6.5.5 Land Disposal

Both process options are designed to reclaim water suitable for reuse in the Village. However, provision must be made for land disposal of the effluent in case the demand for reuse water is not fully realized. Chapter 309.20, subchapter C of the TNRCC rules, contains information on the requirements for land disposal of sewage effluent. The rules require that a water balance be calculated on a month-by-month basis to determine the agronomic application of the effluent to ensure that the irrigated crop fully-utilizes the water fed to it. The application rate must also limit the nitrogen loading to ensure all nitrogen is used by the crop and that the dissolved solids loading is not excessive, causing salt build up that is detrimental to crop growth. Table 6-8 lists the design specifications for land disposal of the effluent.

Table 6-8
Effluent Land Disposal Design Specification

	Phase 1	Phase 2	Ultimate
Irrigation Area (acres)	21	105	136
Crop	Reed Canary Grass		
Reservoir Volume (MG)	22	108	141
Reservoir Depth (ft)	10	10	10
Reservoir Area	7	34	44
Total Treatment Area (acres)	28	139	180

6.5.6 Other Equipment

In addition to the major equipment items described in the preceding sections, both process options require preliminary treatment in the form of screens and degritting in order to protect process equipment. For the MBR fine, 1/8", screens are required and for the conventional treatment ¼" screens will suffice.

7.0 Collection System and Probable Costs

7.1 Overview

This section discusses the methodology for sizing the mains in the collection system and the probable costs associated with the improvements.

7.2 Methodology

The Wimberley CCN was initially divided into 26 watersheds based on topography from USGS regional maps as shown in Figure 7-1. The sewer mains were sized based on the minimum velocity and slope criteria provided in the Texas Natural Resource Conservation Commission (TNRCC) Chapter 317, which is titled Design Criteria for Sewerage Systems. The TNRCC requires that all sewers be designed and constructed with slopes sufficient to give a velocity when flowing full of not less than 2.0 feet per second. The TNRCC minimum slope requirements are summarized in Table 7-1.

Table 7-1
Texas Natural Resource Conservation Commission
Minimum Slope Requirements For Sanitary Sewers

Size of Pipe (in)	Minimum Slope (%)
6	0.50
8	0.33
10	0.25
12	0.20
15	0.15
18	0.11
21	0.09

Calculation of the peak hour wastewater flow in each watershed was necessary in determining the sizing of the mains within each watershed. The following assumptions were made in determining the peak hour wastewater flow per watershed.

- One home per lot
- Three persons per home
- Average daily flow of 100 gallons per capita per day
- Peak hour factor of 3 to convert average daily flow to peak hour flow

The peak hour wastewater flow per watershed is summarized in Table 7-2. Total connections for the anticipated Phase 1 system is outlined on Figure 7-1 and includes 366 residential connections and approximately 40 commercial connections. Phase 2 system total is the calculated 2074 lots from Table 7-2 plus 206 lots from the anticipated Blue Hole Development.

Table 7-2
Peak Hour Wastewater Flow

Watershed	No. of Lots	Peak Hour Wastewater Flow
		(cfs)
1	-----	0.0000
2	49	0.0684
3	190	0.2646
4	-----	0.0000
5	-----	0.0000
6	325	0.4526
7	20	0.0279
8	290	0.4038
9	110	0.1532
10	150	0.2089
11	-----	0.0000
12	-----	0.0000
13	90	0.1253
14	150	0.2089
15	-----	0.0000
16	-----	0.0000
17	-----	0.0000
18	195	0.2715
19	480	0.6684
20	-----	0.0000
21	25	0.0348
22	-----	0.0000
23	-----	0.0000
24	-----	0.0000
25	-----	0.0000
26	-----	0.0000

Example Calculation (Watershed 3)

Number of Lots	=	190
Number of Homes	=	190 Lots x 1 Home per Lot = 190 Homes
Number of People	=	190 Homes x 3 People per Home = 570 People
Average Day Wastewater Flow	=	570 People x 100 gpcd = 57,000 gpd
Peak Hour Wastewater Flow	=	57,000 gpd x 3 = 171,000 gpd = 0.2646 cfs

The sewer mains were sized based on these peak hour flows and the minimum slope and velocity requirements stated previously.

7.3 Collection System & Probable Costs

The proposed collection system for Phase 1 and Phase 2 is shown in Figure 7-1. The first phase inclues the downtown area, the Lumberyard Development and the Blue Hole Area. The second Phase includes the remaining areas served by the collection system as shown in Figure 7-1. The collection system has been broken down by watershed for costing and discussion purposes. The following is assumed in the layout of the collection system.

- PVC Pipe
- Maximum manhole spacing of 500 feet for sewers up to 15-inch in diameter
- Maximum manhole spacing of 800 feet for sewers 18-inch to 30-inch in diameter
- Sewers are generally located within existing streets
- Discount in cost because of high volume

The collection system is designed so that gravity flow is maximized flowing to a wastewater treatment plant near the Blanco River on the east side of Wimberley. The unit costs used are summarized in Table 7-3.

Table 7-3
Unit Costs

Item	Unit Cost
8-inch Sanitary Sewer	$75/ft
10-inch Sanitary Sewer	$90/ft
12-inch Sanitary Sewer	$105/ft
15-inch Sanitary Sewer	$115/ft
18-inch Sanitary Sewer	$125/ft
Lift Station *	$60,000
6-inch Fore Main	$55/ft

* This cost does not include any communication or special instrumentation

The estimated quantities and costs for the collection system are summarized in Table 7-4.

Table 7-4
Estimated Quantities and Probable Costs

Watershed	Length of 8" Sewer (ft)	Length of 10" Sewer (ft)	Length of 12" Sewer (ft)	Length of 15" Sewer (ft)	Length of 18" Sewer (ft)	Cost of 8" Sewer	Cost of 10" Sewer	Cost of 12" Sewer	Cost of 15" Sewer	Cost of 18" Sewer	TOTAL
1	0	0	0	0	0	$0	$0	$0	$0	$0	$0
2	1,100	0	0	0	0	$82,500	$0	$0	$0	$0	$82,500
3	5,500	0	0	0	0	$412,500	$0	$0	$0	$0	$412,500
4	0	0	0	0	0	$0	$0	$0	$0	$0	$0
5	0	0	0	0	0	$0	$0	$0	$0	$0	$0
6	32,300	0	0	0	0	$2,422,500	$0	$0	$0	$0	$2,422,500
7	0	0	0	0	0	$0	$0	$0	$0	$0	$0
8	16,140	2,400	1,700	0	0	$1,210,500	$216,000	$178,500	$0	$0	$1,605,000
9	17,000	0	0	3,800	0	$1,275,000	$0	$0	$437,000	$0	$1,712,000
10	6,200	0	0	5,200	0	$465,000	$0	$0	$598,000	$0	$1,063,000
11	0	0	0	0	0	$0	$0	$0	$0	$0	$0
12	0	0	0	0	0	$0	$0	$0	$0	$0	$0
13	500	0	0	0	5,100	$37,500	$0	$0	$0	$637,500	$675,000
14	13,200	0	0	0	4,900	$990,000	$0	$0	$0	$612,500	$1,602,500
15	0	0	0	0	0	$0	$0	$0	$0	$0	$0
16	0	0	0	0	0	$0	$0	$0	$0	$0	$0
17	0	0	0	0	0	$0	$0	$0	$0	$0	$0
18	12,200	0	0	0	0	$915,000	$0	$0	$0	$0	$915,000
19	36,600	6,000	0	0	0	$2,745,000	$540,000	$0	$0	$0	$3,285,000
20	0	5,000	0	0	0	$0	$450,000	$0	$0	$0	$450,000
21	0	0	1,600	0	0	$0	$0	$168,000	$0	$0	$168,000
22	0	0	0	0	0	$0	$0	$0	$0	$0	$0
23	0	0	0	0	0	$0	$0	$0	$0	$0	$0
24	0	0	0	0	0	$0	$0	$0	$0	$0	$0
25	0	0	0	0	0	$0	$0	$0	$0	$0	$0
26	0	0	0	0	0	$0	$0	$0	$0	$0	$0
Phase 1	17,000	0	0	3,800	0	$1,275,000	$0	$0	$437,000	$0	$1,712,000
TOTAL	157,740	13,400	3,300	12,800	10,000	$11,830,500	$1,206,000	$346,500	$1,472,000	$1,250,000	$16,105,000

7.4 Phasing of Improvements

Construction of the collection system will occur in two phases. Phase 1 will include the downtown area, the lumber yard, and the Blue Hole. The area of immediate concern is that of the downtown area which is located in watersheds 8 and 9 and the trunk main running to the proposed interim wastewater treatment plant located at the Blue Hole Development. Phase 2 will include the remainder of the densely populated collection system that can be economically served by the permanent WWTP. Phase 1 and Phase 2 are summarized in Table 7-5.

Table 7-5 Capital Costs for Phases 1 and 2	
Phase 1	
Collection System	$1,712,000
Pump Station	$60,000
Force Main	$110,000
Subtotal	$1,882,000
Phase 2	
Collection System	$14,393,000
Pump Station (3)	$180,000
Force Main	$220,000
Subtotal	$14,793,000
TOTAL COST	$16,675,000

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map Figure 7-1

8.0 Plant Siting

The purpose of this section is to identify potential sites that are suitable for a wastewater treatment plant and effluent disposal site for the Village of Wimberley. Considerations for the site include size, topography, flood plane, geology, proximity to the recharge zone, and location of archeological sites.

8.1 Topography

Topographical considerations include general slope the surrounding area and the elevation of the site compared to the service area.

Most wastewater treatment plants with discharges to streams or lakes are located close to the point of discharge which is also one of the lower points in the service area. The benefit is to flow by gravity from most of the customers to the point of treatment. This is both more reliable and more affordable than pumping the raw sewage to a higher elevation for treatment. This plant is planned without a discharge to the Blanco River or Cypress Creek, but the benefits of gravity flow to the plant are still the same. The general slope of the area is toward the Blanco River from north and the south and down stream in the direction of the Blanco River, from west to east. To gravity flow a majority of the proposed CCN to the plant therefore the plant should be located near the Blanco River on the eastern halve of the CCN.

The slope of the land in the immediate area surrounding the plant can affect the cost and functionality. If a site slopes too much, some structures may be buried while others in the process train may be built at or above grade. Steeply sloping sites may also require extensive retaining walls or erosion controls for site development. The maximum slope recommended for a treatment site is about 5%. The areas with slopes greater than 5% have been noted on Figure 8-1 and eliminated from consideration.

8.2 Flood Plane

The Federal Emergency Management Agency (FEMA) establishes the boundaries for the 100-year flood plane in all areas of the United States. The limits of the 100-year flood plane for the CCN have been noted on Figure 8-1. For the safety and protection of the plant, for water quality protection and insurance purposes the area within the 100-year flood plane is eliminated from consideration for the plant site.

8.3 Geology

The U.S. Soil Conservation Service has prepared a soil survey for Hays County that provide detailed information on soil characteristics. There are generally two types of soil within the planning area. The Lewisville -Gruene-Krum soils lie primarily along and adjacent to the Blanco River. They are described as nearly level to gently sloping soils lying over stream terraces of the Edwards Plateau. The remainder of the study area are the Brackett-Comfort-Real soils which lie on the uplands of the Edwards Plateau, and they are characterized as shallow, undulating to steep soils over limestone or strongly cemented chalk.

The areas noted on the soil survey as the Lewisville formation are noted on Figure 8-1 as the preferred geology. These soils are most likely to support the cultivation of grasses, storage or percolation of the finished wastewater effluent. These maps are very broad in their scope and will not identify all suitable soils configurations in the area. If a suitable site cannot be identified within the preferred geology, other flat, valley type areas near they Blanco may be suitable for the plant site.

8.4 Edwards Aquifer Recharge Zone

TNRCC Chapter 213, Subchapter A was developed to regulate activities having the potential for polluting the Edwards Aquifer and hydrologically connected surface streams in order to protect existing and potential uses of groundwater and maintain Texas Surface Water Quality Standards. The Edwards Aquifer extends into the southern and southeastern edges of the ETJ (Extra Territorial Jurisdiction) and across approximately one-half mile of the southern portion of the City Limits. The Edwards Aquifer crosses the Blanco River just outside of the eastern edge of the ETJ as shown on Figure 4-1. The applicability of Chapter 213, Subchapter "A" requires that:

1. Any construction of any kind that is on the recharge zone must have an approved Water Pollution Abatement Plan. (213.5 (a) (1))
2. Sewer collection systems built in the recharge zone must meet the requirements of Chapter 317, and special requirements of 213.5 (c)
3. Land application of wastewater through evaporation of irrigation must meet requirements of Chapter 309 and will be approved on a case by case basis. (213.6 (b))

Because of these regulations and the public perception and potential concern by neighboring communities, it is recommended that the plant and disposal site not be built over the

Edwards Aquifer Recharge Zone and these areas are therefore eliminated from consideration as noted on Figure 8-1.

8.5 Archaeological and Environmental Considerations

Archaeological and Environmental concerns were discussed briefly in the 1996, "Wimberley Regional Wastewater Planning Study". The area is rich in water features, wildlife and plant species. Mapping in that report indicates known environmental features and Indian burial grounds. There are eight animal species in the Wimberley area that are endangered, threatened or candidates for protection with either the US Fish and Wildlife Service or the Texas Parks and Wildlife Department. A detailed cultural/environmental investigation of the area was not completed in that report and has not been completed for this study, but it is recommended prior to design of the final improvements.

Dr. Dee Ann Story, a retired professor from the University of Texas at Austin and resident of the Wimberley area assisted Black & Veatch in identifying potential areas of concern for archaeological significance. The areas identified in the 1996 report and those provided by Dr. Story have been shown on Figure 8-1. These areas will generally be avoided in the site selection and emphasize the need for a detailed investigation to determine the extent of the features and required mitigation measures.

8.6 Land Size and Availability

Based on the analysis in the Wastewater Treatment Process Section of this report the land required for the construction of the plant for land application and irrigation is approximately 140 acres. Additional land is required for the plant, buffer zones, roadways and drainage; therefore an anticipated site of approximately 160 acres is required. The Figure 8-1 shows more than 20 individual property tracts that are approximately 160 acres in size. Three of these sites are outside of the areas eliminated by topography, flood plane, and Edwards' Aquifer Recharge Zone and are in the general area desired by being close to the Blanco River and east of the Village. These sites should be investigated in detail to determine their availability and cost. In negotiations a preliminary archaeological and geotechnical investigation should be conducted to insure that the site is acceptable for the treatment and disposal of the wastewater.

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map Figure 8-1

9.0 Project Cost and Customer Rates

9.1 Overview

This section summarizes capital and O&M costs developed in other chapters, identifies the revenue requirements and estimates a typical customer monthly rate. Funding alternatives to be investigated in detail are listed at the end of the chapter.

9.2 Project Costs

The project costs shown in Table 9-1 are based on collection system and wastewater treatment facilities identified in previous chapters. Costs were estimated using historical construction cost estimates from previous Black & Veatch projects and adjusted for this project. O&M costs were determined by using typical waste treatment operating costs.

Table 9-1
Cost Summary Table

Item	Phase 1 (306,000 gal/day)	Phase 2 (1,529,000 gal/day)
Capital Costs		
Collection System	$1,712,000	$14,393,000
Pump Stations	$60,000	$180,000
Force Mains	$110,000	$110,000
Land Purchase	$0	$560,000
Wastwater Treatment Plant		
Headworks	$62,500	$318,600
Aeration Basin	$323,200	$1,461,100
Blower Building	$113,000	$542,500
Clarifiers	$282,000	$1,195,500
Filters	$144,000	$734,400
Sludge digester	$159,200	$631,100
Drying Beds	$25,400	$104,500
UV Disinfection	$51,000	$260,000
Total Capital Costs	$3,042,300	$20,490,700
Engineering, Legal, & Administrative (15%)	$456,345	$3,073,605
Contingency (10%)	$349,865	$2,356,431
Total Up Front Costs	$3,848,510	$25,920,736
O&M Costs		
Total Average Flow, MG	85.9	429
Estimated Cost/1000 gallons	$1.00	$0.80
Total O&M Costs	$85,900	$343,200
Customer Connections		
Initial Connections		
Residential	160	1,915
Commercial	40	40
Future Connections		
Residential	205	691
Commercial	5	20
Total Connections	410	2,666
Contributions		
Lumberyard Development	$200,000	
Blue Hole	Land for plant site and disposal	

Connections are estimated based on lot counts and growth projections from previous chapters.

9.3 Revenue Requirements

Financing summary tables are based upon the data shown in Table 9-1 and previous chapters. Due to the lack of existing or historical data, estimates were made to approximate costs and the resulting customer bills necessary to recover those costs. Operating expenses are based on operating and maintenance costs for systems of similar size and function. An initial cost of $1.00 per thousand gallons for Phase 1, and $0.80 per thousand gallons for Phase 2 result in estimated O&M costs of $85,900 and $411,900 respectively as shown in Table 9-2. It should be noted that in the financial analysis Phase 2 includes the cost of Phase 1 since Phase 1 costs will continue to be incurred during and after construction of Phase 2. A reduced O&M cost per thousand gallons is expected once Phase 2 construction is completed due to reduced unit costs from the use of modern technologies and extensive automation.

Capital financing estimates are based on requirements similar to other existing Texas utility bond issues. It is assumed that 30 year bonds are issued at an average interest rate of 6% and a 1.5% issuance cost is included to finance the capital costs for Phase 1 and Phase 2. The initial bond issue of approximately $3,703,200 would be used to cover the costs of construction of Phase 1 and the cost of issuing the bonds. A subsequent bond issue of approximately $26,106,500 would be needed to fund the cost of Phase 2 construction and the cost of issuance. Resulting annual debt service payments for these bond issues are estimated at $267,600 for Phase 1 and $2,168,900 for Phase 1 and Phase 2 combined. The annual cost of debt is the most significant portion of annual costs and accounts for the majority cost to be recovered from monthly customer bills.

9.4 Customer Rate Determination

Estimates of expected customers were made in order to facilitate the approximation of a monthly sewer bill for residential and commercial customers. Commercial customer rates are considered to be twice that of residential customers due to the higher cost of treatment and volume expected from these customers. Initial customer connections are shown in Table 9-2. Future Phase 1 connections consist of new developments expected to come on-line at approximately the same time as the completion of the plant and collection system construction. Phase 2 estimates of initial connections are based on existing properties that would be connected to the expanded collection system. Future Phase 2 connections are based on growth estimates through 2010.

In order to generate sufficient revenue to cover the cost of O&M and debt service a residential average bill will be approximately $65 for Phase 1 and $68 for Phase 2 as shown in Table 9-2. Commercial bills are assumed to be twice that of residential bills resulting in a $130 monthly bill for Phase 1 and $135 monthly bill for Phase 2. These bill estimates are based on the assumption that no outside funding or starting capital other than the Lumberyard Development contribution of $200,000 is available.

Table 9-3 shows an estimate of the necessary level of starting capital for Phase 1 and Phase 2 in order to keep the monthly residential bill below a target of $50 per month. In order to reduce the bill sufficiently to meet that target, initial funding of approximately $1,098,200 will be necessary for Phase 1 and $8,074,200 for Phase 2. On a per customer basis this is approximately $2,700 for Phase 1 and $3,000 for Phase 2. Starting capital as detailed above would reduce debt service costs and thus reduce the monthly residential bill to about $50 per month.

9.5 Funding Alternatives

Funding alternatives including low or no interest loans and grants should be investigated and pursued to reduce customer costs for the system. This project is attractive for grants because it is a new system, it is driven by water quality and environmental concerns, and it will incorporate the reuse of the treated effluent. The following are agencies and programs that should be investigated.

- USDA, Rural Development, Rural Utilities Services (FmHA)
- Texas Department of Health, Texas Small Towns Environment Programs
- Texas Department of Housing and Community Affairs, Texas Community Development Program
- Texas Water Development Board, Financial Assistance Programs
- US Department of the Interior, Bureau of Reclamation, Water Reclamation and Reuse Program
- Others

Table 9-2
Finanacing without Starting Capital

Item	Phase 1 (306,000 gal/day)	Phase 2 (1,529,000 gal/day)
Capital Costs	**$3,848,510**	**$29,769,245**
O&M Costs		
Total Average Flow, MG	85.9	514.9
Estimated Cost/1000 gallons	1.00	0.80
Total O&M Costs	$85,900	$411,920
Customer Connection		
Initial Connections		
Residential	160	2,075
Commercial	40	80
Future Connections		
Residential	205	896
Commercial	5	25
Total Connections	410	3,076
Bills	4,920	36,912
Financial Contributions		
Lumberyard Development	$200,000	
Blue Hole	Land for plant site and disposal	
Capital Financing		
Bond Proceeds	$3,648,510	$29,569,245
Years	30	30
Interest Rate	6.0%	6.0%
Issuance Cost	1.5%	1.5%
Payments	60	60
Annual Cost of Debt	$267,618	$2,168,901
Residential Bill		
O&M/Bill	$15.73	$10.79
Capital/Bill	$49.01	$56.82
Total Bill	**$64.75**	**$67.61**
Commercial Bill *		
O&M/Bill	$31.47	$21.58
Capital/Bill	$98.03	$113.64
Total Bill	**$129.49**	**$135.22**

* Commercial Bills are assumed to be twice residential

Table 9-3
Financing with Starting Capital

Item	Phase 1 (306,000 gal/day)	Phase 2 (1,529,000 gal/day)
Capital Costs	**$3,848,510**	**$29,769,245**
O&M Costs		
Total Average Flow (Million Gallons)	85.9	514.9
Estimated Cost/1000 gallons	$1.00	$0.80
Total O&M Costs	**$85,900**	**$411,920**
Customer Connections		
Initial Connections		
Residential	160	2,075
Commercial	40	80
Future Connections		
Residential	205	896
Commercial	5	25
Total Connections	**410**	**3,076**
Bills	4,920	36,912
Contributions		
Lumberyard Development	$200,000	
Starting Capital	$1,098,200	$9,172,400
Blue Hole	Land for plant site and disposal	
Capital Financing		
Bond Proceeds	$2,550,300	$20,396,900
Years	30	30
Interest Rate	6.0%	6.0%
Issuance Cost	1.5%	1.5%
Payments	60	60
Annual Cost of Debt	$187,064	$1,496,111
Residential Bill		
O&M/Bill	$15.73	$10.79
Capital/Bill	$34.26	$39.19
Total Bill	**$49.99**	**$49.99**
Commercial Bill *		
O&M/Bill	$31.47	$21.58
Capital/Bill	$68.52	$78.39
Total Bill	**$99.99**	**$99.97**
Starting Capital Per Customer	$2,700	$3,000

* Commercial Bills are assumed to be twice residential