City of Bishop
Wastewater Master Plan

Prepared For:

The City of Bishop
Department of Public Works

Submitted By:

Nolte Associates, Inc.

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1.0 Executive Summary

Introduction

The City of Bishop (City) requested the assistance of Nolte Associates, Inc. to provide a comprehensive evaluation of the City's wastewater facilities and present recommended improvements in a Wastewater Master Plan. The Wastewater Master Plan was developed concurrently with the Water Master Plan.

The primary goals of this Master Plan are to guide the development and operation of the City's sewer system, and to develop a Capital Improvements Plan that is responsible, realistic, and appropriate for the City. From this, the City will have a solid foundation to continue providing wastewater collection and treatment services to the City and to proceed with projects to improve and maintain that service.

The main objectives that Nolte considered encompass the fundamental concerns of the Master Plan are listed below:

1. Reduce Operation Costs
2. Comply with Regulatory Requirements
3. Improve System Reliability and Redundancy
4. Increase Utilization of Capacity/Increase Revenue
5. Improve Customer Service
6. Improve Water Quality
7. Improve System Operations

Methodology

The City of Bishop supplies sewer service to most of its residents and businesses. Nolte investigated the facilities owned and operated by the City: 6-inch to 18-inch gravity pipelines, one lift station on Johnston Drive, a diversion structure located in a sanitary sewer manhole located in Wye Road near the intersection of Main Street/ Highway 6 and Highway 395, and a wastewater treatment facility. Nolte also evaluated the City's budget information and billing. This process assisted Nolte to identify the City's wastewater system deficiencies, outline the potential project alternatives to address these deficiencies, and research financial resources that will help fund the construction of such projects.

The Master Plan was developed through a series of steps. The investigation of the existing facilities, operations, and billing system provided the foundation for the Master Plan. Following the investigation of existing facilities, a comprehensive evaluation of the facilities and the City's needs was performed to develop improvement alternatives for the City's infrastructure and operations. Each improvement alternative was analyzed using a selection matrix to help determine the recommended improvement alternatives for the City. Finally, the recommended improvement alternatives were incorporated into a Capital Improvements Plan, outlining and prioritizing future infrastructure projects for the City.

Major Wastewater System Deficiencies

Most of the deficiencies identified in the wastewater collection system and the wastewater treatment plant are related to the aging infrastructure. For instance, the last significant work at the plant was in the 1970's. Much of the City of Bishop wastewater system is reaching the end of its useful life and major repairs, replacements, and upgrades are necessary. Other deficiencies are related to more stringent sate and federal requirements and to increased customer expectations.

Some of the major deficiencies identified through the investigation of existing facilities process are:

Wastewater Collection System:

1. Nolte investigated 256 sanitary sewer manholes in the City of Bishop by surface inspection. In general, the majority of the manholes are in a good operational condition. There are approximately 66 manholes that need immediate attention and require either re-grouting of manhole material, channel replacement, or pipe replacement. Several manholes lack defined channels causing clogged lines. In addition, numerous manholes have unsafe or insufficient rungs, which should be improved or removed to enhance safety.

   The majority of the inspected manholes have excessive rag, paper, solids and grease build up either in the channel or the bench causing manholes to back up and cause the manhole to flood at some time.

2. Nolte and its sub-consultant inspected approximately 20,000 linear feet of sewer lines by mean of closed-circuit television (CCTV). Generally, the inspected sewer lines are in poor condition. Common problems were root penetrations, grease build up, offset joints, dips and sags, collapsed pipe, structural damage, and infiltration. These conditions may not be indicative of the remainder of the City, as the inspected areas were suspected by the City staff as problematic. The degree of deterioration of these pipes can be attributed to aging and many years of service, and can result in clogging of the lines and/or spills.

Wastewater Treatment Plant:

3. The bar screen that is currently in place does not have an automatic self-cleaning mechanism and is in a deteriorated physical condition. The treatment plant operators propose a more state-of-the art automatic screening mechanism that is more efficient and requires minimal maintenance and operator supervision. Large organic objects caught by the bar screen are broken down with high pressure spray. The spray includes an added effluent spray bar. The effluent spray is a potential health and safety concern with the current plant configuration.

   Additionally, the current grit chamber is not efficiently removing larger settleable solids. These solids can create problems downstream in the biological process since the grit chamber its not separating grit from the organic matter. This unit requires grit to be removed by hand (rake) to the grit pump intake. The grit chamber also lacks aeration.

4. Sludge from the clarifiers is pumped to the digesters manually twice a day. The automatic sludge transfer system intended for this purpose is not used due to electrical and mechanical failures and due to obsolescence. The sludge pumps and valves are deteriorated and need replacement. The operators suggest a more modern and automated sludge transfer system.

   The sludge pump vault seems to be of adequate size to access all pumps and valves conveniently, but the operators have expressed their desire to improve ventilation in the building. The sludge pumps and valves are deteriorating and need replacement. The operators opt for a modern sludge transfer facility with new equipment and instrumentation and controls to allow for automatic transfer of sludge.

5. The digesters are showing signs of aging (built in the 1950s) like "leaks" around the access openings that have been adequately sealed. The digesters require a lot of propane, the methane generated is not sufficient and it is augmented by two propane tanks existing at the treatment facility. There is a gas collection system but both digesters lack hand railings and a gas storage system facility.

6. Upcoming discharge regulations related to BOD, Nitrates and disinfection can develop into potential deficiencies if the City is not prepared to address them. At this time it is uncertain which of these requirements, if any, are coming to the City of Bishop. The City should consider implementing the State Water Resources Control Board's monitoring and sewer management programs to comply with discharge regulations in case these requirements have to be adopted.

Solution Alternatives

Alternatives were developed to address the wastewater system deficiencies identified in the evaluation phase. Project cost opinions were prepared by Nolte for each alternative. Each solution alternative addresses one or more of the main objectives that are considered in the Master Plan.

Project Selection

There are several projects that have more than one solution alternative to address them. A selection matrix was created to score each alternative based on several criteria. The selection matrix outlines all of the alternatives, their scores for each criteria, the weighing factor for each criteria, and their overall ranking. The preferred alternative for each project is that which resulted in the highest total score. The criteria applied to select the solutions to deficiencies with multiple solutions are listed below:

- Capital costs
- Operation and maintenance costs
- Land requirement/environmental impacts
- Funding agency assistance
- Operational complexity
- Correspondence with other City projects
- Reliability
- Time for implementation

Project Prioritization

A prioritization process was implemented among the selected projects, and the projects that only have one alternative solution. This process allowed the City and Nolte to determine the urgency and time horizon to complete each project. Their priority was established based on a scoring system similar to the one in the selection process. The following criteria were used to score each alternative:

- System Reliability
- Capital Cost
- Employee Health and Safety
- Correspondence with Other projects
- Revenue and Operational Cost
- Funding Agency Assistance
- Regulatory Requirements

Top Priority Projects

The City identified five projects (top priority projects) necessary to achieve the objectives of the Master Plan:

1. **Trunk Sewer Hydraulic Analysis:** The purpose of this project is to investigate the possibility of collecting the wastewater generated form the K-Mart area into the COB wastewater collection system. Currently, this portion of the city is connected to the ESCSD collection system. The hydraulic model will evaluate the lines between manholes T9 located west of the Johnston Drive Lift Station and manhole TL2.

2. **Replacement of Bar Screen:**
The proposed project involves the installation of a new automatic headworks bar screen system to replace the manual bar screen. The bar screen will separate solids from primary screenings while returning the organics to the biological process The bar screen will capture large objects and protect downstream mechanical equipment at the wastewater treatment facility. A separation occurs, the liquid and fine organics pass through the screen.

In addition to acting as a solids washer, the bar screen, conveys and dewaters the captured solids so that the weight and volume of the final screenings are greatly reduced and they are discharged with maximum dryness and minimum odor. The estimated cost of this project is $250,000 and it should be coordinated with the construction of the upgraded grit chamber.

3. **Grit Chamber Upgrade:**
A new aerated grit chamber allows for better separation between sand and organic material. Grit such as sand and other fine material have to be captured as they are erosive to the equipment. The proposed project involves the installation of an aerated grit chamber to replace the existing rectangular grit chamber downstream of the bar screen. The new grit removal system is a compact, circular trap which will be located downstream of the proposed bar screen. The estimated cost of this project is $125,000 and its completion should be coordinated with the replacement of the bar screen.

4. **Sludge Pump Room Improvements:**
The sludge pumping room will transfer the primary sludge from the clarifiers to the anaerobic digesters for stabilization.

A new sky light and floor access hatch for accessing and removing mechanical equipment can be added to the existing room. A unisex bathroom can be built adjacent to the pump room. The pump station will include a solenoid valve connected to a timer to control the quantity of sludge withdrawn from the primary clarifiers and allow for automatic sludge transfer without the presence of operators. Also, the room will be connected to a SCADA system with alarms and controls.

The estimated cost of this project is $373,000. Funding may be available through the United States Department of Agriculture (USDA) as a long term low interest loan or a grant.

5. **New Anaerobic Digesters:**
The digesters will stabilize and reduce the volume of sludge before final disposal. The proposed one stage anaerobic digester will supplement and eventually replace the existing two-stage anaerobic digester system. It can be located west of the existing primary digester.

The proposed digester will be approximately 27 feet in diameter and 20 ft side wall depth with a fixed cover and concrete structure. The proposed digester will have sludge mixing, recycle, and heating mechanisms. The gas generated from the will be collected via a gas collection system for later storage and reuse or flared. In addition, the digester will be equipped with sufficient instrumentation and control to allow for ease of operation and system measurements. The estimated cost of the digesters is $3,000,000 and can be funded through USDA loans or grants.

Capital Improvements Plan

The capital improvements plan for the City of Bishop wastewater system lays out the anticipated improvements, their year of implementation, and their costs. The time horizon for the Capital Improvement Plan is 20 years (2008-2027). The solution alternatives for the proposed projects were broken up into phases depending on the type of project. The project cost of each proposed improvement was estimated for each project in 2007 dollar amounts.

An annual inflation rate of 8% was used based the recent rapid increase in construction material and labor cost. The main criterion for spreading out the capital projects and their costs in the next 20 year period is the correspondence of any of the projects with a top priority project. The future value for the completion of each phase was calculated on the estimated year of completion of the project phase.

For many of the 20 years in the Capital Improvements Plan's time horizon, the projected capital expenditure exceeds the City's annual capital projects budget. To address this, the City has applied to outside agencies for financial assistance. Sources of funding include USDA. The City has the option of financing projects in part through debt. In addition, many projects with a long term horizon (2014-2027) can be further phased or postponed. Reasonable increases in user rates will not permit the City to pay for these projects on a cash basis.

The following table lists some of the major proposed projects and their time for implementation:

Time Horizon	Project	Cost ($2007)
Immediate Projects 2008	Grout/Mortar and Epoxy Manholes (Design Phase)	$7,000
	Installation of Grease Traps	$43,200
	Install Cured-in-place Pipe	$57,200
Future projects 2009-2013	Grout/Mortar and Epoxy Manholes (Construction Phase I and II, 2009-2010)	$397,000
	Pipeline Replacement (2009-2013)	$1,380,000
	Replacement of Bar Screen (2009)	$262,000
	Grit Chamber Upgrade (2010)	$125,000
	Installation of SCADA system at WWTP (2009)	$28,000
Long Term Projects 2014-2027	Sludge Pump room Improvements (2014)	$373,000
	Improve lighting (2014)	$40,000
	New Anaerobic Digesters (2018)	$3,000,000

2.0 Introduction and Purpose

The City of Bishop (City) requested the assistance of Nolte Associates, Inc. to provide a comprehensive evaluation of the City's wastewater facilities and present recommended improvements in a Wastewater Master Plan.

The City engaged in an opportunity to determine deficiencies in its systems and endeavor to examine the potential for further cooperation with other wastewater systems to the extent that such cooperation is mutually beneficial. One end of the spectrum of ways the City could further cooperate is through some sort of consolidation with those systems, but that is only one possible outcome and not a goal or purpose in itself. In addition, develop a Capital Improvements Plan (CIP) to enable the City to continue to provide service to its customers for decades.

The Wastewater Master Plan aims to achieve the following goals:

- Identify the system's deficiencies and means to address them
- Foresee future system trends, needs, and improvements
- Enable the City to operate and maintain the systems more efficiently
- Evaluate financial impact to the wastewater funds and user rates
- Contain a detailed analysis of the first four capital improvements projects based on project prioritization matrix in which several factors such as Capital cost, Revenue and Operation Cost, Agency Funding and other factors are considered.
- Guide the City's wastewater efforts for the next two decades

One goal of the Master Plan is to refine the City's CIP to provide a long term plan to guide operation and improvements of the wastewater collection and treatment system. The CIP should be responsible, realistic, and appropriate for the City. From this, the City will have a solid foundation to proceed with projects.

The Master Plan was completed concurrently with the development of the Wastewater Master Plan and a Geographic Information System (GIS) for the City.

2.1 Geographic Location and Study Area

The City of Bishop is located in Inyo County, at the northern end of the Owens Valley. The City covers an area of approximately 1.8 square miles and has a population of approximately 3,575 (united States Census 2000). The population is expected to remain relatively steady because it is largely prevented from growth because the City is surrounded by a combination of public and Native American lands. The City of Bishop was incorporated in 1903 and the residential neighborhoods where this project is set were developed in the early decades in the 1900's with single and multiple family structures.

The Owens River, which is located east of the City of Bishop, flows to the south down the valley. The valley is bounded by the Sierra Nevada mountain range to the west and the White Mountains range to the east. Numerous creeks and ditches carry water from the Sierra Nevada Mountains toward the Owens River.

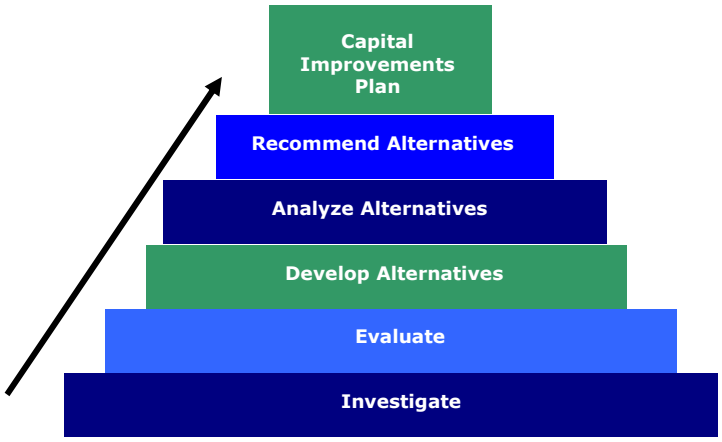
Bishop is located in the rain shadow of the Sierra Nevada. The warmest month of the year is July with an average maximum temperature of about 98 degrees Fahrenheit. The coldest month of the year is December with an average minimum temperature of 22 degrees Fahrenheit. Temperature variations between night and day are over 40 degrees during the summer and over 30 degrees during

winter. The annual average precipitation at Bishop is 5 inches. The wettest month of the year is February with an average rainfall of 1 inch.

2.2 Methodology

The Master Plan was developed through a systematic, proven process. The investigation of the existing facilities provided the foundation upon which the Master Plan was designed. Following the investigation a comprehensive evaluation of the facilities and City's needs was performed to develop improvement alternatives for the City's infrastructure. Each improvement alternative was analyzed using a selection matrix to help determine the recommended improvement alternatives for the City. Finally, the recommended improvement alternatives were incorporated into a Capital Improvements Plan outlining and prioritizing future infrastructure projects for the City. The development of the Master Plan is characterized by the flow chart pictured in Figure 2.1.

Figure 2.1: Methodology Flow Chart



Investigation of Existing Facilities and Conditions
A comprehensive investigation of the City's facilities was completed through site visits with City staff. System Design and Performance Criteria were developed and used to compare to existing facility capacity and conditions of the wastewater systems. These were utilized in the evaluation of facilities and development of improvement alternatives.

The investigation of facilities included the wastewater treatment facility, wastewater pump station, manholes, and other features readily seen from the surface, and the City's wastewater office and maintenance areas. Input was gained from the operators during site visits on how well these systems meet the needs of the City, what difficulties they have, and how specific modifications could facilitate system maintenance and operations. Through the site visits, the wastewater collection system and wastewater treatment plant deficiencies and possible steps the City can take to improve operational efficiency, effectiveness, and reliability were identified. This information provided the foundation for determining system deficiencies and potential solutions to those deficiencies.

Documentation provided by the City, including system atlas maps and Regional Water Quality Control Board documentation (permits and violations), wastewater operations and capital budgets, wastewater treatment facility flows, and anticipated customer growth within the City's service area was reviewed. The City's GIS system was used extensively for system information as well. The age of the information, such as the system atlas maps being 50 years old, was also taken into account during the investigation.

Adjacent wastewater agencies were also investigated to identify the potential benefit of added cooperation on shared needs and services with adjacent agencies.

Evaluation of Existing Facilities
Following the information obtained from document review, and discussions and field visits with City staff, an evaluation of how well the existing wastewater facilities meet the existing and future needs of the City was completed. This evaluation was performed in graphical, tabular, and text forms. It

included the City wastewater treatment facility, wastewater pump station, manholes, and the City's wastewater office and maintenance areas.

A computer model was created for the wastewater collection system in H_2OMap Sewer. The model was calibrated based on the flows at the headworks of the treatment plant. The flow at the headworks is considered uncertain, due to lack of flow data from July through October 2005. In 2006, the flow meter was replaced and moved to the headworks. Readings at the headworks are not consistent with previous reading taken after the clarifier. Flow measurements need to be calibrated to match the true flows to the plant. The model enabled Nolte to identify shortcomings in the pipeline systems and the improvement options. The loading in the wastewater collection system model was based on average day peak hour generation. The model illustrated whether the system was capable of meeting the planning and design criteria during these scenarios. The performance of the modeled system was then compared to the System Design and Performance Criteria outlined in Section 3.0: Investigation of Existing Facilities and Conditions.

The existing facilities were compared to the current and future needs of the City on a facility-by-facility basis, to identify specific improvement areas. The capacities of individual facilities (headworks, primary treatment units, sludge transfer facility, digesters, etc.) were compared to the existing, seasonal, and future needs. Future wastewater flows require additional treatment capacity is available for the full build out wastewater flow scenario (almost fivefold). The results of these comparisons are presented in Section **4.2 Wastewater Treatment Plant Evaluation.**

The Residential Land Use Districts were evaluated to estimate the future build out wastewater generation. Wastewater flows were assumed based on industry standards for residential, commercial and industrial areas. For maximum build-out conditions it is anticipated that additional wastewater collection and treatment capacity is required.

The projected average wastewater demand for full build out is 4.67 million gallons per day. Residential demands account for approximately 1.2 gallons of that demand, commercial for 3.2 and industrial/schools for the remaining 170,000 gallons per day. The existing wastewater treatment plant has the capacity to treat 1.6 million gallons a day. The full build out average wastewater flow cannot be handled by the existing facility. The treatment capacity will have to be more than doubled under full build out conditions.

Development of Improvement Alternatives
Improvement alternatives were developed to address the identified wastewater deficiencies. For each alternative, the proposed improvement, how the deficiency will be rectified, the capital cost, the impact to operational expenses, facility footprint, useful life and annual reserve requirements for future replacement, and benefits and drawbacks to the alternative. Multiple improvement alternatives were developed for most deficiencies.

Recommendation of Improvement Alternatives
The improvement alternatives were prioritized and recommendations of alternatives were made based on the criteria developed with the City. A draft Capital Improvements Plan (CIP) for the wastewater system was developed and included a provision for inflation for each project, depending on the timeline for the improvement.

Capital Improvements Plan
A detailed analysis of the first four capital projects was prepared to provide more accurate capital cost opinions; identify impacts from existing facilities, rights of way, groundwater and soils conditions (excluding geotechnical investigations), and land features (rivers, wetlands, structures and pavement); map regulatory and funding agency approval procedures; and a more detailed project

schedule. The first four capital projects were selected based on a prioritization matrix, discussion with city, and project complexity. The City has expressed particular interest in the following projects:

- Aerated Grit Chamber
- Automatic Bar Screen
- New Anaerobic Digester
- Sludge Pump Room Improvements
- Automating Plant Operations

The Capital Improvements Plans was finalized and the impact it may have on existing user rates and capacity fees was evaluated. The Capital Improvements Plan will be the primary springboard from which the City can proceed with implementation of projects to address system deficiencies.

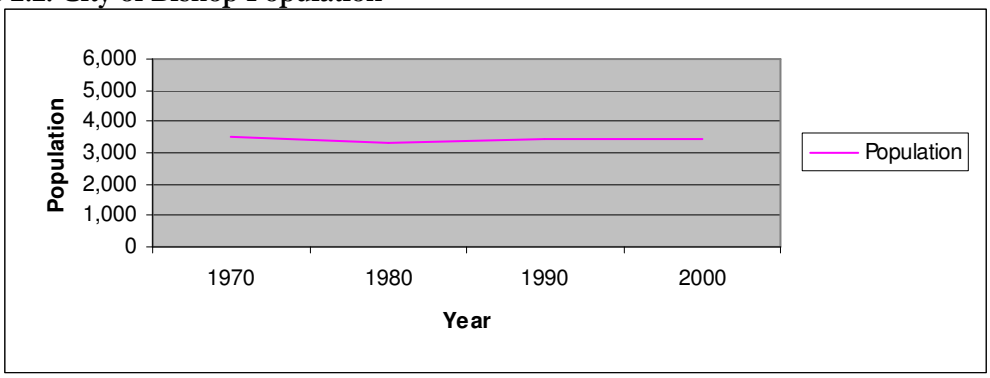
2.3 Climate, Economy, and Demographics

The City was incorporated in 1903 and has a population of 3,575 (U.S. Census 2000). As pictured in Figure 2.2, the City's population has remained steady over the last 10 years. The City is largely confined by adjacent landowners: Bishop Paiute Tribe, Los Angeles Department of Water and Power (DWP), and the Bureau of Land Management (BLM). The United States Forest Service (USFS) owns most of the property in the mountains. The BLM owns the property between the USFS land and the DWP land. This has contributed to the minimal population growth in recent decades.

It is difficult for the City to anticipate the size of future developments, as this is largely dependant upon the release of DWP property. The City foresees the possibility of individual small lots or larger parcels of land being developed in upcoming decades. Therefore for the purpose of this Master Plan, a schematic system to serve build-out of the City limits will be examined.

The City's recreation-based economy encourages large numbers of visitors and lodgers in comparison to the permanent resident population.

Figure 2.2: City of Bishop Population

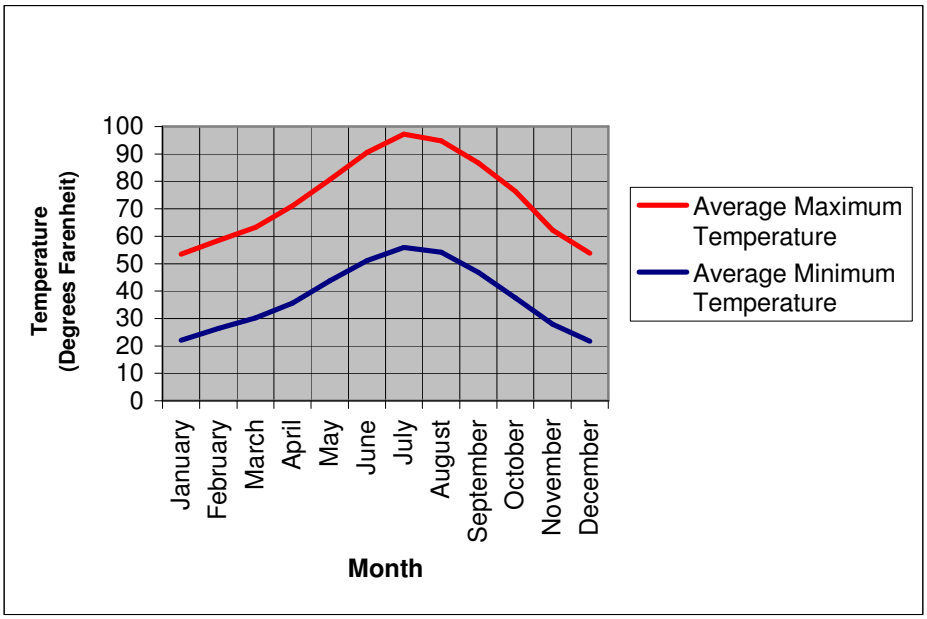


Source: State of California City/County Population and Housing Estimates (January 1, 2000)

Climate

Bishop experiences a wide range of temperatures. The summer temperatures can reach 100°F, while the winter minimum temperatures are near 0°F. Figure 2.3 portrays the average maximum and minimum temperatures over 29 years (from 1961 to 1990).

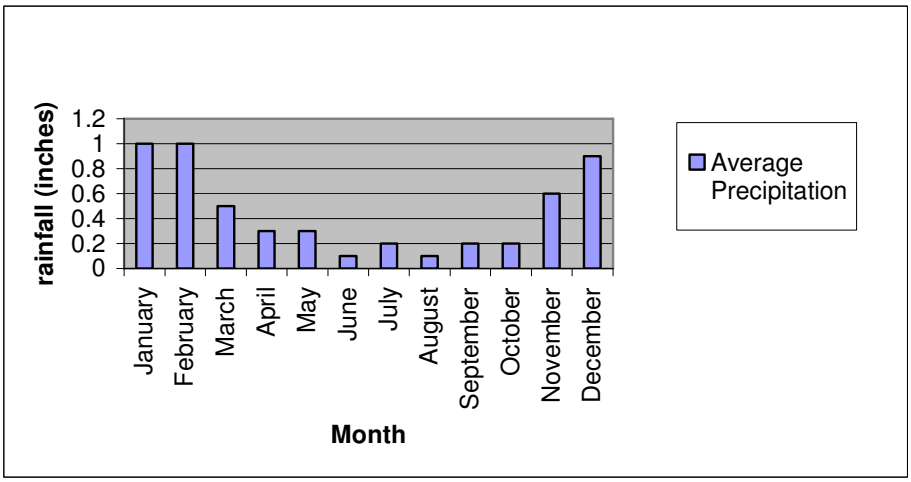
Figure 2.3: Average Temperatures in Bishop



Source: World Climate (www.worldclimate.com). Data is derived from NCDC TD 9641 Clim 81 1961-1990 Normals. The average was determined based on data from 1961 through 1990.

The greatest precipitation months are November through April. January is the wettest month during which the City receives 1.0 inches out of a 5.72 inch annual average. The City experiences occasional thunderstorms from May to August. Some of the greatest influxes on monsoon moisture occur in September. Bishop also receives snowfall every year; occasionally the amount can be significant.

Figure 2.4: Average Precipitation in Bishop



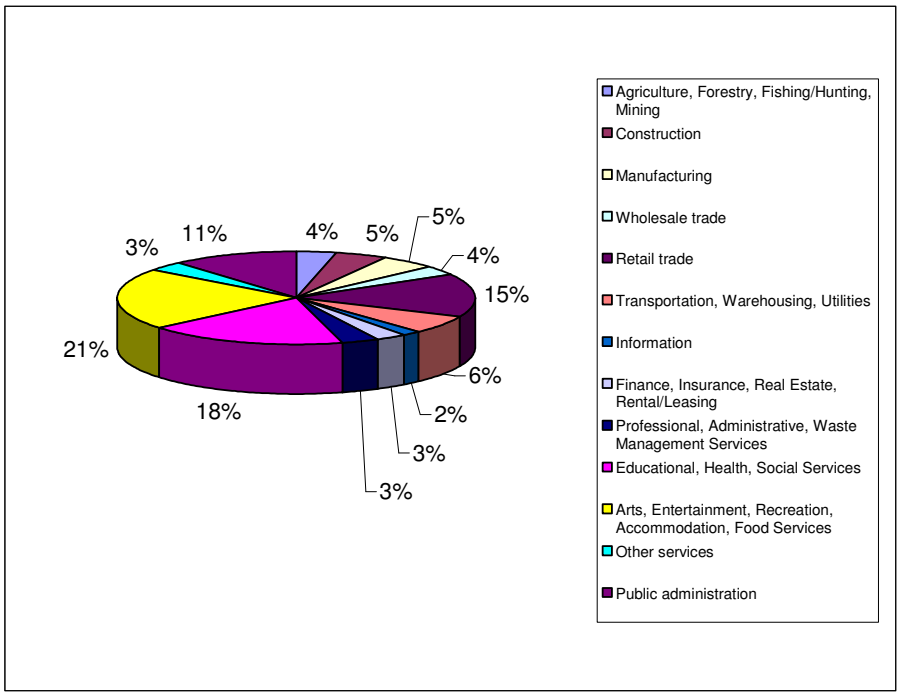
Source: World Climate (www.worldclimate.com). Precipitation data is derived from NCDC Cooperative Stations. The average was determined based on data from 1948 through 1995.

Economy and Demographics

The largest economic base in Bishop is the government and the recreation and tourism industry. Bishop is a prime attraction for fishermen, skiers, hunters, and campers. It is also a popular retirement location.

Education/health/social services, public administration, and retail trade are the next largest industries. Manufacturing and industrial enterprise are not large components of Bishop's economy.

Figure 2.5: Industries in Bishop as a Percentage of Total Economy



Source: U.S. Census 2000

The per capita income for the city was $17,660. The median income for a household in the City was $27,338 and the median income for a family was $34,423. About 16% of the population was below the poverty line (US Census 2000).

3.0 Description of Existing Wastewater Facilities

3.1 Wastewater Collection System

The City of Bishop supplies sewer service to most of its residents and businesses. The City is served extensively with a collection system, as depicted in Figure 3.1. The collection system is currently of 6-inch to 18-inch gravity pipelines. These pipelines carry the wastewater to the trunk line which flows to the City's WWTP for treatment. The sewer mains are constructed of vitrified clay pipe (VCP) with small amount of plastic sewer pipe. The sewer laterals are constructed of a variety of cast iron, steel, VCP, and Orangeburg pipe (or Bituminous Fiber sewer pipe).

A portion of the City is served by the Eastern Sierra Community Services District (ESCSD). Some of the City's customers' sewage flows on a permanent basis to the ESCSD wastewater treatment plant (WWTP). The ESCSD WWTP is located at immediately south of the City's WWTP. In return, for one week of every month the City accepts and treats flow that normally is treated by the ESCSD. For this reason, average daily flows are higher during the week when the City accepts flows from ESCSD than during other weeks in a given month. This transfer of flow is provided by a diversion structure located in a sanitary sewer manhole located in Wye Road near the intersection of Main Street/Highway 6 and Highway 395.

The City utilizes one lift station, located south of Johnston Drive, to pump the sewage into the main line before it goes to the City's WWTP. The lift station collects sewage from approximately 16 homes. It is an "ejector" type pump station and is not metered.

3.2 Wastewater Treatment Facility

The wastewater collection system routes all of the sewage to the Wastewater Treatment Plant, located on Sewer Plant Road, approximately one mile east of the City on Poleta Road. The facility is depicted in Figure 3.2. The City of Bishop treats its wastewater using primary and secondary (biological) methods. Wastewater treatment is provided by a Headwork Structure (rotating bar screen and grit chamber), primary clarifiers, oxidation ponds and percolation/evaporation ponds. Digesters and sludge drying beds provide solids handling on-site. The WWTP collects, treats, and disposes of an average of 0.80 million gallons per day (mgd) of domestic wastewater. The facility was originally designed to have a capacity of 1.6 mgd.

