CHAPTER 10

RECOMMENDED SANITARY SEWER SYSTEM IMPROVEMENTS

This chapter discusses recommended improvements to address existing sanitary sewer system deficiencies as well as recommended improvements to meet future planning area needs. The nature and extent of existing system deficiencies were identified and discussed in Chapters 9 and 10. The improvements to meet future needs are based on the expansion of the existing sewer system into the undeveloped areas to facilitate growth as projected in the Village's Comprehensive Plan.

10.1 IMPROVEMENTS TO ADDRESS EXISTING DEFICIENCIES

The improvements to address existing deficiencies are shown in Figure 10-1 and summarized in Table 10-1. These improvements address three types of identified system deficiencies:

- Potential future capacity restrictions
- Pipe settlements
- Sump manholes

The remainder of Section 10.1 discusses improvements to address these existing system deficiencies.

10.1.1 Potential Future Capacity Restrictions

As shown in Figure 9-1, the sanitary sewer pipe segment from MH 015 to MH 013 is 75 to 100 percent utilized under existing development conditions. In addition, a number of pipe segments on either side of this pipe are 50 to 75 percent utilized under existing conditions. Sewer pipes that are highly utilized under present conditions have little capacity remaining to accommodate additional growth. This is particularly critical for these sewer pipe segments, because the affected sewer line is a main trunk sewer which serves the largest part of the Village service area, and could also be used to serve future expansion areas to the south. These pipes could be removed and replaced with a larger diameter size, or they could be enlarged using trenchless techniques. Either method would be quite expensive.

A more cost effective option would be to create a diversion upstream of the problem area by redirecting some of the wastewater flow around the area in question. Such a sewer flow diversion appears to be possible south of Maple Drive and west of Claflin Street. The existing sanitary sewer pipe runs from MH 39 to MH 37 along the west side of the cemetery to Maple Drive, and then turns west toward Hwy 42. Another subsystem begins east on Maple Drive at MH 193 and runs east to MH 177, and then turns north on Claflin Street. The existing manhole invert elevations would allow for a diversion to be constructed by installing a new manhole between MH 39 and MH 37, and installing a pipe from this new manhole to MH 193, thus diverting flow into sewer lines along Claflin Street, Mill Road and South Spring Road. This diversion can be seen in Figure 10-1.

10.1.2 Pipe Settlements

Inspection of television camera video footage has revealed a large settlement in the existing 10 inch sanitary sewer pipe between MH 47 and MH 45. This sewer line was constructed through an existing ravine that was subsequently filled as part of the project. This dip that was created in the sewer line causes

TABLE 10-1

IMPROVEMENTS TO ADDRESS EXISTING DEFICIENCIES

SISTER BAY SANITARY SEWER SYSTEM

VILLAGE OF SISTER BAY, WISCONSIN

System Deficiency	System Location	Description	Recommended Improvement	Alternative Improvement Option
Potential Future Capacity Restriction	MH019 to MH011	Highest Utilized Pipes in System	Construct Partial Diversion From MH039 to MH193	Enlarge pipe size from 10-inch to 12-inch using Trenchless Methods
Capacity Restriction due to Pipe Settlement	MH047 to MH045	Negative pipe slope due to settlement of sewer pipe; sedimentation of solids	Remove and replace 10-inch pipe	N/A
Sump Manholes	MH073 to MH121 MH123 to MH131 MH220 to MH228 MH198 to MH204	Sumps create maintenance problems due to sedimentation of solids	Pour concrete inverts in manholes to eliminate sumps	N/A

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low flow velocities and the sedimentation of solids which results in on-going sewer maintenance problems.

This sewer pipe segment will be difficult to repair without removing and replacing the settled sections of pipe. Due to the potential for further settlement, it is recommended that the entire segment from manhole to manhole be removed and replaced. This will allow inspection of the trench bottom prior to new pipe installation, to determine if the trench bottom needs additional treatment prior to installation of a new sewer pipe.

10.1.3 Sump Manholes

Several sanitary sewer system manholes were constructed without poured inverts, and currently act as sump manholes. During periods of low flow, wastewater solids drop out of suspension into these sumps, and the sumps need to be regularly cleaned. This is an unnecessary recurring system maintenance activity that can be eliminated with proper manhole construction.

Sump manholes are found in the following locations:

- Sister Bay Estates: MH 73 – MH 121, and MH 123 – MH 131
- North Spring Road: MH 220 – MH 228
- Pheasant Court: MH 198 – MH 204

The remedy for the sump manhole conditions is to pour concrete inverts into the manholes. The recommended improvement will require a contractor to temporarily bypass pump around the affected manholes, properly clean the sumps, pour new concrete inverts, and allow the concrete inverts to properly cure prior to removing the temporary bypass.

10.2 IMPROVEMENTS TO MEET FUTURE NEEDS

The remainder of this chapter discusses system improvements recommended to provide sewer service to the areas within the study planning boundary that are currently unsewered. The following discussion will include the methodology used, analysis conducted, results obtained, and proposed system improvement recommendations.

10.2.1 Computer Model of Future System

A hydraulic computer model of the future sanitary sewer system was developed to aid in capital improvement planning. This model was constructed similar to the existing sanitary sewer system model described in Section 9.1, but with a few differences. The primary difference between the existing system model and the future model was in the estimated future sewer flows. Instead of using aerial photography and current zoning maps to determine flows tributary to each manhole, the future model utilized the Planning Districts Map provided by the Village to estimate future flows. The Planning Districts Map is shown in Figure 2-1.

10.2.2 Flow Generation Rates

For the purposes of sizing sanitary sewer pipes to serve future development, it is prudent to be conservative when estimating future flows. Sewer pipes can typically have a useful life of 60 years or more, and there is a relatively small difference between the cost of larger pipe sizes, compared to the cost

of initial pipe installation and trench restoration. Therefore, it is usually more cost-effective over the long-term to design sewer trunk facilities to be conservatively large rather than too small when planning sewer service for future long-term development.

For this reason, and based on discussions with Village staff, it was assumed that land use areas identified as "Countryside" and "Large Lot Residential" on the study Planning Districts Map may potentially be reclassified to the next higher level of development density during the life of the sewer system, and contribute higher sewer flows to the system. For example, land uses currently defined as Countryside were treated as if they were rezoned Large Lot Residential in the future system model. Similarly, Large Lot Residential land uses were treated as if they were rezoned as Single Family Residential in the future system model. All other future land uses were treated the same as they were in the existing system computer model.

