Green Sanitary District

Wastewater Collection System Master Plan

Prepared for:

Green Sanitary District

SHN Consulting Engineers & Geologists, Inc.

365 North 4th Street
Coos Bay, OR 97420-2219
541 / 266-9890

February 2006

4617.100

Reference: 004617.100

February 24, 2006

Kay Huff, District Manager
Green Sanitary District
3879 Old Highway 99 South
Roseburg, OR 97470

Subject: Wastewater Collection System Master Plan

Dear Kay:

Enclosed please find eight copies of the final Master Plan report. This Plan has incorporated all of your comments from the previous drafts and the conclusions at the Board meetings. At this time, the Board should make the Plan available for public review and pending public comments, adopt the Final Plan. Once the plan is adopted, the GSD can begin its implementation.

Should you have any questions, or comments, feel free to give me a call.

Sincerely,

SHN Consulting Engineers & Geologists, Inc.

Steven K. Donovan, P.E.

SKD: dkl
Enclosures:

Reference: 004617.100

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QA / QC: skd

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GLOSSARY OF TERMS

FLOWS

Average Dry-Weather Flow (ADWF) - The average of daily flows over the 6-month dry-weather period, May though October.

Maximum Monthly Dry Weather Flow (MMDWF-10) - The monthly average flow corresponding to the monthly rainfall accumulation during May with a 10% probability of being exceeded in any given year. West of the Oregon Cascades May is usually the rainiest summer month of high groundwater.

Maximum Monthly Wet Weather Flow (MMWWF-5) - The average monthly flow in the rainiest winter month (November-April) with high groundwater. West of the Oregon Cascades, this month usually corresponds to January. The 5-year MMWWF corresponds to the monthly rainfall accumulation during January with a 20% probability being exceeded. That is the amount of rainfall that exceeds 4 out of 5 totals that have been recorded in January.

Peak Daily Average Flow (PDAF-5) - The total daily flow that will result from a 5-year storm during a period of high ground water.

Peak Instantaneous Flow (PIF-5) - The peak hourly flow associated with a 5-Year PDAF. This value determines the hydraulic capacity of major process traits, sewers, channels, and pumps.

INFLOW AND INFILTRATION (I/I)

Infiltration – Water that enters the sewage system from the surrounding soil. Common points of entry include broken pipe and defective joints in pipe and manhole walls. Although generally limited to sewers laid below the normal groundwater level, infiltration also occurs as a result of rain or irrigation water soaking into the ground and entering mains, manholes, and even shallow house sewer laterals with defective joints or other faults.

Inflow - Storm water runoff that enters the sewerage system only during or immediately after rainfall. Points of entry may include connections with roof and area drains, storm drain connections, and holes in manhole covers in flooded streets.

INFLUENT AND EFFLUENT CHARACTERISTICS

Biochemical Oxygen Demand (BOD) The amount of oxygen required to stabilize the organic material in sewage by aerobic processes.

Total Suspended Solids (TSS) - All of the solids in sewage that can be removed by sealing or filtration.

OTHER TERMS AND ACRONYMS

NPDES - National Pollutant Discharge Elimination System - Waste discharge permit issued by the Department of Environmental Quality. Includes conditions and limitations for operation of a wastewater collection, treatment, and disposal system and required effluent quality for disposal to public waters.

DEQ - Department of Environmental Quality

POTW-Public Owned Treatment Works

SDC - Systems Development Charge

MGD – Million Gallons per Day

Executive Summary

The Green Sanitary District provides sanitary sewage service to the Green District, an urbanized unincorporated area encompassing 2,025 acres in Douglas County Oregon. The District currently owns and operates two major pump stations, approximately 32 miles of gravity sewer ranging in diameter from 6-inches to 24-inches, 766 manholes, and 2.55 miles of forcemain ranging in size from 4-inches to 12-inches. The District also maintains 13 septic tank effluent pumping (STEP) systems including one commercial STEP system and 12 residential STEP systems. Within its boundaries, the District collects wastewater from 2,390 customers including residential, commercial, light and heavy industrial, mobile home parks, and institutions. The District has partnered with the City of Winston for ownership and operational responsibility of the Winston Green Regional Wastewater Treatment Facility (WWTP). Prior to this plan, the District did not have a Master Plan for the wastewater collection system.

This Master Plan is comprised of seven sections presenting the following information.

- Section 1 introduces the sanitary district, provides background regarding the Plan, and outlines the report scope of work.

- Section 2 provides additional background data on the study area including regional economic conditions and population growth rate factors.

- Section 3 expands upon the previous section by evaluating wastewater characteristics from existing users. Unit design factors are prepared and used to qualify existing and projected flow contributions.

- Section 4 summarizes the existing collection system including a detailed description of each drainage basin and the District facilities comprising the system. A wastewater hydraulic model is presented which is used in the Plan to simulate the impacts to existing facilities from various growth scenarios and expansion of the District's service boundary. Based on modeling and land-use characteristics, a build-out scenario is prepared.

- Section 5 provides a detailed inventory and assessment of the collection system. Based on this assessment, components of the system were evaluated and system deficiencies defined. Section 5 also suggests operational guidance that allows the District to focus its resources on maintaining the integrity of the system throughout the planning period. The concept of "just in time" rehabilitation is introduced.

- Section 6 provides the capital improvement plan including options to correct anticipated deficiencies. Cost estimates for various improvements are developed and form the basis of a recommended improvement plan and implementation schedule.

- Section 7 discusses financing programs including local, state, and federal alternatives. Local funding programs are recommended including changes to the current systems development charges (SDC), an increased sewer connection fee, and a rate increase. Both the SDC and the rate increase are proposed as the most economical means to fund the improvements recommended in this Plan.

In 1955, the Green Sanitary District formed in response to residents who where concerned about failing septic tank drain fields causing health and environmental problems. In 1962, the first major components of the collection and treatment system were constructed to serve a total of 355 houses. At that time, the cost for sewerage service was $ 4.00 per household.

Since its formation, the District has experienced rapid growth and in 2005, the service population increased to 8,053 persons or 3,097 equivalent dwelling units (EDUs), based on a population equivalence of 2.6 persons per household. Within the last 10 years, population growth has exceeded 4 percent per year. Based on discussions with the District Board, population growth within the District is anticipated to occur at an annual rate of 4 percent per year for the first ten years followed by the Douglas County rural lands average growth rate of 1.53 percent per year for the last ten years of the twenty-year study period. Based on this growth scenario, the number of equivalent dwelling units served by the District will increase by 2,241 EDUs. The annual average flow delivered to the WWTP is projected to increase from 0.838 million gallons per day (MGD) to 1.347 MGD while the peak day flow is projected to increase from 2.58 MGD to 4.15 MGD. The increase in the peak day flow is based on no reduction in infiltration and inflow (I/I).

Today, the District's goals focus on maintaining the collection system, economizing system operations, maximizing available treatment capacity, controlling the expansion of infiltration and inflow, and planning for anticipated growth. At this time, the cost for sewerage service is $ 25.00 per equivalent household, a rate that is lower than the majority of other Oregon communities with similar economic and social demographics.

In general, the District is well managed and maintained. Extraneous flows from sources of I/I are not considered excessive although flows could increase from the expansion of I/I once components in the collection system begin to achieve their design life. Based on hydraulic modeling, the majority of the collection system has adequate capacity to collect and convey flows throughout the study period and throughout build-out. In some cases, however, the capacity of a few collection system elements will need to be expanded. The areas in need of expansion form the basis of the capital improvement plan and include the following projects.

- The G-4 pump station requires an upgrade in Year 2 of the Plan. This improvement will increase the firm capacity of the facility from 1,600 gallons per minute (gpm) to 2,500 gpm by providing a 3rd pump and increasing the motor sizes to 125 Hp. Of the $ 292,000 cost for the improvement, it is estimated that 39 percent of the project will be funded by SDC and the remainder funded by a rate increase.

- In Year 5 of the Plan, a segment of sewer between manhole P-27 and P-14 will need to be upsized to 15-inches to reduce the potential for overflows in the tributary collection system. The project cost is estimated at $ 43,000. Approximately 50-percent of the project will serve future capacity and therefore $ 21,500 is SDC eligible.

- In Year 15 of the Plan, a new pump station will need to be constructed to divert flows from the G-4 station directly to the WWTP. This project will involve locating a new pump station (known as G-5) near MH K-12 and pumping flows to the Landers Lane system where the existing gravity sewer will be upsized to the WWTP. The cost for this project is estimated at $2,840,000 of which, 50 percent of the project is SDC eligible.

- The final CIP project (scheduled for Year 20) identifies two gravity line segments in Basin I where the minimum slope of the sewer is capacity limiting. A project to replace these line sections is recommended at a cost of $ 182,000. Approximately 33 percent of this project is eligible for SDC reimbursement.

- In addition to capital improvements, the Plan presents approximately 40,000 lineal feet of rehabilitation projects that are based on the concept of a "just in time" replacement schedule. This approach is used to establish a budget to rehabilitate transite pipelines that have a 50-year or greater service life. For budgetary purposes, the Plan estimates that during the 20-year planning period, a total capital need of $ 2,707,000 will be required to fund anticipated rehabilitation projects. By implementing this approach, it is believed that the District will maintain or improve its control over I/I in the collection system. Project scheduling is based on 5-year increments.

Funding for the proposed improvements is based on a combination of increased SDC charges and a rate increase, with both accounts providing a sinking fund for CIP implementation. To meet the projected resource requirement, the SDC will need to be increased by $ 1,249 to $ 2,586 and a $6.00 per month rate increase will be required. The total revenue generated from these increases should provide the District with an additional $ 400,000 per year to be allocated to the CIP program.

In addition to CIP rate and SDC charges, the plan also presents justification for increasing the District's connection fee to $ 450 per new connection. This cost will cover expenses directly incurred by the District for each new service added to the system. By increasing the connection fee, the District should recover an additional $ 40,000 per year in labor and equipment expenses.

A final element of the plan is guidance with operational practices that will assist the District to identify deficiencies in the system. Much of the guidance suggested is based on improved monitoring and record keeping activities. The suggested activities include the following:

1. Expansion of electronic database, implementation of a GIS, and records conversion
2. Manhole inspections
3. Smoke testing
4. Closed circuit televising inspection
5. Annual flow mapping studies
6. Flow monitoring data collection and analysis

In summary, the GSD is a well managed and operated collection system. The District should continue with its good practices while expanding its ability to reinvest in the system's infrastructure. The reinvestment will provide improved environmental compliance, expand the capacity for future users, and ultimately reduce WWTP expenses related to the treatment of I/I. By implementing this Master Plan, the District will advance the value it provides for the Green community throughout and well beyond the 20-year planning period.

1.0 Introduction, Purpose, and Need

1.1 Introduction

The Green Sanitary District provides sanitary sewage service to the Green District, an urbanized unincorporated area (UUA) in Douglas County Oregon. As shown in Figure 1, Green is located in central Douglas County, approximately two and one half miles south of the City of Roseburg and just east of the City of Winston.

The District service area encompasses approximately 2,025 acres. Within its boundaries wastewater is collected from a total of 2,390 customers, including residential, commercial, light and heavy industrial, mobile home parks, and institutions. Infrastructure within the District currently includes two pump stations, approximately 32 miles of collection system consisting of 8-inch to 20-inch diameter pipelines, and over 1.8 miles of a 12-inch pressure main. The District has partnered with the City of Winston for ownership and operational responsibility for the Winston Green Regional Wastewater Treatment Facility.

1.2 Background and Need

The Green Sanitary District (GSD) formed in 1955 in response to residents who were concerned about failing septic tank drain fields causing health and environmental problems. In 1961, the State of Oregon funded the construction of a wastewater collection system and wastewater treatment lagoons for a cost of approximately $400,000. The initial system provided sanitary sewer service to 255 residential and commercial customers with a maximum design capacity for 355 houses. Based on the initial system cost, the first rate paid by customers of the GSD was $ 4.00 per residential user.

By the early 1970s, continued growth within the Green Area caused the GSD Board to raise concerns about the capacity of the treatment lagoons. The neighboring City of Winston was also concerned about the capacity of its wastewater treatment system and both communities began discussing how to solve their problems concurrently. Results of these discussions led to a 1974 regional wastewater treatment study that recommended construction of a centralized treatment facility (WWTP) located between Winston and Green. By 1980, the new facility was constructed (with Douglas County as the Owner) for a total cost of $9.2 million using a 68 percent grant from the EPA and a 32 percent loan from Douglas County.

The new WWTP, utilized Rotating Biological Contactors as the secondary process and had a design capacity of 3.5 million gallons per day (MGD). At the same time, the Green collection system was modified to convey flows from the old lagoon system to the new WWTP. Modifications to the Green system included construction of the following:

- A new raw sewage pump station known as the G 4 Pump Station (PS),
- A new 12-inch force main to route flows from G 4 PS to the new WWTP,
- An 18-inch to 20-inch interceptor from the G 4 PS discharge to the WWTP,

Insert Figure 1 Location Map

In 1993, the biological capacity of the treatment facility was achieved and additional, more stringent regulatory criteria (total maximum daily loads and waste load allocations were pending for wastewater discharges to the South Umpqua River. In 1994 a Wastewater Facilities Plan was prepared to address the regional WWTP needs. In 1995 an agreement developed between the GSD and City of Winston stipulating that once flows reached 85 percent of the capacity of the facility, planning for a WWTP expansion would be undertaken. In 1997, a Predesign report was also prepared, providing further details regarding the proposed improvements. By 1999, a new modern facility was constructed incorporating biological nutrient removal and improved solids handling. In 1999, GSD's G4 station was also modified to improve control systems. In 2005, the agreement between GSD and the City of Winston was modified to require a feasibility study at 75% of peak dry weather capacity.

Throughout its history, the Green UUA has experienced unprecedented growth. Since 1970 to 2000, the average growth rate was approximately 4.8 percent. During the same time period, the growth rate for all of Douglas County was only 1.4 percent per year. According to the Douglas County Comprehensive Plan, the high growth rate for the Green UUA is attributed to a number of factors, such as the availability of sewer, relatively inexpensive developable land, and the proximity to major employment centers. The Comprehensive Plan states that sustaining continued growth will, in part, be dependent on support facilities (i.e. the availability of sewer and water). In recognition of its roll, as the sanitary sewerage authority for the Green UUA, the GSD has undertaken the development of this Wastewater Collection System Master Plan.

1.3 Study Objective

The primary purpose of the Plan is to examine how the existing infrastructure can support the continued expansion of population in the Green area and whether or not the infrastructure is capable of supporting expansion areas outside the current Green UUA.

1.4 Scope of Study

Preparation of this Master Plan is based on four general tasks, as described below:

Task 1: Planning and Background- hold a scoping meeting with the GSD and establish the Master Plan objectives and define the GSD's understanding of existing conditions.

Task 2: Collect and analyze data pertaining to population and flows, the level of service provided by the existing system, the potential impacts of expansion on the existing system, evaluate pump stations, and summarize and incorporate flow monitoring data into the analysis of the collection system.

Task 3: Prepare a hydraulic model of the sewer system and analyze existing and future conditions. Evaluate deficiencies with the existing system, projected deficiencies from growth induced flows, and evaluate alternatives to improve and ready the system for continued development.

Task 4: Based on preceding work, develop a capital improvement plan and prepare a Master Plan Report. Utilizing available data and information generated by the Master Planning effort prepare a fixed asset valuation and revise Systems Development Charges.

Planning Period

The planning period for this Wastewater Collection System Master Plan is 20 years, ending in the year 2025. The period must be short enough for current users to benefit from system improvements, yet long enough to provide reserve capacity for future growth and increased demand. Existing residents should not pay an unfair portion for improvements sized for future growth, yet it is not economical to build improvements that will be undersized in a relatively short time. OAR 690-086-0140 suggests that demands be projected over 20 years, which is a typical planning period for most municipal master plans.

Planning Area

The Green Unincorporated Urban Area encompasses the Green Sanitary District boundary and generally defines the planning area. Potential growth areas adjacent to the UUA include large areas to the east and south of the District's Boundary. It is unknown whether additional acreage will be annexed to the District during the 20-year planning period. However, a reasonable assessment of expansion areas was required to evaluate how much or if any of the surrounding areas could be served by the District's existing infrastructure system. Recommendations for annexation into the study area are not intended or inferred by this plan.

1.5 Authorization

The Firm of SHN Consulting Engineers and Geologists, was retained by the Green Sanitary District to prepare a Wastewater Collection System Master Plan on November 8, 2004.

2.0 Study Area Characteristics

2.1 Study Area

The Green Sanitary District, shown in Figure 2, is located in central Douglas County northeast of the City of Winston and southwest of the City of Roseburg. An area known as the Green District encompasses the Sanitary District. This rural unincorporated area has a total area of approximately 4.7 square miles. The Green area serves as a major transportation hub for north and south moving traffic and commerce along Interstate 5. The Umpqua River forms the boundary of the District to the north and partially to the west. Interstate 5 runs through the eastern edge of the GSD though a small area of the District is located east of the interstate. Highway 99 crosses north and south through the District merging with and becoming Highway 42/99. The Central Oregon Pacific Railroad also crosses north and south through the District parallel to Highway 99 and forms the eastern Boundary of the GSD south of Highway 42/99. Highway 42/99 transects the District east and west of Interstate 5 ending at exit milepost 119. A portion of the southern boundary of the District is adjacent to a hillside that is reported to have geologic instability.

2.2 Physical Environment

Green enjoys four distinct seasons in a year. Summers are typically dry with low humidity and provide a long 217-day growing season. Winters are cool without much freezing. Snowfall is rare while winter rains represent the majority of the areas annual 34-inches of rainfall. The climate in general can be characterized as moderate with low and high temperatures ranging between 34 to 48 degrees Fahrenheit in January, 39 to 63 in April, 53 to 84 in July, and 43 to 67 in October. A summary of climate data for the Roseburg area, typical for Green, is provided below in Table 2.1.1.

Table 2.2.1
Roseburg Area Climate Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg. T High	48°	54°	57°	62°	68°	76°	84°	84°	78°	67°	54°	48°
Avg. T Low	34°	35°	37°	38°	44°	50°	54°	54°	48°	44°	38°	34°
Mean T	41°	45°	48°	51°	57°	64°	68°	68°	64°	55°	47°	42°
Avg. Precip.	5.0 in	3.7 in	3.6 in	2.3 in	1.5 in	0.8 in	0.4 in	0.7 in	1.1 in	2.4 in	5.7 in	5.6 in

2.3 Economic and Demographic Conditions

The Green Sanitary District has an economic base consisting of commercial services, manufacturing, industrial, farming and forest products, construction, and public service occupations. Planning for Douglas County identifies the need to diversify this economic base including expansion of the base to include a possible 390 acres industrial site adjacent to Green.

Insert Figure 2

According to the 2000 Census, the Green work force for persons over the age of 16 is estimated at 2,965 persons and is divided equally between men and women. The unemployment rate reported for Green residents was 5.6 percent, which compares to a State average rate of 6.5 percent during the year 2000. Approximately 27 percent of the workforce includes both parents in the labor force and 37 percent of these families have children under the age of 6.

According to the census data, the median household income for Green is $ 35,660. Median mortgage values for owner occupied homes were $ 92,200 with the average mortgage cost being $ 716 per month or 24 percent of the monthly median household income.

2.4 Population

The current (year 2005) population of the Green Sanitary District is estimated at 7,162 persons based on the total number of residential and mobile home accounts times the average household size of 2.60 persons as reported by Douglas County [Comprehensive Plan for the Green Urban Unincorporated Area]. The GSD population estimate is summarized in Table 2.3.1.