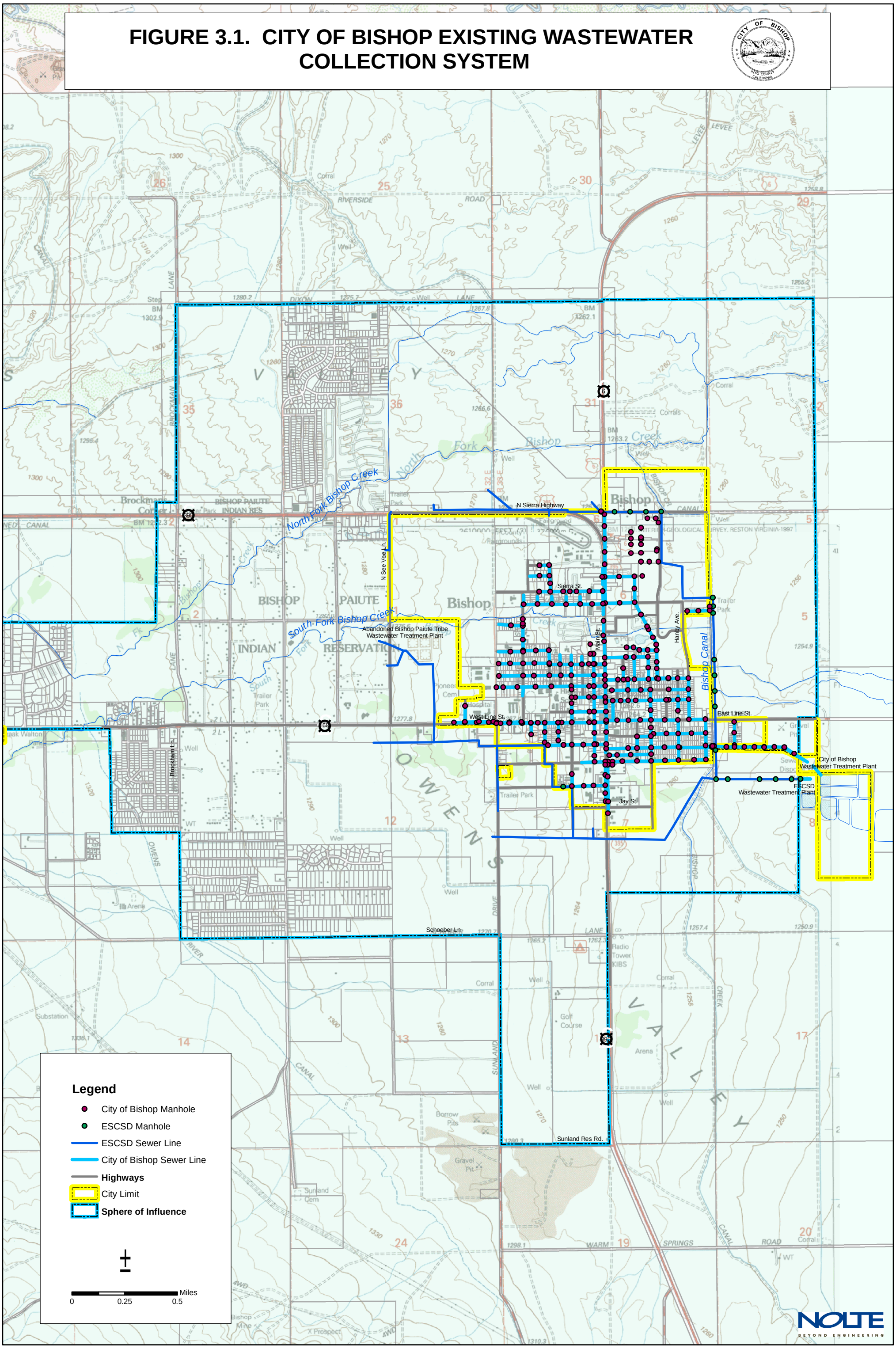
Headworks

The first step of the treatment process is the headworks. The headwork treatment consists of a mechanical bar screen to remove large objects followed by a grit chamber for sediment removal. A bypass channel and grit chamber is located adjacent to the primary headwork treatment path when it requires work. The grit collected from the grit chamber is pumped to the grit drying beds. Solids collected from the bar screen are shoveled by the operators and are disposed in the trash receptacle.

Primary Clarifier

Following the headworks, the wastewater travels to the primary clarifier. The clarifier has a skimming structure that skims the surface of the wastewater and the floatable materials are manually skimmed from the clarifier. Those materials are collected in a sump. The materials collected in the sump, as well as settled solids, are pumped into the digesters by the sludge pumps. A portion of the clarified effluent is recycled back by the pump to the bar screen at the spray bar. The clarified effluent flows by gravity into the secondary treatment ponds.

FIGURE 3.1. CITY OF BISHOP EXISTING WASTEWATER COLLECTION SYSTEM



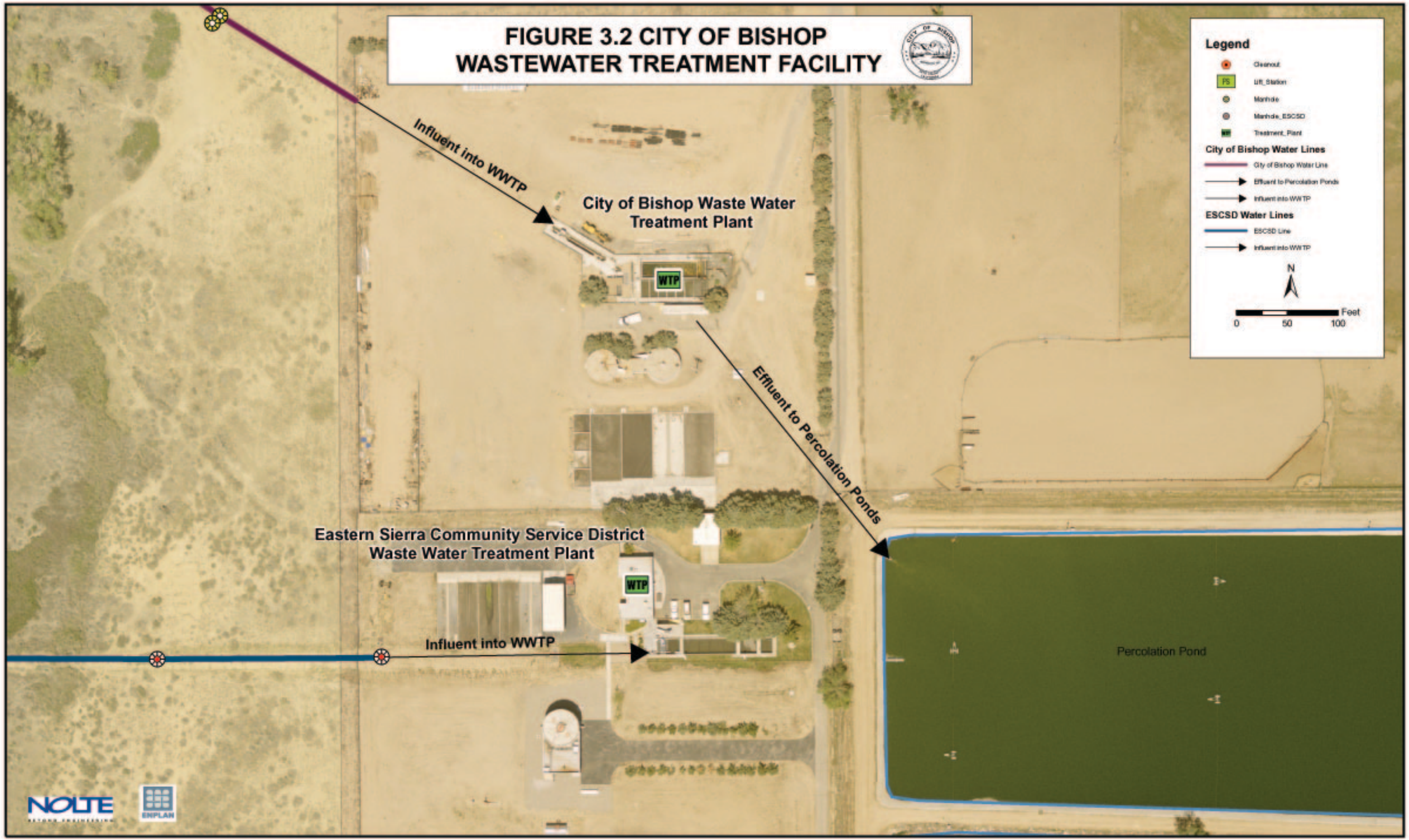


FIGURE 3.2 CITY OF BISHOP
WASTEWATER TREATMENT FACILITY
Influent into WWTP
City of Bishop Waste Water
Treatment Plant
WTP
Effluent to Percolation Ponds
Eastern Sierra Community Service District
Waste Water Treatment Plant
WTP
Influent into WWTP
Percolation Pond
Legend
Cleanout
Lift_Station
Manhole
Manhole_ESCSD
Treatment_Plant
City of Bishop Water Lines
City of Bishop Water Line
Effluent to Percolation Ponds
Influent into WWTP
ESCSD Water Lines
ESCSD Line
Influent into WWTP
N
Feet
0
50
100
NOLTE
ENPLAN

Sludge Pump, Digesters, and Sludge Drying Beds

Primary sludge (from primary clarifier) drains into the sump then gets pumped to two anaerobic digesters through a 6-inch diameter pipeline for further treatment. The sludge transfer pumps are activated manually by the City's operators once in the morning and once in the afternoon.

The digested sludge is pumped out to the sludge drying beds, located immediately south of the digesters. The supernatant from the digesters flows back into the clarifier for treatment. Sludge is discharged manually from clarifier during the morning and afternoon while operators are on duty. Overflow from the digester goes to a secondary digester for thickening and further treatment. Digested sludge is transferred to the sludge drying beds. Most of the dried sludge is taken to the Inyo County Landfill. Most of the generated methane gas is burned in the boiler for digesters. Currently, the burner does not work so any methane that goes to the burner escapes.

Oxidation and Percolation/Evaporation Ponds

The effluent from the clarifier undergoes further biological treatment in facultative percolation/evaporation ponds in which the stabilization of wastes is brought about by a combination of aerobic, anaerobic, and facultative bacteria. The influent passes through up to six ponds but it can be as little as three ponds. Treated effluent is discharged to pasture land downstream of the ponds. The effluent is used to irrigate 125 acre of pasture. Per the California Regional Water Quality Control Lahonton Region Board Order #6-94-025, the key discharge limits are biochemical oxygen demand (BOD) = 50 mg/l and total suspended solids (TSS) = 45 mg/l. There is no reclamation of the treated wastewater.

3.3 Wastewater Generation

The City's wastewater generation varies throughout the year. The average flow rate, peak flow rate, and peak factor from 2004 through 2006 is listed in the following table and figures. A replacement flow meter was installed upstream of the bar screen in 2007. This location has been proved unsuitable for flow measuring. Hence, for the last year flow measurements have been very unreliable. The meter was not calibrated when it was acquired. Thus, the readings are not accurate and are indicative of relative flows as opposed to absolute flows.

Flows are higher in the summer months because of the City's recreation-based economy and the influx of visitors. The flows below include the larger received during the week-long receipt of flows from the ESCSD on a monthly basis.

3.4 Existing Facility Operation

The WWTP is manually controlled, although the City intends to pursue automation. The treatment facility has one flow meter upstream of the bar screen that sends a reading to the control room. Because of ongoing flow measurement difficulties the meter is planned to move to the downstream end of the grit chamber near a venture located there.

Seven Publics Works 'personnel operate the WWTP and also maintain sewer collection system, fix leaks, sweep streets and plow snow. Figure 3.6 displays how the City's Public Works Department is organized, for the purposes of wastewater facility operation.

Figure 3.6: Organization Chart

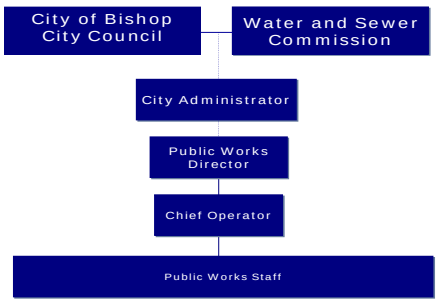


Table 3.1: WWTP Flow Data (Years 2004 to 2006)

Month	Year								
	2004			2005			2006		
	Avg. Flow Rate mgd	Avg. Peak Flow Rate mgd	Peak Factor -	Avg. Flow Rate mgd	Avg. Peak Flow Rate mgd	Peak Factor -	Avg. Flow Rate mgd	Avg. Peak Flow Rate mgd	Peak Factor -
J	0.49	1.03	2.1	0.57	1.60	2.8	0.63	1.1	1.7
F	0.52	1.07	2.1	0.58	1.07	1.8	0.65	1.21	1.9
M	0.64	1.14	1.8	0.59	2.90	4.9	0.65	1.03	1.6
A	0.60	2.66	4.4	0.55	1.10	2.0	0.76	1.34	1.8
M	0.60	1.64	2.7	0.60	1.27	2.1	0.83	1.34	1.6
J	0.76	4.08	5.4	0.74	2.73	3.7	0.86	2.4	2.8
J	0.79	1.48	1.9	NA*	NA	NA	-	-	-
A	0.75	2.11	2.8	NA	NA	NA	-	-	-
S	0.67	1.21	1.8	NA	NA	NA	-	-	-
O	0.56	2.94	5.3	NA	NA	NA	-	-	-
N	0.43	0.93	2.2	0.58	2.23	3.8	-	-	-
D	0.48	1.05	2.2	0.50	1.36	2.7	-	-	-

Plant experienced power surge in late June. Therefore, July-October, 2005 flow rate readings are not available.

Figure 3.3: WWTP Flow Variation 2004

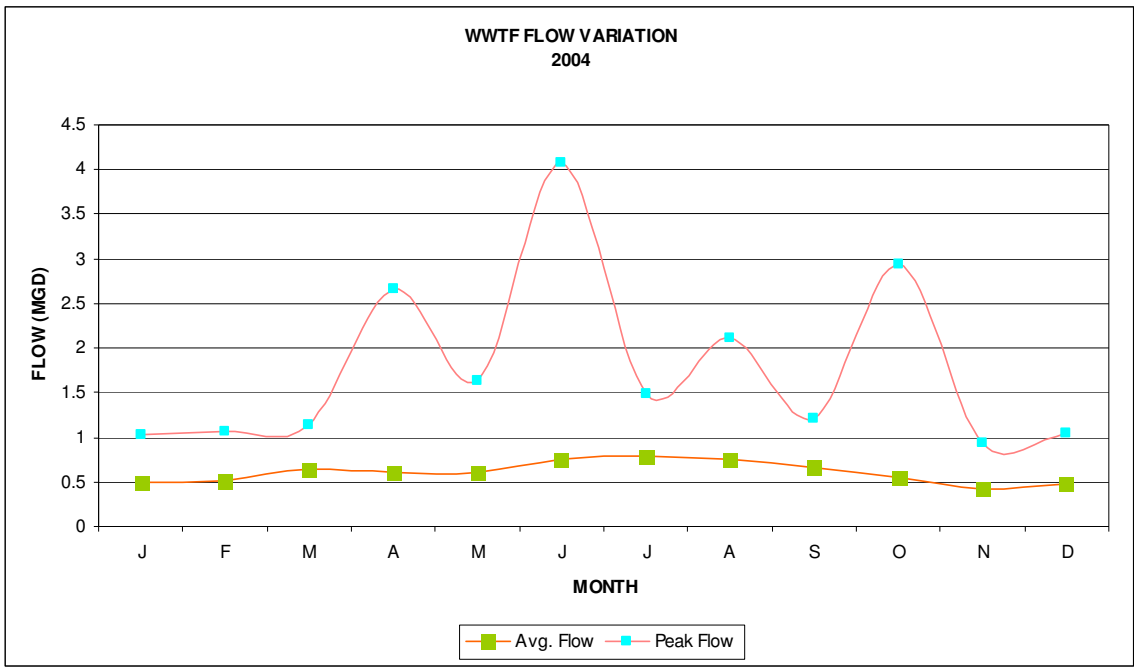


Figure 3.4: WWTP Flow Variation 2005

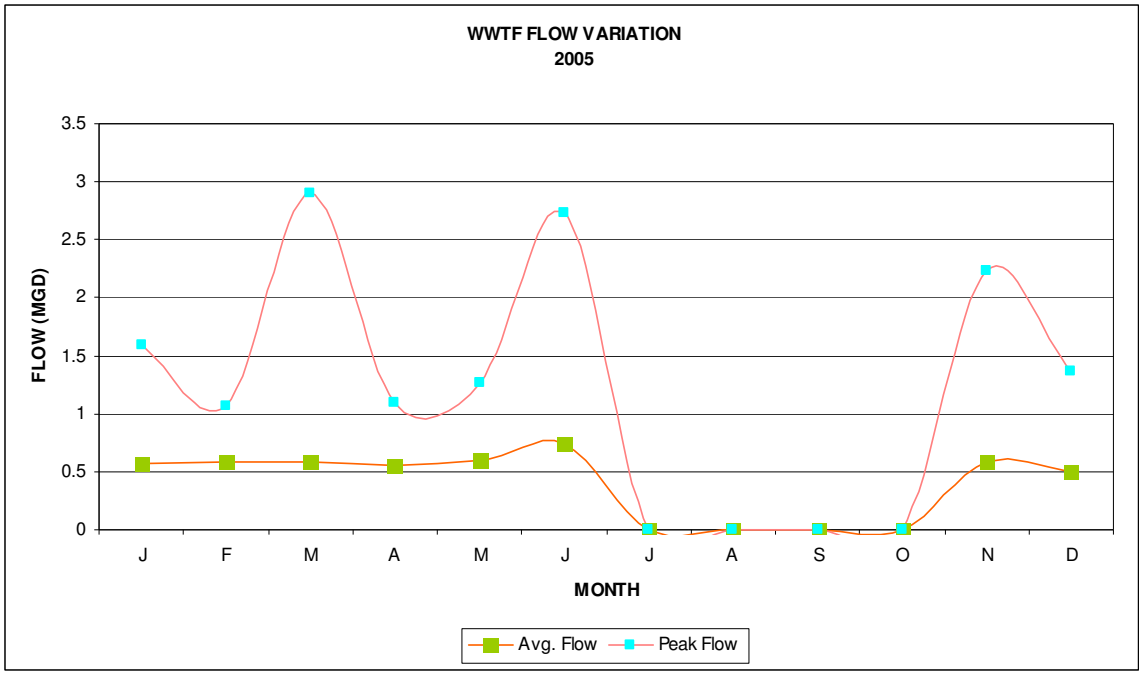
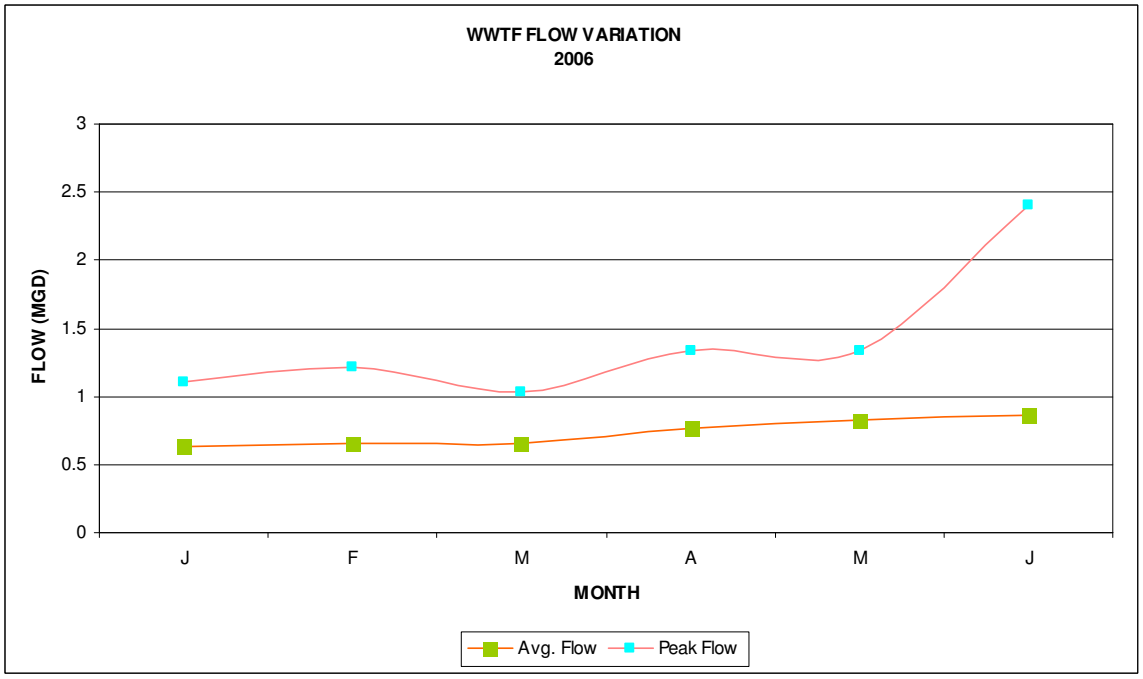


Figure 3.5: WWTP Flow Variation 2006



3.5 Design and Performance Criteria

The City has established criteria upon which all new wastewater facilities should be designed. The criteria were developed in 1991 and were updated in September 2004. A summary of the proposed design criteria for use in this Master Plan is listed in the Table 3.2.

Table 3.2: System Design and Peformance Criteria

System Element/Condition	Capacity/Limits
Pipe Material	Poly Vinyl Chloride (PVC) for all new pipe
Manning's Coefficient (N)	0.011 for PVC 0.013 for Vitrified Clay Pipe (VCP)
Peak Factor	3.0
Minimum Pipe Diameter	8 inches
Percent Full (d/D)	
12 inches and smaller	50%
15 inches and larger	75%
Minimum Pipeline Grades:	
Pipe Size in Inches	Minimum Grade %
8	0.40
10	0.28
12	0.28
15	0.22
18	0.12
21	0.10
24	0.08
Minimum pipeline velocity under peak hour flows	Greater than or equal to 2.0 fps
Backup power	4 hours of typical electrical loading
Wastewater treatment capacity	125% of anticipated flows
Sewers shall run in straight line between manholes	
Sewer pipelines in streets are normally located 5 feet from and parallel to street centerline	
Minimum depth from finished street grade to the top of sewer main	6 feet. Commonly accept sewers shallower than 6 feet.
Manholes are required at:	Changes of slope in sewers over 0.1 %
	Changes of direction of sewers
	Junction of sewers
	Termination of sewers, except at locations approved by the City
	Change of pipe size in sewers
	Other locations specified by the City
Maximum manhole spacing	300 feet
Minimum manhole diameter	4 feet
Manhole material	Concrete

System Element/Condition	Capacity/Limits
Minimal head losses in manhole	Straight run through manholes based on 0.00 foot loss
	Right angle turn in manholes based on 0.5 velocity head loss, or 0.10 feet whichever is greater
Change in Direction	No change of flow direction within a manhole shall exceed 90 degrees
The smaller pipe shall have its crown elevation equal or higher than the crown elevation of the larger sewer	
Minimum separation between sewer and water mains (edge of pipe to edge of pipe)	10.0 feet for parallel and nearly parallel pipes
Discharge criteria	Per Regional Board permit

Source: City of Bishop Specifications for Domestic Water and Sanitary Sewer Systems, 1991.

3.6 Budget Information

The City of Bishop provided Nolte Associates with its preliminary budget for the fiscal year 2007-08. On July 1st of 2006, the sewer fund had a beginning balance of $720,952, and the ending balance as of July 1st, 2007 was $551,268. Revenues from the sewer fund for 2006-07 totaled $680,528, and came primarily form the sewer service collections. Other sources of revenues are interest on bank deposits, and sewer service penalties.

The major expenditures of the sewer fund include: salaries and benefits, supplies and services, and capital improvements. These expenditures added up to $850,212.

The approved budget by the Council for the fiscal year 2007-08 for the sewer fund was $867,645. The proposed capital improvement, equipment, and replacement budget for fiscal year 2007-08 is $254,250.

3.7 Sewer Rates and Billing Structure

The City of Bishop collects fees for the sewer services provided to its residents. The sewer rates are based on the Single Family Residential User Equivalency (SFRUE), which is $20.00 per month as of July 1, 2007. The minimum sewer rate is one SFRUE per month. Sewer connections are placed into categories and are charged in accordance with the Table 3.3. The billing rate is a flat fee, regardless of the amount of water used.

Table 3.3: Sewer Rate Categories and Monthly Rates

Sewer Rate Category	Monthly Rate
Single Family Residence	1 SFRUE/ per unit
Multiple Family Residence	0.80 SFRUE/per unit
Church	1 SFRUE plus 1 SFRUE for each recreation hall
Hospital	1/3 SFRUE per maximum licensed patient bed capacity
Lodge and Meeting Hall	1 SFRUE plus 1 SFRUE for each bar with alcoholic beverage license
Elementary School	0.04 SFRUE per ADA
High School	0.04 SFRUE per ADA
Other School	0.32 SFRUE per ADA

Sewer Rate Category	Monthly Rate
Fairgrounds	7 SFRUE
Service Station	0.40 SFRUE per island
Car Wash	3 SFRUE per rack
Beauty or Barber Shop	1 SFRUE per shop
Bar	0.08 SFRUE/unit of seating capacity
Hotel or motel	1 SFRUE per manager's quarters plus 0.25 SFRUE per rental unit
Laundries, Commercial	3 SFRUE per washing unit
Laundromat with automatic washers	0.80 SFRUE per automatic washer
Restaurant	0.10 SFRUE per unit of seating capacity
Trailer Dump Station	2 SFRUE
All Others	1 SFRUE per water closet or per equivalent fixture unit

Revenues from these charges are used to pay for Operation and Maintenance (O&M) and capital expenses. Capital improvements on the wastewater system are necessary to provide satisfactory service to the residents of Bishop and to meet regulatory agency requirements.

The new rates that went into effect in July 2004 included four annual increases through July 2007. The SFRUE increased to $20.00 per month on July 1, 2007. Each year the City will receive a departmental analysis of the status of the infrastructure and finances affecting the Wastewater department. In 2008 the department will provide a comprehensive review including engineering, capital improvement program and progress toward meeting capital funding programs.

Based on the sewer rates, the City of Bishop's annual operating revenue is estimated to be $680,000. The amount is calculated by multiplying the monthly sewer rate per SFRUE for that year times the number of equivalent units, times 12.

Approx. Annual Operating Revenue = Monthly Service Rate x Number of Equivalent Units x 12

4.0 Evaluation of Existing Wastewater Facilities

4.1 Wastewater Collection System (WCS) Evaluation

Manhole Evaluation:
Nolte Associates, Inc. inspected approximately 256 sanitary sewer manholes in the City of Bishop by surface inspection. The manholes are spread throughout the city. In general, the majority of the manholes are in a good operational condition. There are manholes that need immediate attention and require either re-grouting of manhole material, channel replacement, or pipe replacement. Several manholes lack defined channels or inlet/outlet pipes, causing clogged lines and making invert elevation very difficult to determine. In addition, numerous manholes have unsafe or insufficient rungs, which should be improved or removed to enhance safety. The manhole conditions and recommended improvements are shown in Table 1.

The majority of the inspected manholes have excessive rag, paper, solids and grease build up either in the channel or the bench causing manholes to back up and cause the manhole to flood at some time. The sewer lines both upstream and downstream of these manholes require regular flushing and vacuuming.

A database for manhole investigation was prepared during this report.

Sewer Lines Evaluation:
Between the period of July 11 and July 25, 2006, Nolte and its sub-consultant inspected approximately 70 sewer lines by mean of closed-circuit television (CCTV). The inspected lines were chosen after discussions with the City Engineer and maintenance personnel who provided us with a list of priority sewer lines to be inspected. Pipe diameters varied between 6" and 10". Generally, the inspected sewer lines are in poor condition. Common problems were root penetrations, grease build up, offset joints, cracked pipe, missing pipe, structural damage, and infiltration. These conditions may not be indicative of the remainder of the City, as the inspected areas were suspected by the City staff as problematic.

It is recommended that all structurally damaged pipes be replaced. In addition, some lines had excessive grease build up causing blockages to the flow of water. These lines should be regularly cleaned. Several lines have serious dips/sages causing water stagnation and need to be replaced. Almost all lines that were inspected have serious root problem. Roots have penetrated through the pipes at cracks and joints. Some lines were blocked due to extreme root growth and require cleaning.

Appendix C has a summary of the lines that were inspected, their conditions and observations.

Deficiencies:

WCS-1: Sixty six (66) manholes throughout the collection system have problems such as deteriorated grout, missing or eroded channel bottom, broken inlet/outlet pipes, build up of solids, rags and grease, root invasions, insufficient or missing rungs, and flooded manholes. Table 1 showing the conditions of the manholes is attached in Appendix B.

WCS-2: Generally, the inspected sewer lines were in fair to poor condition. Common problems were root penetrations, grease build up, offset joints, dips and sags, cracked pipe, structural damage, and infiltration. Appendix C shows the conditions of the sewer lines.

WCS-3: Several lines have excessive grease build up causing flow back ups.

WCS-4: There is a serious infiltration problem in the line between manholes WY1 and PA20. Although the line was not videotaped, visual inspection of both upstream and downstream manholes reveals that this line has high infiltration. The City will attempt to videotape his line in then near future to determine the cause of high flows during low flow hours.

WCS-5: Some sewer laterals were constructed of steel and may have corrosion.

WCS-6: Not used.

WCS-7: The Johnston Drive lift station adds annual electrical and O&M costs to the city which could be saved if the pump station were removed.

WCS-8: The City does not have SCADA capability at Johnston Drive lift station which would allow for remote monitoring and control. This would alert City staff of mechanical problems or spill risks and decrease response time.

4.2 Wastewater Treatment Plant (WWTP) Evaluation

Projected flows:

Although the trend of population growth within City limits has remained flat for recent decades, growth beyond City limits is very probable. It is advisable that the City work with adjacent agencies to address the impacts of future population growth on the wastewater collection and treatment systems.

At the present time, the Bishop Paiute Tribe has a contract with Eastern Sierra Community Services District (ESCSD) for the treatment and disposal of up to 0.285 mgd. In the event that the Tribe needed additional capacity, it is highly recommended that the feasibility of combining efforts with the District to collect and treat the additional wastewater flows generated in the reservation be evaluated. The City should consider this opportunity as a new source of revenue in years to come. In the event that the COB and ESCSD were to come to an agreement, the District would continue to handle most of the flow generated within the reservation, whereas the City would pick up the difference. To resolve growth and treatment capacity issues, it is the City's policy to work for the Tribe through the District.