Although the maximum density allowable for Single Family Residential is 1 unit per 20,000 square feet, this density was considered too high to use for estimating average sewer flows within the planning area. A number of existing rural residential developments were checked, and the average density in many of the rural settings was closer to 1 unit per acre. Therefore, it was anticipated that future Single Family Residential areas would have an average development density of 1 unit per acre within the future service planning area. This average single family residential development density would also take into account some of the more rugged terrain areas which result in large areas of unbuildable space on some lots.

The development densities and sewer flow generation rates used for the future service planning area are summarized in Tables 10-2 and 10-3.

10.2.3 Trunk Sewer Extensions

Another difference between the existing system model and future model was in the treatment of undeveloped land outside the current sewer system area but within the study planning area boundary. For the existing model, undeveloped land was not included in the flow analysis. For the future model, it was assumed that this land would develop in general accordance with the Planning Districts Map and need sanitary sewer service. As such, planned sewer extensions and lift stations to serve these future areas were located and sized to include future areas into the model. As is common for sewer system planning studies, only the planned trunk facilities were included in the future model; smaller individual sewer lines were not included.

Planned sewer extensions were located in natural valleys wherever possible to provide the maximum service by gravity to the upland areas. In areas where gravity sanitary sewers were not possible due to topographic elevation, planned lift stations and force mains were included in the model to serve the lowest areas.

In addition to topography, the proposed routes selected for trunk sewer facilities were also influenced by locations of roadways, parcel lines, and land uses. It is important to note that the size and location of planned sewers is conceptual in nature, and actual sewer pipe alignments would need to be determined through feasibility studies and final design prior to construction. The proposed conceptual locations of future sanitary sewer trunk facilities needed to adequately serve the planning area are illustrated in Figures 10-2 and 10-3.

TABLE 10-2

DEVELOPMENT DENSITIES FOR FUTURE CONDITIONS

SISTER BAY SANITARY SEWER SYSTEM

VILLAGE OF SISTER BAY, WISCONSIN

		Current Zoning Densities		Units/Acre	People/Unit
Land Use Type	**Zoning Catagories**	**Lot Size**	**Dwelling Units per Lot**	**Future Assumed Density (units/acre)**	**Future Assumed Density (persons/unit)**
Residential	(CS-1) Countryside	10 acre	1	0.20	3.00
	(R-1) Single-Family Residence	20,000 sq. ft.	1	1.00	2.50
	(R-2) Multiple-Family Residence	20,000 sq. ft.	6/acre	6.00	2.25
	(R-3) Large Lot Residence	5 acre	1	1.00	2.50
	(R-4) Small Lot Residence	4,500 sq. ft.	1	9.68	2.00
Non-Residential	(B-1) General Business	20,000/25,000 sq. ft.		2.18	
	(B-2) Downtown Business Transition	4,500 sq. ft.		9.68	
	(B-3) Downtown Business	4,500 sq. ft.		9.68	
	(I-1) Institutional				
	(P-1) Park/Recreation				
	Liberty Grove Industrial	60,000 sq. ft.		0.73	
	Liberty Grove Natural Area	15 acre	1	0.07	

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TABLE 10-3

UNIT AND AREA FLOW GENERATION RATES FOR FUTURE CONDITIONS

SISTER BAY SANITARY SEWER SYSTEM

VILLAGE OF SISTER BAY, WISCONSIN

Land Use Type	Zoning Catagories	Future Flow Rate in Gallons per Capita per Day (GPCD)	Future Flow Rate in Gallons per Acre per Day (GAD)
Residential	(CS-1) Countryside	110	66
	(R-1) Single-Family Residence	100	250
	(R-2) Multiple-Family Residence	90	1,215
	(R-3) Large Lot Residence	100	250
	(R-4) Small Lot Residence	85	1,646
Non-Residential	(B-1) General Business		1,200
	(B-2) Downtown Business Transition		1,500
	(B-3) Downtown Business		1,500
	(I-1) Institutional		1,500
	(P-1) Park/Recreation		75
	Liberty Grove Industrial		1,500
	Liberty Grove Natural Area		10

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10.2.4 Routing of Future Flows to WWTP

The first option for conveying the future planning area sewer flows to the WWTP was to route the flows through the existing sewer system, and simulate the resulting system impact using the computer model. Simulated model results of future flow conditions were then compared to the existing pipe capacities. Existing sewer pipes with a future utilization of 100 percent or more indicated a future capacity restriction deficiency. Since critical sections of the existing sanitary sewer system are already near capacity with the current development levels, this flow conveyance option resulted in large sections of the existing system becoming overloaded and needing reconstruction.

Other options for conveying future sewer flows to the WWTP were also evaluated. For example, the feasibility of constructing new lift stations and force mains in the growth areas to pump flows directly to the WWTP was evaluated. The estimated costs for building new sewer facilities to convey flows to the WWTP were compared to the estimated costs for reconstructing sewers and upgrading existing facilities. The purpose of this comparison was to determine the most cost-effective and feasible approach to providing sewer service to the future growth areas. This comparison will be detailed further in the following sections.

To better delineate phases of construction and the associated costs, the future expansion area was broken down into “regions” for further analysis. There are six individual sewer service regions identified in the northern portion of the future sewer service expansion area (Regions A – F), and four regions identified in the southern portion of the expansion area (Regions G – J).

10.2.5 Northern Regions

The northern sewer service planning regions include Regions A – F as illustrated in Figure 10-2. Due to the flat topography and limited gravity sewer alignment options, sewer service to Regions A, B, C and D will require lift stations and force mains. Lift stations for each region would pump to the adjacent region, with the sewer flows for the four regions eventually discharging into existing system MH 298. In addition to the cost of the lift stations, these regions will be more expensive to develop and provide sewer service due to the subsurface rock and the tight working conditions.

Future development located on the eastern end of Region C will be a difficult area to serve due to the existing flat terrain and the need for a lift station. The costs for providing sanitary sewer service to this relatively small area will be high. As a result, this area (indicated in Figure 10-2) is not recommended to receive sanitary sewer service at this time due to the high cost per acre of providing service.

On the other hand, Regions E and F are not expected to need lift stations, and can be served by gravity from the existing sewer system. Region E would discharge into the north end of the existing system, and Region F would discharge into the area north of the WWTP. These areas will be less expensive to serve per acre because of the lower infrastructure costs, the closer proximity to the existing collection system, and the less developed conditions which will require less restoration.

10.2.6 Southern Regions

10.2.6.1 Regions G, I and J

The southern sewer service planning regions include Regions G – J as illustrated in Figure 10-3. Region G can feed directly into the existing sewer system near the Little Sister Lift Station.