Table 2.4.1
Population Estimate for the
Green Sanitary District Service Area

Account Types	Year		
	2004	2003	2002
Residential	2098	2005	1986
Multi Family Residential	99	85	77
Mobile Home Parks	461	437	371
Estimated Population[1]	6,911	6,570	6,328

[1]Population Estimate based on 2.6 persons per household

2.5 Population Growth

Green has experienced rapid population growth since 1970. According to the Comprehensive Plan, the average growth for the Green UUA from 1970 to 1997 was approximately 4.8 percent per year. The average growth rate for Douglas County over this same time period was only 1.4 percent per year. From 1970 to 1980, the average growth rate for the Green UUA was approximately 6.6 percent per year while the average growth rate for Douglas County was approximately 2.7 percent per year. During the last five years, the District has experienced an average yearly growth rate for its customer base of 4.0 percent per year.

The County attributes the high growth rate for the Green area to the availability of relatively inexpensive land, the availability of water and sewer service, and the proximity to major employment centers. The outlook for continued population growth in the Green area is reported to be dependent on factors such as the economic outlook for Douglas County, fertility and mortality rates, migration trends, and the capacity of infrastructure to sustain these high growth rates. Douglas County Planning estimates that a sustained growth rate of 2.54 percent should be utilized for population projections from 1997 to 2020.

Based on the previous five years of continued and steady demand for new sewer service construction, the Green Sanitary District Board of Directors has indicated that an average annual growth rate of 4.0 percent should be utilized for the first ten (10) years of planning projections. Following this period, the District population projections will be based on the County's planning guidance which suggest that population growth should be projected at a rate of 1.53 percent per year.

Equivalent Dwelling Units

Projections for population growth are often utilized to estimate the future demand for public utility services, such as water and sewer. Typically, the future demand is based on an estimated number of residential homes, called average dwelling units, projected for the planning horizon. Residential dwelling units are only a portion of the demand placed on a public utility service. Commercial, industrial, and institutional customers will also demand services. Accounting for these customer types requires comparing the demand for services from the respective customer with the demand from the average dwelling unit. The relationship is defined as the equivalent dwelling unit (EDU) methodology. The typical method for establishing EDU counts for wastewater systems is based on equating nonresidential water usage to residential water usage. The EDU methodology is also used by the GSD as the basis for establishing fair and equitable user charges. An example of the EDU methodology follows:

Example:

> ***If a typical residential family requires, on the average, 250 gallons of water per day while a restaurant requires 1000 gallons of water per day, the demand for water from the restaurant is numerically equal to four residential units. In this case, the restaurant is said to be equal to four EDU's.***

Equivalent Populations

By totaling all of the commercial and industrial users in terms of residential units with the total number of residential units in a community, the demand for public services can be established in terms of EDU's. The total number of EDU's can be further used to estimate future demands based on the average household size and the future population. In the example provided above, if the average household consisted of 2.6 persons and in 20 years there are 100 households and one restaurant in the community, the equivalent population of the community would be 270 (260 people for the 100 houses + 10 equivalent people for the restaurant).

By evaluating the demand for the residential customers, the commercial, industrial, and institutional demand can be converted from connections to EDU's. The combination of EDU's can then be used to evaluate sewer usage based on equivalent population values. Table 2.5.1 summarizes the GSD EDU totals along with the equivalent population estimated from water usage.

Table 2.5.1 Equivalent Dwelling Units by Customer Class Green Sanitary District Service Area			
Account Types	Year		
	2004	2003	2002
Residential	2098	2005	1986
Vacant Residential	164	133	103
Multi Family Residential	99	85	77
Mobile Home Parks	461	437	371
Institutions	17	16	16
Industrial	14	21	21
Commercial (based on water use)	125	87	81
Total Number of EDUs	2,978	2,784	2,655
Equivalent Population[1]	7,743	7,238	6,903

[1]Based on Douglas County estimate of 2.6 people per household

Based on a continued 4 percent growth rate through the 2005 season, the equivalent population of the Green Sanitary District is estimated at 8,053 equivalent persons.

2.6 Land Use Characteristics

Residential

Residential land use comprises approximately 70% of the developed lands within the Green UUA.

The first type of residential housing is single-family homes. Depending on the required lot size residential housing is zoned as R1 for low-density development, or R2 for medium density development. The second type of residential housing consists of trailer parks and manufactured homes spread throughout the community; these multi-family units are located in areas zoned as high density residential, R3.

According to 2000 US Census data, approximately 69% (1,608 units) of all housing in the Green UUA is single family residential, approximately 30% (706 units) is mobile home or RV, and the remainder is 5 to 9 unit apartment buildings. The GSD notes a correction in the published census data where the remainder of the residential units are duplex housing rather than multiple unit apartments.

Commercial

Commercial land use comprises approximately 3% of the developed land within the Green UUA. The majority of commercial establishments are located along Carnes Road and Highway 42/99 and Highway 99. Commercial activity is partially related to the vicinity of the community to Interstate 5.

Industrial

Industrial land uses comprise approximately 17% of the developed lands within the Green UUA. Existing industrial land is almost all located in the area bounded by Carnes Road, Highway 42/99, and Interstate 5.

Public

Public land uses comprise approximately 8% of the developed lands within the Green UGB. These areas consist of two schools, a park, a fire station, an Oregon Department of Transportation Maintenance Facility, and the Winston Green regional wastewater treatment facility.

3.0 Wastewater Characteristics

3.1 Terminology

As a preface to the review of wastewater characteristics, the following terms are defined below.

Base Sanitary

The base sanitary flow represents the domestic component of the wastewater in the sanitary sewer system resulting from the use of potable water.

Base Infiltration

The average amount of extraneous water entering the sewer system during the dry season is referred to as base infiltration. This parameter is determined by subtracting the Base Sanitary flow from the Average Dry Weather flow. In general, the base infiltration is not cost effective to remove from the system and an allowance for this flow is typically included in the estimate of flows for each future connection.

Infiltration and Inflow

Infiltration and inflow (I/I) describes a broad range of extraneous flow entering into a wastewater collection system. Infiltration is defined as groundwater that leaks into pipelines through joints and pipe or manhole defects. Infiltration typically occurs on a continuous but gradually varying rate. Inflow is defined as direct flow into the collection system through openings in manholes, lateral clean-outs, improperly installed storm water systems, and area or roof drains. Inflow typically causes a significant rate of change in flow over a short period of time and usually is correlated to rainfall events. The impacts of I/I can be significant and cause sizing problems in pipelines that are otherwise properly sized.

Average Dry Weather Flow

The average daily flow in the sewer system occurring during the dry season months, from the beginning of May through the end of October, is the average dry weather flow (ADWF).

Average Wet Weather Flow

The average daily flow in the sewer system occurring during the wet season months, from the beginning of November through the end of April, is referred to as average wet weather flow (AWWF).

Yearly Average Flow

The yearly average flow or annual average flow (AAF) is the flow averaged for the entire year. The AAF is based on a 365 day running average and is not necessarily on a calendar basis. Changes in the AAF can be reflective of a community's effort to control infiltration and inflow.

Maximum Month Dry Weather Flow

The maximum month dry weather flow (MMDWF) is the monthly average flow, which has a 10 percent probability of occurrence from May through October in any given year. This flow represents the wettest dry weather season monthly average flow, which is probabilistically occurring every ten years. For western Oregon, the highest monthly average dry weather flow typically occurs in May.

Maximum Month Wet Weather Flow

The maximum month wet weather flow (MMWWF) is the monthly average flow, which has only a 20 percent probability of occurrence from November through April in any given year. This flow represents the wettest wet season monthly average flow that is anticipated to have a five-year recurrence interval. For western Oregon, typically the month of January has the highest averaged wet weather flow period.

Peak Week

This flow parameter is the largest averaged flow experienced over a 7-day period during any year. The peak weekly flow is probabilistically estimated as the flow occurring 1.9 percent of the time or 1 week out to 52 weeks of the year. The peak week is based on a probability analysis projected from the peak day, MMWWF and AAF.

Peak Day

The peak day flow is the largest daily flow experienced over a 24-hour period during any year. The peak daily flow has a 0.27 percent probability of occurrence or 1 day in 365 day of any given year. Projection of the peak day flow is based on a regression analysis of daily plant flows during or immediately following wet season significant rain fall events (greater than 1-inch in a 24 hour period).

Peak Instantaneous Flow

The peak instantaneous flow (PIF) is the highest sustained hourly flow rate during wet weather. The peak instantaneous flow has 0.011 percent probability of occurrence (1 hour in 8,760 hours of the year). This flow parameter provides the basis for the hydraulic design of channels and pumps at the treatment facility.

Biochemical Oxygen Demand (BOD)

The biochemical oxygen demand (BOD) is a measure of wastewater strength in terms of the quantity of oxygen required for biological oxidation of the organic matter contained in wastewater. The BOD loading imposed on a treatment plant influences both the type and degree of treatment that must be provided to produce the required effluent quality. This parameter is often expressed in concentration units of mg/L or in mass loading units of pounds per day.

Total Suspended Solids (TSS)

Total suspended solids is a measurement of the quantity of suspended material contained in the wastewater. The quantity of TSS removed during the treatment of wastewater influences the sizing of solids handling and disposal processes, as well as the effectiveness of filtration and disinfection with chlorine. This parameter is often expressed in concentration units of mg/L or in mass loading units of pounds per day.

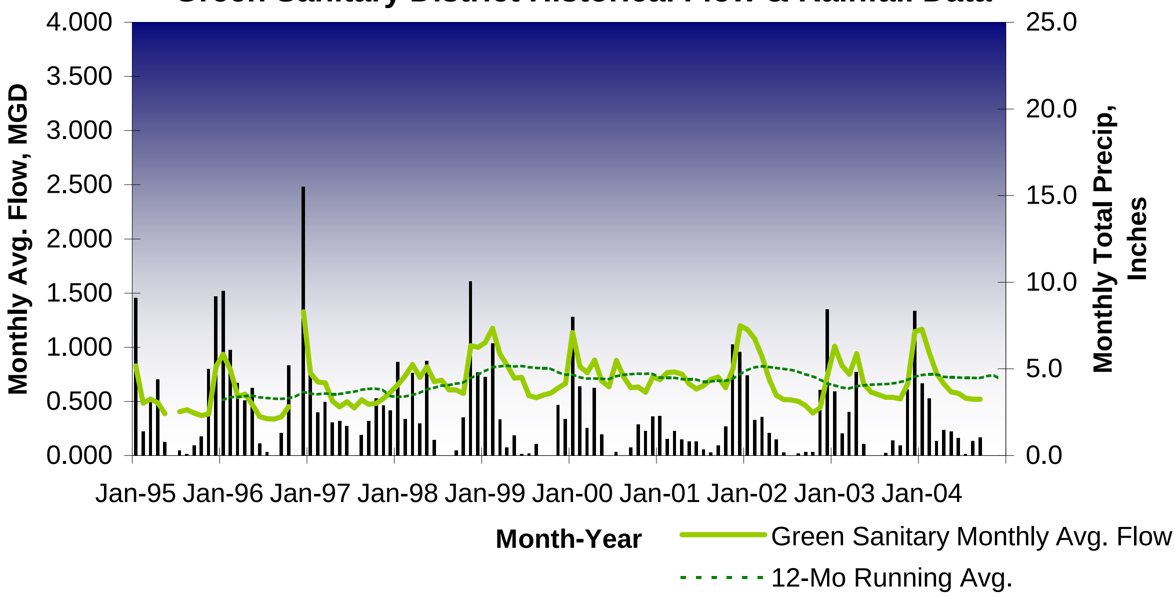
Equivalent Dwelling Units

An equivalent dwelling unit (EDU) is the term for equating commercial, industrial, and institutional wastewater flow rates and strength to the rates and strength generated by a typical residential household.

3.2 Wastewater Volume

Wastewater flows within the Green Sanitary District vary through the year, with wet weather flows exceeding dry weather flow. This typical western Oregon pattern reflects the presence of infiltration and inflow in the collection system. A plot of the historical GSD average flows and cumulative monthly rainfall based on data from the WWTP for the period between 1995 and 2004 is provided in Figure 3.2.1 below.

Figure 3.2.1
Green Sanitary District Historical Flow & Rainfall Data



A comparison of the GSD ADF and the AWWF shows a 46 percent average difference between flows delivered to the WWTP during the summer and winter seasons. Also, the comparison of the AAF and the peak day flow shows a 3.1 to 1 peaking factor. As a general engineering guide, a wastewater collection system should be conservatively designed to handle a peaking factor for the peak day of greater than 4:1 with 75 percent of the rated full pipe flow. It can be concluded that although I/I appears to be in the GSD system, the impacts of I/I may not be overly significant.

More importantly, the significance of the magnitude of infiltration and inflow in a collection system is relative to the capacity of the wastewater treatment system serving the community. For the GSD, the wastewater treatment plant is shared with the City of Winston; therefore a comparison between the impact of I/I on the GSD system and on the City of Winston system is warranted.

Table 3.2.1 provides a comparison of the GSD and City of Winston flow contributions to the regional WWTP during the period of 1995 through 2004. During the summers, GSD contributed approximately 54 percent of the flow received at the regional treatment facility. Higher summertime flows may be a good indication that Green has a larger customer base than the City of Winston. During the winter and on an annual basis, the GSD contributes 46 percent and 49 percent of the flow, respectively. Based on this comparison, it can be concluded that while the GSD may have a larger customer base, the volume of I/I delivered to the WWTP from the GSD system is less than the City of Winston. The comparison also shows that the yearly usage of the WWTP appears to be shared equally between the two communities and in 2004, the annual flow delivered to the WWTP was shared nearly equally.

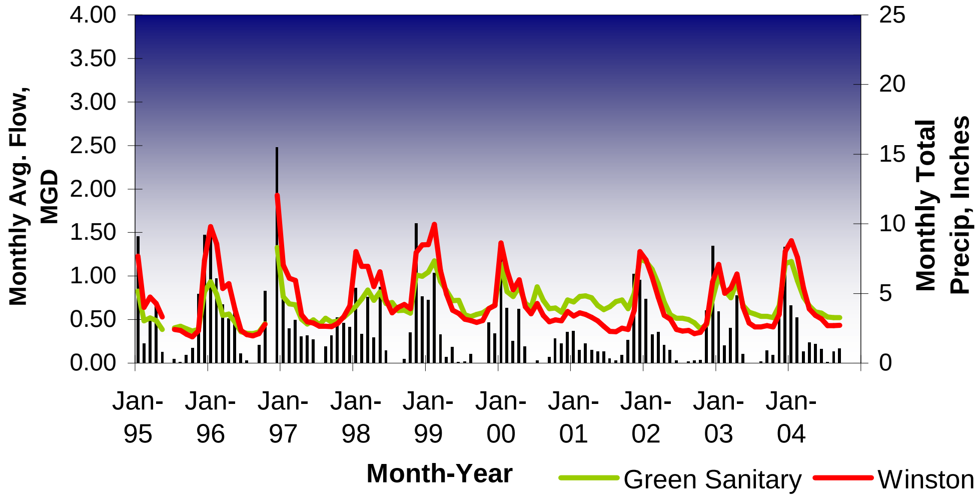
Table 3.2.1
Comparison of GSD and City of Winston Average Flows[1]

Flow Parameter	Green Sanitary District	City of Winston
ADF	0.551	0.476
AWWF	0.799	0.939
AAF	0.675	0.707
Max Monthly Average	1.327	1.927

[1] 1995 – 2004 data

A summary of both communities' monthly average flow and precipitation, based on DMR data from 1995 to 2004, is shown in Figure 3.2.2.

Figure 3.2.2
Historical Flow & Rainfall Data



3.3 Dry Weather Flows

Average Dry Weather Flow

The GSD average dry weather flow (ADF) was estimated to be 0. 595 MGD based on an analysis of DMR flow records for the months of May through October from year 2000 through 2004. The average dry weather flow can be divided into the following two descriptive engineering components:

1. Base sanitary flow and
2. Base infiltration

Base Sanitary Flow

The portion of sewer system flow that is entirely attributable to domestic sanitary sewage is known as the base sanitary flow. Base sanitary flows are determined from average residential water consumption and/or the recorded seasonal low wastewater volumes. Water consumption records for the months of November through April in 2000, 2001, 2002, and 2003 indicate that the typical domestic water use is 211 gpd / EDU's. Assuming approximately 80 percent of the domestic water reaches the treatment plant [1] the base sanitary flow is approximated as 169 gpd/EDU's (65 gpcd) or 0.450 MGD for permanent residences. Winter water usage is employed to estimate base sanitary flow due to the potential for irrigation water use during the summer months.

Base Infiltration

In determining projected flows, allowances must be made for unavoidable infiltration which is dependant upon such factors as the quality of material, workmanship in the sewers and building connections, maintenance efforts, and the elevation of the ground water compared with the elevation of the sewer pipes. The base infiltration is found from the difference in the ADF and the

[1] Metcalf and Eddy, 1991

base sanitary flow. Accordingly, the base infiltration is estimated at 0.145 MGD or 21 gpcd. The addition of future connections to the system will include a reduced allowance for base infiltration of 20 gpd/EDU's, or 8 gpcd in new units because it is assumed that modern construction of sewer connections will result in reduced amounts of infiltration.

3.4 Average Wet Weather

As previously discussed, the wet weather period between November and April results in increased flows in the collection system because of I/I. The analysis of the Green wet weather season data from the WWTP suggests that the GSD average wet weather flow during this period was approximately 0.876 MGD or 127 gpcd.

3.5 Annual Average Flow

The Annual Average Flow (AAF) experienced in the Green collection system has been determined by averaging the ADF and the AWWF, resulting in an annual average flow of 0.736 MGD or 106 gpcd.

3.6 Maximum Monthly Flows

The calculation of Maximum Monthly Flows is somewhat more complex than that for other flow parameters. The methodology employed is based on Department of Environmental Quality (DEQ) guidelines that identify the seasonal maximum monthly average flow, which has the probability of recurrence once every 5 years during the winter and once every 10 years during the summer. The basis of these recurrence intervals is the DEQ policy to accept a failure of a treatment facility or overloading of the collection system due to rainfall effects once every 5 years.

Calculation of the Maximum Monthly Flow is based on identifying the monthly rainfall and the monthly average wastewater flows during the months when I/I impacts the collection system. Once these flows are identified, they are plotted on a graph to establish a linear relationship between monthly rainfall and wastewater flow. The resulting relationship is used to predict the monthly average flow for the 80 percent and 90 percent probability (one in five year and one in ten year recurrence). The method estimates the anticipated flow that will occur if rainfall for the month exceeds the historic probabilistic amounts for the dry and wet seasons. For western Oregon, the historically dry and wet season months with the highest rainfall occur during May and January, respectively.