At full build-out, the COB's projected average daily wastewater flow will be approximately 4.67 mgd (see Table 3 in Appendix E for calculations). The Bishop Paiute Tribe currently generates 0.225 mgd of sewage. The Bishop Paiute Tribe's projected full build-out wastewater flow is projected to reach approximately 0.35 mgd (Bishop Paiute Wastewater Treatment facility Feasibility Study, September 2005).

As both the COB and the Bishop Paiute Tribe expand, the sewage flow will increase up to the 2 mgd level; the 2 mgd level is an arbitrary flow which is expected to occur at some point in the future. This projected flow is called the 2 mgd scenario.

This full build-out projection represents a significant increase to flows to the COB WWTP. This projection is conservative and highly dependent upon the built commercial areas. Possible future flow scenarios are shown in Table 4.1.

Table 4.1 Possible Wastewater Flow Scenarios

Average Daily Flow (present)	0.8 mgd
Average Daily Flow + Tribe Flow (present)	1.08 mgd
Arbitrary Average Daily Flow (future)	2.0 mgd
Average Daily Flow (City full build out)	4.67 mgd

Bishop Treatment Plant (TP)
The City of Bishop wastewater treatment plant consists of primary and secondary treatment facilities which were designed on the basis of meeting a Waste Discharge Requirement of 30 mg/l of BOD at an average daily flow rate of 1.6 mgd. To meet the requirement the plant was modified and expanded in 1979. At that time, BOD testing was allowed on filtered samples. In October 1985, the Waste Discharge Requirements were modified to require a discharge BOD requirement of 50 mg/l on an unfiltered sample.

The automatic sludge removal facilities were constructed as part of the 1979 plant expansion. These facilities included pneumatically operated valves for automatic withdrawal from the clarifier hoppers, sludge density mater, and a bubbler system for automatic tart and stop of the sludge pumps. Due to failures in the automatic valves, this system is no longer used and sludge is removed manually twice a day.

Each of the major components of the wastewater treatment facility has been analyzed as to its capability of operating satisfactorily at the above mentioned flow scenarios. At the end of each section, a list of deficiencies is included.

Primary Treatment Facilities
The major components of the primary treatment units consist of the following:

1. Barminutor
2. Grit Chamber
3. Dual Clarifiers
4. Sludge Transfer Facility
5. Two Stage Digesters (Primary & Secondary)
6. Grit and Sludge Dying Beds

Barminutor
The existing bar screen is manufactured by Wiesemann Engineering, Model number FS304-23-126 with ½" openings, 75 Degree Pivot Mounting, ¾ Horse Power 230/460/3/60, 2 feet wide. It is capable of passing 4.0 MGD of wastewater at a velocity of 1.71 ft/sec.

This hydraulic capacity of the unit is sufficient for the above mentioned flow scenarios except for ultimate build out (4.67 mgd). At that flow, a second bar screen is needed.

The unit is in a deteriorating physical condition and maintenances and cleaning of the barminutor's teeth and comb have to be performed very frequently. The treatment plant operators propose a more state-of-the art automatic screening mechanism that is more efficient and requires minimal maintenance and operator supervision. Large organic objects caught by the bar screen are broken down with high pressure spray. The spray includes an added effluent spray bar. The effluent spray is a potential health and safety concern with the current plant configuration.

Figure 4.1 Existing Barminutor

Deficiencies:

1. TP-4 Lack of hand railings around the screen area.
2. TP-9 Bar screen lacks self cleaning mechanism. Staff is required to move solids into a dumpster by hand (shovel).

Grit Chamber

The grit chamber has been designed for a velocity of 1 ft/sec at the design flow which will settle out heavier grit from the sewage. The grit chamber is cleaned twice a day manually. From a hydraulic point of view, the grit chamber has enough capacity to handle the flow scenarios except for average daily flow at ultimate build out (4.67 mgd). At that flow, a second grit chamber is needed.

The current chamber requires grit to be removed by hand (rake) to the grit pump intake. Moving material by hand at the plant should be eliminated. The wastewater treatment plant operators propose a more modern grit chamber design with automatic controls that allows for more efficient separation between grit and organics. An aerated grit chamber is a viable option. The current grit chamber can be converted or replaced by an aerated grit chamber.

Figure 4.2 Existing Grit Chamber

Deficiencies:

1. TP-4 Lack of hand railings around the grit chamber
2. TP-10 Grit chamber requires manual clean and lacks aeration. Grit chamber performance would be enhanced with an aerated grit chamber.

Clarifiers

Each of the two clarifiers is 18 feet wide, 70 feet long and average depth of about 7.25 ft. Both clarifiers have all parts necessary to operate, including sludge scrapping. One clarifier is partially disassembled to protect plastic parts from sun damage. In addition, while one clarifier is out of operation, the City plans to obtain replacement parts.

A comparison of the actual loadings at the design flow of 1.6 mgd with the recommended loading ranges is shown below:

	Design Loading	Recommended Range
Surface Loading (gpd/ft^2)	635	600-1200
Detention Time (hr)	2	1.5-3

The hydraulic capacity of the two clarifiers was evaluated against the different wastewater flow scenarios. The clarifiers' hydraulic detention time and surface lading rate were compared to recommended design values commonly used in the design of primary wastewater clarifiers.

Figure 4.3 Existing Clarifier

The current clarifier capacity is sufficient for the flow scenarios with the exception of full built-out situation, in which additional clarifiers are needed. For the ultimate build out peak flow scenario, the combined capacity of the clarifiers needs to increase by 350%, which equals five more clarifiers with the same dimensions as the ones currently in place. Since the full build out wastewater flow scenario will probably not happen in the next 20 years, upgrades to the wastewater treatment plant have to be gradual.

A viable option would be to construct a larger clarifier when it is deemed required (100% of the existing capacity), and maintain the existing ones in operating condition to accommodate gradual increases in wastewater flows when they become necessary. Gradual increases in capacity offer more flexibility to the operation of the WWTP, and facilitate hydraulics throughout the plant by providing more redundancy.

Also, at full build out, upgrading or converting the treatment plant to an activated sludge systems should be considered. If the plant is converted to an activated sludge system, aeration tanks with both aerobic and anaerobic zones would replace the existing oxidation and percolation/evaporation ponds. This option will save land and will produce consistent plant effluent that meets regulatory requirements.

Deficiencies:

1. TP-12 One non-operational clarifier lacks replacement parts for the scraping mechanism.
2. TP-18 Lack of sampling capability after the clarifier.

Sludge Transfer Facility

The sludge feed from the clarifiers is sent to the sludge pump room by gravity. The operators dump approximately 2000 gal/day of sludge. The sludge is later pumped into the digesters for treatment. Although an automatic sludge removal system was constructed which allowed for sludge withdrawals based on a timer set schedule, the system is not currently used due to periodic electrical and mechanical failures. Therefore, the sludge is removed from the hoppers manually twice a day.

The sludge pump vault seems to be of adequate size to access all pumps and valves conveniently. In addition, the stairs into the vault seem adequate. The roof of the vault was recently replaced with a roof that will be easier o remove so that heavy equipment such as pumps can be easily moved in and out of the vault.

The sludge pumps and valves are deteriorating and need replacement. The operators opt for a modern sludge transfer facility with new equipment and instrumentation and controls to allow for automatic transfer of sludge. Also, the 6" sludge line to the clogged with grease and only 4" of the line is used to sludge transfer.

Deficiencies:

1. TP-11 Pumping equipment (pumps and valves) is constantly failing.

Digesters

The COB digester system is a two a two-stage system consisting of a 28' ft. diameter by 14 ft. high primary unit and a 32 foot diameter by 8 ft. high secondary unit. The primary digester's contents are heated by recirculation through heat exchanger and mixed by means of gas recirculation. The

secondary digester is not heated. Based on discussions with the treatment plant operators, the digesters, from a functionality stand point, work within their design capacity and temperature. The methane produced from the digesters is intended to be used as fuel for the boiler that heats the sludge, but it is currently non-operational.

Figure 4.4 Existing Digester

The digesters are shown signs of aging (built in the 1950s). There are some "leaks" around the access openings. These leaks were adequately sealed with sealant when the access openings were re-closed after cleaning. Both digesters lack hand railings. The digesters require a lot of propane, the methane generated is not sufficient and it is augmented by two propane tanks existing at the treatment facility. The digesters lack gas storage facility. The methane piping from the digesters was recently replaced in the summer of 2005 when the digesters were cleaned.

The current digester capacity is sufficient for the flow scenarios with the exception of full build-out situation, in which additional digesters are needed. For the ultimate build out peak flow scenario, there is a need of five additional digesters (of the same dimensions as the existing digesters) to be in operation. Similarly to the clarifiers, a viable option is to build bigger size digesters to cut down on the number of digesters; when the capacity of the existing digesters is maxed out, one digester that accommodates the combined volume of waste sludge should be build while the two remaining digesters remain on stand by to supply additional capacity with gradual waste sludge flow increases. This approach offers flexibility to the operation of the sludge handling units in the WWTP.

Also, the replacement of the existing digesters should be considered to allow for the installation of more modern digesters equipped with sufficient instrumentation and controls to minimize maintenance. New and modern digesters equipped with gas collection system will ensure the efficient treatment of sludge and ease of operation and maintenance with minimum down time.

Deficiencies:

1. TP-4 Digesters lack hand railings.
2. TP-13 Digesters nearing end of useful life.
3. TP-14 Gas cannot be stored.

Grit and Sludge Drying Beds

Digested sludge is laid out on the COB's four sludge drying beds. Each bed is approximately 70 ft. long and 30 ft. wide. The assessment of the sludge drying beds was based upon the number of inhabitants for each of the flow scenarios and assuming the per capita area required is 2 ft^2.

The current sludge drying beds holding capacity is enough for the present average daily flow of 0.80 mgd. Provisions will have to be made for future increases in waste sludge, for example, in the event of the City accepting flows from ESCSD. For an additional 0.285 mgd that would be diverted to the City's WWTP originating from ESCSD (1.087 mgd), there will be a need for two 2 additional sludge drying beds, one additional bed will be used as a backup in case other beds needs repair or maintenance (total of 7 beds). At the 2 mgd scenario, there will be a need for one additional bed. At full build out (4.67 mgd), upgrading/converting the drying process to include mechanical drying capabilities should be considered.

Figure 4.5 Existing Grit and Sludge Drying Beds

In addition, there are four grit drying beds which receive the grit form the grit chamber. Grit consists mostly of sand, gravel, cinders, and other heavy materials that have higher specific gravities. The grit chambers clog up quickly because they have poor drainage, therefore, should be eliminated as part of a head works improvements program. The grit cambers are another part of the plant that requires material (grit) to be removed by hand (shovel). One viable option is a new aerated grit chamber instead of the existing grit chamber. If an aerated grit chamber is used, there will be no need for grit drying beds.

Deficiencies:

1. TP-15 Grit drying beds have poor drainage and lack access ramps for maintenance and
2. TP-16 Sludge drying beds are close to trees owned by ESCSD WWTP which prevent sun needed for drying.

Secondary Treatment Facilities (Ponds 1, 2 and 3)

The secondary treatment facilities consist of three bentonite lined facultative (oxidation) ponds. Pond 1 of the ponds has concrete slopes. The ponds were designed primarily as stabilization ponds; however there are currently 12 aerators to enhance Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS) removal. The ponds are not operated anywhere to their design depths. Operating the ponds at their design depth (6 ft approximately) optimizes the benefits of a facultative pond by allowing the anaerobic layer to develop on the bottom of the pond, and allowing the aerators to mix the upper layers without completely mixing the pond contents.

The original design criteria for the ponds are as follows:

Pond	Area (Ac.)	Depth (ft.)	Detention Time (Days)
1	6	7	9
2	4.8	6	6
3	5.8	6	7

To access the capacity of the stabilization ponds, the Duncan Mara Formula was used. This formula is as follows: BOD_5

A_F (acres)= $Q*(L_i-L_e)/(18*D_F)*(1.05)^{T-20}$

Q (mgd) =Wastewater Flow

L_i =BOD_5 Concentration at Inlet mg/l

L_e =Desired BOD_5 Concentration at Outlet mg/l

D_F (feet) =Depth of Pond

T (°F)=Mean Temperature of the Coldest Month

A_F (acres)= Facultative Pond Surface

In this equation, it was assumed that the influent BOD_5 after the clarifier is 164 mg/l with an average BOD_5 removal of efficiency of about 70%. These assumptions are within the design parameters of waste stabilization ponds. Complete stabilization pond calculations are attached in Appendix F.

Figure 4.6 Existing Oxidation Pond

The existing oxidation pond capacities are sufficient for the flow scenarios with the exception of full build-out situation, in which additional pond area is required. For the ultimate build out peak flow scenario (4.67 mgd), there is a need of 35.4 acres. The existing total area for ponds 1, 2 and 3 is approximately 16.6 acres; therefore, an additional 18.8 acres are required for ultimate build out. If the wastewater flow reaches the 4.67 mgd level, the treatment plant should be converted to an activated sludge system to reduce land requirements and maximize the property the City already owns.

An activated sludge treatment consists of an aerobic bacterial culture that is maintained in suspension in a reactor, which carries out the conversion of organic waste into carbon dioxide, water, new bacterial cells and other end products. The aerobic environment in the reactor is achieved by the use of diffused aeration, which also helps maintain the mixed liquor in a mixed regime. After a specified time, the mixture of new cells and old cells is passed into a settling tank where the cells are separated from the treated wastewater. A portion of the settled cells is recycled to maintain the desired concentration of organisms in the reactor, while the other portion is wasted

Also, if the required BOD effluent concentration levels are lowered, the aeration or pond area may need to increase, or make other plant improvements. Converting to an activated sludge system could save the current 16.6 acres of oxidation pond area and the 29 acres percolation area.

The treatment plant operators completed a sludge reduction program in 2007 performed in Pond 3, in which a product called BioEnergizer reduces the sludge through biological action. This program was started about 3 years ago and has been proven to work. They started with a sludge layer in the bottom of the pond of as much as 4 feet in spots and after one year the sludge layer was reduced to less than 6 inches. They are currently adding BioEnergizer to Pond 2 and expect to see the same results. The operators put the majority of their effort to Pond 3 because that is where the BOD samples are taken, and is also what the State Water Quality Control Board considers to be the Discharge Point. These ponds can not be drained.

Deficiencies:

1. TP-17 Ponds cannot be drained for clean up, corroded inter-pond piping and valves, clogged 12" CMP line between pond 3 and 4.
2. TP-18 Lack of sampling capability between ponds. It is possible that no special facilities for sampling were considered in the original design.

Effluent disposal (Ponds 4, 5 and 6)

The COB method of disposal is by discharge to three unlined percolation ponds totaling approximately 15 acres. In addition the effluent can discharged to about 165 acres of pasture land.

The COB performs some minor maintenance to Ponds 5 and 6 each year. This work includes drying of the ponds and then scrapping the bottom to enhance the pond's percolation capabilities without

sacrificing the ponds 'bottom. The wastewater treatment plant operators do not have operational problems with these ponds. These ponds cannot be drained.

Other Deficiencies

1. TP-1 Lack of back up generator at the WWTP. The generator will serve as an auxiliary power source in the event of a power outage.

2. TP-2 Lack of on-site bathroom facility which is an inconvenience of the WWTP operators and could become a health and safety concern. The operators currently use the bathroom area located at the adjacent ESCSD WWTP.

3. TP-3 Insufficient lighting. This will enhance safety at the WWTP and assist in emergency repairs and inspections during night hours.

4. TP-5 Lack public works yard. Currently the COB uses the public works yard which is located in downtown Bishop on Warren Street, next to City Hall. It is utilized for the storage of pipes, valves, backhoes & other equipment, and used to accommodate employee parking, offices, and the maintenance shop. If a new storage/work shop area is built in the WWTP, this building could be demolished and re-developed according to its zoning designation. The existing yard parcel could be better served by other purposes.

5. TP-6 Existing propane tanks are too close to an old flame check and could cause safety concerns.

6. TP-7 Lack of SCADA system which allows for remote monitoring and control.

7. TP-8 Lack of emergency interconnection between COB and ESCSD WWTPs. This interconnection will allow for diverting the sewage flow from the ESCSD WWTP to the COB WWTP in case the ESCSD treatment plant is running at full capacity and cannot receive additional sewage. An inter-tie with ESCSD is one of the most potential value for the master plan.

4.3 Regulatory Requirements (RR) (Conversation with Mr. Doug Fey RWQCB)

RR-1: Upcoming regulations on BOD level. If the COB discharge permit is reviewed, the RWQCB could set the BOD level at 25 mg/l instead of the current 50 mg/l. This will require the effluent downstream of the oxidation ponds to be treated up to the new standard before final discharge.

RR-2: Upcoming regulations on Nitrate-N level. The Nitrate-N level could be set at less than 7 mg/l. In addition, if the City expands and more flow is generated, the permit will definitely include Nitrate-N as a parameter to monitor.

RR-3: Upcoming regulations on disinfection. This regulation is concerned with the removal of bacteria and viruses, that will need to be removed by disinfection. As the city continues to grow, the RWQCB could push for tertiary treatment such as sand filters and/or disinfection to protect public health.

RR-4: Upcoming Waste Discharge Requirements (WDR). The State Water Resources Control Board (State Water Board) adopted Statewide General Waste Discharge Requirements (WDRs) for Sanitary Sewer Systems, Water Quality Order No. 2006-0003 (Sanitary Sewer Order) on May 2, 2006. The Sanitary Sewer Order requires public agencies that own or operate sanitary sewer systems to develop and

implement Sewer System Management Plan (SSMP) and report all Sewer System Overflows (SSOs) to the State Water Board's online SSO database.

RR-5: California Toxics Rule. This relates to hazardous substances. According to the RWCQB, the COB does not have any industries that contribute these substances into the sewage. If these substances exist, the sludge should be sampled and tested for hazardous material before disposal into hazardous material landfill, which is very expensive. These substances are not and will not be included in the COB new permit unless industries are connected to the system. Should such industries connect to the COB sanitary sewer system, pre-treatment, monitoring, and capital and operations cost impacts should be measured and paid for by the industry.

4.4 General Items (GI)

GI-1: Lack of cell tower for wireless communications. Installing a cell tower at suitable location in the WWTP will enhance the communications network, increases coverage and increase city revenues. A suitable location for this cell tower could be on top of the existing or future digesters. It is worthwhile to verify if the market supports a cell tower at the plant. Also, the proximity of the plant to the Bishop airport could limit the usefulness of such tower.

GI-2: Lack of Water Conservation and Time of Use Plan**.** Based on the Consumer Confidence Report of 2005, and on the City of Bishop's water consumption records, the average per capita water demand has exceeded 400 gallons per capita per day for the last seven years, even almost doubling these amounts during the hot summer months. The volume of water consumed on a yearly basis considerably high for a population of less than 4,000. Water conservation measures will have a positive affect on the sanitary sewer collection system by keeping pipes running at their designed capacity, preventing sewer overflow spills, reducing peak hour flows at the WWTP, and enhancing plant efficiency and performance by preventing hydraulic or biological over loadings.

GI-3: The current City of Bishop *Water and Sewer Standard Specifications* were prepared in 1991 and have not been revised or amended since then to include up to date construction and materials provisions.

5.0 Alternatives

Alternatives were developed to address the deficiencies that were in the sewer collection system and the wastewater treatment plant (WWTP) during the evaluation phase. The alternatives described in this chapter compile and group the deficiencies outlined in the previous section and offer costs for addressing these. Budgetary cost estimates were prepared for the proposed improvements to the existing wastewater infrastructure and they are presented in Appendix G of his document. A budgetary cost estimate is a preliminary cost opinion prepared for this master plan that includes labor and material costs and adequate contingency at planning level.

The proposed alternatives to address individual and combined deficiencies were based on the following main objectives of this master plan:

1. Reduce Operation Costs
2. Comply with Regulatory Requirements
3. Improve System Reliability and Redundancy
4. Increase Utilization of Capacity/Increase Revenue
5. Improve Customer Service
6. Improve Water Quality
7. Improve System Operations

The preparation of the cost opinions for the different water system improvements assumed prevailing wages applied

5.1 Wastewater Collection System (WCS) Alternatives

WCS-1: Several manholes throughout the collection system have problems such as deteriorated grout, missing or eroded channel bottom, broken inlet/outlet pipes, build up of solids, rags and grease, root invasions, insufficient or missing rungs, and flooded manholes. The manhole problems and the number of manholes with the specific problem are listed below:

Grout/mortar manholes with brick and mortar and reform channels	48
Add/replace manhole rungs	7
Replace broken manhole rings and covers	7
Replace broken inlet/outlet pipes	8

A. Grout/mortar manholes with brick mortar and reform channels, replace manhole rungs, replace broken rings and covers and replace inlet/outlet pipes.

B. Grout/mortar and epoxy manholes with brick mortar and reform channels, replace manhole rungs, replace broken rings and covers and replace inlet/outlet pipes (48 manholes).

C. Grout/mortar and epoxy manholes with brick mortar and reform channels, replace manhole rungs, replace broken rings and covers and replace inlet/outlet pipes (66 manholes).

The rehabilitation of some of the manholes is concurrent with a portion of the street improvements project. This is an opportune time to address the grouting and/or replacement of some of the deteriorated manholes.

WCS-2: Generally, the inspected sewer lines were in fair to poor condition. Common problems were root penetrations, grease build up, offset joints, dips and sags, cracked pipe, missing pipe, structural damage, and infiltration.

A. Pipe Replacement

Pipe replacement is used when the physical condition of the pipe is beyond repair due massive structural collapse, has long sag or belly, or has myriad problems occurring simultaneously.

The list of deficient sewers and the recommended method to address each deficient pipe segment is listed in Appendix C. The rehabilitation of some of the sewer lines is concurrent with a portion of the street improvements project. This is an opportune time to address the replacement or repair of some of the deteriorated sewer lines.

B. Install Cured In-Place Pipe (CIPP)

CIPP technology uses resin-saturated coated felt tube to rehabilitate sewer lines. After the tube is inserted, it is cured in place by hot water or steam to form a tight fighting, jointless, and corrosion-resistant pipe. This technology is appropriate for pipes with extensive root invasions, minor structural collapse and offset joints.

C. Point repair

Point repairs are used for sewer lines that are generally in good working condition that have minor deficiencies such as offset joints or a collapsed short stretch of pipe.

D. Pipe Bursting

Pipe bursting is a method for inserting a new plastic pipe of equal or larger diameter into an existing pipeline by bursting open the existing pipe and pulling or pushing the new pipe into the old pipe and expanded surrounding soil. The new pipe is simultaneously inserted into the enlarged hole created by the burster (or expander). This option involves more excavation than the CIPP method and may cause laterals to break during the bursting process. It is more appropriate for trunk lines and it is about 20 to 25% cheaper than cut excavation method.

WCS-3: Several lines have excessive grease build up causing flow back ups.

A. Grease Traps

An effective system of in-restaurant traps would seem to be the most effective to handle grease from restaurants. The installation of grease traps will minimize grease build up in sewers, especially in sewers located near restaurants or facilities that generate significant amounts of grease. Almost every restaurant has a grease trap. Grease traps are owned by restaurant owners and they have the responsibility to maintain these traps. Maintaining and servicing these traps is crucial to the effectiveness of reducing grease build up in the sewer lines. An education an outreach program should be implemented by the City to guarantee the adequate management of the grease traps by restaurant owners.

WCS-4: There is an infiltration problem in the line between manholes WY1 and PA20. Although the line was not video taped, visual inspection of both manholes reveal that this line always has high flow regardless of the time of day. This problem should be verified. The City plans on videotaping this line in the early months of 2008.

A. Point repair

B. Cure In-Place Pipe (CIPP)

It is advisable that the line be CCTV to recommend an alternative.

WCS-5: Some sewer laterals were constructed out of steel and many have since corroded away. This can enhance root intrusions and contaminate groundwater. An inert material should be used.

A. Replace steel sewer laterals with different type material according to standard engineering practices and specifications. The cost of replacement is assumed to be approximately $1,000.00 per lateral. A City program to replace these laterals should be integrated with other City projects such as sewer line improvements so that both the sewer line and the existing laterals can be replaced at the same time.

WCS-6: Not used

WCS-7: The need for Johnston Drive Pump Station

A. Continue to use the lift station

B. Lower trunk line adjacent and abandon the lift station

The Johnston Drive lift station collects sanitary sewage from approximately 14 houses and it is used to pump the sewage into the trunk line flowing towards the COB WWTP.

The rim elevation of MH JO1 (north of the trunk line) is 4124.082 ft. and invert elevation is 4118.292 ft. The rim elevation of MH T7 (manhole south of MH JO1) is 4125.788 ft. and invert elevation is 4120.888 ft. Because the invert of the trunk line is higher than the invert of the manhole that collects sewer from the houses on Johnston Drive, the lift station is needed.

Also, connecting the pipeline between MH JO1 and the nearest ESCSD's manhole is not possible. The rim elevation of ESCSD's manhole is 4125.227 ft. with invert elevation of 4118.727 ft. which is still at a higher elevation than the invert elevation of MH JO1. Therefore, the connection with the current conditions is not possible. The location of these manholes is illustrated in Appendix D.

The need for the lift Station on Johnston Drive could be eliminated if the trunk sewer could be lowered. This is furthered examined in section 6.3 Priority projects.

The lift station adds approximately $600.00 of electrical cost to the COB annually. In addition, the cost of claims due to sewage flowing into homes when the lift station fails could be significant. The cost to continue the use of the lift station will be considerably lower than lowering the trunk line. If the COB wishes to pursue Alternative B. further engineering work is required. Pumping at the treatment plant may also be required.

WCS-8: Lack of telemetry or SCADA capability at Johnston Drive Lift Station

A. Install SCADA system

Integrate and monitor Lift Compressor 1 & 2 status and alarms. Integrate and monitor lift level and alarms. The automatic tracking and reporting of compressor run hours.

5.2 Wastewater Treatment Plant (TP) Alternatives.

TP-1: Lack of backup power

A. Install a portable generator

This portable generator can be used for both the WWTP and the water supply system and should be sized to handle electrical loads for each system. A manual transfer switch could to be installed adjacent to the meter in the existing main service switchboard.

TP-2: No bathroom at WWTP

A. Share bathroom located at ESCSD WWTP

B. Build new bathroom

Building a new bathroom is more convenient to COB WWTP personnel, especially during night, weekends and when ESCSD is not manned.

TP-3: Insufficient lighting through out the WWTP

A. Install lighting in areas lacking sufficient lighting

This alternative will enhance the safety and security at the WWTP and facilitate night time repairs and troubleshooting.

TP-4: Lack of hand railings at headworks and digesters.

A. Installation of hand railings

TP-5: Public works yard

A. Relocate public works yard.

This property could be better utilized by another City facility or by a private entity. This could increase the City's revenue by selling the property, increased sales tax and increased property tax. The public works yard is located off South Warren Street in

downtown Bishop next to City Hall. It is utilized for the storage of pipes, valves, backhoes & other equipment, and used to accommodate employee parking, offices, and the maintenance shop. See section 4.5 General Water System Evaluation; section G-2 in the Water Master Plan.

TP-6: Propane storage tanks are too close to the flame which may not be working.

A. Relocate propane tank to safe location

B. Relocate burner to a safe location

TP-7: No telemetry or SCADA capability at the WWTP

C. Install a SCADA system

The installation of a SCADA system will fully integrate all facilities and increase system reliability. The SCADA system will integrate and monitor the most important variables in the operation of each one of the treatment units to guarantee the desired water quality, and to facilitate the management of sludge: headworks flow and pH, sludge inlet temperature, sludge outlet temperature, hot water boiler temperature, hot water bath high temperature alarm, hot water bath low level alarm, flame failure alarm and WWTP general alarm.

TP-8: Lack of an emergency interconnection between ESCSD and COB WWTPs to divert sewage from and to the treatment plants and deal with excess flow in emergency situations.

A. Emergency interconnection; pump into COB trunk line

The emergency interconnection will involve diverting the flow from the last manhole in the ESCSD sewer system before the ESCSD WWTP with a slide gate and installing 8" PVC line from this manhole to the COB diversion structure. Two submersible pumps will be used to pump the sewage with a third as a standby. The discharge line of the pump will be equipped with a quick disconnect mechanism to connect to the PVC stub outs located near by the manhole and the diversion structure.

B. Emergency interconnection; connect trunk lines

An interconnection at the crossing at the Bishop Canal is not possible because the existing city trunk sewer is near capacity. Therefore the City's trunk sewer is not hydraulically able to receive additional flow from the District, especially during peak hour. An interconnection at this location could be made part of a project to increase the capacity of the city trunk sewer. It is necessary to upsize the trunk line at a flatter grade that would allow diversion of ESCSD flows to the trunk line where the pipes cross. If possible, the configuration should allow additional ESCSD flows to also be brought to the trunk line from the major ESCSD branch south of Bishop to this same point, perhaps even along the adverse slope of the existing ESCSD line. This would allow for the elimination of the Johnston Drive lift station.

TP-9: Bar screen needs upgrade to allow for automatic grinding and dumping of trash and solids.

A. Continue manual clean up

B. Replace bar screen with automatic cleaning

The WWTP operators emphasized the need for a modern bar screen. This will provide automatic cleaning of the screen and direct disposal to a receptacle. Also, manual handling of solids would be eliminated.

TP-10: Grit chamber requires manual clean up and lacks aeration.

A. Continue manual clean up (2 times/day)

B. Install new aerated grit chamber

The WWTP operators emphasized the need for a modern aerated grit chamber. Vendors for aerated grit chambers were contacted and provided a budget cost. The existing grit chamber can be either retrofitted to include an aeration system or a new aerated grit chamber can be installed.

TP-11: Sludge vault pumping equipment is wearing out.

A. Design new sludge pumping room with automatic sludge transfer capability. Include new bathroom with project (TP-2)

TP-12: One non operational clarifier lacks replacement parts for the scraping mechanism.

A. Purchase replacement parts

This will allow either or both clarifiers to be used.

TP-13: Existing digesters were build during the 1950s and nearing the end of their useful life. The likelihood of failure is high.

A. Build two new digesters.

TP-14: Excess methane gas cannot be stored.

B. Install gas storage tank.

TP-15: Grit drying beds have poor drainage.

A. Grit drying beds could be eliminated with the use of a new aerated grit chamber (see TP-10). A new aerated grit chamber will eliminate the need to make improvements to the drainage of the existing units.

TP-16: Trees owned by ESCSD are next to sludge drying beds which prevents sun light needed to dry the sludge

A. Remove or trim trees. The trees have been recently removed.

TP-17: All ponds can not be drained. All ponds should have the ability to be bypassed and drained. In addition, almost all pipes and valves are badly corroded and should be replaced. The 12" CMP line between pond 3 and 4 is clogged.

A. Install diversion structure around pond 1, install new inter-pond piping and valves, fluch/vac. CMP line

TP-18: Lack of sampling between treatment units

A. Conduct weekly sampling program for BOD, TSS, TKN, NH_4 and NO_3 Sampling locations should include the clarifier and between the oxidation ponds to have a better understanding of removal efficiencies between process units. It is recommended to conduct sampling on a regular basis to compile and have data readily available if upcoming discharge regulations require it.