The small area inside the planning boundary southeast of Lift Station H would require a lift station to be served. Because this area is small, outside the Village corporate limit, difficult to serve, and the cost per acre to provide sanitary sewer service would be high, extending service to this area is not recommended at this time.

A lift station is anticipated to be needed south of Plateau Road on Woodcrest Road to serve Region I. This region is a naturally low lying area that drains to the east. Proposed Lift Station I would pump north and discharge near the intersection of Plateau Road and Woodcrest Road.

Region J is lower in elevation than the receiving area at the WWTP, and therefore will need a lift station located near the lowest point in the region. The likely location would be in the park near the intersection of Woodcrest Road and Autumn Court. From proposed Lift Station J, wastewater flows would be pumped a short distance east to the WWTP.

10.2.6.2 Region H

Region H is a large area that can be served by a single lift station located immediately north of the intersection of Country Lane and Hwy 57. This station may need to be relatively deep to serve the low-lying area northwest of this intersection. This approach to serving Region H would also allow the abandonment of the existing Fieldcrest Lift Station because a new gravity sewer line (P134) would be installed south along Fieldcrest Road to Proposed Lift Station H. This sewer alignment would divert the current Fieldcrest Lift Station service area flow out of the existing system, which would provide additional existing system capacity for the anticipated flows that would be added from serving Region G.

Multiple options were evaluated to determine the best way to serve Region H. After many discussions with Village staff, a preferred alternative was established. The preferred alternative will consist of running the future force main from Lift Station H north along Hwy 57 to the crest of the hill north of Country Walk Drive. At the crest of the hill, the force main will discharge into a new gravity trunk sewer that will run down Hwy 57 and Bay Shore Drive to Lift Station 1. Flows at Maple Drive and Mill Road will be picked up by this new pipe. In addition, the existing sewer pipe located through the back yards east of Bay Shore Drive can be abandoned once all existing service laterals are reconnected to the new pipe. Lift Station 1 will need to be upgraded, but the existing force mains pumping to the WWTP appear to have sufficient capacity to accommodate the additional flow. The route of the proposed trunk sewer through the downtown area to serve Region H is shown in Figure 10-4.

Under this alternative, the recommended force main pipe from Lift Station H to the crest of the hill would be 8 inches in diameter. The downstream trunk sewer to Lift Station 1 will steadily increase in size as it proceeds downstream, and will range from approximately a 10” pipe to an 18” pipe, depending on the location along the route and the number of connections to the existing system which are made.

Lift Station 1 will need to be upgraded by increasing the pump capacity. More study would be needed to determine the exact improvements needed at the station, but at this time, it is estimated that the total pumping capacity at the station would need to increase by approximately 50 percent. As the service area fills in and the existing system expands in other areas, Lift Station 1 may need to be upgraded even further in the long-term future.

A number of alternatives were studied prior to determining the preferred option for serving Region H. Information pertaining to these other options can be found in Appendix F. The primary advantages to the preferred alternative are listed below:

- This alternative may allow more development to occur faster in the southern part of the service area, because it would not be dependent on development in Regions I and J.
- It would provide additional sewer capacity in the downtown area.
- It would provide a level of redundancy that currently does not exist in the downtown area. This would allow some of the existing sewer mains to be taken out of service for maintenance if needed, while still providing sewer service to customers.
- If the project is done concurrently with the State's Hwy 57 reconstruction project, there should be cost sharing opportunities with the State on the surface restoration.

Detailed feasibility studies should be conducted to confirm the preliminary findings before any improvements are designed or constructed.

10.2.6.3 Region H – Interim Lift Station

Development pressure currently exists in the northeast part of Region H. Based on the model assumptions; it is projected that the existing system could accommodate a small interim lift station located in the northeast part of Region H as an interim way to provide sewer service in this area. This interim station would only be a temporary solution until such time as Lift Station H and the associated downstream improvements were constructed.

If the diversion were constructed from MH 39 to MH 193, it is estimated that an interim lift station with duel 100 gpm pumps could be constructed somewhere in the northeast part of Region H. If the diversion were not constructed, there would not be capacity in the Mill Road sewer to accommodate this additional flow, so the diversion must be constructed first. The maximum pumping rate of the station should not exceed 150 gpm with both pumps operating simultaneously. The flow could be temporarily pumped to MH 317, which is located on the south end of Smith Drive. For comparison, this interim station would be the approximate size of the existing Fieldcrest Lift Station.

As part of the design on this interim lift station, a detailed feasibility study would be required to confirm that the downstream system is adequate to accept the flows resulting from the specific pumps and pumping conditions being proposed for that lift station.

If the interim station were to be constructed, it is recommended that flow monitors be periodically installed in the downstream system to monitor the flow levels after the station comes on line. This would allow the Village to observe the flow levels and take appropriate action if the levels become too high. The monitors should be installed on the critical segments of both sides of the diversion (i.e., the Maple/Mill Road side and the Claflin/South Spring side). Lift Station 1 should also be monitored for any capacity issues.

Using the flow rates assumed in the this report, the maximum pumping rate of 150 gpm translates into approximately 150 single family homes. Although the minimum lot size for R-1 zoning is 20,000 square feet (approx. 0.5 acre), the amount of land typically attributed to each new lot is significantly more if roadways, ponding areas, and open spaces are also included. For example, depending on the development layout, it would not be uncommon for each lot to consume 1 acre or more of land. Under this scenario, 150 residential units might require 150 acres of land.

Figure 10-5 shows one option for serving the northeast part of Region H. The approximate sewer service boundary is shown based on the existing topography. Areas beyond the limits shown would be difficult to serve without additional lift stations. This option illustrates providing service to only the undeveloped land north of Hwy 57. The interim lift station is located near Northwoods Drive in the lowest part of the service area to save costs on sewer pipe depth. The force main would pump northeast along Hwy 57 to MH 317.

Planning level costs for the interim station are summarized in Table 10-4. The force main cost is based on an assumed 6 inch diameter force main, and contains a significant allowance for rock excavation, restoration and contingencies. A detailed feasibility study should be conducted to confirm the preliminary findings before any improvements are designed or constructed.

For the purposes of this cost estimate, it was assumed that the size of the lift station would be similar to the Fieldcrest Lift Station. A less costly grinder pump system was considered due to the smaller design flows, but it was determined that the flows could exceed the recommended threshold for a grinder pump. In addition, using a 100 gpm duplex station for each option would provide the Village with the most flexibility for providing sanitary sewer service to this developing area.