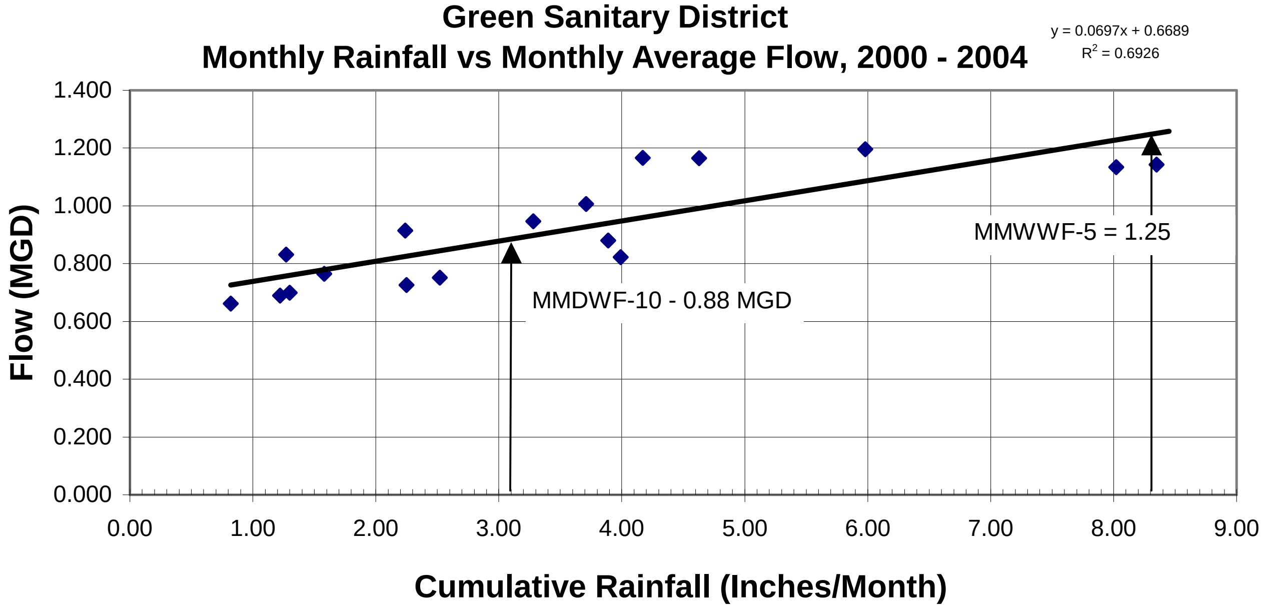
Maximum Month Dry Weather Flow

The Maximum Month Dry Weather Flow (MMDWF) was ascertained from the plot shown in Figure 3.6.1 as developed from the maximum monthly average flows and rainfall recorded at the WWTP between the periods of year 2000 through year 2004. Based on historical climatological data (1940 – 1979) the maximum rainfall with the one-in-ten year recurrence for the month of May is 3.1 inches as recorded for Roseburg, Oregon. The calculated MMDWF with the same recurrence interval is 0.880 gpd or 127 gpcd.

Maximum Month Wet Weather Flow

The Maximum Month Wet Weather Flow (MMWWF) was also ascertained from the plot shown in Figure 3.6.1. Based on the same climatological data, the maximum monthly rainfall with the one in five year recurrence interval for January is 8.2 inches. The calculated MMWWF for the 5-year recurrence interval is 1.250 MGD or 181 gpcd.

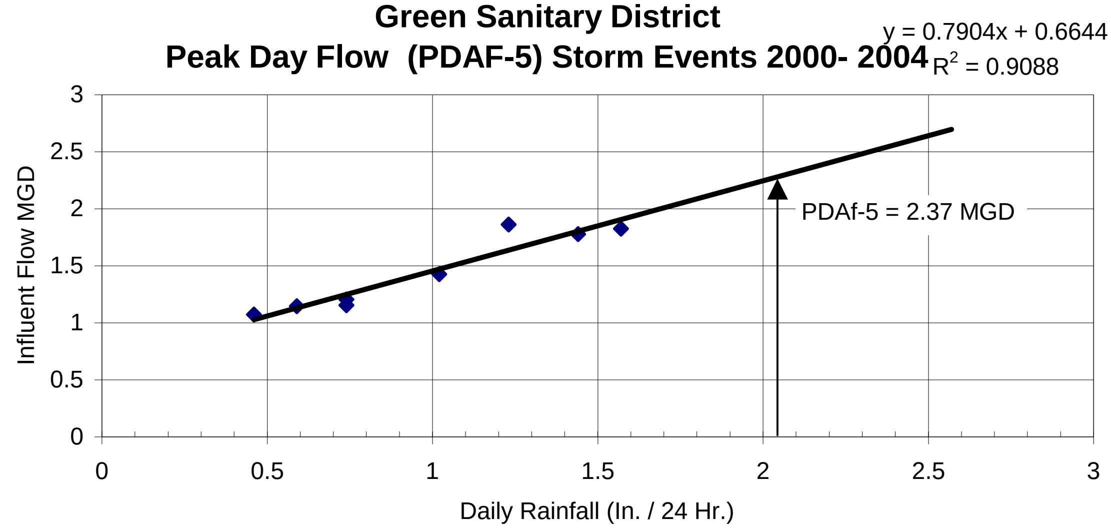
Figure 3.6.1
Green Sanitary District
Monthly Rainfall vs Monthly Average Flow, 2000 - 2004



3.7 Peak Day Flow Event

During times of extended, heavy precipitation, I/I flows impact the GSD system causing flows received at the WWTP to increase. The Peak Day Flow event is determined from a plot of the recorded daily flow that occurred during, or 24 hours after, a significant rainfall event. By performing a regression analysis of this data, a linear relationship is established as shown in Figure 3.7.1. The Peak Day Flow is based on the intercept of this line with the 5-year, 24-hour precipitation event. For GSD, the 5-year rainfall event is a 2.1 -inch storm event resulting in a Peak Day Flow of 2.27 MGD.

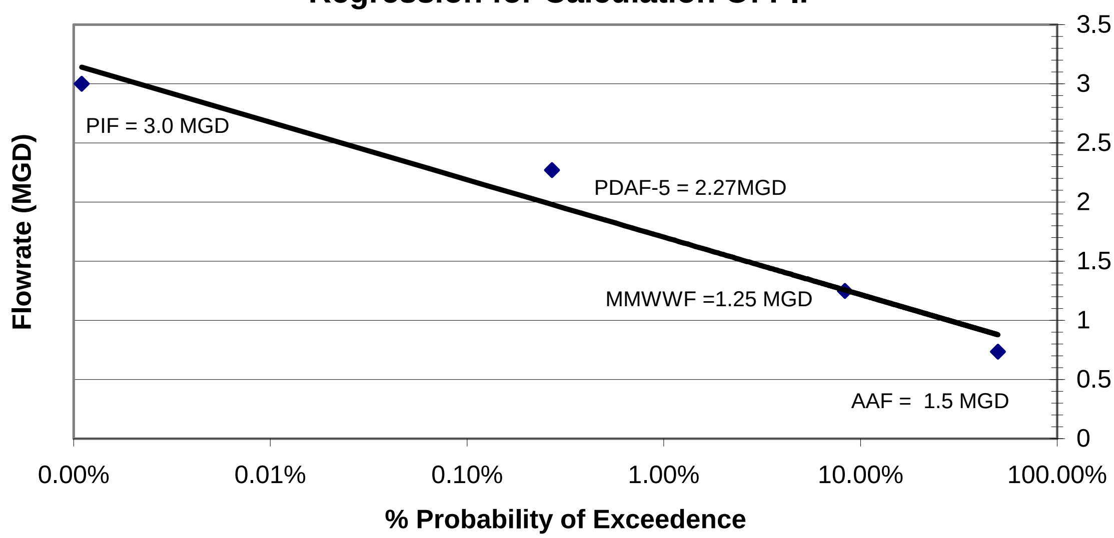
Figure 3.7.1
Green Sanitary District
Peak Day Flow (PDAF-5) Storm Events 2000- 2004



3.8 Peak Instantaneous Flow

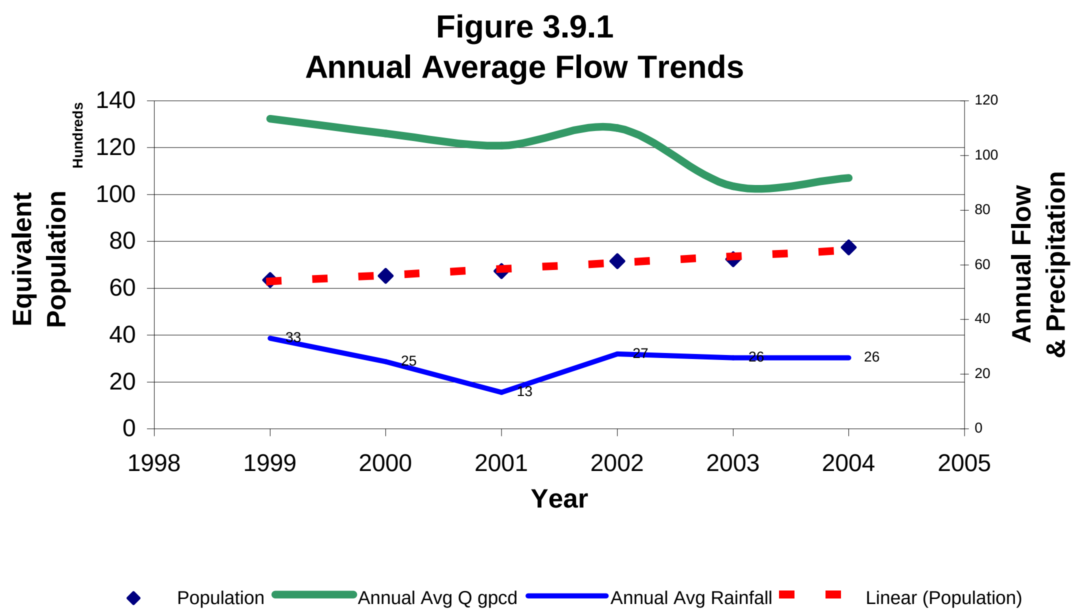
Determination of the Peak Instantaneous Flow (PIF) results from a probability projection of the Annual Average, Maximum Month, and Peak Day Flow parameters. The example plot shown in Figure 3.8.1 projects the PIF at 3.0 MGD.

Figure 3.8.1
Green Sanitary District
Regression for Calculation Of PIF



3.9 Infiltration and Inflow (I/I) Flow

The Green Sanitary District has made significant efforts to reduce the quantity of infiltration and inflow in the wastewater collection system. Past projects have included lateral replacement programs, new pipe replacement, and manhole rehabilitation. During the last 5 years, wet weather flows have declined while the customer base has grown. Figure 3.9.1 demonstrates the recent trends in I/I removal for the GSD.



3.10 Summary of Existing Flows

The evaluation of dry and wet weather wastewater flows for the GSD collection system was based on the recorded flow data reported in the Winston Green Wastewater Treatment Facility daily monitoring reports for the period beginning in January 2000 and ending in September 2004.

Per capita design values were established from the equivalent population using the methodology presented in Section 2. The equivalent population was averaged for each year of data to establish the per capita design value. A summary of the flow data is provided in Table 3.10.1 below.

Table 3.10.1
GSD Summary of Flow Projections

Flow Parameter	Daily Flow	Per-capita Flow[1]
Base Sanitary	0.450 MGD	65 gpcd
Base I/I	0.145 MGD	21 gpcd
Average Dry Weather Flow (ADWF)	0.595 MGD	86 gpcd
Average Wet Weather Flow (AWWF)	0.876 MGD	127 gpcd
Average Annual Flow (AAF)	0.736 MGD	106 gpcd

Table continued next page

Flow Parameter	Daily Flow	Per-capita Flow[1]
Max Month Dry Weather (MMDWF-10)	0.880 MGD	127 gpcd
Max Wet Month Weather (MMWWF-5)	1.250 MGD	181 gpcd
Peak Day Avg. Flow (PDAF-5)	2.270 MGD	328 gpcd
Peak Instantaneous Flow (PIF-5)	3.000 MGD	434 gpcd
[1]—per capita flow based on equivalent population		

3.11 Flow Projections

Projected population growth and the existing per capita design values developed above will be used to predict wastewater flow characteristics at the end of the 20-year planning period. These wastewater characteristics form the basis for evaluating alternatives and, if necessary, the basis for recommending the design or modification of new facilities.

The potential for growth, residential, commercial, and industrial exists in the Green UUA. Based on historical data, it is likely that the current growth trends will continue and within this planning period, the District will begin to experience build-out in portions of the system. In 1997, Douglas County identified the potential need for additional lands to be incorporated into the Green UUA. Therefore, it is reasonable to assume that growth could occur at the rates discussed in Section 2 and as this growth occurs, it may include build-out or require expansion of the District.

The permitted capacity of the WWTP and the District's wastewater collection system will need to accommodate this growth. It is anticipated that the recommended improvements presented in this plan will become necessary to support the growth of up to 2,800 new EDUs.

Basis of Wastewater Flow Projections

The following are the assumptions made to project flows within the District's system during the 20 year planning period.

- The equivalent population for the plan year 2005 is estimated at 8,053 equivalent persons, which is based on water consumption records for the District's current customer base and an average of 2.6 persons per household.

- Wastewater flow records for the low flow dry season months allow estimating the average dry weather flows in the collection system. These dry weather flows will serve as the basis for projecting increased flows due to population increases.

- When evaluating new connection impacts and projecting future flows, the base infiltration component will be reduced to 20-gpd for each new connection as previously discussed. New sanitary sewer connections will have less I/I due to newer construction methods resulting in a decreased base infiltration component.

- The growth rate for the first 10 years of the planning period is estimated at 4 percent, based on the District Board's consideration of current trends.

- The growth rate for the second 10 years of the planning period is estimated at 2.54 percent, based on the Douglas County Comprehensive Plan.

- It has been assumed that growth within the District will occur within the District's boundaries, however, future scenarios include an assessment of impacts from areas outside of the District's current boundaries.

Projected Flows Based on Current Conditions

Based on the assumptions stated above, unit design values, equivalent population, and flow projections for five-year increments are summarized in Table 3.11.1. The 20-year unit design values reflect a general decline in the per-capita flow rate. This change is based on newer construction providing reduced infiltration and inflow.

Table 3.11.1
Green Sanitary District Flow Projections[1]

Year		Avg. 2000-2004	2005	2010	2015	2020	2025	20-Year per-capita gpcd
Population Equivalence		7,081	8,053	9,797	11,920	12,863	13,880	
Flow Design Parameter	Per capita flow, gpcd	MGD	MGD	MGD	MGD	MGD	MGD	
Base Sanitary	65	0.450	0.512	0.623	0.758	0.817	0.882	64
Base I/I[2]	21	0.145	0.169	0.182	0.198	0.205	0.212	15
ADF	86	0.595	0.681	0.805	0.955	1.022	1.094	79
AWWF	127	0.876	0.996	1.177	1.397	1.495	1.600	115
AAF	106	0.736	0.838	0.991	1.176	1.258	1.347	97
MMDWF	127	0.880	1.001	1.183	1.404	1.502	1.608	116
MMWWF	181	1.250	1.422	1.680	1.994	2.134	2.284	165
PDAF-5	328	2.270	2.582	3.051	3.622	3.875	4.148	299
PIF-5	434	3.000	3.412	4.032	4.787	5.121	5.482	395

[1] Growth projections are based on 4% over the first 10-years followed by the County Average 1.53% the next 10 years
[2] Base Sanitary is reduced to 20 gal/EDU (7.4 gpcd) for new connections only

4.0 Existing Wastewater Collection System

4.1 General

As shown in Figure 4.1.1, the Green Sanitary District serves an area of approximately 2,025 acres. Within this area, the District has constructed and maintains nearly 32 miles of gravity pipelines, 2.55 miles of forcemain piping, 763 sanitary manholes, two pump stations, and thirteen STEP systems. The two primary pump stations, G4 and Briarwood, are considered major facilities. The Ingram Station is an 8,000-gallon STEP system serving a light industrial facility while the remaining 12 STEP systems are for residential services. All of the STEP systems are maintained and serviced by the District on a routine maintenance schedule. The maintenance schedule includes pumping and servicing the Ingram Station every two months and four months, respectively; and inspecting and servicing the remaining STEP systems every 12 months..

The inventory of the collection system ranges in size from 8-inch to 21-inch diameter pipe for the gravity system and 6-inch and 12-inch pipe for the two major pressure pipelines. Based on previous planning studies conducted by the District, the service area has been divided into 18 sub-basins, each identified by letter. Manholes and pipelines have been tagged with the sub-basin designation followed by a numerical assignment beginning at the lowest section of the basin and working up through the tributaries. An inventory of piping for each sub-basin is provided in Table 4.1.1. A detailed breakdown of the inventory including pipeline type and year installed is provided in Section 5.0.

Table 4.1.1
Inventory of Collection System Components

Basin ID	Total Lineal Feet	Miles of Pipeline	Pipe Segments
A	8,869.2	1.7	37
B	12,643.41	2.4	51
C	10,415.89	2.0	49
D	10,582.8	2.0	47
E	12,334.7	2.3	61
F	9,112.6	1.7	45
G	7,925.1	1.5	40
H	10,015	1.9	41
I	9,580.64	1.8	47
J	9,748.94	1.8	34
K	10,654.6	2.0	46
L	10,992	2.1	52
M	12,317	2.3	55
N	6,683.8	1.3	29
O	4,107.6	0.8	27
P	12,269.4	2.3	52
Q	7,877.5	1.5	33
LP	17,833.56	3.4	8
TOTAL	183,963.7	34.84	754

Insert Figure 4.1.1 Existing System

4.2 Wastewater Collection System Modeling & Inventory

The existing wastewater collection system for the Green Sanitary District was hydraulically modeled using Haestead Methods Sewer CAD. The following provides a summary of the methodology employed to develop the model and analyze the system.

The existing sanitary sewer system data was first compiled from Green Sanitary District As-Built and survey information. The manhole rim elevation, pipe invert, pipe size and material, pump information, wet well size and location, and installation dates were compiled in Sewer CAD and output to a database, which is provided as Appendix A.

The sanitary sewer flow data was estimated from a combination of the Green Sanitary base map, aerial photography, Douglas County planning data, Winston-Green sanitary flow data, G4 pump station flow records, flow metering efforts conducted as part of this project, and the District's existing I/I study.

First, the sewer model was run in steady-state condition using the existing physical parameters of the system and the estimated I/I data. The model was then calibrated using a combination of flow data collected from the District's Flow Dar and the influent flow meter at the WWTP. Flow Dar installations were strategically located and included sanitary sewer manholes A-3, D-2, C-32, and J-10.

Dry Weather Flow Diurnal Pattern

The dry weather diurnal pattern was estimated from sanitary flow data using the following methodology.

The daily flow data from each of the flow metering stations was averaged through a week period when no rainfall was registered at the treatment plant rain gauge. This produced an average 24-hour diurnal pattern for each of the monitored basins. The 24-hour diurnal pattern for each monitored basin were combined and averaged to create a unit average diurnal pattern representative of basins A, B, and the westerly residential portion of basin D. This pattern was used as the dry-weather diurnal pattern for the Sewer CAD input file for all sanitary sewer basins in the GSD system. The use of this diurnal pattern for the entire District was based on the limited duration of flow monitoring events and the assumption that these basins are representative of the entire system.

Wet Weather Flow Pattern

The wet weather flow pattern was estimated from storm event data collected on December 8, 2004. Based on climatological data the 5-year storm event should produce approximately 2-inches of daily rainfall. The December 8, 2004 storm-event registered 2.03" at the Winston-Green Wastewater Treatment Plant and therefore was considered representative of a 5-year storm producing a peak day flow event. During the "design" storm event, the wet weather flows were monitored by the Flow Dar installation at manhole A-3. The dry weather diurnal pattern was subtracted from the flow monitored during the storm event to produce a wet weather peaking factor. This wet weather peaking factor was then applied to all sub-basins based on the total inch diameter miles in the system.

Profiles and the hydraulic grade line for the trunk sewer mains in each basin are also provided in Appendix B.

4.3 Basin Descriptions

Basin A

Sewer Basin A, also referred to as the Landers basin, is comprised of approximately 94.5 acres located in the southwest portion of the District. Existing land-use in Basin A is primarily residential. Development in the Basin occurred in the late 1980's. The Basin A collection system flows by gravity through a series of 8-inch PVC sewer mains. This system discharges directly to the wastewater treatment plant, which is also located within Basin A. A Parshal Flume with an ultrasonic level sensor is located near the discharge to the WWTP. The current annual average daily flow estimated from Basin A is 0.035 MGD.