5.3 Regulatory Requirements (RR)

Upcoming discharge regulations related to BOD, Nitrates and disinfection can develop into potential deficiencies if the City is not prepared to address them. At this time it is uncertain which of these requirements, if any, are coming to the City of Bishop. The City should consider implementing the State Water Resources Control Board's monitoring and sewer management programs to comply with discharge regulations in case these requirements have to be adopted.

RR-1: BOD level will drop to 25 mg/l. If the COB discharge permit is reviewed, the RWQCB will set the BOD level at 25 mg/l instead of the current 50 mg/l. More advanced treatment is required to reach this future limit.

A. Install sand filter to reduce BOD to the future limit.

RR-2: Nitrate-N level will be < 7 mg/l

A. Create anoxic zone for Nitrogen removal in ponds downstream of pond 1.

RR-3: Install a UV disinfection unit

A. Install UV disinfection unit to meet tertiary treatment requirements.

RR-4: Meet Waste Discharge requirements (WDR)

A. Develop and implement Sewer System Management Plan (SSMP) and report all sewer system overflows to State Water Board's online database.

RR-6: Waste Discharge Requirements: The State Water Resources Control Board (State Water Board) adopted Statewide General Waste Discharge Requirements (WDRs) for Sanitary Sewer Systems, Water Quality Order No. 2006-0003 (Sanitary Sewer Order) on May 2, 2006. The Sanitary Sewer Order requires public agencies that own or operate sanitary sewer systems to develop and implement Sewer System Management Plan (SSMP) and report all Sewer System Overflows (SSOs) to the State Water Board's online SSO database. The State Water Board tasks and the required course of action to comply with this order and the cost associated with that task are listed in Appendix I.

To this date the City of Bishop has completed four parts of the SSMP.

1) The City filled out a collection system questionnaire. The questionnaire is very information orientated; it inquired about physical features such as the age of the collection system, the number of miles of pipe installed, and pipe materials.
2) The second part of the SSMP was the Sewer System Management Plan Certification. This consisted of getting the City enrolled in the Electronic Reporting Program.
3) The third task consists on doing the electronic reporting of Sewer Overflows. The City started electronically reporting in September of 2007.
4) The fourth item in the SSMP is setting goals for the City's collection system. This section is not due until May 2, 2008, but the City has already submitted. The goals defined by the City are found in Appendix I.

5.4 General Items (GI)

GI-1: Installation of cell tower

A. Install cell tower, this is a revenue generating measure of which the COB can take advantage. It is worthwhile to verify if the market supports a cell tower at the plant. Also, the proximity of the plant to the Bishop airport could limit the usefulness of such tower.

GI-2: High per capita water demand

A. Develop Water Conversation and Time of Use Plan. See the General Water System Evaluation, Section G-5 of the Water Master Plan. This will have a positive affect on the sanitary sewer collection system by keeping pipes running at their designed capacity, preventing sewer overflow spills, reducing peak hour flows at the WWTP, and enhancing plant efficiency and performance by preventing hydraulic or biological over loadings

GI-3: The City of Bishop Specifications for Domestic Water and Sanitary Sewer Systems, have not been updated since 1991.

A. Update standards to include modern design practices, specifications and materials.

6.0 Recommended Wastewater Improvements

6.1 Alternative Selection Matrix

Selection Criteria
The purpose of this section is to present the recommended alternatives and methodology used to recommend the different sewer system components. The evaluation was performed using an alternative selection matrix in which several criteria were defined and weighted in terms of their importance.

The alternatives were evaluated based on the following criteria:

- Capital costs
- Operation and maintenance costs
- Land requirement/environmental impacts
- Funding agency assistance
- Operational complexity
- Correspondence with other City projects
- Reliability
- Time for implementation

Each criterion was given a weighing factor ranging between 1 and 3 depending on the importance of the criterion. A higher weighing factor correlates with higher importance and a lower weighing factor correlates with lower importance. In addition, a scale from 1 to 5 was given to each criterion with 1 being "least favorable" and 5 being "most favorable". The total number of points for each alternative was calculated by summing the results of multiplying the weighing factor of the criterion by its given scale. The results of the alternatives selection matrix showing the selected alternatives are included in Appendix J. This methodology was used for deficiencies that have more than one alternative. Deficiencies with only one alternative were not included in this alternative evaluation. Hence not all capital projects are described in this section.

Based on this methodology, the selected projects are the following:

WCS-1C: Grout/Mortar and Epoxy Manholes
WCS-2A: Pipeline Replacement
WCS-3A: Installation of Grease Traps
WCS-4B: Install Cured-in-place Pipe
WCS-7A: Continue to use Johnston Drive Lift Station
TP-2B: Installation of New Bathroom
TP-3B: Improve lighting
TP-9B: Replacement of Bar Screen
T**P-10B:** Grit chamber upgrade

6.2 Prioritization Matrix

Prioritization Criteria
The methodology employed for prioritizing the sewer collection system and WWTP improvements projects was based on a prioritization selection matrix. The scoring is performed as discussed in the previous section: The higher the score, the higher the priority of the project and vice-versa.

The prioritization process was implemented among the selected projects described in Section 6.1, and the projects that only have one alternative solution. Their priority was established based on a scoring system similar to the one in the selection process. A score between one and five was given to each project and its alternative based on the following criteria:

- System Reliability
- Capital Cost
- Employee Health and Safety
- Correspondence with Other projects
- Revenue and Operational Cost
- Funding Agency Assistance
- Regulatory Requirements

The results of the prioritization selection matrix are included in the Appendix K. The three projects with the highest priority for the sewer collection system are as follows:

- WCS-1C: Deteriorating manhole conditions
- WCS-2A: Replacement of sewer pipelines
- WCS-4B: Cured-in-place pipe

The five priority projects for the WWTP improvements are as follows:

- TP-8A: Emergency interconnection between COB and ESCSD WTTPs
- TP-6A: Relocation of propane tanks
- TP-7A: Installation of SCADA system at WWTP
- TP-9B: Replacement of bar screen
- TP-11A: Replacement of sludge pumping equipment

6.3 Priority Projects

After conversations with the City of Bishop Public Works Department and WWTP operators, the City's top priority projects that require special attention are as follows:

1. Trunk Sewer hydraulic Analysis
2. Bar screen replacement
3. Grit chamber replacement
4. Sludge pumping room upgrade
5. new anaerobic digesters

1. Project Title: Trunk Sewer Hydraulic Analysis

   Improvement Number: WCS-9

   Project Summary: There are four objectives for performing this analysis: 1) determine if the City of Bishop trunk can be lowered so that flow can be diverted from the ESCSD branch (and vice-versa with a diversion structure or valve configuration) at the location where they cross, east of the Bishop Canal, 2) determine if flow from the southern ESCSD branch could reach a lowered Bishop trunk, 3) determine if the Johnston Drive Lift Station could be eliminated and, 4) determine how much of the northeast part (K-mart area) of the City could be served by the Bishop plant.

1) To determine if the Bishop trunk can be lowered, a hydraulic analysis was performed between COB manholes T9 and TL2 to determine normal depth under peak hour flow (1.6 mgd). The existing pipe that connects these two manholes is a 15" VCP pipe. Pipeline information (invert elevations, diameter, lengths, etc.) provided by the City was used to obtain the mean slope of this reach (S=0.00432). The existing invert elevation difference for these manholes is 7.623', separated by a horizontal distance of approximately 1,765'. Under peak hour flow conditions, the velocity and depth of the flow are within the acceptable values for performance criteria set forth in **Section 3.5.**

   Section **3.5 Design and Performance Criteria** recommends that under peak hour flow, pipes 15" and larger should run no more than 75% full (d/D=0.75; d≤11.25 inches) with minimum velocities of 2.0 feet per second to prevent solids deposits and risks for spills. Both these conditions are met under existing conditions at peak hour flow; the normal depth of the flow is 8.23 inches (< 11.25 inches). Thus, the City's trunk line can be lowered at the upstream end, manhole T9. However, it can be lowered to a certain elevation in order to pick up a portion or the entirety of the sewer flow from the northern ESCSD trunk line (approximately 361,500 gpd under peak hour flow) and still meet the recommended percent full and velocity requirements.

   ESCSD manhole invert elevations are not available at the time. As part of the Street Improvements Project, Nolte will survey all City of Bishop and some ESCSD and Bishop Paiute Tribe manholes. Utilizing the criteria described in **Table 3.2**, and a minimum slope of 0.22% for a 15" pipe, the trunk line could be lowered by 3.88' near manhole T9 where the City's trunk line and the District's trunk line cross. The velocity in the City's pipe is 2.75 feet per second and the normal depth is 10.31 inches, below the maximum that is acceptable.

   In the event that the COB lowered its 15" trunk line to receive flows from the District, an additional 666,500 gpd would flow into the City's system during peak hour: 305,000 gpd form the Tribe plus an estimated 361,500 gpd from the northern part of the District. These are all additional peak hour flows that the City could collect in the future in its trunk sewer for a total of 2.26 mgd. At this new slope (0.22%) and peak hour flow the sewer pipe surcharges.

   This result indicates that the initial 3.88' of available drop calculated originally is not possible. It cannot be determined at this point how much the City's manhole can be lowered in order to allow the interconnection and to convey the City's peak hour flow plus the additional flows from the District. There is not enough ESCSD manhole and sewer line information available at this time. Described in numeral 2) below, using a larger diameter pipe does allow the trunk line to convey the flow within the design criteria.

2) The invert elevation difference between the City's manhole and ESCSD's trunk line is unknown. The City's trunk line needs to be upsized in order to carry the additional flows. The following analysis was performed assuming a 4 feet drop (> 3.88') at the proposed interconnection manhole T9, an 18" PVC pipe, and a peak flow of 3.2 million gallons per day (mgd). This flow was obtained by multiplying the existing City of Bishop WWTP capacity by a peak hour factor of 2 to obtain peak hour flow, since the capacity of the plant is for average daily flow (1.6 mgd).

   Under these parameters, the following flow conditions were obtained:
   Flow depth (d) =12.62 inches, d/D=0.72%;
   Velocity=3.63 f/s;
   Slope=0.0021

3) To determine if the Johnston Drive can be eliminated, a hydraulic analysis (based on the parameters listed above) was performed assuming that the crowns of the proposed 18" and the incoming 6" sewer line from Johnston Drive match. The crown of the incoming 6" sewer line is located at 4118.87'. This crown elevation requires the invert of manhole T7 to be located at 4117.27'.

   The invert elevation of manhole T7 (adjacent to the Johnston Drive Lift Station) with the new slope of 0.0021 is 4119.53', approximately 1.36' higher than required in order to receive the Johnston Drive flow. Thus, the Johnston Drive Lift Station cannot be eliminated.

4) The sewer collection system at K-mart/Vons is made up of 8" sewer pipes. The manhole on the southeast portion of the shopping center KV1, has an invert elevation of 4130.50'. Assuming a new 8" pipe from Kmart/Vons with a minimum grade of 0.004, would require the crown of the proposed 18" on manhole T9 to be located at 4111.81'. The lowest point of the proposed trunk line is above this elevation, downstream by manhole T2L (4116.91'). Thus, the minimum recommended grade cannot be achieved. Assuming a peak hour flow from the K-mart/Vons area of 150,000 gpd through an 8" sewer pipe at the future available drop between manholes KV1 and T9 (S=0.00167), wastewater would flow at a velocity of 1.52 feet per second. This velocity is outside recommended guidelines for sewer pipes.

Lowering the trunk line at the upstream end (manhole T9) and maintaining the minimum required slope throughout (0.0021) will allow manhole T10 to be lowered too. Manhole T10 is located west of the Bishop Canal. Its existing invert elevation is 4126.08'. If the proposed 18" trunk line is extended to manhole T10 with a slope of 0.0021, the invert elevation of this manhole can be lowered to an elevation of 4122.27', approximately 4' lower. Currently, the existing sewer line crosses through the Bishop Canal. It is encased in concrete. In 2006, the top of the portion of the City's trunk line that runs across the Bishop Canal collapsed. Lowering the trunk line would help alleviate this situation by providing more protection to the pipe.

The analysis is necessary to guarantee adequate velocities and conveyance capacity during peak hour flows. Based on the results described above, the trunk line can be lowered but it cannot be determined by how much at this point. This hydraulic evaluation should be revised when manhole rims belonging to the City, the Bishop Paiute Tribe and ESCSD are surveyed as part of the street improvement projects. If the City decides to move forward with the lowering of the trunk line and the interconnection with ESCSD's collection system, these projects should be completed in conjunction with the headworks improvements project, and the relocation of the Johnston Drive Lift Station. The vicinity of the project location should be checked out for existing utilities that might conflict with the proposed improvements.

2. **Project Title:** Replacement of Bar Screen

   Improvement number: TP-9B

   Improvement Summary: The bar screen will capture large objects and protect downstream mechanical equipment at the wastewater treatment facility. The aerated grit chamber will capture sand and other fine material as they are abrasive to equipment.

   Project capital cost: $250,000

   Detailed description of work: The proposed project involves the installation of a new automatic headworks bar screen system to replace the manual bar screen. The system will be the turbo-washing screening system. It separates solids from primary screenings while returning the

organics to the biological process. Solids are washed and rinsed by natural influent flow using vigorous agitation.

Solids are captured on the fine screen. The influent level rises until a level switch activates the turbo washer and spiral drive. The spiral turns in reverse direction forcing the solids into the turbo washing impeller. A separation occurs, the liquid and fine organics pass through the screen. When the liquid level drops to a predetermined point the motor stops. On the final wash cycle, the well washed screenings are conveyed out of the screening zone. The captured solids are collected in a bin through an automatic chute.

In addition to acting as a solids washer, the bar screen, conveys and dewaters the captured solids so that the weight and volume of the final screenings are greatly reduces and they are discharged with maximum dryness and minimum odor.

The layout of the proposed bar screen system is attached in Appendix M.

Related Work: This work can be completed concurrently with the following projects: Lighting improvements (TP-3), SCADA System (TP-7), and Grit Chamber Upgrade (TP-10B).

Identified Permitting: NPDES-Coordination with Regional Water Quality Control Board, Air Permit.

3. Project Title: Grit Chamber Upgrade
   Improvement number: TP-10B

Improvement Summary: A new aerated grit chamber allows for better separation between sand and organic material. Grit such as sand and other fine material have to be captured as they are corrosive to equipment. The proposed project involves the installation of an aerated grit chamber to replace the existing rectangular grit chamber downstream of the bar screen. The new grit removal system is a compact, circular trap which will be located downstream of the proposed bar screen (TP-9B above).

Project capital cost: $125,000

Detailed description of work: The influent enters tangentially and flows around the tank, it then exists parallel to the inlet. Grit settles within the lower hopper and is transferred by a pumping system to a separately mounted screw classifier. Water containing the mixture of solids enters the settlement bowl of the classifier. The screw is rotated and the settled solids are transported up the incline archemidian screw. The grit product remains in the screw and is dewatered as it is elevated to the high level discharge. All other solids and water are drained to the main sewage flow. Both of these systems, the bar screen and the grit chamber will be connected to a SCADA system with alarms and controls.

The layouts of the proposed aerated grit chamber and screw classifier systems are attached in the Appendix N.

It is important to note that, the existing headworks and grit chamber could be abandoned if these upgrades are made. The future layout of the headworks and the grit chamber will be provided at the engineering design stage of the project.

Related Work: This project can be coordinated with project TP-9B, Replacement of Bar Screen, Lighting Improvements (TP-3), and SCADA system (TP-7).

4. **Project title:** Sludge Pump Room Improvements

   Improvement number: TP-11A

   Improvement summary: The sludge pumping room will transfer the primary sludge from the clarifiers to the anaerobic digesters for stabilization. The improved sludge pumping room will provide safer operating conditions for operators than the existing room.

   Project capital cost: $373,000

   Detailed description of work: The new room should allow for expansion and addition of new pumps, preferably peristaltic pumps. The sludge from the sludge sump will be discharged through a common header and pumped by two sludge pumps to the digesters.

   A new sky light and floor access hatch for accessing and removing mechanical equipment can be added to the new room. A unisex bathroom can be built adjacent to the pump room.
   The pump station will include a solenoid valve connected to a timer to control the quantity of sludge withdrawn from the primary clarifiers and allow for automatic sludge transfer without the presence of operators. Also, the room will be connected to a SCADA system with alarms and controls.

   By pass pumping will be used to transfer the sludge from the sludge sump to the digesters during the construction phase. A conceptual layout of the sludge pump room is included in Appendix M.

   Related Work: This improvement should be coordinated with Lighting Improvements (TP-3), SCADA System (TP-7), and Installation of New Bathroom (TP-2).

   Identified Permitting and Right of Way Issues: NPDES-Coordination with Regional Water Quality Control Board**,** Air Permit**.**

   Outside Funding Opportunities: USDA

5. **Project Title:** New Anaerobic Digesters

   Improvement number: TP-13A

   Improvement summary: The digester will stabilize and reduce the volume of sludge before final disposal. The proposed one stage anaerobic digester will supplement and eventually replace the existing two-stage anaerobic digester system. It will be located west of the existing primary digester.

   Project Capital Cost: $3,000,000

   Detailed description of work: The proposed digester will have sufficient capacity to handle the sludge generated by a 2 mgd average treatment plant flow with a projected sludge flow of approximately 3,740 gpd. The digester will be approximately 27 feet in diameter and 20 ft side wall depth with a fixed cover and concrete structure. The proposed digester will have sludge mixing, recycle, and heating mechanisms. The gas generated from the digester which is estimated to be approximately 7,000 ft^3 will be collected via a gas collection system for later storage and reuse or flared. In addition, the digester will be equipped with sufficient instrumentation and control to allow for ease of operation and system measurements. The

expected detention time in the digester is around 23 days which is sufficient for sludge stabilization. The major components of the proposed anaerobic digester are as follows:

- Concrete structure
- Fixed digester cover
- Pump mixing
- Heat exchanger
- Boiler
- Gas collection system and piping
- Flare facility
- Gas compressor
- Gas storage tanks
- Valves
- Instrumentation and controls

A Preliminary Engineering Report should be completed before the design of the proposed digester. ESCSD's anaerobic digester can be used temporarily during the construction of the new digester. The existing City of Bishop digesters should remain operational during the construction of the future digesters, and after. The proposed layout for the anaerobic digester is shown in Appendix O.

Related Work: This project can be coordinated with Sludge Pump Room Improvement (TP-11) and SCADA system (TP-7).

Identified Permitting and Right of Way Issues: NPDES-Coordination with Regional Water Quality Control Board**,** Air Permit**.**

Outside Funding Opportunities: USDA

7.0 Wastewater System Suggested Capital Improvements Plan

This section outlines and schedules the capital improvements to Bishop's wastewater system that were selected and prioritized in Chapter 6. Improvements are included for the systems collection, treatment, and disposal elements. The schedule for capital improvements has been developed by identifying deficiencies that need to be addressed at the present and anticipating future infrastructure improvements to meet growing demands and changes in federal and state regulations and goals.

The capital improvement plan for the City of Bishop sewer system is presented in Appendix L. Appendix L shows the anticipated improvements, their year of implementation, and their costs. The solution alternatives for the proposed projects were listed and were broken up into phases depending on the type of project. Potential funding agencies were listed next to each proposed project. The project cost of each proposed improvement is shown for each project in 2008 dollars.

The time horizon for the Capital Improvement Plan is 20 years (2009-2028). In recent years construction materials and labor costs increased by 10% to 15 %. Although the construction/building boom has slowed down, numerous inflationary pressures remain. Therefore, the annual cost increase for budgetary project cost increase has been lowered to 8%. Rates of inflation will likely vary throughout the capital improvement plan time horizon. The City should monitor factors that affect project costs and adjust project costs when necessary. The main criteria for spreading out the capital projects and their costs in the next 20 year period are the correspondence of any of the projects with a top priority project, the cost of completing such improvements, and the further utilization of existing infrastructure. The future value for the completion of each phase is shown on the estimated year of completion of the project phase.

For many of the 20 years in the CIP's time horizon, the projected capital expenditure exceeds the City's annual capital projects budget. To address this, the City has applied to outside agencies for financial assistance. The City has the option of financing projects in part through debt. In addition, many projects with a long term horizon (2015-2028) can be further phased or postponed. Reasonable increases in user rates will not permit the City to pay for these projects solely on a cash basis.

7.1 Immediate Projects (2008-2009)

The timeline for completing the proposed improvement projects was chosen based on the top priority projects described in section 6.3. The first projects that should be completed in the coming year, 2009, include the design phase for the grouting and mortar of the deteriorated manholes (improvement WCS-1), the installation of the grease traps in restaurants (WCS-3), and the inspection of the line suspected of allowing infiltration in which case would have to be lined with CIPP technology (WCS-4).

To correspond with the City's 2007 Road Projects Map, the manhole rehabilitation project WCS-1 should be scheduled for 2009. To correspond with the road improvement projects, the manholes located along the streets that would be repaired should be scheduled to be replaced simultaneously.

The design phase of project TP-9, Replacement of Bar Screen, is also scheduled to be initiated in 2009. It is possible to obtain funding for this project through the United States Department of Agriculture (USDA). A rate study has also been projected to be completed in 2009.

7.2 Future Projects (2010-2014)

The projects scheduled for the years 2010 through 2014 include Phases I and II of the rehabilitation of the deteriorated manholes, and the construction phases of the replacement of the pipelines that exhibit sagging.

Two of the top priority projects were schedule in the short term time horizon; the replacement of the bar screen and the upgrade of the aerated grit chamber. The design of the grit chamber project is set to begin in 2011 and its construction in 2012. The grit chamber will not have the capability to remove plastics. It is important the existing bar screen be maintained or that it be upgraded.

There are other projects that take place every other year or every five years, like the rate studies and future master plans.

The SCADA system upgrade is scheduled for 2010 to coincide with the finalization of the improvements to Well 4, Well 2 and the construction of Well 3, on the water system.

7.3 Long Term Projects (2015-2028)

The major projects scheduled to be completed in the long term include the design and construction phases of the improvements to the sludge pumping room with automatic sludge transfer capability. The completion of this project should be combined with the construction of a new bathroom. This project has been projected to be completed in the year 2015.

Other projects include the installation of an upgraded lighting infrastructure that will be manually operated with no glare fixtures. This project will be corresponding to the construction of the improvements to the sludge pump room.

The construction of the new digesters is estimated to begin in the year 2019 with its design, and will extend to through the year 2022. The relocation of the public works yard has been scheduled for the year 2020.

8.0 Appendix

Appendix A: List of Abbreviations

Terms	Abbreviation
Mile	mi.
Million Gallon	MG
Number	No.
Rotations Per Minute	RPM
Horsepower	HP
Gallons per Minute	GPM
Total Dynamic Head	TDH
Pounds per square inch	psi
Milligrams per Liter	mg/l
Pressure Reducing Valve	PRV
Upstream	U/S
Downstream	D/S
Maximum Contaminant Level Goal	MCL
Trihalomethane	TTHM
Chlorine	Cl2
Maximum Residual Disinfectant Level	MRLD
Total Dissolved Solids	TDS
Insurance Services Office	I.S.O.
Operations and Maintenance	O&M
Single Family Residential Unit Equivalent	SFRUE
Capital Improvements Plan	CIP

Agency Names	Abbreviation
City of Bishop	COB
Citizen's Advisory Committee	CAC
United States Environmental Protection Agency	USEPA
California Department of Public Health	CDPH

Appendix B: Manhole Conditions and Recommended Solutions

	Manhole Name	Location	Problem	Solution
23	SO2	South St. between Second St. and First St.	Eroded bench grout	Re-grout bench
24	SO1	First St. and South St.	Eroded bench grout	Re-grout bench
25	WA3	Clarke St. and Second St.	Insufficient rungs	Add rungs for safety
26	PA7	Hanaby St. and Pine St.	Eroded grout	Regrout bricks
27	WAW16	Willow St. between High St. and Third St.	Deteriorating concrete	Add concrete
28	WAW15	Willow St. and Third St.	If line flowing south backs up, MH floods and drains to east	Hydraulic assessment
29	CE2	Pine St. and Central St.	Bricks need to be replaced	Replace bricks and re-grout
30	PA11	Third St. and Pine St.	Brick has one large crack	Replace bricks and re-grout
31	PA23	Middle of Maciver St.	Broken VCP channel between inlet and outlet	Replace VCP between inlet and outlet pipe
32	PA17	Bishop creek in park south side of siphon	Broken piece of pipe in channel	Replace MH channel VCP
33	PA14	South east corner of park, just outside park	Broken ring and cover	Replace ring and cover
			Missing pipe in 8" inlet pipe	Replace 8" inlet pipe
34	CL7	Main St. between Line St. and Lagoon St.	Very narrow channel	Hydraulic assessment and modify channel
35	WAWI12	Main St. and Pine St.	Insufficient rungs	Add rungs for safety
36	EP5	Main St. and Grove St.	Broken rungs	Replace broken rungs
37	EP6	Main St. and Elm St.	Bench channel not well defined	Redefine channel
38	PA25	Main St. in front of Vagabond Inn	Missing VCP piping channel, straight down to sand	Construct channel between inlet and outlet pipe
39	PA26	Main St. near Smart St. and Final St.	Broken piece of VCP in channel	Replace broken pipe
40	PA28	Main St.	Bricks need re-grouting	Re-grout bricks
41	WAWI	Line St.	Bricks need re-grouting	Re-grout bricks
42	PA4	Line St. and Hanby St.	Bricks need re-grouting	Re-grout bricks
43	SM2	Main St. and South St.	Manhole cover does not sit flush	Inspect and adjust cover
			Missing bottom channel for 8" inlet and outlet pipe	Construct channel
44	WA10	Main St. and South St.	Bricks need re-grouting	Re-grout bricks

	Manhole Name	Location	Problem	Solution
45	WA11	Main St. and South St	Bricks need re-grouting	Re-grout bricks
46	IR1	Line St. and Warren	Broken ring piece	Replace ring piece
47	WA16	Line St. and Warren St.	Bricks need re-grouting	Re-grout bricks
			Broken ring piece	Replace ring piece
48	WA15	Line St. and Warren St.	Missing channel bottom on inlet half of channel	Replace channel
49	WL4	Line St. and Fulton	No apparent channel bottom	Inspect and replace channel
50	IR4	Line St. and Edwards	No apparent channel bottom	Inspect and replace channel
51	WL6	Line St. between Iris St. and Edward St.	Broken VCP	Replace pipe
			Possibly broken channel bottom	Inspect and replace channel
52	AC1	Academy St. and Warren St.	Broken ring	Replace ring
53	WA14	Warren St. between Line St. and Lagoon St.	Bricks need re-grouting	Re-grout bricks
54	WA17	Warren St. and Church St.	Bricks need re-grouting	Re-grout bricks
			No apparent bottom of 12" VCP	Inspect and replace bottom
55	CH1	Church St. and Warrant St.	No apparent channel bottom	Inspect and replace channel
56	WP7	Pine St. and School Exit	No apparent channel near outlet bottom	Inspect and replace channel
57	WP6	Pine and School Exit	Broken ring	Replace ring
58	WA19	Pine St. and Warren St.	Bricks need re-grouting	Re-grout bricks
59	PA29	Main St. and Wye Rd.	Bricks need re-grouting	Re-grout bricks
60	EE6	Elm St. between Central St. and Howard St.	Minor manhole cracks	Re-grout cracks
61	WIMA1	May St. and Third St.	Not well defined channel	Replace channel
62	PA9	Pine St. and Second St.	Missing piece of channel	Replace channel
63	PA8	Pine St. and Second St.	Bricks need re-grouting	Re-grout bricks
64	WY3	Main St. and Yaney St.	No apparent channel bottom, straight to sand	Replace channel bottom
65	WY2	Main St. and Yaney St.	broken VCP near south inlet	Replace broken VCP
66	T9	East Side of canal	No apparent channel bottom	Inspect and replace channel bottom

	Manhole Name	Location	Problem	Solution
1	MA1	Tri County Fair Entrance	Covered by tree	Clear roots
2	MA3	Maple and Tri County Fair	Beneath fence	Adjust fence
3	WY4	Yaney St.	Deteriorating grout between bricks	Re-grout bricks
4	WY5	Crosby St. and Yaney St.	Cracked concrete ring below cover	Replace ring
5	WY6	Yaney St. and Lee St.	Top bricks and concrete deteriorating	Replace bricks and ring
6	SI2	Sierra St.	Eroded bottom channel	Replace bottom channel
7	SI5	Sierra St. and Lee St.	Pipe entrance/exit not visible	Reshape bench and pipe
8	SI6	Sierra St. and Coats St.	Pipe not visible on east side	Reshape bench and pipe
9	WA31	Rome Dr.	Deteriorating top brick grout	Re-grout bricks
10	KE1	Home St. and Keough St.	Deteriorating top brick grout	Re-grout bricks
11	WE3	Elm St. and Home St.	Deteriorating top brick grout	Re-grout bricks
12	GR4	Grove and Home St.	Water slide (No channel)	Add channel
			Insufficient rungs	Add rungs for safety
13	GR3	Grove St. between Home St. and Hobson St.	Insufficient rungs	Add rungs for safety
14	GR2	Grove St. and Hobson St.	Insufficient rungs	Add another rung for safety
15	HA1	Elm St. and Warren St.	Steep slope between inlet and outlet pipe	Milder slope
16	WA21	Grove St. and Fowler St.	Insufficient rungs	Add rungs for safety
17	WA13	Lagoon St. and Warren St/	Eroded brick mortar	Re-grout bricks
18	LA3	Fowler St. and Lagoon St.	Eroded brick mortar	Re-grout bricks
19	WA8	South St. between Third St. and Main St.	Requires regrouting	Re-grout bench
20	WA7	South St. and Sneden St.	Eroded brick grout	Re-grout bricks
21	WA5	South St. between Third and Second St.	Eroded brick grout	Re-grout bricks
22	WA4	South St. and Second St.	Eroded brick grout	Re-grout bricks

Appendix C: Sewer Lines Conditions, Observations and Recommendations (7/11 to 7/25 2006)

Manhole	Street Name/Location	Pipeline Condition	Pipeline Observations	Dia. (in.)	CCTV length (ft.)	MH to MH Length (ft)	Recommendation	Priority	Unit Cost ($/ft.)	Improvement Cost	Comment
MA2 TO MA3	Fairgrounds	Poor	Roots from joints Offset joint @ 90.3 ft. Possible collapse @ 95.5 ft.	**6**	96	267	CIPP section and CCTV remaining section	**1**	**$146/LF CIPP, $2/LF CCTV**	**$ 17,000**	CIPP 96 ft. and CCTV 171 ft.
KE2 TO KE1	Keough St.	Poor	Roots from joints Offset joints (6) Missing pieces @ 84.8 and 197.4 ft. Cracks @ 156.5, 197.5, 245.5, 295.6 ft.	**6**	310	310	CIPP	**1**	**146**	**$ 46,000**	-
WA28 TO WA27	Keough St.	Poor	Roots from Joints Cracks @ 12.8, 41.4, 104.2, 108.5, 116.4, 138.9 ft. Offset joints (2, @ 14.9 145.0 ft.) Dip/sag @ 51.7 ft. Piece missing @ 66.6 ft. Root ball @ 161.7 ft. (can not pass roots)	**6**	162	325	CIPP	**1**	**146**	**$ 48,000**	CIPP 325 ft.
WA27 TO WA28			Roots from Joints Cracks @ 18.2, 24.1, 30.2 ft. Pieces missing @ 30.2, 31.5, 105.7 ft. Dip/sags (1 @ 35.2 ft.)		142						
WA27 TO WA26	Keough St.	Very poor	Roots from Joints Cracks @ 5.8, 14.2, 16.2, 19.8 Severe pipe damage @ 19.1 ft., can not continue	**6**	20	325	CIPP	**1**	**146**	**$ 48,000**	CIPP 325 ft.
WA26 TO WA27			Roots from joints Cracks @ 51.5, 64.8, 65.7, 66.9, 78.0, 135.1, 141.2, 186.4, 217.6 ft. Missing pieces @115.8 ft. Structural damage @ 64.6 ft. Dip/sag @ 67.8, 130.6, 198.7ft. Offset joints (1) Can not pass @ 218.8 ft.		219						
WA26 TO WA25	Hobson St.	Poor	Roots from joints Cracks throughout stretch Dip/sag @ 162.9 ft. Protruding lateral @ 180.0 ft. (can not continue)	**6**	180	325	CIPP	**1**	**146**	**$ 48,000**	CIPP 325 ft.
WA25 To WA26			Roots from Joints Cracks @ 16.2, 44.3, 52.3, 56.6, 80.5, 92.9, 100.6, 123.2, 137.8 ft. Offset joints (1) Dip/sag @ 61.6, 105.9 ft. Can not continue @ 140.6 ft.		141						
WA22 TO WA21	Fowler St.	Very poor	Roots from joints Offset joints (4, @ 104.4, 179.3, 212.4, 214.2 ft.) Structural damage (2, @ 164.8 and 167.1 ft.) Cracks @ 167.7, 174.8 ft. Belly @ 199.7 ft. Dip/sag @ 172.6 ft.	**6**	214	280	Replace Pipe	**1**	**313**	**$ 88,000**	-
WP2 TO WP3	W. Pine St.	Very Poor	Collapse in Pipe @ 9.5 ft (can not continue) Short stretch	**6**	10	503	Point repair and CCTV remaining section	**1**	**$10,000/point repair, $2/LF CCTV**	**$ 15,000**	CCTV 493 ft.
LA2 TO LA1	Lagoon St.	Poor	Structural damage @ 213.8 ft. Dips/sags @ 163.4 and 223.6 ft. Roots from joints Severe dip/sag (can not continue) @ 242.3 ft.	**6**	242	277	Replace Pipe	**1**	**313**	**$ 87,000**	-
EE6 TO EE5	E. Elm St.	Poor	Roots from joints Piece missing @ 5.5 ft. Cracks @ 27.7, 38.1, 44.5, 54.3, 62.4, 64.5, 82.6, 84.9, 105.3, 108.5, 148.3, 166.8 ft. Dip/sag @ 88.3 ft. Offset joints (2)	**6**	195	195	CIPP	**1**	**146**	**$ 29,000**	CIPP 195 ft.
EE5 TO EE4	E. Elm St.	Poor	Roots from joints Dip/sag @ 23 ft. Offset joints (2) Crack @ 33.7 ft. Extreme offset joint @ 51.5 ft. (cannot continue)	**6**	52	354	Two point repairs to fix offset and protruding lateral, CIPP section and CCTV remaining section	**1**	**$10,000/point repair, $146/LF CIPP, $2/LF CCTV**	**$ 34,000**	CIPP 86 ft and CCTV 268 ft.
EE4 To EE5	E. Elm St.	Poor	Roots from joints Piece missing @ 5.1 ft. Crack @ 5.1 ft. Dip/sag @ 9.3 ft. Severe belly @ 22.7 ft. Protruding lateral @ 33.8 ft. (can not continue)	**6**	34	354					
EE3 TO EE2	N. Third St.	Poor	Roots from joints Dip/sag @ 7.4, 45.9, 82.7, 120.4, 133.7 ft. Cracks @ 10.5, 66.5 ft. Piece missing/huge void @ 122.7 ft.	**6**	276	276	CIPP	**1**	**146**	**$ 41,000**	CIPP 276 ft.
EP1 TO EP1ACO	Howard St.	Poor	Roots from joints Cracks @ 38.7, 125.5, 212.8, 257.4 ft. Offset joints (3) Broken pipe @ 279.7 ft.	**6**	280	280	CIPP	**1**	**146**	**$ 41,000**	CIPP 280 ft.

