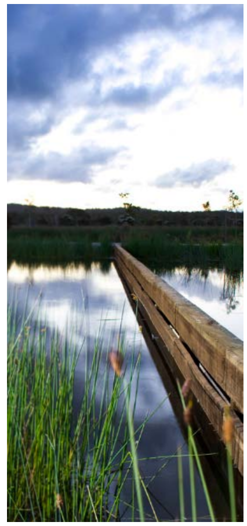
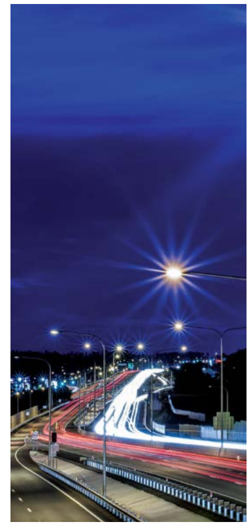


Preliminary Engineering and Alternatives Analysis Report

Manila Community Services District

GHD | 718 3rd Street Eureka CA 95501

11181126 | 20 |

Table of Contents

Figure Index

Table Index

1. Introduction

1.1 Background

Manila is an unincorporated community, which receives water, wastewater, and recreation services from Manila Community Services District (or District). The District boundary encompasses 1,650 acres. The District facilities are comprised of water mains, a storage tank, a booster pump station, a wastewater conveyance and treatment system, percolation ponds, a community park, a community center, a recreation area, and a limited stormwater drainage system. Previous reports have focused on water system infrastructure. This report is focused on wastewater infrastructure.

The District wishes to make strategic improvements to their wastewater infrastructure, some of which has been in service for more than 40 years. This report reviews the wastewater infrastructure and identifies a preferred project alternative. Following the identification of a preferred project, the District will seek funding for the construction of the project to provide improved wastewater infrastructure for the community of Manila, California.

This document presents the Preliminary Engineering Report (PER) for the Manila CSD Wastewater Infrastructure Improvement Project (project). The District has received funding for this project under the State Water Resources Control Board's Clean Water State Revolving Fund (CWSRF). The District's design consultant for the project is GHD Incorporated (GHD) of Eureka, California.

The PER is a planning document required by the CWSRF as part of the process of obtaining financial assistance for development of the project. This PER describes the proposed project from an engineering perspective, analyzes alternatives for the project, estimates potential project costs, and provides information to assist in the underwriting process. The content of this report follows the guidance in USDA RUS Bulletin 1780-2 dated April 4, 2013 as adapted for the specific circumstances of the Manila project.

1.2 Brief History and Need for Project

The Humboldt County Board of Supervisors formed the District on July 20, 1965 as an independent multi-purpose district organized pursuant to Resolution No. 2130 adopted under the Community Services District Law, pursuant to Title 6, Division 2, of the California Government Code (Humboldt Local Agency Formation Commission, 2007).

The original Septic Tank Effluent Pump (STEP) system was installed in 1978. At the time, a regional treatment system and ocean discharge was being planned to serve numerous communities including Manila so a temporary leach field system was initially installed. The regional concept never came to fruition so the District built a new leach field system. This system began to show signs of failure within a year. Additional improvements were subsequently made including mechanical system upgrades, treatment wetlands, and rapid infiltration basins. These last improvements were made over 20 years ago and many of the components have reached the end of their useful life or have become obsolete. With many mechanical components over 20 years old and some system components over 40 years old, the system needs rehabilitation to make improvements to help the District extend the useful life of the wastewater system over the coming decades.

This Preliminary Engineering Report provides information on the District, the facilities, future needs, and identifies a preferred approach for moving forward with system upgrades. The necessary upgrades for the system are based on the future of the planning for the needs of the District.

2. Project Planning

This section of the report describes the project planning area, including location, land use, environmental resources present, current population trends, and community engagement.

2.1 Location

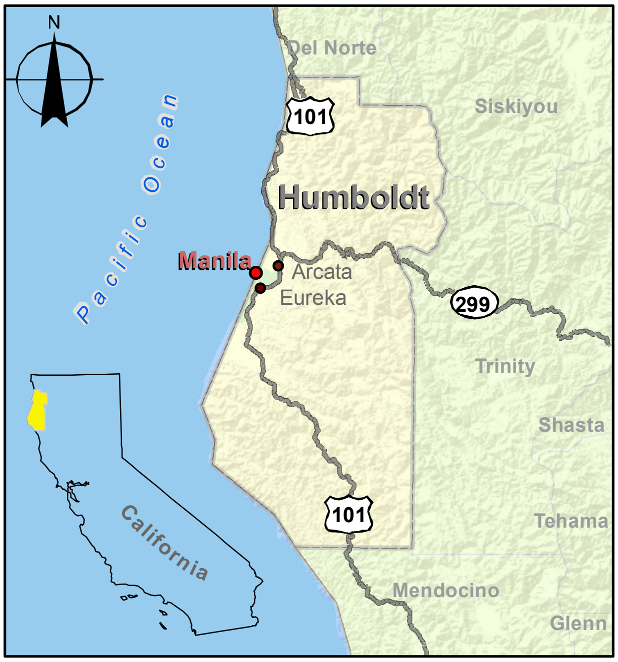
The District is located along the north spit of Humboldt Bay on the Samoa Peninsula between the bay and the dunes. Manila is located approximately four miles northwest of Eureka along Highway 255. Manila's current boundary encompasses approximately two square miles, bounded by the Pacific Ocean on the west and Humboldt Bay on the east, and extends approximately six miles north from the Samoa Bridge to the Mad River Slough and is presented in Figure 1 on the following page.

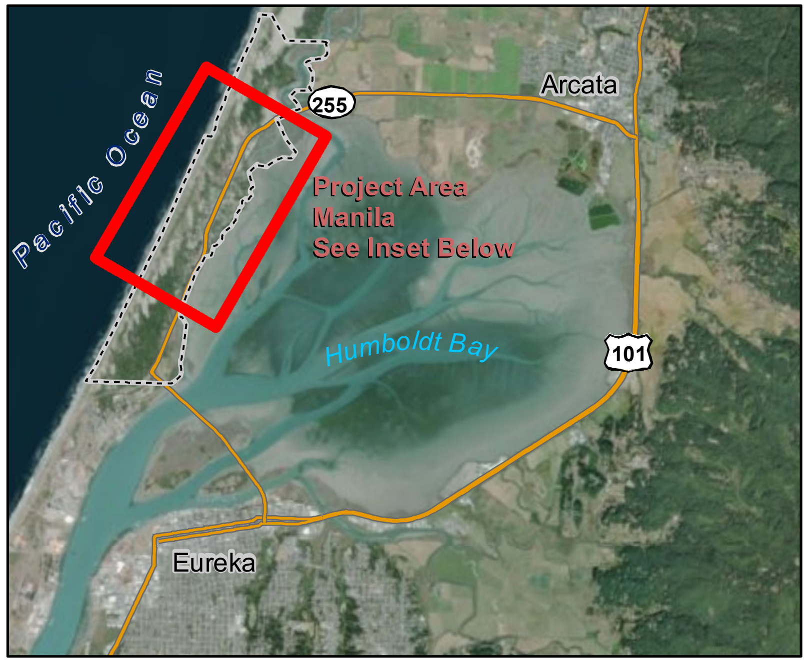
2.2 General Geology

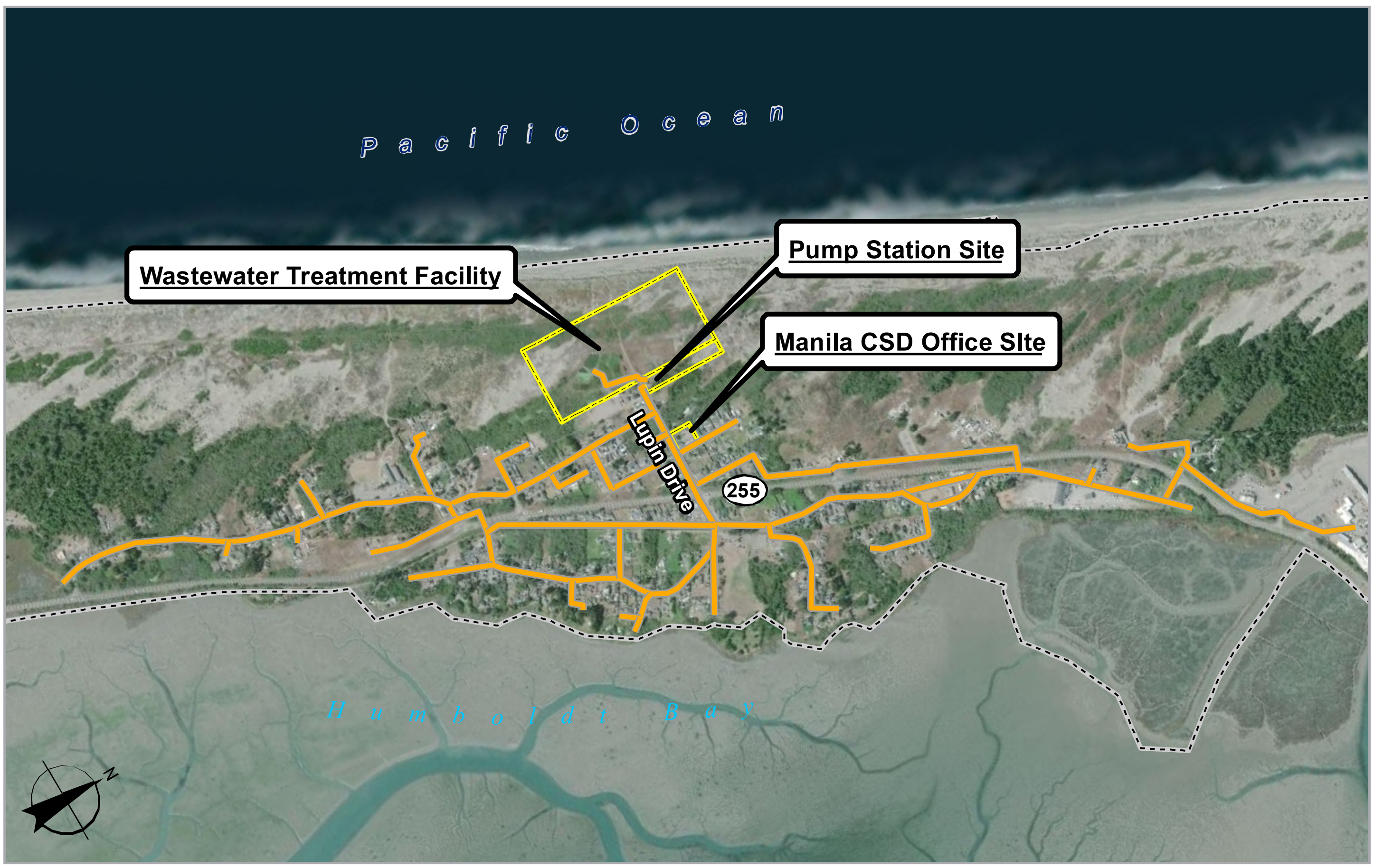
The general geology of project site, Samoa Peninsula, is described as undeformed marine shoreline and Aeolian deposits (USGS, 2000) with gravel and sand deposits on the shoreline. The regional geology is further described as having late Pleistocene dune sands. The area is described as a continuous strip of windblown dune sand that reaches up to 70 feet above sea level (Evenson, 1959). Everson indicates that while the full thickness of deposit is not known, historical groundwater wells were unable to fully penetrate the deposit so it is believed that the deposit may be greater than 100 feet thick.

2.3 Flood Hazards

The Federal Emergency Management Agency (FEMA) delineates regional flooding hazards as part of the National Flood Insurance Program and includes areas adjacent to Manila. The project planning area includes select areas of the wastewater household pretreatment (septic), conveyance and treatment system. The septic and conveyance system is generally between elevations 12 to 25 feet (NAVD88). The treatment site elevation is approximately 40 feet (NAVD88). The most recent Flood Insurance Rate Map (FIRM) Panel 06023C0830F, encompassing the planning area, became effective on November 4, 2016. The FIRM indicates that the project planning area is located within Zone X, which is defined as areas outside the 0.2% annual chance floodplain. The Flood Insurance Study for Humboldt County, California and Incorporated Areas identifies an elevation of 9.67 feet (NAVD88) for the 1% annual chance stillwater elevation for Humboldt Bay at Eureka and King Salmon.







Existing Wastewater Conveyance System
Manila CSD Service Area
Manila CSD Facility Locations

Paper Size ANSI A

0 500 1,000 1,500 2,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

GHD

Manila Community Services District
Wastewater Infrastructure Improvement Project
Clean Water State Revolving Fund

Project Area Map

Project No. 11181126
Revision No. -
Date 12/14/2018

FIGURE 1

N:\US\Eureka\Projects\111\11181126 Manila CSD-Plan Design WW Infrastruct\08-GIS\Maps\Deliverables\Engineering Report\F1_Project_Area_Map.mxd
Print date: 14 Dec 2018 - 13:42

Data source: GHD, Service Pedestals, AARV, and Conveyance System, 2018 (based on Winzler & Kelly, As-Built Drawings, 1979). Humboldt County GIS, Parcel v61, 2018. GHD, Manila CSD Service Area, 2018 (based on Humboldt Local Agency Formation Commisison, Municipal Service Review, 2007). USDA/FSA - Aerial Photography Field Office, USDA-FSA-APFO NAIP MrSID Mosaic, 2014. ESRI, Base Map World Imagery, 2018.Bureau of Reclamation, County Lines, 2009. ESRI, StreetMap USA, 2012. Sources: Esri, USGS, NOAA

2.4 Tsunami Hazard

The planning area within Manila is located within a moderate tsunami hazard area, due to its elevations between 9.8 to 32.8 feet (3 to10 meters), as described in the Relative Tsunami Hazard Mapping for Humboldt and Del Norte Counties, California (Patton & Dengler, 2006).

2.5 Earthquake Hazard

The planning area is within a seismically active area, bound by the Mad River, Freshwater and Table Bluff fault zones that surround Humboldt Bay to the north, east and south, respectively.

2.6 Environmental Resources Present

The community of Manila is located on the half-mile wide peninsula between the Pacific Ocean and Humboldt Bay. The foredunes, a series of dunes and ridges parallel to the waves slope, buffer the community from the waveslope of the Pacific Ocean. Pockets of dune and wetland habitat are scattered throughout the community, between the foredunes and salt marshes, mudflats and of Humboldt Bay.

The entirety of the community is within the Coastal Zone. The dune ecosystem is considered to be an Environmentally Sensitive Habitat Area (ESHA) per the Coastal Act. An ESHA is an “area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could easily be disturbed or degraded by human activities or development” (Section 30107.5). Areas of wetland-type vegetation in accordance with the California Coastal Commission, as well as wetlands having wetland-type vegetation, hydric soils, and wetland hydrology in accordance with the US Army Corps of Engineers are present throughout the community.

This Preliminary Engineering Report is part of a larger planning project which includes a Biological Evaluation of areas potentially affected by proposed wastewater system upgrades. The Biological Evaluation will consist of a review for potential Federal and State sensitive-listed plant and animal species which may occur at the site, review for sensitive vegetation communities, and conducting seasonally appropriate plant surveys. A wetland investigation will also be conducted to identify the location of jurisdictional wetlands within the proposed project improvement areas in support of permitting, environmental documentation, and construction planning. Completion of the Biological Evaluation at this planning stage will help streamline subsequent project implementation.

2.7 Current Land Use

Manila is characterized predominantly by residential land uses with few public, commercial, and industrial lands. Active commercial land use is currently limited to a single location in the center of the community. Industrial land use exists in discrete locations in the northern portion of the District at the former mill site and existing trucking facilities. Currently developed areas are generally surrounded by areas managed for natural resources. Further to the northeast, between Manila and Arcata, are agricultural lands. To the south, the community of Samoa, which was founded around the former Hammond Lumber Company’s mill site, is a combination of industrial lands with some public and residential land uses.

2.8 Population Trends

The District's service area encompasses approximately two square miles. To provide overall context for this report, population trends are considered in this section. Potential future population, based on historical trends, is presented to provide additional reference information for the overall report.

Manila is a small, unincorporated coastal community, and population trend data specific to Manila is not available. However, general regional population trends and characteristics provide insight into potential population trends for Manila.

The US Census Bureau defines the community of Manila as a Census Designated Place (CDP). The first recorded population Census data for Manila CDP occurred in 2010, which reported a population of 784 with 411 housing units (368 occupied, 43 vacant) (US Census Bureau, 2017). Further, the US Census Community Survey estimated that Manila CDP had a population of 724 with 406 housing units for 2015, with margin of errors reported as 153 total population and 56 housing units. For the purpose of this study, the current population is assumed to be 780 people.

Since the US Census does not specifically develop population forecasts for the District's service area, the population trend for Manila for planning purposes will be based on regional population information.

Population trends reported in the Humboldt County General Plan (Dyett & Bhatia, 2002), indicate that Humboldt County experienced 16.6 percent growth from 1980 to 2000 (0.83 percent annual), and projected 11.5 percent growth from 2000 to 2020 (0.58 percent annual). However, the growth in Manila is likely slightly less than the County as a whole and could be more on the order of 0.5% per year. Over a twenty-year planning horizon, a 0.5% annual growth rate over a base population of 780 results in a forecasted population of 860. This represents a growth over 20 years of only 10%. Since other factors will govern the sizing of system components, this very modest potential population growth is not material to the overall component sizing.

The District is not aware of any significant developments or factors that would induce a significant change in the community population in the next five-years that would be large enough to significantly affect future demand on the facilities.

2.9 Current Wastewater System Users

Over the past three years, active sewer connections have varied from 326 to 342 with an average of 335 for any given month. Similar to the water system, these up and down changes in the numbers of active connections are likely due to the variability in occupation of rental properties and are not indicative of a trend in community growth or decline.

The District's STEP system serves mostly single- and multi-family residential properties with few public and commercial customers. A summary of customers and Living Unit Equivalents (LUEs) is presented in Table 1, below.

Table 1. Existing sewer system customers and associated living unit equivalents (LUEs)

Type	Property Description	LUEs
District Owned Properties	Community Center/Redwood Coast Montessori	2
	Manila RV Park	1
	Manila Park	1
Commercial	Redwood Coast Trucking	4
	JBM Land LLC (Former Sierra Pacific Industries Mill Site)	5
	JBM Land LLC (Former Sierra Pacific Industries Truck Shop)	4
	Lighthouse Plaza	1
Religious and Non-Profit	Friends of the Dunes	1
	Free Holiness Church	2
	Manila Community Church of God	1
Residential	Single (323)	1
	Multi-Family Residential (24)	2-6

The STEP system utilizes pumps within the septic tank to transport water to the treatment system and these pumps are fed power from an above ground pedestal. Some power pedestals and septic tanks serve multiple properties, others serve single properties. The power cost is incorporated into the billing rate structure and the District supplies power to a majority of connections. Fourteen septic tanks are powered by customer meters and the District reimburses the customer for this power cost.

2.10 Regulatory Requirements

The wastewater system is operated to meet the requirements of Division 7 of the California Water Code and regulations adopted thereunder as defined in the California Regional Water Quality Control Board North Coast Region Waste Discharge Requirements (WDR) Order No. 95-2 (ID No. 1B801620HUM) for the Manila Community Services District. A summary of the main requirements of the WDR are summarized below

A. <u>Discharge Prohibitions</u>

1. The discharge of any waste not specifically regulated by Order No. 95-2 is prohibited.
2. Creation of a pollution, contamination, or nuisance, as defined by Section 13050 of the California Water Code (CWC), is prohibited. [Health and Safety Code, Section 5411]
3. The discharge of waste to Humboldt Bay is prohibited
4. The discharge of untreated waste from anywhere within the collection, treatment, or disposal facility is prohibited.
5. The discharge of waste to land not under the control of the discharger is prohibited.

B. <u>Effluent Limitations</u>

1. Representative sample of the discharge shall not contain constituents in excess of the following limits, presented Table 2 below:

Table 2. Discharge Permit effluent limitations.

Constituent	Unit	Discharge Permit 30-Day Average*	Discharge Permit Daily Maximum
BOD (20°, 5-day)	mg/l	50	80
Suspended Solids	mg/l	50	80
Settleable Solids	mg/l	0.1	0.2
Hydrogen Ion	pH	Not less than 6.5 nor greater than 8.5	Not less than 6.5 nor greater than 8.5

*The arithmetic mean of the values for effluent samples collected in a period of 30 consecutive days.

C. Solids Disposal

1. Collected screenings, sludges, and other solids removed from liquid wastes shall be disposed of at a legal point of disposal, and in accordance with the provisions of Title 23, Division 3, Chapter 15 of the California Code of Regulations or as waived pursuant to Section 13269 of the California Water Code and Section 503 of the Federal Clean Water Act.

2.11 Community Engagement

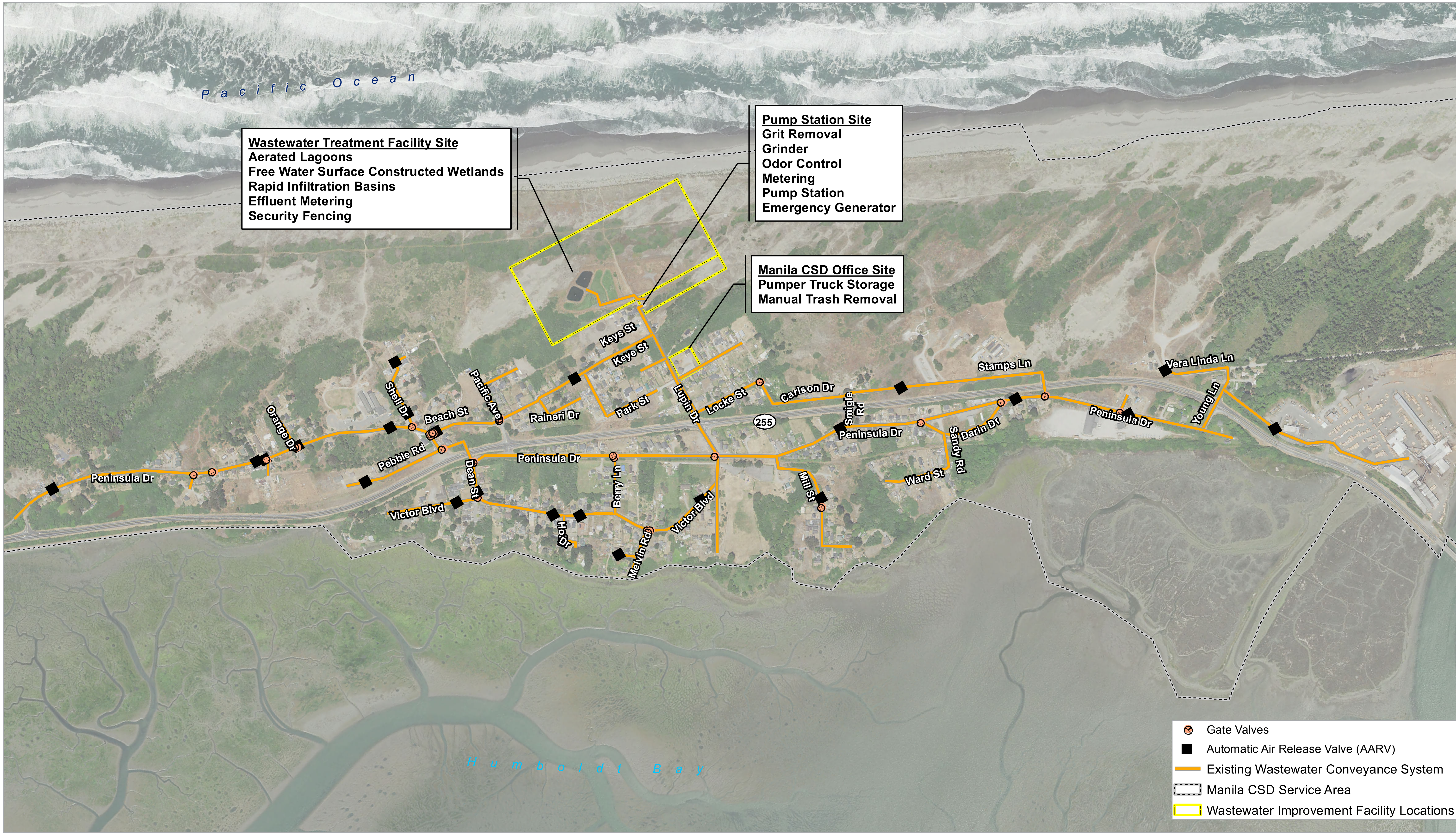
The District serves a small regional community and there are a number of means for engaging the community to receive input and to inform the public of progress and decisions. The District engages the community through regular public meetings where information on the current status and plans for the wastewater system are reviewed. This process will continue to be used throughout the design, permitting and future implementation process. The District's Board of Directors meetings are open to the public and agenda's are posted on the District's website, at locations within the community and on social media through Nextdoor, a free private social network for neighborhoods and communities.

3. Existing Wastewater Facilities

The existing wastewater system includes household pretreatment, conveyance, treatment, and disposal. Household pretreatment is accomplished through septic tanks that include a pump and a force main to the treatment system. This is known as a Septic Tank Effluent Pump (STEP) system. Initially the treatment system was developed with a grit removal vault, a grinder vault, a metering vault, and a wet well and pump house. The effluent is pumped to aerated lagoons and treatment wetlands and it flows by gravity through an effluent metering vault to rapid infiltration basins.

3.1 Wastewater Facility Layout

The layout of The District's existing wastewater facilities is shown in Figure 2 on the following page. An existing facility process schematic is shown in Figure 3 on the subsequent page. The overall history and condition of the existing facility is discussed in the next section.



Note: Wastewater system map shows existing locaiton of the collection system force mains, main valves and treatment facilities. System components, such as individual septic tanks, valves and other appurtantances are not shown for clarity. Refer to 1978 and 1995 wastewater system plans for complete map of exisiting wastewater system facilities.

Manila Community Services District
Wastewater Infrastructure Improvement Project
Clean Water State Revolving Fund

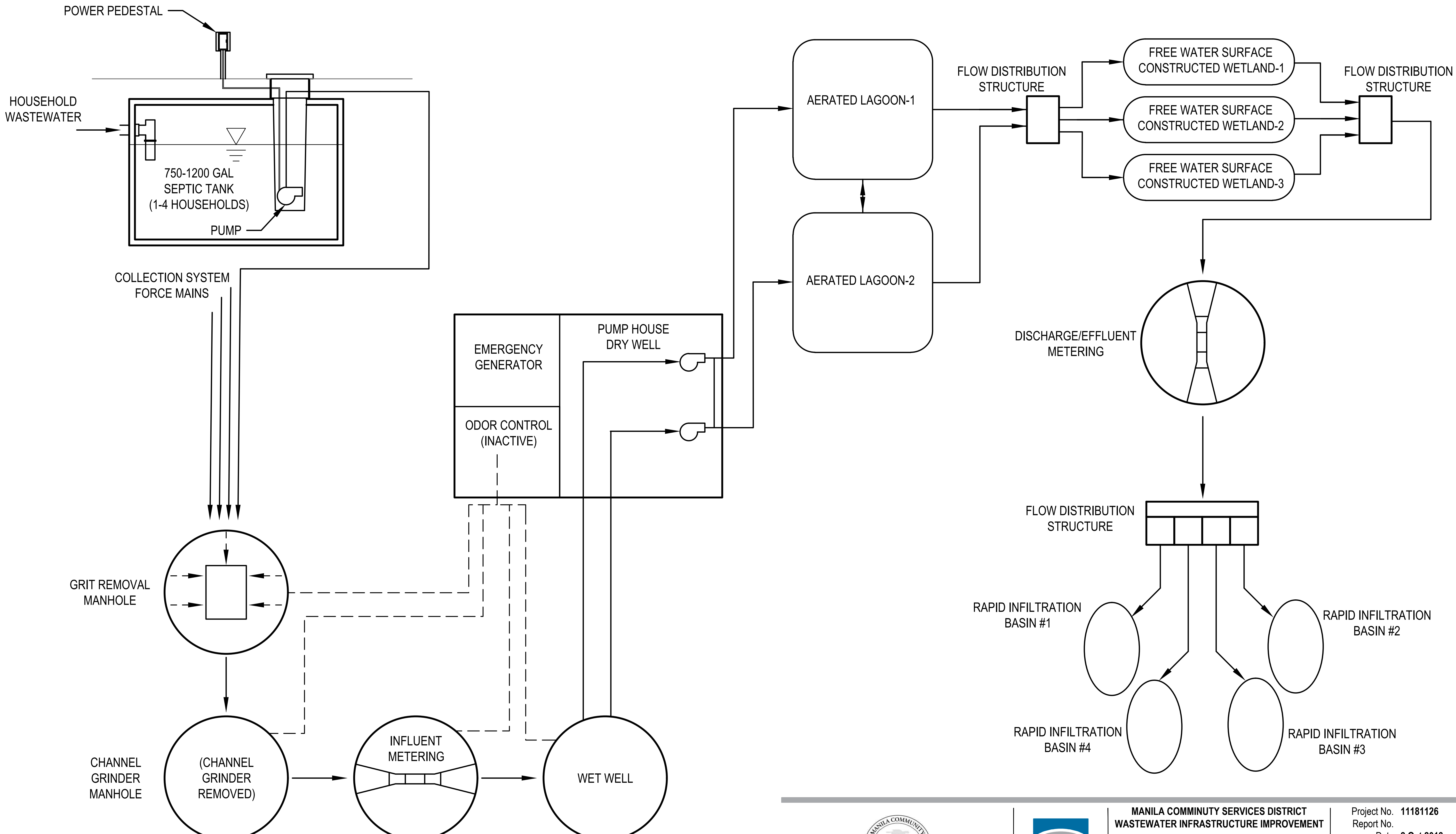
Existing Wastewater Facilities Overview

Project No. 11181126
Revision No. -
Date 12/14/2018

FIGURE 2

N:\US\Eureka\Projects\111\11181126 Manila CSD-Plan Design WW Infrastruct\08-GIS\Maps\Deliverables\Engineering Report\F2_Wastewater_Facilities.mxd
Print date: 14 Dec 2018 - 13:40

Data source: GHD, Service Pedestals, AARV, and Conveyance System, 2018 (based on Winzler & Kelly, As-Built Drawings, 1979). Humboldt County GIS, Parcel v61, 2018. GHD, Manila CSD Service Area, 2018 (based on Humboldt Local Agency Formation Commisison, Municipal Service Review, 2007) . Created by: bvivyan



MANILA COMMUNITY SERVICES DISTRICT
WASTEWATER INFRASTRUCTURE IMPROVEMENT

WASTEWATER SYSTEM SCHEMATIC

Project No. **11181126**
Report No.
Date **2 Oct 2018**

FIGURE 3

Filename: G:\111\11181126 Manila CSD-Plan Design WW Infrastruct\06-CAD\Figures\Wastewater_Schematic_11x17.dwg
Plot Date: 2 October 2018 - 3:02 PM

Source:

History of the Wastewater System

The Humboldt County Board of Supervisors formed the Manila Community Services District on July 20, 1965 as an independent multi-purpose district organized pursuant to Resolution No. 2130 adopted under the Community Services District Law, pursuant to Title 6, Division 2, of the California Government Code (Humboldt Local Agency Formation Commission, 2007).

The original STEP system was installed in 1978, which included the following components:

- Septic tanks serving one to four units
- Septic tank pumps and power pedestals
- Sanitary sewer conveyance system (force mains)
- Pump station with meter vault, odor control, wet well, backup generator and laboratory
- Temporary leach field

The original leach field disposal system was developed based on the expectation that the pump station would discharge the septic tank effluent to the proposed regional wastewater treatment plant that was planned be located on the Samoa Peninsula (CRWQCB, 1996). However, the regional system was not constructed and the temporary leach field operated for ten years until 1988. The temporary leach field was not intended for long term use and so a dual pressure distribution leach field disposal system was then constructed as a replacement with the intent of providing a long term disposal system. However, the replacement system began to show signs of overloading and failure a little over a year after implementation. In 1995 further improvements were made to implement a more sustainable treatment and disposal system that is predominately in operation currently. The 1995 improvements include the following major components:

- New Grit removal vault
- New Channel grinder Vault
- New Influent metering
- New wet well and conversion of the previous wet well to dry well
- New dry well pumps, piping, and controls
- Two new aerated lagoons
- Three new free water surface treatment wetlands
- New effluent metering vault
- Four new rapid infiltration basins.

Since this last major improvement project more than 20 years ago, minor maintenance and modification projects have been undertaken throughout the system. The following sections highlight the condition of the major system components and maintenance, upgrade, and decommissioning activities that have transpired.

3.3 Condition and Operating Characteristics of Existing Facilities

The overall wastewater management system can be considered as the three major sub components of Septic Systems, Conveyance System, and Treatment and Disposal System. The following sections describe the overall condition and operating characteristics of these three existing wastewater subsystems. The general function, condition and challenges, if any, are described as they relate to each major system component

3.3.1 Septic Systems

The District owns, operates and maintains 292 septic tanks as part of the wastewater management system. Individual STEP systems include a septic tank and electric pump. Wastewater is gravity fed from homes into septic tanks where the solids settle and the clear zone wastewater is pumped through the conveyance system to the treatment facility. The septic tank itself provides an important pretreatment function by settling and digesting solids, thereby relieving the subsequent treatment system of some of the biological load. The settling of solids and debris allows for clear water to be pumped through the force main system to the treatment plant, which simplifies conveyance system operations.

Septic tanks service one to four units and range in size from 750 to 1,200 gallons. Tanks are either fiberglass or concrete. Periodic maintenance of septic tanks is required to remove accumulated sludge, scum, and debris and to perform maintenance such as pump replacements or electrical repairs.

The District periodically inspects septic tanks to check scum and sludge thickness, to check the mechanical operation of pumps and alarms, and to inspect the condition of the tank, riser and lid. District staff regularly find that garbage, that is meant for solid waste disposal, accumulates in septic tanks. The service area is relatively flat with high winter groundwater and some of the septic tank risers and lids are in low areas subject to rainwater inflow. An example of a ground level septic tank lid is shown in Figure 4.

a.

b.

Figure 4. Examples of Septic Tank Risers at Ground Level

Septic tanks are equipped with high level alarms audible in the vicinity of the tank and control box, but these alarms require the homeowner to contact the District as there is no connection to a Supervisory Control and Data Acquisition (SCADA) system. If a homeowner shuts off the alarm without notifying the District it is possible that a septic tank could back up the plumbing into a house or overflow. The District works to educate homeowners regarding their responsibility to notify the District of any septic tank issues they notice, but periodically homeowners wait until a warning alarm becomes an operational problem before contacting the District.

The District works to reduce the potential for emergencies by regularly maintaining septic tanks. The District pumps septage from tanks when necessary to keep them in good operating condition and checks pump operation and overall condition. The frequency of pumping varies by tank due to the variability in the usage by homeowners and specific site conditions. Some tanks may require pumping every three to five years, while others may require much less frequent pumping.

District staff currently service septic tanks with a 2,000 gallon vacuum pumper truck as shown in Figure 5. Tanks are only pumped during the summer months, which is the dry season, as emptying the septic tanks for any prolonged period in winter runs the risk of causing the tanks to float due to high ground water, which could damage piping connections. Historically McKinleyville, Arcata, and Eureka Wastewater Treatment Plants accepted septage in the past, but these agencies were contacted as part of this study and all three indicated they no longer accept septage. Only the Ferndale Wastewater Treatment Plant currently take septage from outside entities.

Figure 5. View of the District's 2,000 Gallon Pumper Truck

If a septic pump fails and a tank is nearing overflow conditions, the District must act quickly to pump the tank and repair or replace the pump or make other repairs as necessary. During such conditions the District only has the available capacity in the vacuum truck and does not have the ability to quickly store excess septage. In the case that a septic tank has the potential to overflow, the District will pump it and if it cannot be immediately hauled to disposal, then the District's practice is to discharge into the District's Office 750 gallon septic tank. This is only done very slowly as the capacity of the truck is greater than the capacity of the tank. It is added at the rate it can be pumped to the treatment system. Also, there is a simple screen in the riser to remove debris and grit which slows the discharge process and the screen must be cleaned during discharge. The riser and screen with typical debris is shown in Figure 6.

Figure 6. Septic Tank Riser with Screen at District Office

Debris and grit screened from septage is placed in the District's trash receptacle and hauled off with standard solid waste disposal services through Humboldt Waste Management Authority. Grit, consisting small rocks and sand is removed, rinsed and disposed of on site.

The vacuum excavator truck is used for the dual purpose of septage removal and removal of fill material around valves and septic tanks lids, which results in the need to conduct extra rinsing and washing of the comingled grit.

A number of issues have been identified with the septic systems as discussed above that should be addressed to reduce wet weather inflow and infiltration (I/I), reduce the potential for tank overflows, and provide the District with more effective means of pumping and managing septage. These issues are summarized as follows:

- Low septic tank lids and leaky risers in some locations
- Improper stormwater connections possible in some locations
- No integration of septic tank alarms into a District SCADA system
- Pumps need replacement in some locations
- Septage screening and storage needed for better management
- Garbage enters and remains in septic tanks

3.3.1 Sanitary Sewer Conveyance System (Force Mains)

Clearwater from the septic tanks is conveyed to the treatment system through a series of pressure sewer lines known as force mains. Hydraulic head for conveyance is created by the pumps in the individual septic tanks. The conveyance system is comprised of 1 ½-inch to 8-inch diameter pipes, gate and air release valves, pressure taps, cleanouts, and associated appurtenances.

Although a force main system typically does not require significant maintenance, many of the valves and mechanical components are 40 years old and are potentially unreliable and malfunction can cause operational problems. For example, septic tank effluent can produce gasses and if these gasses accumulate in high points in the pipes, it can cause an air lock and prevent efficient flow through the pipes. Air Release Valves (ARV's) are installed at strategic high points in the conveyance system and are intended to release the gasses and prevent air locks. The ARV's are intended to operate automatically, but many of the older ARV's do not function properly and cause backups and must be manually operated to purge gasses from the system. District staff manually relieve pressure as often as weekly for some of the ARV's. An example of an existing ARV is shown in Figure 7. Given the age and condition of these mechanical components, all of the ARV's in the system should be replaced and vaults upgraded to provide easier access for maintenance.

Figure 7. View of Air Release Valve (ARV) in a Vault.

Several of the isolation valves and other mechanical infrastructure have degraded over the four decades of operation and need replacement as well.

The overall conveyance system issues as discussed above are summarized as follows:

- Poorly functioning ARV's
- Select isolation valves and other mechanical equipment needs replacement

3.3.2 Treatment and Disposal System

The clearwater from the septic tanks is conveyed to the treatment system, which is made up of the following major components:

- Pump Station
- Aerated Lagoons
- Treatment Wetlands
- Rapid Infiltration Basins

Each of these elements is briefly discussed in the following sections.

3.3.2.1 Pump Station

The pump station has been modified over time as part of the major upgrade projects. The overall pump house and yard is shown in Figure 8.

Figure 8. Existing Pump Station

The pump station facility includes the following major elements:

- Grit Removal Vault
- Grinder Vault
- Metering Vault
- Wet Well
- Dry Well
- Odor Control System
- Standby Generator
- Controls, Laboratory, and Support Facilities

The history, operation, and condition of each of these elements is briefly discussed below:

3.3.2.1.1 Grit Removal Vault

The conveyance force mains from septic tanks throughout the District converge into four force mains that discharge into the grit removal vault at the pump station facility as shown in Figure 9. The grit removal vault was installed with the 1995 improvements. The concept of a grit removal vault is to trap rocks and sand and avoid pumping it to the treatment ponds. Gravity collection systems typically have a significant amount of grit and therefore a grit removal system is important to overall operations. However, the District operates a pressurized conveyance system and has found that staff only need to clean out the grit removal vault on an annual basis where between 1 to 2 cubic feet of grit is removed. This is a very small amount and is generally what would be expected from a STEP system.

Figure 9. Grit Removal Vault

3.3.2.1.2 Grinder Vault

Following grit removal, flow is conveyed by gravity to the adjacent grinder vault as shown in Figure 10. The grinder vault was installed with the 1995 improvements. However, the septic tanks remove essentially all of the types of solids that would typically warrant grinding and District staff found that the grinder provided essentially no benefit and had significant maintenance requirements. In addition, the grinder increased turbulence in the wastewater and increased the odor potential. District staff eventually deemed the channel grinder unnecessary and removed it altogether around 2006.

Figure 10. Grinder Vault. Note: Grinder Has Been Removed.

3.3.2.1.3 Metering Vault

Flow entering the Influent Metering Manhole passes through a 2-inch fiberglass Parshall Flume installed with the 1995 improvements, where the depth of flow in the flume is measured with an ultrasonic level sensor and converted to flow in the Programmable Logic Controller (PLC). The metering vault is shown in Figure 11 and the Hach flow metering and data recorder equipment is shown in Figure 12. Daily maximum, minimum and average influent flow is stored in the Hach data recorder. Due to limitations in the existing instrumentation, the data can only be stored for a short period of time and cannot be electronically transferred and hence the data is then manually transferred to paper data sheets on a monthly basis and stored in hard copy only.

Figure 11. Influent Metering Vault with Parshall Flume

Figure 12. Hach Flow Meter and Data Recorder

Several years of influent flow data measured in the Parshall flume were analyzed as part of the preparation of this engineering report and compared to the 1995 as-built design flows and are presented in Table 3. The flow data was transcribed from hand written paper records for the years October 2015 through August 2017.

Table 3. Summary of Recorded Influent Flows for 2015 Through 2017

Flow	Design (mgd)	2015-2017 Recorded (mgd)	Percent of Design Value
Average Day	0.104	0.067	64%
Maximum Month Average Day	0.140	0.128	91%
Maximum Month Maximum Day	0.210	0.197	94%
Peak Hour (2.5*Max Month Average Day)	0.35	N/A	N/A

*Based on recorded influent flows from October 2015 through August 2017.

Typical flows were below design flows despite the extremely wet January and February of 2017. Average day flows were typically 64% of design flow. The maximum month was February 2017 and resulted in average day and maximum day flows that were approximately 91% and 94% of design, respectively. Table 3 shows there is ample average day capacity, which can accommodate the anticipated modest growth for the service area.

Based on typical average flows during drier months, the increased flows were suspected to be due to inflow and infiltration (I/I) to septic tanks. Examples of inflow include ponding rainwater that flows into a septic tank riser placed at a low spot and an area drain or downspout connected to the sewer lateral to a home. Examples of infiltration are seasonally high groundwater that leaks into a septic tank through poorly fitting lateral pipes or a riser that is not properly sealed to the lid of the septic tank. Both inflow and infiltration introduce additional water into septic tanks that require additional pumping and management through the treatment and disposal system. A comparison of precipitation, influent flows and energy use, shown in Figure 13 below, shows that sustained higher flows and energy use occur during the wet weather months and increased daily flows and energy also increase during precipitation events.

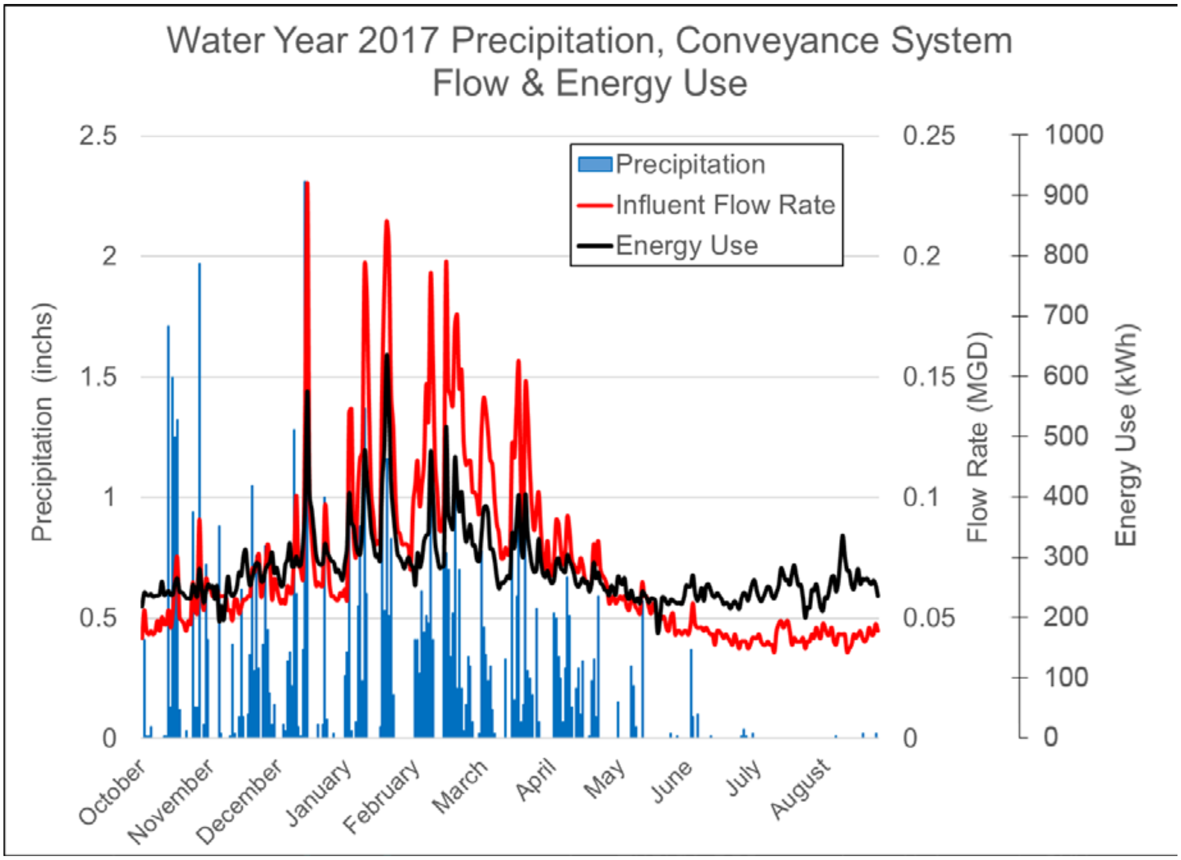


Figure 13. Comparison of daily precipitation and influent flow rate to the treatment facility.

As can be seen in the previous Figure, early season storm events don't necessarily result in energy use and higher influent flow rate, while later season storm events exhibit a greater correlation. This suggests that higher ground water and ground saturation conditions are necessary to create I/I. This is typical of wastewater collection systems. The data indicates that I/I may be predominately due to seasonally high groundwater infiltrating into piping and connections to tanks, as well as overall ground saturation and localized ponding in the vicinity of low septic tank access covers that runs into the tanks. Although improperly connected downspouts and area drains may be contributing to I/I as well. This conclusion also correlates with District staff understanding of seasonal variations of flows and their observations of a number of tanks with low access covers and the potential for wet weather ponding. The causes of the I/I should be addressed to reduce the peak flows, which also reduces District pumping costs. District staff identified power pedestals that showed increased pumping during wet weather months and inspected 110 septic tanks and the surrounding area to determine tank lid elevations relative to ground level and drainage patterns, as well as lid condition. The District identified thirty (30) septic tanks in need of new risers and sealing to reduce I/I at these locations.

3.3.2.1.1 Wet Well

From the influent metering vault, wastewater flows into a vault serving as a wet well for the dry pit pumps located in the basement of the adjacent pump station building. The wet well was constructed with the 1995 improvements and is located outside of the building and it is shown in Figure 14. In an effort to reduce odors from the wet well, the District added an elbow and pipe extension to discharge water into the wet well below the water surface thereby reducing turbulence of influent wastewater.

Figure 14. Original Wet Well Showing Influent Elbow to Reduce Odor Potential

3.3.2.1.2 Dry Well

The original 1978 pump station was designed with a large underground wet well below the block building on top. The wet well was converted into a dry well and the new wet well shown in Figure 14 above was installed to serve the new dry well pumps in 1995. The Dry Well now houses two pumps and piping as shown in Figure 15. These pumps convey wastewater from the outside wet well to the aerated treatment lagoons through two 4 inch force mains.

Figure 15. Two 5hp Pumps and Equipment within the Dry Well

The existing pumps, installed in 1995, have the following design parameters:

Number of Pumps: 2
Type: Centrifugal, Horizontal
Horsepower: 5
Discharge Capacity: 300 gallons per minute (gpm)
Total Dynamic Head: 31 feet

The overall wastewater conveyance system relies upon these pumps to convey the water from the force mains to the aerated lagoons. It is possible that a commercial power failure could affect the District's pump station, but not affect all the septic tank pumps throughout the District. The District has a standby generator at the pump station for this case as further discussed later in this section. However, there could also be a mechanical failure at the District's pump station which could lead to backing up of wastewater in the pump station wet well because the septic tank pumps would continue to operate under commercial power. Such a situation occurred several years ago and the pump station vaults nearly overflowed. It is recommended that yard piping modification be completed to allow the wastewater to bypass the pump station and allow the septic tank pumps to discharge directly to the aerated lagoons as an emergency operational option. This requires approximately 20 feet of additional hydraulic head. There are a variety of septic tank pumps in the system and based on a review of available pump curves, some of the septic pumps may not be able to produce this additional head. Therefore, the septic pumps that do not provide sufficient head should be replaced as well as many of these are older and near the end of their useful life.

In addition, the dry well piping, equipment, and pumps are now nearly 25 years old and showing signs of aging and potential failure. There are also a number of issues with the drywell pump configuration and condition that should also be addressed. One issue is that the type of pump in place uses a shaft sealing system relying on the pressurized wastewater being pumped in the seal and fine grit in the wastewater can wear the seals and hence the system necessitates additional maintenance. This could be rectified through replacement of the dry well pumps, however the overall configuration of the pumping system should be reconsidered.

The use of an underground drywell was a common configuration in the past, but there are a variety of issues with this arrangement and many wastewater pump stations are being reconfigured with modern equipment. The potential reconfiguration of the pumping arrangement is discussed further under the Alternatives Comparison section of this report.

3.3.2.1.3 Odor Control System

District operators indicated that many years ago before they started working with the District that there were reports of some odors from the exterior vaults. A blower had been installed to pull air from the grit removal vault, grinder vault, metering vault, and wet well as shown in Figure 16. The incoming air was chemically scrubbed in an attempt to reduce odors and the air was ducted outside. Over the years a number of modifications were made and alternative approaches implemented to reduce periodic odors. At one point an ozone generator was attempted, but it is believed by staff that the ozone was degrading the concrete in the vaults and its use was discontinued. The eventual removal of the channel grinder and the installation of the discharge elbow in the wet well as previously discussed appears to have addressed the odor issues and the District no longer operates odor control equipment. The District no longer receives odor complaints at the pump station and so it is recommended that the obsolete and unused odor control be removed. If there were future odor issues, then the District could consider odor control options at that time.

a. 

b. 

Figure 16. Unused Odor Control Equipment

3.3.2.1.4 Standby Generator

The pump station was constructed with a standby generator in 1978 to continue the operation of the pump station during power outages. The original generator was replaced in 1995 with a 45kw propane generator as shown in Figure 17. The generator is exercised weekly and comes on automatically during an outage of commercial power. Although the generator has relatively few running hours, maintenance is becoming more frequent, and it is located in a corrosive atmosphere. The existing generator also does not conform to all current air quality standards. The generator is also very loud and the District occasionally gets complaints regarding the noise. At nearly 25 years old, the generator is near the end of its useful life and should be replaced with a modern cleaner, quieter, and more efficient generator.

Figure 17. Standby Propane Powered Generator.

3.3.2.1.5 Controls, Laboratory, and Support Facilities

The pump station facility includes electrical and control panels, a small laboratory, and other support facilities such as spare parts, tools, and records storage. The main control panel was upgraded in 1995 and is shown in Figure 18. The main control panel includes alarms to indicate high wet well, and other conditions requiring operator attention. Low wet well, grinder jam, and high sump level alarm notification is sent to an alarm company, who in turn notifies District staff. The overall alarm communications system is antiquated and relies on the use of a commercial alarm company and District staff are not always notified of alarms. The District does not have a functioning Supervisory Control and Data Acquisition (SCADA) system. Other equipment, such as the flow recorder, do not function either. The District should develop a basic functioning SCADA and data logging system to allow for reliable remote monitoring of systems as well as alarm notifications and simple remote operation of some systems.

Figure 18. The Main Pump Station Control Panel

3.3.3 Aerated Lagoons

Wastewater is pumped from the wet well to two aerated lagoons with plastic liners as shown in Figure 19. These lagoons were built as part of the 1995 upgrades. The lagoons allow settling of heavy solids and the aeration promotes biological oxidation of the wastewater. The aquatic vegetation in the lagoons is managed to keep open water in the lagoons. This allows sun light to penetrate the water and promote the growth of algae which releases oxygen into the water to promote biological activity. The amount of oxygen available from algae production varies throughout the year and over the day. There tends to be diminished oxygen production when sunlight is not present, as the algae is not biologically active. One aerator is located in the center of each basin (cell) and typically operated during night time hours to boost oxygen levels.

Figure 19. One of Two Aerated Lagoons

The overall design parameters for the aerated lagoons, based on the 1995 plans, are presented below:

Number of Cells: 2
Depth: 10 feet
Minimum Surface Area (Each): 12,000 ft^2
Total Volume (includes estimated 5 years sludge): 645,000 gallons
Detention Time: @ 0.104 mgd: 12.7 days
@ 0.140 mgd: 9.4 days
Aerators (one per cell), continuous operation: 5 Horsepower (each)

The District collects influent grab samples monthly for Five-day Biological Oxygen Demand (BOD5) and Total Suspended Solids (TSS), then sends samples to North Coast Labs for analysis. The results were analyzed for 2013 through 2018 and a summary is presented in Table 4 and Table 5.

Table 4. Aerated Lagoon Design and Measured Concentrations of BOD5 and TSS.

Parameter	Design BOD5	2013-2018 BOD5	Design TSS	2013-2018 TSS
Average (mg/l)	140	73	75	104
lb/day @ 0.104 MGD	121		65.1	
lb/day @ 0.140 MGD	163		87.6	

Table 5. Average Concentrations and Removal Rates of Aerated Lagoons.

Parameter	2013-2018 BOD5	2013-2018 TSS
Effluent Concertation Average (mg/l)	35	45
Removal Rate Average	53%	43%

Aeration lagoon influent concentrations average approximately 50% of the expected design average BOD5 concentrations and 140% of design average TSS. BOD5 removal averages 53% and TSS removal averages 43%.

The depth of sludge accumulation in the aerated lagoons was measured in 2006. No documentation was provided at the time but District Staff recall the depth to be approximately 1-inch deep. Sludge depth in the aerated lagoons was measured again on October 9, 2018 and ranged from 0 to 18-inches deep in both aerated lagoons 1 and 2. Assuming an average depth of 9 inches of accumulated sludge, original design volume and current estimated volume are shown in Table 6.

Table 6. Sludge Accumulation in the Aerated Lagoons.

Parameter	1995 Design Volume (gal)	1995 Design Depth (ft)	2018 Estimated Volume (gal)	2018 Estimated Average Sludge Depth (in)	% of Design Volume Remaining
Lagoon 1	627,500	10	587,000	9	94%
Lagoon 2	658,000	10	616,000	9	94%

While TSS influent loading to the lagoons is higher than expected, based on the 1995 design plans, the volume of the lagoons has diminished by 6% in the 23 years since installation. The impermeable liner appears to be in good condition, as shown in Figure 20. The portion above the water line is exposed to UV. Such liners are manufactured with UV inhibitors to extend the life of the liner exposed to sunlight. The life of the liner could be extended further by installing a strip of additional liner material over the exposed portion around the perimeter of the lagoons. Additionally, removal of aerators for maintenance and replacement requires District staff to position a backhoe along the bank, exposing the liner to potential damage and potential entry of the backhoe into the lagoon.

The District staff are in the process of removing the hydrocotyle growing on the surface of the aerated lagoons as a part of their regular maintenance.

a. b.

Figure 20. The Aerated Lagoon Impermeable Liners (a. 2006, b. 2018).

3.3.4 Free Water Surface Wetlands

Effluent from the aerated lagoons is conveyed by gravity through three free water surface wetlands, shown in Figure 21. Flow is controlled by a flow distribution structure and may be conveyed in parallel or series. Typical operation is in parallel. The hydraulic gates in the control structure became very difficult to exercise due to the highly corrosive environment and is no longer adjustable. These should be replaced so the operators can readily change flow patterns if needed. Based on visual observations, the wetlands appear to be in good condition and the District should continue to monitor performance and continue with periodic vegetation maintenance.

Figure 21. One of three free water surface wetlands used to treat effluent conveyed from SAF lagoons.

The overall design parameters for the constructed wetlands, based on the 1995 plans, are listed below.

Number of Cells: 3
Minimum Surface Area (Each): 16,700 ft^2
Total Area: 50,700 ft^2 (1.16 acres)
Total Volume: 0.82 MG
Depth (Maximum): 6 feet
Depth (Average): 2 feet
Loading- Aeration Basin Effluent
BOD5 (mg/l): 50
TSS (mg/l): 50

Design detention time and loading rates are presented in Table 7

Table 7. Free Water Surface Wetlands Design Parameters.

Parameter	@ 0.104 MGD	@ 0.140 MGD
Hydraulic Detention Time (day)	7.9	5.8
Hydraulic Loading Rate (cm/day)	8.4	11.3
Surface Loading rate (lb. BOD_5/acre day)	37.4	50.3

Similar to the aerated lagoons, the District collects influent grab samples monthly for BOD5 and TSS, then sends samples to North Coast Labs for analysis. Average influent concentration and removal rates for BOD5 and TSS results were analyzed for 2013 through 2018 and a summary is presented in Table 8.

Table 8. Concentrations and Removal Rates of the Free Water Surface Wetlands.

Parameter	2013-2018 BOD5	2013-2018 TSS
Effluent Concentration Average (mg/l)	13	5
Removal Rate Average	59%	88%

The average concentration of BOD5 and TSS within the wetlands is reduced to below regulatory discharge levels of 50 mg/l for each parameter, with a removal rate average of 59% and 88% respectively. The TSS and BOD effluent values demonstrate that the District's overall treatment system is very effective, even though it is a relatively simple low technology approach to wastewater management.

3.3.5 Discharge Metering and Sampling

Effluent is metered and sampled after leaving the wetlands and before discharging to the rapid infiltration basins. Similar to the influent, flow entering the Effluent Metering Vault passes through a 2-inch fiberglass Parshall flume where flow is measured and recorded (Figure 22).

a. b.

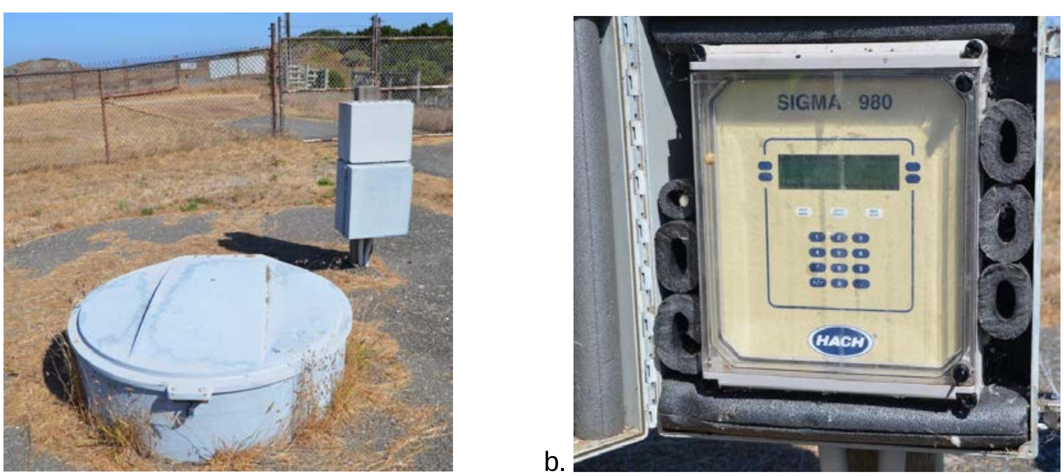


Figure 22. Discharge metering manhole (a.) and data recorder (b.).

The District collects effluent grab samples monthly for BOD5 and TSS, and weekly for pH, BOD5 and TSS samples are sent to North Coast Labs for analysis and the District measures and record pH. Average effluent concentrations for BOD5 and TSS results were analyzed for 2013 through 2018 and compared to regulatory requirements. A summary of the results is presented in Table 9.

Table 9. Discharge Permit Limitations and Sampled Effluent Values.

Constituent	Unit	Discharge Permit 30-Day Average*	2013-2018 Monthly Average Values	Discharge Permit Daily Maximum	2013-2018 Daily Maximum Values
BOD (20°, 5-day)	mg/l	50	17	80	55
Suspended Solids	mg/l	50	6	80	19
Settleable Solids	mg/l	0.1	0.01	0.2	0.4**
Hydrogen Ion	pH	Not less than 6.5 nor greater than 8.5	6.9	Not less than 6.5 nor greater than 8.5	8.4

*The arithmetic mean of the values for effluent samples collected in a period of 30 consecutive days.

**Occurred October 14, 2016. Settleable solids are typically 0.0 mg/l.

The TSS and BOD effluent values demonstrate that the District's overall treatment system is effective and consistently meets permit limitation, even though it is a relatively simple low technology approach to wastewater management.

3.3.6 Rapid Infiltration Basins

Effluent is ultimately discharged to one of four rapid infiltration basins shown in Figure 23. Flow to the Rapid Infiltration Basins is rotated monthly.

Figure 23. Rapid Infiltration Basins.

The Rapid Infiltration Basins were constructed based on the following 1995 design parameters:

Number of Cells: 4
Alternating Operation
Minimum Bottom Surface Area (each): 13,500 square feet
Total Bottom Surface Area: 55,000 square feet
Saturated Soil Permeability: 0.0014 centimeters/sec
Minimum Measured Infiltration Rate: 47.6 inches/day
Required Infiltration rate (inches/day): 3.03 @ 0.104 MGD
4.08 @ 0.140 MGD

The District conducts maintenance on the vegetation as needed and has not noted any deficiencies in the performance of the Rapid Infiltration Basins to infiltrate effluent flows.

3.3.7 Treatment Facility Security Fencing

Security fencing located around the perimeter of the treatment facility influent handling structures, aeration basins, wetlands, and rapid infiltration basins protect the facilities. A public access path and Humboldt Bay Municipal Water District distribution line from Lupin Drive to the Manila Dunes Recreation Area separate the rapid infiltration basin area from the aeration basins and wetlands. The original metal fencing is significantly corroded and degraded, as shown in Figure 24. The coated wire fencing and posts exhibit extensive corrosion and has led to failure of structure supports and the fencing. The District is currently repairing the most severe failures, although the entire fence should be replaced.

Figure 24. Security Fencing Surrounding the Treatment Facility.

3.3.8 Ground Water Monitoring Wells

Groundwater is monitored from a well to the west and downhill from the treatment facilities, as shown in Figure 25. Monitoring is conducted twice a year, in February and August, for total coliform, fecal coliform, total nitrogen, and nitrate nitrogen.

Figure 25. Groundwater Monitoring Well

Groundwater monitoring grab samples are sent to North Coast Labs for analysis. Results from 2013 to 2017 were analyzed and are presented below in Table 10.

Table 10. Grab Sample Results at Groundwater Monitoring Well.

Year/Season	Total Coliform MPN/100 ml	Fecal Coliform MPN/100 ml	Total Nitrogen mg/L	Nitrate mg/L
2013 Feb.	17	<1.8	ND	ND
2013 Aug.	<1.8	<1.8	ND	ND
2014 Feb.	<1.8	<1.8	ND	ND
2014 Aug.	<1.8	<1.8	ND	ND
2015 Feb.	350	2	ND	ND
2015 Aug.	2.1	<1.8	1.2	ND
2016 Feb.	21	2	1.1	ND
2016 Aug.	1.8	<1.8	ND	ND
2017 Feb.	11	<1.8	ND	ND
2017 Aug.	4	<1.8	ND	ND

Sampling results are typically Non Detect (ND) for all parameters, but occasionally some parameters are detected. The occurrence of the coliform in February, 2015 at 350 MPN/100ml appears unusual and may be due to some type of error or a localized effect.

3.4 Financial Status of Existing Facilities

The District has been able to conduct operations, maintain, and develop capital facilities and systems without the need to incur debt for wastewater facilities. The District currently collects fees from users based on living unit equivalent (LUE). A detailed sewer rate study was completed in March 2017 to establish the current rate structure.

3.4.1.1 Budget for Sewer System Expenditures

Based on the trends observed over the previous years of financial expenditures and review of the capital projects annual funding, the projected financial expenditures were estimated and are presented in (Table 11). The estimated five-year financial expenditures were estimated as follows:

- Payroll & Benefits- current salaries with adjustments averaging 2% per year and health insurance for three full time employees
- Administration- average expense from previous 2 years as the District has been able to reduce costs and will maintain similar practices
- Operations, Maintenance and Repairs- average expense from previous 4 years
- Professional Fees- average expense from previous 4 years
- Utilities- average 7% annual increase continued previous 4 year trend
- Capital Projects- average 5 year cost

Table 11. Projected Sewer Expenditures

Item	2017/2018*	2018/2019	2019/2020	2020/2021	2021/2022
Payroll & Benefits	$95,082	$107,098	$109,390	$111,732	$114,126
Administration	$8,791	$17,500	$17,500	$17,500	$17,500
O&M and Repairs	$18,573	$16,800	$16,800	$16,800	$16,800
Professional Fees	$6,912	$6,500	$6,500	$6,500	$6,500
Utilities	$24,628	$24,053	$25,737	$27,539	$29,466
Capital Projects	$15,800	$15,800	$15,800	$15,800	$15,800
Estimated Annual Operating Budget	**$169,786**	**$187,751**	**$191,727**	**$195,871**	**$200,193**

*Actual FY 2018 expenditures

3.4.1.2 Projected Debt

No additional loans are anticipated, as the District has identified and is collecting funds for improvements to the sewer system. However, if costs are greater than expected or loans are needed, sewer rates will need to be adjusted again to collect funds for sewer system projects.

3.4.1.3 Number of Active Connections

Historical sewer billing data was used to determine the projected number of active connections. To reduce the potential for over estimating active sewer connections, and thus underestimating revenue, connections were removed from the data set based on the consistency of connection (active connection) and trends in water use. An anticipated 337 active connections with a total of 378 LUEs were used to develop sewer rates in the 2017 study. Based on historical trends in the District's population and active connections, these connections and LUEs represent a slightly conservative estimate for use in projecting future sewer service revenue.

3.4.1.4 Sewer Rates

The rate structure is based on the annual budget, presented above, with increases each year to meet projected budgets and is shown in Table 12.

Table 12. Proposed Sewer Rates

Proposed Sewer Rates	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022
Monthly Rate per LUE	$40.55	$41.39	$42.27	$43.18	$44.13
Annual Increase for Median Water User (1 LUE, 600 CF/Month)	$2.22	$0.84	$0.88	$0.91	$0.95
Estimated Annual Revenue (378 LUEs)	**$183,935**	**$187,751**	**$191,727**	**$195,871**	**$200,193**

3.5 Water/Energy/Waste Audits

Water, energy or waste audits were not conducted beyond the basic assessment of wastewater flows and District energy use shown in Section 3.3.2. An estimate of projected energy costs is provided in the project budget above.

4. Need for Project

The District has made effective use of the existing wastewater infrastructure over the last 40 years. Ongoing monitoring demonstrates the overall effectiveness of the system. Strategic improvements are needed to address the current inefficiencies, deficiencies and vulnerabilities of the existing system facilities to continue the effective conveyance, treatment and disposal of wastewater through the coming decades. A summary of health, sanitation and security, aging infrastructure, and growth estimates are presented in the following sections followed by a summary of recommended improvements.

4.1 Health, Sanitation, and Security

While the District is regularly in compliance with discharge requirements, strategic system improvements can be implemented to improve operations and develop a more robust system to help the District maintain a system to promote health, sanitation, and security, a number of improvements are recommended.

The last major system upgrade was more than 20 years ago and much of the mechanical equipment has reached the end of its useful life. The facilities are also located very close to the coast and the harsh marine environment has led to the corrosion of exposed fencing and other metals. The age of the infrastructure under the local conditions has resulted in the need for a series of recommended upgrades as summarized in Section 4.3. The upgrades are intended to address system deficiencies and operational challenges as well as extend the operational life of the facilities and reduce District maintenance issues.

4.2 Reasonable Growth

As discussed in Section 2.8, growth at approximately 0.5% per year is forecasted for planning purposes resulting in a total growth of approximately 10% over the 20 year planning horizon. As shown in Table 3, the Average Day design flow of the plant is 0.104 mgd, while the measured Average Day flow from 2015-2017 was reported at 0.067 mgd, which is 64% of the design value. If actual Average Day flow increased 10% corresponding with the forecasted population, then the result would be 0.074 mgd. This forecast increase in Average Day flow is well within the existing design capacity. However, I/I is an issue that should be addressed as previously discussed and I/I improvements are included in the overall recommendations.

4.3 Summary of Recommended Improvements

Based on the analysis in this report, a series of improvements are recommended for the Septic Systems, Conveyance System, and Treatment and Disposal System as summarized below.

4.3.1 Septic Systems

The existing septic systems throughout the District need a variety of improvements to reduce I/I, provide remote monitoring of septic tank levels and pumping, and to improve septic tank cleaning and maintenance. These issues, their impacts, and proposed improvements are summarized in Table 13.

Table 13. Issues and Improvements Associated With Septic Systems

Issue	Impact	Improvements
• Low elevation of risers causing potential infiltration of surface water into septic tanks • Poor seals between septic tanks, risers and lids causing infiltration of groundwater into septic tanks	• Increased pumping costs • Potential overflow of tanks	• Installation of new risers to increase elevation of tank rim • Reseal risers to tanks
• Some of the original pumps have not yet been replaced and have reached the end of their useful lives.	• Potential for pump clogging or failure resulting in potential overflow conditions.	• Replace all older pumps.
• No SCADA communication of pump failures or high level alarms to District office. Currently rely on homeowners calling the District.	• Potential for problems to not be communicated to the District resulting in potential tank overflow.	• Integrate each septic tank control panel into a District SCADA system.
• The District's ability to respond to emergencies by pumping and trucking septage is limited by the existing resources. If there is the need for multiple truckloads in a short time, the District's existing septic tank at the office is not designed to receive septage from a truck.	• District must slowly discharge septage into the tank at the office through a fine screen at a rate that does not overwhelm the existing pumps.	• Install a septage holding tank and a simple screening system to allow for fast unloading of septage that can then be taken to a treatment facility at a later time. See Section 5.
• There are very few local options for disposal of septage and very limited District staff and equipment available to pump septic tanks, address maintenance needs, and respond to emergency conditions.	• The time between tank pumping by the District has been increasing due to staff and equipment limitations and few disposal options.	• Develop an overall septage management strategy considering the potential to contract out regular hauling and District staff focus on management, maintenance, and emergency response. See Section 5.
• Garbage in septic tanks	• Clogged pumps and Increased cost of septage disposal	• Develop informational brochure to educate residents about the STEP system and their impacts.

4.3.2 Conveyance System

The existing conveyance system is relatively simple and generally operates well, although the ARV's should be replaced throughout the system, and the operations staff should have the ability to bypass the existing pumping station and discharge directly to the lagoons. The conveyance system issues, their impacts, and recommended improvements are summarized in Table 14.

Table 14. Issues and Improvements Associated With the Conveyance System

Issue	Impact	Improvements
• The current system does not have the ability to bypass the existing grit pumping facility and convey flow directly to the treatment lagoons.	• In the event of an electrical or mechanical failure at the pumping facility (Figure 7), septic tank pumps continue to operate, which could result in wet well overflow.	• Install bypass piping and valves at the pumping facility and replace any septic tank pumps that do not produce the hydraulic head necessary to pump directly to the treatment lagoons.
• The conveyance system has a series of air relief valves that have been in service for decades and have corroded and failed.	• Failed air relief valves can cause air to accumulate and in piping and cause an air lock blocking the flow. The District must manually purge air when air accumulates.	• Replace all air relief valves throughout the system.

4.3.3 Treatment System

The existing treatment system consists of the main pump station, aerated lagoons, treatment wetlands, and infiltration basins. These components have been in service for many years and are in need of targeted upgrades and maintenance as summarized in Table 15.

Table 15. Issues and Improvements Associated With the Treatment System

Issue	Impact	Improvements
• No SCADA communication directly to District Staff. Currently rely on a third party alarm company to notify staff. No way to check status remotely.	• Potential for problems to not be communicated to the District resulting in potential overflow.	• SCADA system with notification and status direct to District Staff
• Channel grinder removed from service	• None. District staff found that very few bulk solids are conveyed from the septic tanks and the grinder was simply an operational and maintenance problem.	• None. Recommend not replacing grinder.
• Odor control system is not functional	• None. Odors not currently a problem given the removal of the grinder and the discharge elbow installed in the wet well.	• None now. If odors are an issue in the future, then additional odor control can be considered at the time.

Issue	Impact	Improvements
• Dry well pumps are at the end of their useful life and the drywell configuration presents maintenance problems and potential flooding risk.	• Access for maintenance is difficult and extends the time needed for equipment replacement. Mechanical failure could lead to backflow and dry well flooding.	• The pumping system should be upgraded with either a new dry well system or convert to a submersible wet well system. See Section 5.
• No check valve between the dry well pumps and aeration lagoons.	• Potential flooding of dry well	• Incorporate an air gap at effluent pipe to aeration lagoons.
• The existing generator is over 20 years old and is subject to the corrosive environment and does not meet modern air quality standards.	• The generator is a greater polluter than modern generators. Ongoing corrosion and wear of the generator could lead to failure.	• Replace the generator with a modern unit integrated into the electrical and control systems.
• Pond liners exposed to sunlight above the waterline.	• Long term exposure to UV radiation degrades the liner and can lead to failure.	• Install a protective strip of lining material to exposed areas along the shoreline.
• A number of hydraulic control structures are corroded and inoperable.	• The District cannot readily change hydraulic operations.	• Replace mechanical components of hydraulic control structures and apply epoxy/protective coating on existing concrete.
• Removal of aerators for maintenance is difficult and requires positioning of backhoe along shore of lagoons	• Potential for liner damage and entry of backhoe into lagoons.	• Winch and floating platform for aerator removal and placement on vehicle
• Site fencing is severely corroded.	• Compromises site controls and security.	• Replace all site fencing.

5. Alternatives Considered

As discussed in the previous sections, the District is planning to upgrade select components of the septic, conveyance, and wastewater treatment systems. Applicable alternatives to the recommended improvements, as introduced in Section 4, are discussed further herein. The alternatives discussion focuses on the following:

- Consolidation with Neighboring Wastewater Treatment Districts
- Alternative Approaches to Ownership and Management
- Septage Management Alternatives
- Pumping System Upgrade Alternatives
- Septage Screening Alternatives

These alternatives are reviewed in the following sections and a recommended approach is identified.

5.1 Consolidation with Neighboring Wastewater Treatment Districts

The original Septic Tank Effluent Pump (STEP) system was installed in 1978. At the time, a regional treatment system and ocean discharge was being planned to serve numerous communities including Manila. The regional concept never came to fruition and so Manila implemented additional improvements including mechanical system upgrades, treatment wetlands, and rapid infiltration basins to improve treatment and discharge facilities. Solids treatment was not included in the District's waste discharge permit, therefore off-site disposal at a separately owned and operated facility that is permitted to accept septage is required. Currently, the only local treatment facility accepting septage is Ferndale Wastewater Treatment Plant. Local septic tank pumping services include Steve's Septic and Roto-Rooter.

Located on the Samoa Peninsula, the District is geographically isolated from either of the nearest wastewater treatment plants (City of Arcata and City of Eureka). The City of Arcata is located four miles to the north east, separated by the Mad River Slough, coastal lands, and agricultural lands. Consolidation with the City of Arcata would require additional centralized pumping facilities as well as upgraded conveyance mains. The City of Eureka is located three and a half miles to the south, separated by the Humboldt Bay. Consolidation with the City of Eureka would require a conveyance main traversing Humboldt Bay. Consolidation or development of an intertie to convey septic tank effluent are not practicable alternatives, nor would they provide any significant benefit because the Manila treatment and disposal facility is in relatively good condition and meets regulatory requirements.

The town of Samoa is located approximately three miles south of Manila on the Samoa Peninsula and is currently served by individual household septic tanks and leach fields. The newly formed Samoa Community Services District is currently working on the permitting and design of a new community wastewater treatment plant. Consolidating with the future Samoa plant does not appear to provide any practical benefits given the adequate capacity and performance of the existing Manila system. However, opportunities may exist to develop the Samoa plant to not only serve the wastewater needs of their local community, but also to take septage from the many septic systems throughout the peninsula. This could benefit Manila by providing a nearby reliable septage disposal option if the new Samoa plant were developed with septage capabilities.

Due to the geographic and infrastructure limitations, the alternative to consolidate with neighboring wastewater management districts will not be considered further. However, it is recommended that future options for septage management at the future Samoa wastewater facility be considered.

5.2 Alternative Approaches to Ownership and Management

Much like the concept of consolidation, changes in the ownership or management of the system will not address the underlying resilience issues facing The District and are not included in the alternatives analysis.

5.3 Septage Management Alternatives

The District relies on septic tanks for individual homes or clusters of homes to provide solids settling and a degree of treatment. Septic tanks require regular inspection, maintenance, and pumping of solids. The solids must be trucked to a facility that can provide further treatment and ultimate disposal. The pumping cycle of septic tanks varies based on the user characteristics, but an average cycle of pumping about every four years is a reasonable septage management goal.

Historically, District Staff performed the inspection, maintenance, and pumping duties. District staff also transported septage to a treatment and disposal location including Steve's Septic in McKinleyville, to the McKinleyville Community Services District Wastewater Treatment Plant, to the City of Arcata's Wastewater Treatment Plant, or to the City of Eureka's Wastewater Treatment Plant. Only Steve's septic continues to take septage as the other facilities have generally discontinued acceptance of septage from outside entities. Based on discussions with local wastewater agencies, only Steve's Septic and the Ferndale Wastewater Treatment Plant were found to currently accept septage. Steve's Septic provides both pumping and treatment/disposal as a service, while Ferndale will accept septage from a variety of pumpers.

Increased demands on District staff as infrastructure ages and limitations and reliability of the District's aging pumper truck have not allowed existing District staff to keep up with all the septic management requirements so pumping frequency has decreased. District staff are focused on preventative maintenance and addressing critical Issues as they arise. The District could benefit from the development of a more structured septage management plan to formalize the inspection and maintenance protocol, septic tank pumping schedules, treatment and disposal services and locations, and routine maintenance requirements. As part of the evaluation of the District's wastewater infrastructure it became clear that septage management is a key element of the system and that there are a number of alternatives the District could consider. The preferred approach should be incorporated into a septage management plan.

The following alternatives were considered for septage management:

- Alternative 1: District Pumps and Transports Septage for Treatment and Disposal
- Alternative 2: District Contracts for Pumping, Transport, Treatment, and Disposal

Although it may be technically possible for the District to develop their own septage treatment and disposal system, the Regional Board permit does not currently allow it and it would require significant capital infrastructure and would represent a major shift in District operations. There is the significant potential for odor issues as well. Therefore, this option is not considered further. The status quo option is also not considered further as it does not adequately address the long term needs for septage management in the District.

The following assumptions are used in the analysis of Alternatives 1 and 2:

- District staff completes tank inspection, pumping preparations and repairs
- Maintenance frequency per septic tank is assumed to be every four (4) years (The District owns and operates 300 tanks resulting in 75 tanks per year requiring pumping)
- Tank size is on average 1,000 gallons (existing tanks are 750, 1,000 or 1,250 gallons)

5.3.1 Alternative 1: District Pumps and Transports Septage for Treatment and Disposal at Ferndale

For the purposes of this analysis, it is assumed that the future Samoa facility is not available for septage and that the District hauls septage a 40 mile round trip to the Ferndale Wastewater Treatment Plant. The City of Ferndale was contacted and treatment plant staff stated that they have capacity to receive up to approximately 12,500 gallons of septage from Manila per month. Given the assumed pumping schedule, this would take about six months of the year. This is consistent with the District's desire to pump during the drier months when groundwater is low to avoid the potential for septic tanks floating after being pumped.

At the Ferndale facility, the received septage is gravity drained into a retention pond and then processed. Ferndale charges $0.18/gallon of septage. A pH reading is due at the time of receipt, and a waste hauler permit must be signed by the District agreeing to Ferndale's terms.

For the District to reliably haul this distance and on the required schedule, the District should replace their aging 2,000 gallon pumper truck. The quoted cost of a new 2,000 gallon pumper truck is approximately $100,000, with a financing plan including annual payments of $15,000 for 10 years. Due to the limited District Staff (one operator), it is assumed that the District would need to hire one part-time employee for septage pumping and disposal. Annual costs, including amortized cost of a new truck, associated with the District transporting septage to Ferndale on a regular basis are shown in Table 16 below.

Table 16: Annual Costs Associated with Alternative 1

Item	Annual Cost District Pumps and Transports Septage For Treatment and Disposal at Ferndale
Staff Time[1]	$7,130
Pumper Truck Capital[2]	$15,000
Fuel[3]	$1,125
Maintenance/Repair/Insurance[4]	$9,600
Septage Disposal[5]	$13,500
Total Annual Cost	**$46,355**

[1] Operator hourly rate of $23.46/hr (includes taxes and benefits), 8 hour round trip, 38 trips/year

[2] Based on $15,000 per year for ten years

[3] 1,500 miles/year, 5 miles/gallon, $3.75/gal

[4] Annual O&M budget for septic service trucks (Steve's Septic, 2018)

[5] $0.18/gallon for 75,000 gallons

5.3.2 Alternative 2: District Contracts for Pumping, Transport, Treatment and Disposal at Ferndale

Septic tank pumping services for the Manila community are currently limited to Steve's Septic Service and Roto-Rooter based on telephone outreach. One other company, Wycoff's Plumbing may be able to provide pumping services, but they indicated they don't typically serve the Manila area. Both active companies provide septic pumping and hauling services. Both companies transport and dispose of septage at the Ferndale WWTP. Steve's Septic can also provide septage treatment at their McKinleyville site, with residual solids hauled to the Anderson Landfill.

The current commercial rate for regular pumping and disposal of septage has been quoted at $0.38 per gallon. Based on the anticipated annual septage quantity for Manila as used under Alternative 1, the total annual cost for Alternative 2 based on contracting for both the pumping and disposal is summarized in Table 17 below.

Table 17: Annual Costs Associated with Alternative 2

Item	Annual Cost District Contracts for Pumping, Transport, Treatment and Disposal at Ferndale
Pumping, Transport, and Disposal[1]	$28,500
Total Annual Cost	**$28,500**

[1] $0.38/gallon for 75,000 gallons

5.3.3 Alternatives Comparison

The annual costs summarized in Tables 17 and 18 for the two septage management alternatives suggest that it is more cost effective for the District to hire a contractor to pump and haul septage to Ferndale, than it is for the District to do the pumping and hauling themselves. The major cost difference is in staff time and a new truck needed for the District to do their own pumping and hauling.

The costs presented in Table 17 are annual and the truck is forecast to have a capital cost of $15,000 per year for ten years including financing. However, at the end of ten years, the truck is expected to have remaining salvage value. To compare the two alternatives and consider this remaining value after ten years, a net present value analysis was completed which is summarized in Table 18 below.

Table 18: present Value Cost Comparison of Septage Management Alternatives

Item	Annual Cost	Salvage Value	Present Value [1]
Alternative 1 – Annual Cost From Table 17	$46,355		$375,980
Alternative 1 – Salvage Value After 10 Years		$50,000[2]	$33,778
Alternative 1 – Net Present Value			**$342,202**
Alternative 2 – Annual Cost From Table 18	$28,500	n/a	$231,160
Alternative 1 – Net Present Value			**$231,160**

[1] Discount Rate Assumed to be 4% per year. Analysis Period Assumed to be 10 years.

[2] Salvage Value of Truck Assumed to be $50,000 after 10 years.

The net present value of Alternative 1 is based on the present value of the annual costs summarized in Table 17 minus the present value of the future salvage value of the truck assumed to be $50,000 after ten years. The net present value of Alternative 1 is approximately $340,000. The net present value of Alternative 2 is based on the present value of the annual costs summarized in Table 18 and there is no salvage value since Alternative 2 is simply based on a contractor providing all pumping, hauling, and disposal services. The net present value of Alternative 2 is approximately

$230,000, which is significantly less than the cost of Alternative 1. The new truck required for the District under Alternative 1 is expensive and is not being utilized year round, as it would with a commercial operator.

Therefore it is recommended the District focus on their primary operations, maintenance, and management expertise and contract for the pumping, hauling, and disposal of septage. This could be accomplished through the preparation of a scope of services and a competitive bid package for septage pumping and hauling services.

5.4 Pumping System Upgrade Alternatives

As previously discussed, the existing pump station was originally constructed with a large underground wet well below the block building on top. This wet well was retrofitted with the 1995 project to be a dry well, and a new 72" diameter fiberglass wet well was installed outside of the building. The retrofitted underground dry well now houses the pumps, valves, piping, mechanical equipment, controls, and electrical systems. The pumps and equipment in the underground dry well beneath the building pose difficulties in getting equipment down the stairs into the dry well. The dry well would be subject to flooding if there is a mechanical breach in the piping or failure of a check valve or isolation valve during maintenance. In addition, the underground area is humid and is subject to rainwater leaks leading to corrosion of electrical and control equipment.

Given the condition and age of the existing pumps, piping, mechanical, and electrical equipment that has been in place for more than 20 years, replacement and upgrade of pumps in the near term is recommended. Pumps may be replaced essentially in kind in the existing dry well beneath the building, or modern rail mounted submersible pumps could be installed into the existing 72" fiberglass wet well outside of the building, eliminating all the drywell pumps, piping, and mechanical equipment. Pumps could be easily removed from the wet well for maintenance with a winch. This is how many similar pump stations have been retrofitted due to maintenance problems in dry well systems and advancements in submersible pump and rail mounting technology. This would significantly simplify operations and maintenance and eliminate risks of dry well flooding and mechanical equipment corrosion.

A comparison of the two alternatives is presented in Table 19 below.

Table 19: Comparison of Dry Well and Wet Well Pump Configuration Alternatives

Characteristic	Dry Well Configuration	Wet Well Configuration
Pump Location	Installed in Dry Well	Installed on Rails in Wet Well
Pump Cooling	Air Cooled. Subject to Potential Overheating	Submerged. Cooled by Water Flowing in Wet Well
Piping and Valve Location	Installed in Dry Well. Access via Stairs	Installed in Vault in Yard Adjacent to Wet Well
Access to Pumps	Via Stairs. Remove with Winch at Stairwell.	Rail Mounted. Remove with Winch.
Drywell Flood Hazard	Yes	No
Dry Well Electrical and Controls Corrosion Hazard	Yes	No

5.4.1 Alternatives Summary

As summarized in the table above, the wet well configuration has a series of advantages over the dry well configuration, especially in terms of ease of operation and maintenance. In terms of capital cost, the two alternatives are similar insofar as both alternatives warrant new pumps, piping, valves, mechanical and electrical systems, although the configuration varies between the two. The power costs are similar between the two alternatives, given similar pump efficiency. The maintenance costs of a new submersible pump system is expected to be less than the dry well system. Reduced maintenance cost is one of the main reasons for the industry change in pump station configurations for similar sized pump stations from dry well to wet well systems over the last several decades. Actual maintenance costs will depend on system operational characteristics and equipment performance. Submersible pumps have a long reputation for reliable service and in many ways perform better than dry well pumps. The main cost savings comes into play if there is an issue that warrants pump removal. Submersible pumps can readily be removed by simply hoisting on a winch to lift the pumps from the wet well. They can then be serviced at the site or simply winched into a truck. A replacement pump can be quickly slid back down the guide rails into place and back in service by simply reconnecting the electrical cable. With dry well pumps, on the other hand, the piping and pumps would need to be unbolted and removed and the electrical connections would need to be disconnected. If the pump could not be serviced in place, it would need to be hauled to the winch located at the stairwell from the dry well and a replacement pump hauled back down.

From an overall reliability and ease of operations standpoint, it is recommended that the existing 72" diameter fiberglass wet well be retrofitted with submersible rail mounted pumps and that valves and piping be installed in an adjacent vault. The existing dry well pumps, piping, and equipment can then be removed from the dry well.

5.5 Emergency Septage Screening and Storage Alternatives

The District has periodically experienced emergency conditions where a septic pump fails and the tank backs up and needs to be pumped quickly to prevent overflow and to allow the District to make repairs. The District needs to respond quickly and there may not be time to pump and haul to Ferndale for disposal. Therefore, the District would benefit from a septage holding tank at the District's yard to allow for unloading of septage. Excess supernatant could be pumped into the treatment system and then solids could be pumped and taken to a treatment facility at a later time.

A typical septage truck can hold up to 2,000 gallons and the District may need storage capacity for more than one truck load. Therefore it is recommended the District install several 2,000 gallon septage holding tanks in series to provide emergency storage.

It is desirable from an operations standpoint to provide some type of screening of septage as it is discharged into the holding tank. A simple passive bar screen system is compared to a mechanical septage receiving station in the following sections.

5.5.1 Simple Passive Bar Screen System

A simple bar screen system, such as the ScreenCo Systems product MaxiScreen, as shown in Figure 26, is passive, similar to the existing crude screening process the District currently implements, but with added features to more efficiently separate, wash, and discard garbage. This system provides improved flow capacity to more quickly empty the truck contents and allows the operator to easily remove trash from the bar screen by washing and raking the contents aside for drying and disposal. This system's 3/8-inch gap bar screen can process an effluent flow of up to 500 gpm. Septage is discharged from the vacuum pumper truck to the MaxiScreen, shown in Figure 27, where garbage is captured on the bar screen and wastewater flows by gravity to the septic holding tank. Garbage is washed with a simple garden hose, left to dry, then raked away into an attached trash chute and into a trash receptacle. This type of system is easily moved if needed. Simple bar screen systems such as this were quoted at a capital cost of approximately $15,000 (ScreenCo Systems, 2018).

Figure 26: ScreenCo Systems' MaxiScreen Product

Figure 27: Septage being gravity fed into the ScreenCo Systems' MaxiScreen Product

5.5.2 Mechanical Septage Receiving Station

The second type of screening system considered was a mechanical septage receiving station. This type of system is often used at treatment plants receiving regular septage deliveries. Mechanical systems typically include a grit and rock trap, a grinder, a screening system, and a screenings washer compactor. An example system, Franklin Miller's Taskmaster TT Grinder, is shown in Figure 28. The screened septage would then be conveyed to the septic holding tank where it is pumped to the District's conveyance system. The complete system has an equipment capital cost of approximately $150,000 (Franklin Miller, 2018). This type of system requires site work, electrical, controls, and installation, which could be nearly the same as the equipment cost depending on the circumstances.

Figure 28: Example Grinder Product, Franklin Miller's Taskmaster TT (franklinmiller.com)

Figure 29: Example Washing, Compaction and Cleaning System, Franklin Miller's Spiralift SR (franklinmiller.com)

5.5.3 Alternatives Summary

Given the modest need the District has for emergency septage storage, a simple passive bar screen system appears to be most appropriate. A mechanical septage receiving station is typically employed at treatment plants with regular septage deliveries and could cost 10 to 20 times as much as a passive bar screen. Plus, a mechanical septage receiving station will have significant operations and maintenance costs. With a goal of providing simple screening for septage that is being temporarily stored for future pumping and off site treatment, the simple passive bar screen appears to be most appropriate for the District.

6. Overall Configuration and Characteristics of Preferred Alternative (Proposed Project)

This section summarizes the overall configuration and characteristics of the preferred project alternative along with conceptual capital and operations & maintenance costs the Proposed Project includes the following components:

Septic System

- Septage Management Plan including a competitive bid package for septage pumping and hauling services
- Selective installation of new risers to increase elevation of tank rim and reseal (30 total)
- Replace all pumps greater than 15 years old (125 total)
- Integrate each septic tank control panel into a District SCADA system
- Septage holding tank and a simple screening system
- Educational brochure for STEP system (developed as a part of this planning study)

Conveyance System

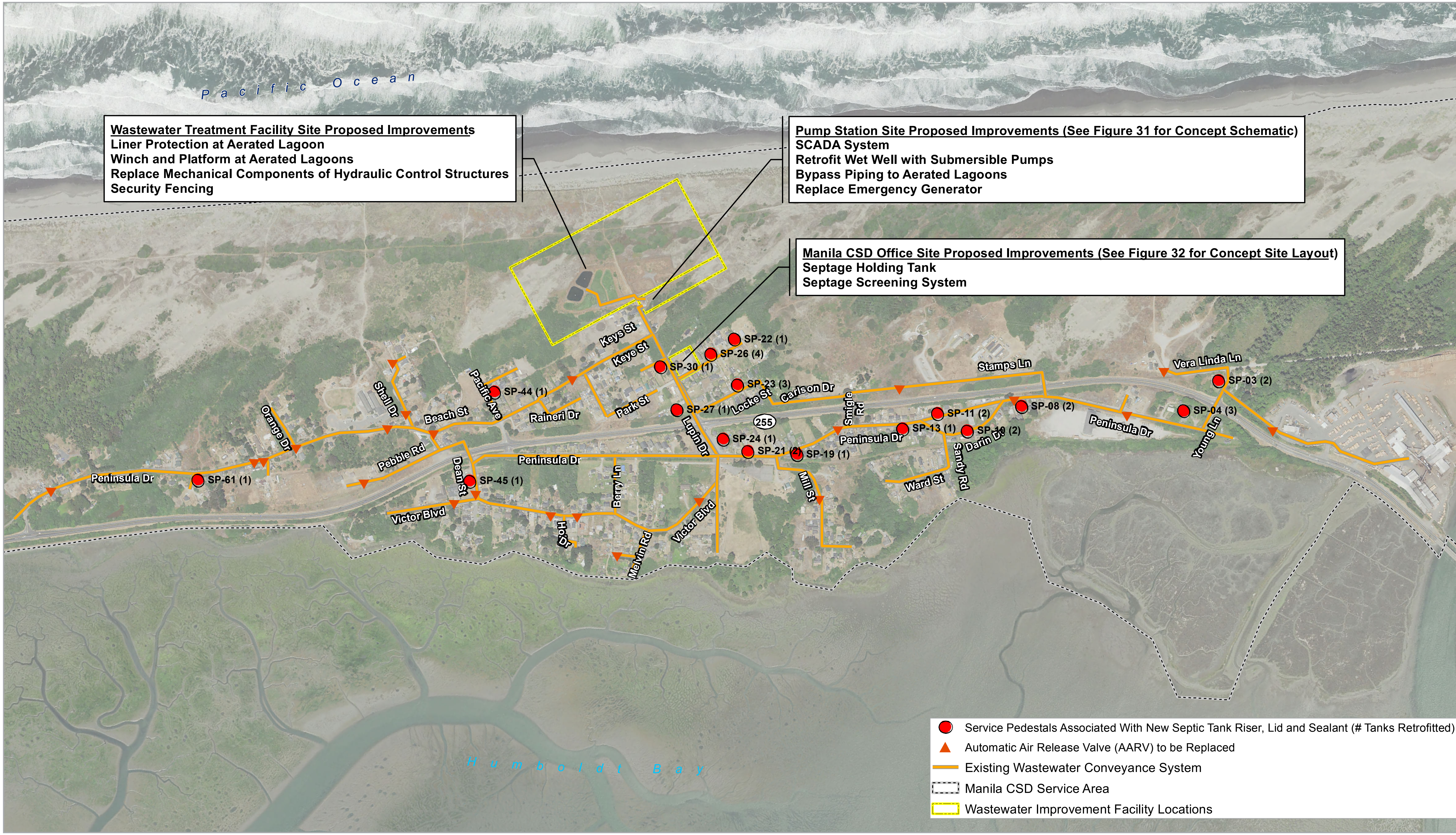
- Bypass piping from conveyance system to Aerated lagoons
- Replace all air relief valves throughout the system (23 total)

Treatment System

- SCADA system with notification and status direct to District Staff
- Air gap at aeration lagoon influent
- Retrofit of existing 72" diameter fiberglass wet well with submersible rail mounted pumps with valves and piping installed in an adjacent vault
- Removal of existing well pumps, piping, and equipment from the dry well
- Replace the generator with a modern unit integrated into the electrical and control systems
- Install a protective strip of lining material to exposed areas of pond liner along the shoreline
- Replace mechanical components of hydraulic control structures
- Winch and platform to remove aerators
- Replace all treatment plant site fencing

6.1 Map and Location of Proposed Improvements

See Figure 30 for an overview map of the wastewater system proposed improvements on the next page.



Note: Wastewater system map shows existing collection system piping, existing service pedestals associated with septic tank upgrades, and proposed system improvements. Improvements not shown include: SCADA systems and new septic tank pumps.

Functioning components such as gate valves and pressure taps are not shown. See 1978 and 1995 wastewater system plans for complete map of the existing waste watersystem facilities.

Paper Size ANSI B

0 250 500 750 1,000

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

Manila Community Services District
Wastewater Infrastructure Improvement Project
Clean Water State Revolving Fund

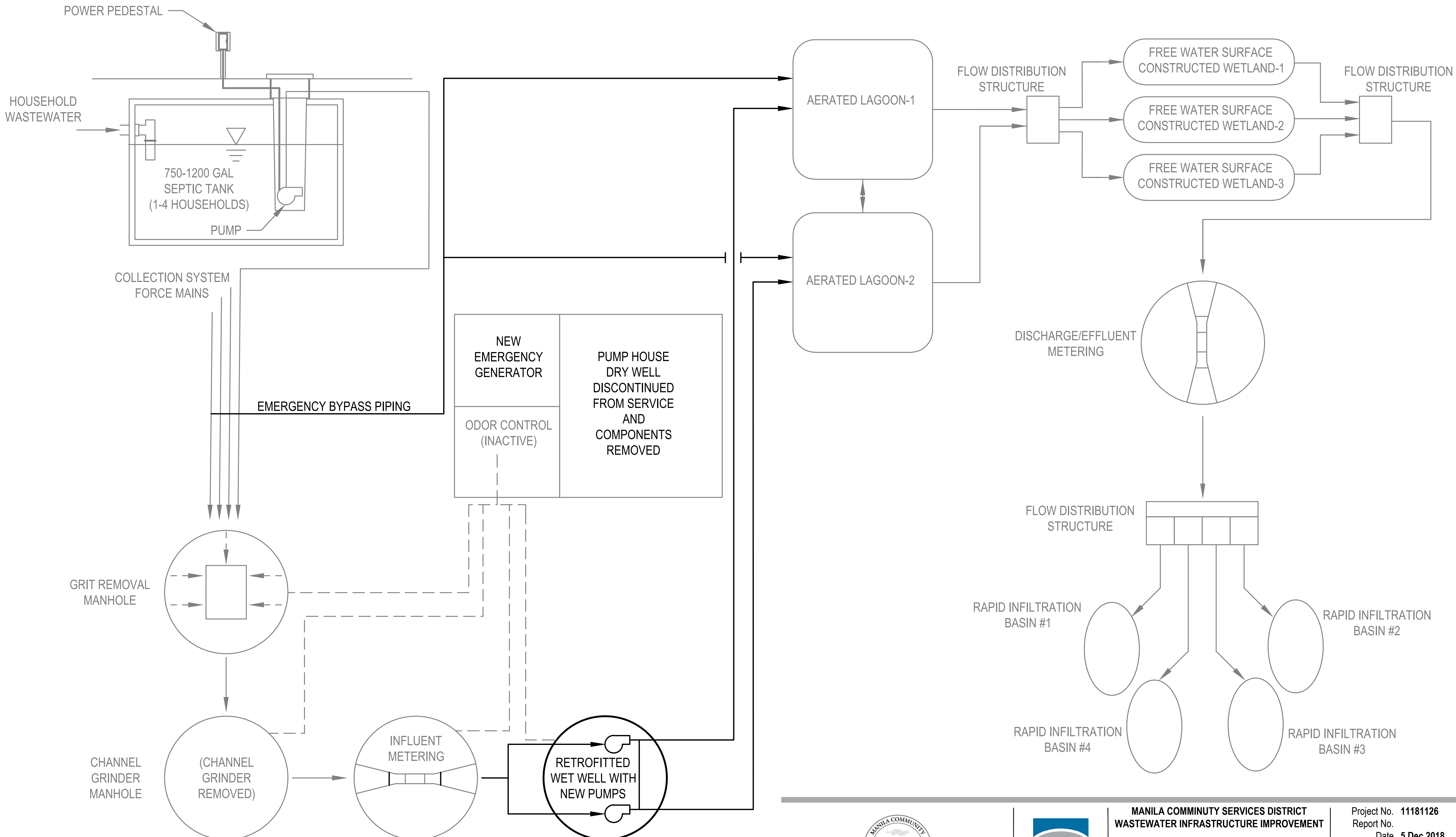
Existing Wastewater Facilities Overview

Project No. 11181126
Revision No. -
Date 12/14/2018

FIGURE 30

N:\US\Eureka\Projects\111\11181126 Manila CSD-Plan Design WW Infrastruct\08-GIS\Maps\Deliverables\Engineering Report\F32_Wastewater_System_Improvements.mxd
Print date: 14 Dec 2018 - 13:37

Data source: GHD, Service Pedestals, AARV, and Conveyance System, 2018 (based on Winzler & Kelly, As-Built Drawings, 1979). Humboldt County GIS, Parcel v61, 2018. GHD, Manila CSD Service Area, 2018 (based on Humboldt Local Agency Formation Commisison, Municipal Service Review, 2007) . Created by: bvivyan



MANILA COMMINUTY SERVICES DISTRICT
WASTEWATER INFRASTRUCTURE IMPROVEMENT

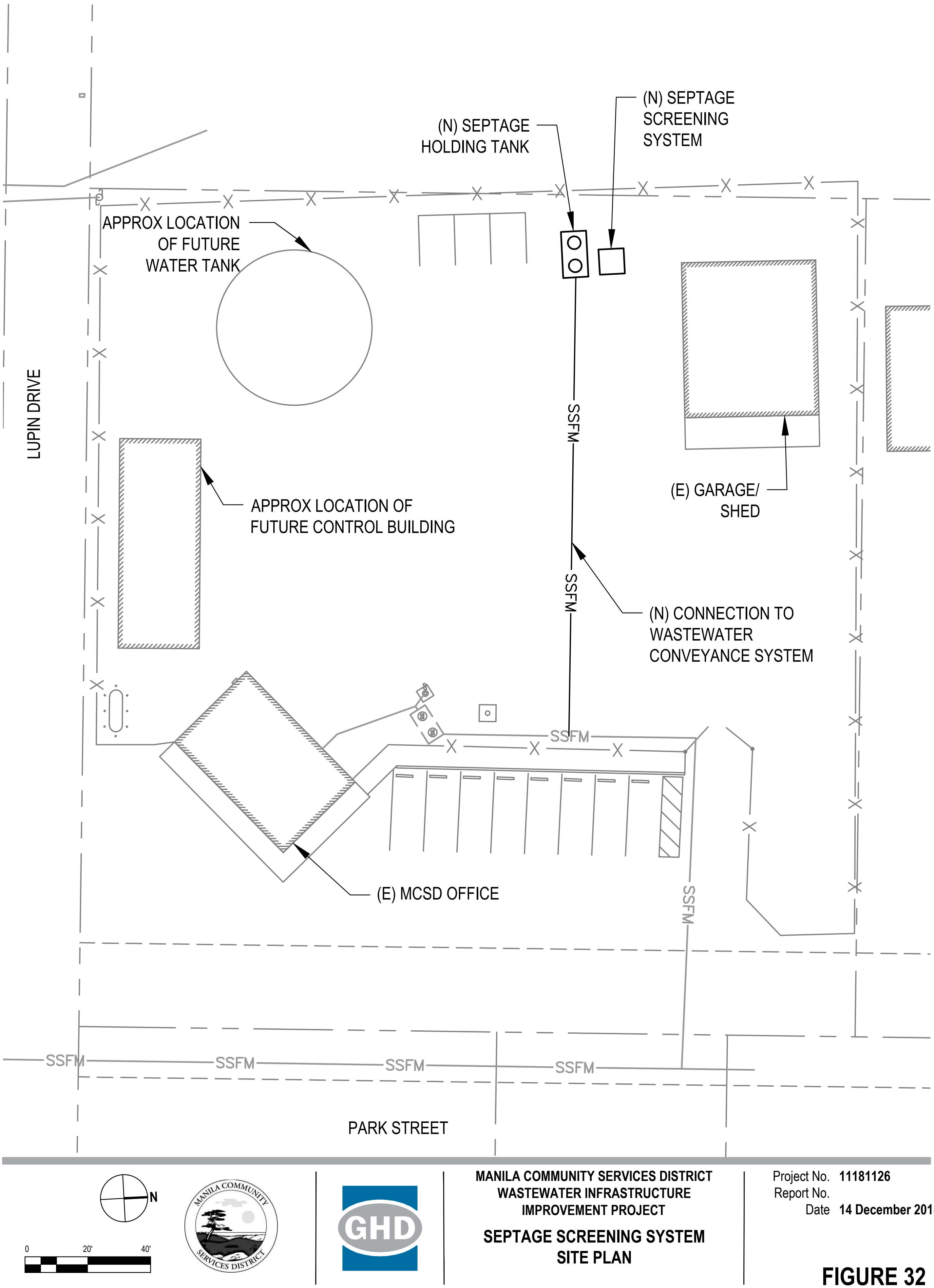
WASTEWATER SYSTEM BYPASS AND WET WELL RETROFIT SCHEMATIC

Project No. 11181126
Report No.
Date 5 Dec 2018

FIGURE 31

Filename: G:\111\11181126 Manila CSD-Plan Design WW Infrastruct\06-CAD\Figures\WetWell_Wastewater_Schematic_11x17.dwg
Plot Date: 5 December 2018 - 4:01 PM

Source:



MANILA COMMUNITY SERVICES DISTRICT
WASTEWATER INFRASTRUCTURE
IMPROVEMENT PROJECT

SEPTAGE SCREENING SYSTEM
SITE PLAN

Project No. **11181126**
Report No.
Date **14 December 2018**

FIGURE 32

Filename: G:\111\11181126 Manila CSD-Plan Design WW Infrastruct\06-CAD\Figures\Office Site Plan.dwg
Plot Date: 14 December 2018 - 2:22 PM

Source:

6.3 Land Requirements

No additional property will be needed for construction as proposed project components are located within The District property or within existing infrastructure on private property, for which the District has existing utility easements.

6.4 Potential Construction Challenges

The District's service area is surrounded by sensitive dune habitat. Therefore, the project will aim to perform all construction within previously disturbed areas and existing rights-of-way. A biological resources investigation and wetland delineation will be completed to identify sensitive habitats so that the project footprint and construction methods may minimize impacts to these habitats.

The area is also known to have cultural artifacts. Tribal Historic Preservation Officers for the Wiyot tribes will be consulted throughout the design process. A cultural resources investigation will be performed in advance to minimize cultural impacts. However, due to the unknown nature of buried materials the project may encounter artifacts during construction.

A California Environmental Quality Act (CEQA) Categorical Exemption will be completed for the proposed project. Federal requirements will be included in the biological resources investigation and cultural resources investigation. Federal Cross-Cutters will be completed in conformance with the water board's construction funding application.

6.5 Project Schedule

Implementing the preferred project will require completion of a number of additional steps as introduced above. The forecasted project schedule is summarized in Table 20 below.

Table 20: Anticipated Project Schedule

Project Phase	Anticipated Start	Anticipated Completion
Engineering Report and Confirm Approach	Ongoing	December 2018
Engineering Design	January 2019	April 2019
CEQA and Permit Applications	January 2019	February 2019
Water Board Review	May 2019	June 2019
Pursue Project Implementation Funding	April 2019	June 2019
Finalize Bid Package	November 2019	December 2019
Bidding	January 2020	February 2020
Construction	May 2020	September 2020
Startup, Testing, Project Closeout	September 2020	October 2020

6.6 Permit Requirements

The following sections identify the anticipated local, state and federal permitting associated with the proposed project.

The project will need to meet environmental permitting requirements, both Federal and State, as well as several other local and state project related permits.

6.6.1 Environmental Permitting Requirements

The potential for the project to cause environmental impacts were evaluated and are summarized below:

- **Waters of the State and U.S.:** Improvements at the project site would not disturb a stream, creek, floodplain, or other waterbody, and would not result in the temporary or permanent fill of Federal or State protected wetlands or waters. Minor excavation resulting in temporary disturbance of a wetland may occur as a part of septic tank lid and riser replacements.
- **Biological Resources:** No impacts to special status plants or animals are anticipated to occur at the project site due to a lack of potential habitat within roadways and previously disturbed areas.
- **Cultural Resources:** Improvements at the project site will avoid or minimize disturbance of designated historical structures or known archaeological resources.
- **Agricultural Resources:** Improvements at the project site would not result in the conversion of farmland to non-agricultural use.

Minor modifications to the existing wastewater system qualify for a categorical exemption under the California Environmental Quality Act (CEQA). In addition to CEQA, to support the construction application and meet federal requirements, a biological report that meets the requirements of Section 7 of the Endangered Species Act, and a cultural report that meets the requirements of Section 106 of the National Historic Preservation Act will be completed.

Permits necessary for the preferred project are anticipated to include the following:

- Humboldt County Coastal Development Permit
- Humboldt County Grading Permit
- Humboldt County Building Permit

6.7 Sustainability Considerations

One of the goals of the District is to upgrade the system and improve environmental, social, and economic benefits to help create a more resilient wastewater utility system for the community. The main elements of this approach are discussed below.

6.7.1 Water and Energy Efficiency

Based on the District's customer billing history, there are potential locations of increased pumping due to I/I. Repair of worn out seals and sub-grade risers will reduce the occurrence of I/I and therefore potentially reduce energy expenses for unnecessary pumping. Connecting each septic pump to a SCADA system will allow the District to monitor operation, run time, and alarms. Combined with water use data and precipitation data, the District will be able to more readily identify I/I issues at individual septic tanks. Development and implementation of a formal septage management plan will help maintain the overall system and decrease the potential for septic tank issues and enhance efficiency of the system.

6.7.2 Green Infrastructure

The overall wastewater management system based on treatment lagoons and wetlands is a good example of "green infrastructure" intended to mimic natural processes to manage wastewater. The proposed improvements will help maintain the system and continue the operation of the natural treatment system.

6.7.3 Other

As is the case with many small systems, the operations of the current wastewater system relies on experienced operators with institutional knowledge. The proposed upgrades will help develop more comprehensive and sustainable approach and provide additional documentation for the procedures for future staff to build upon. The additional data collection through the upgraded SCADA system will also help provide operators with real time information to help manage operations and conduct preventative maintenance. The proposed improvement project will provide current and future District staff with a system that is based on a logical maintenance schedule that better meets current operational needs, incorporates equipment that is more modern, improves monitoring and control capabilities, and improved maintenance capabilities for long-term sustainability.

6.8 Total Project Cost Estimate (Engineer's Opinion of Probable Cost)

The potential conceptual costs of the suite of recommended improvements were estimated based on the concept improvements and anticipated order of magnitude costs. Based on the conceptual nature of the project, a Class 4 Cost Estimate was prepared, which is intended for project definition level of 1% to 15% from a concept study. The anticipated accuracy is from minus 15% to plus 50%. This cost estimating system was developed by the Association for Advancement of Cost Engineering International (AACEI) and is in common use for infrastructure and industry.

The regular Operations and Maintenance costs for the basic infrastructure are anticipated to be essentially the same after the project as before because a similar level of staffing and maintenance requirements are anticipated. Due to the need to address the lag in septage pumping, transport and disposal, servicing of all tanks within one year is recommended and then implement a regular, four-year service cycle for each tank. An estimated $120,000 is allocated for this effort.

The Opinion of Conceptual Costs is presented in Table 21 below. An estimating contingency of 15 percent was used to account for the fact that the estimate is conceptual in nature and is not based on a final design. The Opinion of Conceptual Costs will be updated with each design submittal. The District will apply for grant funding to complete implementation of this project. If full grant funding is not obtained for the project, water rates will need to be adjusted to collect funds for this wastewater system project.

Table 21: Opinion of Conceptual Cost of Proposed Project

Item	Quantity	Unit	Unit Cost	Total Cost
Demolish Existing Dry Well Components	1	LS	$5,000	$5,000
Demolish Obsolete Odor Control Components	1	LS	$5,000	$5,000
Demolish Obsolete Electrical and Control Components	1	LS	$5,000	$5,000
Demolish Fencing	1	LS	$10,000	$10,000
Installation of New Risers and Seals	30	EA	$1,500	$45,000
Septic Tank Pumps	125	EA	$750	$93,750
Replace Air Relief Valves	23	EA	$1,500	$34,500
Miscellaneous Replacement Valves	1	LS	$50,000	$50,000
Passive Septage Screening System	1	LS	$15,000	$15,000
Septage Holding Tank System	1	LS	$20,000	$20,000
Wetwell Pump and Rail System	1	LS	$55,000	$55,000
Yard Piping, Valves, and Vault	1	LS	$30,000	$30,000
Bypass Piping	100	LF	$125	$12,500
Influent Splitter Box	1	LS	$20,000	$20,000
Pond Liner Shore Reinforcement	1	LS	$20,000	$20,000
Hydraulic Control Box Replacement Gates	1	LS	$20,000	$20,000
Site Fencing	3100	LF	$75	$232,500
Pump and Clean All Septic Tanks	1	LS	$120,000	$120,000
Generator System Replacement	1	LS	$100,000	$100,000
Septic Tank SCADA Upgrades	1	LS	$250,000	$250,000
Influent Pump Electrical and Control Upgrades	1	LS	$25,000	$25,000
Plant Electrical and Control Upgrades	1	LS	$175,000	$175,000
SUBTOTAL CONSTRUCTION				**$1,343,250**
Estimating Contingency	15%			$201,488
SUBTOTAL WITH CONTINGENCY				**$1,544,738**
General Conditions, Mobilization, Demobilization	7%			$108,132
Bonds and Insurance	3%			$46,342
General Contractor Fee	10%			$154,474
Surveying and Materials Testing During Construction	3%			$46,342
TOTAL CONSTRUCTION ESTIMATE				**$1,900,027**
Finalize Plans and Bidding	3%			$46,342
Finalize Permits	2%			$30,895
Construction Inspection and Management	15%			$231,711
Startup and Testing	1%			$15,447
Project Administration and Funding Management	2%			$30,895
TOTAL PROJECT ESTIMATE				**$2,255,317**

6.9 Annual Operating Budget

The proposed project is comprised of various infrastructure components to improve efficiency and reduce costs for the District. The following sections present actual income, expenses, debt and reserves for fiscal year 2018 (July 2017 through June 2018) with consideration of the additional septage disposal services. Increases in annual expense and revenue, based on the 2017 rate study, were presented in Section 3.4.

6.9.1 Income

The District's currently collects sewer fees from users based on living unit equivalent (LUE). The rate during fiscal year 2018 was $40.55 per LUE and will increase to each year, up to $44.13 in fiscal year 2022. Based on the 2017 rate study's 378 LUEs, a summary of rates and sewer income is presented below in **Error! Reference source not found.**.

Table 22. Estimated Annual Income

Proposed Sewer Rates	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022
Monthly Rate per LUE	$40.55	$41.39	$42.27	$43.18	$44.13
Estimated Annual Income	$183,453*	$187,751	$191,727	$195,871	$200,193

*Actual FY 2018 revenue (includes monthly rates, penalties and miscellaneous)

6.9.2 Annual O&M Costs

As described in Section 6.8, the regular Operations and Maintenance costs for the basic infrastructure are anticipated to be essentially the same after the project as before because a similar level of staffing and maintenance requirements. Following the initial servicing of all septic tanks, included in the Capital Costs, an allowance of $30,000 per year has been assumed for contractor provided septage pumping, transport and disposal to achieve the recommended four-year pumping cycle of 70 tanks per year, with an average volume of 1,000 gallons and rate of $0.38/gallon. The actual amount could be more or less depending on the number of septic tanks pumped each year. The District's base Operations and Maintenance costs were evaluated in the recently completed Rate Study, which were presented previously in this report in Section 3.4. If actual expense and revenue are consistent with projected expense and revenue, the District will need to raise rates to rates by $6.62/LUE/Month to accommodate the increase of $30,000 annually. However, based on the most recent expense and revenue for FY 2018, actual expenses were lower than estimated, allowing for additional funds to be placed in reserves or allocated to future septage pumping, transport and disposal.

6.9.3 Debt Repayments

The District does not currently hold debt on sewer related infrastructure.

6.9.4 Reserves

The District currently has $97,855.95 in Capital Improvement Reserves. These reserved are used for both sewer and water projects. The District allocates $15,800 from sewer fee revenue into reserves.

7. Conclusions and Recommendations

The District has made effective use of the existing wastewater infrastructure over the last 40 years. Ongoing monitoring demonstrates the overall effectiveness of the system. Strategic improvements are needed to address the current inefficiencies, deficiencies and vulnerabilities of the existing system facilities to continue the effective conveyance, treatment and disposal of wastewater through the coming decades. A summary of recommended improvements include:

Septic System

- Septage Management Plan including a competitive bid package for septage pumping and hauling services
- Selective installation of new risers to increase elevation of tank rim and reseal (30 total)
- Replace all pumps greater than 15 years old (125 total)
- Integrate each septic tank control panel into a District SCADA system
- Septage holding tank and a simple screening system
- Educational brochure for STEP system (developed as a part of this planning study)

Conveyance System

- Bypass piping from conveyance system to Aerated lagoons
- Replace all air relief valves throughout the system (23 total)

Treatment System

- SCADA system with notification and status direct to District Staff
- Air gap at aeration lagoon influent
- Retrofit of existing 72" diameter fiberglass wet well with submersible rail mounted pumps with valves and piping installed in an adjacent vault
- Removal of existing well pumps, piping, and equipment from the dry well
- Replace the generator with a modern unit integrated into the electrical and control systems
- Install a protective strip of lining material to exposed areas of pond liner along the shoreline
- Replace mechanical components of hydraulic control structures
- Winch and platform to remove aerators
- Replace all treatment plant site fencing

8. References

CRWQCB. (1996, February). Waste Discharge Requirements for Manila Community Services District. California Regional Water Quality Control Board.

Dyett & Bhatia. (2002, February). Building Communities Report. *Humbldt County General Plan*. County of Humboldt.

Evenson, R. E. (1959). *Geology and Ground-Water Features of the Eureka Area Humboldt County, California.* Washington: United States Government Printing Office.

Franklin Miller. (2018, November). Personal Communication.

Humboldt Local Agency Formation Commission. (2007, November). Manila Community Services District Municipal Service Review.

Patton, J., & Dengler, L. (2006). *Relative Tsunami Hazard Mapping for Humboldt and Del Norte Counties, California.* Arcata: Redwood Coast Tsunami Work Group.

ScreenCo Systems. (2018, November). Personal Communication.

Steve's Septic. (2018, November). Personal Communication.

US Census Bureau. (2017). *Population, Manila CDP, California*. Retrieved January 11, 2017, from American Fact Finder: https://factfinder.census.gov

USGS. (2000). *Geology of the Cape Mendocino, Eureka, Garberville, and Southwestern Part of the Hayfork 30 x 60 Minute Quadrangles and Adjacent Offshore Area, Northern California*. Retrieved from Miscellaneous Field Studies Map MF-2336: https://pubs.usgs.gov/mf/2000/2336/