10.2.7 Impact of Future Expansion on Existing Facilities

The computer model was used to evaluate the impact to the existing system of adding the flows from proposed Regions A, B, C, D, E, F, G, H and I. Other than the issues already mentioned, the results of this analysis indicated that only a single sewer pipe segment would have a capacity restriction with the addition of these flows. The affected segment is an 8 inch pipe from MH 106 to MH 104 which has a very flat slope. The model results indicate that this pipe segment would significantly exceed its capacity due to the additional flows from the north. Accordingly, it is recommended that this segment be removed and replaced with a larger diameter sewer pipe prior to the full build-out of Regions A – D. The location of this pipe segment is shown in Figure 10-6.

10.3 RECOMMENDED SANITARY SEWER CAPITAL IMPROVEMENTS

10.3.1 Estimated Cost of Trunk Facilities to Address Existing Needs

The improvements to address existing deficiencies are shown in Figure 10-1 and summarized in Table 10-1. These improvements address three different types of deficiencies: potential future capacity restrictions, pipe settlements and sump manholes.

The estimated costs to address existing deficiencies are presented in Table 10-5. These are preliminary budget estimates only, and actual costs must be determined through the competitive bidding process. The costs are in 2006 dollars and include anticipated contingencies and indirect project costs.

TABLE 10-4

PLANNING LEVEL COST FOR INTERIM LIFT STATION IN REGION H

SISTER BAY SANITARY SEWER SYSTEM

VILLAGE OF SISTER BAY, WISCONSIN

ITEM	Size (in.)	Length (ft.)	Cost per Foot	Estimated Construction	Restoration Unimproved (ft.)	Restoration Partial Improved (ft.)	Restoration Cost*	Rock Excavation Cost**	Subtotal Construction	Contingencies and Engineering (30%)	Total Estimated Cost
F.M.	6 FM	2,750	$40	$110,000		1,900	$57,000	$165,000	$332,000	$99,600	$431,600
L.S.	100 gallons/minute			$90,000					$90,000	$27,000	$117,000
TOTAL											**$549,000**

***Restoration cost based on $.60 per linear foot for unimproved and $30 per linear foot for partially improved areas.**

**** Rock Excavation estimated at $60 per linear foot, assumed to be an average area of 4' wide x 6' deep.**

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TABLE 10-5

ESTIMATED COST OF IMPROVEMENTS TO ADDRESS EXISTING DEFICIENCIES
SISTER BAY SANITARY SEWER SYSTEM
VILLAGE OF SISTER BAY, WISCONSIN

System Deficiency	System Location	Description	Recommended Improvement	Approximate Quantities	Planning Level Costs (2006 Dollars)
Potential Future Capacity Restriction	MH019 to MH011	Highest Utilized Pipes in System	Construct Partial Diversion From MH039 to MH193	75 LF of 10 inch pipe plus bypass pumping, manholes, restoration, and traffic control	$50,000
Capacity Restriction due to Pipe Settlement	MH047 to MH045	Minimal pipe slope due to settlement of sewer pipe; sedimentation of solids	Remove and replace 10-inch pipe	Remove and replace 240 LF of 10 inch pipe, plus bypass pumping, restoration and traffic control	$60,000
Sump Manholes	MH073 to MH121 MH123 to MH131 MH220 to MH228 MH198 to MH204	Sumps create maintenance problems due to sedimentation of solids	Pour concrete inverts in manholes to eliminate sumps	34 manholes plus cleaning, bypass pumping and traffic control	$40,000

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10.3.2 Estimated Cost of Trunk Facilities to Serve Future Growth

Preliminary cost estimates for the proposed trunk facility improvements to serve expansion areas in 2006 dollars are presented in Table 10-6. These estimates include allowances for surface restoration, construction contingencies, and engineering.

The linear foot costs listed in the table for each pipe size are approximate. They are based on recent projects, and make assumptions for some rock excavation and dewatering averaged out across the system. In areas where sewer and water are located in a common trench, the rock excavation and restoration costs have been split between the sewer and water categories. Actual costs may vary significantly depending upon actual conditions within each region and within each sub-region.

Two different restoration categories are used to address anticipated restoration costs. The first restoration category is for unimproved areas. In this category, it is assumed that pipes will be installed across an undeveloped, "unimproved" area. Restoration costs for this category include only turf establishment within the work area. The second category of restoration is for "partially improved" areas. This category assumes that the pipes will be installed along and near a street (perhaps in a ditch area), and that part of the pavement and shoulder may need to be replaced. Table 10-6 lists the assumed restoration type and length for each pipe run.

An allowance was included in the cost estimate for rock excavation and dewatering. The rock excavation allocation represents the cost of about 6 foot of rock excavation depth across all of the piping. Since actual depth of rock excavation at each location is unknown, this allowance may be high or low, depending on the actual conditions at each location. It should be noted that costs for rock excavation were split between the sewer and water categories in areas where the utilities were installed in a common trench.

Due to the exact location of the trunk facilities being unknown at this time, costs are considered preliminary. Extraordinary costs such as subsurface crossings, removal and replacement of other existing utilities, easement costs, etc., are not included in the preliminary estimates. However, the 20% contingency may cover a number of these miscellaneous costs.

Table 10-6 lists the costs for the facilities that are needed within each of the 10 future sewer service regions. Since some flows are conveyed from one region through another region, some facilities would need to be designed larger to accommodate flows from other regions. As a result, if the Village wishes to pass these costs back to the regions in some manner, there is an important distinction that is worth noting. The costs spent within any particular region to construct the facilities may be higher that the costs that are incurred as a result of serving that particular region. This will be true for regions that are located downstream of other regions.

As this study's recommendations are conceptual in nature, detailed feasibility reports and cost estimates should be prepared prior to the design and construction of any improvements.

Operating costs for the future collection system facilities primarily involve electricity to run the new lift station pumps. The annual operating cost for any lift station will depend on the peak flow rate and head conditions at the station. It will also depend on the cost of electricity. Since pumps slowly wear over time, electrical costs will increase over time, due to increased friction, decreased efficiency, and the need for more power to run the pumps. Operating costs could also include the cost to operate portable generator sets, which are needed to run the stations if electrical power is interrupted. Due to the many variables

TABLE 10-6

ESTIMATED COST OF TRUNK FACILITIES TO SERVE EXPANSION AREAS
SISTER BAY SANITARY SEWER SYSTEM
VILLAGE OF SISTER BAY, WISCONSIN