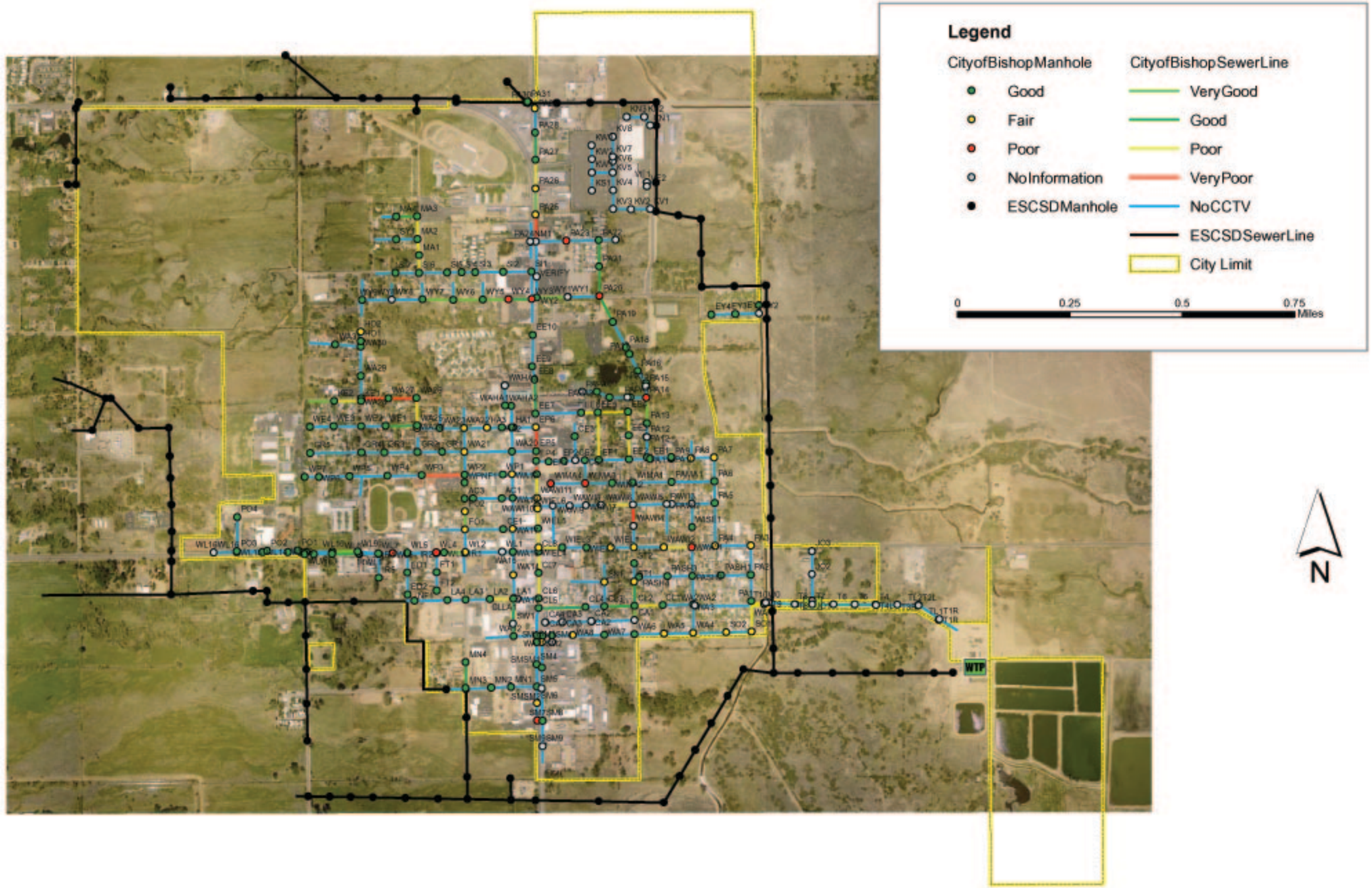
Manhole	Street Name/Location	Pipeline Condition	Pipeline Observations	Dia. (in.)	CCTV length (ft.)	MH to MH Length (ft)	Recommendation	Priority	Unit Cost ($/ft.)	Improvement Cost	Comment
EE4 TO EE3	N. Third St.	Poor	Roots from joints Cracks @ 5.7 ft. Dip/sag @ 53.6 ft. Severe belly @ 103.8 (can not continue)	**6**	104	280	Point repair to fix belly, CIPP section, CCTV remaining section	**1**	**$10,000/point repair, $146/LF CIPP, $2/LF CCTV**	**$ 26,000**	CIPP 104 ft. and CCTV 176 ft.
CL7 TO CL6	S. Main St.	Poor	Dip/sag @ 21.9, 37.1, 45.9, 122.9 ft. Cracks @ 25.2, 45.9, 90.9, 98.4 ft. Offset joints (3) Piece missing @ 25.2 and 87.6 ft. Broken pipe/structural damage @ 87.6 ft.	**6**	301	303	Replace Pipe	**1**	**313**	**$ 95,000**	-
WIEL5 TO WIEL6	S. Main St.	Poor	Offset joints (7) Cracks @ 30.8, 90.1, 92.5, 98.1, 101.7, 134.1, 136.1, 157,.3, 185.0 ft. Missing piece @ 53.8, 101.7, 134.9 ft. Broken pipe/structural damage @ 53.8, 90.1, 133.4 ft. Big offset at end of pipe	**6**	223	232	Replace Pipe	**1**	**313**	**$ 73,000**	-
WIEL5 TO WIEL4	S. Main St.	Poor	Cracks @ 10.7, 13.0, 18.3, 20.9, 30.0, 33.3, 58.8, 76.3, 107.5, 112.6, 153.4, 163.8, 212.2 ft Broken pipe/structural damage @ 4.4, 28.3, 30.0, 33.3, 76.3, 112.6, 170.5 ft. Dip/sag 66.4 and 118.9 ft.	**6**	218	221	Replace Pipe	**1**	**313**	**$ 70,000**	-
WAWI12 TO EP4	N. Main St.	Very poor	Structural damage @ 19.5 ft. Bottom of pipe missing @ 19.5 ft. Short stretch	**6**	20	153	Point Replacement and CCTV Remaining Section	**1**	**$10,000/point repair and $2/LF CCTV**	**$ 11,000**	CCTV 133 ft.
WIEL4 TO WIEL3	E. Line St.	Poor	Cracks @ 12.3, 42.4, 65.3, 88.7, 106.7, 107.5191.8 ft. Offset joints (9) Missing piece @ 88.7, 97.4, 122.7, 216.4 ft. Structural damage @ 122.7 ft. Dip/sag @ 174.7, 206.3, 250.2 ft. "Y" junction belly @ 254.8 ft. Offset joint, NO vision (can not continue)	**6**	262	278	Replace Pipe	**1**	**313**	**$ 88,000**	-
PA24 TO PA25	N. Main St.	Very poor	Dip/sag @ 44.6 and 113.5 ft. Offset joints (3) Collapse in line	**8**	128	314	Point repair and CCTV remaining section	**1**	**$10,000/point repair, $2/LF CCTV**	**$ 11,000**	CCTV 151 ft.
PA25 To PA24			Belly @ 11.9 ft. Dip/sag @ 28.6 ft. Offset joint (2) Offset joint (can not continue)		35						
WAWI2 TO WAWI1	E. Line St.	Poor	Offset joints (3) Cracks @ 54.8, 84.3, 136.9, 262.3, 266.2 ft. Dip/sag @ 144.7 ft. Structural damage @ 264.0 Broken pipe @ 322.3 ft.	**10**	328	332	Point repair and CIPP section	**1**	**$10,000/point repair, $146/LF CIPP**	**$ 59,000**	1 point repair and CIPP 332 ft.
CL3 TO CL2	Clarke St.	Poor	Roots from joints Cracks @ 12.4 ft. Dip/sag @ 18.1, 74.8, 195.9, 279.9 and 328.9 Offset joints (1) Collapse in lateral @ 138.1 ft	**8**	353	253	CIPP	**1**	**146**	**$ 37,000**	CIPP 253 ft.
WAWI6 TO WAWI5	Willow St.	Poor	Roots from joints Offset joints (2) Dip/sag @ 44.8, 70.4, 158.9 ft. Cracks @ 49.6 ft. Piece missing @ 49.6, 59.6 ft.	**8**	183	374	CIPP	**1**	**146**	**$ 55,000**	CIPP 374 ft.
WAWI5 TO WAWI6			Offset joint (1) Dip/sags @ 9.1, 47.9, 63.7	**8**	138						
PA27 TO PA26	N. Main St.	Poor	Offset joints (4) Wrench in joint (can not continue)	**8**	141	338	Replace Pipe	**1**	**335**	**$ 114,000**	-
PA26 to PA27			Offset joints (1) Crack @ 5.2 ft. Belly between 49.0 and 103.4 ft. Separated joint @ 47.0 ft.	**8**	195						
WAWI11 TO WAWI12	S. Main St.	Poor	Offset pipe (4) Major grease build up Piece missing @ 3.0 ft. Dip/sag @ 189.3 ft. Infiltration @ 243.7 ft.	**6**	259	280	CIPP	**1**	**146**	**$ 41,000.00**	CIPP 280 ft.
WAWI12 TO WAWI11			Offset joint @ 14.4 ft. End due to offset (can not continue)		14						

Manhole	Street Name/Location	Pipeline Condition	Pipeline Observations	Dia. (in.)	CCTV length (ft.)	MH to MH Length (ft)	Recommendation	Priority	Unit Cost ($/ft.)	Improvement Cost	Comment
EP6 TO EP5	N. Main St.	Poor	Cracks @ 9.3, 24.6 ft.	6	118	278	Replace Pipe	1	313	$ 88,000	-
			Offset joints (3)								
			No roots								
			Minor grease build up								
			Offset joint @ 117.8 ft. (can not continue)								
EP5 TO EP6			Offset joints (5)		176						
			Cracks @ 65.0 and 159.6 ft								
			Piece missing/structural damage @ 6.4, 29.0 ft.								
EE8 TO EE7	N. Main St.	Poor	Offset joints (5)	6	330	400	Replace Pipe	1	312	$ 125,000	-
			Cracks @ 45.5, 75.2, 167.5, 196.9, 234.4, 260.6, 262.8, 296.3 ft.								
			Belly @ 22.5 ft.								
			Dip/sag 12.9 ft.								
			Offset joint @ 330.3 ft. (can not continue)								
EE7 TO EE8			Dip/sag @ 10.3 ft.		70						
			Belly @ 38.4 ft.								
MA1 TO MA2	Fairgrounds	Poor	Roots from joints (0-104.5 ft.)	6	105	193	Point repair and CIPP section	2	$10,000/point repair and $146/LF CCTV	$ 39,000	CIPP 193 ft.
			Offset joints (2, @ 24.5 and 78.0 ft)								
			Dip/sag @ 65.0 ft.								
			Root ball at end of stretch.								
MA2 TO MA1			Roots from Joints		53						
			Start report at offset joint @ 53.5								
WE1 TO WA25	W. Elm St.	Poor	Roots from joints	6	368	371	CIPP	2	146	$ 55,000	CIPP 371 ft.
			Offset joints (2)								
			Cracks @ 15, 146.7, 339.3 ft.								
			Dip/sag @ 301.1 ft.								
			Pieces missing @ 111.9, 271.5, 355.5 ft.								
CL8 TO CL7	S. Main St.	Poor	Cracks @ 9.5, 37.3, 44.9, 73.2, 75.6, 101.3, 106.4, 136.5, 149.4, 151.2 ft.	6	151	250	CIPP	2	146	$ 37,000	CIPP 250 ft.
			Dip/sag @ 111.5 ft.								
			Piece missing/broken pipe @ 151.2 (can not continue)								
CL7 TO CL8			Offset joints (4)	6	96						
			Crack @ 56.3 ft.								
			Piece missing 69.0 and 91.9 ft.								
			Broken pipe @ 91.5 ft.								
			End or report due to offset @ 95.9 ft.								
WAWI5 TO WAWI4	N. Third St.	Very Poor	Cracks @ 13.7, 142.7 ft.	8	246	250	Replace Pipe	2	335	$ 84,000	-
			Dip/sag @ 68.9, 174.0, 213.6 ft.								
			Large belly between 92.3 and 138.3 ft.								
			Missing piece @ 169.8								
ST1 TO SN1	S. Third St.	Poor	Roots from joints	6	81	351	CIPP	2	146	$ 52,000	CIPP 351 ft.
			Cracks @ 17.6 ft.								
			Elliptical pipe @ 39.7 ft.								
			Missing piece @ 17.6 ft.								
			Offset joints (2)								
			Heavy roots at end @ 81.3 ft. (can not continue)								
PA26 TO PA25	N. Main St.	Poor	Roots from joints	8	303	306	Replace Pipe	2	146	$ 45,000	-
			Dip/sag @ 69.2, 82.1, 218.1,270.9 ft.								
			Offset joints (6)								
			Minor grease build up								
CL5 TO CL4	Clarke St.	Good	Roots from joints	8	552	552	Replace Pipe	2	335	$ 185,000	-
			Cracks @ 59.2, 232.6, 351.2 ft.								
			Dip/sag @ 394.6, 498.2, 542.9 ft.								
			No grease build up								
PA22 TO PA21	Mac Iver St.	Good	Roots from joints	10	306	306	Replace Pipe	2	405	$ 124,000	-
			Dip/sag @ 156.9, 202.4, 240.6, 271.3 ft.								
			Crack @ 299.1ft.								
			Piece missing @ 301.8 ft.								
PA21 TO PA20	Lush Meadows	Good	Roots from joints	10	348	348	CIPP	2	146	$ 51,000	CIPP 248 ft.
			Crack @ 8.1 ft.								
			Grease build up								
			Offset joints (2)								
			Dip/sag @ 151.1 and 326.1 ft.								
PA20 TO PA19	E. Yaney St.	Good	Roots from joints	10	156	348	Replace Pipe and CCTV remaining section	2	$405/LF replacement, $2/LF CCTV	#VALUE!	Replace 156 ft. and CCTV 192 ft.
			Grease build up								
			Offset joint (1)								
			Dip/sag @ 35.9 and 95.2 ft.								
			Belly @ 126.6 ft.								
			High flow (can not continue)								

Manhole	Street Name/Location	Pipeline Condition	Pipeline Observations	Dia. (in.)	CCTV length (ft.)	MH to MH Length (ft)	Recommendation	Priority	Unit Cost ($/ft.)	Improvement Cost	Comment
LA1 TO WA12	S. Warren St.	Good	Cracks (2, @ 12.6 and 103.1 ft.) Offset joints (2) Piece missing @ 51.9 ft. Protruding lateral (can not continue)	**6**	166	440	CIPP section and CCTV remaining section	**3**	**$146/LF CIPP, $2/LF CCTV**	**$ 25,000**	CIPP 166 ft, CCTV 274 ft.
ST1 TO CL2	S. Third St.	Good	Roots from joints Offset joints (3) Crack @ 99.3 ft Protruding lateral @ 120.2 ft. (can not continue)	**6**	120	286	CIPP	**3**	**146**	**$ 42,000**	CIPP 286 ft.
CL2 TO ST1			Roots from Joints		140						
CA1 TO CL2	S. Third St.	Good	Roots from joints Offset joint (1) Cracks @ 62.9 ft. Dips/sags @ 64.5 and 96.5 ft. Camera flipped (can not continue)	**6**	130	167	CIPP	**3**	**146**	**$ 25,000**	CIPP 167 ft.
WY4 TO WY3	N. Main St.	Good	Grease build up Dip/sag @ 32.1, 100.7, 152.9, 203.6, 263.4 ft.	**6**	274	275	Replace Pipe	**3**	**313**	**$ 87,000**	-
WLWL1 TO IRWL1	W. line St.	Good	Crack @ 127.5 ft. Dip/sag @ 142.3 and 295.1 ft. Belly @ 307.1 ft. Grease build up	**6**	315	326	Point Repair	**3**	**$10,000/point repair**	**$ 30,000**	3 point repairs
MA4 TO MA3	Maple St.	Good	Crack @ 7.7 ft. Roots form joints (153-199 ft.)	**6**	245	245	CIPP	**3**	**146**	**$ 36,000**	CIPP 245 ft.
HO1 TO HO2	Home St.	Good	Root from Joints	**6**	107	110	CIPP	**3**	**146**	**$ 17,000**	CIPP 110 ft.
CL6 TO CL5	S. Main St.	Good except at the end	Cracks @ 10.8, 92.1 and 93.4 ft. Broken pipe @ 106.7 ft.	**6**	107	107	Point Repair	**3**	**$10,000/point repair**	**$ 10,000**	1 point repair
FO1 TO FO2	N. Fowler St.	Vey good	Offset joints (5)	**6**	212	213	Replace Pipe	**4**	**313**	**$ 67,000**	-
PA14 TO PA13	SE. Corner Park	Very Good	No roots No cracks No grease No offset joints Dip/sag @ 70.8 ft.	**8**	108	300	Point Repair	**4**	**$10,000/point repair**	**$ 10,000**	1 point repair
PA28 TO PA27	N. Main St.	Very good	Offset joints (4)	**8**	316	318	Point Repair	**4**	**$10,000/point repair**	**$ 40,000**	4 point repairs
IR2 TO IR1	W. Line St.	Very Good	Dip/sag @ 110.0, 388.7, 531.5 ft. Offset joint (1) No roots No grease build up No cracks	**10**	556	556	Point Repair	**5**	**$10,000/point repair**	**$ 40,000**	4 point repairs
MA4 To MACO#1	Maple St.	Very good	Root from Joint @ 23.5 ft.	**6**	198	198	Cut Roots	**5**	-	-	-
WA28 TO KE1	Home St.	Very Good	Roots from joints @ 19.3 and 23.1 ft. Crack @ 19.9 ft.	**6**	25	30	Cut Roots	**5**	-	-	-
WL10 TO WL9	W. Line St.	Excellent	No problems	**8**	299	301	NA	-	-	-	-
WY7 TO WYCO1	W. Yaney St.	Excellent	Nothing major	**6**	180	180	NA	-	-	-	-
KE2 TO KE3	Keough St.	Unknown	Severe Offset Joint (cannot continue) Short Stretch	**6**	40	NA	Re-Assessment (MH KE3 NOT ON MAP)	-	-	-	-
PA1 TO SO1	First St.	Unknown	Piece missing @ 26.0 ft. Cracked @ 26.0 ft. Offset joint (1) Severe dip/sag @ 26.4 (can not continue)	**6**	26	357	Re-Assessment/CCTV	-	-	-	-
EP4 TO EP5	N. Main St.	Unkown	Video not clear-camera flipped Offset joints (2) Short stretch	**6**	22.5	119	Re-Assessment/CCTV	-	-	-	-
CL1 TO CL2	Clarke St.	Unkown	Roots from joints Cracked @ 22.2 ft. Offset joints (1) Dip/sag @ 35.2 ft. Large belly @ 48.4 ft., no vision (can not continue)	**8**	48	333	Re-Assessment/CCTV	-	-	-	-
CL2 TO CL1			Severe dip/sag @ 24.2(can not continue) Short stretch of pipe		27	333	Re-Assessment/CCTV	-			

Appendix D: City of Bishop Existing Wastewater Collection System and Manhole Conditions Exhibit

Appendix D: CITY OF BISHOP EXISTING WASTEWATER COLLECTION SYSTEM AND MANHOLE CONDITIONS



Appendix E: City of Bishop Full Build-Out Flow Projections

The map shown in the following exhibit was created based on the City's 1991 General Plan Land Use map. The undeveloped areas were counted, measured, and assigned a land use obtained from the Land Use map.

For existing conditions, the contribution of each category (residential, commercial, industrial, etc.) was estimated using the total number of SFRUE that each category represents, divided by the total number of SFRUE (3327.32). The total number of accounts was disregarded for the estimates. Based on these results, residential users represent approximately 48.5% percent of the total daily average flow (800,000 gallons per day); commercial 34.5%; and hospital, hotels and schools approximately 17%. Wastewater of industrial origin is practically not generated within the City.

Full build out projections for wastewater flows are different. The total average daily wastewater flow at full build out is projected to be 4.67 million gallons a day, of which residential wastewater flows only constitute about 29% of the total. Commercial flows contribute the most to the total flow (60%). Schools, hospitals and hotels account for approximately 9%. Industrial sewer flows are generated but in minor amounts (2%).

Letter	Residential Land Use Districts			Source
	Low Density Residential			
A	Total Area	118	Ac.	Land Use Map
B	Number of Dwellings Per Acre	5	DU/Ac.	Land Use Map
C	Number of Dwellings (AXB)	590	DU	
D	Number of Inhabitants per Dwelling	2.3	-	CDF
E	Number of People Served (CXD)	1,357	-	
F	Per Capita Water Demand	200	gal/day	Assumption
G	**Water Demand (EXF)**	**271,400**	gal/day	
H	**Wastewater Generated (75% of water demand)**	**203,550**	gal/day	
	Medium Density Residential			
I	Total Area	14	Ac.	Land Use Map
J	Number of Dwellings Per Acre	22	DU/Ac.	Land Use Map
K	Number of Dwellings (IXJ)	308	DU	
L	Number of Inhabitants per Dwelling	2.3	-	CDF
M	Number of People Served (KXL)	708	-	
N	Per Capita Water Demand	170	gal/day	Assumption
O	**Water Demand (MXN)**	**120,428**	gal/day	
P	**Wastewater Generated (80% of water demand)**	**96,342**	gal/day	
	High Density Residential			
Q	Total Area	103	Ac.	Land Use Map
R	Number of Dwellings Per Acre	35	DU/Ac.	Land Use Map
S	Number of Dwellings (QXR)	3,605	DU	
T	Number of Inhabitants per Dwelling	2.3	-	CDF
U	Number of People Served (SXT)	8,292	-	
V	Per Capita Water Demand	100	gal/day	
W	**Water Demand (UXV)**	**829,150**	gal/day	
X	**Wastewater Generated (80% of water demand)**	**663,320**	gal/day	
	Total Average Residential Wastewater Flow Generated (Excluding Existing)	**963,212**	gal/day	
	General Commercial			
Y	Total Area	52	Ac.	Land Use Map
Z	Total Area (YX43,560)	2,265,120	ft^2	
A1	Assumed Built-Out Area (50% of Total Area)	1,132,560	ft^2	
B1	Per Unit Water Demand	2.5	$gal/ft^2.d$	Qasim (1999)
C1	**Water Demand (A1XB1)**	**2,831,400**	gal/day	
D1	**Wastewater Generated (90% of Water Demand)**	**2,548,260**	gal/day	
	Industrial			
E1	Total Area	62	Ac.	Land Use Map
F1	Assumed Built-Out Area (65% of Total Area)	40.3	Ac.	
G1	Per Unit Water Demand	2,300	gal/Ac.day	Qasim (1999)
H1	**Water Demand (F1XG1)**	**92,690**	gal/day	
I1	**Wastewater Generated (90% of Water Demand)**	**83,421**	gal/day	
J1	**Total Commercial and Industrial Wastewater Demand**	**2,631,681**	gal/day	
K1	Present Wastewater Generated (Average Daily Flow)	**800,000**	gal/day	WWTP Operators
L1	Provision for Infill (20% of Existing Wastewater Generated)	**160,000**	gal/day	Assumed
M1	Number of Projected Additional Students	1,000	-	Number of future dwellings
N1	Per Student Water Demand	25	gal/day	Metcalf and Eddy (1991)
O1	Projected Additional Student Water Demand (M1XN1)	25,000	gal/day	
P1	**Student Wastewater Generation (80% of Demand)**	**20,000**	gall/day	
Q1	**Total Projected Average Wastewater Generated (H+P+X+D1+I1+K1+L1)**	**4,574,893**	gal/day	
R1	Peak Factor	2.0	-	
S1	**Total Projected Peak Hour Wastewater Generated (Q1XR1)**	**9,150,000**	gal/day	

3-The commercial per unit water demand is 2.5 gal/ft^2.day (Qasim, 1999)
4-Industrial water demand is 2,300 gal/ac. (Qasim, 1999)
5- Additional flow from parks and public lands is anticipated to be minimal

Area	Zoning Designation	Acreage	Density (DU/Ac.)	Number Of Dwellings	Built Out Area (Ac.)	Per Unit Water Demand (gal/Ac.)	Total Water Demand (gal/day)	Total Wastewater Demand (gal/d)
1	Industrial	24.00	-	-	16	2,300	36,800	**33,120.0**
2	Industrial	7.00	-	-	5	2,300	11,500	**10,350.0**
4	Industrial	31.00	-	-	21	2,300	48,300	**43,470.0**
	Total	**62.0**			40.3	2,300	92,690	**83,421.0**

Area	Zoning Designation	Acreage	Density (DU/Ac.)	Number Of Dwellings	Built Out Area (ft^2)	Per Unit Water Demand (gal/ft2.d)	Total Water Demand (gal/day)	Total Wastewater Demand (gal/d)
3	General Commercial	4.60	-	-	100,188	2.5	250,470	**225,423**
16	General Commercial	1.00	-	-	21,780	2.5	54,450	**49,005**
20	General Commercial	4.10	-	-	89,298	2.5	223,245	**200,921**
35	General Commercial	1.82	-	-	39,640	2.5	99,099	**89,189**
36	General Commercial	1.30	-	-	28,314	2.5	70,785	**63,707**
37	General Commercial	7.40	-	-	161,172	2.5	402,930	**362,637**
38	General Commercial	24.78	-	-	539,708	2.5	1,349,271	**1,214,344**
13	Heavy Commercial	2.20	-	-	47,916	2.5	119,790	**107,811**
17	Heavy Commercial	1.30	-	-	28,314	2.5	70,785	**63,707**
18	Heavy Commercial	2.67	-	-	58,153	2.5	145,382	**130,843**
	Total	**52.00**			1,132,560	2.5	2,831,400	**2,548,260**

Area	Zoning Designation	Acreage	Density (DU/Ac.)	Number Of Dwellings	Number of Inhabitanats Per Dwelling	Number of People Served	Per Capita Water Demand (gal/d)	Total Water Demand (gal/day)	Total Wastewater Demand (gal/d)
8	Low Density Residential	3.84	5	19	2.3	44	200	8,832	**6,624**
9	Low Density Residential	2.87	5	14	2.3	33	200	6,601	**4,951**
10	Low Density Residential	6.03	5	30	2.3	69	200	13,869	**10,402**
11	Low Density Residential	3.97	5	20	2.3	46	200	9,131	**6,848**
12	Low Density Residential	11.67	5	58	2.3	134	200	26,841	**20,131**
22	Low Density Residential	5.05	5	25	2.3	58	200	11,615	**8,711**
23	Low Density Residential	2.35	5	12	2.3	27	200	5,405	**4,054**
24	Low Density Residential	2.18	5	11	2.3	25	200	5,014	**3,761**
25	Low Density Residential	13.50	5	68	2.3	155	200	31,050	**23,288**
26	Low Density Residential	12.38	5	62	2.3	142	200	28,474	**21,356**
27	Low Density Residential	1.53	5	8	2.3	18	200	3,519	**2,639**
28	Low Density Residential	13.61	5	68	2.3	157	200	31,303	**23,477**
29	Low Density Residential	15.33	5	77	2.3	176	200	35,259	**26,444**
19	Low Density Residential	6.54	5	33	2.3	75	200	15,042	**11,282**
32	Low Density Residential	5.70	5	29	2.3	66	200	13,110	**9,833**
43	Low Density Residential	10.86	5	54	2.3	125	200	24,978	**18,734**
	Total	**118**	**5**	**590**	**2.3**	**1,357**	**200**	**271,400**	**203,550**

