Depth (Feet)	Status of Normal and Emergency Operations (active, inactive, emergency only, retail/wholesale interconnection)	Does this Source have a Dedicated Emergency Power Source?
Groundwater	Well No. 5	1991	450	287	Active	Yes
Groundwater	Well No. 6	1999	750	295	Active	No
Groundwater	Well No. 7	2003	500	547	Active	Yes
Groundwater	Well No. 8	2008	1500	550	Active	Yes

All of Jordan's water is pulled from groundwater sources. Well No. 5 and Well No. 6 draw from the Ironton / Galesville aquifer, and Well No. 7 and Well No. 8 draw from the Mt. Simon aquifer. Water levels within these wells are monitored on a daily basis using Supervisory Control and Data Acquisition (SCADA). Well No. 6 has rising water levels. All of the others have a stable water level at this time.

Water withdrawals from a source can have an impact on natural resources. The City must identify the greatest risks to the natural resources and asses these risks. Both aquifers are at risk of water level decline and degrading water quality trends. The water levels will continue to be monitored, and tests will be conducted on water quality. The City will need to increase conservation practices and change groundwater pumping patterns if a problem is identified.

Another at risk water resource in Jordan is Sand Creek. The creek is at risk of a decline in water level and degrading water quality. Currently the creek is listed by the Minnesota Pollution Control Agency (MPCA) as an impaired water. The impairments include turbidity, nutrient eutrophication, and chloride. The City is making efforts to increase conservation in regards to the creek. Water levels and water quality will be compared to historical data to determine trends and evaluate condition.

Water Conservation and Reuse

To preserve water sources and water quality the City must implement water conservation practices and policies. Since 2006, the City of Jordan has taken the following conservation actions:

- Water rates structure has been changed to provide conservation pricing.
- Water supply system improvements (e.g. leak repairs, valve replacements, etc.) have been undertaken.

- Educational efforts have been made.
- New water conservation ordinances were put into practice.
- Violation of conservation actions were enforced.

As a result of these actions, the City has seen a decrease in residential and total per capita demand. The average day demand and maximum day demands have also remained consistent despite increasing population. This shows that conservation measures have helped to reduce water use per capita during average and peak demands.

With the population projected to increase, the City must continue to increase conservation efforts. The following actions will be incorporated to continue reducing demand per capita:

- Revise city ordinances/codes to only allow odd/even day watering for lawn use.
- Continue to make water system infrastructure improvements.
- Switching from bimonthly to monthly billing.

'Unaccounted for water' is a valuable statistic that can be used to evaluate water conservation. All water connections in Jordan are metered, allowing the City to monitor water usage and unaccounted-for water. In Jordan, like all cities, the volume of water pumped during a year does not equate exactly to water metered at point of sale. There are several reasons for 'unaccounted for water' including hydrant flushing, leaks, and other system maintenance operations which discharge water unmetered. The American Water Works Association (AWWA) recommends that the amount of unaccounted for water be less than 10%. The MnDNR uses this figure as a benchmark to gauge a City's accounting for its water usage. Historically the City has had a low average unaccounted-for water. From 2010 to 2013 the unaccounted-for water was 4.2%.

To track success over the next ten-year period the City will continue tracking residential and total per capita water demand to see if they remain consistent or decline. The City will continue to monitor unaccounted for water to ensure proper metering and appropriate water use monitoring practices are used within the City.

Emergency Preparedness

The City of Jordan has a federal emergency response plan in accordance with the Safe Drinking Water Act. Contamination, loss of production, infrastructure failure, and executive order by the governor are all emergency triggers. Notification of a water emergency is sent out through the City website, social media, and a press release. A list of emergency contacts can be found in the Water Supply Plan in the appendix. In the case of an emergency, water use will be reduced to the minimum amount needed. Priority will be given to residential use followed by commercial/institutional/industrial use.

V. CAPITAL IMPROVEMENT PLANNING

The existing infrastructure within the City of Jordan is able to meet the current water demands; however, the City has plans to increase capacity and improve infrastructure to meet future demands and to improve water conservation. The proposed CIP for the water supply system is shown in the table below:

TABLE 4-18
WATER SYSTEM CIP

System Component	Planned Action	Anticipated Construction Year
Wells/Intakes	Drill new well No. 10	2025
Water Storage Facilities	Add a 500,000 gallon elevated storage tank to support continued development in the SE corner of the City	2023
Water Treatment Facilities	No planned expansion	
Distribution Systems (pipes, valves, etc.)	Distribution pipe replacement and upgrades for new development and water looping in distribution system	2018-2040
Pressure Zones	Rehab pressure reducing valve station No. 1	2021
	Rehab pressure reducing valve station No. 2	2027
Other: Booster Pump Station	Rehab existing booster pump stations	2023

LOCAL WATER MANAGEMENT PLAN

I. EXECUTIVE SUMMARY

The City of Jordan's Comprehensive Surface Water Management Plan (Plan) was prepared, in part, as an update to the previous Surface Water Comprehensive Plan (updated November 2007). The intent of this revised Plan is adoption in conjunction with the Scott Watershed Management Organization (Scott WMO) Comprehensive Water Resource Management Plan (CWRMP) and accompanying Rules, as amended, to meet the requirements of the Scott WMO regulations as well as applicable regulations specific to the State of Minnesota and Scott County. The City of Jordan (City) will utilize this Plan, the accompanying Rules, and existing and new Ordinances as the basis for managing wetlands, surface, storm, flood, and groundwater within the municipal boundary. The Plan incorporates hydrologic surface water modeling not only for the area within the existing municipal boundary but also for the area extending out to the City's ultimate growth boundary.

This Plan, accompanying Rules, and revised Ordinance, when adopted in conjunction with the Scott CWRMP and Rules, as amended, will provide the management goals, policies, and objectives the City will implement to protect, improve, and preserve wetlands, surface, storm, flood, and groundwater resources within the City. It will also address the topics required to meet Scott WMO criteria for a Local Water Plan for submittal, acceptance, and approval under Minnesota Statutes 103B and Minnesota Rule 8410.

The Plan has been prepared with cooperation of the City of Jordan staff and the Jordan City Council to address the concern for the City's bluffs, wetlands, surface, storm, flood, and groundwater impacts resulting from continued development and growth both in and adjacent to the City of Jordan.

This Plan addresses various methods of ensuring that continued growth and development does not adversely affect the city's natural resources as well as the existing storm sewer, open channel, and regional pond networks. Acceptance of this Plan by the Scott WMO identifies the City of Jordan as the Local Government Unit (LGU) for matters related to protection, preservation, use, and regulation of surface and groundwater resources. In addition, this Plan includes a review of the surface water related costs associated with continued development in the city. It identifies a basis and a methodology for storm sewer infrastructure related charges associated with the corresponding development and provides a framework for managing the city's natural resources in relation to continued development and urban growth. The costs and regulatory efforts are proportional to the burdens that urban development places on existing and future public infrastructure as well as the city's natural resources. Given this information, the findings and goals of this Plan are summarized as follows:

A. The majority of the existing storm sewer and regional detention basin networks serving the developed portion of the city is adequately sized to accommodate the design storm runoff from the existing service area given current land use data.

B. The existing storm sewer conveyance and regional detention systems do not have capacity to accommodate future development within the city's ultimate growth boundary.

C. The existing natural resources within the city must be preserved while accommodating the projected growth and development. The City's goal for wetland management is for "no net loss" of wetland area. The City anticipates working with Scott WMO and the Minnesota Pollution Control Agency (MPCA) in developing future Total Maximum Daily Load (TMDL) Implementation Plans for Sand Creek. The City's ordinance and permitting process will ensure that development in the vicinity of the creek and bluffs will be completed in a responsible and safe manner. The groundwater resources in the City will be managed in conjunction with Minnesota Department of Health (MDH) through the Wellhead Protection Plan (WHPP).

D. Although there are numerous alternative methods of accommodating future development and growth, the City is advocating the continued design and construction of upstream regional and localized stormwater detention basins as the preferred BMPs for water quality and rate control associated with future development within the City's ultimate growth boundary.

E. Regional and localized detention basins are advocated for because of a number of benefits. They are the most easily adapted to unforeseen changes in development design and layout. They can accommodate changes in the rate and location of development. Regional ponding also reduces the number of individual ponds constructed. This will reduce the number of ponds that will require future operation and maintenance support by City staff. The construction of upland regional detention basins will compensate for increased flow volumes and rates (due to continued development) to the existing downstream system. This approach has the additional benefit of decreased long-term maintenance and capital costs associated with public infrastructure improvements.

F. The City has about 184 structures in the proposed floodplain of which approximately 105 are in residential zoned areas and 79 are in institutional, commercial, or industrial zoned limits. The City currently has 90 properties carrying flood insurance. Achievement of these goals could help the 90 properties referenced by reducing or eliminating flood insurance premiums. The goals could also help improve the property value and viability of all structures located in the floodplain by varying levels. In 2017 the City considered five goals as potential solutions to flood control issues in the city limits, and is anticipated to consider review of these concepts during the next 10 years:
   1. Improvement of existing and creation of new certified levees
   2. Creating a diversion for floodwaters to the large wetland area at the SW quadrant of Hwy 169 and 282.
   3. Investigate and potentially widen bridge and large box culverts within city limits along Sand Creek and its tributaries.
   4. Consider enrollment in the FEMA Community Rating System (CRS) program.
   5. Promote the installation of additional gages along Sand Creek by other agencies.

G. Due to the extreme volume of data contained in the Hydrologic modeling files (Storm and Sanitary Analysis), this information has not been included in this plan. Detailed information including proposed pond locations, surface areas, storage volumes, and estimated flow rates into and out of the proposed ponds for both the existing and developed conditions, etc. will be available upon request and modified as required to account for future development and to provide the required level of service.

H. An estimate of the costs associated with the design and construction of the proposed regional pond network has been included in this Plan. These estimated costs were used to

formulate a City Storm Area Charge (SAC). The SAC is a per-acre fee that is collected from developers based on market rate land values. A multiplier has been developed to account for proposed land use. Because of the extreme variability in land values and rapidly increasing mean value paid for land in Scott County, the SAC will be adjusted on an annual basis. This annual review is intended to account for changes in construction costs, materials costs, bonding costs, legal costs, etc. The proposed land use type is the primary component of the SAC fee because higher density land use types, with more impervious area, create more stormwater runoff. The three identified land use rate categories are: 1) Single Family Residential, 2) High Density Residential, and 3) Commercial/Industrial.

I. This Plan is a document-in-progress and will be amended as required. As development occurs, the hydrologic model will be reviewed and modified to account for the differences between the actual (developed) and the modeled hydrologic conditions. It is anticipated that, as development layouts are submitted for review, the proposed storm sewer and detention pond improvements can be temporarily entered into the hydrologic model and analyzed for possible adverse effects on the area hydrology. If accepted and constructed, these improvements can be permanently entered into the comprehensive hydraulic and hydrologic model as an existing condition.

J. The goal of this Plan is to provide and compile information relative to the current surface water planning needs, to protect the natural resources within the municipal boundary, and to some extent propose and predict sustainable methods of accommodating continued growth and development within the ultimate growth boundary. This Plan will also ensure that future development is in compliance with the associated Rules, for the management of urban stormwater and protection of natural resources within the City.

II. WATER RESOURCE MANAGEMENT RESPONSIBILITIES AND RELATED REGULATORY RESPONSIBILITIES

The City of Jordan (City) will be assuming regulatory authority for land use development while recognizing the role of other local, state, and federal entities. Several entities will have administrative responsibilities within the planning area. For a local water management effort to be successful, each entity's commitment and role must be clearly understood. The agencies currently having some level of administration responsibility include the City, Scott Watershed Management Organization (WMO), Scott County, Minnesota Department of Natural Resources (MNDNR), Minnesota Pollution Control Agency (MPCA), the U.S. Army Corps of Engineers (USACE), the Minnesota Board of Water and Soil Resources (BWSR), and Scott County Soil and Water Conservation District (Scott SWCD). It has been recognized that regulatory agencies can achieve common goals by joining together to combine already scarce financial and regulatory resources.

Intergovernmental cooperation is an excellent tool to address natural resource protection. This is due to the fact that natural resources do not recognize political boundaries and are often located across local, state, and/or federal regulatory boundaries. The City is ultimately responsible for planning, permitting, construction, maintenance, and other aspects related to the City's surface water and ground water infrastructure and will work in conjunction with all state and federal agencies to achieve its goal of sound and sustainable resource management. The City anticipates and looks forward to cooperating with intergovernmental agencies in the future if the need should arise.

The major task of administering this Plan will be in the permitting process. It is the intent of the City to assume the role of permitting for all land alteration, thereby enforcing the policies and standards of this Plan. The City's existing permit procedures include surface water management elements outlined in this Plan and the current Subdivision Ordinance (Chapter 153). Surface water management elements will be reviewed concurrently as all other land-use and zoning permits are reviewed. The reviewed surface water elements will meet the requirements of existing City Ordinance, design standards of this plan, and the associated Rules.

To ensure conformance to this Plan and the associated Rules, the City's preliminary and final platting, and site plan approval process will require additional detailed information. Erosion control, water quality, and other pertinent information such as stormwater rate and volume control calculation, regarding local plan standards are among the elements that will be addressed on preliminary and final plans and/or site plan approval. Conditional approvals by the Planning Commission and/or City Council must require the incorporation of conditional elements into the submitted plan to ensure compliance.

The revised plan will then be re-distributed to City staff to confirm the inclusion of the provisions under which the plans were approved. The Building Permit issuance process can be the checkpoint for staff to review final plans for compliance with this Plan and associated Rules while holding the condition of building permit issuance as the incentive. Engineering staff will have a sign-off procedure prior to permit issuance.

The City's administrative responsibilities include, but are not limited to the following:

- Comprehensive Plan update(s);
- Land use regulation;
- Ordinance review and amendment;
- Local plat review and amendments;
- Building permits;
- Wetland management as the LGU;
- Sediment and erosion control (Ordinance);
- Groundwater – wells;
- Participation and cooperation with the programs of the Scott WMO, Minnesota DNR, and Scott County;
- Hydrologic model update with comprehensive plan changes;
- Financing alternatives;
- Capital improvements; and
- Conveyance system and detention pond maintenance.

Scott WMO responsibilities and authorities may include but are not limited to the following:

- Monitoring;
- Establishing land use or ordinance requirements;
- Local plan review and approval;
- Administering a permit program;
- Projects of regional significance; and
- Verification of Plan implementation.

Metropolitan Council: Comprehensive Plan Amendment
Metropolitan Council has a regional review authority regarding surface water management including:

- Local Plan review; and
- Regional controls related to point and nonpoint source pollution.

This Plan and all subsequent amendments will become part of the City's Comprehensive Plan (adopted by reference), in accordance with Minnesota Statutes 103B.235, Subd. 3A and 473.859, Subd. 2 (Chapter 176, Laws of Minnesota 1995), as part of the adoption process for this Plan.

This Plan does not have to be resubmitted as a formal comprehensive plan amendment, subject to additional review, at a later date. The adopted City Plan and associated Rules will satisfy Metropolitan Council's requirements and will be thereby recognized as an amendment to the City's Comprehensive Plan.

Water Resource Related Agreements

The City's zoning ordinance requires developers to enter into a development agreement when new development occurs to ensure that storm water management planning is incorporated.

III. PHYSICAL ENVIRONMENT AND LAND USE

The total hydrologic study area includes over 21,000 acres of watershed. The area of the study lies both within and outside of the current city limits and generally terminated at the ultimate growth boundary. It has been assumed that growth around Jordan will continue to the south and along the approaches of U.S. Highway 169. The overall flow characteristics of the Jordan watersheds include a trend for stormwater runoff to flow toward Sand Creek and from there Sand Creek flows to the Minnesota River, northeast of the city. The stormwater runoff begins in the uppermost basins as sheet and shallow concentrated flow. This flow follows existing contours and steep ravines and develops into intermittent surface flows and creeks, directed to the relatively flat area adjacent to Sand Creek and the Minnesota River.

Project specific stormwater detention basin design procedure requires ponds to be sized to ensure there is no net increase in offsite flow rates for specific storm events. This procedure will minimize adverse effects to downstream properties. Unfortunately, when this procedure is applied to individual development sites without comprehensive review of regional drainage patterns the cumulative effect may be to inadvertently increase downstream flow conditions and possibly cause flooding at some locations. The use of large regional detention ponds has been proposed as a comprehensive stormwater management tool. This will better coordinate the possible development design changes and avoid, as much as possible, numerous smaller upstream localized ponds that would be provided on a project-by-project basis.

Based on our analysis, the existing regional pond and culvert system will function properly for storm events less than or equal to the 100-year, 24-hour storm. However, for future detention and water quality ponds the 100-year storm events will need to be managed to prevent damage to the downstream properties. This may be accomplished by proper siting of improvements, consideration and protection of natural resources, constructing emergency spillways, providing larger interconnecting conveyance systems, diversion piping, increased pond storage volume, and/or adoption of low-impact site design practices. All of these options can be implemented while protecting the existing natural features of the city. These improvements should be coordinated with potential, future flood control efforts to ensure hazard conditions are not created as a result of city improvements.

The primary objectives of this Section are:

- Map and evaluate the existing city storm drainage conveyance network,
- Identify problem areas where the existing system should be modified or upgraded,

- Define requirements to improve the existing storm sewer conveyance, water quality, and detention system,
- Define surface water requirements associated with continued upstream development,
- Coordinate the design requirements of the proposed stormwater conveyance system with the most recent flood control studies to minimize flooding of the Sand Creek corridor (when accepted by the Council), and
- Require BMPs to accommodate continued development within the city's ultimate growth boundary while minimizing effects on water quantity and water quality.

Land and Water Resource Inventory
The Scott County WMO Comprehensive Water Resource Management Plan – Section 1, Land and Water Resource Inventory, as amended, contains the most current and comprehensive inventory for the city. Please reference Section 1, page 4, of the Scott WMO Comprehensive Water Resource Management Plan for further information.

IV. GOALS AND POLICIES

The primary goal of the City's Plan and associated Rules is to provide the framework for the management of all forms of surface water as development occurs within and adjacent to the City in the area defined as the City's ultimate growth boundary. This Plan provides clear guidance on how the City will manage surface water both in terms of quantity and quality.

Much has changed since the City prepared its first SWMP. Since that time the City has seen a marked increase in residential and commercial development. Population growth, resource education, and increasing regulation of surface water at the State, County, and Federal levels necessitate that the City's surface water management goals evolve over time with increased awareness.

The goals and policies detailed in this Plan focus on future development as much as the existing infrastructure. The City only conducts plan reviews "as development occurs" as part of the preliminary plat submittal and approval process. This emphasis on future requirements ensures that future development augments the City's amenities rather than diminishes the complex environments that have been created by the City and its population.

Goal 1: Water Quantity
The purpose of this goal is to control flooding and minimize related public capital and maintenance expenditure necessary to control excessive volumes and rates of surface water runoff, in accordance with the Scott WMO CSWMP, as amended. Traditional surface management deals with just one component of the hydrologic cycle; surface runoff. Large amounts of energy are directed towards alleviating significant negative impacts of surface runoff and flooding for the cultural, water, and natural resources.

The primary management strategy is shifting from detention in both existing natural and constructed basins, to Low Impact Development (LID) techniques and Integrated Management Practices (IMPs) that emphasize reduction of runoff volume and on-site runoff control via infiltration or small volume storage to mimic predevelopment hydrology for more frequent rainfall events. This trend will help remedy the negative impact of stormwater runoff on water quality. With increased value placed on natural wetlands, the number and extent to which wetlands can be used for detention is already in decline. The approach to sound water management relates directly to water quality, wetland management, erosion control, and land development

strategies. By comprehensively managing the quantity and quality of surface water runoff, the other goals of this Plan are more efficiently achieved.

Subject: Surface Water Runoff (Rate and Volume) Management
Purpose: Control post-development stormwater runoff
Goal: Control flooding, protect human life, protect public and private property, minimize related public capital and maintenance expenditure necessary to control excessive volumes and rates of surface water runoff, and maintain or improve downstream conveyance system.

Water Quantity Policies

Policy 1.1: Utilize LID site design techniques where applicable, along with conventional regional detention ponds for large, infrequent rainfall events. These design techniques will be relied upon to help mimic pre-development hydrology and to control downstream flooding. Pre-developed peak flow rates for the 1-yr, 2-yr, 10-yr, and 100-yr, 24-hour, storm events cannot be exceeded by new development.
Policy 1.2: Increases in the volume of runoff should be minimized by utilizing LID practices to control the runoff volume as required by the NPDES Construction Stormwater Permit.

Policy 1.3: Where LID techniques and localized ponding are not feasible, the City will require regional detention areas to small, on-site ponds for large infrequent storm event runoff rate and volume control. The BMP selection requirement will be based on the existing hydrologic model completed for the City.

Policy 1.4*:* Emergency overflows or outlets for drainage systems are required and shall be provided to prevent flood damages and overtopping of constructed basins. The emergency outlets shall not be a minimum of 1-foot below the Low Floor Elevation (LFE) of adjacent structures, stormwater basin berms, or other provisions designed to minimize flooding.

Policy 1.5: The minimum building elevation shall be set/designed to prevent flood damage from the established 100-year, 24-hour, storm event in accordance with established City Ordinances and the standards of this Plan, and associated Rules.

Policy 1.6: The City rewards the use of alternative landscape techniques and materials to reduce rates and volumes of stormwater runoff.

Policy 1.7: The City shall require stormwater ponds, wetlands, floodplains, and ditches to be located in outlots as part of the land development approval process.

Goal 2: Water Quality
The purpose of this goal is to achieve water quality standards in lakes, creeks, and wetlands consistent with the intended use and classification, in accordance with the Scott WMO CWRMP. Water quality is often directly related to the level of nutrients in the water body. While nutrients comprise only one category of substances that can affect water quality, nutrients, principally phosphorous, must be controlled to achieve the water quality goals of this Plan. Phosphorous is generally the limiting factor to plant growth. An increase in phosphorous will cause the plant species dominating the lakeshore, open water, or marsh to shift in favor those plants that can best take advantage of the increased supply of the nutrient.

Controlling nutrients through housekeeping practices are a way for city residents to make a difference. According to the Minneapolis Chain of Lakes Clean Water Partnership, many people

do not realize that organic materials like leaves, grass clippings, fertilizers, pesticides, and pet waste can disrupt the fragile ecosystem of a lake or creek.

