22-0820

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April 19, 2022

Mr. Greg Minikel, P.E., Engineering Division Manager
City of Manitowoc
900 Quay Street
Manitowoc, WI 54220

Re: South 19th Street Pumping Station Study

Dear Mr. Minikel:

Enclosed is one PDF copy of the draft South 19th Street Pumping Station Study for your review.

Please call 608-251-4843 with questions.

Sincerely,

STRAND ASSOCIATES, INC.®

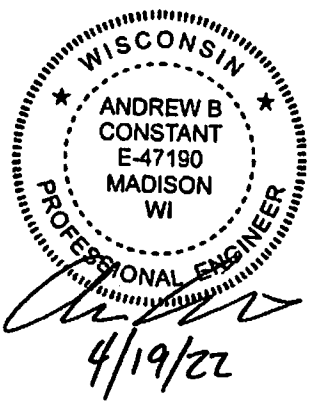
Andy Constant

Enclosure: Report

22-0820

Report for
City of Manitowoc, Wisconsin

South 19th Street Pumping Station Study



Prepared by:

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April 2022

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The purpose of this report is to study the existing and future sanitary sewer flows tributary to the South 19th Street Pumping Station located in in the City of Manitowoc, Wisconsin (City), and prepare conceptual layouts and budgets for future conveyance system improvements.

BACKGROUND

A. Previous Studies

There is a previous study that relates to the South 19th Street Pumping Station and the areas it serves. This report, titled *Collection System Lift Station Evaluation*, was completed in November 2002 by Foth & Van Dyke and Associates, Inc. (Foth) for the City. The purpose of this previous study was to evaluate the existing conditions of the pumping station, provide recommended improvement upgrades, and to review the existing pumping station capacity. This report concluded that the South 19th Street Pumping Station had sufficient pump capacity for the current flow demands. The report stated the current flow demands were also the ultimate flow demands for the South 19th Street Pumping Station, implying no planned growth in the service area.

The report concluded that the South 19th Street Pumping Station structure, piping, and valves were in generally fair condition. It was recommended that the pumps be replaced and miscellaneous structural, mechanical, heating, ventilation, and air conditioning (HVAC), and electrical updates be completed.

B. Existing Facility Information

The South 19th Street Pumping Station was originally constructed in 1939 and is located on the north end of South 19th Street, approximately 600 feet north of Wollmer Street. The pumping station is located along the south shore of the Manitowoc River. When originally constructed, the pumping station consisted of an abovegrade brick building with a lower-level pump room, lower-level bar screen and wet well, and an above-level control room. The pumping station was upgraded in 1991, which included structural changes to separate the wet well from the control room and dry well, new station controls, and emergency portable generator connections. New telemetry alarm systems were installed in 2000.

Figure 1 Existing South 19th Street Pumping Station

The existing pumping station contains two 20-horsepower (hp) Fairbanks Morse pumps, each with an estimated capacity of 1,400 gallons per minute (gpm) at 34 feet of total dynamic head (TDH). The existing force main for this pumping station includes approximately 600 linear feet (LF) of 12-inch-diameter C-900 polyvinyl chloride (PVC) force main (installed in 2006) and discharges into a manhole located in the intersection of Wollmer Street and South 19th Street.

As outlined in the following section, the estimated existing peak design flow for this pumping station is 604,614 gallons per day (gpd [420 gpm]). This pumping station currently has an estimated firm pumping

capacity (one pump out of service) of 1,400 gpm. If one pump were to be placed out of service, this pumping station should handle existing peak flows.

SEWER SERVICE AREA ANALYSIS

An analysis of the existing and future land use within the study area was conducted. Land use and the number of residential units, if applicable, were obtained from the City's zoning maps and City staff. The type of land use and quantity of each land use was used to estimate the average wastewater flows using typical flow rates, such as per capita per acre rates for various land uses. Peaking factors were then applied to the average flow rates.

A. General Design Criteria

When planning for sanitary sewers, the size and character of the ultimate service area must be defined. The size of the service area is important in that the amount of area served impacts the estimated wastewater flow from the service area. The type of development (industrial, commercial, or residential) also influences the estimated wastewater flow from the service area.

The sanitary sewer service area for the South 19th Street Pumping Station was defined in cooperation with city staff. It was based on existing planning documents and topographic, and environmental constraints where appropriate. Land use within the service area was obtained from the City's land use maps. The existing sewer service area contained two land use classifications: heavy industrial district, and single- and two-family district. The following assumptions were made for the various land use classifications and were used to estimate the average wastewater flow rates to the pumping station.

Land Use	Average Wastewater Contribution (gpad)
Single- and Two-Family District	1,200
Heavy Industrial District	2,500

Note: gpad=gallons per acre day

Table 1 Wastewater Flow Assumptions

Sanitary sewer pumping stations are typically designed to accommodate peak wastewater flows. Peak flow accounts for variations in water use during the course of a day. Peak flows are normally determined by applying a peaking factor to the average daily flow rate. Peaking factors, like unit flow rates, can vary from community to community. In general, as the residential land area and/or population served by a particular sanitary sewer or pumping station increases, the peaking factor decreases. This occurs because the increase in population serves as a dampening effect on the variations in peak flow, therefore decreasing the residential peaking. Peaking factors for industrial and commercial areas are normally lower as these flows typically do not exhibit as wide of variation as residential flows. The following peaking factors were used in determining peak flow rates.

Area Served	Peaking Factor
0 to 250 Acres Residential	4
250 to 500 Acres Residential	3.5
500+ Acres Residential	2.5
Industrial or Commercial	2.5

Table 2 Peaking Factors

B. South 19th Street Pumping Station Service Area Analysis

1. Existing Flow Analysis

This section will evaluate existing station flows using two different methods: pump run times and service area analysis.

The average daily flows, expressed in gpm, to the pumping station from January 2019 to July 2020 are shown in Table 3. These existing flows were calculated by estimating the pump capacities and referencing the pump run times obtained from the City. It should be noted that the pump run time data was obtained every 16 days, on average, and the average daily flow rates are an approximation. If the City were to have daily run time data from its supervisory control and data acquisition (SCADA) system, these approximate flows would likely be more accurate.

Area Served	Pump 1	Pump 2	Total
Average Pump Run Time/Day (hours)	1.43	1.63	3.06
Estimated Pump Capacity (gpm)	1,400	1,400	-
Estimated Average Daily Flow (gpd)	120,010	136,909	256,919
Estimated Maximum Daily Flow (gpd)	252,000	294,000	546,000

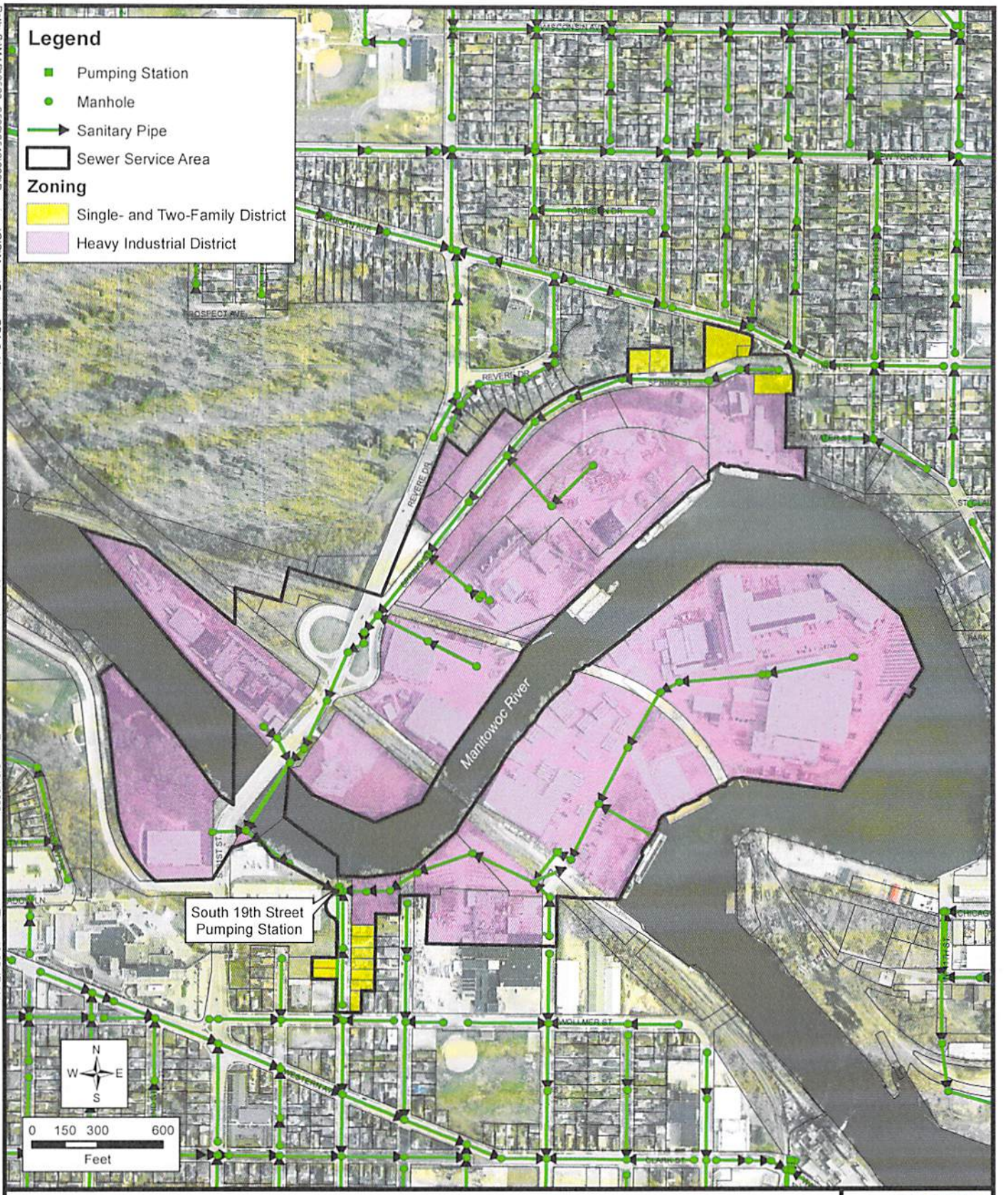
Table 3 South 19th Street Pumping Station Flow Estimation

The sanitary sewer service area for the South 19th Street Pumping Station is shown in Figure 2 and the total estimated wastewater flow rate summary is displayed in Table 4.

Land Use	Acres	gpad	Estimated Average Flow (gpd)	Estimated Peak Flow (gpd)
Single- and Two-Family District	2.8	1,200	3,343	13,373
Heavy Industrial District	94.6	2,500	236,497	591,241
Total	**97.4**		**239,840**	**604,614**

Table 4 South 19th Street Pumping Station Wastewater Flow Rate Summary

The estimated daily average flow of 239,840 gpd based on the service area analysis corresponds reasonably close to the estimated daily average flow of 256,919 gpd calculated from the average



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SEWER SERVICE AREA

SOUTH 19TH STREET PUMPING STATION STUDY
CITY OF MANITOWOC
MANITOWOC COUNTY, WISCONSIN

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FIGURE 2
3516.029

pump run time data. For the purposes of this study, the flow figures calculated from the sewer service area analysis will be used as they are generally more conservative.

2. Future Flow Analysis

The future service area for this pumping station is not anticipated to grow significantly because of the site topography, existing development, and existing layout of the collection system. An increase in flows to this pumping station would likely be a direct result of redevelopment or change of land use or industry within the service area. For this reason, this study will consider the flow calculations included for the existing service area to be an adequate representation of anticipated future flows.

3. Station Capacity

The existing station capacity is believed to be 1,400 gpm based on existing information provided by the City. The calculated average and peak flows for this pumping station are 239,840 gpd (167 gpm) and 604,614 gpd (420 gpm), respectively. This shows that the current pumps provide more than enough capacity to handle the existing and future flows. Because the City has not expressed any concerns with pump capacities or pump cycling times, it is recommended that any future pumps match the existing pump capacity, resulting in pumps that would be able to handle changes within the service area and flows, if necessary.

IMPROVEMENT ALTERNATIVE ANALYSIS

The City's geographical information system (GIS) mapping of the sanitary sewer system was used for this study. Manhole and pumping station depths were determined based on existing record drawings. The design criteria for pumping station improvements follow Chapter NR 110 of the Wisconsin Department of Natural Resources (WDNR) administrative code.

A. Alternative A–Rehabilitation of South 19th Street Pumping Station

This improvement alternative will consider the rehabilitation of the South 19th Street Pumping Station to handle current and future flows. For the purposes of this study, complete replacement of the pumping station facilities to meet current code requirements was assumed even though some of the existing components could be reused. Appendix A contains various photographs of the existing pumping station and Appendix B displays the plan and section views of the potential rehabilitation improvements to the existing pumping station as discussed in the following.

1. Building Site and Utilities

The rehabilitation of this pumping station would reduce the need for significant site modifications as all improvement efforts would be focused on the interior of the existing building. Additionally, since the pumping station location would not change, there would be no need to acquire new land or easements. The existing influent gravity sewer and effluent force main would remain unchanged outside of the building footprint.

2. Building Facilities

Figure 3 Existing Bar Screen in the Wet Well Area

This alternative would reuse the existing cast-in-place (CIP) concrete wet well/dry well and the existing building. Costs would be included to make necessary repairs due to deterioration over time and modifications to the structure to accommodate new equipment.

The existing wet well area is accessed through a separate doorway with stairs that lead down to the top of the influent channel. The existing channel includes a manual bar screen that can be raked onto a concrete platform. There is also an existing sluice gate located at the entrance of the gravity sewer into the channel that is currently inoperable. This could be replaced as part of rehabilitation to allow for isolation of the pumping station. The existing metal stairs appear to be structurally sound. There was evidence of some concrete spalling on the underside of the influent channel and the floor of the room that should be repaired. The existing wet well was unable to be viewed during a cursory site review; however, an allowance will be included to review the existing walls and make any necessary repairs.

The existing dry well area is accessed through a separate doorway. The ground level of the dry well contains the pump motors and electrical equipment. A metal spiral staircase leads to the lower level of the dry well area where the pumps, piping, valves, and sump are located. The existing concrete walls of the concrete appear to be in good condition, however, there was some evidence of paint chipping off the wall. This should be repainted as part of the rehabilitation project.

The interior and exterior of the existing brick building appeared to be in good condition. The roof was not assessed as part of the site review, however, costs for a membrane roof replacement will be included, if necessary. Graffiti was also noted on the north exterior wall of the building. An anti-graffiti coating could be provided to allow for easier removal of these instances in the future.

The following is a list of proposed building modifications:

a. Repair concrete in the wet well and provide liner coatings on concrete walls and channels in wet well area.
b. Replace existing sluice gate in wet well channel with new stainless steel, manually operated sluice gate.
c. Fill and patch existing conduit through walls not to be reused.
d. Repaint the concrete walls within the dry well area.
e. Evaluate roof condition and provide replacement as necessary.
f. Provide anti-graffiti coating on all exterior masonry surfaces.

3. HVAC

The existing wet well area and dry well area are provided with ventilation by separate supply fans located on the roof, which is ducted through the ceiling. The air is relieved by an exhaust louver located along the north wall. Each area is heated through separate electric unit heaters.

Figure 4 Unit Heater, Louver, and Ductwork Within the Wet Well Area

The pumping station will require upgraded HVAC systems to meet current code requirements relative to ventilation and to provide cooling for the new electrical equipment. Additionally, the upgraded HVAC systems will be designed to control temperature and humidity in the dry well area.

For the improvements, each room will be classified in accordance with National Fire Protection Associates (NFPA) 820 and the National Electrical Code (NEC). An analysis will be performed during detailed design to determine the ventilation rates and other fire protection measures required by NFPA 820.

4. Electrical

The majority of the electrical equipment at the pumping station has exceeded or is nearing its 30-year service life. The existing electrical distribution equipment in the pumping station (such as motor control centers [MCC], disconnects, motor controls, and receptacles) will be replaced because the equipment is at the end of its expected service life and modern electrical distribution equipment designs will improve operator safety. It is also anticipated that the new pumps will operate on variable frequency drives (VFDs) to maximize efficiency during periods of lower flows.

5. Pumps and Piping

It appears that the majority of the existing interior piping, fittings, and all shutoff valves are original to the pumping station. The check valves and shutoff valves are vital operating components of the pumping station and allow for isolation and routine maintenance. Replacement of the suction, discharge, and header piping is recommended, along with redundancy improvements such as adding a bypass pumping connection to allow for isolation of the force main and pumping station.

Figure 5 Existing Pump, Valves, and Piping Within the Dry Well Area

The existing pumps and motors also appear to be original to the station, if not nearing the end of their service life. Replacement of the pumps with either vertical centrifugal pumps or vertical dry-pit submersible pumps is recommended to maintain the continued operation of this pumping station. The system head curve for a preliminary pump selection is shown in Figure 6. Since these new pumps will be on VFDs, it will not only be able to convey the design flow of 1,400 gpm, but they could also be reduced in speed to better serve average daily flows. A preliminary evaluation of the operating levels and the wet well size indicates that it is sufficient to meet WDNR codes for minimum pump cycle times and wet well detention times at the average flow.

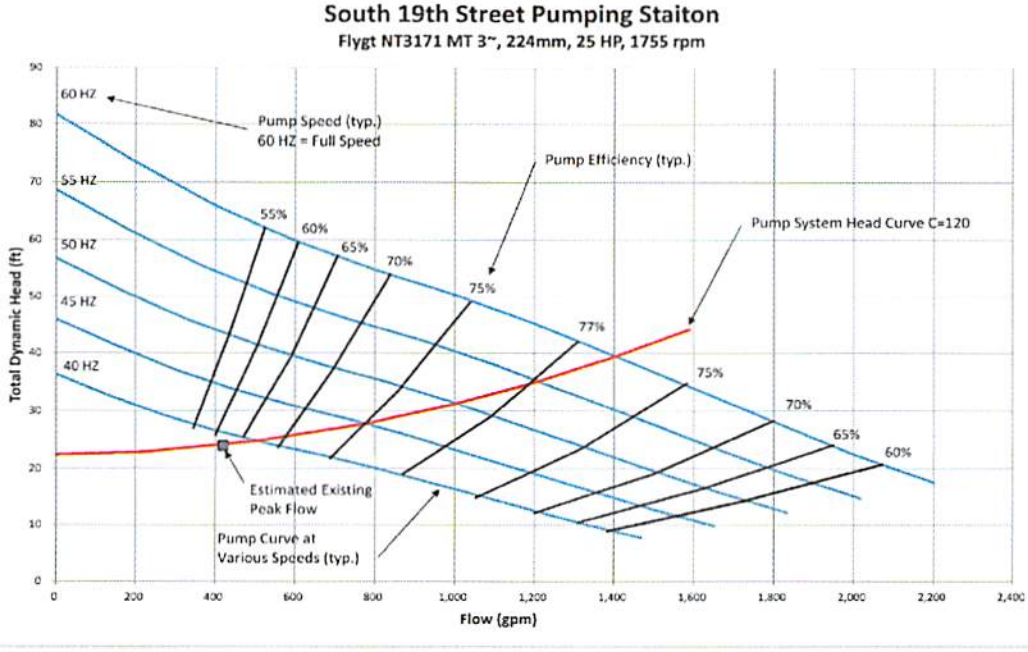


Figure 6 Potential New Pump Selection

The bypass pumping capabilities will consist of piping routed from the 12-inch-diameter header pipe located in the lower level of the wet well up to the first floor of the pumping station, and then out through the wall to a quick connect coupling. This would allow the flow to bypass the pumping station if it ever needed to be taken offline. Additionally, if there were ever any issues with the force main, flow could be pumped through the bypass connection into tanker trucks or piped to the discharge point 600 feet south of the pumping station.

B. Alternative B–Replacement of South 19th Street Pumping Station

This improvement alternative will consider the replacement of the South 19th Street Pumping Station to handle current and future flows. For the purposes of this study, complete replacement of the pumping station facilities to meet current code requirements was assumed even though some of the existing components could be reused.

It is proposed that a new South 19th Street Pumping Station would be a wet well/dry well-type facility similar to the existing structure. The benefits of this type of facility includes pumps and equipment that are more easily accessible for routine maintenance without a confined space entry permit. However, because of the increased structure size associated with this type of facility, space constraints may be a concern on smaller sites along with a cost increase for additional excavation and structure size.

A wet well/dry well-type pumping station uses a wet well to collect wastewater and an adjacent dry well to house the pumps, controls, and other miscellaneous equipment. Wastewater is pulled from the wet well into the dry well through suction piping and is then pumped into a singular header pipe that eventually leaves the station. It is intended that this underground structure would be cast-in-place, with a brick-and-mortar building placed over top to house the controls and equipment. Excavation to install a new pumping station this close to the river will present challenges with sheeting and dewatering.

The replacement of this pumping station would require the purchase of additional land and/or easements to construct because there is not enough room in the current parcel to place a new pumping station. Additionally, new gravity sewer and force main would need to be installed to connect to the existing utilities. In addition to the utilities, pavement replacement would be necessary to restore utility trenches and new pavement added to provide access to the new pumping station. See Figure 7 for a potential site layout of the new pumping station site.

The building facilities, HVAC and electrical considerations, and pumps and piping layouts would remain similar between the rehabilitation and replacement options.

C. Summary of Alternative Costs

The summary of the anticipated capital costs for each alternative is summarized in Table 5. These costs include the estimated costs for technical design services and construction. Construction engineering is not included in the estimate. A detailed breakdown of these costs is included in Appendix C.

Alternative	Capital Costs
Alternative 1–Rehabilitation of South 19th Street Pumping Station	$844,000
Alternative 2–Replacement of South 19th Street Pumping Station	$1,742,000

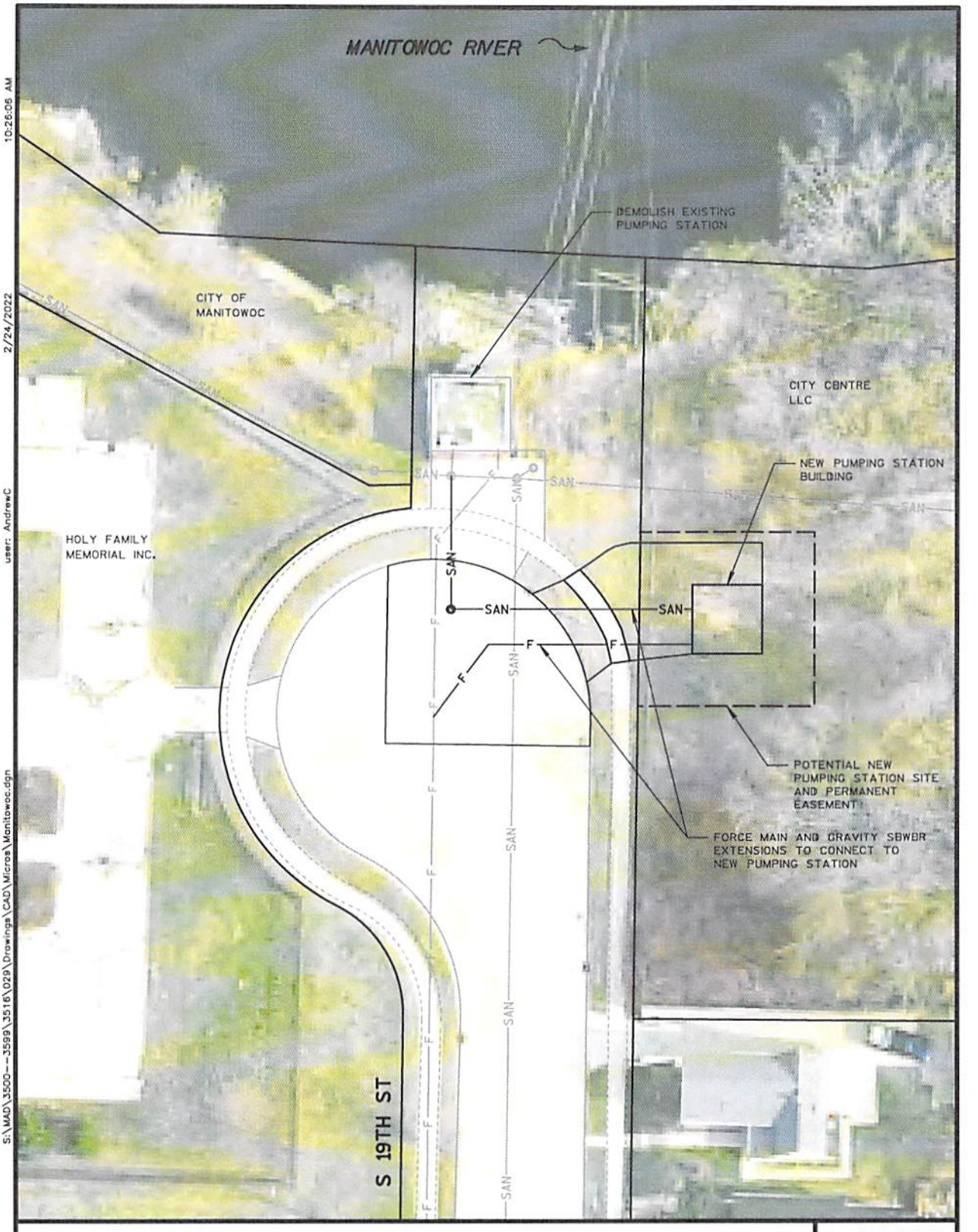
Table 5 Summary of Alternative Costs

ADDITIONAL CONSIDERATIONS

Additional project considerations regarding the project schedule, funding, and phasing are discussed in the following section.

A. Funding Opportunities

Typical of most wastewater pumping station projects, the WDNR Clean Water Fund Program (CWFP) is an applicable source of funding that should be considered for this project. A summary of this funding opportunity is listed in Table 6.



ALTERNATIVE B - PUMPING STATION REPLACEMENT
SITE PLAN

SOUTH 19TH STREET PUMPING STATION STUDY
CITY OF MANITOWOC
MANITOWOC COUNTY, WISCONSIN

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FIGURE 7

Funding Source	Available Funding	Maximum Funding	Local Share	Typical Deadlines	Application Cycle
CWFP–WDNR	Varies Yearly	Principal forgiveness based on project ranking	1.485 percent interest for areas with no financial need; 0.891 percent for disadvantaged municipalities; 0 percent for extremely disadvantaged municipalities	Intent to Apply (ITA) due October 31 of year before application, Application due September 30 if requesting principal forgiveness, otherwise, can be submitted year-round	Annual

Table 6 Funding Sources Summary

In addition to the CWFP, additional infrastructure funding may be available with the recently enacted bipartisan infrastructure law taking effect in the coming months.

B. Schedule

To take advantage of the CWFP offered by the WDNR, this project could be presented for construction in 2024. For this option, a preliminary schedule is listed below.

1. Keep ITA–October 2022
2. Information Gathering–Fall/winter 2022
3. Design–January through September 2023
4. CWFP Application for Principal Forgiveness–September 2023
5. Advertise to Bid and Construction–November 2023 through December 2024

Alternatively, if the City has funds available and is looking to construct in 2023, Strand Associates, Inc.® (Strand) recommends a design period in 2022. However, potential CWFP funding would not be available as an ITA would not have been submitted for that application cycle.