Area	Zoning Designation	Acreage	Density (DU/Ac.)	Number Of Dwellings	Number of Inhabitanats Per Dwelling	Number of People Served	Per Capita Water Demand (gal/d)	Total Water Demand (gal/day)	Total Wastewater Demand (gal/d)
15	Medium Density Residential	8.26	22	182	2.3	418	170	71,053	**56,842**
21	Medium Density Residential	5.01	22	110	2.3	254	170	43,096	**34,477**
	Total	**14**	22	308	2.3	**708**	170	120,428	**96,342**

Area	Zoning Designation	Acreage	Density (DU/Ac.)	Number Of Dwellings	Number of Inhabitanats Per Dwelling	Number of People Served	Per Capita Water Demand (gal/d)	Total Water Demand (gal/day)	Total Wastewater Demand (gal/d)
5	High Density Residential	3.36	35	118	2.3	270	100	27,048	**21,638**
6	High Density Residential	3.78	35	132	2.3	304	100	30,429	**24,343**
7	High Density Residential	15.32	35	536	2.3	1,233	100	123,326	**98,661**
14	High Density Residential	5.60	35	196	2.3	451	100	45,080	**36,064**
30	High Density Residential	3.90	35	137	2.3	314	100	31,395	**25,116**
31	High Density Residential	5.82	35	204	2.3	469	100	46,851	**37,481**
33	High Density Residential	7.40	35	259	2.3	596	100	59,570	**47,656**
34	High Density Residential	7.25	35	254	2.3	584	100	58,363	**46,690**
39	High Density Residential	16.00	35	560	2.3	1,288	100	128,800	**103,040**
40	High Density Residential	7.74	35	271	2.3	623	100	62,307	**49,846**
41	High Density Residential	10.78	35	377	2.3	868	100	86,779	**69,423**
42	High Density Residential	15.23	35	533	2.3	1,226	100	122,602	**98,081**
	Total	**103**	35	3,605	2.3	**8,292**	100	829,150	**663,320**

Primary Clarifier Evaluation

Present (2007)	mgd	ft^3/hr
Average Flow 2007	0.800	4,456
Peaking Factor:	2.0	
Peak Flow 2007	1.600	8,912

No. of Clarifiers	2
Length, ft	70
Width, ft	18
Depth, ft	7.25
Area, ft^2	2,520
Volume, ft^3	18,270
Total Weir Length, ft	144
Operating Units	2

Parameter	Present (2007)	
	Average Flow	Peak Flow
HRT, hr	4.1	2.1
Overflow Rate, gpd/ft^2	317	635
Weir Loading, gpd/ft	2,778	5,556

Present (2007) With Tribe (0.285 mgd)	mgd	ft^3/hr
Average Flow 2007	1.085	6,043
Peaking Factor:	2.0	
Peak Flow 2007	2.170	12,087

No. of Clarifiers	2
Length, ft	70
Width, ft	18
Depth, ft	7.25
Area, ft^2	2,520
Volume, ft^3	18,270
Total Weir Length, ft	144
Operating Units	2

Parameter	Present With Tribe	
	Average Flow	Peak Flow
HRT, hr	3.0	1.5
Overflow Rate, gpd/ft^2	431	861
Weir Loading, gpd/ft	7,535	15,069

Full Build Out	mgd	ft^3/hr
Average Flow	4.950	27,572
Peaking Factor:	2.0	
Peak Flow	9.900	55,143

No. of Clarifiers	2
Length, ft	70
Width, ft	18
Depth, ft	7.25
Area, ft^2	2,520
Volume, ft^3	18,270
Total Weir Length, ft	144
Operating Units	2

Parameter	Full Build Out	
	Average Flow	Peak Flow
HRT, hr	0.7	0.3
Overflow Rate, gpd/ft^2	1,964	3,929
Weir Loading, gpd/ft	34,375	68,750

Design (1980)	mgd	ft^3/hr
Average Flow	1.600	8,912
Peaking Factor:	1.5	
Peak Flow	2.400	13,368

No. of Clarifiers	2
Length, ft	70
Width, ft	18
Depth, ft	7.25
Area, ft^2	2,520
Volume, ft^3	18,270
Total Weir Length, ft	144
Operating Units	2

Parameter	Design (1980)	
	Average Flow	Peak Flow
HRT, hr	2.1	1.4
Overflow Rate, gpd/ft^2	635	952
Weir Loading, gpd/ft	11,111	16,667

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2 MGD Scenario	mgd	ft^3/hr
Average Flow	2.000	11,140
Peaking Factor:	2.0	
Peak Flow	4.000	22,280

No. of Clarifiers	3
Length, ft	70
Width, ft	18
Depth, ft	7.25
Area, ft^2	2,520
Volume, ft^3	18,270
Total Weir Length, ft	144
Operating Units	2

Parameter	2 MGD Scenario	
	Average Flow	Peak Flow
HRT, hr	1.6	0.8
Overflow Rate, gpd/ft^2	794	1,587
Weir Loading, gpd/ft	13,889	27,778

	Falls within typical design parameters*
	Falls outside lower limit of typical design parameters*
	Falls outside upper limit of typical design parameters*

*Wastewater Engineering: Treatment, Disposal, Reuse. Metcalf and Eddy, 3rd Edition, 1991

Stabilization Ponds Evaluation

Pond 1+Pond 2+ Pond 3-Oxidation Ponds

	Unit	Year (2007)		Year (2007)+ Tribe Flow		2 MGD Scenario	2.1MGD Scenario	2.2MGD Scenario	2.3 MGD Scenario	Full Build Out	Design
		Winter	Summer	Winter	Summer	-	-	-	-	-	-
Average Dry Weather Flow	mgd	0.560	0.800	0.845	1.085	2.0	2.1	2.2	2.3	4.95	1.6
Average Dry Weather Flow	ft^3/hr	3,119	4,456	4,707	6,043	11,140	11,697	12,254	12,811	27,572	8,912
Peaking Factor:	-	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Peak Dry Weather Flow	mgd	1.1	1.6	1.7	2.2	4.0	4.2	4.4	4.6	9.9	3.2
Peak Dry Weather Flow	ft^3/hr	6,238	8,912	9,413	12,087	22,280	23,394	24,508	25,622	55,143	17,824
Inflow BOD Concentration	mg/l	164	164	164	164	164	164	164	164	164	164
Designed BOD Removal Rate	%	71	71	71	71	71	71	71	71	71	71
Desired Effluent Concentration	mg/l	48	48	48	48	48	48	48	48	48	48
Pond Bottom Elevation	ft	4104.9	4104.9	4104.9	4104.9	4104.9	4104.9	4104.9	4104.9	4104.9	4104.9
Pond Dike Elevation	ft	4115.0	4115.0	4115.0	4115.0	4115.0	4115.0	4115.0	4115.0	4115.0	4115.0
Required Free Board	ft	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Average Pond Depth	ft	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Available Pond Area	ft^2	723,090	723,090	723,090	723,090	723,090	723,090	723,090	723,090	723,090	723,090
Required Pond Area	ft^2	174,234	30,158	262,886	41,037	622,231	653,297	684,364	715,512	1,539,986	248,859
Required Pond Area	Ac.	4.0	0.7	6.0	0.9	14.3	15.0	15.7	16.4	35.4	5.7
Available Pond Volume	ft^3	5,061,633	5,061,633	5,061,633	5,061,633	5,061,633	5,061,633	5,061,633	5,061,633	5,061,633	5,061,633
Required Pond Volume	ft^3	1,219,641	211,104	1,840,205	287,262	4,355,616	4,573,080	4,790,545	5,008,584	10,779,899	1,742,016
Design Temperature (Winter)	°F	21	-	21	-	21	21	21	21	21	21
Design Temperature (Summer)	°F	-	99	-	99	-	-	-	-	-	-
Available Retention Time	d	68	47	45	35	19	18	17	16	8	24
Required Retention Time	d	16	2	16	2	16	16	16	16	16	8

Duncan Mara Formula

$A_F = Q*(L_i-L_e)/(18*D_F)*(1.05)^{\wedge T-20}$

Q =Wastewater Flow

L_i =BOD5 Concentration at Inlet mg/l

L_e =Desired BOD5 Concentration at Outlet mg/l

D_F =Depth of Pond

T =Mean Temperature of the Coldest Month

A_F = Facultative Pond Surface

BOD_{IN}	280	mg/l
BAR SCREEN BOD REMOVAL	10%	
BOD AFTER SCREEN	252	mg/l
CLARIFIER BOD REMOVAL	35%	
BOD AFTER CLARIFIER	164	mg/l
OXIDATION PONDS AVG. REMOVAL	80%	
BOD AFTER OXIDATION PONDS	33	mg/l

Digester Evaluation

	Unit	Year (2007)		Year (2007)+ Tribe Flow	2 MGD Scenario	Full Build Out
Projected Population Equivalent	People	4,000	7,400	5,400	10,000	24,500
Per Capita Sludge Production	ft^3/capita	2.5	2.5	2.5	2.5	2.5
Volume Needed	ft^3	10,000	18,500	13,500	25,000	61,250
Design Retention Time	d	30	30	30	30	30
Sludge Flow Rate	ft^3/day	333	617	450	833	2,042
Sludge Flow Rate	gal/day	2,494	4,613	3,366	6,234	15,273
Available Digester Volume	ft^3	18,500	18,500	18,500	18,500	18,500
Primary	ft^3	9,000	9,000	9,000	9,000	9,000
Secondary	ft^3	9,500	9,500	9,500	9,500	9,500
Resulting Retention Time	d	56	30	41	22	9
Number of Digesters Needed (set of 2)	-	0.54	1.00	0.73	1.35	3.31
Number of Digesters Needed	-	1.08	2.00	1.46	2.70	6.62
Actual Number of Digesters	-	2	2	2	3	7

Sludge Drying Beds(Uncovered) Evaluation

	Unit	Year (2007)	Year (2007)+ Tribe Flow	2 MGD Scenario	Full Build Out
Projected Population	Inh.	4,000	5,400	10,000	24,500
Per Capita Area Required	ft^2/capita	2	2	2	2
Area Required	ft^2	8,000	10,800	20,000	49,000
Length of Sludge Bed	ft	70	70	70	70
Width of Sludge Bed	ft	30	30	30	30
Available Area	ft^2	2,100	2,100	2,100	2,100
Number of Sludge Beds	-	4	4	4	4
Total Available Area	ft^2	8,400	8,400	8,400	8,400
Number of Sludge Beds Needed	-	4	5	10	23
Back UP Drying Beds	-	0	1	1	1
Total Number of Sludge Drying Beds	-	4	6	11	25

Grit Chamber Evaluation

Design Calculation	Unit	Present (2007)	Present (2007) + Tribe Flow (2007)	2 MGD Scenario	Full Build Out
Design Wastewater Flow	mgd	0.8	1.085	2.0	4.95
Design Wastewater Flow	ft^3/sec	1.23	1.67	3.08	7.62
Design Velocity	ft/sec	1	1	1	1
Settling Velocity of Grit Particle	ft/min	3.8	3.8	3.8	3.8
Settling Velocity of Grit Particle	ft/sec	0.06	0.06	0.06	0.06
Minimum Cross Section of Grit Chamber	ft^2	1.23	1.67	3.08	7.62
Width of Grit Chamber	ft	2.75	2.75	2.75	2.75
Required Depth of Chamber	ft	0.45	0.61	1.12	2.77
Required Retention Time for Settling	sec	7.07	9.59	17.68	43.75
Minimum Length of Grit Chamber	ft	7.07	9.59	17.68	43.75

Present Flow = 0.8 mgd
Presebt + Tribe = 1.085 mgd (0.8 mgd from city + 0.285 from tribe)
2 mgd Scenario = 0.800 mgd plus 0.347 mgd = 1.147 mgd assume 2 mgd
Tribe at full build out will generate 0.632 mgd, right now they send 0.285 mgd to ESCSD
Therefore, at full build out, they need to send 0.347 to COB WWTP
Full Build Out = 4.94 mgd = 4.6 mdg (see calculation for city full build out) + 0.347 mgd (from tribe at full build out)
Grit chamber duplication is not needed at 2mgd scenario

Appendix G: Improvements Cost Estimates

Manhole Improvements (Alternative A)				
Item	**Quantity**	**Unit**	**Unit Price**	**Total Cost**
Grout/Mortar Manholes with Brick and Mortar and reform Channels	48	EA	$1,500.00	$72,000
Bypass Pumping	48	EA	$500.00	$24,000
Add/Replace Manhole Rungs	7	EA	$2,500.00	$17,500
Replace Broken Manhole Rings and Covers	7	EA	$2,000.00	$14,000
Replace Broken Inlet/Outlet Pipes	8	EA	$4,000.00	$32,000
Subtotal				**$159,500**
Civil Design and Specifications	10	%	-	$15,950
Construction Management and Inspection	8	%	-	$12,760
Contractor Bonding and Insurance	2	%	-	$3,190
Traffic Control	3	%	-	$4,785
Contractor Mobilization	10	%	-	$15,950
Bidding and Advertisement	1	LS	-	$2,000
Subtotal				**$54,635**
Contingency	15	%	-	**$32,120**
TOTAL				**$247,000**

*Assumes Prevailing Wages are applicable

Manhole Improvements (Alternative B)				
Item	**Quantity**	**Unit**	**Unit Price**	**Total Cost**
Grout/Mortar and Epoxy Manholes with Brick and Mortar and Reform Channels	48	EA	$3,200.00	$153,600
Bypass Pumping	48	EA	$500.00	$24,000
Add/Replace Manhole Rungs	7	EA	$2,500.00	$17,500
Replace Broken Manhole Rings and Covers	7	EA	$2,000.00	$14,000
Replace Broken Inlet/Outlet Pipes	8	EA	$4,000.00	$32,000
Subtotal				**$241,100**
Civil Design and Specifications	10	%	-	$15,950
Construction Management and Inspection	8	%	-	$12,760
Contractor Bonding and Insurance	2	%	-	$3,190
Traffic Control	3	%	-	$4,785
Contractor Mobilization	10	%	-	$15,950
Bidding and Advertisement	1	LS	-	$2,000
Subtotal				**$54,635**
Contingency	15	%	-	**$44,360**
TOTAL				**$341,000**

*Assumes Prevailing Wages are applicable

Manhole Improvements (Alternative C)				
Item	**Quantity**	**Unit**	**Unit Price**	**Total Cost**
Grout/Mortar and Epoxy Manholes with Brick and Mortar and Reform Channels	66	EA	$3,200.00	$211,200
Bypass Pumping	64	EA	$500.00	$32,000
Add/Replace Manhole Rungs	7	EA	$2,500.00	$17,500
Replace Broken Manhole Rings and Covers	7	EA	$2,000.00	$14,000
Replace Broken Inlet/Outlet Pipes	8	EA	$4,000.00	$32,000
Subtotal				**$306,700**
Civil Design and Specifications	10	%	-	$15,950
Construction Management and Inspection	8	%	-	$12,760
Contractor Bonding and Insurance	2	%	-	$3,190
Traffic Control	3	%	-	$4,785
Contractor Mobilization	10	%	-	$15,950
Bidding and Advertisement	1	LS	-	$2,000
Subtotal				**$54,635**
Contingency	15	%	-	**$54,200**
TOTAL				**$416,000**

Sewer Line Improvements (6" Pipe Replacement)-267 ft.				
Item	**Quantity**	**Unit**	**Unit Price**	**Total Cost**
Install 6" PVC Sewer Pipe	267	LF	$72	$19,224
Remove and Dispose of Old 6" PVC Pipe	1	LS	$3,000	$3,000
Bypass Pumping for Pipe Removal and Installation	1	LS	$500	$500
Reconnect Sewer Laterals	7	EA	$150	$1,050
Backfill	237	CY	$28	$6,636
Pavement	8	CY	$145	$1,088
Dewatering	1	LS	$5,000	$5,000
Subtotal				**$36,498**
Design	15	%	-	$5,475
Geotechnical Investigation	1	LS	$5,000	$5,000
Survey	1	LS	$5,000	$5,000
Construction Staking	2	%	-	$730
Construction Management and Inspection	10	%	-	$3,650
Contractor Bonding and Insurance	2	%	-	$730
Contractor Mobilization	15	%	-	$5,475
Traffic Control	3	%	-	$1,095
SWPPP Preparation	1	LS	$3,000	$3,000
Legal and Adminstration	1	LS	$2,000	$2,000
Bidding and Advertisement	1	LS	$1,000	$1,000
Subtotal				**$33,154**
Contingency	20	%	-	**$13,930**
TOTAL				**$83,582**

*Assumes Prevailing Wages are applicable

Total Cost/Foot **$ 313**

Asuume 7 laterals per line

Assume 8 ft. deep, 3 ft wide trench, 267 ft. long = 6408 ft2 = 237 CY

Assume 3" deep

Sewer Line Improvements (8" Pipe Replacement)-300 ft.				
Item	**Quantity**	**Unit**	**Unit Price**	**Total Cost**
Install 8" PVC Sewer Pipe	300	LF	$96	$28,800
Remove and Dispose of Old 8" PVC Pipe	1	LS	$3,000	$3,000
Bypass Pumping for Pipe Removal and Installation	1	LS	$500	$500
Reconnect Sewer Laterlas	7	EA	$150	$1,050
Backfill	237	CY	$28	$6,636
Pavement	8	CY	$145	$1,088
Dewatering	1	LS	$5,000	$5,000
Subtotal				**$46,074**
Design	15	%	-	$6,911
Geotechnical Investigation	1	LS	$5,000	$5,000
Survey	1	LS	$5,000	$5,000
Construction Staking	2	%	-	$921
Construction Management and Inspection	10	%	-	$4,607
Contractor Bonding and Insurance	2	%	-	$921
Contractor Mobilization	15	%	-	$6,911
Traffic Control	3	%	-	$1,382
SWPPP Preparation	1	LS	$3,000	$3,000
Legal and Adminstration	1	LS	$2,000	$2,000
Bidding and Advertisement	1	LS	$1,000	$1,000
Subtotal				**$37,655**
Contingency	20	%	-	**$16,746**
TOTAL				**$100,474**

*Assumes Prevailing Wages are applicable

Total Cost/Foot **$335**

Asuume 7 laterals per line
Assume 8 ft. deep, 3 ft wide trench, 267 ft. long = 6408 ft2 = 237 CY
Assume 3" deep

Sewer Line Improvements (10" Pipe Replacement)-306 ft.				
Item	**Quantity**	**Unit**	**Unit Price**	**Total Cost**
Install 10" PVC Sewer Pipe	306	LF	$120	$36,720
Remove and Dispose of Old 10" PVC Pipe	1	LS	$3,000	$3,000
Bypass Pumping for Pipe Removal and Installation	1	LS	$500	$500
Reconnect Sewer Laterlas	7	EA	$150	$1,050
Backfill	237	CY	$28	$6,636
Pavement	8	CY	$145	$1,088
Dewatering	1	LS	$5,000	$5,000
Subtotal				**$53,994**
Design	15	%	-	$8,099
Geotechnical Investigation	1	LS	$5,000	$5,000
Survey	1	LS	$5,000	$5,000
Construction Staking	2	%	-	$1,080
Construction Management and Inspection	10	%	-	$5,399
Contractor Bonding and Insurance	2	%	-	$1,080
Contractor Mobilization	15	%	-	$8,099
County Permitting	1	LS	$4,000	$4,000
County Plan Review	1	LS	$4,000	$4,000
Traffic Control	3	%	$5,000	$1,620
SWPPP Preparation	1	LS	$3,000	$3,000
Legal and Adminstration	1	LS	$2,000	$2,000
Bidding and Advertisement	1	LS	$5,000	$1,000
Subtotal				**$49,377**
Contingency	20	%	-	**$20,674**
TOTAL				**$124,045**

*Assumes Prevailing Wages are applicable

Total Cost/Foot **$405**

Asuume 7 laterals per line
Assume 8 ft. deep, 3 ft wide trench, 267 ft. long = 6408 ft2 = 237 CY
Assume 3" deep

Trunk Sewer Line Improvements (10" Pipe Replacement)				
Item	**Quantity**	**Unit**	**Unit Price**	**Total Cost**
Install 15" PVC Sewer Pipe	1,780	LF	$180	$320,400
Remove and Dispose of Old 10" PVC Pipe	1	LS	$10,000	$10,000
Bypass Pumping for Pipe Removal and Installation	1	LS	$1,000	$1,000
Reconnect Sewer Laterlas	7	EA	$150	$1,050
Backfill	1,200	CY	$28	$33,600
Dewatering	1	LS	$5,000	$5,000
Subtotal				**$371,050**
Design	15	%	-	$55,658
Geotechnical Investigation	1	LS	$5,000	$5,000
Survey	1	LS	$5,000	$5,000
Construction Staking	2	%	-	$7,421
Construction Management and Inspection	10	%	-	$37,105
Contractor Bonding and Insurance	2	%	-	$7,421
Contractor Mobilization	15	%	-	$55,658
County Permitting	1	LS	$4,000	$4,000
County Plan Review	1	LS	$4,000	$4,000
Traffic Control	3	%	$5,000	$11,132
SWPPP Preparation	1	LS	$3,000	$3,000
Legal and Adminstration	1	LS	$2,000	$2,000
Bidding and Advertisement	1	LS	$5,000	$1,000
Subtotal				**$198,394**
Contingency	20	%	-	**$113,889**
TOTAL				**$683,332**

*Assumes Prevailing Wages are applicable

Sewer Line Improvements CIPP				
Item	**Quantity**	**Unit**	**Unit Price**	**Total Cost**
Furnish and Install 6" CIPP	245	LF	$45	$11,025
Bypass Pumping for CIPP Installation	1	LS	$500	$500
Reconnect Sewer Laterals	7	EA	$150	$1,050
Subtotal				**$12,575**
Contractor Bonding and Insurance	2	%	-	$252
Design	15	%		$1,886
Contractor Mobilization	15	%	-	$1,886
Traffic Control	3	%	-	$377
Bidding and Adverisement	1	LS	$2,000	$2,000
Subtotal				**$6,401**
Contingency	15	%	-	**$2,846**
TOTAL				**$21,823**

*Assumes Prevailing Wages are applicable

Total Cost/Foot **$89**

Sewer Line Improvements CIPP and Point Repairs				
Item	**Quantity**	**Unit**	**Unit Price**	**Total Cost**
Furnish and Install 6" CIPP - Fairgrounds (MA1 - MA2)	193	LF	$45	$8,685
Furnish and Install 6" CIPP - Fairgrounds (MA2 - MA3)	267	LF	$45	$12,015
Furnish and Install 6" CIPP - Keough (KE2 - KE1)	310	LF	$45	$13,950
Furnish and Install 6" CIPP - Keough (WA28 - WA27)	325	LF	$45	$14,625
Furnish and Install 6" CIPP - Elm (EE6 - EE5)	195	LF	$45	$8,775
Furnish and Install 6" CIPP - Howard (EP1 - EP1ACO)	280	LF	$45	$12,600
Furnish and Install 6" CIPP - S. Main St (WAWI11 - WAWI12)	280	LF	$55	$15,400
Furnish and Install 6" CIPP - W. Elm St (WE1-WA25)	371	LF	$55	$20,405
Furnish and Install 6" CIPP - S. Third St (ST1 - SN1)	351	LF	$45	$15,795
Furnish and Install 10" CIPP - Lush Meadows (PA21 - PA20)	348	LF	$53	$18,444
Furnish and Install 8" CIPP - E. Yaney (WY1 - PA20)	372	LF	$49	$18,228
Furnish and Install 6" CIPP - S. Warren (LA1 - WA12)	440	LF	$45	$19,800
Furnish and Install 6" CIPP - S. Third St (CA1 - CL2)	167	LF	$45	$7,515
Furnish and Install 6" CIPP - S. Third St (ST1 - CL2)	286	LF	$45	$12,870
Furnish and Install 6" CIPP - Maple St (MA4 - MA3)	245	LF	$45	$11,025
Furnish and Install 6" CIPP - Home St (HO1 - HO2)	110	LF	$45	$4,950
Bypass Pumping	1	LS	$2,000	$2,000
Reconnect Sewer Laterals	40	EA	$150	$6,000
Subtotal				**$223,082**
Contractor Bonding and Insurance	2	%	-	$4,462
Caltrans Permitting	1	LS	$12,000	$12,000
Design	10	%		$22,308
Construction Management	10	%		$22,308
Contractor Mobilization	10	%	-	$22,308
Traffic Control	2.5	%	-	$5,577
Legal	1	LS	$1,000	$1,000
Bidding and Adverisement	1	LS	$2,000	$2,000
Subtotal				**$91,963**
Contingency	12	%	-	**$37,805**
TOTAL				**$353,000**

*Assumes Prevailing Wages are applicable

Sewer Line Improvements CIPP and Point Repairs				
Item	**Quantity**	**Unit**	**Unit Price**	**Total Cost**
Point Repair - Fairgrounds (MA1-MA2)	4	EA	$10,000	$40,000
Point Repair - Fairgrounds (MA2-MA3)	2	EA	$10,000	$20,000
Point Repair - Keough St (KE2-KE1)	6	EA	$10,000	$60,000
Point Repair - Keough St (WA28-WW27)	4	EA	$10,000	$40,000
Point Repair - Pine St (WP2-WP3)	1	EA	$10,000	$10,000
Point Repair - Elm (EE6-EE5)	3	EA	$10,000	$30,000
Point Repair - Howard (EP1-EP1ACO)	4	EA	$10,000	$40,000
Point Repair - N. Main St (WAWI12-EP4)	1	EA	$10,000	$10,000
Point Repair - E. Linte St (WAWI2-WAWI1)	3	EA	$10,000	$30,000
Point Repair - S. Main St (WAWI11-WAWI12)	6	EA	$10,000	$60,000
Point Repair - W. Elm St (WE1-WA25)	3	EA	$10,000	$30,000
Point Repair - S. Third St (ST1-SN1)	4	EA	$10,000	$40,000
Point Repair - Lush Meadows (PA21-PA20)	4	EA	$10,000	$40,000
Point Repair - S. Warren St (LA1-WA12)	3	EA	$10,000	$30,000
Point Repair - W. Line St (WLWL1 - IRWL1)	3	EA	$10,000	$30,000
Point Repair - S. Main St (CL6 to CL5)	1	EA	$10,000	$10,000
Point Repair - Park Area (PA14 - PA13)-Dip/Sag Removal	1	EA	$10,000	$10,000
Point Repair - N. Main Street (PA28 - PA27)	4	EA	$10,000	$40,000
Point Repair - W. Line Street (IR1 - IR2)	4	EA	$10,000	$40,000
Root Cutting - Maple Street & Home Street	2	EA	$1,500	$3,000
Protruding Lateral - S. Warren Street	1	EA	$2,000	$2,000
Point Repair - Keough Street (KE2 - KE3) - 6"	1	EA	$11,000	$11,000
Point Repair - N. Main Street (EP4 - EP5) - 6"	2	EA	$10,000	$20,000
Bypass Pumping	1	LS	$2,000	$2,000
Reconnect Sewer Laterals	40	EA	$150	$6,000
Subtotal				**$654,000**
Contractor Bonding and Insurance	2	%	-	$13,080
Caltrans Permitting	1	LS	$12,000	$12,000
Design	10	%		$65,400
Construction Management	10	%		$65,400
Contractor Mobilization	10	%	-	$65,400
Traffic Control	2.5	%	-	$16,350
Legal	1	LS	$1,000	$1,000
Bidding and Adverisement	1	LS	$2,000	$2,000
Subtotal				**$240,630**
Contingency	12	%	-	**$107,356**
TOTAL				**$1,002,000**

*Assumes Prevailing Wages are applicable

Sewer Line Improvements - Replacement				
Item	**Quantity**	**Unit**	**Unit Price**	**Total Cost**
Replace 6" Pipe - Keough St (WA27-WA26)	219	LF	$100	$21,900
Replace 6" Pipe - Hobson St (WA26-WA25)	325	LF	$100	$32,500
Replace 6" Pipe - Fowler St (WA22-WA21)	28	LF	$100	$2,800
Replace 6" Pipe - Lagoon St (LA2-LA1)	277	LF	$100	$27,700
Replace 6" Pipe - E. Elm St (EE5-EE4)	254	LF	$100	$25,400
Replace 6" Pipe - N. Third St (EE3-EE2)	276	LF	$100	$27,600
Replace 6" Pipe - N. Third St (EE4-EE3)	280	LF	$100	$28,000
Replace 6" Pipe - S. Main St (CL7-CL6)	303	LF	$100	$30,300
Replace 6" Pipe - S. Main St (WIEL5-WIEL6)	232	LF	$100	$23,200
Replace 6" Pipe - S. Main St (WIEL5-WIEL4)	221	LF	$100	$22,100
Replace 6" Pipe - E. Lime St (WIEL4-WIEL3)	278	LF	$100	$27,800
Replace 8" Pipe - N. Main St (PA24-PA25)	314	LF	$120	$37,680
Replace 8" Pipe - Clarke St (CL3-CL2)	253	LF	$120	$30,360
Replace 8" Pipe - Willow St (WAWI6-WAWI5)	374	LF	$120	$44,880
Replace 8" Pipe - N. Main St (PA27-PA26)	338	LF	$120	$40,560
Replace 6" Pipe - N. Main St (EP6-EP5)	278	LF	$100	$27,800
Replace 6" Pipe - N. Main St (EE8-EE7)	400	LF	$100	$40,000
Replace 6" Pipe - S. Main St (CL8-CL7)	250	LF	$100	$25,000
Replace 8" Pipe - N. Third St (WAWI5-WAWI4)	250	LF	$120	$30,000
Replace 8" Pipe - N. Main St (PA26-PA25)	303	LF	$120	$36,360
Replace 8" Pipe - Clarke St (CL5-CL4)	552	LF	$120	$66,240
Replace 10" Pipe - Mac Iver St (PA22-PA21)	306	LF	$140	$42,840
Replace 10" Pipe - E. Yaney St (PA20-PA19)	348	LF	$140	$48,720
Replace 6" Pipe - N. Main St (WY4-WY3)	275	LF	$100	$27,500
Replace 6" Pipe - N. Fowler St (FO1-FO2)	213	LF	$100	$21,300
Replace 6" Pipe - First St (PA1-SO1)	357	LF	$100	$35,700
Replace 6" Pipe - N. Main St (EP4-EP5)	119	LF	$100	$11,900
Replace 8" Pipe - Clarke St (CL1-CL2)	333	LF	$120	$39,960
Bypass Pumping for CIPP Installation	1	LS	$500	$500
Reconnect Sewer Laterals	7	EA	$150	$1,050
Subtotal				**$877,650**
Design	10	%		$87,765
Contractor Bonding and Insurance	2	%	-	$17,553
Caltrans Permitting	1	LS	$12,000	$12,000
Construction Management	10	%		$87,765
Contractor Mobilization	10	%	-	$87,765
Traffic Control	3	%	-	$26,330
Legal	1	LS	$1,000	$1,000
Bidding and Adverisement	1	LS	$2,000	$2,000
Subtotal				**$322,178**
Contingency	15	%	-	**$179,974**
TOTAL				**$1,380,000**