Leaves and grass clippings that make their way into lakes and creeks are doing more damage than fertilizers, pesticides, or motor oils, according to the Minneapolis Chain of Lakes Clean Water Partnership. Once in the lakes and creeks, these organic materials decay, and subsequently release nutrients. The excess nutrients increase algae growth, which inhibits the growth of other aquatic plants and animals. When algae die and decay, they exert a biological oxygen demand on the lake, depleting available oxygen for fish. Algae growth due to nutrient loading can damage or even kill a lake's ecosystem.

Fertilizer application may be necessary for a healthy lawn, but the nutrients in fertilizer can be harmful to lakes, creeks, and wetlands. Nutrients from fertilizers run off lawns and ultimately discharge to area lakes, creeks, and wetlands. Effective January 1, 2005, in Minnesota, fertilizers containing phosphorous cannot be used on lawns. Refer to the Minnesota Department of Agriculture (www.mda.state.mn.us/appd/ace/phoslaw.htm) website for additional information. Applying the proper fertilizer, in the right amount, ensures a healthier lawn and healthier lakes, creeks, and wetlands.

Subject: Water quality in lakes, rivers, creeks, and wetlands.
Purpose: To protect and enhance water quality.
Goal: Achieve water quality standards in lakes, rivers, creeks, and wetlands consistent with their intended use and established classification.

Water Quality Policies

Policy 2.1: Development that disturbs more than one acre, or creates more than one acre of impervious surface, shall demonstrate that phosphorus and Total Suspended Solids (TSS) reduction in discharge runoff meets NURP levels described in this Plan and accompanying Rules.

Policy 2.2: Public road and utility projects that disturb greater than one acre must include temporary BMPs to control water quality; if more than one acre of additional impervious surface is created, the project shall include permanent water quality BMPs to meet the requirements of the National Pollutant Discharge Elimination System/State Disposal System (NPDES/SDS) Permit, this Plan, and accompanying Rules.

Policy 2.3: Proposed developments must identify all reasonable steps taken to avoid water quality impacts. They must also mitigate unavoidable impacts with appropriate BMPs to prevent water quality in receiving waters from falling below established standards including TMDLs, and to meet City erosion control Ordinance standards.

Policy 2.4: The City shall supplement its regulatory approach with an education-based approach to achieve appropriate yard care measures. This will reduce nutrient loading to City lakes, creeks, and wetlands, and will reduce the impacts of domestic animal waste.

Policy 2.5: The City shall promote the reduction or minimization of hard surfaced areas, where applicable.

***Policy 2.6*:** The City will balance protection of natural wetlands and utilization of constructed wetlands to protect the water quality of other water resources (i.e., wetlands, lakes, creeks) based on Mn/RAM 3.4 wetland classification.

Policy 2.7: The City encourages and rewards the use of alternative landscape techniques and materials and LID IMPs to reduce and mitigate water quality impacts.

Policy 2.8: The City will manage public properties in accordance with the appropriate BMPs.

The City of Jordan Subdivision Ordinance addresses the current water quantity requirements. When this Plan is adopted the Ordinance will be revised as necessary to incorporate and reflect any new policies, goals, and accompanying Rules.

Goal 3: Erosion Control

The purpose of this goal is to minimize soil erosion through increased education and enforcement, in accordance with the Scott WMO CWRMP. Water quality problems are frequently linked to high phosphorus concentrations. Phosphorus is often transported to surface water through soil erosion but can also be transported to waters in a variety of other mechanisms. Nevertheless, erosion control is an important factor in the effort to improve surface water quality. Soil erosion and sediment deposition can also impact pond and drainage-way performance and create maintenance issues.

Ponds and drainage facilities may be impacted by erosion and sedimentation from a variety of sources including construction sites and winter street sanding. The coarse sediment accumulates in ditches and ponds where runoff velocities are low. When a sand delta appears at a storm sewer outfall that is a visible indication of the effectiveness of erosion and sediment control measures and road maintenance activities of the past winter. As the sediment builds up over time, it reduces the capacity of the drainage system and the pollutant removal capabilities of ponds by reducing storage volume below the outlet. This also reduces the infiltration rates for stormwater facilities. Extending the life of facilities involves source control and elimination of the material that causes the problem. Regulatory actions will control a major portion of the sediment. Street maintenance and an effective sweeping program will also have a positive impact.

Creek and riverbank erosion occurs as a result of increasing peak flow rates and sustained high flows. These issues can severely damage stream bank vegetation, cause bottom scour, and accelerate the erosion process. The Scott SWCD has survey Sand Creek and identified areas currently experiencing localized erosion. The City will continue to monitor these locations and control the rates of discharge from developments in its efforts to provide adequate control. The City will consider opportunities to implement bioengineering practices and approaches to help stabilize the creek bank and reduce bank erosion along the Minnesota River.

Subject: Erosion control.
Purpose: To control erosion and sedimentation.
Goal: Minimize soil erosion through increased education, enforcement and management of stormwater.

Erosion Control Policies

Policy 3.1: Erosion and Sedimentation Control Plans shall be reviewed and enforced by the City for all grading activities. These plans shall conform to the general criteria set forth by the City's

erosion and sediment control Ordinance and applicable NPDES /SDS Permit (MPCA Permit MN R100001) requirements.

Policy 3.2: The City will implement an erosion control Ordinance to control erosion and sediment to extend the effective life of water resource facilities and reduce pollutant loading to streams, lakes, and wetlands.

Policy 3.3: The City will develop proactive measures such as education, incentives, and recognition of erosion control efforts to prevent soil erosion and encourage responsible site development.

Policy 3.4: Construction site inspection by the City must be completed prior to commencing earthwork activities to ensure the proper BMPs are in place and operational.

Policy 3.5: Horizontal, vegetative buffer zones between twenty and fifty feet are required around existing wetlands based on the MnRAM rating. Stormwater ponds shall have a minimum 10-foot building setback from buffers. New development or redevelopment projects must provide the appropriate buffer zone around new and existing wetlands and are encouraged to provide 20-foot buffers around existing stormwater ponds. Buffers shall be maintained in native vegetation to provide habitat for wildlife.

Policy 3.6: The City will maximize the use of bioengineering approaches whenever possible for all slope stabilization and permanent erosion control projects, including considerations of reducing bank erosion along Sand Creek.

The City of Jordan Erosion Control Ordinance addresses the current erosion control requirements. When this Plan is adopted the Ordinance will be revised as necessary to incorporate and reflect any new policies, goals, and accompanying Rules.

Goal 4: Wetlands

The purpose of this goal is to maintain or increase the amount of wetland acreage and increase the wetland functions and values within the City, in accordance with the Scott WMO CWRMP. The City is the LGU for the Wetland Conservation Act (WCA). The City has not completed a Comprehensive Wetland Management Plan. The wetland inventory is based on the wetlands in the National Wetland Inventory (NWI) and Scott County's records, which may not include all of the wetlands and aquatic resources in the City. The City does not have the resources to survey all of the wetlands at this time. Field delineation, assessment of hydrology, identification of plant species, characterizations of soils, MnRAM assessment and restoration are generally completed and reviewed on an "as development occurs" basis. This approach places the financial burden for identification, delineation, and possible restoration on the land developer.

The policies below will be used to achieve the City's wetland goals. The strategies will apply to new development and redevelopment projects submitted to the City for review and approval. Any wetland habitat on property to be developed will be subject to the following management strategies, as well as the rules and requirements of the WCA and other City, State, and Federal regulations.

Proper implementation of stream, bluff, and wetland buffers in new developments is paramount. Without proper implementation of buffers stream and wetland water temperatures increase, sediment deposition increases, stream and bluff bank erosion and collapse are more severe, and

riparian habitats are destroyed.

Subject: Wetland Management
Purpose: To utilize, protect, preserve, and enhance existing natural wetlands.
Goal: Maintain or increase the amount of wetland acreage and increase the wetland functions and values within the City, in accordance with the WCA, USACE, and Scott WMO CWRMP.

Wetland Policies

Policy 4.1: The City shall administer wetland protection and mitigation as the LGU for the WCA in accordance with the Minnesota WCA, Scott WMO CWRMP.

Policy 4.2: The artificial water level fluctuation (bounce) in wetlands resulting from stormwater runoff will be managed in accordance with the WCA and Scott WMO Rules.

Policy 4.3: Where open water areas have been permitted to be excavated in wetlands for the purpose of creating habitat diversity, the excavation shall be done in conformance with City Ordinance, DNR regulations, the Minnesota WCA, USACE, and the Scott WMO CWRMP.

Policy 4.4: The City will require the establishment of vegetative buffer strip at the shoreline of wetlands between all adjacent property owners as prescribed in the Minnesota WCA and Scott WMO CWRMP Rules. Development or redevelopment of an area adjacent to a wetland will require the establishment of the appropriate buffer.

Policy 4.5: The City may utilize the available technical resources of outside agencies, such as the Minnesota DNR, USACE, Scott SWCD, the Board of Water and Soil Resources and/or the Scott WMO, for review of private developments and City-proposed projects that may affect wetland resources.

Policy 4.6: Developers must provide a field delineation in accordance with applicable rules and regulations to determine the jurisdictional boundaries of wetlands, including a report of the results of the field delineation, detailing the methodology and findings of the delineation. A printed and electronic copy (.dwg) of the approved delineation boundary will be required to be submitted to the City.

Policy 4.7: Prior to any site development activities, the City will verify through a wetland boundary delineation review, the location and extent of all wetlands present. The results of the wetland boundary delineation will be compared to the field delineation data provided by the developer.

Policy 4.8: Any review of a proposed wetland encroachment must first address the issue of avoidance and project alternatives. Prior to allowing any wetland encroachment, all reasonable attempts to avoid such alteration must be demonstrated. This avoidance must also consider the reasonableness of the no-build alternative.

Policy 4.9: Replacement for unavoidable wetland impacts will be provided (if possible, within the same subwatershed), in accordance with the requirements of the Scott WMO CWRMP, and Minnesota WCA.

Policy 4.10: The City will not allow excavation, or other non-filling related alterations to an existing wetland without the expressed written approval of the City Administrator or designee and in compliance with the Wetland Conservation Act (WCA). The WCA, administered by the Local Government Unit, jurisdiction begins above the OHW of the waterbody, while MN DNR jurisdiction lies below the OHW. Section 404 of the Clean Water Act, administered by the Army Corps of Engineers, has jurisdiction over all aquatic resources in the area. No filling within DNR public water wetlands will be allowed for development per the MN DNR. Other fill in public water wetlands, such as the large wetland south of 169 in Jordan, must be approved by the MN DNR.

Policy 4.11: The City shall require pretreatment of stormwater runoff discharged directly into wetlands, except possibly for wetlands with a low quality MnRam rating. Treatment will be required to meet or exceed N.U.R.P. efficiencies for removal of TSS and total phosphorous prior to discharge.

Policy 4.12: The City supports the use of banking wetland credits for the mitigation of wetland impacts. Those proposing banking projects are encouraged to locate mitigation banks in those subwatersheds within the City having lost significant wetland habitat and at sites approved by the City. Restoration of wetland habitat is preferred to wetland creation. Priorities for wetland banking include interspersion of wetland types, successful revegetation with diverse native species, areas greater than 10 acres in size, and locations within a watershed that provides needed functions.

Policy 4.13: The City will encourage developers to include wetland restoration as well as wetland protection strategies in proposed development and redevelopment projects. Public Value Credits (PVCs) may be provided for improvement of existing wetland habitat associated with development and/or wetland replacement projects, in accordance with established WCA rules.

The City of Jordan Subdivision Ordinance addresses the current wetland requirements. When this Plan is adopted the Ordinance will be revised as necessary to incorporate and reflect any new policies, goals, and accompanying Rules.

Goal 5: Public Participation, Information & Education

The purpose of this goal is to increase public participation and knowledge in management of the City's water resources, in accordance with the Scott WMO CWRMP. Public involvement is a strategy that recognizes people want to be involved in decisions that affect any facet of their life. It provides opportunities for the public to participate in the processes that lead to decision-making.

Website Availability - http://www.ci.jordan.govoffice.com/. The website is an alternative medium to provide municipal information to both city residents and those people who live outside Jordan. An electronic version of this Plan will ultimately be accessible on the website. Because the Plan has such a wide audience including engineers, planners, developers, citizens, scientists, and educators, electronic access to the text and mapping creates a better understanding of the goals, policies, and activities of this Plan.

The City will continue to distribute information on pertinent water and wetland management issues via the City of Jordan quarterly newsletter (Jordan City News). The newsletter will promote opportunities for residents to participate in water resources management activities. The City will make an ongoing effort on both a citywide and watershed level toward educating the public by distributing information to its residents on responsible practices they should employ to protect water resources within the community. The program will also educate residents on the benefits of using phosphorus-free fertilizer.

Subject: Enhancement of Public Participation, Information and Education
Purpose: Encourage active community involvement in water resources management.
Goal: Increase public participation and knowledge in management of the water resources of the community.

Public Involvement Policies

Policy 5.1: The City will use a public involvement process in resource management decision-making (i.e., the Parks Commission, and the Planning Commission).

Policy 5.2: The City will use a variety of media, including newsletters and the City's website, to inform the community about water resource issue programs including alternative landscapes, phosphorus free fertilizer, aquatic plant management, etc. The City will make an ongoing effort on both a local and municipal level to distribute information to residents on responsible practices to protect water resources in the city. Educational information will also be provided regarding the proper use of a wide range of lawn chemicals and proper disposal of hazardous household materials.

Policy 5.3: The City will work with all available resources to increase public participation in water resources management.

Policy 5.4: The City will establish model interpretive sites for public education.

The City of Jordan Ordinance does not currently address public education. When the City becomes a Municipal Separate Storm Sewer System (MS4) community, the City Ordinance will be revised to incorporate and reflect the new policies, goals, and accompanying Rules.

Goal 6: Groundwater Management

The City's groundwater resources are identified in the City of Jordan Wellhead Protection Plan. The City's aquifers have been assigned a "Not Vulnerable" rating. This rating indicates "there is not a hydraulic connection between surface waters and the aquifer serving the water supply system for the City."

The City of Jordan Wellhead Protection Plan currently outlines requirements for continued groundwater protection and well management. The report is obtainable upon request to the City.

Subject: Groundwater Management
Purpose: To protect groundwater quality and improve groundwater supplies through effective management.
Goal: Provide clean and safe drinking water for the City while managing increased development and population.

Groundwater Management Policies

Policy 6.1: Promote ongoing evaluation of land use impacts on groundwater quality and quantity.

Policy 6.2: Provide information to the public by revising and updating the City Wellhead Protection Plan as required by the Minnesota Department of Health.

Policy 6.3: Support identification and reduction of groundwater contamination from both point and non-point sources.

Policy 6.4: Promote water conservation efforts to reduce water use and conserve the City's groundwater resources.

The City of Jordan Municipal and Public Utilities Ordinance addresses the current municipal and private water supply requirements. When this Plan is adopted the Ordinance will be revised as necessary to incorporate and reflect any new policies, goals, and accompanying Rules.

V. ASSESSMENT OF PROBLEMS

The assessment of problems in the Plan includes reviewing possible adverse effects of surface water that have been identified by state and federal agencies, in research, literature, and other stormwater management materials. The assessments were divided into three potential sources of problems (Source Areas).

1. The first potential Source Area addresses public lands or areas that are managed by public agencies (i.e., public streets, parking lots, sewer lines, parks, public facilities, etc.). The identified potential problems in this source area include but are not limited to:

    a) Existing and potential flooding problems associated with Sand Creek and the Minnesota River at various locations within the city. The City has reviewed and included the Sand Creek erosion identification efforts that have been conducted by the Scott SWCD. Identification and documentation are the initial steps required to understand the dynamic nature of Sand Creek and the possible impact increased development may be having on it. These locations will be monitored and assessed annually by the City.

    b) The need to maintain high quality recreational use of the city's lakes and creeks, whether it is for waterfowl habitat, canoeing, fishing, etc. The MPCA first listed Sand Creek as a state impaired water in the 2002 Final TMDL List of Impaired Waters.

    c) The need for community education programs regarding sustainable water resource management.

    d) The need for an adequate road salt management program.

    e) The importance of maintaining the City's surface water management system and overall goals while encouraging private development.

2. The second potential Source Area addresses existing development on privately owned lands (i.e., private homes, small businesses, large commercial areas, industrial areas, private parking lots, and private streets, etc.). The identified potential problems in this source area include but are not limited to:

    a) Soil erosion from site disturbances (construction) on private lands.

    b) Private lawn and garden maintenance (phosphorous and nitrogen loading).

c) Landscaping of stream banks on private land.

d) Litter accumulation on private lands.

e) Stream buffer degradation on private lands.

f) Stream bank erosion and collapse on private lands.

g) Private vehicle and equipment storage sites.

h) Snow and ice removal methods from private parking lots and streets.

i) Impervious surface management (private streets and parking lots).

j) Illicit discharge to storm sewers.

3. The third potential source area focuses on new residential, commercial, and industrial development. Possible surface water problems in this section are directly associated with the construction process and how new developments may impact local natural resources and public infrastructure both during construction and after they are completed.

   A major source of concern for the City is the projected development rate and associated stormwater volume, rate, and pollutant loading increases. In addition, problems caused by development in environmentally sensitive areas are also a concern (i.e., bluffs, buffers, and wetlands). The identified potential problems in this Source Area include but are not limited to:

   a) Concern about excessive nutrient contamination of Sand Creek and public conveyance networks with sediment from construction sites and improper use of BMPs in new developments (e.g., detention basins, grass swales, etc.).

   b) Proper implementation of creek, bluff, and wetland buffers in new developments. Without proper implementation of buffers, creek and wetland water temperatures increase, sediment deposition increases, creek and bluff bank erosion and collapse are more severe, and riparian habitats are destroyed. See Appendix A for the applicable area maps. As part of the development permitting process the City will determine, based on accurate topographical maps, whether development will be permitted in any particular bluff, creek, or wetland area.

4. Impaired Waters

   Sand Creek, from Porter Creek to the Minnesota River, was initially added to the list of 303d impaired waters in 2002. It is currently listed for impairments due to aquatic macroinvertebrate bio assessments, fishes bioassessments, E. coli bacteria, turbidity, chloride and nutrient/eutrophication biological indicators. The City looks forward to working with the MPCA and Scott County in the TMDL study planning process.

   There is an unnamed creek that parallels the south side of TH 169, from its headwaters to Sand Creek, that is on the draft 2018 list of 303d impaired waters. It is listed for impairments due to aquatic macroinvertebrate bioassesments and fishes bioassessments.

VI. CORRECTIVE ACTIONS

Programmatic improvements and implementations will be required to manage the water resources within the city more effectively. For the area within the city's defined ultimate growth boundary where there has been increased development and larger stormwater runoff systems have been/are being planned, corrective actions may include but are not be limited to:

a) Development of a comprehensive operations and maintenance plan (O&M Plan), including a funding mechanism for ongoing costs (both capital and non-capital). A comprehensive O&M Plan will improve the likelihood of possible federal, state, and County funding for various City projects.

b) When the O&M Plan is complete modifications and revisions would be considered for inclusions provided they increase the speed or cost effectiveness of a planned stormwater system improvement.

c) Implement City programs to target developer and resident education efforts. The programs will outline what residents and developments can do to improve the efficiency of nitrogen and phosphorus reduction from existing and proposed surface water runoff.

d) Review of proposed development submittals to verify the requirements stated in the City Comprehensive Surface Water Management Plan Rules and existing City Ordinances have met prior to approval. This will ensure that the approved BMPs have been selected and the City is engaged in a pattern of sustainable growth.

Financial Considerations
As with all improvements, there is a cost associated prudent stormwater management. To that end, the plan includes a cursory estimate of the costs for:

a) Mainline storm sewer pipe construction to deliver the runoff to each regional pond
b) Projected pond construction
c) Turf restoration
d) Piped outfall construction
e) Ravine stabilization
f) Regional pond land acquisition costs
g) Estimated engineering services
h) 15% contingency

Table 4-19 summarizes the costs associated with each growth area of the proposed development areas. **As with all estimates of this nature, they are based on current construction costs and should be adjusted annually to account for inflation, bonding costs, legal costs, interest costs, etc.**

TABLE 4-19:
STORMWATER MANAGEMENT SYSTEM APPROXIMATE EXPECTED COST

District	Total	Area Served (acres)
A	$18,635,370	6,213
B	$19,511,553	2,428
C	$21,493,420	3,831
D	$18,455,883	2,824
E	$2,231,580	1,153
F	$2,705,589	1,649
Total	**$83,033,395**	**18,098**

It is the current policy of the City to charge new land development a Stormwater Area Charge (SAC) to finance storm drainage improvements on a per-acre basis, taking into account the proposed land use type. The amount of imperviousness on a parcel is directly related to the water quality, quantity, and conveyance impacts on the downstream stormwater conveyance system. Commercial, industrial, and high-density residential developments contribute significantly more stormwater runoff than single-family residential development. Given this, it is recommended that the City charge proportionally higher SAC fees for those areas that contribute more runoff.

For determining a land-use based charge, the runoff from a 10-year storm event occurring over watersheds illustrated in **Map 4-12** was compared for three land-use categories, as shown in the following table. Based on this information a runoff multiplier was calculated by comparing the runoff amount for a particular land use to that from single family residential land use. The equivalent number of acres was calculated and the resulting SAC fee per acre of development was calculated for each land use.

TABLE 4-20
STORMWATER AREA CHARGE (SAC) COST SUMMARY

Land Use	Developable Acres	Curve Number	10-Year 24-Hour Runoff	Multiplier	Equivalent Acres	Area Charge
Single/Medium Family Residential	17,244	72	1.60"	1	17,244	$4,400
High Density Residential	105	85	2.64"	1.65	173	$7,260
Commercial/ Industrial	749	90	3.11"	1.94	1,453	$8,536
Total	18,098				10,522	
Total Stormwater Management System Cost = $83,033,395						
Cost Per Equivalent Acre = $4,400						

Adopting the land-use based SAC enables the construction of, and provides for, the effective management and financing of the recommended regional ponding storm sewer system within the projected city growth boundary area. Existing areas of development, large wetland areas, trunk highway rights-of-way and the areas shown on the watershed drainage district map that require further analysis have been excluded in the future when computing the SAC for new development.

Because of the extreme variance in land values and rapidly increasing value paid for land in Scott County, along with increasing construction costs, the SAC should be reviewed on an annual basis to account for land value increases and adjusted accordingly.

VII. IMPLEMENTATION

Implementation Priorities

The criteria, considerations, and constraints used to prioritize City surface water improvements and activities reflect the City's values, goals, and policies. Changes in any one of these factors can result in a change in project priority. The City's stormwater management program has evolved over time, and in view of recent challenges, the future will bring even more significant change. The breadth and extent of these changes, at present, are largely unknown.

Some factors that influence the City's stormwater management program do not lend themselves to a quantitative system of prioritization. For example, deciding the exact projects to include in each year's City improvement plan requires a high level of professional judgment based upon the best available knowledge and awareness of the local political climate toward cost-effective improvements. Many projects that are included in an annual improvement package most likely will have surface water components although the project focus is not surface water. Though difficult to quantify, these components and influences play an important part in deciding the inclusion of selected projects into the following improvement program.

The City of Jordan will continue to conduct private development project reviews on a "project-by-project" basis. Based on when specific property owners choose to develop the City will take that opportunity to implement the following priorities. The City will also implement the following components of possible CIP projects:

A. Surface Water Quantity Management

Prioritize City projects that provide storm water runoff quantity management. The purpose is to control post-development surface water runoff. The goal is to promote projects that control flooding and minimize related public capital and maintenance expenditure necessary to control excessive volumes and rates of runoff.

B. Surface Water Quality Management

Prioritize projects that provide water quality improvements in lakes, creeks, and wetlands within the City. The purpose is to protect and improve water quality in the City's lakes, creeks and wetlands. The goal is to achieve water quality standards in lakes, creeks, and wetlands consistent with their intended use and established classification.

B.1. Chloride Management

Estimates indicate that 80 percent of the environmental damage caused from de-icing chemicals is a result of inadequate storage of the material (MPCA 1989). Therefore, proper storage of salt is critical in reducing the amount of chloride that is transported to the environment. The following procedures can be used as a guideline for de-icing storage practices.

- Store de-icing material in waterproof sheds. If this is not possible, stockpiles shall be covered with polyethylene.
- Divert off-site runoff away from storage locations. Berms and shallow drainage swales may need to be constructed.

- Place stockpiles on impervious surfaces. Infiltration of runoff high in chloride content can pollute the ground water. Impervious surfaces also provide easier year-end cleanup of loading areas and will not become muddy during the spring.
- Contain runoff from stockpile locations. Runoff from stockpiles shall not be allowed to flow directly into streams or wetlands where environmental damage can occur.
- Road de-icing stockpiles shall not be located near municipal well areas or in other sensitive ground water areas.

Practices shall also be followed to reduce the amount of salt that is applied to roads. One method is to limit the amount of salt applied to low traffic areas and straight level areas. Streets shall be inspected for the need for de-icing prior to application. Equipment shall be maintained in good working order to evenly distribute salt on roadways and shall be properly calibrated to prevent excessive application. The City currently follows these practices.

C. Erosion Control Management

Prioritize projects that minimize the mobilization of sediment and enhance site erosion control requirements. The purpose is to control erosion and sedimentation on private developments and in public drainage systems. The goal is to minimize soil erosion through increased education and enforcement of existing BMP Ordinance.

D. Wetland Management

Prioritize projects that enhance the City's wetland management. The purpose is to utilize, protect, preserve, and enhance existing natural wetlands. The goal is to maintain or increase the amount of wetland acreage, and increase the wetland functions and values within the city, in accordance with the Scott WMO CWRMP.

E. Public Participation and Education

Prioritize projects that enhance the current level of public participation, information, and education on City projects. The purpose is to encourage active community involvement in all aspects of surface water resources management. The goal is to increase public assistance, participation, and knowledge in management of the water resources of the community.

F. Groundwater Management

Prioritize projects that provide sound, long-term groundwater and aquifer management. The purpose is to protect groundwater quality and improve groundwater supplies through effective management. The goal is to provide clean and safe drinking water for the city while managing increased development and population.

G. Implementation Program

The primary means the City will use to implement the standards of this Plan, the Scott WMO CWRMP is through the adoption and implementation of the City of Jordan Plan, associated Rules, and Ordinances. Private development projects within the city are reviewed on a "project-by-project" basis and it is during this review the City has the opportunity to implement the goals, policies, and priorities developed in the Plan.

The annual City improvement projects provide another opportunity for the City to implement the goals, policies, and priorities developed in this Plan. Most CIP projects generally have a surface water component. Development of a CIP will serve as a useful planning tool for City sponsored surface water projects.

There are also specific development-independent implementation goals that the City will continue to develop on a parallel administrative track to the general goals listed above. The City

will finance these goals either directly or by specific development related review and construction inspection budgets.

The following is an implementation process list of the recommended actions, timing, responsible party, and the cost or funding sources which are presented for the City Council's consideration based upon the data compiled in this report. Actions are listed in order of priority, from highest to lowest.

TABLE 4-21
IMPLEMENTATION PLAN

Action	Timing	Responsible Party	Funding Source
Maintain and implement Capital Improvement Program	Ongoing, updated on a 5 year period	City of Jordan	Storm water utility fund. Estimated costs per project specific budgets
Continue the storm water maintenance program to ensure the successful operation of the drainage system.	Ongoing	City of Jordan	Storm water utility fund. Costs to be identified per specific maintenance needs but estimated to be $25,000 annually.
Implement corrective actions for storm water problems identified on a complaint basis.	Ongoing, as problems are brought to the attention of Staff	City of Jordan	Storm water utility fund. Costs to be identified per specific needs but estimated to be $25,000 annually.
Enforcement of the erosion and sedimentation control ordinance for new developments.	Ongoing, as development projects are submitted to the City for approval	City of Jordan	Funding by developers, building permits and fines collected for non-compliance
Encourage low impact development and better site design components for new development projects.	Ongoing, as development projects are submitted to the City for approval	City of Jordan	Funding by developers with amounts dependent on the size and impact of the development.
Require modeling for storwmater management, maximum flow rates, and volumes during initial phases of development projects.	Ongoing, as developments are submitted to the City for approval	City of Jordan	Funding by developers with amounts dependent on the size and impact of the development.
Review procedures to be established to ensure all construction projects within the city are in compliance with erosion control ordinance.	Annual	City of Jordan	Funding by developer's fees and project budgets. Estimated amounts dependent on the size and impact of the project.
Update the City detailed hydrologic analysis during final design of all ponding areas.	Currently in place. Update as necessary.	City of Jordan	Funding by developers' fees and project specific engineering budgets. Estimated amounts

Action	Timing	Responsible Party	Funding Source
			dependent on the size and impact of the project.
Require building finished floor elevations be established to meet requirements per this Plan, Rules, and Ordinance adjacent to ponding areas and floodplains.	Ongoing, as development projects are submitted to the City for approval	City of Jordan	Funding by developers with amounts dependent on the size and impact of the development.
Require emergency overflow routes to be established and maintained to provide stabilized relief during extreme storm conditions, which exceed design conditions.	Ongoing, as development projects are submitted to the City for approval	Private developers & City of Jordan	Funding by developer's fees and project specific engineering budgets. Estimated costs are dependent on size of developments and associated stormwater flows.
Develop an education program for city residents, staff, and development community to be developed and implemented.	Complete with CRS participation within 2 years.	City of Jordan	Estimated cost of $2,000. City of Jordan with assistance from Scott WMO, DNR, U of M Extension Service, SWCD
Amendments to the SWMP be adopted and implemented and the SWMP be updated.	As warranted by future standards or regulations	City of Jordan	Storm water utility fund and annual engineering budget
Regulate construction and land uses along the bluffs, to prevent erosion and bluff destabilization	Ongoing, as developments are submitted to the City for approval	City of Jordan	Funding by developer's fees and project specific engineering budgets
Encourage landowners to retain areas of native vegetation, and to plant species native to the area, to protect and improve wildlife habitat and maintain the historic ecological role.	Ongoing, as developments are submitted to the City for approval	City of Jordan	Funding by developer's fees, storm water utility and project specific engineering budgets. Estimated cost dependent on size of development.
Continue citywide street sweeping in the spring and fall and consider a prioritization schedule in the event sweeping cannot be completed on schedule as intended.	Annual	City of Jordan	Estimated cost of $20,000 annually from the Storm Water Utility
Implement a flood control improvement project	Within 10 Years	City of Jordan,	$6,000,000 from partners, grants, Storm

Action	Timing	Responsible Party	Funding Source
		MnDNR, Scott WMO	Water utility fund, general tax levy, and/or special assessments
Develop an implementation strategy for Lower Minnesota River TMDL/WRAPS when study is complete	After EPA has approved study and TMDL has been developed	City of Jordan, MPCA, Scott WMO	MPCA, Scott WMO, BWSR, DNR, etc.

H. Capital Improvement Plan

The City of Jordan Capital Improvement Plan as of August 1, 2018 is included on the next two pages. The CIP illustrates the planned specific projects to be led by the City of Jordan along with their estimated timing and costs. The CIP is to be updated on an annual basis, typically in the late summer or early fall. The current CIP is available on the City of Jordan website.

City of Jordan 2020 - 2028 Capital Improvement Program

		Bonding					Non-Bonding				Grants / External				
		Total Bonding Amount	General Tax Levy / Streets Debt Levy Amount	Water Fund Debt Levy Amount	Sanitary Fund Debt Levy Amount	Storm Fund Debt Levy Amount	General Tax Levy / Streets	Water Fund	Sanitary Fund	Storm Fund	MSA Construction Funds	MSA Maintenance Funds	Special Assessments	Funding by Other Agencies	
Proposed 2020 Projects															
Number	**Project**	**Total Bonding Amount**													**Total Estimated Project Cost**
C.P. 2020 - 01	2020 Syndicate Street Resurfacing	$ 600,000	$ 600,000												$ 600,000
C.P. 2020 - 02	Jordan PD Parking Lot Resurfacing	$ 210,000	$ 210,000												$ 210,000
C.P. 2020 - 03	TH 21 Watermain Relocation (MnDOT Bridge Project)	$ -									$ 150,000				$ 150,000
C.P. 2020 - 04	SW Trunk Sewer Phase 2	$ 3,000,000			$ 3,000,000										$ 3,000,000
C.P. 2020 - 05	2022 Bluffs at Cedar Ridge Resurfacing	$ 450,000	$ 450,000												$ 450,000
C.P. 2020 - 06	Annual Pavement Crack Sealing	$ -										$ 29,000			$ 29,000
C.P. 2020 - 07	Wastewater Treatment Facility Plan	$ 50,000			$ 50,000										$ 50,000
C.P. 2020 - 08	190th Street Trail	$ 250,000	$ 250,000											$ 65,000	$ 315,000
	Total for Year	**$ 4,560,000**	**$ 1,510,000**	**$ -**	**$ 3,050,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 150,000**	**$ 29,000**	**$ -**	**$ 65,000**	**$ 4,804,000**
Proposed 2021 Projects															
Number	**Project**	**Total Bonding Amount**													**Total Estimated Project Cost**
C.P. 2021 - 01	2021 Creek Lane Improvements, Eldorado To 169, Including 282	$ 600,000	$ 500,000			$ 100,000					$ 1,100,000			$ 1,075,000	$ 2,775,000
C.P. 2021 - 02	2021 Lowertown Area Street Resurfacing	$ 1,703,000	$ 1,703,000												$ 1,703,000
C.P. 2021 - 03	2021 Meadow Wood Court Improvements	$ 450,000	$ 200,000	$ 100,000	$ 100,000	$ 50,000							$ 65,000		$ 515,000
C.P. 2021 - 04	2021 South Broadway / Kipp Improvements	$ 900,000	$ 350,000	$ 200,000	$ 175,000	$ 175,000							$ 100,000		$ 1,000,000
C.P. 2021 - 05	2021 Water Tower & Hope Booster Station Upgrades	$ 1,800,000		$ 1,800,000											$ 1,800,000
C.P. 2021 - 06	282 Trail to the Bluffs	$ -					$ 50,000							$ 100,000	$ 150,000
C.P. 2021 - 07	2020 Creek Lane Resurfacing	$ 223,000	$ 223,000												$ 223,000
C.P. 2021 - 08	2021 Whispering Meadows Reclamation & Watermain Replacement	$ 575,000	$ 300,000	$ 275,000									$ 50,000		$ 625,000
C.P. 2021 - 09	Annual Pavement Crack Sealing	$ -										$ 31,000			$ 31,000
C.P. 2021 - 10	Flood Control - Phase 1	$ 1,062,500	$ 265,625			$ 796,875								$ 1,062,500	$ 2,125,000
	Total for Year	**$ 7,313,500**	**$ 3,541,625**	**$ 2,375,000**	**$ 275,000**	**$ 1,121,875**	**$ 50,000**	**$ -**	**$ -**	**$ -**	**$ 1,100,000**	**$ 31,000**	**$ 215,000**	**$ 2,237,500**	**$ 10,947,000**
Proposed 2022 Projects															
Number	**Project**	**Total Bonding Amount**													**Total Estimated Project Cost**
C.P. 2022 - 02	2022 Lydia Rd Resurfacing	$ 375,000	$ 375,000												$ 375,000
C.P. 2022 - 03	2022 Maple Lane Resurfacing	$ 150,000	$ 150,000												$ 150,000
C.P. 2022 - 04	2022 Heritage Hills Resurfacing	$ 150,000	$ 150,000												$ 150,000
C.P. 2022 - 05	Sawmill Road / CR 66 / TH 21 Roundabout	$ -									$ 300,000			$ 900,000	$ 1,200,000
C.P. 2022 - 06	Annual Pavement Crack Sealing	$ -										$ 33,000			$ 33,000
C.P. 2022 - 07	Flood Control - Phase 2	$ 434,700	$ 108,675			$ 326,025							$ 200,000	$ 634,700	$ 1,269,400
	Total for Year	**$ 1,109,700**	**$ 10,076,925**	**$ 4,750,000**	**$ 3,650,000**	**$ 2,569,775**	**$ 100,000**	**$ -**	**$ -**	**$ -**	**$ 2,650,000**	**$ 153,000**	**$ 630,000**	**$ 6,139,700**	**$ 30,719,400**
Proposed 2023 Projects															
Number	**Project**	**Total Bonding Amount**													**Total Estimated Project Cost**
C.P. 2023 - 01	Annual Pavement Crack Sealing	$ -										$ 35,000			$ 35,000
C.P. 2023 - 02	2022 Bridle Creek South Resurfacing	$ 1,150,000	$ 1,150,000												$ 1,150,000
C.P. 2023 - 03	Flood Control - Phase 3	$ -											$ 500,000	$ 854,600	$ 1,354,600
C.P. 2023 - 04	Flood Control - Phase 4	$ -											$ 200,000	$ 1,211,000	$ 1,411,000
	Total for Year	**$ 1,150,000**	**$ 1,150,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 35,000**	**$ 700,000**	**$ 2,065,600**	**$ 3,950,600**
Proposed 2024 Projects															
Number	**Project**	**Total Bonding Amount**													**Total Estimated Project Cost**
C.P. 2024 - 02	190th Street Improvements - Convert to Urban Roadway Section	$ 2,100,000	$ 1,650,000			$ 450,000									$ 2,100,000
C.P. 2024 - 03	Annual Pavement Crack Sealing	$ -										$ 35,000			$ 35,000
C.P. 2024 - 04	Flood Control - Phases 5 & 6	$ -											$ 75,000	$ 4,501,000	$ 4,576,000
C.P. 2024 - 05	Hope Pond Trail Reconstruction	$ 142,000	$ 142,000												$ 142,000
	Total for Year	**$ 2,242,000**	**$ 1,792,000**	**$ -**	**$ -**	**$ 450,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 35,000**	**$ 75,000**	**$ 4,501,000**	**$ 6,853,000**
2020-2024 Total		**$ 16,375,200**	**$ 18,070,550**	**$ 7,125,000**	**$ 6,975,000**	**$ 4,141,650**	**$ 150,000**	**$ -**	**$ -**	**$ -**	**$ 3,900,000**	**$ 283,000**	**$ 1,620,000**	**$ 15,008,800**	**$ 57,274,000**

Other Future Projects (In 2019 Dollars)

Est. Year	Project	Total Bonding Amount	General Tax Levy	Water Fund	Sanitary Fund	Storm Fund	General Tax Levy	Water Fund	Sanitary Fund	Storm Fund	MSA Construction Funds	MSA Maintenance Funds	Special Assessments	Grants / External Funding	Total Estimated Project Cost
2024 - 2030	Alley Improvements - 10 Blocks	$ 600,000	$ 600,000									$ 200,000	$ 200,000		$ 1,000,000
2025	Grassmann Park - Phase 2	$ 800,000	$ 800,000												$ 800,000
2025	169 / 282 / 9 Interchange, CR 9 / Valley View Dr Intersection	$ 1,000,000	$ 1,000,000								$ 1,000,000			$ 28,000,000	$ 30,000,000
2026	Varner St Bridge & Riverside Lane	$ 350,000	$ 150,000	$ 50,000	$ 100,000	$ 50,000							$ 25,000	$ 600,000	$ 975,000
2027	Ervin Industrial Drive / Enterprise Drive Reclamation	$ 600,000	$ 600,000												$ 600,000
2027	Timber Ridge Court Reclamation	$ 175,000	$ 175,000												$ 175,000
2028	Mini Met Park Lot Reclamation	$ 250,000	$ 250,000												$ 250,000

VIII. AMENDMENTS TO THE PLAN

Amendment Process

For the Plan to remain a dynamic, effective document, a system must be identified and available to update information and implement new ideas, methods, standards, management practices, and any other changes, which may affect the intent and/or results of the Plan. This Plan shall remain in effect from its adoption by the Councilor until an amended Plan is adopted, not to exceed 10 years from the date of initial adoption. Any person or persons either residing or having business within the City can request amendment proposals at any time. The City itself may amend this Plan at any time if changes are required or if issues or opportunities arise that are not currently addressed. All amendments shall be in accordance with Minnesota Rules 8410.0160 Subp. 4 and Minnesota Statutes 103b.235 Subd. 5.

Request for Amendment

The amendment process begins when a written request for a plan amendment is submitted to the City administrator. The request must outline the need for the specified amendment as well as additional materials that the City will need to consider before making its decision.

City Staff Review

A decision is made as to the validity of the request. Two options exist;

- Accept the amendment as a minor issue, with minor issues collectively added to the Plan during the annual review process; and
- Accept the amendment as a major issue, and refer the matter to the City Council for consideration. In acting on an amendment request, staff shall recommend to the City Council whether or not a public hearing is warranted.

Council Consideration

The amendment and the need for a public hearing shall be considered at a regular or special City Council meeting. Staff recommendations should also be considered before decisions on appropriate action(s) are made.

Public Hearing and Council Approval

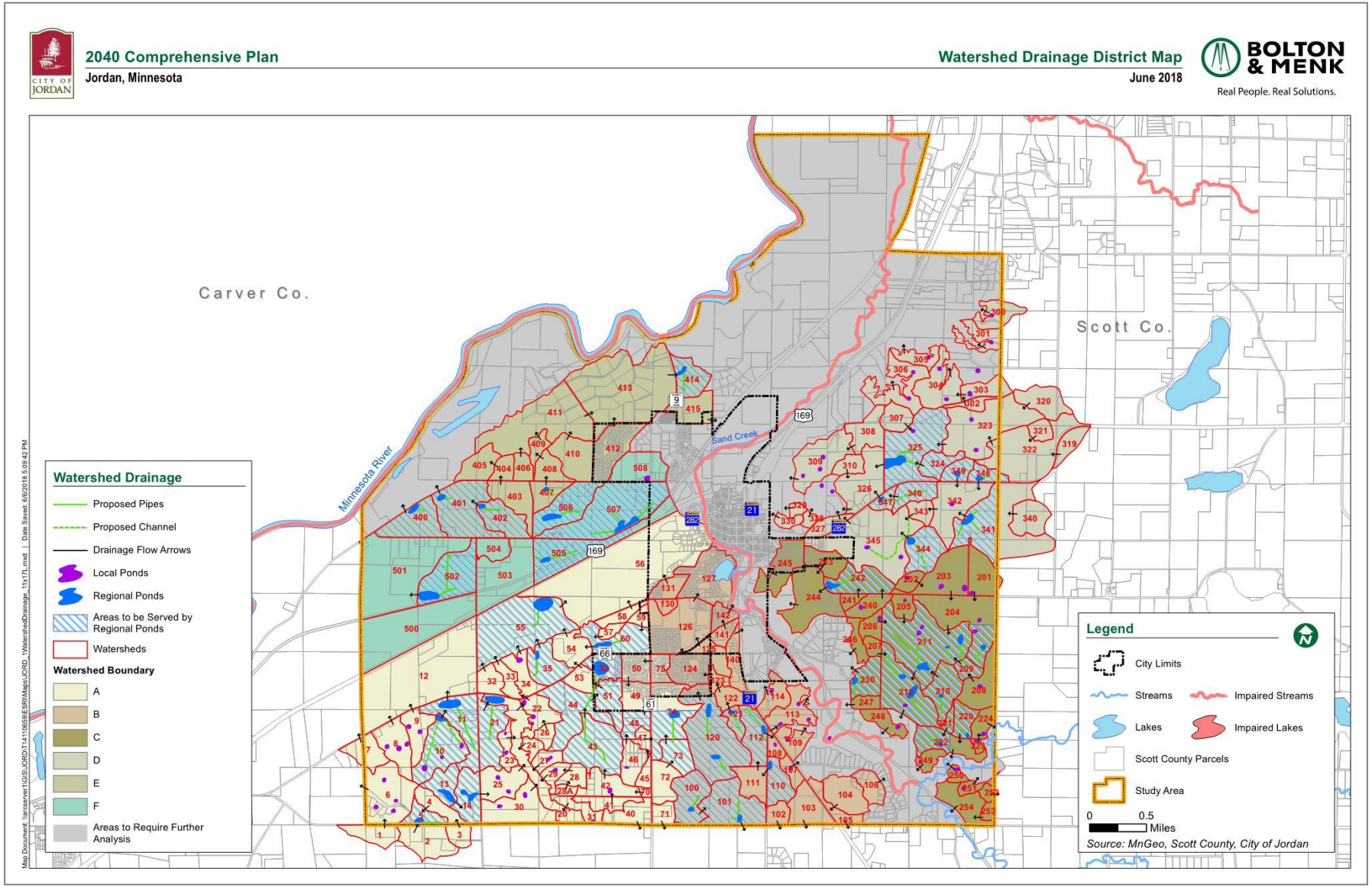
This step allows for public input based on public interest. The City Council shall determine when the public hearing should occur in the process. Based on the Public hearing, the City Council will approve or reject the amendment.

IX. EXISTING DRAINAGE PATTERNS

The total hydrologic study area includes over 21,000 acres of watershed. The area of the study lies both within and outside of the current city limits and generally terminated at the ultimate growth boundary. **Map 4-13** identifies the drainage districts in the city. It has been assumed that growth around Jordan will continue to the south and along the northeast and southwest approaches of U.S. Highway 169. The overall flow characteristics of the Jordan watersheds include a trend for stormwater runoff to flow toward Sand Creek and from there Sand Creek flows to the Minnesota River, northeast of the city. The stormwater runoff begins in the upper-most basins as sheet and shallow concentrated flow. This flow follows existing contours and steep ravines and develops into intermittent surface flows and creeks, directed to the relatively flat area adjacent to Sand Creek and the Minnesota River.

Project specific stormwater detention basin design procedure requires ponds to be sized to ensure there is no net increase in off-site flow rates for specific storm events. This procedure will minimize adverse effects to downstream properties. Unfortunately, when this procedure is applied to individual development sites without comprehensive review of regional drainage patterns the cumulative effect may be to inadvertently increase downstream flow conditions and possibly cause flooding at some locations. The use of large regional detention ponds has been proposed as a comprehensive stormwater management tool. This will better coordinate the possible development design changes and avoid, as much as possible, numerous smaller upstream localized ponds that would be provided on a project-by-project basis.

MAP 4-13: WATERSHED DRAINAGE DISTRICT MAP



Based on our analysis, the existing regional pond and culvert system will function properly for storm events less than or equal to the 100-year, 24-hour storm. However, for future detention and water quality ponds the 100-year storm events will need to be managed to prevent damage to the downstream properties. This may be accomplished by proper siting of improvements, consideration and protection of natural resources, constructing emergency spillways, providing larger interconnecting conveyance systems, diversion piping, increased pond storage volume, and/or adoption of low-impact site design practices. All of these options can be implemented while protecting the existing natural features of the city.

The primary objectives of this Section are to:

- Map and evaluate the existing city storm drainage conveyance network.
- Identify problem areas where the existing system should be modified or upgraded.
- Define requirements to improve the existing storm sewer conveyance, water quality, and detention system.
- Define surface water requirements associated with continued upstream development.
- Coordinate the design requirements of the proposed stormwater conveyance system with potential, future flood control efforts to minimize flooding of the Sand Creek corridor (when accepted by the Council).
- Require BMPs to accommodate continued development within the city's ultimate growth boundary while minimizing effects on water quantity and water quality.

2. Watershed Delineation

The scope of this section of the Plan is the development of a design document intended to size and locate future storm sewers, regional and localized detention basins, and other drainage facilities within the city as dictated by development in the ultimate growth boundary area of the city. Preparation of the Plan follows traditional storm sewer modeling and design procedures. The following summarizes the major activities associated with Plan development:

a) Existing city utility maps were reviewed to determine overall drainage patterns (major and sub-watersheds), catch basin locations, culverts, and other applicable drainage features.

b) Scott County 2-foot contour maps covering the area within the ultimate growth boundary were used to delineate major and sub-watersheds.

c) Field inspections of selected areas of concern, identified on the topographic map, were made to verify the accuracy of the model. When development in these areas occurs, a more detailed topographic survey will be required from the developers to verify the existing drainage conditions and existing and proposed structures.

d) Each drainage area flowing to a low point, natural agricultural depressions, or existing storage areas upstream from roadway culverts; was identified and mapped. Over 250 individual subwatershed collection areas were identified.

e) All major watershed and subwatershed boundaries were exported into a GIS mapping program (ArcGIS) and drainage areas computed.

f) Existing public storm sewer data was compiled and included.

g) Approximately 250 interior subwatersheds were delineated within the six major watersheds.

h) Subwatershed maps were developed for each major drainage area within the city's ultimate growth boundary. These maps were used to review existing drainage patterns and develop reasonable alternatives for future storm sewer improvements. Many factors were considered in this planning/design process including, but not limited to:

1. Verification and inclusion of the most recent storm sewer improvements into the model.

2. Incorporation of detention BMPs for flood protection and cost-effective pipe sizing wherever public open space for future development accommodated such facilities.

3. Rerouting of sections of major watersheds to provide cost effective storm sewer improvements and to reduce existing flooding issues.

4. Rerouting of subwatershed areas into detention basins to assist in stormwater quality management.

i) Surface runoff and storm sewer conveyance design is dependent upon the permeability of existing surfaces. Representative runoff coefficients ("C factors") for the rational method (CIA) of stormwater conveyance modeling and Curve Numbers for the SCS method were computed for each major watershed to reasonably reflect the degree of existing residential, commercial, agriculture, and industrial development. Undeveloped areas were modeled using runoff coefficients and curve numbers representative of the existing land use and soil type.

j) Based on subwatershed routing analysis as well as existing and proposed public ROW a proposed future storm sewer conveyance system was developed.

k) For each proposed detention basin site, Soil Conservation Service (SCS), Technical Release (TR), TR-20 and TR-55 methods were used to design basins to meet rate control and water quality requirements. Storm and Sanitary Analysis (SSA) and HydroCAD were used as a hydrologic modeling tool for detention basin sizing. Preliminary basin sizing was based on the Guidelines recommended by the Minnesota Pollution Control Agency "*Protecting Water Quality in Urban Areas*" and also in accordance with the recommendations of the Minnesota Board of Water Resources (BWSR) for wet detention basins and water quality enhancement. Finally, the *Minnesota Urban Small Sites BMP Manual* as prepared by the Metropolitan Council was consulted for recommendations relative to meeting additional NPDES stormwater management requirements.

l) Storm sewer conveyance pipe sizing upstream and downstream of detention basins was integrated into the model. Such integration is intended to reduce the possibility of oversizing conveyance pipe and reduce the likelihood of surface and street flooding from large storm events.

m) As each downstream subwatershed design was completed, the proposed storm sewer pipe sizes, drainage swales, and regional ponds were added to the topographic map. Preliminary locations for localized treatment basins have been shown on the maps in areas that will likely require ponding when development occurs.

n) Printed reports (SSA and HydroCAD) for each drainage area and corresponding detention basin design have not been prepared. Copies of the report summaries are available by contacting the City Planning Department.

o) The stormwater management system costs, which are needed to assist the City in calculating the Stormwater Area Charge (SAC), have been included in the Economic Considerations, of this report. SACs have been calculated for three different land use types, based upon the amount of runoff generated from each area. The more impervious area in a given land use, the more runoff that is generated. This justifies charging a higher SAC fee for the land use that produces greater amount of runoff. The three area charge categories are: 1) single family residential, 2) high density residential, 3) commercial/industrial.

3. Hydrologic Methodology

The existing conditions hydrologic analysis utilized in this Plan has been performed using the SSA modeling software. The model is based on the EPA Stormwater Management Model (SWMM). The EPA SWMM model is a dynamic rainfall-runoff simulation model used for single event or long-term (continuous) simulation of runoff quantity and quality from primarily urban areas. The runoff component of SWMM operates on a collection of subcatchment areas that receive precipitation and generate runoff and pollutant loads. The routing portion of SWMM transports this runoff through a system of pipes, channels, storage/treatment devices, pumps, and regulators. SWMM tracks the quantity and quality of runoff generated within each subcatchment, and flow rate, flow depth, and quality of water in each pipe and channel during a simulation period comprised of multiple time steps. This methodology is widely accepted among water resource engineers across the United States.

The SWMM engine accounts for various hydrologic processes that produce runoff from urban areas. These include:

- time-varying rainfall
- evaporation of standing surface water
- snow accumulation and melting
- rainfall interception from depression storage
- infiltration of rainfall into unsaturated soil layers
- percolation of infiltrated water into groundwater layers
- interflow between groundwater and the drainage system, and
- non-linear reservoir routing of overland flow.

Information such as existing and proposed pond storage volumes, runoff slopes, drainage areas and ditch locations were compiled directly from the topographic maps. Topographic slope information in conjunction with the "equivalent width" factor was used to calculate the time of concentration for each sub-watershed, a critical parameter in the hydrological analysis. Soil cover was compiled from review of orthographic photos obtained from Scott County.

The SCS defines the time of concentration as the total travel time of a particle of water from the hydraulically most distant point in the watershed to the outlet itself. The time of concentration was tabulated for each sub-basin by utilizing the Kirpich Method. The Kirpich Method is the recommended method when using the EPA SWMM hydrologic engine.

Stormwater detention and water quality ponds were modeled using an elevation, storage, and discharge relationship. A storage volume was determined for incremental elevations in each pond. The outlet devices for each proposed pond were sized based on downstream conveyance capacity and located either by review of topographic maps and/or field verification. In the proposed condition the detention basins were modeled to mitigate the effects of continued development and increased runoff by increasing the storage capacity.

For purposes of this report, the effects of a 2.8-in, 4.2-in, and a 6.1-I storm event were modeled. These events have probabilities of occurring once every 2-year, 10-years, and 100-years, respectively. Conceptually, the 2-year storm event has a 50 percent chance of occurring in any given year. Similarly, the 10-year storm event has a 10 percent chance and the 100-year storm event has a 1 percent chance of occurring in any given year.

4. Future Considerations

As noted in the Watershed Delineation section, numerous factors were considered in developing the proposed future storm sewer plan for the City. Because of the intricacies of the planned improvements, this summary report will not discuss every detail. However, we wish to highlight several key design features and recommendations.

a) Proposed regional and localized detention/water quality ponds are shown on the proposed conditions map. Ponds have been located in strategic low areas on or near the watershed or subwatershed perimeter and upstream to accommodate future development (generally residential). These locations are intended to provide water quality enhancement and serve as protection for existing developments from upstream agricultural runoff.

Key design criteria have been noted on the map and are documented in greater detail in the calculations. Upstream basins have been sized to accommodate ultimate watershed development and have been preliminarily sited to suit existing closed depressions. The actual shape and location of the constructed ponds may differ from what is shown provided that controlling design conditions are maintained (storage volume, maximum elevation, MPCA and BWSR requirements). In the event the development characteristics of any of the subwatersheds change significantly, pond design and storm sewer conveyance design will need to be modified accordingly.

Siting of detention basins was based on existing open space and individual subwatershed hydraulic requirements. Cursory consideration has been given to land use, development potential, property boundaries, etc. Many of the recommended detention sites are already prone to intermittent flooding and would require substantial grading for development.

b) Unfortunately, in the older, more densely developed areas of the community, such as the originally platted areas and the historic downtown business and residential districts, the possibility of acquiring space for regional or localized detention basin construction is improbable. Throughout most of this area, new detention basin construction would require site clearing and re-platting of developed properties.

   Consequently, in these developed areas, water quality and detention requirements will be complicated and may require construction of storm sewer interceptors. The hydrologic analyses of these areas may be reviewed on a case-by-case basis, as required.

   To meet the future Scott County or possible NPDES requirements, it may be necessary to construct and/or install some form of in-line treatment that does not require a large amount of open space. *Stormwater Management, Inc., Bay Saver and Stormceptor* are a few of the many in-line treatment systems being presently incorporated into existing developed areas across the Metro area.

c) The floodplain areas adjacent to the Minnesota River and the corridor along Sand Creek, which consists of steep slopes and benches, have not been included in the watershed model. These regions are typically protected from future development by zoning,

floodplain, and/or bluff ordinances. If areas within these regions are developed in the future, hydrologic analyses may be completed on a case-by-case basis, as required.

5. Pond Design Goals and Criteria

For the most part, the upper area surrounding Jordan consists of sandy-clayey nonporous soils. Although some areas have high sand content with high infiltration, a large percentage of the soils found within the study area were classified as being SCS, type B and/or type C, which are known to have moderate to low infiltration capabilities.

Whenever possible, regional detention/water quality ponds will meet NURP standards and City requirements. Wet settling basins are accepted and proven BMP technique widely accepted for stormwater quality treatment prior to discharge. All regional and localized detention/water quality pond design parameters will need to be carefully considered to ensure that there is no impact to existing downstream properties. It is imperative not to increase the groundwater gradient and the potential for basement seepage associated with regional or localized detention/water quality ponds.

Every attempt has been made to strategically locate regional and localized detention/water quality ponds in existing closed depressions within a given watershed or subwatershed. Steps have been taken to avoid wetlands and DNR waters in every case. The intent is to minimize the excavation required and optimize the volume and size of storm sewer conveyance piping associated with pond construction.

In some areas, smaller upgradient ponds have been proposed to minimize additional erosion of existing ravines due to the increased runoff associated with urban development. The smaller upstream ponds are proposed to manage stormwater volumes equal to the runoff from a 2-year, 24-hour rainfall event (2.8-in). The smaller ponds will treat the runoff through sedimentation and minimize peak discharge flow rates into existing ravine(s) enroute to larger, downstream regional ponds.

Similarly, the regional basins may be designed to reduce the quantity of large diameter trunk storm sewer pipe that would be required for stormwater conveyance. The proposed detention/water quality ponds may be designed as non-uniform meandering waterways, creating a more natural appearance while maintaining the design intent and providing cost savings by reducing the length of large diameter pipe.

When reviewing development plans the SCS runoff curve number (CN) for the existing agricultural areas and the minimum CN's for developed conditions should be limited to the values in the following table:

Maximum existing----------CN = 70
Minimum residential development----------CN = 72
Minimum high density residential development ------CN = 85
Minimum commercial development----------CN = 90
Minimum industrial development----------CN = 90

These values are general in nature and typically apply to the urban development of existing farmland. We anticipate instances in which the existing land use is either pasture, wetland, or ungrazed meadows, etc., which will require appropriate curve number adjustment in accordance with standard SCS TR-20 and TR-55 methodology.

6. Existing Watersheds and Required Improvements

The following is a brief description of the various major watershed areas studied. At present, the descriptions are limited to the ultimate growth boundary of the City of Jordan.

A. Drainage District A

Drainage District A is located in the southwest portion of the regional growth boundary area. District A is approximately 7,000 acres in size. District A generally slopes down from the south to the north with runoff collecting in one of two centrally located ravines and discharging into a large DNR protected wetland (DNR#220w) located in the southwest quadrant of the U.S. Highway 169 (US 169) and State Highway 282 (TH282) intersection. This wetland discharges into Sand Creek north US 169. The soils in this area are typically sandy-clayey. This district is currently farmed with sparse residential development.

The regional and localized pond network is proposed as an economical and effective method of managing the increased runoff rates and volumes projected from continued urban development in District A. This proposed stormwater detention/water quality pond network includes fourteen regional ponds, with each basin located along an existing drainage route. Each proposed pond would be designed MPCA standards and City regulations prior to discharging stormwater to the north of CR 66. The existing culverts crossing CR 66 will be utilized as outlet conveyance. In the upland areas, where runoff is presently discharge directly into ravines, the use localized stormwater detention/water quality ponds is proposed to minimize erosion.

The benefits of the required District A regional and localized stormwater detention/water quality pond system are:

- The reduction of the developed property runoff rates and volumes to pre-developed levels.
- Treatment of stormwater quality to MPCA standards and City regulations prior to discharge.
- Improved flood control management in the vicinity of CR 66 and US 169.
- Utilization of existing infrastructure and flow paths when practical.

B. Drainage District B

Drainage District B is located in the south central section of the regional growth boundary area. District B is approximately 2,850 acres in size. The general slope of District B is from the south to the north toward the Jordan Mill Pond and/or east toward Sand Creek. District B has been further subdivided into two major subdistricts with CR 21 as the internal boundary. The area east of CR 21 and Delmar Avenue drains into Sand Creek, to the east. The area west of CR 21 and Delmar Avenue drains to the north into the Jordan Mill Pond (DNR #113p) and across a concrete weir into Sand Creek.

The soils within District B are typically sandy-clayey. The dominant existing land use is row crop production with areas of development to the north and south of CR 66.

The regional and localized pond network, is proposed as an economical and effective method of managing the increased runoff rates and volumes projected from continued urban development in District B. This network includes nine regional and nineteen localized stormwater detention/water quality ponds. Each proposed pond will be designed to

MPCA standards and City regulations prior to discharging stormwater. For the portion of District B that drains easterly toward Sand Creek, localized ponds are proposed along the east side of TH 21. These localized ponds would be located upstream of the existing ravines to minimize possible erosion due to increased flow rates and volumes. The reminder of District B will be served by localized ponds as growth dictates.

The benefits of the required District B regional and localized stormwater detention/water quality pond systems are:

- The dampening of the developed property runoff rates to match pre-developed flow rates.
- Treatment of stormwater to MPCA standards and City regulations prior to discharge.
- The post-development runoff velocities can be controlled upstream of the existing ravines to minimize additional erosion and better manage the runoff rate and volume prior to it entering the regional pond system.
- Improved flood control management adjacent to CR 66.
- Proposed pond locations utilize existing closed depressions and outlet conveyances.
- Improved flood control management adjacent to Hillside Drive and the existing development in the vicinity of Stuart Drive.

C. Drainage District C

Drainage District C is located in the southeastern regional growth boundary area. District C is approximately 4,250 acres in size. The soils are found to be sandy-clayey. The general slope of District C is from the east down to the west. The district land use is primarily agricultural with a few scattered wetlands and some isolated areas of development.

The regional and localized pond network is proposed as an economical and effective method of managing the increased stormwater runoff rates and volumes projected from continued urban development in District C. This network includes thirteen regional and forty-six localized stormwater detention/water quality ponds. Each proposed pond will be designed to MPCA standards and applicable City regulations prior to discharging stormwater.

The benefits of the required District C regional and localized storm water detention/water quality pond system are:

- The dampening of the developed property runoff rates to match pre-developed flow rates.
- Treatment of stormwater to MPCA standards and City regulations prior to discharge.
- The post-development runoff velocities can be controlled upstream of the existing ravines to minimize additional erosion and better manage the runoff rate and volume prior to it entering the regional pond system.
- The regional ponds manage both on-site stormwater and agricultural stormwater drainage from off-site sources with a single pond, eliminating the need for multiple localized ponds.

D. Drainage District D

Drainage District D is located in the northeastern regional growth boundary area. District D is approximately 3,260 acres in size. District D is comprised of relatively flat highlands sloping from the east down to the west toward steep bluffs abutting the western and northern district boundary. The soils are found to be a sandy-clayey mix. The land use is primarily agricultural. Wetland are scattered throughout the district and there is limited residential development.

The regional and localized pond network is proposed as an economical and effective method of managing the increased stormwater runoff rates and volumes projected from continued urban development in District C. This network includes thirteen regional and forty-six localized stormwater detention/water quality ponds. Each proposed pond will be designed to MPCA standards and applicable City regulations prior to discharging stormwater.

The benefits of the required District C regional and localized storm water detention/water quality pond system are:

- The dampening of the developed property runoff rates to match pre-developed flow rates.
- Treatment of stormwater to MPCA standards and City regulations prior to discharge.
- The post-development runoff velocities can be controlled upstream of the existing ravines to minimize additional erosion and better manage the runoff rate and volume prior to it entering the regional pond system.
- Improved flood control management adjacent to TH 282 and in the vicinity of Morlock Drive.

E. Drainage District E

Drainage District E is located on the northwest side of the city and is bordered by the Minnesota River on the north. District E is approximately 1,330 acres in size. The general slope of the land is from the south down to the north, toward the Minnesota River. The soils are characterized as sandy-loam. These soils are a moderately porous soil. The land use is primarily agricultural. Wetlands are scattered throughout the district. There is an area of large rural residential parcels and a number of high-density residential developments.

The regional pond network is proposed as an economical and effective method of managing the increased stormwater runoff rates and volumes projected from continued urban development in District E. This network includes five regional stormwater detention/water quality ponds. Each proposed pond will be designed to MPCA standards and City regulations prior to discharging stormwater. A number of smaller localized stormwater detention/water quality ponds will be required as urban development continues. The regional pond system will accommodate the anticipated development from approximately 680 acres. Localized development ponds will accommodate the remaining area as required by the patterns of future urban development.

The benefits of the required District E regional and localized storm water detention/water quality pond system are:

- The dampening of the developed property runoff rates to match pre-developed flow rates.
- Treatment of stormwater to MPCA standards and City regulations prior to discharge.

- Improved stormwater quality prior to discharge into the Minnesota River.
- Improved flood control management adjacent to the Minnesota River and in areas of the Minnesota River floodplain.

F. Drainage District F

Drainage District F is located in the area immediately north and west of the intersection of US 169 and TH 282. District F is approximately 2,050 acres in size. US 169 is the southern boundary of this area. The general slope of the land is from the northwest down to the southeast toward the US 169 intersection with TH 282. Stormwater runoff is presently discharged to the northeast of TH 282 into Sand Creek. The soils are characterized as sandy-loam which are found to be porous in nature.

The regional pond network is proposed as an economical and effective method of managing the increased stormwater runoff rates and volumes projected from continued urban development in District F. This network includes seven regional and ten localized stormwater detention/water quality ponds. Each proposed pond will be designed to MPCA standards and City regulations prior to discharging stormwater. The regional pond system will accommodate the anticipated development from approximately 510 acres. Localized development ponds will accommodate the remaining area as required by the patterns of future urban development.

The benefits of the required District F regional and localized storm water detention/water quality pond system are:

- The dampening of the developed property runoff rates to match pre-developed flow rates.
- Treatment of stormwater to MPCA standards and City regulations prior to discharge.
- Improved stormwater quality prior to discharge into the Sand Creek.

7. Conclusions

The city's existing storm sewer treatment and conveyance system cannot accommodate continued development in the regional growth boundary area without upgrades to existing infrastructure. If development in this area continues as predicted and the existing treatment and conveyance system is utilized, it will require major improvements to serve the existing and future community without exacerbating intermittent flooding issues.

The regional and localized stormwater detention/water quality pond model presented in this Plan is one approach to accommodate the predicted urban development in the regional growth boundary area of the city based on precipitation estimates from Technical Paper 40. The City will use the most recent rainfall estimates, such as NOAA Atlas 14 at the time this plan is drafted, to ensure proper sizing of ponding and associated stormwater infrastructure. Further enhancement of this model is necessary on a project by project basis to accommodate new rainfall estimates and where a private development will be constructing a regional pond as a condition of their permit. These updates will ensure that adjustments, due to new construction and urban development, can be coordinated with the model and regional flow rates and volumes can continually be reviewed, verified, and updated. The components of the proposed SAC should also be updated annually. These reviews will ensure that developers are paying their fair share for the improvements.

This model is predominantly based on information obtained from available Scott County GIS mapping data, the city aerial and contour maps, field verification of accurate watershed boundaries, and discussions with City staff relative to the historical flooding areas. Based on all available information the modeled system closely matches qualitative descriptions given by individual observation. We believe this Comprehensive Surface Water Management Plan has significant benefit as a planning, engineering, and design tool. However, this Plan and the regional and localized stormwater and water quality pond network model is not necessarily the only method of accomplishing the goal of comprehensive surface water management. The quality and accuracy of this model may be further validated with more detailed survey data at the time of proposed development in the regional growth area of the city.