There are approximately 23.6 acres of vacant land zoned medium density residential within the current basin boundaries. In addition, there are approximately 118-acres of vacant land located just north of Basin A, which is zoned medium density residential. For the purposes of this study, and based upon the topography of the land, it was assumed that 47-acres of this land would drain through Basin A when developed, with the remainder of the flow draining through Basin H.

Basin B

Sewer Basin B is located in the southwest portion of the district, just north and east of Basin A. Basin B is comprised entirely of residential development, which was constructed in the late 1980's and early 1990's. The basin collection system flows by gravity through a series of 8-inch and 10-inch PVC sewer mains to sewer manhole C-33, later connecting to the 21" PVC Sewer interceptor at manhole C-11 before flows are conveyed by gravity to the treatment plant. Basin B encompasses approximately 108 acres, with 36 acres of vacant land. The current annual average daily flow estimated from Basin B is 0.065 MGD.

Basin C

Sewer Basin C is comprised of approximately 89 acres in the southwest portion of the District, and includes the wastewater treatment plant and a portion of State Highway 42/99. Basin C is a residential basin, which was constructed in the late 1970's and early 1980's. Approximately 30 acres of vacant land remain within this Basin. The current annual average daily flow estimated from Basin C is 0.028 MGD.

Basin D

Sewer Basin D consists of approximately 84 acres including residential, commercial, and light industrial land located in the southeast portion of the District. There are approximately 10-acres of vacant land within Basin D, zoned medium density residential. In addition, there are approximately 156 acres of buildable vacant land just south of Basins D and E, which are being included in Basin D for the purposes of this report. The 156-acres of vacant land are zoned as follows: 13-acres low density residential, 109-acres of medium density residential, and 34-acres of high density residential. The current annual average daily flow estimated from Basin D is 0.007 MGD.

Basin E

Sewer Basin E consists of approximately 102-acres of mixed residential and commercial land use located in the west portion of the District. Sewer Basin E straddles Highway 42/99 and includes a 70-unit trailer park, four (4) restaurants, and five (5) commercial establishments along the highway. There are approximately 15 acres of vacant land inside Basin E, zoned commercial. The current annual average daily flow estimated from Basin E is 0.06 MGD.

Basin F

Basin F consists of approximately 114-acres of mixed residential, commercial, and industrial land located near the center of the District. The Green School is located near the center of Basin F. There are approximately 13 acres of buildable vacant land in Basin F, zoned industrial. The current annual average daily flow estimated from Basin F is 0.041 MGD.

Basin G

Sewer Basin G consists of approximately 71-acres of medium density residential land near the center of the District. Aside from single-family residential dwellings, the Basin includes most of the Sunnyslope School property. There are approximately 13.5-acres of vacant land in Basin G; 9.1-acres are zoned high density residential, and 4.4 acres are zoned medium density residential. Sewage collected from Basin G flows through the 15-inch and 18-inch trunk line to the G4 pump station. The current annual average daily flow estimated from Basin G is 0.030 MGD.

Basin H

Sewer Basin H consists of approximately 72 acres of medium density residential land on the west side of the District. There are approximately 12.3-acres of vacant land within Basin H, zoned medium density residential. In addition, there are approximately 118-acres of vacant land located just south of Basin H, which is zoned medium density residential. For the purposes of this study, and based upon the topography of the land, it was assumed that 71-acres of this land would drain through Basin H when developed, with the remainder of the flow draining through Basin A. Sewage from Basin H flows through the 15-inch and 18-inch trunk line to the G4 pump station. The current annual average daily flow estimated from Basin H is 0.114 MGD.

Basin I

Sewer Basin I consists of approximately 77-acres of single-family residential land located on the west side of the District. There are approximately 21-acres of vacant land within Basin I, all zoned medium density residential. The current annual average daily flow estimated from Basin I is 0.039 MGD.

Basin J

Sewer Basin J consists of approximately 74-acres of single-family residential land located near the northwest portion of the District. A portion of the Sunnyslope School is located within Basin J. There are approximately 2.8-acres of vacant land within Basin J, zoned residential hazard (flood plain). The current annual average daily flow estimated from Basin J is 0.026 MGD.

Basin K

Sewer Basin K is a residential basin located in the westerly portion of the District along the Umpqua River. Basin K consists of approximately 94-acres of land, all of which is zoned for residential. There are approximately 18-acres of vacant land within Basin K, all zoned residential hazard (flood plain). The current annual average daily flow estimated from Basin K is 0.038 MGD.

Basin L

Sewer Basin L consists of approximately 70.4 acres of land located in the northwestern portion of the district. There are approximately 12.5-acres of vacant land located within Basin L, zoned medium density residential. In addition, there is an approximately 84-acre residentially zoned plot of land located just west of Sewer Basins L and M (and within the Green UUA boundary). For the purposes of this study, and based upon the topography, it was assumed that 47-acres of medium density residential development would flow through Basin L at build-out, with the remainder draining through Basin M. The current annual average daily flow estimated from Basin L is 0.041 MGD.

Basin M

Basin M consists of approximately 158 acres of residential land located in the northwestern portion of the district. This basin includes two high-density mobile home parks, River Place and Littlebrook. There are approximately 11-acres of vacant land located within Basin M, zoned low density residential. In addition, there is an approximately 84-acre residentially zoned plot of land located just west of Sewer Basins L and M (and within the Green UUA boundary). For the purposes of this study, and based upon the topography, it was assumed that 37-acres of low density residential development would flow through Basin M at build-out, with the remainder draining through Basin L. The current annual average daily flow estimated from Basin M is 0.046 MGD.

Basin N

Sewer Basin N consists of approximately 128-acres of land comprised of a mixture of residential and industrial land located in the northern portion of the District. There are approximately 18 acres of vacant industrial land in the northern portion of the basin along Happy Valley Road, and approximately 8 acres of vacant industrial land in the southern portion of the basin along the Central Oregon Pacific Railroad. The current annual average daily flow estimated from Basin N is 0.032 MGD.

Basin O

Sewer Basin O is a small residential basin located in the northern portion of the district along the Umpqua River. Basin O consists of approximately 50-acres of land, with approximately 4.2 acres of vacant land along the river, zoned low density residential. There are approximately 100 potential new units in the residential area known as Shady, which have been proposed for connection to the Green Sanitary District system within the planning period. Sewage from Basin O flows to the G-4 pump station. The current annual average daily flow estimated from Basin O is 0.042 MGD.

Basin P

Sewer Basin P consists of approximately 245 acres of mostly industrial land, with some light commercial use. Basin P is located between Carnes Road and Interstate 5 in the northeast portion of the District. There is a 110-unit trailer park located near the center of the basin.

There is a large block of approximately 101 acres of vacant industrial land located on the west side of the basin, as well as approximately 4.2 acres of vacant commercial land along the highway, and an additional 65-acres of vacant industrial land on the east side of the basin. The current annual average daily flow estimated from Basin P is 0.061 MGD.

Basin Q

Sewer Basin Q consists of approximately 291 acres of mostly industrial land that is located on the east side of the District. There is also a 120-unit trailer park located near the center of the basin. There are approximately 13 acres of vacant commercial/industrial land located at the south end of Basin Q, and approximately 43 acres of industrial land located on the east side of Basin Q. The current annual average daily flow estimated from Basin Q is 0.041 MGD.

4.4 Allocation of Existing and Future Flows

Existing flows have been allocated throughout the District based on current land use and the GSD residential customer database. Future flows have been allocated to the vacant lands according to land-use designations as shown in Figure 4.4.1. The vacant land inventory includes Douglas County records and the GSD staff information. A summary of the potential new units and flows from each respective basin is provided in Table 4.4.1. The potential new units represent an estimate of build-out conditions within the respective Basin.

Table 4.4.1 Allocation of Existing and Projected Annual Average Flows in Sewer Basins							
Basin	Area (acres)	Existing Units (EDU)	Annual Avg. Flow, (gpd)	Vacant Land (acres)	Vacant Land Zoning	Potential New Units, (EDU)	Annual Avg. Flow, (gpd)
A	94.5	126	34,726	70.6	RMD	494	170,872
B	108	237	65,317	36	RMD	252	134,768
C	89.4	104	28,662	29.3	RMD	205	85,160
				7	RLD	21	5,788
D	83.9	24	6,614	12.8	RLD	38	17,087
				109.3	RMD	765	210,834
				33.8	RHD	676	186,306
E	102	232	63,939	15	C		63,939
F	114.3	150	41,340	13	I		41,340
G	70.6	108	29,765	4.4	RMD	31	38,308
				9.1	RHD	182	50,159
H	71.6	413	113,823	83.3	RMD	583	274,498
I	77.4	140	38,584	21.4	RMD	150	79,924
J	74.2	96	26,458	2.8	RHZ	9	28,938
K	94.3	137	37,757	18	RHZ	54	52,640
L	70.4	149	41,064	59.5	RMD	417	155,990
M	158	167	46,025	48	RLD	144	85,712
N	128	117	32,245	26	I		32,245
O	50	152	41,891	4.2	RLD	13	45,474
P	245	223	61,459	166	I		61,459
				4.2	C		6,300
Q	291	148	40,789	43	I		40,789
				13	LI		19,500
Totals	1,922.6	2,723	750,459	829.7		4,034	1,888,029

RLD = Residential Low Density = 3 units / acre
RMD = Residential Medium Density = 7 units / acre
RHD = Residential high Density = 20 units / acre
RHZ = Residential Hazard = 3 units / acre
I = Medium Industrial = 3000 gal / acre-day
LI = Light Industrial / Commercial = 1500 gal / acre-day
C = Commercial = 1500 gal / acre-day

Insert Figure 4.4.1 Vacant Lands

4.5 UUA Expansion Areas

Expansion of the District outside of the existing service area boundary may occur in the future. Based on discussions with the District, the two areas of primary consideration are the area known as Shady and a 420-acre area south east of the District south of Highway 42/99 and west of Interstate 5.

Estimates of flow contributions from Shady are based on the District's understanding that this area could contribute up to 100 new units to the District's sewer system. The flow contribution from these units represents an increase in the District's annual average flow of 25,000 gpd.

Estimates of flow for the new UUA area south of the District were based on the existing development mix currently experienced in the District. The assumption was made that Area A and Area C of the UUA expansion area (shown in Figure 4.4.1) would be brought into the District providing up to 150.6 acres for residential and commercial developments. Assuming commercial development represents 3 percent of the area and occurs near Highway 42/99 and residential development occurs in the remaining areas at a rate of 5 units per acre (a density of development between Low Density and Medium Density zoning) approximately 748 new EDUs could be added to the GSD system. The flow contribution from these units represents an increase in the District's annual average flow of 186,700 gpd.

Assuming the remaining 270 acres in the UUA expansion area is dedicated to industrial development and industrial use occurs in approximately 2/3rds of the lands with activities generating up to 1,000 gallons of wastewater per acre per day; an additional 181,000 gpd could be added to the District's annual average flow. This quantity of wastewater is equivalent to 725 EDUs. (Note wastewater generated from industrial lands can vary significantly depending on the type of activity and actual flow rates may vary significantly from the values assumed for this analysis.) A summary of the basis for projecting flows from this area is provided in Table 4.5.1 below.

Table 4.5.1
Allocation of Flows in UUA Expansion Area

Land-use Classification	Percent of UUA Area	Basis for Projecting Flow
Residential	35%	RMD/RLD (5 units/acre)
Commercial	1%	1,000 gal/acre-day
Industrial	43%	1,000 gal/acre/day
Public/Semi-Public	21%	Open land

Based on the analysis presented above, the total additional annual flow from expansion of the UUA is potentially equivalent to 1,523 EDUs or 0.392 MGD. Approximately 25,000 gpd of the AAF would flow directly into the G-4 system from the addition of Shady. Hydraulic modeling of the additional flow contributions indicated that the collection system in Basin O would have sufficient capacity for the Shady units while the remaining 0.367 MGD generated in the new UUA area would need to be delivered to the District's system into Basin D.

4.6 Description of Pumping Facilities

G-4 Pump Station

The G-4 Pump Station is the main pump station for the District. Wastewater collected from Basins E through Q flow into this critical piece of the District's infrastructure.

The G-4 station was originally constructed as a three level dry pit/duel wet pit configuration. Two pumps are located in the bottom floor of the facility, motors are located on the intermediate floor, and the controls, power system, and back-up power supply are located on the top floor. There is space and plumbing to allow a third pump installation. The wet well is a two bay configuration with gates and operators that allow the wet well sumps to function independently or in concert. A gate is also located on the inlet sewer which allows isolation of the wet well for short periods of time.

The station currently utilizes vertical shafted 100 Hp centrifugal pumps equipped with variable speed drives. Current operational practices have limited the pump speed to 85 percent of the full motor rating. This limitation is based on the GSD staff's plan to limit the flow delivered to the WWTP from the Green Collection System based on the GSD staff's understanding of how the wet weather flow capacity of the WWTP should be shared equally between the City of Winston and the District. During peak wet weather events, the throttled output of the G-4 pumps causes the 15-inch and 18-inch tributary sewer to surcharge. Once the system surcharges and the high water level alarm is triggered, the operator is called and one of the pumps is manually adjusted to 100 percent of full speed.

Based on hydraulic modeling of the system, the G-4 pump station is currently under capacity and an upgrade requiring a third pump will be required.

Table 4.6.1 Design Data G-4 Pump Station	
Parameter	Value/Description
Station	G-4
Piping:	12-inch
Type:	Ductile iron
Pump Type (2)	Shaft driven self-priming variable speed centrifugal.
Brand:	Worthington Model 4MF-15
Draw down Pump #1 at 85% speed	1,380 gpm
Draw down Pump #2	1,360 gpm
Draw down Pump #2 at 100% speed	1,560 gpm
Motors:	100HP @ 1750rpm: 1/60/480V (three phase)
Drive:	Direct
Impeller Diameter	Unknown
Level Control:	Ultra sonic level sensor with float switch backup
Overflow Point:	Manholes northwest of Carnes Road
Auxiliary Power Type:	None
Alarm Type:	Float Switch, visible alarm
EPA Reliability Class I:	Yes
Tributary Flow Contributions	
ADF	4,158 gpd
$PDAF_5$	1.3 MGD
Wet Well Diameter:	Rectangular Structure 30 deep x 400 square feet cross section
Wet Well Volume:	90,000 gallons
$PDAF_5$	1.3 MGD gpd
Time to Overflow PDAF	100 minutes
Force Main	
Length:	10,249 LF
Diameter:	12”
Detention Time @ ADF	36 minutes
Material:	DI
Profile:	1960 LF Ascending, 760 LF Descending, 6800 LF Ascending
Blow-off Valve	Roberts Creek Crossing (low point)
Vacuum Release Valves:	350-ft north of intersection Doris Street and Carnes Road
Sulfide Control System:	None
Discharge	
Location:	MH C-27 Intersection of Landers Avg. and US Hwy 99/42
Condition:	Fair (Rehab channel 7 MH downstream)
Firm Capacity:	1560 gpm

Briarwood Pump Station

The Briarwood Pump Station is a small Flyte packaged unit located in the Briarwood development. The need for this station appears to be based on lifting the flows generated in the development across the street to the grade of the existing collection. The station and forcemain are in excellent condition and no further action appears required for this facility.

Table 4.6.2
Design Data Briarwood Pump Station

Parameter	Value/Description
Station	Briarwood
Piping:	4-inch
Type:	DI
Pump Type (2)	Submersible package.
Brand:	Flygt Model CP3085-438
Draw down Pump #1	244 gpm
Draw down Pump #2	159 gpm
Motors:	3HP @ 1700rpm: 3/60/230V (three phase)
Drive:	Direct
Impeller Diameter	Unknown
Level Control:	Float Switches
Overflow Point:	Manholes northwest of Carnes Road
Auxiliary Power Type:	None
Alarm Type:	Float Switch, visible alarm
EPA Reliability Class I:	No
Tributary Flow Contributions	
ADF	15,960 gpd
$PDAF_5$	39,900 gpd
Wet Well Diameter:	5-foot
Wet Well Volume:	93.5 gallons per vertical foot
$PDAF_5$	39,900 gpd
Time to Overflow PDAF	46 minutes
Force Main	
Length:	60 LF
Diameter:	4”
Detention Time @ ADF	1 minutes
Material:	DI
Profile:	Ascending
Blow-off Valve	None
Vacuum Release Valves:	None
Sulfide Control System:	None
Discharge	
Location:	MH E-6
Condition:	Good
Firm Capacity:	159 gpm

5.0 Design Criteria and Level of Service

5.1 General

In previous sections of this Master Plan, background information, projections for growth, and the anticipated wastewater composition and flows were developed. A hydraulic model with hydrologic features was prepared to simulate the operation of the system for both current and future conditions. This section builds upon this information by identifying and examining deficiencies within the collection system. Operational strategies are presented that will address the prevention of these types of deficiencies by extending the life of the system. In Section 6, recommendations are presented in the form of a capital improvement plan, which outline alternatives to correct or prevent deficiencies including the anticipated costs. Financial strategies and possible financing agencies are presented in Section 7.

5.2 Inventory of Collection System

Utilizing existing GSD as-built data, a complete inventory of the collection system was prepared. A summary of the gravity system inventory based on material, size and year of construction is provided in Table 5.2.1 and 5.2.2. The areas shaded in Table 5.2.2 represent the oldest and lowest quality material in the system. These areas have been identified as the highest priority for investigations. In the valuation of the District's infrastructure, the shaded cells in Table 5.2.2 are considered nearing their intended design life.

Table 5.2.1
Inventory of Gravity Sewer by Materials and Size

Size	PVC, ft	AC, ft	Total	Percent of System
6	804	2,271	3,075	2%
8	71,228	61,880	133,108	86%
10	501	3,286	3,787	2%
12	0	990	990	1%
15	2,931	5,315	8,246	5%
18	4,204		4,204	3%
21	2,081		2,081	1%
24	78		78	0%
Total	81,827	73,742	155,569	
Percent of Total	52.6%	47.4%		100%

Table 5.2.2 Inventory of Gravity Sewer by Materials, Size and Year Installed					
Size	Year	AC	PVC	Total (ft.)	% of Total
6”	60's	173		173	0.11%
	70's	2,098		2,098	1.35%
	80's		302	302	0.19%
	90's		502	502	0.32%
	2000's				0.00%
8”	60's	32,280		32,280	20.75%
	70's	29,600		29,600	19.02%
	80's		41,110	41,110	26.43%
	90's		30,118	30,118	19.36%
	2000's			0	0.00%
10”	60's	3,027		3,027	1.95%
	70's	259		259	0.17%
	80's		413	413	0.27%
	90's			0	0.00%
	2000's		88	88	0.06%
12”	60's	227		227	0.15%
	70's	391		391	0.25%
	80's	372		372	0.24%
	90's			0	0.00%
	2000's			0	0.00%
15”	60's	4,942		4,942	3.17%
	70's	373		373	0.24%
	80's		2,807	2,807	1.80%
	90's		21	21	0.01%
	2000's		103	103	0.07%
18”	60's			0	0.00%
	70's		4,204	4,204	2.70%
	80's			0	0.00%
	90's			0	0.00%
	2000's			0	0.00%
21”	60's			0	0.00%
	70's		2,081	2,081	1.34%
	80's			0	0.00%
	90's			0	0.00%
	2000's			0	0.00%
24”	60's			0	0.00%
	70's		78	78	0.05%
	80's			0	0.00%
	90's			0	0.00%
	2000's			0	0.00%
	Total	73,742	81,827	155,569	100.00%

An inventory of manholes, based on year of construction is provided in Table 5.2.3.

Table 5.2.3 Manhole Inventory by Year Installed		
Year	Number	% of Total
60's	197	26%
70's	190	25%
80's	220	29%
90's	149	20%
2000's	10	0.1%
Total	766	100%

An inventory of the pump station forcemains, based on size and material is provided in Table 5.2.4.

Table 5.2.4 Pressure Pipe Inventory by Size and Material		
Size	Length	% of system
4"	99	1%
6"	3,882	29%
12"	9,483	70%
Total	13,464	100%
Material	Length	% of system
PVC	3,045	23%
DIP	10,419	77%
Total	13464	100%

5.3 Basis for System Evaluation

Development of engineering solutions required identifying the goals for the infrastructure based on standard engineering and wastewater operating principals. The following provides a brief discussion concerning the basis for evaluating and planning the District's improvements.

Planning Period

The planning period must be long enough to ensure the new facilities will be adequate for future needs, but short enough to ensure effective use during their economic life. The improvement plan for the selected alternative will be based on a twenty-year planning period. This time period represents a reasonable basis for predicting system demands from population changes and depreciation effects over this same time period. During the planning period, it is anticipated that additional information will be required to establish a design before implementing the improvement.

Design Life Cycle

The planning period is not necessarily the same as the infrastructure's life cycle. Many facilities will have life cycles that extend well beyond the planning period. Recommended life cycles for collection system components includes the following:

- Buried pipelines should have a life of 50 years or greater.
- Pumping stations should have a design life of 40 years, however mechanical and electrical equipment may only have a life cycle of 15 to 20 years.
- Instrumentation and control systems should have a life cycle of 10 years before new technologies should be considered.

System Operability

The conveyance system should allow for flexibility in operation and maintenance. Conveyance equipment design should be such that maintenance, both routine and emergency can be performed without creating an excessive manpower requirement. Flexibility is also required in the infrastructure's ability to meet daily and seasonal wastewater flow variations for the 20-year growth estimated by this plan.

Reliability

The reliability of the conveyance system depends on the conservative selection of equipment to ensure long life and minimal maintenance costs. Each pump or control element should be selected based on its capacity to meet design conditions for the 20 year planning period. Capabilities of the District's operation staff and the community emergency response system should also be considered. Systems that require a high degree of manual labor and specialized instrumentation or programming should be more carefully considered or avoided. The selection of equipment should also reflect the level of training and understanding of operations and maintenance personnel.

Durability

Conveyance systems should consist of materials and equipment that are capable of satisfactory performance over the entire design period for each system component. The selection of durable components is a matter of judgment based on such factors as the type and intensity of use, type and quality of materials used in construction, the quality of workmanship during the initial installation, and the expected maintenance to be performed during the life of the component.

Cost Benefit

The cost for new equipment and infrastructure should also be considered against the benefit of more or less robust systems. Considering the harsh environment of a wastewater collection system, a least cost option may place greater demands on the District operations during critical periods and result in a less reliable system or an unsatisfactory design life. At the same time, construction of facilities using only the highest of quality standards is often unnecessary. A "good" cost benefit balance involves engineering, operations, and management contribution.

5.4 Evaluation of Conveyance System

An analysis and evaluation of the GSD wastewater collection system was performed during the 2005 plan year. Efforts focused on modeling the collection system's current and future performance based on sewer flow data collected from the Flo-Dar installation, pump station data, and flow data from the Winston Green Regional WWTP.

Summary of Conveyance System Problem Areas

Overall, the GSD system is a relatively new collection system, well maintained, and in good condition. The system is tight with localized infiltration and inflow impacts associated with the most extreme wet weather events. With a few exception areas, the capacity of the gravity collection system was determined to be sufficient for projected peak day flows through out the 20-year planning period and for build-out in each sub basin. A summary of current and projected flows is provided in Figure 5.4.1.

Infiltration and Inflow

As shown in Figure 3.9.1, annual average flow for the GSD decreased at an annual rate of 3.2% per year. During the same time period, population growth has averaged over 4.0% per year. The downward trend in the AAF reflects the District's operational staff's success with implementing infiltration and inflow reduction projects during this time period.

During the next 20 years, it is anticipated that the collection system will continue to deteriorate as portions of the gravity system begin to reach their intended design life. Maintenance of facilities will likely increase unless a replacement schedule is developed and a budget established to allow implementation of just-in-time rehabilitation projects. A description of methodologies for evaluating and prioritizing repairs to the collection system are discussed later in this section. A proposed budget for a just-in-time rehabilitation program is addressed in Section 6.0.

Insert Figure 5.4.1

Capacity Limitations

As previously discussed, at actual build-out conditions, segments of the collection system are projected to exceed their hydraulic capacity depending upon the growth of infiltration and inflow. The impact of build-out flows and I/I on the capacity of each segment of the collection system is shown in Figure 5.4.2. Capacity limitations are projected for the following locations.

Problem Area 1
Between MH P-27 to MH P-14 approximately 128 lineal feet of 10-inch pipe requires upsizing to match down slope pipe size and capacity of the existing 15-inch pipe.

Problem Area 2
Between MH K-10 to MH K-4, approximately 1,433 lineal feet of 10-inch pipe installed at a low slope requires upsizing to 15-inch; and between MH K-4 and MH M-2 approximately 4,315 lineal feet of 15-inch pipe installed with segments at lower slopes requires upsizing to 18-inches; and between MH M-2 to G-4 Pump Station approximately 593 feet of 18-inch pipe installed at lower slope requires upsize to 21-inch. The project would also require replacement of the inverted siphon below MH M-2.

An alternative to correct problem area 2 is to construct a new pump station near MH K-10 and divert flows from the down slope sewers and the G-4 station into Basin A. With this alternative, approximately 1.2 MGD of flow from Basin I, Basin H, and a small portion of Basin K would be diverted to a new pump station (G-5), which would discharge into MH A-28. From MH A-28, approximately 2,300 lineal feet of new 12-inch sewer would be installed to replace the existing 8-inch sewer to MH A-1 (also known as the Lander's Lane system).

A cost evaluation for both alternatives will be provided in Section 6.

Problem Area 3
Between MH I-7 to MH K-11, approximately 1,617 lineal feet of 8-inch pipe was installed with two sections (320 lineal feet between segment MH I-7 and MH I-6 and 230 lineal feet between segment MH I-3 and MH I-1) at slopes near or less than the DEQ minimum allowable. The low slope segments are providing a restriction. This project may require upsizing the entire section to 10-inch or selective replacement of the two critical areas.

Additional areas of concern have been identified if expansion of the District occurs south of Highway 42/99 along Interstate 5 (see Figure 10). This area was identified by the District as an area of potential expansion. Modeling of wastewater inputs from the 420 to 500 acre area indicates that any significant contributions to Basins Q and P or to Basins F and N (basins tributary to the G-4 pump station) would exceed the capacity of these systems. To avoid a major upgrade to either or both trunk lines tributary to the G-4 pump station, the expansion area should be required to construct a new pumping facility. This facility would discharge into the trunk interceptor at MH C-27. The remaining capacity of the trunk interceptor potentially available for the expansion area is approximately 1.2 MGD, which is equivalent to the peak day flow contribution from 1,438 new residential units.

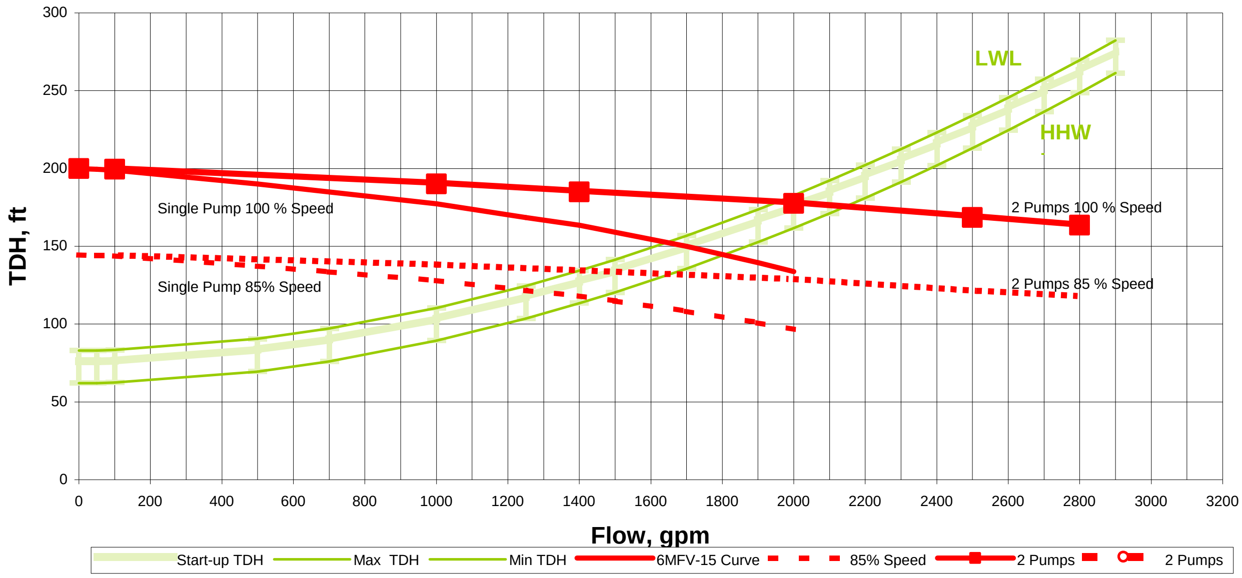
Insert Figure 5.4.2

G-4 Pump Station

Based on current experiences with surcharging in the G-4 tributary system and data collected during the pump station capacity analysis, it can be concluded that the G-4 station has reached its current pumping equipment capacity. An upgrade to the facility is required to satisfy DEQ requirements for pump station reliability criteria and to prevent sewage spills during wet weather events.

Changes to the operation strategy for the G-4 pump station are also required. The existing strategy involves throttling the pump output to promote wet weather storage in the tributary collection system. While this strategy has been successful in reducing the District's hydraulic demand at the WWTP, the need for full pumping rates has become, on occasion, critical. The system curve and pumping rates for the existing equipment are shown below in Figure 5.4.3. Based on the analyses of the pumping system, there are three options for upgrading the station.

FIGURE 5.4.3
G4 PS SYSTEM CURVE



Upgrade Option 1
The first alternative involves installing a third 100 Hp pump and operating two pumps at 2,000 gpm with the third pump on stand-by. Modeling of this alternative indicates the third 100 Hp pump will provide short-term benefits but within 5 years, the District will need to revisit the need for an upgrade. The benefits of this option include a relatively low cost to achieve compliance with DEQ redundancy criteria.

Upgrade Option 2
The second alternative involves increasing the pump motor sizes to 125 Hp. Under this scenario, the station output would increase to up to 2,500 gpm. Based on information from the District, it is believed that the electrical system for the station has been oversized and can accommodate the 125 Hp motors. Modeling of this scenario indicates that the capacity of the station would serve the

District for approximately 10 to 15 years once the G-5 station is completed. An electrical engineer should investigate the alternative before the District fully commits to this solution.

The benefits of Option 2 include the ability to increase the pumping capacity of the station without having a major electrical system upgrade. Costs for the project would, however, be more extensive than the previous option.

Upgrade Option 3
The final alternative is to increase the capacity of the electrical system to handle 150 Hp pumps. By using 150 Hp pumps, the District would increase the pumping rate up to 2,900 gpm, the maximum design rate for the existing 12-inch forcemain. This option represents the ultimate capacity of the G-4 station. Future upgrades to the G-4 station would not be anticipated. Achieving the ultimate capacity of G-4 will require an extensive electrical system upgrade involving new motor control centers, new VFDs, a new generator, and a new power service.

The benefits of Option 3 include investing in the ultimate capacity of the station now rather than at a later date.

Required G-4 Upgrades
Additional improvements required for all options considered for the G-4 station include the following:

- Installation of piping and valves for the third pumping unit
- Installation of a new magnetic flow meter on the 12-inch forcemain
- Installation of improved control equipment including a new PLC
- Replacement of the existing sump pump

5.5 Collections Monitoring Program

In order to monitor conditions in the collection system and develop and implement an ongoing infiltration and inflow reduction program, it is necessary to identify the following:

- Priorities of concern based on the age of the collection system components.
- The impact of high groundwater and rainfall on the collection system.
- Areas in the system with potential for limited hydraulic capacity.
- Areas in the system experiencing blockages or overflow problems.

The ongoing evaluation of the collection system performed by the GSD operational staff should involve the following inspections and investigative techniques:

7. Expansion of electronic database and record conversion
8. Manhole inspection
9. Smoke testing
10. Closed circuit televising inspection

11. Annual flow mapping studies
12. Flow monitoring data collection and analysis

Expansion of Electronic Database

The GSD has an extensive database including infrastructure mapping on electronic media. Modeling prepared for this project also provides a recorded benchmark of the system performance based on the data available for the study period. Both records should be maintained and updated as new information becomes available. The District should expand the electronic database into a GIS system that allows access to images of historical records, operational records, and data collected during future collection system investigations.

The county's inspection and photo records of the expansion of the collection system should be scanned into an electronic media. Hard copies of the reports should be considered for retention or disposal. Photo records of the construction should be integrated into the GIS database.

Methods for retaining records of physical inspections, smoke testing, flow mapping, and flow monitoring should be developed. Future engineering services contracts should include a requirement for the contractor to provide the District with electronic copies of any inspections performed on the District's facilities.

Physical Inspections

Records of sewer system inspections involving observing into a manhole should be recorded in an electronic database. Manhole inspections performed during routine activities should include examining the frame, cover, grade rings, joints between barrel sections, the base, and the pipe penetrations for sources of infiltration, the presence of roots, or deterioration. A standardized checklist form should be developed and carried in the vehicles of the operations staff to document their observations. Over the life of the facility, there should be multiple records of inspection reports for each manhole in the District.

Smoke Testing

There are several methods available for identifying I/I sources in sewer systems. One method, the smoke test, is a relatively inexpensive and quick method for detecting I/I sources (primarily inflow). Smoke testing involves the release of nontoxic smoke into a partitioned section of a sewer system. Visible smoke plumes will emanate from direct openings in the sewer. Ideally, smoke signs will only be observed rising from each house's vent. In practice, smoke signs appear from a variety of locations making this test particularly useful in identifying the following inflow sources:

- Combined storm sewer sections,
- Point source leaks in drainage paths or ponding areas,
- Yard and area drains,
- Roof drains,
- Abandoned building sewers,

- Open clean outs, and
- Faulty service connections.

Smoke testing was performed on portions of the District's collection system during September of 2004. Results of the smoke test identified potential I/I sources from several locations and repair recommendations were made for the obvious problem sites. These included:

- Plug or repair open cleanouts,
- Plug openings providing area drains,
- Disconnect roof drains discharging to sanitary laterals,

The District is very familiar with smoke testing and is conscientious of informing customers of these testing activities. A form letter has been prepared that notifies customers of the testing schedule, reason for testing, and the activities that can be expected to occur around the neighborhood. A similar letter is on file that informs customers of any problems relevant to the respective private property. The District policy of assisting customers implement the necessary repairs should be continued. A review of the policy and establishment of ground rules should be considered.

Recommended smoke testing activities should be scheduled according to the following:

Age of System	Annual Interval Between Smoke Testing
Known problem areas	Within 5 years
New Construction	End of 20 year period
New construction older than 20 years	Once every 15 years or less
Old construction (AC and concrete pipe)	Once every 10 years or less

A notebook and map of the testing areas, year of the test, and the locations of deficiencies in the District system should be prepared. Minor repairs to the system should be completed within one year unless a significant problem is encountered. Where major construction is required but an emergency is not warranted, the project should be added to the capital improvement plan and scheduled according to other project priorities.

Cleaning and Televising

Television inspection and cleaning of sewer mains is an essential collection system-monitoring and maintenance tool. Cleaning provides an effective method for removing excessive grease build-up and line blockages. The existing program implemented by the District should continue.

Videotape cassettes or DVD files, video logs, and written reports for each pipeline segment should be collected and stored in a database. Based upon an annual rate of 10,000 feet per year, the District would have a complete record of the system within the 20-year planning period. Any new sewers should be televised as a requirement of acceptance and the video record stored in the District's database. Problem areas should be inspected as frequently as required.

Flow Mapping Studies

Flow mapping studies have been used successfully by the District to evaluate the collection system, review the effectiveness of past repair projects, and to track the growth of I/I flows in problem areas. Each wet season the District should continue to implement a flow-mapping study in a few basins to identify the amount of I/I present in various sections of the collection system. Ideally, the flow monitoring studies should encompass the entire District within a 5-year time frame.

To maintain consistency in timing of the data, the District could establish a study start date based piezometer levels near the District's office or after a target amount of rainfall (i.e. 1 week after a significant rainfall event after 50-percent of the average rainfall in January has occurred).

Results from the annual flow mapping studies should be recorded on a map of the collection system. Any problem areas should be investigated further using CCTV or evaluated for repair using funds dedicated in a replacement budget category.

Flow Monitoring Studies

The District should continue monitoring flows in the collection system using the Flo-Dar instrumentation, which was purchased to collect data for this study. Candidate basins for Flow Dar deployment should be based on the areas where the majority of the AC pipe remains or areas where the GSD operational staff has identified problems. The duration of each installation should be extended to a minimum of three months during the wet season to capture multiple storm induced flow periods.

5.6 Typical System Deficiencies

Based on discussion with GSD operations staff, sources of I/I in the collection system have included poor lateral taps, leaky lateral pipelines, leaky pipe joints, and a few isolated structural defects and root intrusion. Similar problems are anticipated once the sewer system-monitoring program has been implemented. A summary of the types of problems repaired in the last few years is included below.

Major Line Failures

Major pipeline failures have not been observed within the system. Several severe inflow problems were identified and corrected on the creek under crossings.

Spot Failures

Spot failures can occur in many forms including circumferential cracks, holes in the pipe walls, areas of minor root intrusion, chipped and broken pipe joints, displaced or gapped joints, and joints with excessive deflection. Some areas of spot failure may exhibit signs of active or past I/I or downstream sections will have observable quantities of sand and gravel. Often, spot failures are candidates for rehabilitation using modern, highly cost effective, trenchless spot repair techniques. In the past, spot failures have been identified and corrected by the District using "In-liner Pipe".

Leaky Service Laterals

As is the case in many older collection systems, leaky service laterals in the sewer system are contributing sources of the GSD I/I. Laterals were investigated during the 2004 smoke test and a number of laterals were identified as problem areas. The problems appear to result from improper construction materials, aging, and/or installation methods. In several cases, laterals appeared to have been modified to serve as area drains. Service laterals not of PVC material should be scheduled for replacement in any future manhole-to-manhole lining project.

Heavy Grease Accumulations

Grease accumulation has not been a significant problem in the GSD system. The lack of significant grease accumulation generally indicates effective grease removal mechanisms on commercial establishments.

The removal of grease from the sewer system is important to the proper operation of the system because excessive accumulation of grease can lead to clogging, backflow, and flooding problems. Enforcement of the District's grease trap ordinances and ongoing inspections are a priority for the District. Annual cleaning of lines experiencing grease accumulation should also be considered as part of the District's routine maintenance program.

Leaky Manholes

Physical observations made during routine manhole inspections and subsequent smoke testing efforts identified a few manholes that allowed infiltration into the system. These manholes were repaired using a felt/polyester resin manhole lining system know as Poly triplex. This system provides a "like new" interior lining that adheres to the concrete and seals off leaks while providing a corrosion resistant surface. Manhole channels are not, however, covered by the Poly triplex system and in the more corrosive areas, may require a repair. The manufacturer of the Poly triplex system should be requested to provide a recommended repair method for manholes along the trunk interceptor in Basin B.

The district's current construction standard requires the use of HDPE manholes. This type of manhole is relatively new to the wastewater industry and may provide a superior structure to conventional concrete systems. Because the District is one of the first Oregon agencies using this type of manhole, inspections should be performed to evaluate how the manhole performs over the long term.

Root Intrusion

Root intrusion is believed to be the single largest cause of sewage spills in the United States. Uncontrolled, root intrusions will grow and eventually lead to massive root balls that clog sewers and destroy the pipe. Root controls such as Root – X and root routing followed by a spot repair liner (in massive root problem areas) should be periodically performed whenever a root problem is encountered. Laterals and mainline sections with frequent root intrusion problems should be scheduled for point repair.

5.7 Collection System Improvement Programs

Repair and rehabilitation of the sewer main lines and lateral connections will maintain or reduce the I/I levels currently present in the system. Based on the analysis performed in the preceding section, eventually the District will need to address capacity limitations induced by growth not I/I. Therefore, a major sewer rehabilitation project is not envisioned, but rather, smaller projects that are phased over several years as sewer monitoring and I/I flow mapping data indicate. The description of alternatives presented below is based on this approach.

Complete Pipe Replacement

Pipeline replacement by conventional "cut and cover" means is normally required when the existing pipeline is either undersized or deteriorated so badly that other methods of rehabilitation are not feasible. There are approximately 6,050 lineal feet of pipeline between MH K-10 and the G4 Pump Station and 128 lineal feet of pipeline between MH P-14 and MH P-27 that are predicted to be undersized by the end of the 20-year planning period. Replacement of these sewers with larger pipelines may be required unless other relief alternatives are determined to be more cost effective.

The obvious advantage of pipe replacement is the service life gained with modern materials and methods, which is generally accepted as more than 50 years. The cost of replacement, though, is generally higher than rehabilitation and the associated inconveniences and restoration required can be bothersome to the public. Replacing pipelines also removes any "incidental" I/I (i.e. minor leaks that would not individually be cost effective to remove). Complete replacement also provides the opportunity to correct any misalignments, increase the hydraulic capacity of the line, repair service connections, or eliminate storm water entry points such as catch basins. Complete replacement of a deteriorated pipe segment should therefore significantly reduce I/I especially if service laterals can be replaced to the property line. When rehabilitation of sewers using alternative "trenchless" methodologies is employed, replacement of lateral sewers by conventional construction is typically still required.

Cured In Place Pipe Rehabilitation

Cured in place pipe (CIPP) is best described as "manufacturing a new pipe within an existing pipe". A CIPP installation uses a plastic lined felt bag that has been impregnated with resins. The impregnated bag is lifted over an existing manhole and inverted (turned inside out) allowing the plastic exterior to be turned inward. The inner space of the bag is then filled with water to extend the inverted bag into the existing pipe. The weight of water drives the bag's inversion until the entire section of liner has been turned inside out and the end has been retrieved at the downstream manhole. Once the liner is in place, it is filled with water to force the resin-impregnated material against the interior surface of the existing sewer pipe. The water is then heated, causing the resins in the bag to cure and harden.

The use of CIPP lining is appropriate for pipelines requiring minor structural repair, sealing holes, leaky joints, and leaky misalignments and for correcting corrosion problems. Because this method of rehabilitation does not require excavations, it may be used under highways, railroads, and buildings. Openings for service lateral connections are typically made with special cutters and sealers from inside the pipe. The entire process typically requires less than 24-hours to complete for each manhole section lined. In larger sewer lines, the 24-hour time frame requires the use of bypass pumping equipment to convey flows around the work area. If properly completed, the service life of a cured-in-place pipe has been claimed by several lining manufacturers to be 50 years. In most cases, CIPP provides an economically preferable alternative to complete pipe replacement.

There is approximately 40,650 lineal feet of old (40 to 50 years) and an additional 33,100 lineal feet of aging (less than 40 years) AC pipe in the District's sewer system. In time, these sections of the sewer system may require manhole-to-manhole rehabilitation. Though not currently required, rehabilitation of these sewers could become necessary during the planning period if monitoring efforts reveal excessive or escalating amounts of I/I. If future monitoring and televising activities identify such problems and these problems are determined to originate from joints and/or lateral connection failures, then these sewer sections should be rehabilitated using CIPP. Section 5.8 presents a plan for "just in time" rehabilitation using CIPP.

Manhole Lining

Chemical grouting of manholes is recommended for the majority of smaller manhole repairs required within the District. Chemical grouts used for rehabilitation of sewers include acrylamide, acrylate, or urethane gels. Typical applications consist of two separate chemicals that are pumped through separate hoses to the joint or manhole being sealed. Once the two chemicals are mixed together they are pumped through the defect to the exterior of the structure where the mixture forms a gel or foam that expands around the defect and into the surrounding earth. Typical applications include one tank to mix and dispense the grout and another tank to mix and dispense a catalyst. Once mixed, the catalyst initiates a chemical reaction changing both liquids into a gel (grout). Depending upon the amount of catalyst utilized, the time required to form the grout can be adjusted from a few seconds to several minutes.

The latest and most promising application of grouting is the development of lateral packer. Lateral packers are similar to joint packers except that a packer gland is extended up the service line allowing the connection and several joints to be grouted in one application. Lateral packing can be used in conjunction with CIPP lining when only minor defects are observed at the connection.

Chemical grouting does not improve the structural strength of a pipeline or manhole, therefore this method of rehabilitation should not be used on facilities that are badly broken or deteriorated. If the groundwater table drops below the level of the pipe, the chemical grout may become dehydrated and its useful life shortened. Also, many chemical grouts do not have shear strength and will tear or fracture if a load is applied to the surrounding earth. When used appropriately, rehabilitation by chemical grouting should serve a useful life of ten years.

Manhole Repairs

The District should conduct yearly manhole inspections to identify if any major structural repairs or corrosion prevention are required. A goal of completing up to 80 inspections per year will allow the District to inspect all of the manholes in the system in just under 10 years. In the case of a major structural repair, the District should continue to use the poly triplex manhole lining system. In addition to manhole rehabilitation, it is recommended that the District continue to install manhole lid liners to seal manhole lids in potential inflow areas. It is recommended that the District stock lid liners for this purpose.

Internal Spot Repairs

There are two highly effective methods for performing internal spot repairs without requiring excavations. The two methods are Link-Pipe and ambient cured soft liners. Each method has its advantages.

Link-Pipe is a stainless steel grouting sleeve that is used to accomplish small spot repairs within a sewer line; these sleeves come in a variety of lengths—12, 18, 24 and 36 inches—and diameters ranging between four and 36 inches. Link-Pipe can be used to restore partially collapsed pipes, replace collapsed pipes, close holes created by material loss in pipe walls, and seal infiltrating cracked pipes and pipe joints. This method of rehabilitation requires no trenching and can be performed without bypassing water.

The second method of performing a spot repair is to install an ambient cure soft liner. This type of liner is very similar to CIPP except that the liner does not require an inversion system and the resin does not require an external heat source to harden. Spot repair liners are especially applicable when a section of pipe requires a repair over a few feet in length. Another advantage of an ambient cure liner is that it can be used to repair laterals with or without having to excavate at the mainline connection. A special feature of an ambient cure lateral liner was the invention of a 'top hat.' This mechanism can be inserted and used to seal the lateral connection at the main.

Lateral and Mainline Point Repairs

Mainline and service point repairs describe the installation of short sections of new sewer pipe or new lateral connections using conventional open cut construction techniques. These repairs will require excavation, pipe replacement, and reconnection. Lateral repairs will require installation of new sewer lateral piping and a new connection to the main.

5.8 Planned Rehabilitation Areas

During the end of the planning period, older pipelines within the District's system will reach their intended design life (50+ years). Based on the District's database, these segments include approximately 40,650 lineal feet of the collection system (currently estimated at 40 + years of age). The areas, listed in Table 5.8.1 and shown on Figure 5.8.1 on the following pages, are pipe segments that will exceed their 50-year life at the end of the planning period. These areas should be provided a more intensive monitoring program than other areas of the system. Implementation of the monitoring program described in Section 5.5 will allow documentation of these areas and if problems are observed, will allow scheduling rehabilitation activities as "just-in-time" capital improvements rather than as emergency responses.

It is important to note that the areas identified are not necessarily the only areas that will require monitoring or even rehabilitation. Other areas of the collection system should also be monitored and problems in newer portions of the sewer system could be encountered. The areas identified are, however, the oldest known components of the collection system and based on a 50-year design life are most likely to require some rehabilitation over the next 20 years. Based on this concept, a rehabilitation budget will be estimated to allow the District the means to collect reserve funds for potential rehabilitation projects in these areas. Because some of the pipe segments identified will exceed their design life and to avoid creating a hardship on existing rate payers, a 50% revenue requirement will be projected.

Table 5.8.1
Aging Areas in the Sewer System

Manhole Reach	Line Size	Length of Reach
K-11 to K-4	10-inch	1,981
F-1 to J-21	10-inch	1,259
P-27 to P-14	Scheduled for replacement	0
J-6 to K-4	15-inch	1,000
K-4 to O-2	15-inch	4,220
J 18.1 to J-18	6-inch	173
F-32 to F-1	8-inch	1,666
F-16 to F-7	8-inch	1,018
F-8 to F-1	8-inch	2,220
H-31 to H-1	8-inch	1,295
H-21 to H-19	8-inch	797
H-15 to H-11	8-inch	2,816
J-23 to J-22	8-inch	760
K-18 to K-11	8-inch	1,283
K-29 to K-2	8-inch	3,061
K-35 to K-21	8-inch	521
K-36 to K-4	8-inch	299
M-18 to M-10	8-inch	1,251
M-16 to M-12	8-inch	1,331
N-9 to N-1	8-inch	273
O-20 to O-6	8-inch	2,169
P-50 to P-27	8-inch	1,909
P-6.2 to P-6	8-inch	434
Q-15 to Q-1	8-inch	4,213
Q-24 to Q-15	8-inch	969
J-10 to J-6	8-inch	1,559
J-17 to J-7	8-inch	1,343
J-19 to J-7	8-inch	457
Total		40,277

6.0 Capital Improvement Plan

6.1 Basis of Capital Improvement Cost Estimates

The estimated construction costs in this Section are based on actual construction bidding results from similar work, published cost guides, and other construction cost experience. Reference was made to the available drawings of the existing facilities to determine construction quantities. Where required, estimates were based on preliminary layouts of the proposed improvements. Construction costs are based on the anticipation cost of construction starting in the year 2006.

Contingencies

A contingency factor equal to 20 percent of the estimated construction cost has been added. Recognizing the cost estimates are based on concepts only, allowances must be made for variations in final quantities, bidding market conditions, adverse construction conditions, unanticipated specialized investigations, and other difficulties which cannot be foreseen at this time but which may tend to increase final costs.

Engineering

The cost of engineering services for major projects typically include special investigations, a pre-design report, surveying, foundation exploration, preparation of contract drawings and specifications, bidding services, construction management, inspection, construction staking, start-up services, and the preparation of operation and maintenance manuals. Depending on the size and type of project, engineering costs may range from 15 to 25 percent of the contract cost when all of the above services are provided. The lower percentage applies to large projects without complicated mechanical systems. The higher percentage applies to small, complicated projects. The engineering costs for design and construction of the proposed project will average about 20 percent of the construction cost.

Legal and Administrative

An allowance of four percent of the construction cost has been added for legal and administrative services. This allowance is intended to include internal project planning and budgeting, project administration, liaison, interest on interim financing, legal services, review fees, legal advertising, and other related expenses associated with the project.

Construction Costs

Complete line, lateral, and manhole replacement costs have been based on itemized quantities and unit price estimates for line replacement, service lateral reconnections, manhole replacement, manhole connections, surface restoration, bypass pumping, traffic control, and testing.

Rehabilitation costs for CIPP, spot repair liners, and manhole repairs are based on manufacturer quotes for similar work scheduled during the 2006 construction year.

Additional costs have been included to account for contractor mobilization, demolition and site preparation, exploratory excavations for repairing lateral transition couplings, future televising of areas that should be completed prior to the project design and construction. A total itemized project cost for the recommended projects is provided at the end of this section.

6.2 Collection System Capital Improvements

The District's collection system was evaluated against standard engineering principles and included evaluation of the system wide hydraulic performance after limitations at the G-4 pumping facility have been removed. Modeling efforts focused on identifying future improvements that target relieving predicted hydraulic restrictions in the system as build-out occurs. Improvements are prioritized based on the anticipation that funding will be developed through the District's budgeting process. The recommended projects are shown in Figure 6.2.1. Project descriptions and costs are provided below.

G-4 Upgrade

Option 1 for the G-4 upgrade involves installation of a new pump rated at 100 Hp, a VFD, a PLC and ancillary electrical equipment to drive the machine. Other than a short period of time for the tie-in, the G-4 station can remain in service during the construction project. Cost estimates for the project are summarized in Table 6.2.1. Completion of this project will not increase the G-4 pumping capacity but will bring the system into compliance with DEQ redundancy requirements.

Table 6.2.1
Cost Estimate of G4 Upgrade w/ 100 HP Pump

Item	Description	Units	No.	Unit Cost	Subtotal
1	Temp Facilities & control	LS	All	$ 19,000	$ 19,000
2	Electrical Generator	LS	All	$ -	$ -
2	Pump & 100 Hp Motors	EA	1	$ 23,000	$ 23,000
3	VFD	EA	1	$ 12,000	$ 12,000
4	12" Plug Valve	EA	2	$ 3,400	$ 6,800
5	12" Spool	LF	7	$ 250	$ 1,750
6	10" Reducer	EA	1	$ 1,500	$ 1,500
7	Pressure Assembly	EA	2	$ 1,000	$ 2,000
8	8" Reducer	EA	1	$ 1,500	$ 1,500
9	12" Check Valve	EA	1	$ 8,000	$ 8,000
10	New Flow Meter Assembly	LS	All	$ 19,000	$ 19,000
11	Sump Pump	LS	All	$ 1,500	$ 1,500
12	By Pass Pumping	Day	1	$ 2,500	$ 2,500
13	Electrical Upgrades	LS	All	$ 20,000	$ 20,000
14	Demolition	LS	All	$ 2,000	$ 2,000
15	PLC Instrumentation	LS	All	$ 25,000	$ 25,000
	Construction Subtotal				$ 145,550
	Contingency	20%			$ 29,000
	Engineering	22%			$ 32,000
	Administration	4%			$ 6,000
Project Total					$ 212,550

Insert Figure 6.2.1

Option 2 for the G-4 station involves replacing all of the pumping equipment with 125 Hp units. The project also includes installation of a VFD, a PLC and ancillary electrical equipment to drive the machinery. Other than a short period of time for the tie-in of the third pump, the G-4 station can remain in service during the construction project.

Cost estimates for the project are summarized in Table 6.2.2. Completion of this project will increase the G-4 pumping capacity to 2,500 gpm and will bring the system into compliance with DEQ redundancy requirements. Based on the increase in flow capacity from 1600 gpm to 2500 gpm the portion of the project cost eligible for SDC reimbursement is 36-percent.

Table 6.2.2 Cost Estimate of G4 w/ 125 Hp Motor Upgrade					
Item	Description	Units	No.	Unit Cost	Subtotal
1	Temp Facilities & control	LS	All	$ 26,000	$ 26,000
2	Electrical Generator	LS	All	$ -	$ -
3	New pump	EA	1	$ 12,000	$ 12,000
4	125 Hp Motors	EA	3	$ 15,000	$ 45,000
5	12" Plug Valve	EA	2	$ 3,400	$ 6,800
6	12" Spool	LF	7	$ 250	$ 1,750
7	10" Reducer	EA	1	$ 1,500	$ 1,500
8	Pressure Assembly	EA	2	$ 1,000	$ 2,000
9	8” Reducer	EA	1	$ 1,500	$ 1,500
10	12" Check Valve	EA	1	$ 8,000	$ 8,000
11	New Flow Meter Assembly	LS	All	$ 19,000	$ 19,000
12	Sump Pump	LS	All	$ 1,500	$ 1,500
13	By Pass Pumping	Day	2	$ 2,500	$ 5,000
14	Electrical Upgrades	LS	All	$ 43,000	$ 43,000
15	Demolition	LS	All	$ 2,500	$ 2,500
16	PLC Instrumentation	LS	All	$ 25,000	$ 25,000
	Subtotal				$ 200,550
	Contingency	20%			$ 40,000
	Engineering	22%			$ 44,000
	Administration	4%			$ 8,000
Project Total					$ 292,550

Option 3 for the G-4 station involves replacing all of the pumping equipment with 150 Hp units and providing a complete electrical system upgrade. The project also includes installation of the third VFD, a PLC and ancillary electrical equipment to drive the machinery. Due to the need to take the electrical load off of the equipment during the construction, a long-term bypass period is anticipated, as the G-4 power supply will be taken down.

Cost estimates for the project are summarized in Table 6.2.3. Completion of this project will increase the G-4 pumping capacity to 2,900 gpm, will bring the system into compliance with DEQ redundancy requirements, and will utilize the ultimate capacity of the facility and existing forcemain. Based on the increase in flow capacity from 1600 gpm to 2900 gpm the portion of the project cost eligible for SDC reimbursement is 45-percent.

Table 6.2.3 Cost Estimate of G4 Upgrade w/ 150 HP Pumps					
Item	Description	Units	No.	Unit Cost	Subtotal
1	Temp Facilities & control	LS	All	$ 65,000	$ 65,000
2	Electrical Generator	LS	All	$ 120,000	$ 120,000
3	Pumps & 150 Hp Motors	EA	3	$ 35,000	$ 105,000
4	12" Plug Valve	EA	2	$ 3,400	$ 6,800
5	12" Spool	LF	7	$ 250	$ 1,750
6	10" Reducer	EA	1	$ 1,500	$ 1,500
7	Pressure Assembly	EA	2	$ 1,000	$ 2,000
8	8" Reducer	EA	1	$ 1,500	$ 1,500
9	12" Check Valve	EA	1	$ 8,000	$ 8,000
10	New Flow Meter Assembly	LS	All	$ 19,000	$ 19,000
11	Sump Pump	LS	All	$ 1,500	$ 1,500
12	By Pass Pumping	Day	20	$ 2,500	$ 50,000
13	Electrical Upgrades	LS	All	$ 79,000	$ 79,000
14	Demolition	LS	All	$ 15,000	$ 15,000
15	PLC Instrumentation	LS	All	$ 25,000	$ 25,000
	Subtotal				$ 501,050
	Contingency	20%			$ 100,000
	Engineering	22%			$ 110,000
	Administration	4%			$ 20,000
Project Total					$ 731,050

Recommended G-4 Project

Based on the comparison of pumping capacity and cost, it is recommended that the District implement project Option 2. The capital improvement plan will reflect completion of the G-4 upgrade in Plan Year 2 (2007). The 36-percent capacity gain provided by this project allows the use of SDC funds in the amount of $ 73,140.

Collection System Upgrades

As discussed in Section 5, the gravity sewer between MH P–27 and MH P-14 requires upsizing from 10-inches to 15-inches. This project provides an increase in the system capacity by over 50 percent. Based on this increase in flow capacity, the project could be eligible for up to 50-percent SDC funding. A cost estimate of the project is provided in Table 6.2.4 on the following page. The capital improvement plan will reflect completion of the project in Plan Year 5 (2010).

Table 6.2.4 Cost Estimate of MH P-27 to MH P-14 Replacement Project					
Item	Description	Units	No.	Unit Cost	Subtotal
1	Temp Facilities & control	LS	All	$ 4,000	$ 4,000
2	15-inch Sewer	LF	128	$ 125	$ 16,000
3	Roadway Repair	LF	128	$ 25	$ 3,200
4	Manhole Connections	EA	2	$ 1,000	$ 2,000
5	Lateral Tie-ins	EA	1	$ 2,750	$ 2,750
6	Demolition of Existing	LF	128	$ 15	$ 1,920
7	Clean Out	EA	1	$ 750	$ 750
	Subtotal				$ 30,620
	Contingency	20%			$ 6,000
	Engineering	20%			$ 6,000
	Administration	4%			$ 1,000
Project Total					$ 43,620

The second problem area requiring modification to the collection system includes replacement of the sewer line between MH K-10 and the G-4 station or installation of a new pump station, G-5. Upon closer examination of the two projects, the replacement sewer will force the District to implement the third G-4 upgrade project. We have therefore evaluated the two options with the replacement sewer including a handicap of $ 500,000 (i.e. the difference between the two G-4 upgrade projects). Cost estimates for each project are included in Tables 6.2.5 and 6.2.6, respectively.

Table 6.2.5 Alternative 1: Cost Estimate of K-10 to G-4 Pipeline Replacement Project					
Item	Description	Units	No.	Unit Cost	Subtotal
1	Temp Facilities & control	LS	All	$ 294,000	$ 294,000
2	15-inch Gravity Sewer	LF	1433	$ 110	$ 157,630
3	18-inch Gravity Sewer	LF	4315	$ 135	$ 582,525
4	21-inch Gravity Sewer	LF	593	$ 150	$ 88,950
5	New Inverted Siphon	LF	83	$ 1,000	$ 83,000
6	Roadway Repair	LF	2,000	$ 45	$ 90,000
7	Native Restoration	LF	4,340	$ 15	$ 65,100
8	Manhole Connections	EA	60	$ 1,000	$ 60,000
9	Lateral Tie-ins	EA	300	$ 2,750	$ 825,000
10	Demolition of Existing	LF	2300	$ 10	$ 23,000
11	Clean Out	EA	300	$ 750	$ 225,000
12	G-4 Pump Station Upgrade	LS	All	$ 500,000	$ 500,000
	Subtotal				$ 2,994,205
	Contingency	20%			$ 600,000
	Engineering	20%			$ 600,000
	Administration	4%			$ 120,000
Project Total					$ 4,314,205

Table 6.2.6 Alternative 2: Cost Estimate of G-5 PS					
Item	Description	Units	No.	Unit Cost	Subtotal
1	Temp Facilities & control	LS	All	$ 252,000	$ 252,000
2	12-inch Gravity Sewer	LF	2,300	$ 110	$ 253,000
2	New 8-inch forcemain	LF	6,600	$ 90	$ 594,000
3	Roadway Trench Patch	LF	5555	$ 30	$ 166,650
4	Native Restoration	LF	3345	$ 15	$ 50,175
5	Manhole Connections	EA	24	$ 1,000	$ 24,000
6	Lateral Tie-ins	EA	46	$ 2,750	$ 126,500
7	Demolition of Existing	LF	2,300	$ 10	$ 23,000
8	Clean Out	EA	46	$ 750	$ 34,500
9	G-5 Pump Station	LS	All	$ 450,000	$ 450,000
	Subtotal				$ 1,973,825
	Contingency	20%			$ 394,800
	Engineering	20%			$ 394,800
	Administration	4%			$ 79,000
Project Total					$ 2,842,425

For the gravity replacement sewer and the new G-5 pump station, the project total is estimated at $4.3 million and $ 2.8 million, respectively. Based on the significantly lower cost for the second alternative, the G 5 pump station project is recommended for the Capital Improvement Plan. The project implementation year for the CIP is proposed at Plan Year 10 (2015). Based on the ability to double the local system capacity and increase the allowance for additional pumping at G-4 by an equivalent amount, approximately 50-percent.

The third problem area is the replacement sewer between MH I-7 and MH I-6 and the sewer between MH I-3 and MH I-1. Rather than replace the entire run of sewer between MH I-7 and MH I-1, the recommended project will only upsize the two areas with the critical slope. This improvement will result in flow passing from 8-inch pipe through 10-inch pipe then back to 8-inch pipe in two locations. While these conditions are not ideal, they can only be avoided by a significant capital improvement project that would have a low cost benefit ratio. The replacement of the two line segments is therefore the recommended project. A summary of the project cost estimate is provided in Table 6.2.7 on the following page. Based on the potential to increase the capacity in the two line segments, approximately 33 percent of the project would be eligible for SDC reimbursement. Construction of the recommended project is scheduled for Plan Year 10 of the CIP.

Table 6.2.7 Cost Estimate of MH I-7 to MH I-1 Replacement Project					
Item	Description	Units	No.	Unit Cost	Subtotal
1	Temp Facilities & control	LS	All	$ 18,000	$ 18,000
2	10-inch Sewer	LF	538	$ 100	$ 53,800
3	Roadway Repair	LF	538	$ 45	$ 24,210
4	Manhole Connections	EA	4	$ 1,000	$ 4,000
5	Lateral Tie-ins	EA	4	$ 2,750	$ 11,000
6	Demolition of Existing	LF	538	$ 15	$ 8,070
7	Clean Out	EA	10	$ 750	$ 7,500
	Subtotal				$ 126,580
	Contingency	20%			$ 25,300
	Engineering	20%			$ 25,300
	Administration	4%			$ 5,000
Project Total					$ 182,200

6.3 Sewer Rehabilitation Projects

Based on the age of portions of the sewer system, it is anticipated that sewer rehabilitation will be required during the planning period. Segments scheduled for rehabilitation are based on CIPP lining with lateral replacement to the edge of right of way. The CIP budget for rehabilitating portions of the sewer on a "just-in-time basis" is based on the improvement areas shown in Figure 5.8.1. A preliminary cost estimate for the rehabilitation program is provided in Table 6.3.1.

Table 6.3.1 Cost Estimate of Rehabilitation Projects					
Item	Description	Units	No.	Unit Cost	Subtotal
1	Temp Facilities & control	LS	All	$ 500,000	$ 500,000
2	8-inch CIPP	LF	18,000	$ 35	$ 1,107,504
3	10-inch CIPP	LF	18,000	$ 45	$ 145,800
4	15-inch CIPP	LF	18,000	$ 75	$ 391,500
5	Roadway Repair	LF	8,890	$ 15	$ 133,350
6	Lateral Reinstatement	EA	445	$ 250	$ 111,250
7	Lateral Tie-ins	EA	445	$ 2,750	$ 1,223,750
8	Clean Out	EA	445	$ 750	$ 333,750
	Subtotal				$ 3,813,554
	Contingency	20%			$ 763,000
	Engineering	18%			$ 686,000
	Administration	4%			$ 152,500
Project Total					$ 5,415,000

Considering the cost of rehabilitation, the anticipated growth within the District, and the potential for significant portions of the aging sewer lines to achieve a useful life beyond their 50-year projection, it is reasonable for the District to plan on funding a portion of the total projected rehabilitation cost. Based on discussions with the District staff, a budgetary target of 50 percent of the projected rehabilitation budget will be utilized, making the total present worth of the rehabilitation projects $ 2,707,500. For purposes of projecting cash flow requirements, project scheduling is based on 5-year increments. Actual expenditures will occur as projects are identified and as reserve funds allow.

6.4 Summary of Capital Improvement Plan

Based on the project recommendations listed above, the Capital Improvement Plan and an implementation schedule are provided in Table 6.4.1. Included in the table is the revenue component collected from systems development charges and from rate structuring.

Table 6.4.1
Capital Improvement Plan

Project Description	CIP Year	Cost	SDC Capacity Component	Replacement Component
G-4 Upgrade Project	2	$ 292,000	$ 105,120	$ 186,880
MH P-27 Replacement Project	5	$ 43,000	$ 21,500	$ 21,500
Pump Station G-5 Project	15	$ 2,840,000	$1,420,000	$ 1,420,000
MH I-7 Replacement Project	20	$ 182,000	$ 60,000	$ 122,000
Total CIP		$ 3,357,000	$ 1,592,630	$ 1,742,380
Annual CIP Revenue Required[1]			$ 135,400	$ 117,600
Sewer Rehabilitation [1]			N / A	$ 198,600
Total			$ 135,400	$ 316,200

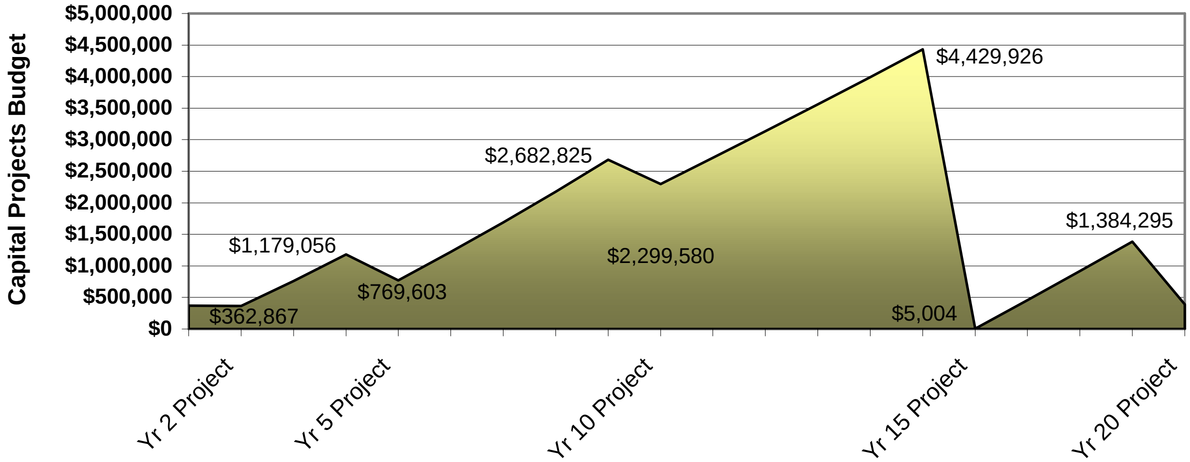
[1]Annual revenue requirements are based on 3% per year inflation and average revenue collected over the 20-year period.

Based on the growth projections for the GSD customer base, over the 20-year planning period an additional 2,117 new EDUS will be added to the system. On average, this equates to a total of 108 new users per year. In order for the District to provide system capacity for these new users, the capacity building component of the SDC should be increased by $ 1,190 per EDU.

The replacement cost including the sewer rehabilitation project will need to be funded by existing and new ratepayers who are connected to the system. Therefore, an average rate increase of $ 6.00 per month per EDU is recommended.

Funds collected from SDCs and the proposed rate increase should be allowed to accumulate until each project in the CIP is funded. A cash flow diagram for the proposed CIP is provided below in Figure 6.4.1. This figure shows how funds will be accumulated before each of the projects is implemented according to the schedule in Table 6.4.1. The projected monetary amounts include a yearly net inflationary factor of 3 percent from the present work cost for each of the projects.

FIGURE 6.4.1
CASH FLOW DIAGRAM



7.0 Financing

7.1 Grant and Loan Programs

Some level of outside funding assistance in the form of grants or low interest loans can help assure that the proposed improvement projects are affordable to residents of the Green Sanitary District. The amount and types of outside funding will dictate the amount of local funding that the District will have to secure. In evaluating grant and loan programs, the major objective is to select a program, or a combination of programs, which are most applicable and available to the intended project.

A brief description of the major Federal and State funding programs, which are typically utilized to assist qualifying communities in the financing of improvement programs, is given below. Each of the government assistance programs has its own particular prerequisites and requirements. These assistance programs promote such goals as aiding economic development, benefiting areas of low to moderate-income families, and providing for specific community improvement projects. Not all communities or projects may qualify for all programs.

The Oregon Economic and Community Development Department (OECDD) is an excellent source of funding to help finance public improvements. The OECDD has three separate programs offering funding assistance, including Community Development Block Grants (OCDBG), the Special Public Works Fund, and the Water/Wastewater Financing Program.

Another excellent source of public infrastructure funding is from federal funds available through the U.S. Department of Agriculture, through its Rural Utility Services section part of Rural Development (RD). The Rural Utilities Service administers the water and wastewater loan and grant program.

Below are more detailed summaries of the funding programs.

Rural Utilities Service (RUS), Water and Waste Disposal Loans and Grants

Rural Utilities Service (RUS) has the authority to make loans to public bodies and non-profit corporations to construct or improve essential community facilities, including water and wastewater systems. Grants are also available to applicants who meet the median household income (MHI) requirements. While eligible applicants must have a population less than 10,000, priority is given to public entities in areas smaller than 5,500 people. Preference is also given to requests, which involve the merging of small facilities and those serving low-income communities, as well as communities that have existing violations.

In addition, borrowers must meet the following stipulations:

- Be unable to obtain needed funds from other sources at reasonable rates and terms.
- Have legal capacity to borrow and repay loans, to pledge security for loans, and to operate and maintain the facilities or services.
- Be financially sound and able to manage the facility effectively.
- Have a financially sound facility based on taxes, assessments, revenues, fees, or other satisfactory sources of income to pay all facility costs including O&M, and to retire the indebtedness and maintain a reserve.
- Loan and grant funds may be used for the following types of improvements:
- Construction costs.
- Legal and engineering costs connected with the development of facilities.
- Other costs related to the development of the facility including the acquisition of right-of-way and easements, and the relocation of roads and utilities.
- Finance facilities in conjunction with funds from other agencies or those provided by the applicant.

The loans have a 30-year term with no pre-payment penalties and the reserve can be funded at 10 percent per year over a ten-year period. Interest rates are set quarterly and are based on current market yields for municipal obligations.

Market Rate*:*
In service areas where the MHI is more than $34,608, applicants pay the market rate (Oregon non-metropolitan MHI in 2003).

Intermediate Rate:

The intermediate rate applies to projects in communities that are not eligible for the poverty rate and have a median household income of less than 100% of the non-urban or state median household income. The intermediate interest rate is set halfway between the poverty line interest rate and the market rate.

Poverty Line Rate:
The poverty line rate of 4.5% per annum applies to communities with a median household income below the state poverty level or 80% of the non-urban population. There must be a health standard violation to receive the poverty loan rate.

Table 7.1.1 Maximum Grant Funding from RUS	
Median Household Income (MHI)	Maximum Grant
< $27,686	75% of eligible project cost
$27,686 to $34,608	45% of eligible project cost
> $34,608	0% of eligible project cost

Eligibility for the RD grants and loans are currently based on the MHI data for the Green Urban Unincorporated Area, which, based on 2000 Census data, is $ 35,660. At this MHI, the District may not be eligible for grant funding or a loan offering at less than the market rate, however, a determination of grant and loan eligibility should be made by the local RUS representative.

If the GSD is determined to be grant eligible, grant funds cannot be used to reduce total user costs below that of comparable communities funded by RUS. The current average rate for wastewater systems receiving RUS funding is approximately $50 per month (in 2002 the average rate for communities funded by RUS was $28). Therefore, the District would also need to raise current sewer rates before grant funds could be made available under this program.

There are other restrictions and requirements associated with RUS loans and grants. If the District becomes eligible for grant assistance, the grant will apply only to eligible project costs. Grant funds are only available after the District has incurred long-term debt resulting in an annual debt service obligation equal to one-half percent of the MHI. In addition, the RUS funds are limited by an annual funding allocation. To receive a RUS loan, the District must secure bonding authority, usually in the form of general obligation or revenue bonds.

Technical Assistance and Training Grants (TAT)

Available through the USDA Rural Utilities Service (RUS) as part of the Water and Waste Disposal programs, TAT grants are intended to provide technical assistance and training to associations on a wide range of issues relating to the delivery of water and waste disposal services.

Rural communities with populations of less than 10,000 persons are eligible along with private, nonprofit organizations that have been granted tax-exempt status by the IRS.

TAT funds may be used for the following activities:

- Identify and evaluate solutions to water and/or waste related problems of associations in rural areas.
- Assist entities with preparation of applications for Water and Waste Disposal loans and grants.
- Provide training to association personnel in order to improve the management, operation and maintenance of water and/or waste disposal facilities.

- Pay expenses related to providing the technical assistance and/or training.

Grants may be made for up to 100 percent of the eligible project costs. Applications are filed with any USDA Rural Development office. For additional information on RDA loans and grant programs call 1-541-673-0136 or visit the RUS website at http://www.usda.gov/rus/water/.

Oregon Community Development Block Grant (OCDBG) Program

The Community Development Program section of the Oregon Economic and Community Development Department (OECDD) administers the OCDBG Program. Funds come from the U.S. Department of Housing and Urban Development (HUD) and, under the Public Works category, are targeted to water and wastewater systems. OCDBG grants are available for each of three (3) phases necessary to complete water and/or wastewater system improvements.

- Phase 1: Planning and Preliminary Engineering.
- Phase 2: Final engineering, financial analysis, and environmental review.
- Phase 3: Construction.

Total public works project grants are limited to $750,000 for the combined total of all phases. Grants awarded may be used for the following public works applications:

Projects that are necessary to bring municipal water and sewer systems into compliance with:

- The requirements of the Safe Drinking Water Act or the Clean Water Act administered by the Oregon Health Division (OHD)
- The requirements of water quality statutes, rules or permits administered by the Oregon Department of Environmental Quality (DEQ) or the Environmental Quality Commission (EQC)
- Projects where the municipal system has not been issued a notice of non-compliance from the Oregon Health Division or the Department of Environmental Quality. The department may determine that a project is eligible for assistance if there is a high probability that within two years the system will be notified of non-compliance and it is reasonable and prudent to use program funds to bring the water or sewer system into compliance with current regulations or requirements proposed to take effect within the next two years.

Applications may be submitted year-round for Public Works grants under the OCDBG Program. To be eligible, a District must have at least 51 percent residents with low or moderate incomes, based on the 2000 Census data or local survey. If eligible, Douglas County would need to sponsor and administer the block grant.

OECDD, Special Public Works Fund

The Special Public Works Fund (SPWF) Program provides financing to local governments to construct, improve, and repair infrastructure in order to support local economic development and create new jobs, especially family wage jobs.

In order to be eligible, the following conditions must be satisfied.

- The existing infrastructure must be insufficient to support current or future industrial or eligible commercial development.

- There must be a high probability that family wage jobs will be created or retained within: 1) the boundary to be served by the proposed infrastructure project, or 2) industrial or eligible commercial development of the properties served by the proposed infrastructure project.

The Oregon State Legislature, through bond sales for dedicated project funds, through loan repayments and other interest earnings, capitalizes the SPWF program through biennial appropriations from the Oregon Lottery Economic Development Fund.

The following criteria are used to demonstrate project eligibility.

- Firm Business Commitment: In addition to creating or retaining permanent jobs as a result of the project, there must be private and/or public investment in the project equal to at least twice the SPWF funding.

- Capacity Building: The applicant is required to document: 1) recent interest benefited by the project, 2) there are ongoing efforts to market the area, and 3) the project will promote future economic development and creation of jobs.

All projects must principally benefit industrial or eligible commercial users. The Department will structure a financing package that may include loans and/or grants. Determination of the final amount of financing and the loan/grant/bond mix will be based on the financial feasibility of the project, the individual credit strength of an applicant, the ability to assess specially benefited property owners, the ability of the applicant to afford annual payment on loans from enterprise funds or other sources, future beneficiaries of the project, and other applicable issues as set by the OECDD.

Maximum SPWF loan per project is $10 million, if funded from SPWF revenue bond proceeds. Projects financed directly from the SPWF may receive up to $1 million. Interest rates are currently estimated at 6.0 percent and are set quarterly by the Department; loan terms cannot exceed twenty-five (25) years. The maximum SPWF grant is $500,000 for a construction project and is not to exceed 85 percent of the total project cost. Grants are made only when loans are not feasible.

OECDD, Water/Wastewater Financing Program

The Water/Wastewater Financing Program was created to assist communities that must meet Federal and State mandates to provide safe drinking water and adequate treatment and disposal of wastewater. The 1993 Legislature created a Water Fund through Senate Bill 81 to provide financing to local governments to construct and improve public drinking water systems. The legislation was primarily intended to assist local governments in meeting the Safe Drinking Water Act and the Clean Water Act. The Oregon State Legislature capitalizes the funding for the program through a biennial appropriation from the Oregon Lottery Economic Development Fund. Program eligibility is limited to projects necessary to ensure compliance with the applicable State regulatory agency standards or rules.

While loans and grants may be awarded, grant funding must be accompanied by loans from the Community Development Program. Loans are based on a municipality's ability to repay. Grant funding is available only if a loan is not feasible. The OECDD will structure a financing package that may include direct loans, bond loans, and/or grants and may include funds from other Community Development programs for which the project is eligible. The mix of loan/grant/bond financing will depend on the financial feasibility of the project and will consider utility rates, per capita income, existing debt, and other factors.

Financing limits are as follows:

Projects financed with bond funds

- Loans- max. $10 million
- Grant - max. $500,000

Projects financed with Water/Wastewater Funds

- Loan - max. $500,000
- Grant – max. $500,000

Technical Assistance (for eligible applicants under 5,000 population)

- Loan - max. $20,000
- Grant - max. $10,000

Interested applicants should contact the OECDD prior to submitting an application. Applications are accepted year-round. For additional information on this and other OECDD programs call 1-800-233-3306 or visit the OECDD website at http://www.econ.sate.or.us/wtrww.htm

Department of Environmental Quality, State Revolving Fund (CW SRF)

The Clean Water State Revolving Fund (CW SRF) Program is administered by the Department of Environmental Quality (DEQ) and was developed to replace the EPA Construction Grants Program. The SRF is a loan program that provides low interest rate loans, instead of grants, for the planning, design, and construction of water pollution control facilities.

Interest rates on all design and/or construction loans are two-thirds of the current municipal bond rate during the quarter that the loan agreement is signed. In addition, an initiation fee (1.5 percent of the loan amount) and a servicing fee (0.5 percent of the outstanding balance are also assessed to cover program administration by DEQ. As an example, the interest rate for design or construction loans signed in March of 1999 was 3.33%. The interest rate for facility planning was 2.50%. The interest rates change quarterly based on the national average municipal bond rate. Loans can be in the form of general obligation bonds or other rated debt obligations, revenue secured loan, or a discretionary loan.

An applicant must follow three steps in applying for an SRF Loan:

- Submit a preliminary application within 30 days of receipt from DEQ.
- Secure placement on the Intended Use Plan Priority List. Prospective projects are ranked, and only those on the Priority List are eligible for loans.
- Submit a final application.

SRF funds are allocated based on a prioritization process. Based on the preliminary applications, projects are assigned points and ranked in priority order based on:

- Severity of water quality/health hazard problem;
- receiving water body sensitivity; and
- population served by the project.

The Intended Use Plan is one part of Oregon's annual SRF capitalization grant application. This plan includes lists of eligible projects ranked in priority order. When projects have been allocated funds, they are placed in the Funded List. Projects that are not funded remain on the Planning List to receive funds if any of the funded list projects do not complete the loan process. Projects identified on the funded list from prior years, which have not been initiated, are placed on a Supplemental List.

For additional information on this and other DEQ programs, call 1-800-452-4011 or visit the DEQ website at http://waterquality.deq./state.or.us.

7.2 Local Funding Sources

Local revenue sources for capital expenditures include ad valorem taxes, various types of bonds, sewer service charges, connection fees, and system development charges. Local revenue sources for operating costs include ad valorem taxes and wastewater service charges. The amount and type of local funding obligations required for sewer system improvements will depend, in part, on the amount of grant funding anticipated and the requirements of potential loan funding. The following sections identify local funding sources and financing mechanisms that are most common and appropriate for the improvements in this study.

The municipal bond market is the source of most loans for municipalities in the United States, including Oregon. The municipal bond market will purchase one of two types of bonds from the

District — a general obligation bond or a revenue bond. The two types of bonds differ in how the District chooses to repay the loan, and are discussed in more detail below.

General Obligation Bonds

General obligation (G.O.) bonds are backed by the District's full faith and credit, as the District pledges to assess property taxes sufficient to pay the annual debt service. This tax is exempt from the State's constitutional limit of $10/$1,000 of assessed value. The District may, at its discretion, use any other source of revenue, including wastewater rate revenues, to repay the bonds. If it uses these other sources, it then reduces the amount to be collected from taxes.

Oregon Revised Statutes limit the maximum bond term to 30-years for districts. Except in the event that RD will purchase the bonds, the realistic term for which G.O. bonds should be issued is fifteen (15) to twenty (20) years. Under the present economic climate, the lower interest rates will be associated with the shorter terms.

Financing of wastewater system improvements by G.O. bonds is usually accomplished by the following procedure:

1. Determination of the capital costs required for the improvement.

2. An election by the voters to authorize the sale of bonds.

3. The bonds are offered for sale.

4. The revenue from the bond sale is used to pay the capital costs associated with the project(s).

General Obligation bonds are preferable to revenue bonds in matters of simplicity and cost of issuance. Since the bonds are secured by the power to tax, these bonds usually command a lower interest rate than other types of bonds. General obligation bonds lend themselves readily to competitive public sale at a reasonable interest rate because of their high degree of security, their tax-exempt status, and public acceptance.

These bonds can be revenue-supported wherein a portion of the user fee is pledged toward payment of the debt service. Using this method, the need to collect additional property taxes to retire the bonds is eliminated. Such revenue-supported G.O. bonds have most of the advantages of revenue bonds, plus lower interest rate and ready marketability. General obligation bonds are normally associated with the financing of facilities, which benefit an entire community and must be approved by a majority vote.

The disadvantage of G.O. bond debt is that it is often added to the debt ratios of the underlying municipality, thereby restricting the flexibility of the municipality to issue debt for other purposes. Furthermore, G.O. bond authorizations must be approved by a majority vote and often necessitate extensive public information programs.

Revenue Bonds

For revenue bonds, the District pledges the net operating revenue of the utility to repay the bonds. The primary source of the net revenue is user fees, and the primary security is the District's pledge to charge user fees sufficient to pay all operating costs and debt service. The lender requires the District to provide two additional securities for the revenue bonds that are not required by a G.O. bond. First, the District must establish a bond reserve fund equal to the lesser of maximum annual debt service or 10% of the bond amount. Second, the District must increase user fees such that net cash flow from operations plus interest earnings are equal to or greater than 125% of annual debt service, known as a 1.25 debt coverage ratio.

The general shift away from ad valorem property taxes and toward a greater reliance on user fees makes revenue bonds a frequently used option for payment of long term debt. Many communities prefer revenue bonding, because it insures that no tax will be levied. In addition, debt obligation will be limited to system users since repayment is derived from user fees. An advantage with revenue bonds is that they do not count against a municipality's direct debt, but instead are considered "overlapping debt". This feature can be a crucial advantage for a municipality near its debt limit. Rating agencies evaluate closely the amount of direct debt when assigning credit ratings. Revenue bonds also may be used in financing projects extending beyond normal municipal boundaries. These bonds may be supported by a pledge of revenues received in any legitimate and ongoing area of operation, within or without the geographical boundaries of the issuer.

Successful issuance of revenue bonds depends on the bond market evaluation of the revenue pledged. Revenue bonds are most commonly retired with revenue from user fees. Recent legislation has eliminated the requirement that the revenues pledged to bond payment have a direct relationship to the services financed by revenue bonds. Revenue bonds may be paid with all or any portion of revenues derived by a public body or any other legally available monies. If additional security to finance revenue bonds is needed, a public body may mortgage grant security and interests in facilities, projects, utilities, or systems owned or operated by a public body.

Normally, there are no legal limitations on the amount of revenue bonds to be issued, but excessive issue amounts are generally unattractive to bond buyers because they represent high investment risks. In rating revenue bonds, buyers consider the economic justification for the project, reputation of the borrower, methods and effectiveness for billing and collecting, rate structures, a provision for rate increases as needed to meet debt service requirements, track record in obtaining rate increases historically, adequacy of reserve funds provided in the bond documents, supporting covenants to protect projected revenues, and the degree to which forecasts of net revenues are considered sound and economical.

Special districts may elect to issue revenue bonds for revenue producing facilities without a vote of the electorate (ORS 288.805-288.945). Certain notice and posting requirements must be met and a 60-day waiting period is mandatory. A petition signed by five percent of the agencies registered voters may cause the issue to be referred to an election.

Improvement Bonds

Improvement (Bancroft) bonds can be issued under an Oregon law called the Bancroft Act. The bonds are an intermediate form of financing that is less than full-fledged G.O. or revenue bonds, but is quite useful especially for smaller issuers or for limited purposes.

An improvement bond is payable only from the receipts of special benefit assessments, not from general tax revenues. Such bonds are issued only where certain properties are recipients of special benefits not occurring to other properties. For a specific improvement, all property within the improvement area is assessed on an equal basis, regardless of whether it is developed or undeveloped. The assessment is designed to apportion the cost of improvements, approximately in proportion to the afforded direct or indirect benefits, among the benefited property owners. This assessment becomes a direct lien against the property, and owners have the option of either paying the assessment in cash or applying for improvement bonds. If the improvement bond option is taken, the District sells Bancroft improvement bonds to finance the construction, and the assessment is paid over 20 years in 40 semi-annual installments with interest. Cities and special districts are limited to improvement bonds not exceeding three percent of true cash value.

With improvement bond financing, an improvement district is formed, the boundaries are established, and the benefited properties and property owners are determined. The engineer usually determines an approximate assessment, either on a square foot or a front-foot basis. Property owners are then given an opportunity to object to the project assessments. The assessments against the properties are usually not levied until the actual cost of the project is determined. Since this determination is normally not possible until the project is completed, funds are not available from assessments for the purpose of making monthly payments to the contractor. Therefore, some method of interim financing must be arranged, or a pre-assessment program, based on the estimated total costs, must be adopted. Commonly, warrants are issued to cover debts, with the warrants to be paid when the project is complete.

The primary disadvantage to this source of revenue is that the property to be assessed must have a true cash value at least equal to 50 percent of the total assessments to be levied. As a result, owners of undeveloped property usually require a substantial cash payment. In addition, the development of an assessment district is very cumbersome and expensive when facilities for an entire community are contemplated. In comparison, G.O. bonds can be issued in lieu of improvement bonds, and are usually more favorable.

Capital Construction (Sinking) Fund

Sinking funds are often established by budget for a particular construction purpose. Budgeted amounts from each annual budget are carried in a sinking fund until sufficient revenues are available for the needed project. Such funds can also be developed with revenue derived from system development charges or serial levies.

In Section 6.8, the District capital improvement plan is presented with a sinking fund for each eligible revenue source for the District. As presented, this fund includes the rehabilitation of existing infrastructure and construction of new infrastructure elements. Segregation of funds will be necessary since SDC funds, discussed below, cannot be utilized on all of the projects presented.

Connection Fees

Most cities charge connection fees to cover the cost of connecting new development to wastewater systems. Based on recent legislation, connection fees can no longer be programmed to cover a portion of capital improvement costs. Instead, connection fees should be based on reimbursement of the District's actual expenses related to each connection. As a component of the Master Plan, an accounting of all expenses related to a new connection was prepared and is presented in Table 7.2.1. Based on this analysis, the Master Plan recommends that the District increase its connection fee to $ 450 per hook-up. This increase will recover District expenses on new connections in the amount of $ 48,600 per year.

Table 7.2.1
Calculation of GSD Connection Fee Cost

New Connection Cost Item	GSD Labor Staff	Labor	Subtotal
Administrative / File Set-up	Administrative	2 hours	$ 46.00
Permits	Operations / Maintenance	0.5 hours	$ 16.50
Construction Guidance	Operations / Maintenance	0.5 hours 0.5 hours	$ 16.50 $ 13.00
One Call Locates	Operations / Maintenance	1.5 hours 0.5 hours	$ 49.50 $ 13.00
Inspection	Operations / Maintenance	4 hours	$132.00
As-built Drawings	Operations / Maintenance	2 hours	$ 52.00
Coordination	Management	0.5 hour	$ 17.50
Mileage / fuel / consumables			$ 27.50
Tapping Supplies			$ 65.00
ACAD Updates			$ 5.00
Total			$453.50

System Development Charges

Like many public utility owners in Oregon, cities and special districts are faced with increasing costs for the expansion of each of their facilities capacity to serve growth. To mitigate this cost of growth, many utility owners have historically assessed system development charges (SDCs) to new customers. A system development charge (SDC) is a fee collected as each piece of property is developed. The SDC is used to finance the necessary capital improvements and municipal services required by the development. Such a fee can be used to recover the capital costs of infrastructure. Operating, maintenance, and replacement costs cannot be financed through SDCs.

The Oregon Systems Development Charges Act was passed by the 1989 Legislature (HB 3224) and governs the requirements for systems development charges effective July 1, 1991. Oregon law defines SDCs and specifies how they shall be calculated, applied, and accounted for by local government. By statute, an SDC is the sum of two components: a reimbursement fee, designed to recover costs associated with capital improvements already constructed or under construction, and an improvement fee, designed to recover costs associated with capital improvements to be constructed in the future. The reimbursement fee considers the cost of existing facilities and the value of unused capacity in those facilities. The calculation must ensure that future system users contribute no more than their fair share of costs for existing facilities. The improvement fee calculation considers the cost of future capital improvements to increase system capacity. The revenue generated by this fee is typically used to pay back existing loans for improvements. The costs of planned projects that correct existing system deficiencies and do not increase capacity are not included in the improvement fee calculation

Under the Oregon Systems Development Charges Act, methodologies for deriving improvement and reimbursement fees must be documented and available for review by the public. A capital improvement plan must also be prepared which lists the capital improvements that may be funded with improvement fee revenues and the estimated cost and timing of each improvement. Thus, revenue from the collection of SDCs can only be used to finance specific items listed in a capital improvement plan. SDCs cannot be assessed on portions of the project paid with grant funding.

SDC Calculation

In general, an SDC is calculated by adding the reimbursement fee component to the improvement fee component. A sample calculation is shown below.

Sample Calculation:

Reimbursement Fee		Improvement Fee		SDC
Eligible cost of capacity in existing facilities / Growth in system capacity	+	Eligible cost of planned capacity-increasing capital improvements / Growth in system capacity	=	SDC ($/unit)

Facts About SDCs

SDCs are one-time charges, not ongoing rates or taxes;
SDCs are used to fund additional capacity needed to serve growth;
Already-developed properties do not pay SDCs unless there is an increase in potential system demand or impact;
SDCs do not fund ongoing system maintenance;
SDCs are used for “general” and not “local” facilities;
SDCs include future and existing cost components;
SDCs are intended to recover a fair share of the cost of existing and planned facilities needed to serve new growth.

Green Sanitary District's Existing Wastewater SDCs

The District currently assesses new development an SDC associated with both reimbursement and improvement fees, including costs for administering the fees. The District's SDCs were last updated in January of 2003. The portion of SDCs associated with reimbursement fees are primarily for the costs the District incurred in a wastewater treatment plant expansion project performed in 1999, along with some collection system expansion. The portion of SDCs associated with improvement fees is related to collection system expansion projects, identified in a previous facilities plan, and for funding a future Master Plan and SDC update. The District's current SDCs are:

	Cost per EDU
Plant Reimbursement	$1,032.00
Collection Reimbursement	$ 185.00
Collection Improvement	$ 341.00
Master Plan Improvement	$ 37.00
Administration Fee	$ 83.00
TOTAL SDC	$1,678.00

All of the existing SDCs would remain eligible with the exception of the Collection Improvement Fee that will be replaced by the proposed SDC described below.

Proposed Wastewater SDCs

Following the adoption of this Master Plan, the District should increase its SDC to collect reimbursements of the capacity building component of the projects listed in the capital improvement plan. The amount of the proposed SDC is based upon a sinking fund financing approach and information that suggests the District should not expect to receive offsetting grant funds. The percentage of each project's total cost eligible for SDC reimbursement is presented in Section 6 along with the project description, justification for the "capacity building " component of the project, and detailed estimate of the project. Based on these rational, the capacity building component of the SDC is estimated at $ 1,190 per EDU. In addition the District may also charge a compliance cost to cover the anticipated expenses that are associated with the maintenance of funds and future updates of the SDC. The compliance cost may be set at 5 percent of the new charge, which amounts to $ 59.50. The following table depicts the recommended wastewater utilities SDC based upon the existing and new project costs and funding assumptions:

Table 7.2.2
Compliance Costs and Net SDCs per EDU

New EDUs per year (average over 20 planning period)	108
Sewer "buy-in" costs	$ 1,190.00
Compliance cost per EDU for Sewer SDC	$ 59.00
Existing Plant Reimbursement	$ 1,032.00
Existing Collection Reimbursement	$ 185.00
Existing Master Plan Improvement	$ 37.00
Existing Administration Fee	$ 83.00
Net Sewer SDC ("buy-in" plus compliance) per EDU	$ 2,586.00

Based upon the average number of new EDU's projected, the District should realize approximately $134,892 per year in additional revenue by collecting $ 279,288 per year in SDC funds. Appendix C presents the calculations for the projected SDCs.

Ad Valorem Taxes

Ad valorem property taxes are often used as a revenue source for utility improvements. Property taxes may be levied on real estate, personal property or both. Historically, ad valorem taxes were the traditional means of obtaining revenue to support all local governmental functions.

A marked advantage of these taxes is the simplicity of the system; it requires no monitoring program for developing charges, additional accounting and billing work is minimal, and default on payments is rare. In addition, ad valorem taxation provides a means of financing that reaches all property owners that benefit from a system, whether a property is developed or not. The construction costs for the project are shared proportionally among all property owners based on the assessed value of each property.

Ad valorem taxation, however, is less likely to result in individual users paying their proportionate share of the costs as compared to their benefits.

User Fees

User fees can be used to retire G.O. bonds and loans, are commonly the sole source of revenue to retire revenue bonds and to finance Operation and Maintenance (O& M) costs, and can be used to establish sinking funds. User fees represent monthly charges to all residences, businesses, and other users that are connected to the wastewater system. These fees are established by resolution and can be modified, as needed, to account for increased or decreased operating and maintenance costs. The monthly charges are usually based on an EDU method that accounts for the demand placed on the system for each user class (e.g. single family dwelling, multiple family dwelling, schools, commercial etc.).

In Section 6.0 of this report, it is recommended that the District establish a sinking fund for the CIP and future rehabilitation project. Based on the project schedule, cash flow requirements, and the anticipated SDC revenue, a $ 6.00 per month per EDU charge is recommended. Based upon the existing number of EDU's on the system, the District should realize approximately $316,200 per year in additional revenue.

Assessments

Under special circumstances, the beneficiary of a public works improvement may be assessed for the cost of a project. For example, the District may provide some improvements or services that directly benefit a particular development. The District may choose to assess the industrial or commercial developer to provide up-front capital to pay for the administered improvements.

7.3 Funding Recommendations

Funding recommendations for the wastewater system improvements are based on collection of additional SDC revenue and development of a sinking fund through an additional rate increase.

If the District pursues a major upgrade and seeks funding assistance, the District should attend a "One Stop" meeting where various state and federal agencies can outline and optimize funding packages available for municipal wastewater system improvements.

7.4 Impact to Green Sanitary District Rate Payers

Based on the analysis and discussion presented in this Master Plan, a $ 6.00 per month rate increase is recommended. In addition to the rate increase, the plan also recommends increasing the SDC charge by $ 1,249 to $ 2,586 and increasing the connection fee to $ 450.

Justification for increasing the user rate, systems development charge, and connection fee is provided in the preceding sections of this Master Plan. The total increase in revenues projected by the plan is approximately $ 450,000 per year.

Appendix A

Model Attribute Reports

Appendix B

Mainline Hydraulic Profiles

Appendix C

Systems Development Charge Calculations