*Assumes Prevailing Wages are applicable

Sewer Line Improvements CIPP (WY1 to PA20)				
Alternative 1-Replacement	**Quantity**	**Unit**	**Unit Price**	**Total Cost**
Replace 8" Existing Pipe With 8" PVC	372	LF	$335.00	**$124,620**
Alternative 2- CIPP				
Furnish and Install 8" CIPP	372	LF	$141.00	**$52,452**

*Assumes Prevailing Wages are applicable

*CCTV the line before choosing the appropriate alternative

Work-Storage Area

Item	Unit	Qty	Unit Cost	Cost
8" Block Wall	SF	6,400	$22	$140,800
Roof	LS	1	$10,000	$10,000
Foundation Concrete	CY	44	$500	$22,000
Reinforcement Steel	LB	11,642	$1.3	$15,135
Excavation and Grading	LS	1	$10,000	$10,000
Joints	LS	1	$5,000	$5,000
HVAC Unit	LS	1	$5,000	$5,000
Parking Area Gravel	LS	1	$7,000	$7,000
Doors	EA	2	$1,000	$2,000
Windows	LS	1	$5,000	$5,000
Exterior Lighting	LS	1	$3,000	$3,000
Electrical Service	LS	1	$5,000	$5,000
Utility Connections	LS	1	$5,000	$5,000
Communications Wiring	LS	1	$5,000	$5,000
Alarm System	LS	1	$5,000	$5,000
Signs	LS	1	$200	$200
Minor Appurtences (phone and small furnishings)	LS	1	$10,000	$10,000
Bathroom Building	LS	1	$10,000	$10,000
Architectural Treatment	LS	1	$10,000	$10,000
Subtotal				**$275,135**
Contractor Mobilization	%	15	-	$41,270
Construction Staking	%	2	-	$5,503
Construction Management and Ispection	%	10	-	$27,514
Bonding and Insurance	%	2	-	$5,503
Civil Design	%	15	-	$41,270
Survey	LS	1	$5,000	$5,000
Geotechnical Investigation	LS	1	$5,000	$5,000
Legal and Administration	LS	1	$2,000	$2,000
Structural Design	LS	1	$10,000	$10,000
Architectural Design	LS	1	$5,000	$5,000
HVAC Design	LS	1	$5,000	$5,000
Subtotal				**$428,195**
Contingency	%	20	-	**$85,639**
Total				**$514,000**

**Assumes Prevailing Wages are applicable

WWTP-Sludge Pump Room

Item	Unit	Qty	Unit Cost	Cost
Disassemble Existing Equipment	LS	1	$10,000	$10,000
Bypass Sludge Pumping	LA	1	$10,000	$10,000
Hatch with Latch	EA	1	$3,000	$3,000
Sky Light	EA	2	$5,000	$10,000
HVAC Unit	LS	1	$7,500	$7,500
Bathroom Building	LS	1	$12,000	$12,000
Bathroom Fixtures and Plumbing	LS	1	$10,000	$10,000
4"x6" DI Reducers	EA	2	$250	$500
6" DI Flanged Coupling Adapter	EA	2	$250	$500
6" DI Plug Valve	EA	2	$250	$500
6" Flare Fitting	EA	2	$250	$500
6" DI Dresser Coupling	EA	2	$250	$500
6" DI Ckeck Valve	EA	2	$250	$500
6" DI Pluge Valve	EA	2	$250	$500
3"x1/2" Reducer	EA	1	$100	$100
1 1/2" Gate Valve	EA	1	$100	$100
Pipe and Fittings	LS	1	$10,000	$10,000
Sludge Pumps 7.5 HP	EA	2	$10,000	$20,000
Effluent Pump 2 HP	EA	1	$3,000	$3,000
Adjustable Pipe Support	EA	5	$2,000	$10,000
Interior lighting and electrical	LS	1	$35,000	$35,000
PLC, Instrumentation	LS	1	$35,000	$35,000
Subtotal				**$179,200**
Contractor Bonding and Insurance	%	2	-	$3,584
Construction Management and Inspection	%	15	-	$26,880
Bidding and Advertising	LS	1	$3,000	$3,000
Contractor Mobilization	%	15	-	$26,880
Construction Staking	%	1	-	$1,792
Stormwater Compliance	%	1	-	$1,792
Civil, Mechanical, Architectural & Structural Design	LA	1	$50,000	$50,000
HVAC Design	LS	1	$4,500	$4,500
Electrical, Instrumentation, and Controls Design	LS	1	$8,000	$8,000
Survey	LS	1	$3,000	$3,000
Legal and Adminstration	LS	1	$2,000	$2,000
Subtotal				**$310,628**
Contingency	%	20	-	**$62,126**
Total				**$373,000**

**Assumes Prevailing Wages are applicable

WWTP-Sludge Pump Room

Item	Unit	Qty	Unit Cost	Cost
Disassemble Existing Equipment	LS	1	$10,000	$10,000
Demolition of Existing Building	LS	1	$15,000	$15,000
Excavation and Grading	LS	1	$70,000	$70,000
Shoring	LS	1	$25,000	$25,000
Dewatering	LS	1	$5,000	$5,000
Backfill and Compaction	LS	1	$15,000	$15,000
Aggregate Base	LS	1	$15,000	$15,000
Bypass Sludge Pumping	LA	1	$10,000	$10,000
Filter Fabric	LS	1	$1,000	$1,000
Foundation Concrete	CY	15	$1,500	$22,500
Reinforced Wall Concrete	CY	50	$1,500	$75,000
8" Block Wall Building	SF	700	$22	$15,400
Roof	LS	1	$20,000	$20,000
Joints	LS	1	$5,000	$5,000
Hatch with Latch	EA	1	$3,000	$3,000
Sky Light	EA	2	$5,000	$10,000
Staircase	EA	2	$10,000	$20,000
HVAC Unit	LS	1	$7,500	$7,500
Bathroom Building	LS	1	$12,000	$12,000
Bathroom Fixtures and Plumbing	LS	1	$10,000	$10,000
4"x6" DI Reducers	EA	2	$250	$500
6" DI Flanged Coupling Adapter	EA	2	$250	$500
6" DI Plug Valve	EA	2	$250	$500
6" Flare Fitting	EA	2	$250	$500
6" DI Dresser Coupling	EA	2	$250	$500
6" DI Ckeck Valve	EA	2	$250	$500
6" DI Pluge Valve	EA	2	$250	$500
3"x1/2" Reducer	EA	1	$100	$100
1 1/2" Gate Valve	EA	1	$100	$100
Pipe and Fittings	LS	1	$10,000	$10,000
Sludge Pumps 7.5 HP	EA	2	$10,000	$20,000
Effluent Pump 2 HP	EA	1	$3,000	$3,000
Adjustable Pipe Support	EA	5	$2,000	$10,000
Interior lighting and electrical	LS	1	$35,000	$35,000
PLC, Instrumentation	LS	1	$35,000	$35,000
Subtotal				**$483,100**
Contractor Bonding and Insurance	%	2	-	$9,662
Construction Management and Inspection	%	15	-	$72,465
Bidding and Advertising	LS	1	$3,000	$3,000
Contractor Mobilization	%	15	-	$72,465
Construction Staking	%	1	-	$4,831
Stormwater Compliance	%	1	-	$4,831
Geotechnical Investigation	LS	1	$6,000	$6,000
Civil, Mechanical, Architectural & Structural Design	LA	1	$50,000	$50,000
HVAC Design	LS	1	$4,500	$4,500
Electrical, Instrumentation, and Controls Design	LS	1	$8,000	$8,000
Survey	LS	1	$3,000	$3,000
Legal and Adminstration	LS	1	$2,000	$2,000
Subtotal				**$723,854**
Contingency	%	20	-	**$144,771**
Total				**$869,000**

**Assumes Prevailing Wages are applicable

WWTP-UV Disinfection

Item	Unit	Qty	Unit Cost	Cost
UV Disinfection Unit	EA	1	$175,000	$175,000
Site Preparation	LS	1	$20,000	$20,000
Dewatering	LS	1	$5,000	$5,000
Contractor Mark Up	%	15	-	$26,250
Installation	LS	1	$15,000	$15,000
Piping	LS	1	$10,000	$10,000
Concrete Work	LS	1	$8,000	$8,000
Shade Structure	LS	1	$5,000	$5,000
Bypass Structure	LS	1	$5,000	$5,000
Startup and Testing	LS	1	$2,000	$2,000
Operator Training	LS	1	$2,000	$2,000
Sample Ports	EA	2	$1,000	$2,000
Electrical Conduits	LS	1	$5,000	$5,000
Electrical Panel, SCADASystem	LS	1	$30,000	$30,000
Subtotal				**$310,250**
Contractor Bonding and Insurance	%	2	-	$6,205
Construction Management and Inspection	%	15	-	$46,538
Bidding and Advertising	LS	1	$3,000	$3,000
Contractor Mobilization	%	15	-	$46,538
Construction Staking	%	1	-	$3,103
Stormwater Compliance	%	1	-	$3,103
APCD Permit	LS	1	$2,000	$2,000
NPDES Permit Modification	LS	1	$2,000	$2,000
Geotechnical Investigation	LS	1	$3,000	$3,000
Pre-design Report	LS	1	$3,000	$3,000
Civil, Mechanical, & Structural Design	%	10	-	$31,025
Electrical, Instrumentation, and Controls Design	LS	1	$8,000	$8,000
Survey	LS	1	$3,000	$3,000
Legal and Adminstration	LS	1	$2,000	$2,000
Subtotal				**$472,760**
Contingency	%	15	-	**$70,914**
Total				**$544,000**

**Assumes Prevailing Wages are applicable

WWTP-Digester Cost

Item	Unit	Qty	Unit Cost	Cost	
Site Grading and Preparation	LS	1	$10,000	$10,000	
Dewatering	LS	1	$10,000	$10,000	
Concrete Pad	LS	1	$15,000	$15,000	
Backfill Sand	LS	1	$10,000	$10,000	
Backfill and Compaction	LS	1	$15,000	$15,000	
6" Stainless Steel Pipe	LF	300	$100	$30,000	
Reinforced Concrete for Digetster Tank	CY	110	$1,000	$110,000	
Tank Cover-Fixed	EA	2	$50,000	$100,000	
Spiral Heat Exchanger	EA	1	$40,000	$40,000	
Gas Collection System	EA	2	$100,000	$200,000	
Gas Compressor	EA	1	$10,000	$10,000	
Gas Storage Tanks	EA	2	$20,000	$40,000	
Gas Combustion System	EA	2	$50,000	$100,000	
Gas Stack System	EA	2	$50,000	$100,000	
Solids Handling Pumps	EA	2	$8,000	$16,000	
Digester Valves	LS	1	$30,000	$30,000	
HVAC Unit-Control	LS	1	$5,000	$5,000	
Electrical Improvements	LS	1	$10,000	$10,000	
PLC, Instrumentation	LS	1	$35,000	$35,000	
Sludge Sampling	LS	1	$2,000	$2,000	
Operator Training	LS	1	$5,000	$5,000	
Subtotal				**$893,000**	
Contractor Bonding and Insurance	%	2	-	$17,860	
Construction Management and Inspection	%	10	-	$89,300	
Bidding and Advertising	LS	1	$3,000	$3,000	
Contractor Mobilization	%	15	-	$133,950	8-10%
Construction Staking	%	0.4	-	$3,572	
Air Pollution Permit	LS	1	$20,000	$20,000	
NPDES Permid Modifications	LS	1	$10,000	$10,000	
Geotechnical Investigation	LS	1	$4,000	$4,000	
Preliminary Engineering Report	LS	1	$30,000	$30,000	
Civil, Mechanical, & Structural Design	%	9	-	$80,370	
HVAC Design	LS	1	$4,500	$4,500	
Electrical, Instrumentation, and Controls Design	LS	1	$15,000	$15,000	
Survey	LS	1	$5,000	$5,000	
Legal and Adminstration	LS	1	$2,000	$2,000	
Subtotal				**$1,311,552**	
Contingency	%	10	-	**$131,155**	
Total				**$1,443,000**	

**Assumes Prevailing Wages are applicable

WWTP-POND IMPROVEMENTS

Item	Unit	Qty	Unit Cost	Cost
Diversion Structure	LS	1	$7,000	$7,000
24" PVC Pipe for Diversion	LF	1,100	$252	$277,200
Diversion Structure Gate Valves (24")	EA	2	$5,000	$10,000
Excavation and Grading	LS	1	$30,000	$30,000
24" PVC Inter Pond Piping (40' Typ. Length)	LF	550	$252	$138,600
24" valves	LS	1	$1,000	$1,000
Pipe Grouting Around Box Culverts	LS	1	$10,000	$10,000
Disposal of Old CMP Pipe	LS	1	$3,000	$3,000
Flush/Vac. 12 CMP Line Between Pond 3 and 4	LS	1	$3,000	$3,000
Subtotal				**$479,800**
Contractor Bonding and Insurance	%	2	-	$9,596
Construction Management and Inspection	%	15	-	$71,970
Bidding and Advertising	LS	1	$3,000	$3,000
Contractor Mobilization	%	15	-	$71,970
Construction Staking	%	1	-	$4,798
Stormwater Compliance	%	1	-	$4,798
Geotechnical Investigation	LS	1	$8,000	$8,000
Civil, Mechanical, and Structural Design	LS	1	$40,000	$40,000
Legal and Adminstrative	LS	1	$2,000	$2,000
Survey	LS	1	$11,000	$11,000
Subtotal				**$706,932**
Contingency	%	20		**$141,386**
Total				**$849,000**

***Assumes Prevailing Wages are applicable*

Grit Drying Beds-Access Ramps

Item	Unit	Qty	Unit Cost	Cost
Demolition of Existing Concrete	LS	1	$5,000	$5,000
Ramp Backfill	LS	1	$5,000	$5,000
Ramp Concrete	CY	60	$500	$30,000
Ramp Steel	LS	590	$2.5	$1,475
Subtotal				**$41,475**
Contractor Bonding and Insurance	%	2	-	$830
Construction Management and Inspection	%	15	-	$6,221
Bidding and Advertising	LS	1	$3,000	$3,000
Contractor Mobilization	%	15	-	$6,221
Construction Staking	%	2	-	$830
Geotechnical Investigation	LS	1	$3,000	$3,000
Civil, Mechanical, and Structural Design	LS	1	$15,000	$15,000
Survey	LS	1	$5,000	$5,000
Legal and Administration	LS	1	$2,000	$2,000
Subtotal				**$83,577**
Contingency	%	20		$16,715
Total				**$101,000**

**Assumes Prevailing Wages are applicable

WWTP-Sampling Cost

Item	Unit	Qty	Unit Cost	Cost
BOD	EA	3	$60	$180
TSS	EA	3	$15	$45
TKN	EA	3	$45	$135
NH_4	EA	3	$45	$135
NO_3	EA	3	$45	$135
Subtotal				$630
Contingency	%	20		$126
Total ($/week)				**$800**
Total ($/year)				**$41,600**

Assumes sampling is done on weekly basis.
Samples are: Clarifier effluent (1) and between ponds (2)

WWTP-Hand Railings

Item	Unit	Qty	Unit Cost	Cost
Handirailings	LF	360	$80	$28,800
Subtotal				$28,800
Contingency	%	10		$2,880
Total ($/week)				**$32,000**

ESCSD-COB Emergency Connection

Item	Unit	Qty	Unit Cost	Cost
Slide Gate	LS	1	$3,000	$3,000
8" PVC Pipe for Diversion	LF	1,000	$96	$96,000
Submerssible Pumps (2 active, 1 stand by)	EA	3	$3,000	$9,000
Manhole Adjacent to Conversion Structure	LS	2	$7,000	$14,000
8" gate Valves	EA	2	$800	$1,600
Quick Disconnects	LS	1	$2,000	$2,000
Subtotal				**$125,600**
Contractor Bonding and Insurance	%	2	-	$2,512
Construction Management and Inspection	%	15	-	$18,840
Bidding and Advertising	LS	1	$3,000	$3,000
Contractor Mobilization	%	15	-	$18,840
Construction Staking	%	1	-	$1,256
Stormwater Compliance	%	1	-	$1,256
Legal and Adminstrative	LS	1	$2,000	$2,000
Civil, Mechanical Design	%	10	-	$12,560
Geotechnical Investigation	LS	1	$8,000	$8,000
Survey	LS	1	$11,000	$11,000
Subtotal				**$204,864**
Contingency	%	20		**$40,973**
Total				**$246,000**

**Assumes Prevailing Wages are applicable

15" Trunk Sewer Line Improvements (18" Pipe Replacement)-1,765 ft				
Item	**Quantity**	**Unit**	**Unit Price**	**Total Cost**
Install 18" PVC Sewer Pipe	1,765	LF	$216	$381,240
Remove and Dispose of Old 15" PVC Pipe	1	LS	$5,000	$5,000
Bypass Pumping for Pipe Removal and Installation	1	LS	$5,000	$5,000
Reconnect Johnston Drive Lateral	1	EA	$2,500	$2,500
Backfill	1,890	CY	$25	$47,250
Dewatering	1	LS	$15,000	$15,000
Subtotal				**$455,990**
Design	10	%	-	$45,599
Geotechnical Investigation	1	LS	$5,000	$5,000
Survey	1	LS	$5,000	$5,000
Construction Staking	2	%	-	$9,120
Construction Management and Inspection	10	%	-	$45,599
Contractor Bonding and Insurance	2	%	-	$9,120
Contractor Mobilization	15	%	-	$68,399
County Permitting	1	LS	$4,000	$4,000
County Plan Review	1	LS	$4,000	$4,000
SWPPP Preparation	1	LS	$3,000	$3,000
Legal and Adminstration	1	LS	$2,000	$2,000
Bidding and Advertisement	1	LS	$5,000	$1,000
Subtotal				**$201,836**
Contingency	10	%	-	**$65,783**
TOTAL				**$723,609**

*Assumes Prevailing Wages are applicable

15" Trunk Sewer Line Improvements (18" Pipe Replacement)-1,765 ft				
Item	**Quantity**	**Unit**	**Unit Price**	**Total Cost**
Install 18" PVC Sewer Pipe	1,765	LF	$216	$381,240
Remove and Dispose of Old 15" PVC Pipe	1	LS	$10,000	$10,000
Bypass Pumping for Pipe Removal and Installation	1	LS	$5,000	$5,000
Reconnect Johnston Drive Lateral	1	EA	$2,500	$2,500
Dewatering	1	LS	$15,000	$15,000
Subtotal				**$413,740**
Design	10	%	-	$41,374
Geotechnical Investigation	1	LS	$5,000	$5,000
Survey	1	LS	$5,000	$5,000
Construction Staking	2	%	-	$8,275
Construction Management and Inspection	10	%	-	$41,374
Contractor Bonding and Insurance	2	%	-	$8,275
Contractor Mobilization	10	%	-	$41,374
County Permitting	1	LS	$4,000	$4,000
County Plan Review	1	LS	$4,000	$4,000
SWPPP Preparation	1	LS	$3,000	$3,000
Legal and Adminstration	1	LS	$2,000	$2,000
Bidding and Advertisement	1	LS	$5,000	$1,000
Subtotal				**$164,672**
Contingency	10	%	-	**$57,841**
TOTAL				**$636,253**

*Assumes Prevailing Wages are applicable

Appendix H: Alternative Matrix

CITY OF BISHOP MASTER PLAN
ALTERNATIVES MATRIX

Wastewater Collection System (WCS)						
Deficiency No.	Description	Alternative	Description	Main Objectives*	Capital Cost ($2007)	Comments
WCS-1	Deteriorating manhole conditions	A	Grout/mortar manholes with brick and mortar and reform channels (48 manholes)	2,5	$247,000	48 manholes identified as requiring immediate attention
		B	Grout/mortar and epoxy manholes with brick and mortar and reform channels (48 manholes)		$341,000	
		C	Grout/mortar and epoxy manholes with brick and mortar and reform channels (66 manholes)		$416,000	48 manholes and 16 manholes in fair to poor condition
WCS-2	Deteriorating sewer lines	A	Replace pipeline	2,5	$1,380,000	See attached spreadsheet for detailed collection improvement recommendations
		B	Install CIPP liner		$353,000	
		C	Point repair		$1,002,000	
WCS-3	Grease build up in sewer lines	A	Effective enforcement program	2,3,5	$40,000	Implementation of education and outreach program
		B	More frequent cleaning		$20,000	Annual recurring cost
WCS-4	Infiltration problem between manholes WY1 and PA20. Verify problem	A	Replace pipeline	2,5	$125,000	
		B	Install CIPP liner		$53,000	
WCS-5	Corroded steel sewer laterals	A	Replace laterals	5,6	$100,000	
WCS-6	Lack of hydrovac machine	A	Continue to rent hydrovac	5, 6,7	-	Purchased by City, to be delivered 7/2007
		B	Buy new hydrovac		$175,500	
WCS-7	Need for Johnston Drive Lift Station	A	Continue to use lift station	3,7		Annual O&M cost will continue
		B	Lower trunk line adjacent to pump station and abandon lift station		-	Alternative B will be significantly higher, therefore, this alternative was not priced and is not a viable option by itself
WCS-8	Lack of SCADA system at Johnston Drive Lift Station	A	Install SCADA system	1,3,7	$23,000	Cost of SCADA system
WCS-9	Upgade sewer trunk line	A	Remove and replace existing 15" VCP sewer trunk line to a 18" PVC sewer line.	1,2,3,7	$636,250	Larger diameter pipe might allow for elimination of Johnston Drive lift station
Wastewater Treatment Plant (TP)						
Deficiency No.	Description	Alternative	Description	Main Objectives*	Capital Cost ($2007)	Comments
TP-1	Lack of backup generator	A	Install portable generator	1,5,6,7	$85,600	Approved for purchase 3/12/2006
TP-2	Lack of bathroom	A	Share bathroom with adjacent ESCSD WWTP	3,8	-	
		B	Build new bathroom		-	Cost included in sludge room building (TP-11)
TP-3	Insufficient lighting	A	Use same lighting	1,7,8	-	
		B	Improve lighting with no glare fixtures, manually operated		$40,000	
TP-4	Lack of hand railings at headworks and digesters	A	Install hand railings	5,7,8	$42,000	OSHA requirements for Health and Safety
TP-5	Lack of storage/work area	A	Relocate Public Works yard	2,7	$514,000	Duplicate of Water Master Plan, See G-2
TP-6	Propane storage tanks too close to non-operableold flame check	A	Relocate tanks	5,8	$5,000	OSHA requirements for Health and Safety
TP-7	Lack of SCADA system	A	Install a SCADA system	1,7	$28,000	
TP-8	Lack of emergency interconnection between COB and ESCSD WWTPs	A	Construct emergency interconnection. Pump sewage from ESCSD last manhole into COB conversion structure	1,2,5,7	$246,000	
TP-9	Bar screen lacks automatic self-cleaning mechanism	A	Continue manual cleaning (existing operation)	2,7	-	-
		B	Replace bar screen		$250,000	
TP-10	Grit chamber requires manual clean up and lacks aeration	A	Continue manual cleaning (2 times/day)	7	-	-
		B	Upgrade to an aerated grit chamber		$125,000	-
TP-11	Sludge room pumping equipment is wearing out	A	Replace pumps and valves. Include new bathroom with project (TP-2)	1, 6,7	$373,000	-
TP-12	One non operational clarifier lacks replacement parts	A	Install new sludge scraping mechanism	1, 2,7		-
TP-13	Existing digesters are nearing end of useful life	A	Install new digester	1,7	$3,000,000	-
TP-14	Digester gas cannot be collected	A	Install gas collection tanks	1,7	$10,000	
TP-15	Grit drying beds have poor drainage and lack ramps for maintenance	A	-	3,7	-	Grit drying beds should be eliminated as part of a head-works improvement program
TP-16	Trees owned by ESCSD are south of sludge drying beds which prevent sunlight needed to dry sludge	A	Remove or trim trees	2,7,8	$3,000	Cut down
TP-17	All ponds cannot be drained and lack ability to be bypassed and drained. corroded interpond piping and valves, clogged 12" CMP line between pond 3 and 4	A	Install diversion structure to by pass all ponds, flush/vac. CMP line	1, 6,7	$850,000	-
TP-18	Lack of sampling between treatment units	A	Conduct weekly sampling program for BOD, TSS, TKN, NH_4 and NO_3	5,6,7	$42,000	Cost for first year
Regulatory Requirements (RR)						
Deficiency No.	Description	Alternative	Description	Main Objectives*	Capital Cost ($2007)	Comments
RR-1	BOD level will drop to 25 mg/l	A	Install sand filter to reduce BOD to the future limit	1, 5, 6,7	$675,000	-
RR-2	Nitrate-N level will be < 7 mg/l	A	Create anoxic zone for Nitrogen removal	1,5,7	-	Ponds downstream of pond 1 can be used for nitrogen removal
RR-3	Sand filtration and disinfection	A	Install sand filtration and UV disinfection units	1,5,7	$1,300,000	
RR-4	Meet Waste Discharge Requirements (WDR)	A	Develop and implement Sewer System Management Plan (SSMP) and report all sewer system overflows to State Water Board's online database	1,5,7	$128,000	Capital Cost
					$26,000	O&M cost

General Items (GI)						
Deficiency No.	Description	Alternative	Description	Main Objectives*	Capital Cost ($2007)	Comments
GI-1	Lack of cell tower at the WWTP	A	Install a Cell tower	1,2,7	$2,000	-
GI-2	High demand of water per capita	A	Develop Water Conservation and Time of Use Plan	1, 2, 3	$25,000	Duplicate from Water Master Plan, See G-5
GI-3	The Water and Sewer Standard Specifications have not been updated since 1991	A	Update standards to include modern design practices and specifications	4,7	$20,000	Duplicate from Water Master Plan, See G-6

* Improvement Objectives are Defined as Follows:
1. Improve System Reliability and Redundancy
2. Increase Utilization of Capacity/Increase Revenue
3. Reduce Operation Costs
4. Improve Customer Service
5. Comply with Regulatory Requirements
6. Improve Water Quality
7. Improve System Operations
8. Health, Safety and productivity

Appendix I: Sewer System Management Plan

Bishop Sewer System Plan Time Schedule

SWRCB Due Date	SWRCB Due Date	State Water Board Requirement	Tasks Required to Meet Requirement	Capital Cost	O&M Cost per Year	Comment
RR-06	**Nov-2006**	**Application for Permit Coverage**	File application	-	$872	Annual renewal fee
RR-07	**Nov-2006**	**Reporting Program**	Furnish to SRWB information to modify, revoke, reissue or terminate the order	-	-	-
			Comply with Monitoring and Reporting Program	-	-	-
			Report any SSO greater than 1000 gallons	-	-	-
RR-08	**Nov-2007**	**SSMP Development Plan and Schedule**	Develop plan and schedule for SSMP	$13,000	-	Assumes 3 weeks of work to develop a complete SSMP report
RR-09	**Nov-2007**	**Goals and Organization structure**	Provide SSMP and schedule to manage, operate and maintain all parts of the sanitary sewer system Provide names and telephone numbers for management, administrative and maintenance personnel responsible for implementing the SSMP Provide chain of communications for reporting SSOs	Provided in SSMP	-	-
RR-10	**Aug-2009**	**Overflow Emergency Response Program**	Proper notification procedures to first responders and regulatory agencies	-	-	-
			Prompt notification of all SSOs to all involved entities	-	-	-
			Procedures to ensure appropriate staff and contractor personnel are aware of the Emergency Response Plan and appropriately trained	-	-	-

		Cont.	A program to ensure all reasonable steps are taken to contain and prevent the discharge of untreated and partially treated wastewater	$10,000	-	-
RR-11	**Aug-2009**	**Legal Authority**	Prevent illicit discharges	-	-	-
			Require all sewers and connections be properly designed and constructed	-	-	-
			Ensure access for maintenance, inspection, or repairs for the laterals owned by the public agency	-	-	-
			Limit discharges of fats, oils and grease and other debris	-	-	-
			Enforce any violations of its sewer ordinances	$2,000.00		Legal Fees
RR-12	**Aug-2009**	**Operation and Maintenance Program**	Maintain up to date map of the sanitary sewer system, showing all gravity line segments, manholes, pumping facilities, pressure pipes and valves, and stormwater conveyance facilities	$21,000	-	Work inludes engineering, survey, geotechnical and GIS
			Perform routine prevention O&M activities, including a system for scheduling regulate maintenance and cleaning of the sanitary sewer system with more frequent cleaning at known problem areas	-	$5,000	Monthly staff O&M
			Develop a rehabilitation and replacement plan to identify and prioritize system deficiencies and implement short term and long term rehabilitation actions to address each deficiency	$9,000		Assumes 2 weeks of wrok to develop plan
			Develop regular visual and	-	$10,000	Assumes 5,000 LF of

			TV inspections of manholes and sewer pipes			pipe @ 2/LF for CCTV and cleaning
			Provide training on regular basis for staff in sanitary sewer system operations and maintenance	-	$5,000	Staff training
		Cont.	Provide equipment and replacement part inventories, including identification of critical replacement part.	-	$5,000	Replacement parts
RR-13	**Aug-2009**	**Grease Control Program**	Develop public education program that promotes proper disposal of fat oil and grease	$5,000	-	Media and public awareness programs
			A plan and schedule for the disposal of FOG. This may include a list of acceptable disposable facilities or additional facilities needed to adequately dispose of FOG generated within the sanitary sewer system	$3,000	-	-
			Legal authority to prohibit discharges to the sanitary sewer system and identify measures to prevent SSOs and blockages caused by FOG	2,000	-	Legal fees
			Install grease removal devises such as traps or interceptors where needed and according to standards	$40,000	-	Assumes 10 grease traps @ $4,000 each
			Authority to inspect grease producing facilities	-	-	-
			Identify of sanitary sewer system sections subject to FOG blockages and establishing a regular maintenance schedule	-	-	-
			Develop and implement source control measures for all sources of FOG discharged into the sanitary sewer system	-	-	-