ITEM	Size (in.)	Length (ft.)	Cost per Foot	Estimated Construction	Restoration Unimproved (ft.) [3]	Restoration Partial Improved (ft.) [3]	Restoration Cost	Rock Excavation Cost [4]	Engineering & Contingencies (30%)	Total Estimated Cost (2006 Dollars)
REGION A										
P101	8	1,100	$40	$44,000		1,100	$33,000	$66,000	$42,900	$185,900
P102[1]	8	1,530	$40	$61,200	205	1,325	$19,900	$45,900	$38,100	$165,100
P103	8	930	$40	$37,200		930	$27,900	$55,800	$36,300	$157,200
F.M. - A	6 FM	1,200	$40	$48,000		1,200	$36,000	$72,000	$46,800	$202,800
L.S. - A	20 gallons/minute			$60,000					$18,000	$78,000
REGION A Total										**$789,000**
REGION B										
P104[1]	8	2,015	$40	$80,600		2,015	$30,200	$60,500	$51,400	$222,700
P105[1]	8	800	$40	$32,000		800	$12,000	$24,000	$20,400	$88,400
F.M. - B	6 FM	300	$40	$12,000	300		$200	$18,000	$9,100	$39,300
L.S. - B	15 gallons/minute			$60,000					$18,000	$78,000
REGION B Total										**$429,000**
REGION C										
P106[1]	8	5,700	$40	$228,000		5,700	$85,500	$171,000	$145,400	$629,900
P107[1]	8	1,490	$40	$59,600		1,490	$22,400	$44,700	$38,000	$164,700
P111	8	2,270	$40	$90,800		2,270	$68,100	$136,200	$88,500	$383,600
P111[2]	8	1,400	$40	$56,000		1,400	$21,000	$42,000	$35,700	$154,700
P112	8	4,150	$40	$166,000		4,150	$124,500	$249,000	$161,900	$701,400
P112[2]	8	1,900	$40	$76,000		1,900	$28,500	$57,000	$48,500	$210,000
P113	8	1,700	$40	$68,000		1,700	$51,000	$102,000	$66,300	$287,300
P113[2]	8	2,600	$40	$104,000		2,600	$39,000	$78,000	$66,300	$287,300
P114[1]	8	560	$40	$22,400		560	$8,400	$16,800	$14,300	$61,900
F.M. - C	8 FM	905	$45	$40,700	905		$500	$54,300	$28,700	$124,200
L.S. - C	220 gallons/minute			$144,000					$43,200	$187,200
REGION C - Total										**$3,193,000**

Note: All Region Totals Rounded to the Nearest $1,000

[1] Entire trench common with water piping, costs split for entire lengths
[2] Part of trench common with water piping, costs split for common lengths
[3] Restoration cost based on $0.60 per lineal foot for unimproved and $30 per lineal foot for improved
[4] Rock excavation estimated at $60 per lineal foot, assumed be be an average of 4' wide by 6' deep

TABLE 10-6

ESTIMATED COST OF TRUNK FACILITIES TO SERVE EXPANSION AREAS
SISTER BAY SANITARY SEWER SYSTEM
VILLAGE OF SISTER BAY, WISCONSIN

ITEM	Size (in.)	Length (ft.)	Cost per Foot	Estimated Construction	Restoration Unimproved (ft.) [3]	Restoration Partial Improved (ft.) [3]	Restoration Cost	Rock Excavation Cost [4]	Engineering & Contingencies (30%)	Total Estimated Cost (2006 Dollars)
REGION D										
P115	8	1,300	$40	$52,000		1,300	$39,000	$78,000	$50,700	$219,700
P115[2]	8	2,500	$40	$100,000		2,500	$37,500	$75,000	$63,800	$276,300
F.M. - D	8 FM	330	$45	$14,850	180	50	$1,608	$19,800	$10,900	$47,200
L.S. - D	250 gallons/minute			$144,000					$43,200	$187,200
REGION D - Total										**$731,000**
REGION E										
P116[1]	8	1,200	$40	$48,000		1,200	$18,000	$36,000	$30,600	$132,600
P117	8	1,680	$40	$67,200		1,680	$50,400	$100,800	$65,500	$283,900
P118	8	1,380	$40	$55,200		1,380	$41,400	$82,800	$53,800	$233,200
P119	8	1,300	$40	$52,000		1,300	$39,000	$78,000	$50,700	$219,700
P119[2]	8	700	$40	$28,000		700	$10,500	$21,000	$17,900	$77,400
REGION E - Total										**$947,000**
REGION F										
P120[1]	8	2,800	$40	$112,000		2,800	$42,000	$84,000	$71,400	$309,400
P121	8	525	$40	$21,000		525	$15,800	$31,500	$20,500	$88,800
P122	8	750	$40	$30,000		750	$22,500	$45,000	$29,300	$126,800
P122[2]	8	1,100	$40	$44,000		1,100	$16,500	$33,000	$28,100	$121,600
P123	8	1,250	$40	$50,000		1,250	$37,500	$75,000	$48,800	$211,300
P124[1]	8	3,600	$40	$144,000		3,600	$54,000	$108,000	$91,800	$397,800
P125	8	860	$40	$34,400		860	$25,800	$51,600	$33,500	$145,300
P126[1]	8	925	$40	$37,000		925	$13,900	$27,800	$23,600	$102,300
REGION F - Total										**$1,504,000**

Note: All Region Totals Rounded to the Nearest $1,000

[1] Entire trench common with water piping, costs split for entire lengths
[2] Part of trench common with water piping, costs split for common lengths
[3] Restoration cost based on $0.60 per lineal foot for unimproved and $30 per lineal foot for improved
[4] Rock excavation estimated at $60 per lineal foot, assumed be be an average of 4' wide by 6' deep

TABLE 10-6

ESTIMATED COST OF TRUNK FACILITIES TO SERVE EXPANSION AREAS
SISTER BAY SANITARY SEWER SYSTEM
VILLAGE OF SISTER BAY, WISCONSIN

ITEM	Size (in.)	Length (ft.)	Cost per Foot	Estimated Construction	Restoration Unimproved (ft.) [3]	Restoration Partial Improved (ft.) [3]	Restoration Cost	Rock Excavation Cost [4]	Engineering & Contingencies (30%)	Total Estimated Cost (2006 Dollars)
REGION G										
P127	8	2,200	$40	$88,000		2,200	$66,000	$132,000	$85,800	$371,800
P127[2]	8	800	$40	$32,000		800	$12,000	$24,000	$20,400	$88,400
P128	8	450	$40	$18,000		450	$13,500	$27,000	$17,600	$76,100
P128[2]	8	1,000	$40	$40,000		1,000	$15,000	$30,000	$25,500	$110,500
P129	8	300	$40	$12,000		300	$9,000	$18,000	$11,700	$50,700
P129[2]	8	2,500	$40	$100,000		2,500	$37,500	$75,000	$63,800	$276,300
P130[1]	8	1,100	$40	$44,000		1,100	16,500	33,000	$28,100	$121,600
REGION G - Total										**$1,096,000**
REGION H										
P131[1]	8	3,800	$40	$152,000		3,800	$57,000	$114,000	$96,900	$419,900
P132	8	2,650	$40	$106,000		2,650	$79,500	$159,000	$103,400	$447,900
P133	8	2,350	$40	$94,000		2,350	$70,500	$141,000	$91,700	$397,200
P134[1]	8	3,000	$40	$120,000		3,000	$45,000	$90,000	$76,500	$331,500
P135	8	4,000	$40	$160,000		4,000	$120,000	$240,000	$156,000	$676,000
P135[2]	8	600	$40	$24,000		600	$9,000	$18,000	$15,300	$66,300
P136	8	2,100	$40	$84,000		2,100	$63,000	$126,000	$81,900	$354,900
P136[2]	8	1,600	$40	$64,000		1,600	$24,000	$48,000	$40,800	$176,800
P137	8	300	$40	$12,000		300	$9,000	$18,000	$11,700	$50,700
P137[2]	8	1,000	$40	$40,000		1,000	$15,000	$30,000	$25,500	$110,500
P138	8	500	$40	$20,000		500	$15,000	$30,000	$19,500	$84,500
P138[2]	8	1,000	$40	$40,000		1,000	$15,000	$30,000	$25,500	$110,500
P139	8	2,325	$40	$93,000		2,325	$69,800	$139,500	$90,700	$393,000
P140	8	5,400	$40	$216,000		5,400	$162,000	$324,000	$210,600	$912,600
P141	8	1,100	$40	$44,000		1,100	$33,000	$66,000	$42,900	$185,900
P141[2]	8	2,500	$40	$100,000		2,500	$37,500	$75,000	$63,800	$276,300
P142	8	1,200	$40	$48,000		1,200	$36,000	$72,000	$46,800	$202,800
P143[1]	8	1,125	$40	$45,000		1,125	$16,900	$33,800	$28,700	$124,400
P144	8	1,125	$40	$45,000		1,125	$33,800	$67,500	$43,900	$190,200
P144a[5]	12 - 18	3,600		$342,000					$103,000	$445,000
F.M. - H	8 FM	6,260	$45	$281,700		6,500	$195,000	$375,600	$255,700	$1,108,000
L.S. 1 Upgrade	500 gallons/minute			$176,000					$52,800	$228,800
L.S. - H	340 gallons/minute			$160,000					$48,000	$208,000
REGION H - Total										**$7,502,000**

[1] Entire trench common with water piping, costs split for entire lengths

[2] Part of trench common with water piping, costs split for common lengths

[3] Restoration cost based on $0.60 per lineal foot for unimproved and $30 per lineal foot for improved

[4] Rock excavation estimated at $60 per lineal foot, assumed be be an average of 4' wide by 6' deep

[5] Does not include street restoration costs due to state resurfacing project

Note: All Region Totals Rounded to the Nearest $1,000

TABLE 10-6

ESTIMATED COST OF TRUNK FACILITIES TO SERVE EXPANSION AREAS
SISTER BAY SANITARY SEWER SYSTEM
VILLAGE OF SISTER BAY, WISCONSIN

ITEM	Size (in.)	Length (ft.)	Cost per Foot	Estimated Construction	Restoration Unimproved (ft.) [3]	Restoration Partial Improved (ft.) [3]	Restoration Cost	Rock Excavation Cost [4]	Engineering & Contingencies (30%)	Total Estimated Cost (2006 Dollars)
REGION I										
P145[1]	8	2,325	$40	$93,000		2,325	$34,900	$69,800	$59,300	$257,000
P146	8	1,360	$40	$54,400		1,360	$40,800	$81,600	$53,000	$229,800
F.M. - I	6 FM	1,260	$40	$50,400		1,260	$37,800	$75,600	$49,100	$212,900
L.S. - I	100 gallons/minute			$90,000					$27,000	$117,000
REGION I - Total										**$817,000**
REGION J										
P147[1]	8	2,700	$40	$108,000		1,210	$18,150	$81,000	$41,430	$248,600
P147a	10	1,210	$45	$54,450		2,700	$81,000	$72,600	$41,610	$249,700
P148[1]	8	3,810	$40	$152,400		3,810	$57,200	$114,300	$64,780	$388,700
P149	8	1,160	$40	$46,400		1,160	$34,800	$69,600	$30,160	$181,000
P150[1]	8	1,300	$40	$52,000		1,300	$19,500	$39,000	$22,100	$132,600
P151	8	2,460	$40	$98,400		2,460	$73,800	$147,600	$63,960	$383,800
P152	8	3,205	$40	$128,200		3,205	$96,200	$192,300	$83,340	$500,100
F.M. - J	8 FM	1,900	$45	$85,500		1,900	$57,000	$114,000	$51,300	$307,800
L.S. - J	380 gallons/minute			$165,000					$33,000	$198,000
REGION J - Total										**$2,591,000**

Note: All Region Totals Rounded to the Nearest $1,000

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[1] Entire trench common with water piping, costs split for entire lengths
[2] Part of trench common with water piping, costs split for common lengths
[3] Restoration cost based on $0.60 per lineal foot for unimproved and $30 per lineal foot for improved
[4] Rock excavation estimated at $60 per lineal foot, assumed be be an average of 4' wide by 6' deep

involved in estimating operating costs, such costs are not included in this report. However, approximate operating costs could be estimated by reviewing the electrical records from the Village's existing stations, and by relating these records to similarly sized future stations.

10.3.3 Schedule of Improvements

The timing of future trunk sanitary sewer improvements will be influenced by a number of parameters. Items such as the location of development pressure in specific areas, aging facilities and/or facilities which are undersized, availability of funds, etc., all play a role in the timing of future sanitary sewer improvements.

Because of the factors involved, it is difficult to accurately predict the timing of future improvements, especially those which may occur far into the future. However, some areas of the Village are more likely to experience rapid development than others.

Based on input from Village staff, an estimated Capital Improvement Plan (CIP) for sanitary sewer has been developed. The CIP is broken down into short-term and long-term improvements. Short term improvements generally include improvements that are needed to address existing deficiencies. Short term improvements can also include improvements to accommodate future development in areas where development is relatively cost effective, such as areas that do not need lift stations. Long term improvements typically include providing service to future expansion areas that are located farther from the existing system and are more expensive to construct. The CIP for short term improvements is presented in Table 10-7.

The first and second stages of Region H improvements have been listed under short term improvements. There is development interest in this area, but construction of the full lift station at location H is not necessary or cost effective at this time. The first stage of Region H improvements would include an interim lift station and force main located near the intersection of pipes P135 and P139. This interim station would allow development to occur north of pipe P135, as is currently proposed. The interim force main would connect to the existing system at MH 317. The second stage of Region H improvements would include construction of a small lift station at location H that would be designed to have its pumping capacity increased in the future. An interim force main could be installed along Hwy 57 which would connect to the downstream system.

The recommended construction of P144a, a new trunk sewer down Bay Shore Drive, is also included in the short term improvements. The State plans to do a reconstruction project of Bay Shore Drive in the near future, and the installation of this trunk sewer should be done in conjunction with the State project. Upgrades to Lift Station No. 1 are also part of the short term improvements.

Proposed sanitary sewer Regions E, F and G do not require lift stations, and can be served by gravity sewers discharging into the existing collection system. In addition, sewer service provided to these regions will not cause adverse impacts on the existing system. Accordingly, sanitary sewer improvements in these regions have been identified as short term improvements.

Recommended long term system improvements consist of all remaining facilities identified in the CIP. These projects include the remainder of Region H improvements as well as improvements to provide service to Regions A, B, C, D, I and J. Improvements also include the reconstruction of an existing sewer pipe segment that is undersized to handle the increase in flows for the expansion areas. The 8 inch pipe

TABLE 10-7

SANITARY SEWER CAPITAL IMPROVEMENT PLAN - SHORT TERM IMPROVEMENTS
SISTER BAY SANITARY SEWER SYSTEM
VILLAGE OF SISTER BAY, WISCONSIN

Type of Improvement	System Location	Recommended Improvement	Planning Level Costs (2006 Dollars)
Potential Future Capacity Restriction	MH019 to MH011	Construct Diversion From MH039 to MH 193	$50,000
Pipe Settlement	MH047 to MH045	Remove and replace 10 inch pipe	$60,000
Sump Manholes	MH073 to MH121 MH123 to MH131 MH220 to MH228 MH198 to MH204	Pour concrete inverts in manholes to eliminate sumps	$40,000
Future Expansion	Trunk Sewer P144a	Construct Trunk Sewer in Bay Shore Drive	$445,000
Future Expansion	Lift Station 1	Upgrade Station Capacity	$229,000
Future Expansion	Stage 1 of Region H Improvements	Construct Interim Lift Station and force main (at intersection of P135/P139)	$549,000
Future Expansion	Stage 2 of Region H Improvements	Construct first phase of Lift Station H, interim force main	$2,000,000
Future Expansion	Region E Improvements	Construct Gravity Facilities (no lift stations required)	$947,000
Future Expansion	Region F Improvements	Construct Gravity Facilities (no lift stations required)	$1,504,000
Future Expansion	Region G Improvements	Construct Gravity Facilities (no lift stations required)	$1,096,000
		Total	**$6,920,000**

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from MH 106 to MH 104 will need to be replaced with a 10 inch pipe to accommodate future anticipated flows from development in the northern planning area.

The proposed CIP for long term sanitary sewer improvements is presented in Table 10-8.

10.3.4 Financing of Sewer Improvements

Expanding the existing trunk sanitary sewer system to accommodate future development can include upgrading existing lift stations and force mains, constructing relief sewers in certain areas, constructing new gravity extensions, and constructing new lift stations and force mains in areas where gravity service is not feasible.

It is anticipated that these improvements will either be financed by a developer, assessed to benefiting properties, paid for by the Utility, or a combination thereof. Typically, future trunk extensions will be constructed and paid for in conjunction with a development project. In some communities, the costs of trunk system extensions are the sole responsibility of the developer. In other communities, the developer has the option of allowing the trunk improvements to be constructed by the Utility with all associated costs being assessed back to the benefiting properties.

Construction of future lift stations and force mains can be treated in a similar way to trunk extensions. If the lift stations and force mains are necessary only to serve new development, the entire cost of these facilities can be passed back to the identified new development. If development is staged, it may be possible to stage the improvements to track with the development. When staging improvements is not possible, over-sizing costs can be recovered through special assessments, impact fees, connection charges, or other means. As a last resort, over-sizing costs may need to be carried by the Utility until future development occurs within the larger service area, at which time the costs can be recovered from the development through one of the methods described above.

Upgrading existing lift stations/force mains, and constructing relief sewers in developed areas are more difficult to tie to specific developments, and therefore, they can be more difficult to finance. In addition to a Sanitary Sewer Utility, some communities utilize a municipal Sewer Availability Charge (SAC), a Sewer Connection Charge, a Sewer Trunk Area Charge, or an Impact Fee to build funds that can be used to upgrade existing facilities. These are one-time fees that can be collected at the time of final plat, or at the time of building permit, to supplement the Utility's revenue stream. As significant development is expected to occur in the future, Sister Bay may wish to implement one of these options to help offset the larger demand that the new development will place on the existing sewer utility's customer base.

Although the Utility's current balance in the Sanitary Sewer Fund may comfortably operate the Sewer Utility today, it is insufficient to operate the Utility and also pay for all of the above listed improvements that will be needed prior to full development of the system. Additional funds will be needed. The sewer user charge system and the payment of charges are described in Sections 62-9 and 62-10 of the Village's ordinances. A complete rate analysis and review of the Utility's current account balances is outside of the scope of this study. It is recommended that a separate rate study be performed to compare the projected revenues to the projected costs listed in the Tables 10-7 and 10-8.

TABLE 10-8

SANITARY SEWER CAPITAL IMPROVEMENT PLAN - LONG TERM IMPROVEMENTS

SISTER BAY SANITARY SEWER SYSTEM

VILLAGE OF SISTER BAY, WISCONSIN

Type of Improvement	System Location	Recommended Improvement	Planning Level Costs
Provide Service to Expansion Areas	Stage 3 of Region H Improvements	Enlarge L.S. H, Extend Force Main, Region H Trunk Mains	$4,829,000
Provide Service to Expansion Areas	Region J Improvements	Construct Lift Station and Trunk Mains in Stages	$2,591,000
Provide Service to Expansion Areas	Region I Improvements	Construct Lift Station and Trunk Mains	$817,000
Increase Capacity of Existing Pipe	MH106 to MH104	Upgrade 8 inch Pipe to 10 inch Pipe	$45,000
Provide Service to Expansion Areas	Region D Improvements	Construct Lift Station and Trunk Mains	$731,000
Provide Service to Expansion Areas	Region C Improvements	Construct Lift Station and Trunk Mains	$3,193,000
Provide Service to Expansion Areas	Region B Improvements	Construct Lift Station and Trunk Mains	$429,000
Provide Service to Expansion Areas	Region A Improvements	Construct Lift Station and Trunk Mains	$789,000
		Total	**$13,424,000**

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10.3.5 Short-Term System Improvement Impacts on Utility Revenue Requirements

Table 10-9 summarizes the results of a preliminary analysis of the probable impact on Sewer Utility revenue requirements of implementing the recommended short-term capital improvements. The effect of the short-term improvements with respect to each revenue requirement category has been estimated.

Table 10-10 summarizes projected increases in the Sewer Utility's 2005 revenue requirements with the implementation of the proposed short-term improvements. The Sewer Utility's 2005 revenue requirements were obtained from a review of the Village's 2005 Sewer Rate Study (Revision 5). It is projected that the improvements would cause the Utility's annual revenue requirements to increase by $608,800 to approximately $994,810. This represents a 258 percent increase from the revenue requirements listed in the 2005 Sewer Rate Study report. The actual impact on sewer rates would need to be determined based on the Utility's revenues in the year the improvements were constructed.

10.3.6 Wastewater Collection System Ordinance Review

As part of the analysis of future improvements, a review of the Village's existing wastewater collection regulations and ordinances was conducted. The purpose of this review was to identify any changes that could be made to the ordinances that would allow the Village to better implement the collection system recommendations contained in this report.

Several documents were reviewed, including the Municipal Code of the Village of Sister Bay, and the Engineering Design Manual.

10.3.6.1 Municipal Code

The Municipal Code contains the essential rules and regulations pertaining to governance of the Village. The wastewater collection system is discussed primarily in Chapter 54 (Land Division and Platting Code) and Chapter 62 (Utilities).

Chapter 54 of the Municipal Code contains Section 54.105, Sanitary Sewerage System. This section covers the design, installation and cost recovery aspects of constructing sewer facilities in conjunction with development. Section 54.105 addresses these areas quite thoroughly, and only a few suggested additions are recommended:

1. Reference this Comprehensive Utilities Plan and its role in the development review process in Section 54.105. Although this plan is conceptual and schematic in nature, this plan should be an important tool for the Village in the development review process. The plan is intended to be used as a guide, for both developers and the Village, of an efficient and economic way to construct the future collection system. Concept plans submitted by developers should be consistent with the "spirit" of the plan, whenever possible. This may not be possible in some cases, due to unique conditions and constraints that are not known at this time. However, where it is not possible to follow the concepts identified in the plan, the developer should document why the proposed deviation would be in the best interests of the Village. This plan should be kept on file at the Village Hall, and should be open to inspection by the public during normal office hours.

2. Section 54.104 (k) (3) states that the Village will pay the oversizing costs for sewer pipes that need to be oversized to accommodate future development. It is not clear how the Village recovers the cost for this payment, although sewer connection fees are mentioned in 54.104 (m) and these

TABLE 10-9

CAPITAL IMPROVEMENTS IMPACT ON UTILITY REVENUE REQUIREMENTS

SISTER BAY SANITARY SEWER SYSTEM
VILLAGE OF SISTER BAY, WISCONSIN

		Estimated Increase in Utility Revenue Requirements			
Recommended Sewer System Capital Improvement*	**Budget Cost Estimate**	Operation & Maintenance Expenses	Equipment Replacement Cost	Debt Service**	**Total**
Existing Deficiency Improvements	$150,000	$800	$0	$12,000	**$12,800**
Future Expansion:					
Trunk Sewers	$3,992,000	$20,000	$0	$320,000	**$340,000**
Lift Stations/F.M.	$2,778,000	$27,800	$5,000	$223,000	**$255,800**
Total	**$6,920,000**	**$48,600**	**$5,000**	**$555,000**	**$608,600**

* as taken from Table 10-7 **Debt service calculated based on 5% at 20 year term.

TABLE 10-10

PRELIMINARY COST OF SERVICE ANALYSIS

SISTER BAY SANITARY SEWER SYSTEM
VILLAGE OF SISTER BAY, WISCONSIN

2005 Sewer Rate Study (rev. 5) Revenue Requirement Data

Operation & Maintenance Expenses	$286,965	
Equipment Replacement Costs	$56,123	
Debt Service	$43,122	
Total		**$386,210**
Plus: Increased Revenue Requirements due to Proposed Improvements		**$608,600**
Total Projected Revenue Requirements		**$994,810**
Net Revenue Requirement Increase as a Percentage of 2005 Revenue Requirement Data		***258%***

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fees may be the source of cost recovery for the oversizing. In any event, paying for and carrying this oversizing cost will be one of the major challenges that the Village will face in the future. Section 10.3.4 of the report discusses various options for financing of sewer improvements. In addition to the connection fees which are currently being used, the Village should consider the possibility of implementing some type of an impact fee or trunk area charge to help pay for the pipe oversizing. An impact fee study should be conducted to determine the best way to proceed.

Chapter 62 of the Municipal Code is entitled "Utilities", and it provides rules for the village sewer and water system, and the abandonment of private wells. Again, Chapter 62 is quite comprehensive and thorough, and only a few suggested additions are recommended:

1. Section 62-7 is the same as Section 54.105 (c) – (n), so the comments indicated above for Section 54.105 also apply to Section 62-7.

2. Sections 62-9 and 62-10 discuss Sewer User Charge System and the method of paying these charges. The Capital Improvement Plan contained in this Comprehensive Utilities Plan should be utilized to estimate costs for repair and replacement of existing facilities. The future costs for repair and replacement of existing facilities can be programmed into the rate structure in advance, and the user rates adjusted so that funds can be generated to complete the repairs. Although a complete rate study is outside the current scope of work for this Comprehensive Utilities Plan, it is recommended that the Village consider performing such a rate study as a next step toward implementing the planned improvements.

10.3.6.2 Engineering Design Manual

The Engineering Design Manual contains Chapter 6 that deals with sanitary sewer issues. The purpose of this chapter is to provide guidance to the designer regarding the Village's requirements for design of sanitary sewer facilities. Comments on this document are listed below:

1. The design flows listed in Section B.6 appear to be higher than what is normally used for the type of land use that is expected in Sister Bay. It is recommended that the average flows used in the Village be consistent with Tables 9-1 and 10-3 of this Comprehensive Utilities Plan.

2. Required easement widths for sanitary sewer are listed in Section C.5 as 25 feet, whereas required easement widths in Village Ordinance Sections 54.105 and 62-7 are listed as 30 feet. The 30 foot dimension is recommended.

3. It is recommended that the minimum slopes listed in Section C.6 be changed to match the slopes listed in the Recommended Standards for Wastewater Facilities (10-States Standards), current edition.