RR-14	**Aug-2010**	**Design and Performance**	Provide design, constructions standards and specifications for new sanitary sewer systems, pump stations and other appurtenances, and for the rehabilitation and repair of existing sewer facilities	-	-	-
		Cont.	Develop procedures and standards for inspecting and testing the installation of new sewers, pumps and for rehabilitation and repair projects	-	-	-
RR-15	**Aug-2010**	**System Evaluation and Capacity Assurance Plan**	Prepare and implement a Capital Improvement Plan (CIP) that will provide hydraulic capacity of key sanitary sewer system elements for dry weather peak flow conditions, as well as the appropriate design storm or weather wet event	$9,000	-	Assumes 2 weeks of wrok to develop plan
			Evaluate those portions of the sanitary sewer system that are experiencing or contributing to an SSO discharge caused by hydraulic deficiency according to approved design criteria	$4,000	-	Assumes 1 week for assessment
			Take steeps needed to establish a short-term and long-term CIP to address identifies hydraulic deficiencies, including prioritization, alternatives analysis, and schedules	$4,000	-	Assumes 1 week for assessment
			Develop a schedule of completion dates for all portions of the CIP	$4,000	-	Assumes 1 week of wrok to develop schedule
RR-16	**Aug-2010**	**Final SSMP**	Incorporate all of the SSMP requirements	$2,000	-	Revisions and final submittal
	Total			**$128,000**	**$26,000**	

Appendix J: Selection Matrix

BISHOP WASTEWATER MASTER PLAN
SELECTION MATRIX

ALTERNATIVE SELECTION CRITERIA		Alternative Description	Project Costs $2008	Capital Costs	O&M Costs	Land Requirement/ Enviornmental Impacts	Funding Agency Assitance	Operational Complexity	Correspondence With Other City Projects	Legal/ Water Rights	Reliability	Time For Implementation	TOTAL POINTS
Weighing Factor (1-3)				1	2	1	1	1	3	1	2	1	
Defic. No.	*Altern.*												
WCS-1	A	Grout/mortar manholes with brick and mortar and reform channels (48 manholes)	$247,000	5	3	5	5	5	5	5	3	5	**57**
	B	Grout/mortar and epoxy manholes with brick and mortar and reform channels (48 manholes)	$341,000	4	4	5	5	5	5	5	4	5	**60**
	C	Grout/mortar and epoxy manholes with brick and mortar and reform channels (66 manholes)	$416,000	3	5	5	5	5	5	5	5	5	**63**
WCS-2[a]	A	Replace pipeline	$1,380,000	3	5	5	5	5	5	5	5	3	**61**
	B	Install CIPP liner	$353,000	5	5	5	5	5	5	5	4	5	**63**
	C	Point repairs	$1,002,000	4	5	5	5	5	5	5	4	4	**61**
WCS-3	A	Education and outreach program	$40,000	1	5	5	3	4	5	5	3	5	**54**
	B	More frequent cleaning	$20,000	5	3	5	1	3	5	5	4	5	**53**
WCS-4	A	Replace pipeline	$125,000	1	5	4	3	5	5	5	5	4	**57**
	B	CIPP Pipeline	$53,000	5	5	5	5	5	5	5	4	5	**63**
WCS-7	A	Continue to use lift station	-	5	5	5	5	5	5	5	5	5	**65**
	B	Lower trunk line adjacent to pump station and abandon lift station	-	1	3	3	3	4	5	5	5	1	**48**
TP-2	A	Share bathroom with adjacent ESCSD WWTP	-	5	5	5	3	5	3	5	3	5	**53**
	B	Build new bathroom	-	1	4	4	3	5	3	5	5	4	**49**
TP-3	A	Use same lighting	-	5	5	5	4	5	4	5	3	5	**57**
	B	Improve lighting with no glare fixtures, manually operated	$40,000	4	5	4	4	5	5	5	5	4	**61**
TP-9	A	Continue manual cleaning (existing operation) of bar screen	-	5	5	5	4	4	4	5	2	5	**54**
	B	Replace bar screen	$250,000	4	4	5	4	5	5	5	5	4	**60**
TP-10	A	Continue manual cleaning (2 times/day) of grit chamber	-	5	5	4	4	4	4	5	2	5	**53**
	B	Upgrade to an aerated grit chamber	$125,000	4	4	5	4	5	5	5	5	4	**60**
Scoring: Based on a scale of 1 to 5 with 1 being the "least favorable" and 5 the "most favorable" **Note:** Projects with only 1 Alternative are not included				Equipment, structures, installation	Operator labor, energy	Footprint, land availability, easements/ROW, expansion feasibility, layout, site topography, access roads, noise, traffic	Availability of funds	Operator friendly	Other related City projects	Legal constraints	Resilliency against shock loading, variable water quality, parallel treatment lines, power reliance	Urgency, project need	

[a] Projects are not mutually exclusive

Appendix K: Prioritization Matrix

BISHOP WASTEWATER MASTER PLAN
PRIORITIZATION MATRIX

PRIORITIZATION CRITERIA		Project Desc.	Project Cost $2008	Capital Cost	Employee Health and Safety	Correspondence With Other Projects	Revenue and Operational Cost	Funding Agency Assistance	Regulatory Requirements	TOTAL POINTS
Weighing Factor (1-3)				1	1	2	1	2	2	
Deficiency No.	*Selected Alternative*									
WCS-1	**C**	Grout/mortar and epoxy manholes with brick and mortar and reform channels (66 manholes)	$416,000	3	5	5	5	2	5	**37**
WCS-2	**A**	Replace sewer pipelines	$1,380,000	2	2	5	3	3	5	**33**
WCS-3	**A**	Education, public out reach	$40,000	5	2	2	3	2	5	**28**
WCS-4	**B**	Install CIPP liner	$53,000	5	2	3	3	3	5	**32**
WCS-5	**A**	Replace laterals	$100,000	3	2	5	1	2	4	**28**
WCS-7	**A**	Continue to use lift station	-	5	5	1	1	1	1	**17**
WCS-8	**A**	Install SCADA system at Johnston Drive lift station	$23,000	5	3	5	4	2	1	**28**
WCS-9	**A**	Upsize trunk sewer line to 18"	$636,000	2	5	1	4	3	4	**27**
TP-2	**B**	Build new bathroom	Cost included in sludge room building improvements	5	5	5	1	1	1	**25**
TP-3	**B**	Improve lighting with no glare fixtures, manually operated	$40,000	5	5	3	1	1	1	**21**
TP-4	**A**	Install hand railings	$42,000	5	5	5	1	1	5	**33**
TP-5	**A**	Relocate Public Works yard	$514,000	3	1	2	4	1	1	**16**
TP-6	**A**	Relocate propane tanks	$5,000	5	5	5	1	1	1	**25**
TP-7	**A**	Install a SCADA system at WWTP	$28,000	5	2	5	4	1	1	**25**
TP-8	**A**	Construct emergency interconnection. Pump sewage from ESCSD last manhole into COB conversion structure	$246,000	4	1	5	2	2	3	**27**
TP-9	**B**	Replace bar screen	$250,000	4	5	3	4	2	1	**25**
TP-10	**B**	Upgrade to an aerated grit chamber	$125,000	4	2	3	4	2	1	**22**
TP-11	**A**	Replace Pumps and valves. Include new bathroom with project (TP-2)	$373,000	3	5	3	3	2	2	**25**
TP-12	**A**	Replace Sludge Scraping Mechanism	$110,000	4	1	1	1	2	1	**14**
TP-13	**A**	Install new digester	$3,000,000	1	5	2	2	2	1	**18**
TP-14	**A**	Install gas collection system	$10,000							
TP-15	**A**	Should be eliminated as part of head-works improvement program	-	-	-	-	-	-	-	**-**
TP-17	**A**	Install diversion structure around pond 1, install new interpond piping and valves, flush/vac. CMP line	$850,000	3	2	2	2	2	2	**19**
TP-18	**A**	Conduct weekly sampling program for BOD, TSS, TKN, NH4 and NO3	$42,000	5	1	2	1	2	5	**25**
RR-1	**A**	Install sand filter to reduce BOD to the future limit	$675,000	3	1	1	1	2	4	**19**
RR-2	**A**	Create anoxic zone for Nitrogen removal	-	5	1	1	1	2	5	**23**
RR-3	**A**	Install sand filtration and UV disinfection units	$1,300,000	2	1	1	1	2	5	**20**
RR-4	**A**	Develop and implement Sewer System Management Plan (SSMP) and report all sewer system overflows to State Water Board's online database	$128,000 Capital Cost, $26,000 O&M cost	4	2	2	2	1	5	**24**
GI-1	**A**	Install a cell tower	$2,000	5	1	1	5	5	1	**25**
GI-2	**A**	Develop Water Conservation and Time of Use Plan	$25,000	5	1	3	5	3	2	**27**
GI-3	**A**	Update standards to include modern design practices and specifications	$20,000	5	2	4	4	2	2	**27**
Scoring: Based on a scale of 1 to 5 with 1 being the "least favorable" and 5 the "most favorable"				Equipment, structures, installation	Operator labor, energy	Footprint, land availability, easements/ROW, expansion feasibility, layout, site topography, access roads	Operator friendly and money generated	Availability of funds	Other related City projects	

First Tier Projects
Second Tier Projects
Third Tier Projects
Fourth Tier Projects
Fifth Tier Projects

Appendix L: Capital Improvements Plan

BISHOP WASTEWATER MASTER PLAN

CAPITAL IMPROVEMENTS PLAN

Project	Alternative	Project Desc.	Project Phase	Pot. Fund. Sources	Cap. Cost $2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
WCS-1	C	Grout/mortar and epoxy manholes with brick and mortar and reform channels (66 manholes)	Phase I Design	USDA	$19,000	$ 7,387																			
			Phase I Construction		$198,500		$ 125,026	$ 135,029																	
			Phase II Construction		$198,500				$ 145,831	$ 157,497															
WCS-2	A	Replace pipeline	Phase I Design	USDA	$101,000		$ 127,231																		
			Phase I Construction		$640,000			$ 435,356	$ 470,185																
			Phase II Construction		$640,000					$ 507,800	$ 548,424														
WCS-3	A	Effective enforcement program		USDA	$40,000	$ 46,656																			
WCS-4	B	Install CIPP liner		USDA	$53,000	$ 61,819																			
WCS-5	A	Replace laterals		USDA	$100,000	$ 23,328	$ 25,194	$ 27,210	$ 29,387	$ 31,737															
WCS-7	A	Continue to use lift station			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WCS-8	A	Install SCADA system		USDA	$23,000		$ 28,973																		
WCS-9	A	Upsize trunk sewer to a 15 inch	Design	USDA	$ 45,500				$ 66,854																
			Construction		$ 590,750						$ 1,012,442														
TP-2	B	Build new bathroom			-	SEE TP-11																			
TP-3	B	Improve lighting with no glare fixtures, manually operated			$40,000							$ 74,037													
TP-4	A	Install hand railings		USDA	$42,000		$ 52,908																		
TP-5	A	Relocate Public Works yard			$257,000													$ 377,429	$ 407,624						
TP-6	A	Relocate tanks			$5,000	$ 5,832														$17,130					
TP-7	A	Install a SCADA system		USDA	$28,000		$ 35,272													$95,926					
TP-8	A	Construct emergency interconnection. Pump sewage from ESCSD last manhole into COB conversion structure	Phase I Survey+Geotechnical	USDA	$22,800			$ 31,019																	
			Phase I Design		$15,000				$ 22,040																
			Phase II Construction		$207,900					$ 329,911															
TP-9	B	Replace bar screen	Phase I Design	USDA	$25,000	$ 29,160																			
			Phase II Construction		$225,000		$ 283,435																		
TP-10	B	Upgrade to an aerated grit chamber	Phase I Design	USDA	$12,500			$ 17,006																	
			Phase II Construction		$112,500				$ 165,299																
TP-11	A	Improvements to sludge pumping room with automatic sludge transfer capability. Include new bathroom with project (TP-2)	Phase I Design	USDA	$202,000							$ 186,944													
			Phase II Construction		$171,000								$ 341,830												
TP-12	A	Replace sludge scraping mechanism		USDA	$110,000					$ 161,626															
TP-13	B	Install new digester	Phase I Design	USDA	$300,000											$ 699,492									
			Phase II Construction		$2,700,000												$ 2,266,353	$ 2,447,661	$ 2,643,474						
TP-14	A	Build new ramps		USDA	$100,000							$ 171,382													
TP-16	B	Improve drainage conditions in existing sludge drying beds		USDA	$175,000							$ 299,919													
TP-17	A	Install diversion structure around pond 1, install new interpond piping and valves, flush/vac. CMP line		USDA	$850,000									$ 849,577	$ 917,543										
TP-18	A	Conduct weekly sampling program for BOD, TSS, TKN, NH4 and NO3		Up to:	$42,000	$ 48,989	$ 52,908	$ 57,141	$ 61,712	$ 66,649	$ 71,981	$ 77,739	$ 83,958	$ 90,675	$ 97,929	$ 105,763	$ 114,224	$ 123,362	$ 133,231	$ 143,890	$ 155,401	$ 167,833	$ 181,259	$ 195,760	$ 211,421
RR-1	A	Install sand filter to reduce BOD to the future limit		USDA	$675,000	SEE RR-3																			
RR-2	A	Create anoxic zone for Nitrogen removal			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RR-3	A	Install sand filtration and UV disinfection units	Phase I Design	USDA	$130,000																$ 481,002				
			Phase I Construction		$585,000																	$ 1,168,836	$ 1,262,343		
			Phase II Construction		$585,000																		$ 1,262,343	$ 1,363,330	
RR-4	A	Develop and implement Sewer System Management Plan (SSMP) and report all sewer system overflows to State Water Board's online database	Application Permit		$872	$ 1,017					$ 747	$ 807													
			SSMP Plan Development		$13,000	$ 15,163																			
			Overflow Emergency Program		$10,000		$ 12,597																		
			Legal Authority		$2,000		$ 2,519																		
			O&M Program		$30,000		$ 37,791																		
			Grease Control Program		$50,000		$ 62,986																		
			System Evaluation		$21,000			$ 28,570																	
			Final SSMP		$2,000			$ 2,721																	
			Annual O&M		$26,000	$ 30,326	$ 32,753	$ 35,373	$ 38,203	$ 41,259	$ 44,559	$ 48,124	$ 51,974	$ 56,132	$ 60,623	$ 65,472	$ 70,710	$ 76,367	$ 82,476	$ 89,075	$ 96,200	$ 103,897	$ 112,208	$ 121,185	$ 130,880
GI-1	A	Install a Cell tower			$2,000	$ 2,333																			
GI-2	A	Develop Water Conservation and Time of Use Plan	Phase I		$10,000	$ 11,664																			
			Phase II		$15,000		$ 18,896																		
GI-3	A	Update standards to include modern design practices and specifications			$20,000		$ 25,194																		
G-4	A	Rate Study	Full Rates study		$20,000	$23,328					$34,276					$50,363					$74,000				
			Check up		$10,000			$13,605										$29,372					$43,157		
G-9	A	Water Master Plan			$ 75,000					$ 119,016					$ 174,873					$ 256,946					$ 377,538
Total					**$10,573,822**	**$ 307,003**	**$ 923,684**	**$ 783,029**	**$ 999,510**	**$ 1,415,495**	**$ 1,712,429**	**$ 858,953**	**$ 477,762**	**$ 996,384**	**$ 1,250,968**	**$ 921,091**	**$ 2,451,288**	**$ 3,054,192**	**$ 3,266,805**	**$ 602,966**	**$ 806,604**	**$ 1,440,565**	**$ 2,861,310**	**$ 1,680,275**	**$ 719,838**

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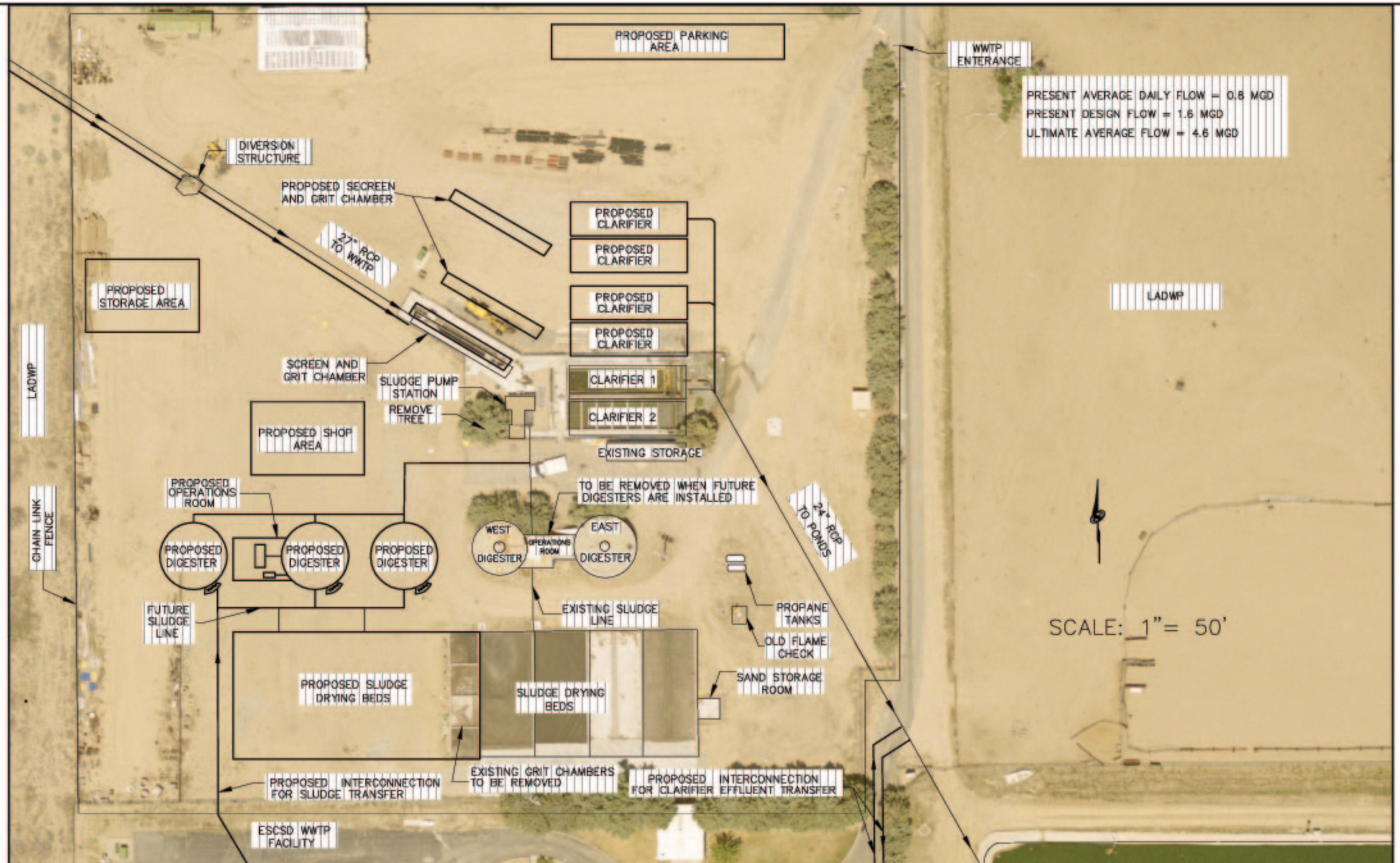
First Tier Projects
Second Tier Projects
Third Tier Projects
Fourth Tier Projects
Fifth Tier Projects

Appendix M: Proposed Facilities Layout



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PAGE SETUP: ----
DESIGNER: #### PROJ. MGR: ####

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10070 AVENUE OF SCIENCE, SUITE 100 SAN DIEGO, CA 92128
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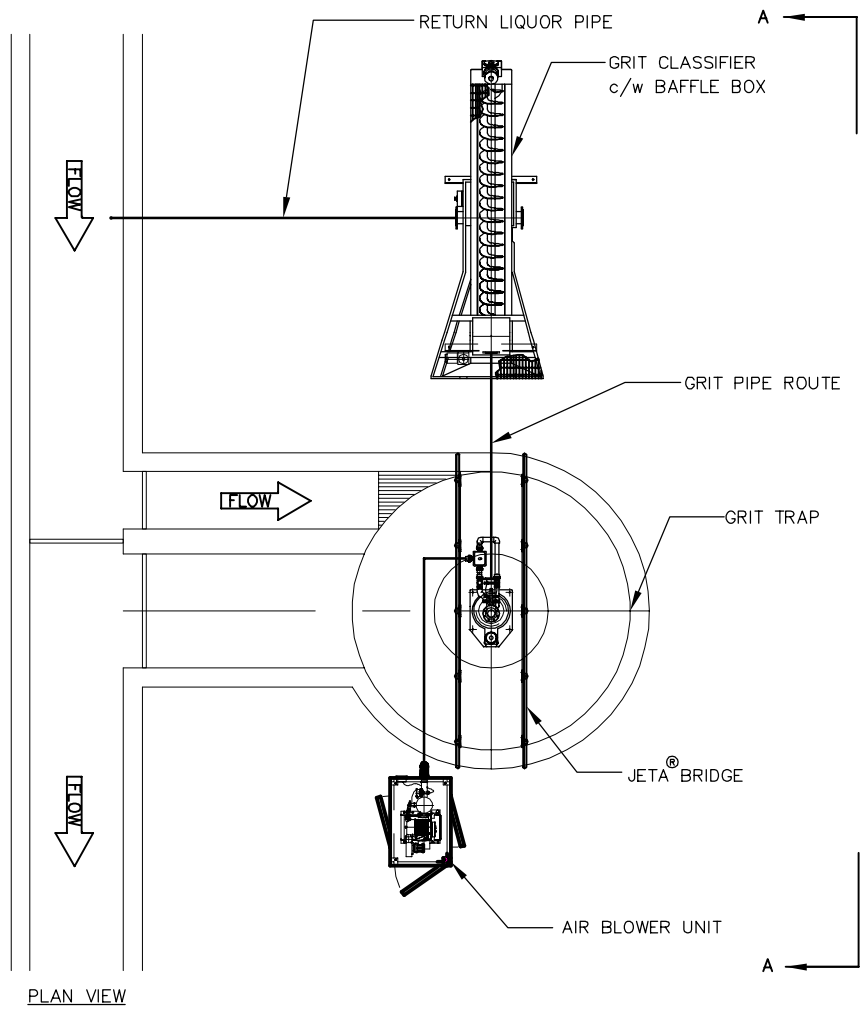
CITY OF BISHOP
WASTEWATER TREATMENT PLANT IMPROVEMENTS
EXISTING AND PROPOSED FACILITIES

PREPARED FOR: CITY OF BISHOP
DATE SUBMITTED: MARCH 2008

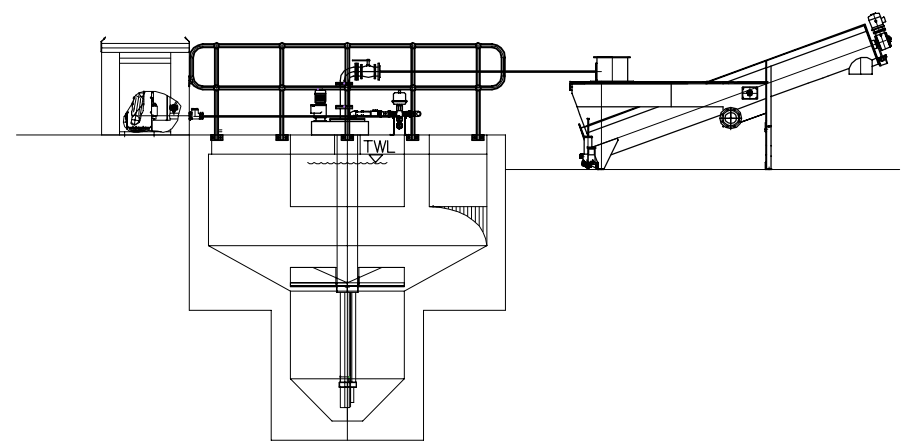
SHEET NUMBER
M
OF NA SHEETS
JOB NUMBER
SDB034100

WLBAT XREF'S:

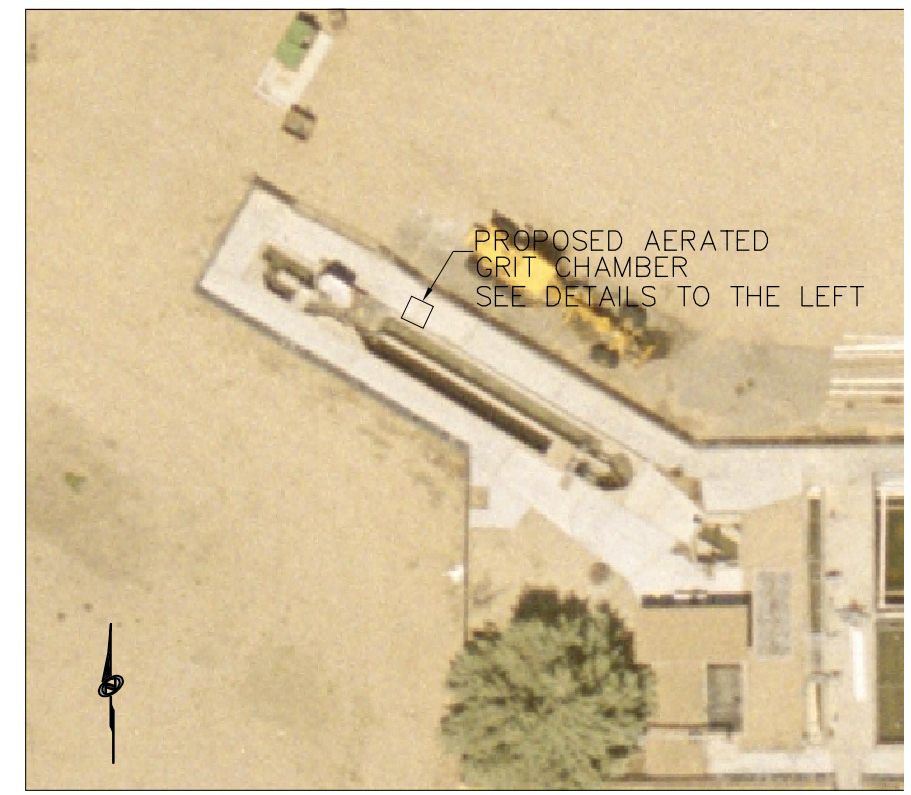
Appendix N: Proposed Grit Chamber Location



JONES & ATWOOD
JETA® GRIT TRAP SINGLE CLARIFIER



SECTION A-A

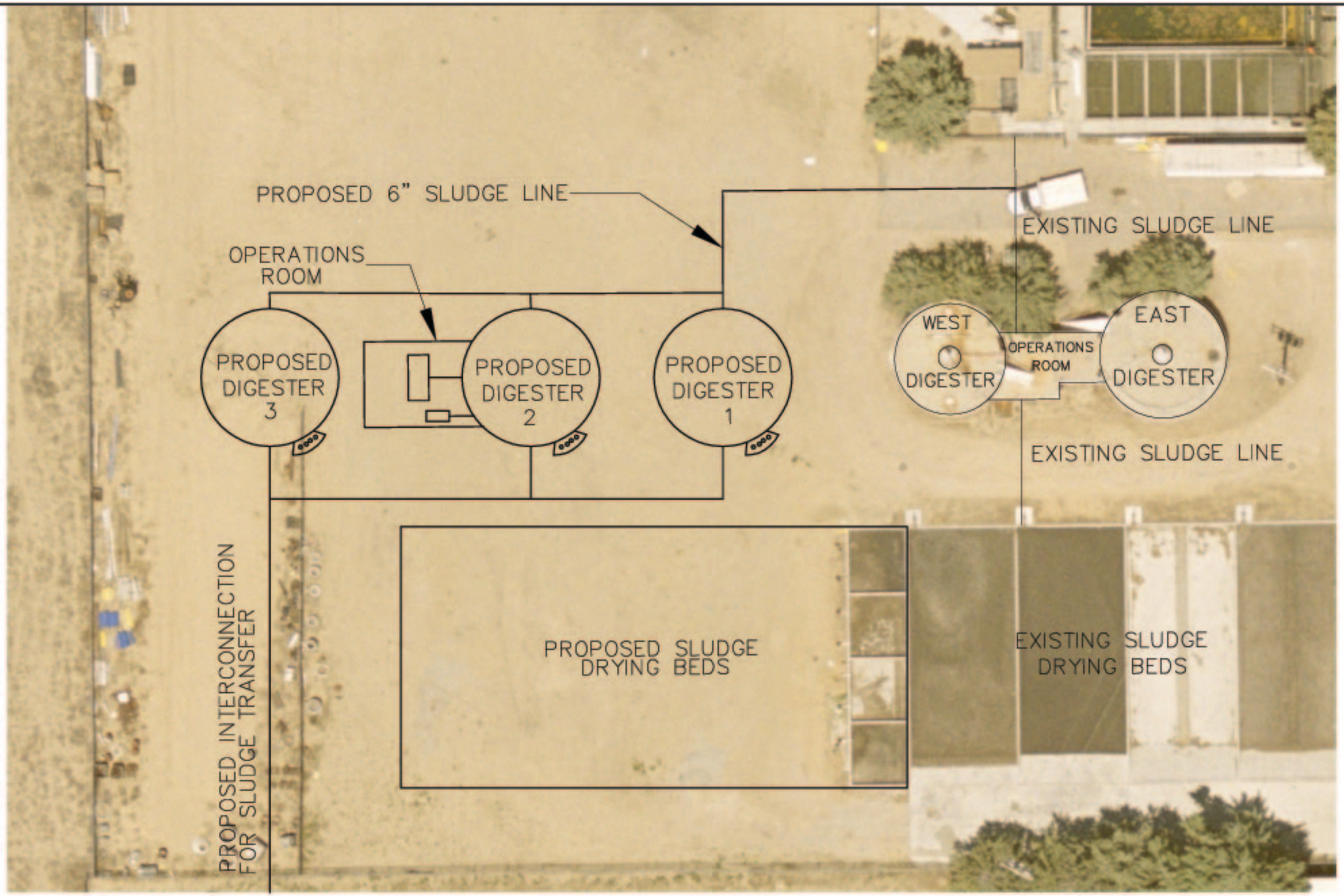


SCALE: 1"=100'

DATE: 3/26/08 TIME: 3:13:54 PM SERVER: NONE LAYOUT: 11X17 PATH: N:\SDB034100\CADD DRAWING NAME: GRIT CHAMBER.DWG PAGE SETUP: ---- DESIGNER: #### PROJ. MGR: ####	NOLTE BEYOND ENGINEERING 15070 AVENUE OF SCIENCE, SUITE 100 SAN DIEGO, CA 92128 858.385.0500 TEL 858.385.0400 FAX WWW.NOLTE.COM	CITY OF BISHOP UPGRADED AERATED GRIT CHAMBER PROPOSED LOCATION	SHEET NUMBER N OF NA SHEETS
		PREPARED FOR: CITY OF BISHOP DATE SUBMITTED: MARCH 2008	JOB NUMBER SDB034100

WILBAT
XREFS:

Appendix O: Proposed Anaerobic Digesters Location



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DESIGNER: #### PROJ. MGR: ####

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CITY OF BISHOP
WASTEWATER TREATMENT PLANT IMPROVEMENTS
PROPOSED ANAEROBIC DIGESTER LOCATION

PREPARED FOR: CITY OF BISHOP
DATE SUBMITTED: MARCH 2008

SHEET NUMBER 0 OF NA SHEETS
JOB NUMBER SDB034100

WLBAT XREF'S: