City of Molalla

Clackamas County, Oregon

WASTEWATER FACILITY AND COLLECTION SYSTEM MASTER PLAN VOLUME 1

DRAFT

OCTOBER 2018

The Dyer Partnership
Engineers & Planners, Inc.

Project No. 100.26

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EXECUTIVE SUMMARY

SECTION ES: **EXECUTIVE SUMMARY**

The following provides a summary of the analysis, conclusions and recommendations contained in this Wastewater Facility and Collection System Master Plan (WWFCSMP). In particular, the following components of the report are summarized in this section:

- Background and Purpose
- WWFCSMP Advisory Committees
- Project Selection
- Population and Flow Projections
- Collection System
- Wastewater Treatment System
- Effluent Disposal Systems
- Recommendations and Costs
- Financing

ES.1 Background and Purpose

The purpose of this Wastewater Facility and Collection System Master Plan is to provide the City of Molalla (City) with a comprehensive wastewater utility planning document. The City's most recent Wastewater Facility Plan (WWFP) was prepared in 2000. Since that time, the City's wastewater collection and treatment system infrastructure has aged and evolved, and the City's population has steadily increased. Recently, the City has also violated the NPDES Permit on several occasions, and entered into a Mutual Agreement Order (MAO) with the Oregon Department of Environmental Quality (DEQ). An updated Wastewater Facility and Collection System Master Plan is necessary to satisfy conditions stipulated in the MAO, quantify existing loads, evaluate existing infrastructure, identify deficiencies, and develop a comprehensive Capital Improvement Plan for the next twenty years.

The City's original Wastewater Treatment Plant (WWTP) was constructed in 1955. Prior to that time, wastewater management systems consisted of individual septic tank and drain field systems. Due to population growth, density of development, and other factors, the original WWTP was abandoned and a new WWTP was constructed in 1980. The City's existing wastewater collection system consists of approximately 160,299 lineal feet of gravity collection pipes, 4,376 lineal feet of pressure sewer mains, 534 manholes, and five pump stations. The City's existing wastewater treatment plant is comprised of an influent fine screen, aerated lagoon, transfer pump station, two facultative/storage lagoons, tertiary treatment, disinfection, and an effluent pump station.

The City operates its wastewater system under NPDES Permit No. 101514, issued May 12, 2014 by the DEQ. There are two permitted outfalls. Outfall 001 is located on the Molalla River at approximately River Mile 20. Discharge is only permitted to the Molalla River Outfall 001 from November 1 to April 30. Outfall 002 is the recycled water outfall for several DEQ approved land application sites. Effluent is land applied in accordance with permit requirements from May 1 through October 31.

Several deficiencies are present throughout the City's wastewater collection system, WWTP, and effluent disposal systems. The City's collection system is antiquated, and suffers from excessive Infiltration and Inflow (I/I). Excessive flows inundate gravity sewers, stress lift stations, and hydraulically overload the WWTP. The WWTP is also overloaded organically, and is routinely out of compliance.

The aerated and facultative lagoons are the main biological processes used for treatment of the City's wastewater. The aerated lagoon and facultative lagoons are 37 years old, hydraulically undersized, and organically overloaded; all based on existing loads. Insufficient hydraulic detention time in the aerated lagoons prevents significant oxidation of biodegradable constituents. Deficient hydraulic detention time in the facultative lagoons inhibits proper biological treatment, but also impedes the City's ability to store recycled water during the summer months. Tertiary treatment systems are overloaded and struggle to remove solids reliably and at necessary flux rates.

As a result of the existing influent loads and deficiencies, the WWTP often performs in violation of the permit. During the winter months, the City regularly violates the Total Suspended Solids (TSS) concentration and mass load limits set forth in the NPDES Permit. During the summer months, because of WWTP capacity limitations and recycled water land application restrictions, the City is often forced to discharge effluent to the Molalla River, in violation of the discharge permit. The City also regularly violates effluent turbidity limits, and disinfection requirements during the summer. The condition of the WWTP is such that it is not possible to operate reliably and dependably in accordance with the current NPDES Permit.

In response to recurrent NPDES Permit violations, the City established a Mutual Agreement and Order with Oregon Department of Environmental Quality. A schedule and interim compliance standards has been established; while the City works to resolve compliance issues and implement requisite improvements.

This WWFCSMP aims to address the inability of the existing wastewater system to effectively treat wastewater in accordance with current NPDES Permit and Total Maximum Daily Load (TMDL) requirements, and outlines the improvements that are necessary to meet regulatory and environmental antidegradation requirements. Wastewater planning is for a 20-year period from the expected project completion date. The existing WWTP is beyond its design life and the treatment capacity for biosolids is neither present nor adequate. In addition to addressing the current deficiencies, the WWFCSMP develops infrastructure needs to serve the anticipated population growth. The City is uniquely positioned near Salem and Portland. The City's population is projected to almost double in the next twenty years.

ES.2 WWFCSMP Advisory Committees

The City of Molalla established two advisory groups (Technical Advisory Committee and Project Advisory Committee) to facilitate the development of the plan and to assist in the development of a Wastewater Facilities Plan that reflects the community values and concerns. The Technical Advisory Committee (TAC) consisted of representatives from the City, County, Fire District, School District, Oregon Department of Land Conservation and Development, and DEQ. The Project Advisory Committee (PAC) included citizens and members of City Council, Planning Commission, and environmental groups.

ES.3 Project Selection

The recommendations summarized within this WWFCSMP are the culmination of an evaluation of alternatives developed for the wastewater collection system, treatment system, and disposal systems. Alternatives were evaluated based on their technical feasibility, life-cycle costs, and several other factors.

The projected project life, based on DEQ State Revolving Fund requirements, is for a 20-year project life. The anticipated time needed to complete this WWFCSMP, secure financing, and complete design and construction is approximately five years. Referenced from the base year of 2018, the recommended planning year is 2043.

The WWFCSMP process including the following steps:

- Analyze influent wastewater characteristics and flows at the WWTP.
- Utilize historical and future population projections to estimate future wastewater flows and loads.
- Evaluate capacity needs and deficiencies in the collection system and at the WWTP to be able to convey and treat the wastewater through the planning period.
- Evaluate treatment process alternatives with regard to regulatory requirements.
- Develop planning level life-cycle cost estimates for each alternative.
- Creating a recommended Capital Improvement Plan for the planning period.
- Identify preliminary financing options.

ES.4 Population and Flow Projections

Population

The City anticipates growth consistent with historical trends. Historical population growth has been strong in the City of Molalla, averaging four percent annually over the last 20 years, slightly higher than the 50 year average of 3.4 percent annual growth. The City of Molalla population projection for the year 2043 is 16,977. Population and EDU growth are analyzed in more detail in Section 2 of this WWFCSMP.

Wastewater Flows and Loads

Recent WWTP Daily Monitoring Report (DMR) records were analyzed to provide the existing wastewater flows and loads. The DEQ guidelines were used to extrapolate the future projected flows and loads. The results are further elaborated on in Section 3. Existing users are estimated to have an average higher per capita flow than newer users due to higher infiltration. Current flows exceed the WWTP design hydraulic capacity. A disciplined I/I rehabilitation program has been implemented and applied to the system, with special focus on areas identified during recent smoke testing and flow poking endeavors. Projected flows and loads for 2043 exceed the WWTP hydraulic and organic capacity. Tables ES.4.1 and ES.4.2, provided below, summarize the existing and projected flows and loads for the City's wastewater system.

TABLE ES.4.1
WASTEWATER FLOWS AND LOADS[1]

PARAMETER	2017	2043	
Population	9,939	16,977	
Base Sewage	0.89 MGD	90 gpcd	1.52 MGD
Base Infiltration	0.22 MGD	23 gpcd	0.38 MGD
AAF	1.85 MGD	186 gpcd	3.16 MGD
ADWF	1.11 MGD	112 gpcd	1.90 MGD
AWWF	2.48 MGD	249 gpcd	4.24 MGD
$MMDWF_{10}$	1.91 MGD	192 gpcd	3.25 MGD
$MMWWF_5$	3.21 MGD	312 gpcd	5.30 MGD
Peak Average Week	4.51 MGD	401 gpcd	6.80 MGD
$PDAF_5$	6.62 MGD	524 gpcd	8.91 MGD
PIF	9.7 MGD	735 gpcd	12.48 MGD

1. Per capita flow rates for 2043 wet weather flows are estimated using current wet weather I/I rates for existing portions of the collection system and lower rates in areas with new sewers.

TABLE ES.4.2
WASTEWATER TREATMENT DESIGN VALUES (2043)

	Flow	BOD_5		TSS	
	MGD	mg/L	ppd	mg/L	ppd
AAF	3.16	126	3,310	133	3,500
$MMDWF_{10}$	3.25	144	3,900	143	3,870
$MMWWF_5$	5.30	60	2,630	68	3,020
$PDAF_5$	8.91	n/a	n/a	n/a	n/a
PIF	12.48	n/a	n/a	n/a	n/a

ES.5 Collection System

Collection System Inventory

The City's collection system consists of approximately 160,299 lineal feet of gravity collection pipes, 4,376 lineal feet of pressure sewer mains, 534 manholes, and five pump stations. An inventory of the existing collection system is provided in Table ES.5.1.

TABLE ES.5.1
WASTEWATER COLLECTION SYSTEM INVENTORY[1]

Item	Item Description	Unit	Quantity
1	4" Sanitary Sewer Line	FT	1,861
2	6" Sanitary Sewer Line	FT	8,104
3	8" Sanitary Sewer Line	FT	114,618
4	10" Sanitary Sewer Line	FT	8,490
5	12" Sanitary Sewer Line	FT	12,192
6	15" Sanitary Sewer Line	FT	14,291
7	18" Sanitary Sewer Line	FT	28
8	21" Sanitary Sewer Line	FT	715
9	24" Effluent Force Main	FT	27,158
10	Manholes	EA	534
11	Cleanouts	EA	95
12	Pump Stations	EA	5

1. Based on City GIS data (September 2017).

Smoke Testing and Flow Mapping

Smoke testing was performed from October 16 through October 18, 2017. The smoke testing was successful in identifying several areas of potential I/I. Through smoke testing efforts, over two-hundred deficiencies were identified, including: leaking service laterals, leaking main lines, catch basin connections, leaking manholes, open cleanouts, plugged house vents, and connected roof drains.

Flow mapping was performed on January 29, 2018 to determine the quantity and sources of extraneous water entering the City of Molalla's sewer collection system. Flow measurements consisted of instantaneous water depth recording using "Flow Poke" equipment at incoming pipe segments within manholes as well as general observations. The flow poking indicated a number of deficiencies that need to be addressed. Problem areas included several sewers located in six sub basins.

The City's wastewater collection system infrastructure is old, and has considerable infiltration and inflow. As infrastructure ages, it becomes more susceptible to deterioration, clogging, and collapse. Infiltration and inflow can become progressively worse, ultimately manifesting in sanitary sewer overflows and overloading the collection system and wastewater treatment plant. Reduction of I/I is critical to maintain the performance of the collection system, release trapped capacity currently occupied by I/I, and minimize peak flows conveyed to the WWTP. Any flows identified and mitigated in the collection system will translate to reductions in capital and operational expenditures at the WWTP. Currently, I/I is approximately 633 gpcd, which exceeds the Environmental Protection Agency (EPA) guidelines. Decreases in I/I will not only relinquish capacity in the collection system, but also decrease future WWTP improvement projects, as well as reduce future WWTP operational expenditures.

Based on the evaluation of the collection system summarized herein, and the principal objective of minimizing the total cost of wastewater service to the City, the City should continue to pursue the reduction of the I/I flow contributions throughout the collection system. The City should identify and allocate funding for additional I/I construction projects in a phased and prioritized approach. Addressing the most severe deficiencies first, generally provides the highest return on investment. After collection system improvements to reduce I/I, reassessment of the influent wastewater flows resulting from the I/I improvements should be performed. Eventual amendments to the WWFCSMP flow projections are recommended after high-priority I/I abatement projects are completed and peak flows theoretically and subsequently subside.

Collection System Improvement Projects

Recommended collection system improvement projects, separated into three phases, are summarized below. A map depicting the location of the collection system improvement projects is provided in Section 4.

- **Phase 1**
  - **Project 1.** *Replace/Rehabilitate existing 8-inch sewer along Fenton Avenue from TL_B_19 to TL_B_20.*
  - **Project 2.** *Replace/Rehabilitate existing 8-inch sewer along Patrol St. from TL_B_2 to TL_B_27.*
  - **Project 3.** *Replace/Rehabilitate existing 8-inch sewer along Lola Avenue from TL_A_33 to TL_A_25.*
  - **Project 4.** *Replace/Rehabilitate existing 8-inch sewer from TL_A_22 to TL_A_21 along East 2nd to TL_A_16 on Eckerd Avenue.*
  - **Project 5.** *Replace/Rehabilitate existing 8-inch sewer along S. Swiegle from BC_A3_17 to BC_A3_7.*
  - **Project 6.** *Replace/Rehabilitate existing 8-inch sewer beginning at the S. Molalla Pump Station, continuing to manhole BC_A1_2, and terminating at the clean-out located east of manhole BC_A1_3. Additional smoke testing and TVing is recommended. A portion of this sewer line extends into an abandoned subdivision that presents a higher risk of infiltration and inflow.*
  - **Project 7.** *Replace/Rehabilitate existing 8-inch sewer along Fenton Avenue from TL_B_20 to TL_B_22.*

- **Phase 2**
  - **Project 8.** *Replace/Rehabilitate existing 8-inch sewer along East Main Street from TL_A_48 to TL_A_28.*
  - **Project 9.** *Replace/Rehabilitate existing 8-inch sewer along Berkley Avenue from BC_A3_18 to clean-out located south of BC_A3_14 near East 5th St.*

- **Project 10.** *Replace/Rehabilitate existing 8-inch sewer beginning at manhole BC_A3_21 and continuing south on Metzler to BC_A3_2, terminating at clean-out at the intersection of Metzler and West 4th Street.*
- **Project 11.** *Replace/Rehabilitate existing 8-inch sewer beginning at TL_B_21 and continuing east on Kimberly Ct until terminating at TL_B_24.*

- **Phase 3**
  - **Project 12.** *Replace/Rehabilitate existing 8-inch sewer beginning at BC_A3_16 along S. Molalla Avenue, continuing south to BC_A3_3, and continuing south until the clean-out in Fox Park (former High School site). Scope of work will include an evaluation of service laterals extending east on 2nd Street.*
  - **Project 13.** *Replace/Rehabilitate existing 8-inch sewer beginning at TL_A2_6, continuing south on S. Cole Avenue until TL_A2_4, and then continuing east on East 7th Street until terminating at the clean-out east of manhole TL_A2_5.*
  - **Project 14.** *Replace/Rehabilitate existing 8-inch sewer beginning at TL_B_2 along North Cole Avenue, and terminating at the clean-out south of TL_B_31.*
  - **Project 15.** *Replace/Rehabilitate existing 8-inch sewer beginning at TL_B_29 along Garden Court until TL_B_4.*
  - **Project 16.** *Replace/Rehabilitate existing 8-inch sewer beginning at TL_B_8 along Oak Street, and continuing to clean-out east of TL_B_12.*
  - **Project 17.** *Replace/Rehabilitate existing 8-inch sewer beginning at TL_B_8 on East Heintz Street to TL_B_9, continuing to TL_B_10 on East Park Avenue.*
  - **Project 18.** *Replace/Rehabilitate existing 8-inch sewer beginning at BC_B_1 along South Molalla Forest Road to BC_B_18. Includes 8" sewer line extending west to BC_B_10.*
  - **Project 19.** *Replace/Rehabilitate existing 8-inch sewer beginning at BC_C_71 along Meadowlawn Place to BC_C_59.*
  - **Project 20.** *Replace/Rehabilitate existing 8-inch sewer beginning at TL_A1_5, continuing to TL_A1_1 on East 8th Street, continuing east on East 8th Street until TL_A1_6, and then terminating at the clean-out at the end of Mathias Court. Additional inspections and TVing is required in subbasin TL_A1 to determine ultimate scope of repairs/replacement work.*
  - **Project 21.** *Replace/Rehabilitate existing 8-inch sewer beginning at TL_C2_11 along Explorer Avenue, continuing to TL_C2_6 along Escort Street, continuing to TL_C2_5 along Bronco Avenue, and continuing along Glory Ln to TL_C2_1. Scope of work shall also include replace/rehabilitate existing 8-inch sewer beginning at TL_C2_15 along Probe Street terminating at TL_C2_16. Additional inspections and TVing is required in subbasin TL_C2 to determine ultimate scope of repair/replacement work.*

In addition to the above projects, the City should implement a CCTV program for the entire collection system over a five-year period (20% per year) and continue to repeat the TVing at five-year intervals.

Pump Stations

The collection system includes five pump stations, listed below. An analysis of each pump station was conducted to identify deficiencies and recommend improvements, if necessary, during the planning period.

- Stowers Pump Station
- South Molalla Pump Station
- Steelhead and Coho Pump Station
- Taurus Pump Station
- East 5th and South Cole Pump Station

The pump station analysis concluded that the Taurus Pump Station and the South Molalla Pump station will require major upgrades during the planning period. The Taurus Pump Station requires frequent oversight, high repair and replacement costs, and consists of pumps that are overloaded during rain events. Installing a new submersible pump station, while using the existing wet well, is recommended. The South Molalla Pump Station is old and approaching the end of its design life. Continuing to operate the pump station in its current condition presents excessive risk of failure and sewage overflows. Installing a new submersible pump station is recommended. Improvements to the South Molalla Pump Station are classified as Phase 1, and scheduled to occur within the next five years. Improvements to the Taurus Street Pump Station are classified as Phase 2 improvements, and scheduled to occur in years 5-10.

Improvement projects will also be required for the remaining pump stations during the planning period. As the pumps and controls age in the remaining pump stations (Stowers, Steelhead & Coho, and East 5th & South Cole), the pumps will eventually require replacement, controls will require upgrades and SCADA integration, and wet wells will require rehabilitation work. Improvement projects related to the Stowers, Steelhead & Coho, and East 5th & South Cole Pump Stations are categorized as Phase 2 improvements and planned to occur in years 5-10.

ES.6 Wastewater Treatment System

Raw wastewater flows by gravity to a headworks system consisting of an automated fine screen, mechanical bar screen, and Parshall flume for flow measurement. Screened raw sewage flows by gravity to a 1.3 MG asphalt-concrete lined aerated lagoon designed with six aspirating aerators. Return Activated Sludge (RAS) is not returned to the aerated lagoon.

A transfer pump station conveys wastewater from the aerated lagoon to the first of two facultative lagoons installed in series; which provide both treatment and storage. Lagoon #1 is 11.4 acres and has a maximum volume of 45 MG at a 12 ft water level. Lagoon #2 is approximately 13.6 acres and has a total volume of 53 MG at a 12 ft water level.

Tertiary treatment is provided by two dissolved air flotation units and four media filters. After filtration, calcium hypochlorite is used for disinfection, immediately prior to entering the chlorine contact basin. Disinfected effluent flows by gravity to the effluent pump station, where it is either land applied or discharged to the Molalla River, depending upon the time of year.

Existing WWTP Condition

The primary objective of the WWTP is to produce water quality in accordance with the NPDES Permit. The existing WWTP, because of several deficiencies and influent loads, frequently violates suspended solids concentration and mass load limits, and often discharges to the Molalla River during the summer months, in violation of the NPDES Permit. A summary of the major WWTP deficiencies is provided in Table ES.6.1. More detailed explanations of each unit process at the WWTP are summarized in Section 2.

TABLE ES.6.1
SUMMARY OF WWTP DEFICIENCIES

Component	Deficiency
Headworks	Undersized for current and future flows (PIF)
	Excludes grit removal
	Slide gates are difficult to remove
Aerated Lagoon	Undersized to initiate appreciable treatment

Component	Deficiency
Aerated Lagoon Cont.	Excessive sludge and grit accumulation[1]
	Asphalt-concrete liner is cracked
	No RAS
	Limited operational control
	Energy inefficient
	Inadequate mixing
Transfer Pump Station	Undersized for future flows (PIF)
Facultative/Storage Lagoons[2]	Excessive solids accumulation
	Undersized to achieve treatment objectives
	Limited operational control to achieve discharge limits
	Limited level control and withdrawal options
	Dike erosion
	Undersized transfer line between Lagoons # 1 and # 2
	Inadequate storage for future flows
	Periodic odors
Dissolved Air Flotation	Undersized given existing solids and hydraulic loading
	DAF # 1 is in need of structural repairs
	O&M intensive
	No waste sludge treatment
Gravity Filters	Undersized given solids and hydraulic loading
	O&M intensive
	No waste sludge treatment
Disinfection	Tablet chlorination system safety concerns
	High operational costs
Chlorine Contact Basin	No redundancy
	Undersized based on current and future flows
	Short circuiting
Effluent Pump Station & Force Main	Undersized for future flows[3]
Outfall	Undersized
	Discharge monitoring station location is O&M intensive
Land Application of Recycled Water	Fail to comply with Class A recycled water discharge limits[4]
	Insufficient liquid storage for existing flows
	Insufficient liquid storage and land area for future flows
Biosolids Management	Solids are rarely wasted and continuously stored at WWTP
	Dredging of solids is cumbersome
	Excess solids in aerated lagoon and Lagoon #1
	Disposing of solids is operationally intensive and expensive

1. Solids (215 dry tons) were removed from the aerated lagoon during the development of this plan.
2. Some solids (699 dry tons) were removed from lagoon #1 during the development of this plan.

3. Assumes no influent flow equalization.
4. RWUP (Dyer Partnership, 2018) received DEQ approval in September 2018, based on Class C recycled water.

The WWTP lacks adequate biosolids management systems. Sludge, including algal-alum sludge from the Dissolved Air Flotation (DAF) backwash, mainly settles and accumulates in the facultative/storage lagoons. Some sludge also settles in quiescent zones in the aerated lagoon. The majority of sludge settles near the inlet of Lagoon #1. Sludge resides in the lagoons for long periods of time, generally years, with little to no removal and disposal. While in the lagoons, sludge is passively and anaerobically digested, and gravity thickened. Biosolids in the lagoons are difficult to remove and dispose of; and are therefore infrequently removed and managed. As solids accumulate in the lagoons, they occupy valuable biological capacity, as well as restrict the ability of the City to store recycled water and modulate flows.

In summary, the existing WWTP is unable to perform in accordance with the NPDES Permit. A major WWTP upgrade project is necessary to address widespread deficiencies, and serve a population projection of 16,977 in 2043.

Permit Modification Applications

The City is currently in the process of permit modification applications that requests an increase to the mass load allocation, as well as a discharge allowance when river conditions allow, which will typically allow the City to discharge to the Molalla River in May. Table ES.6.2 summarizes the proposed permit conditions and supporting justification.

TABLE ES.6.2
SUMMARY OF PROPOSED PERMIT CONDITIONS AND REASONING

Parameter	Proposed Permit Criteria	Reasoning
Flow	350 cfs	Minimum flow so that dilution is sufficient to protect DO.
Temperature	Excess Thermal Load Allocation	Replaces the 18°C discharge limitation with an Excess Thermal Load allocation for each of the months May, June and October as allowed by the Molalla River TMDL.
BOD_5	30 mg/L (November-April), 10 mg/L (May-October)	This is consistent with other permits in the basin and DO modeling with the Streeter-Phelps equation demonstrated that that at a minimum ambient flow of 350 cfs at Canby, this will have a minimal impact on DO in the river.
TSS	30 mg/L (November-April), 10 mg/L (May-October)	This is consistent with other permits in the basin and our mass balance calculations demonstrated that at a minimum ambient flow of 350 cfs at Canby, this will not significantly increase the river TSS.
Mass Load[1] (BOD_5 and TSS)	1,000 lb/day (November-April), 190 lb/day (May-October)	Based on 30/30 mg/L BOD_5/TSS for November-April and 10/10 mg/L for May-October. Based on wet weather design flow rate of 4.1 MGD, and dry weather flow rate of 2.3 MGD.

1. Monthly average mass load based on 2007 design documents.

Another permit modification application is necessary when the new WWTP is constructed. The future permit modification application should be based on future flows (2043) and Willamette Basin standards. Preliminary modeling was completed during the development of this plan, based on future flows and loads. Results from the modeling showed that future flows and loads will not significantly increase TSS and have a small impact on Dissolved Oxygen (DO) in the river.

The status of the pending permit modification applications were unknown at the time that this WWFCSMP was developed. Accordingly, this WWFCSMP evaluates and presents recommendations for four potential future permit conditions, as summarized below, and in Figure ES.6.1.

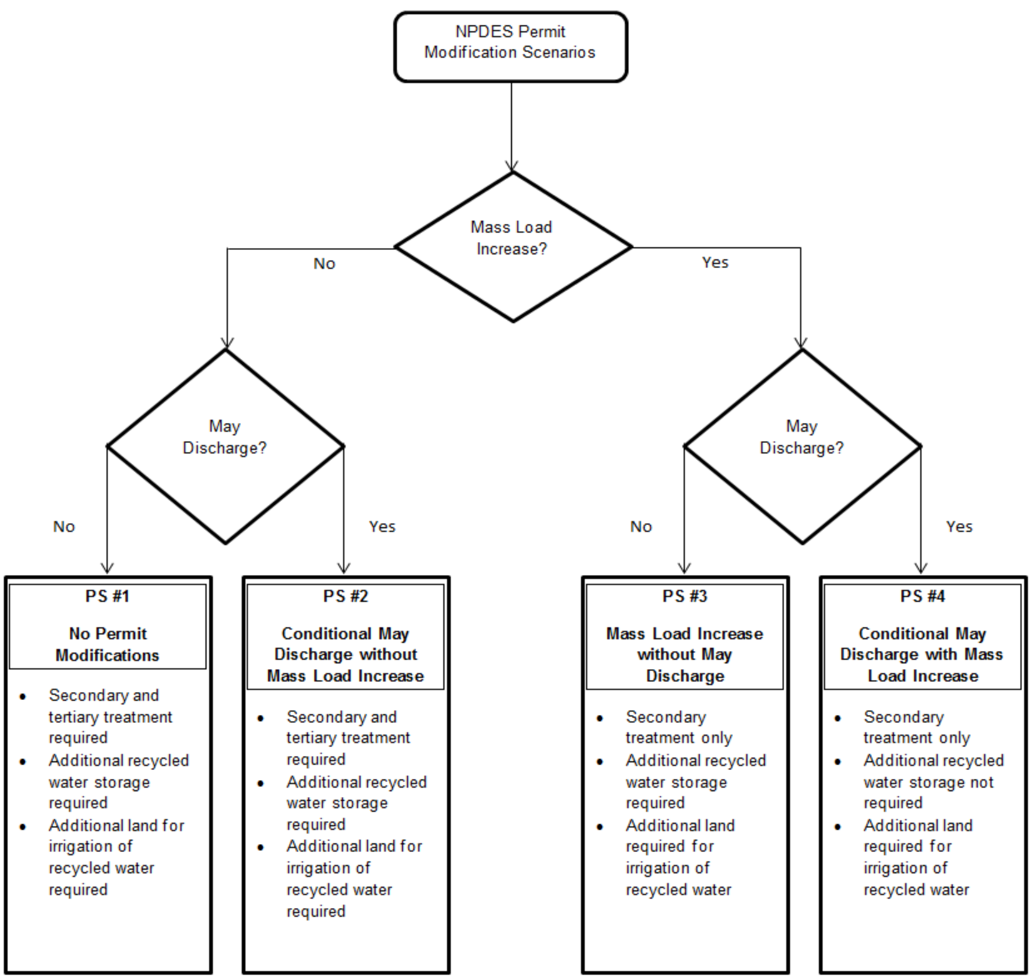
1. Permit Scenario #1 (PS #1). No permit modifications.

2. PS #2. Mass load increase is not approved by DEQ, but conditional May discharge is allowed.

3. PS #3. Mass load increase is approved, but conditional May discharge is not allowed.

4. PS #4. Mass load increase is approved and conditional May discharge is allowed.

FIGURE ES.6.1
NPDES PERMIT SCENARIOS



WWTP Improvements and Expansion

The existing WWTP is deficient in preliminary treatment, secondary treatment, tertiary treatment, solids treatment, and effluent disposal systems. Each major wastewater process area was reviewed with a minimum of three alternatives. The alternatives were examined based on initial capital costs, Operation and Maintenance (O&M) expenditures, footprint, repair and replacement costs, and salvage value. The alternative with the lowest life cycle cost that also satisfied footprint requirements and other considerations was selected for each item. A summary of the WWTP improvement and expansion projects is provided in Table ES.6.3.

TABLE ES.6.3
SUMMARY OF WWTP IMPROVEMENTS AND EXPANSION

Item	Description
Influent Screen Expansion	Install additional 1/4" fine screen in the currently unused channel. The new fine screen will have a capacity of 9.25 MGD.
Grit Removal	Install a new vortex grit removal system. The grit removal system will have a capacity of 12.5 MGD.
Flow Equalization Basin	Convert approx. half of the existing aerobic lagoon into an influent flow equalization basin. Improvements include a new concrete basin. Remaining half of equalization basin will be filled in.
Transfer Pump Station & Force Main	The transfer pump station will be upgraded with new pumps, VFDs, and controls. The existing control building will be used to house the new controls.
Sequencing Batch Reactor (SBR)	A new four cell SBR system will be installed. The SBR will include fine bubble differs, decanters, blowers, controls, SCADA systems, and be capable of achieving < 10/10 BOD_5/TSS and < 2 mg/L ammonia.
Tertiary Filtration	A new disk filtration system will be installed if a mass load increase is not approved (PS #1 and PS #2). The tertiary filter will consist of a rotating disk filtration system sized for peak decant rate of the SBR. Target effluent quality of < 4 – 5 mg/L TSS.
Lagoon Dredging, Dewatering & Disposal	To facilitate the utilization of the existing lagoons as recycled water storage, the solids will be dredged, dewatered, and disposed; all after the commissioning of the new WWTP and supporting systems.
Aerobic Digester	A new aerobic digester, with diffusers for mixing and aeration, will be installed. The aerobic digester will be sized for > 60 days SRT. Total volume is 1.2 MG.
Biosolids Processing Facility	A new biosolids dewatering screw press and dry storage bay will be constructed. The biosolids screw press will have a capacity of 360 lbs/hour.
Disinfection (HS/UV)	A UV disinfection system will be constructed to disinfect the effluent from the SBR prior to discharging to the Molalla River outfall. A new sodium hypochlorite system will be provided to disinfect recycled water prior to land application.
Recycled Water Storage Improvements	The existing lagoons (#1 and #2) will be repurposed to serve as recycled water storage. Dike improvements are required to repair erosion deficiencies. The lagoons will also be lined with a new hypalon liner.
Recycled Water Storage Expansion Systems[1]	Additional recycled water storage infrastructure is required if the City is unable to secure permit modifications. For PS #1, an additional 35 acres of storage is required. For PS #2 and PS #3, an additional 10 acres is required.

Item	Description
Discharge Monitoring Station Improvements	The discharge monitoring station is capacity limited. Improvements will be completed to convey peak flows.
Misc. Equipment	A new standby generator and automatic transfer switch will be installed to serve the SBR, disinfection systems, and critical ancillary facilities. A new truck with spreader will be purchased for biosolids land application.
Effluent Pump Station Upgrade & Expansion	The existing effluent pumps will be replaced and the third effluent pump will be installed in the effluent pump station.
Site Structures	A new controls building will be constructed to house the blowers and controls for the new SBR, including biosolids management controls and systems.
Site Improvements & Yard Piping	Civil site work, including plumbing, grading, drainage, paving, landscaping, and restoration, to support the improvements listed above, are also required.

1. Approximate lagoon surface area based on 6 ft water depth.

ES.7 Effluent Disposal Systems

Molalla River Outfall 001

Effluent disposal is a major problem with the City's wastewater management systems. Based on the current permit, from November 1 to April 30, effluent must be discharged to the Molalla River. Mass load effluent limits for Biochemical Oxygen Demand (BOD_5) and TSS are based on the average wet weather design flow to the facility which equaled 1.92 Million Gallons per Day (MGD). As reported in the 2000 Wastewater Facilities Plan, the Average Wet Weather Flow (AWWF) for 1999 was 1.85 MGD. With consistent development and increase in flows, not surprisingly, actual flows are frequently significantly greater than the permitted wet weather design flows, resulting in recurrent permit violations (mass load) and challenges to discharging effluent at rates necessary to prevent discharging to the Molalla River during the summer months.

Proposed Permit Modification Application #1

The City recently submitted an NPDES Permit modification application based on the Willamette Basin standards and flow data from the existing WWTPs 2007 design documents. The NPDES Permit should be based on the Willamette Basin standards of 30 mg/L BOD_5/TSS (monthly) and 45 mg/L BOD_5/TSS (weekly). Flows from the 2007 design documents are presented in Table ES.7.1.

TABLE ES.7.1
2007 DESIGN DOCUMENT FLOWS

Parameter	2005 (MGD)	2015 (MGD)	2025 (MGD)
ADWF	0.8	1.1	1.4
MMDWF	1.28	1.7	2.3
AWWF	1.3	2.3	3.0
MMWWF	2.04	3.1	4.1
PDF	7.06	8.5	10.3

1. Derived from Tetra Tech/KCM 2007 Wastewater Treatment Plant Improvements Drawings.

The interim permit limits should be based on the following:

1. May 1 – October 31: During this period the permittee must comply with the limits in Table ES.7.2 while discharging to waters of the state. Discharge may not commence until gauged stream flow exceeds 350-cfs and will cease when the average stream flow for the previous seven-day-period is less than 350-cfs.

2. November 1 – April 30: During this time period the permittee must comply with the limits in Table ES.7.2 while discharging to waters of the state.

3. During the term of this permit, the effluent quality must comply with the limits in the following table:

TABLE ES.7.2
PROPOSED NPDES PERMIT LIMITS

Parameter	Units	Average Monthly	Average Weekly	Daily Maximum
BOD_5 (May 1 – October 31)	mg/L	10	15	-
	lbs/day	190	290	380
	% removal	85	-	-
TSS (May 1 – October 31)	mg/L	10	10	-
	lbs/day	190	290	380
	% removal	85	-	-
BOD_5 (November 1 – April 30)	mg/L	30	45	-
	lbs/day	1000	1500	2000
	%	85	-	-
TSS (November 1 – April 30)	mg/L	30	45	-
	lbs/day	1000	1500	2000
	%	85	-	-
pH[b]	SU	Between 6.0 and 9.0		
Design Effluent Flow Dry Season	MGD	2.30	-	-
Design Effluent Flow Wet Season	MGD	4.10		
Total Residual Chlorine[c]	mg/L	0.07	-	0.18
E. coli[ad]	MPN/100 ml	126	-	406
Ammonia	mg/L	16.7	-	25.9
Excess Thermal Load (May)	Shall not exceed a 7-day moving average of the daily excess thermal loads of 77.95 million kcals/day.			
Excess Thermal Load (June)	Shall not exceed a 7-day moving average of the daily excess thermal loads of 72.38 million kcals/day.			
Excess Thermal Load (July, August, September)	No Thermal Load Available – Effluent temperature must be less than 16°C.			
Excess Thermal Load (October)	Shall not exceed a 7-day moving average of the daily excess thermal loads of 42.43 million kcals/day.			
Dilution	Discharge may not commence until gauged stream flow exceeds 350-cfs and will cease when the average stream flow for the previous seven-day-period is less than-350-cfs.			

Notes:
a. No single *E. coli* sample may exceed 406 organisms per 100 mL. The permittee may take at least 5 consecutive re-samples at 4-hour intervals beginning within 48 hours after the original sample was taken and the geometric mean of the 5 re-samples is less than or equal to 126 *E. coli* organisms/100 mL to demonstrate compliance with the limit.
b. May not be outside the range of 6.0 to 9.0 S.U.
c. DEQ has established a minimum Quantitation Limit of 0.05 mg/L for Total Residual Chlorine. In cases where the average monthly or maximum daily limit for Total Residual Chlorine is lower than the Quantitation Limit, DEQ will use the reported Quantitation Limit as the compliance evaluation level.
d. Reported as a monthly geometric mean.

4. Additional information for the limits in the previous table.

   a. The BOD_5 concentration limits are considered equivalent to the minimum design criteria for BOD_5 specified in OAR Chapter 340, Division 41.

b. Mass Load limits for winter time discharge are based on 4.10 MGD. Mass load limits for the summer time are based on 2.3 MGD.

Proposed Permit Modification Application #2

When the new projected WWTP is constructed, it is recommended that the City submit another permit modification application to DEQ, with water modeling justifying the proposed limits, based on future flows. Critical elements of the proposed future permit, based upon future flows, are summarized below and in Table ES.7.3.

1. May 1 – October 31: During this period the permittee must comply with the limits in Table ES.7.3 while discharging to waters of the state. Discharge may not commence until gauged stream flow exceeds 350-cfs and will cease when the average stream flow for the previous seven-day-period is less than 350-cfs.

2. November 1 – April 30: During this time period the permittee must comply with the limits in Table ES.7.3 while discharging to waters of the state.

3. During the term of this permit, the effluent quality must comply with the limits in the following table:

TABLE ES.7.3
FUTURE PROPOSED NPDES PERMIT

Parameter	Units	Average Monthly	Average Weekly	Daily Maximum
BOD_5 (May 1 – October 31)	mg/L	10	15	-
	lbs/day	271	407	542
	% removal	85	-	-
TSS (May 1 – October 31)	mg/L	10	10	
	lbs/day	271	407	542
	% removal	85	-	-
BOD_5 (November 1 – April 30)	mg/L	30	45	-
	lbs/day	1326	1989	2652
	%	85	-	-
TSS (November 1 – April 30)	mg/L	30	45	-
	lbs/day	1326	1989	2652
	%	85	-	
pH[b]	SU	Between 6.0 and 9.0		
Design Effluent Flow Dry Season	MGD	3.25	-	-
Design Effluent Flow Wet Season	MGD	5.30	-	-
Total Residual Chlorine[c]	mg/L	0.07	-	0.18
E. coli[ad]	MPN/100 ml	126	-	406
Ammonia	mg/L	16.7	-	25.9
Excess Thermal Load (May)	Shall not exceed a 7-day moving average of the daily excess thermal loads of 77.95 million kcals/day.			
Excess Thermal Load (June)	Shall not exceed a 7-day moving average of the daily excess thermal loads of 72.38 million kcals/day.			
Excess Thermal Load (July, August, September)	No Thermal Load Available – Effluent temperature must be less than 16°C.			
Excess Thermal Load (October)	Shall not exceed a 7-day moving average of the daily excess thermal loads of 42.43 million kcals/day.			
Dilution	Discharge may not commence until gauged stream flow exceeds 350-cfs and will cease when the average stream flow for the previous seven-day-period is less than-350 cfs.			

Notes:
a. No single *E. coli* sample may exceed 406 organisms per 100 mL. The permittee may take at least 5 consecutive re-samples at 4-hour intervals beginning within 48 hours after the original sample. was taken and the geometric mean of the 5 re-samples is less than or equal to 126 *E. coli* organisms/100 mL to demonstrate compliance with the limit.
b. May not be outside the range of 6.0 to 9.0 S.U.
c. DEQ has established a minimum Quantitation Limit of 0.05 mg/L for Total Residual Chlorine. In cases where the average monthly or maximum daily limit for Total Residual Chlorine is lower than the Quantitation Limit, DEQ will use the reported Quantitation Limit as the compliance evaluation level.
d. Reported as a monthly geometric mean.

4. Additional information for the limits in the above table.

   a. The BOD_5 concentration limits are considered equivalent to the minimum design criteria for BOD_5 specified in OAR Chapter 340, Division 41.

   b. Mass load limits for summer time discharge are based on 3.25 MGD.

c. Mass Load limits for winter time discharge are based on 5.30 MGD.

Recycled Water Outfall 002

In addition to addressing problems associated with the Molalla River outfall, the City needs to expand its recycled water disposal systems. The expansion of recycled water storage systems is dependent on the future mass load allocation, and whether or not the City is allowed to discharge to the Molalla River in May, or other summer months based on acceptable river conditions. Table ES.7.4 summarizes existing and additional land area requirements based on future (2043) conditions.

TABLE ES.7.4
LAND APPLICATION AREA REQUIREMENTS
EXISTING AND FUTURE ADDITIONAL AREA (2043)

Item	Permit Scenario			
	PS #1	PS #2	PS #3	PS #4
Existing Irrigation Area (Acres)	444.5	444.5	444.5	444.5
Additional Irrigation Area (Acres)	~400 to 650	~150 to 275	~100 to 250	~0 to 100
Total Acreage (Acres)	**~844.5 to 1,095.5**	**~594.5 to 719.5**	**~544.5 to 694.5**	**~444.5 to 544.5**

Recycled Water Irrigation and Land Application Sites

To accommodate future flows resulting from population projections, the City must begin to actively identify additional agricultural lands, near the WWTP or existing disposal sites that could be used for recycled water application. Large land area requirements are required if the City is unsuccessful at securing NPDES permit modifications, as indicated in Table ES.7.4.

The City will land apply recycled water in accordance with the DEQ approved Recycled Water Use Plan (Dyer Partnership, 2018). The DEQ approved Recycled Water Use Plan is predicated on the use of Class C water, in accordance with DEQ requirements. The new WWTP will be designed to produce Class B recycled water. Accordingly, in the future, the City has the option of amending the Recycled Water Use Plan based on Class B setbacks.

Based on population projections and the current inability to discharge recycled water at rates necessary to satisfy a water balance, the City must also expand its irrigation output during the summer. In the past, the City has not irrigated at acceptable rates during the summer months. Some of the irrigation restrictions were due to unnecessary restrictions imposed by the City's Consolidated Recycled Water Use Plan (2015). The RWUP (The Dyer Partnership, 2018), approved in September 2018, eliminates burdensome requirements of the preceding Consolidated Recycled Water Use Plan (2015), and allows the City to dispose more recycled water during the summer. The City must also expand its labor and irrigation systems, evaluate the efficacy of automated irrigation systems; all to facilitate the application of recycled water throughout the summer months, especially in July and August.

ES.8 Biosolids Disposal

The City does not currently have adequate sites for the land application of Class B biosolids. The recommended upgrades include the construction of a new aerobic digester, a new biosolids dewatering screw press, and dry storage in a bay adjacent to the proposed building. The City will need to update their Biosolids Management Plan (BMP), continue to expand their land application program, and use landfill disposal as necessary in the interim.

ES.9 Recommendations and Costs

The recommended capital improvement projects, relative to the existing collection system and WWTP, are summarized in this section.

Collection System Improvements

Based on the financial capabilities of the City and severity of deficiencies, the projects are prioritized and separated into three phases. Phase 1 projects will be completed in the next five years. Phase 2 projects will be completed in years 5-10. Phase 3 projects will be completed in years 10-20. Conservatively, all costs assume complete pipe and manhole replacement. Replacement versus rehabilitation should be evaluated on a case-by-case basis, early in the design phase. Cost estimates are presented in Table ES.9.1.

TABLE ES.9.1
COST ESTIMATES FOR SEWER MAIN REPLACEMENT/REHABILITATION PROJECTS

Project No.	Phase	Length (ft)	Construction Cost	Total Project Cost
1	1	850	$333,700	$457,700
2	1	1100	$478,200	$654,200
3	1	1300	$540,200	$740,200
4	1	1300	$471,200	$645,200
5	1	1300	$489,200	$669,200
6	1	2300	$868,200	$1,187,200
7	1	600	$230,200	$316,200
		Subtotal Phase 1	**$3,410,900**	**$4,669,900**
8	2	1900	$810,200	$1,108,200
9	2	1350	$552,700	$755,700
10	2	1000	$401,200	$550,200
11	2	600	$255,200	$350,200
		Subtotal Phase 2	**$2,019,300**	**$2,764,300**
12	3	700	$311,200	$426,200
13	3	2200	$818,200	$1,118,200
14	3	750	$305,700	$418,700
15	3	500	$248,200	$340,200
16	3	800	$332,200	$454,200
17	3	750	$301,700	$413,700
18	3	1800	$584,200	$798,200
19	3	600	$273,200	$374,200
20	3	1150	$496,700	$679,700
21	3	2500	$997,200	$1,362,200
		Subtotal Phase 3	**$4,668,500**	**$6,385,500**
		Total	**$10,098,700**	**$13,819,700**

Annual costs for implementing a CCTV program for the entire collection system over a five-year period (20% per year) are included in Table ES.9.2.

TABLE ES.9.2
ANNUAL TV PROGRAM COST ESTIMATE

Item	Total Cost
Annual CCTV Program	$65,000
Total	**$65,000**

Cost estimates for the proposed pump station improvement projects are summarized in Table ES.9.3. The South Molalla Pump Station improvement project is classified as a Phase 1 project, and scheduled to occur within the next five years. All other pump station improvement projects are categorized as Phase 2 improvements, and will occur in years 5-10.

TABLE ES.9.3
PUMP STATION IMPROVEMENTS COST ESTIMATES

Project	Phase	Construction Cost	Total Project Cost
S. Molalla Pump Station	1	$491,500	$672,500
Taurus Pump Station	2	$269,000	$369,000
Stowers Pump Station	2	$150,000	$206,000
Steelhead & Coho Pump Station	2	$150,000	$206,000
East 5th & South Cole Pump Station	2	$150,000	$206,000
Total		**$1,210,500**	**$1,659,500**

WWTP Improvements and Expansion

Capital costs for the recommended projects and for each potential future permit condition (PS #1, PS #2, PS #3, and PS #4), are summarized in Table ES.9.4.

TABLE ES.9.4
WWTP IMPROVEMENTS AND EXPANSION COST ESTIMATES

Item	Total Cost PS #1	Total Cost PS #2	Total Cost PS #3	Total Cost PS #4
Influent Screen	$485,355	$485,355	$485,355	$485,355
Grit Removal	$901,000	$901,000	$901,000	$901,000
Flow Equalization Basin	$1,190,000	$1,190,000	$1,190,000	$1,190,000
Transfer Pump Station	$844,000	$844,000	$844,000	$844,000
SBR	$6,707,000	$6,707,000	$6,707,000	$6,707,000
Tertiary Filtration	$2,387,000	$2,387,000	-	-
Lagoon Desludging & Disposal	$3,875,000	$3,875,000	$3,875,000	$3,875,000
Aerobic Digester	$3,332,000	$3,332,000	$3,332,000	$3,332,000
Biosolids Processing Facility	$1,867,000	$1,867,000	$1,867,000	$1,867,000
Disinfection (HS/UV)	$1,460,500	$1,460,500	$1,460,500	$1,460,500
Recycled Water Storage Improvements	$3,348,857	$3,348,857	$3,348,857	$3,348,857
Recycled Water Storage Expansion	$13,478,000	$4,356,000	$4,356,000	-
Recycled Water Irrigation Expansion	$2,010,000	$1,170,000	$1,110,000	$413,000
Discharge Monitoring Station	$415,000	$415,000	$415,000	$415,000
Misc. Equipment	$750,000	$750,000	$750,000	$750,000
Effluent Pump Station Upgrade and Expansion	$697,000	$697,000	$697,000	$697,000
Site Structures	$1,170,000	$1,170,000	$1,170,000	$1,170,000
Site Improvements and Yard Piping	$2,519,000	$2,519,000	$2,519,000	$2,519,000
WWTP Construction Estimate Total	**$47,437,000**	**$37,475,000**	**$35,028,000**	**$29,975,000**
Engineering - Design - Bidding Services	$4,744,000	$3,748,000	$3,503,000	$2,998,000
Engineering - Construction Services	$4,744,000	$3,748,000	$3,503,000	$2,998,000
Land Acquisition	$1,500,000	$1,500,000	$1,500,000	$-
Value Analysis and Value Engineering	$225,000	$225,000	$225,000	$225,000
Contingency (15%)	$7,116,000	$5,622,000	$5,255,000	$4,497,000
Environmental Report	$125,000	$125,000	$125,000	$100,000
Wetland Mitigation	$100,000	$100,000	$100,000	$100,000
Review Fees	$15,000	$15,000	$15,000	$15,000
Permitting	$150,000	$150,000	$150,000	$150,000
Administration & Legal	$300,000	$300,000	$300,000	$150,000
WWTP Total Project Estimate	**$66,456,000**	**$53,008,000**	**$49,704,000**	**$41,208,000**

The total present worth costs, in 2018 dollars, for WWTP improvements are summarized in Table ES.9.6.

TABLE ES.9.5
WWTP IMPROVEMENTS
TOTAL PRESENT WORTH ESTIMATE (2018 DOLLARS)

Item	Total Cost PS #1	Total Cost PS #2	Total Cost PS #3	Total Cost PS #4
WWTP Total Project Cost Estimate	$66,456,000	$53,008,000	$49,704,000	$41,208,000
WWTP O&M Total Present Worth	$17,264,000	$16,534,000	$16,286,000	$15,555,000
WWTP Total Present Worth	**$83,720,000**	**$69,542,000**	**$65,990,000**	**$56,763,000**

Total Project Costs

The total project costs, in 2018 dollars, for Phase 1 collection system improvements, Phase 1 pump station improvements, and various WWTP improvements scenarios are summarized in Table ES.9.6.

TABLE ES.9.6
TOTAL PROJECT COSTS (2018 DOLLARS)

Item	Total Cost PS #1	Total Cost PS #2	Total Cost PS #3	Total Cost PS #4
Collection System Improvements – Phase 1	$4,669,900	$4,669,900	$4,669,900	$4,669,900
Pump Station Improvements – Phase 1	$672,500	$672,500	$672,500	$672,500
WWTP Total Project Cost Estimate	$66,456,000	$53,008,000	$49,704,000	$41,208,000
Total Project Cost Estimate	**$71,798,400**	**$58,350,400**	**$55,046,400**	**$46,550,400**

Because funding acquisition and design of improvements will generally require approximately three years to complete, the total projected costs in three years (2021), assuming an annual inflation factor of 3%, is shown in Table ES.9.7.

TABLE ES.9.7
TOTAL PROJECT COST (2021 DOLLARS)

Item	Total Cost PS #1	Total Cost PS #2	Total Cost PS #3	Total Cost PS #4
Collection System Improvements – Phase 1	$5,103,000	$5,103,000	$5,103,000	$5,103,000
Pump Station Improvements – Phase 1	$735,000	$735,000	$735,000	$735,000
WWTP Total Project Cost Estimate	$72,619,000	$57,924,000	$54,313,000	$45,030,000
Total Project Cost Estimate	**$78,457,000**	**$63,762,000**	**$60,151,000**	**$50,867,000**

ES.10 Financing

Some level of outside funding assistance in the form of grants or low-interest loans will likely be necessary to make the proposed improvement projects affordable for the City of Molalla and its citizens. In evaluating loans, grants, and local programs, the primary objective is to select a program, or a combination of programs, that are most applicable and available for the intended project. It is recommended that the City undertake efforts to secure funding in the form of grants, if available, and low interest loans. To achieve this goal, a “One-Stop” meeting with the funding agencies is recommended as soon as the City establishes a firm commitment as to the schedule and the extent of their capital improvements. An initial “One-Stop” meeting was conducted during the development of this plan. However, once the requirements of the NPDES permit are solidified, additional meetings with funding agencies will be required to facilitate funding requirements for infrastructure improvements.

A brief description of the major federal and state funding programs that are typically utilized to assist qualifying communities in the financing of infrastructure improvement programs is provided in Section 6. The primary funders of wastewater infrastructure in Oregon are the State Revolving Fund and United States Department of Agriculture (USDA) Rural Development.

Most state and federal grant programs, with which the supply is constantly diminishing, require that the project address a chronic DEQ issued violation or order and meet or exceed a predetermined user fee before the project is eligible for grant funding. Among other evaluation methods, USDA Rural

Development evaluates sewer user rates and expects local rates to be at or above that of similar communities before the project is grant eligible. The City's median household income is also a factor, as grants are typically only available for low income communities.

Understanding the City's existing rate structure, the additional costs incurred resulting from future incurred debt retirement, and O&M expenditures associated with impending improvements is necessary. Existing wastewater rates are derived based on a base rate and water consumption. Based on a winter water consumption of 150 gpd per Equivalent Dwelling Unit, or approximately 600 cubic feet of monthly water use, the average residential sewer bill is approximately $57.31/month. The average wastewater rate (residential) as a percentage of the Median Household Income (MHI) $55,534 is 1.2%. Based on a Single Family Residence (SFR) usage rate, the City has 3,272 EDUs. Changes to the City's rate structure will be required, and a Sewer Rate Study will be prepared to establish rates to sufficiently fund future capital replacement and improvement needs, provide sufficient revenues for Operation and Maintenance, and maintain an adequate reserve fund.

SECTION 1:

PROJECT PLANNING

SECTION 1: **PROJECT PLANNING**

1.1 Introduction and Location

Purpose

The purpose of this Wastewater Facility and Collection System Master Plan (WWFCSMP) is to provide the City of Molalla (City) with a comprehensive wastewater utility planning document. This WWFCSMP provides guidance for the following:

- Identifying potential improvements and management options.
- Repairing aging infrastructure.
- Addressing current sizing needs.
- Serving as a planning document to meet reasonable long-term growth within the City.
- Addressing regulatory requirements for health, sanitation and security.
- Assisting the City in evaluating available funding for financing improvements.

The City's wastewater collection system consists of approximately 160,299 lineal feet of gravity collection pipes, 4,376 lineal feet of pressure sewer mains, 534 manholes and five pump stations. The City's wastewater treatment plant is comprised of an influent fine screen, aerated lagoon, two facultative/storage lagoons, tertiary treatment, and disinfection. Effluent is discharged to the Molalla River from November 1st to April 30th. Recycled water is land applied from May 1st to October 31st.

The City and Oregon Department of Environmental Quality (DEQ) entered into a Mutual Agreement Order (MAO) that establishes a schedule under which the City must bring the wastewater treatment system into National Pollutant Discharge Elimination System (NPDES) Permit compliance. This WWFCSMP is part of the MAO required projects and identifies alternatives for improving the wastewater collection and treatment system.

Objectives

In order to protect the public health and welfare within the planning area and to improve water quality, the overall objectives of this WWFCSMP are to:

- Evaluate the condition of the existing collection system and assess its capacity, identifying current system deficiencies.
- Estimate current and projected wastewater flows and loads from within the current City Urban Growth Boundary (UGB).
- Develop potential wastewater collection system improvements to correct existing problems and to serve existing and future development within the City Limits consistent with DEQ regulations and requirements.
- Fulfill the engineering planning document requirements of the DEQ Clean Water State Revolving

Fund (CWSRF), Oregon Business Development Department (OBDD) Infrastructure Finance Authority (IFA), and United States Department of Agriculture (USDA) Rural Development (RD).

- Provide cost estimates and phasing recommendations for the recommended improvements.

- Provide recommendations for improvements to the wastewater treatment facility that will (once in operation) meet the conditions of the NPDES waste discharge permit, comply with Total Maximum Daily Load (TMDL), and provide treatment capacity for future growth. The planning period for this study will be through the year 2043 for these objectives. Municipal treatment and pumping equipment is typically designed for a 20-year life. A longer planning period allows additional time for planning, securing funding, design, and construction, to the facilities before becoming operational. Many improvements last well beyond the 20-year design life.

Previous Studies and Information

The following studies, reports and other sources of information have been used in preparation of this WWFCSMP:

- Consolidated Recycled Water Use Plan, City of Molalla, Oregon (Brown and Caldwell, 2015)

- Comprehensive Plan, Molalla, Oregon (2014)

- Wastewater Treatment Plant Technical Assistance Visit, City of Molalla, Oregon (Paul Kennedy / DEQ, 2013)

- Biosolids Management Plan, City of Molalla, Oregon (Jon Patrick, 2013)

- Wastewater Treatment Plant Improvements, City of Molalla, Oregon (Tetra Tech / KCM, 2007)

- Wastewater Treatment Plant Improvements, City of Molalla, Oregon (Tetra Tech / KCM, 2002)

- Molalla Wastewater Facility Plan (Tetra Tech / KCM, 2000)

- Wastewater System Facility Plan, Review Draft, City of Molalla, Oregon (EAS, 1996)

- Highway 211 Sanitary Sewer Improvements – Bear Creek to Molalla Avenue “As-Built,” City of Molalla, Oregon (DeHaas, 1995)

- Toliver / Bear Creek Sanitary Sewer Diversion “As-Built.” City of Molalla, Oregon (DeHaas, 1991)

- Bear Creek Interceptor “As-Built,” City of Molalla, Oregon (DeHaas, 1988)

- East Main Street Sewer Extension, City of Molalla, Oregon (Westech, 1979)

- Sewage Treatment Plant (Schedule T) and Trunk Sewer (Schedule S), City of Molalla, Oregon (Westech, 1977)

- Sewage Collection System, City of Molalla, Oregon (Clark & Groff, 1954)

Scope of Study

The scope of the City of Molalla WWFCSMP is intended to address problems and deficiencies within the collection system and at the WWTP, and to comply with the applicable requirements of the DEQ.

This report is developed in accordance with the guidelines set forth in "*Preparing Wastewater Planning Documents and Environmental Reports for Public Utilities Financed by Infrastructure Finance Authority, Oregon Department of Environmental Quality, Rural Community Assistance Corporation, and United States Department of Agriculture*." A brief summary of the scope of this study is outlined below:

- **Study Area Characteristics.** Study area characteristics were identified; they include both physical and socioeconomic conditions. City population and land use are addressed and projected into the future.

- **Basis of Planning.** Applicable regulatory requirements were identified and addressed, including the City's MAO with DEQ, management plans, current and future treatment criteria, and discharge standards. The present design capacity of the City's conveyance system and treatment plant was estimated to assess the present and future operation of wastewater facilities.

- **Future Design Conditions and Considerations.** Wastewater characteristics were identified in terms of loads, flows, and strength during various times of the year. Future characteristics were projected to establish capacity requirements. Flows were addressed for both dry period and wet period conditions, and unit design values were established. Future wastewater characteristics were projected.

- **Existing System Evaluation.** Existing wastewater facilities were investigated in detail. Data was collected on the existing wastewater collection and treatment systems from such sources as operating records, conversations with City Staff, onsite investigation, maps, as-built records and other pertinent documentation. Existing facilities were evaluated in terms of location, sizing, capacity, condition, limitations, and performance. Consideration was given to the manner in which existing facilities could be utilized in the future. The Infiltration and Inflow (I/I) contribution to the wastewater flow was evaluated based on past and recent I/I investigations and historic plant operating data.

- **Evaluate Improvement Alternatives.** Alternatives were identified for conveyance and treatment. Unfeasible options were dismissed, and a limited number of selected alternatives were established and evaluated in detail.

- **Recommendations and Capital Improvement Plan.** A recommended plan was formulated which will enable the City to meet the present and future demands and requirements of their wastewater facilities. This plan includes preliminary design data, capital improvement and operational costs, a project schedule, and a preliminary financing strategy.

Authorization

The City of Molalla authorized Project Delivery Group, LLC to proceed with this Wastewater Facility and Collection System Master Plan in August of 2017. Project Delivery Group, LLC engaged the services of The Dyer Partnership to lead this effort.

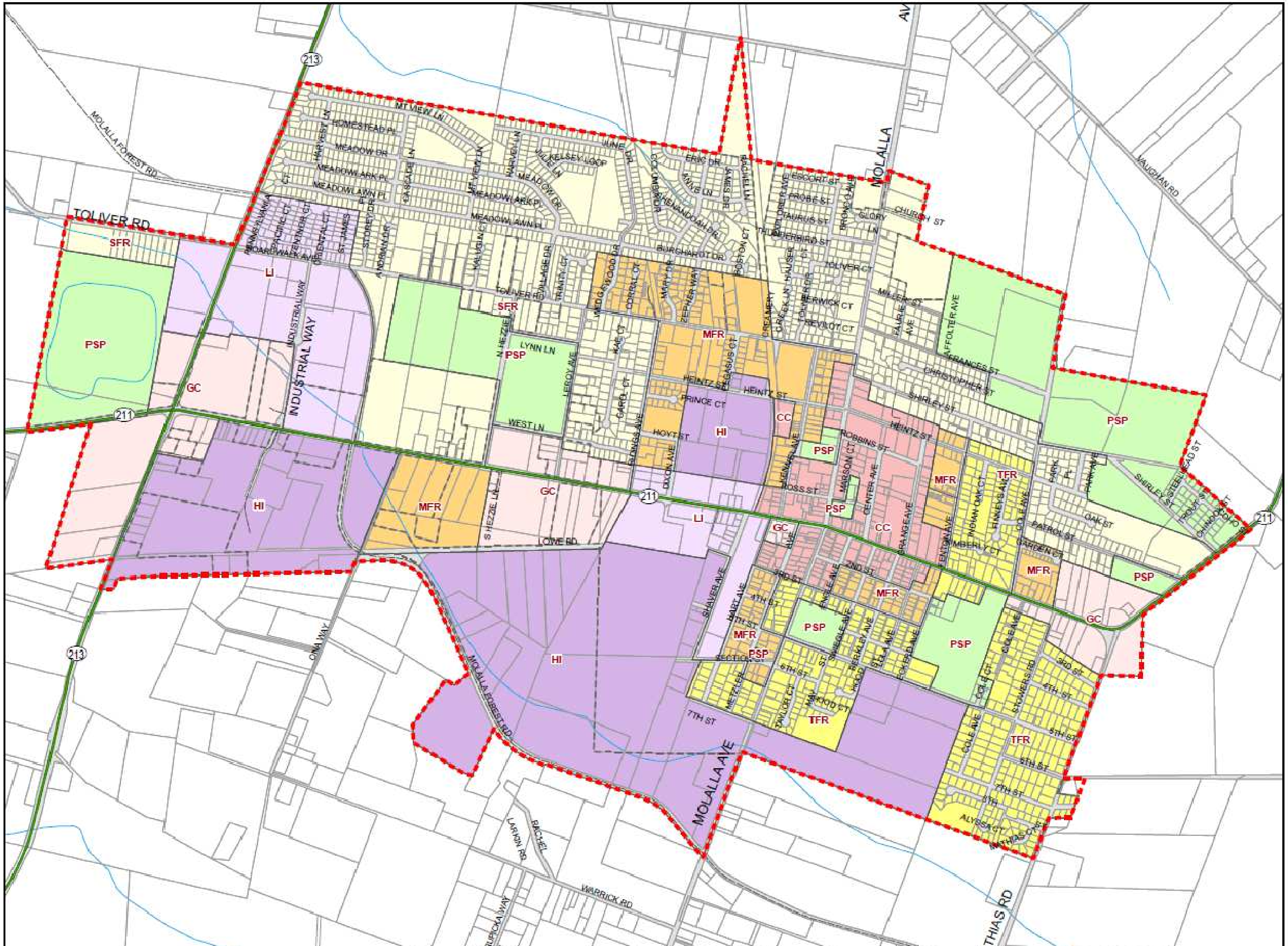
Location and Limits

The City of Molalla is a fast growing rural community located in the southwest section of Clackamas County. The City is approximately 14 miles south of Oregon City via State Highway 213, approximately 25 miles northeast of Salem, and approximately 27 miles southeast of Portland. The surrounding area around the City of Molalla is generally used for agricultural purposes.

Highway 213 runs north-south through the western end of the City, and Highway 211 runs east-west through the midsection of the City. Bear Creek, a tributary of the Pudding River, flows west and is located immediately south of the City. The Molalla River is located about a mile east of the City's current urban growth boundary (UGB). Figure 1.1.1 illustrates the location of the City.

FIGURE 1.1.1
CITY LOCATION

The City of Molalla owns and operates its own municipal wastewater collection and treatment system. The system consists of a gravity flow collection system with five pump stations and a wastewater treatment plant. The service area for this study is defined by the land use plan map, as defined in the City's 2014 Comprehensive Plan. The Comprehensive Land Use Plan Map is illustrated in Figure 1.1.2. The City currently serves most of the constituents within the existing City limits and anticipates the expansion of the City limits through property annexation. This study is based on 20-year population projections and realistic UGB growth possibilities furnished by the City.



City of Molalla

Comprehensive Plan

Adopted 2014

Legend

Comp. Plan Designations

- Single-Family Residential
- Two-Family Residential
- Multi-Family Residential
- Public or Semi-Public
- General Commercial
- Central Commercial
- Light Industrial
- Heavy Industrial
- Urban Growth Boundary
- City Boundary

1:12,800

N

Feet

0 500 1,000

CLACKAMAS COUNTY

GEOGRAPHIC INFORMATION SYSTEMS

DEPARTMENT OF INFORMATION SERVICES/GEOGRAPHIC INFORMATION SYSTEMS
121 LIBRARY COURT
OREGON CITY, OREGON 97045

MolallaPLAN_11x17.MXD | \Projects\Cities\Molalla | Feb 2012

FIGURE NO.
1.1.2

WASTEWATER FACILITY AND COLLECTION SYSTEM MASTER PLAN
CITY OF MOLALLA, CLACKAMAS COUNTY, OREGON

PLANNING AREA

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS

DATE: OCTOBER, 2017

PROJECT NO.: 100.26

\\dyer2\H\dyer-part\AAprojects\100.00 Engineering, Misc\100.26 PDG – Molalla WW Fac & Coll Syst MP\dwg\FIGURE1.1.2.dwg, 10/20/2017 10:37:37 AM

PLOT DATE October 20, 2017

Land Use

The City of Molalla's most recent Comprehensive Plan was published in 2014. A copy of the City's zoning map, as published in the 2014 Comprehensive Plan, is included in Appendix B. The City is primarily zoned residential, with a downtown commercial center and an industrial area to the south and southwest.

1.2 Environmental Resources

The following provides information about the environmental resources in and around the City of Molalla.

Climate

The Molalla area has a temperate maritime climate with dry, moderately warm summers and wet, mild winters. The prevailing winds are from the west and northeast in the summer and from the south and the southwest in the winter. Periods of easterly winds bring cold, clear weather in winter and exceptionally dry, hot weather in the summer. About 60 percent of the annual precipitation occurs from November through February while only about 10 percent occurs from June through September. Winter temperatures below 10 degrees and summer temperatures above 100 degrees are infrequent. Snowfall records are not kept for the City of Molalla, however Salem is the nearest City where records are kept. Salem averages 6.2 inches of snow per year.

Precipitation data was obtained from National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information. The mean annual precipitation for Station USC00355681 from 1981 to 2010 is 47.41 inches. The wettest month is typically November (7.04 inches), followed closely by December (6.9 inches). Precipitation data is included in Appendix B.

Historical Resources

William Russell took up the first land claim in 1840. The fertile soil, ample water and rich grasses of the Willamette Valley soon lured other settlers to follow. Soon the land, once the favorite hunting ground of the Native American, was under cultivation. Ten years later on April 9, 1850, the first Post Office was established near the present site of Liberal, approximately three miles to the north of the City. The Post Office was discontinued at Liberal in 1851. Records do not give the exact location, but it is assumed on December 7, 1868 the Post Office was reestablished in the City of Molalla.

Legend has it that two pioneer trails, east-west and north-south, met at the present intersection of Molalla Avenue and Main Street, and naturally by 1856 the Molalla area was a thriving agricultural center with the first school and a general store opening a year later. The City of Molalla developed rapidly as an important trade center and later, as a lumber manufacturing town.

The year 1913 seemed to be the magical year for the Molalla area; the first railroad, the Willamette Valley Southern, steamed through town. With the railroad came a new Post Office, a new school, and the first weekly newspaper. The first Molalla Buckeroo was held in 1913, the year the City incorporated.

The name "Molalla" has had many different spellings over the years, and there are a number of theories as to its origin. William Hatchette "Uncle Billy" Vaughan, a pioneer of 1885, claimed that the name originated from two Chinook Indian words, "moolek" for elk and "olilla" for berries, both plentiful in the mountain region during that time. Whatever the case, the 27 different spellings have evolved into one and the community has settled on the spelling "Molalla".

Topography

The topography is level to gently sloping land with the center of the City (the intersection of Highway 211 and Molalla Avenue) at an elevation of approximately 375 feet. Elevations within the City range from approximately 300 feet to 420 feet. Ground slopes range from nearly flat to ten percent. Steeply sloped areas within the current City of Molalla UGB are limited to stream embankments within riparian areas, and have very little impact on buildable land supply. However, an escarpment south of the current UGB includes slopes of 25 percent or greater, which is a consideration for long range planning analyses. A general terrain map is included in Appendix B.

Soils

Predominant soils in the study area are alluvial silt deposits of the Concord-Clackamas-Amity and Briedwell associations. These soils have high seasonal water tables and a depth of hard rock of 20 to 40-inches or more. Although classified as silts, these soils contain areas of clay, gravel, or loam and are somewhat poorly drained. Septic tank limitations in the area are classified as moderate to severe. The soils, however, are classified as having fair stability for building sites with slight to moderate restrictions. A Natural Resources Conservation Service (NRCS) soil map for the proposed service area is included in Appendix B.

Water Resources

In the City of Molalla, urban natural resources such as fish and wildlife habitat and riparian vegetation, are associated with significant wetlands and stream corridors. Wetlands are one of the most biologically productive components of the environment. Their functions and value include water quality improvement, fish and wildlife habitat, flood control, point of entry for groundwater discharge, shoreline anchoring, and erosion control.

In 2001, the City completed a Local Wetland Inventory (LWI) and riparian assessment that describes and maps significant wetlands and streams within the City's UGB. The LWI was approved by the Oregon Department of State Lands (DSL) in March of 2004. Most significant wetlands are associated with the creeks and natural drainage ways described below.

As shown on LWI maps in Appendix B, the City of Molalla UGB area has three drainage basins:

- The northeastern portion of the UGB is within the Molalla River basin; drainage from this basin flows northeastward via a natural drainage way to the Molalla River.
- The central portion of the UGB is within the Creamery Creek basin; Creamery Creek flows diagonally from the southeast to the northwest before reaching the Molalla River north of the UGB.
- The southern portion of the UGB is within the Bear Creek basin. Bear Creek joins Kaiser Creek (located south of the UGB) to flow to the Pudding River many miles to the west.

Because the LWI addressed wetlands within the existing UGB, it did not include two large concentrations of hydric soils located northeast and east of the UGB on predominantly Class IV agricultural soils. These "farmed" wetlands are located along Vaughn Road northeast of the current UGB, and generally south of Feyrer Park Road east of the UGB. Local wetland inventory maps are included in Appendix B.

Flooding

Flood hazards are shown on Federal Emergency Management Agency (FEMA) maps. These maps show the floodway, 100-year floodplain, and 500-year floodplain associated with the Molalla River.

Protection of riparian areas associated with Molalla's creeks will also protect nearby development from periodic flooding. See Appendix B for the Flood Insurance Rate Map (FIRM).

There are no designated floodplains in the City of Molalla, but Bear Creek lies within the UGB. Bear Creek's floodplain has not been identified because it was outside corporate limits when the US Army Corps of Engineers last mapped floodplains in Oregon.

Seismic and Fault Hazards

Oregon is located within the circum-Pacific belt of crustal instability along with California, Washington, British Columbia and Alaska. All of these states and provinces, which border the Pacific Ocean, have received violent earthquake shocks in recent years. Since 1841, the State of Oregon has experienced 167 earthquakes and of these, 47 were centered in the Portland vicinity. The Molalla area experienced an earthquake in March of 1993 with a magnitude of 5.7 centered approximately 13 miles southwest of the City.

Economic Conditions

The City of Molalla's economy was historically based on logging and agriculture, but with the decline of the timber industry, the City is focusing on commerce. Major employers include Molalla River School District, Brentwood Industries, and RSG Forest Products. Tourism is also playing a role in the City's efforts to diversify.

Despite hardships resulting from the retraction of the timber industry, the Molalla area remains an attractive location to reside. The City of Molalla is located near numerous recreational activities, and has become a bedroom community to the Portland and Salem areas. However, the City's policy objective is to improve its jobs to housing balance and regain its status as an independent economic region rather than a bedroom community.

The 2011-2015 American Community Survey 5-Year Median Household Income (MHI) estimate is $55,534 (± $3,655). The 5-Year mean household income estimate is $64,447 (± $4,896). The MHI for the State of Oregon is $51,243 (± $271).

Energy Production and Consumption

No major energy resources have been identified in the Study Area. Energy consumption is expected to increase within the Study Area due to population growth during the planning period. Portland General Electric (PGE) provides electrical energy to the City of Molalla.

1.3 Population Trends

An accurate population forecast is required to determine wastewater flow projections through the end of the 20-year study period. Population forecasts are important in that they influence infrastructure sizing requirements. If the 20-year population forecast is severely underestimated or overestimated, the wastewater system will struggle to perform in compliance with permit requirements. Oversized systems result in excess spending, higher operational costs, and increased oversight requirements. Undersized systems create hydraulic and biological limitations.

The City anticipates growth consistent with historical trends. Population growth has been strong in the City of Molalla, averaging 4.0 percent annually over the last 20 years, slightly higher than the 50 year average of 3.4 percent annual growth. The population increased steadily from 1970 to 2000, averaging approximately 70 persons per year. Population increases jumped from 1990-2010, averaging around 200 persons per year. Based on building permit data, this jump in population growth may be largely due to the housing boom from 2000 to 2007, with an average of 72 new permits issues each year. In the latter part of the last decade, building activity declined dramatically, with an average of only 18 new permits issued annually from 2008 to 2010. Overall, there is a low supply of developable residential land in the City of Molalla.

Projections are generally based upon the extrapolation of past trends from an area or region. While history may not repeat itself, it serves as an initial basis for population projections. Key factors that influence population projections include: growth in surrounding communities, available developable land, and job opportunities. In general, northwest Oregon is experiencing strong growth, particularly in Portland and surrounding communities. Communities around the Portland Metro area are experiencing overflow as people seek rural living but within a reasonable commute to Portland's economy and job opportunities. The City of Molalla is therefore positioned to experience considerable growth.

Population data derived from Portland State University (PSU) Population Research and Census Center is summarized in Figure 1.3.1 and Table 1.3.1.

FIGURE 1.3.1
HISTORICAL AND PROJECTED POPULATION

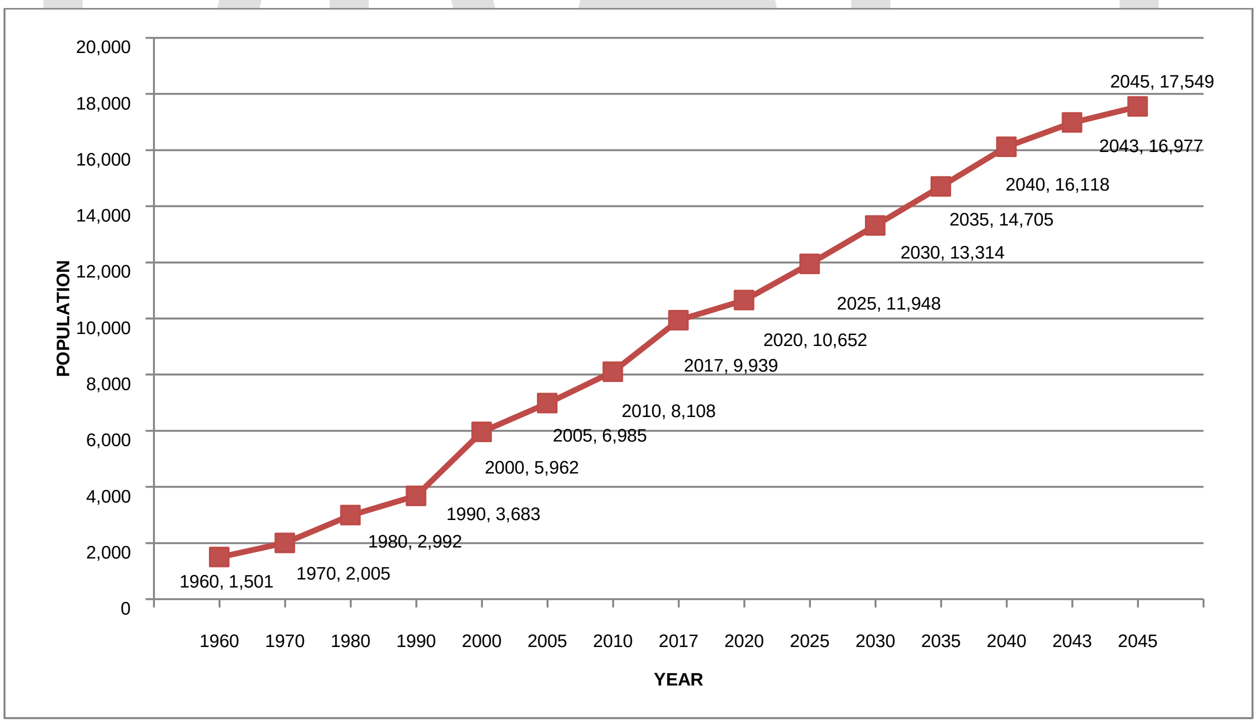


TABLE 1.3.1
PSU POPULATION FORECAST

Year	Population[1]	AAGR[2]
2017	9,939	3.2%
2020	10,652	2.4%
2025	11,948	2.4%
2030	13,314	2.3%
2035	14,705	2.1%
2040	16,118	1.9%
2043	16,977	1.8%
2045	17,549	1.7%

Notes:
1. City of Molalla population forecast prepared by Population Research Center, PSU, June 30, 2017.
2. Average Annual Growth Rate (projected).

The anticipated time needed to complete the facilities plan, secure financing, and complete design and construction is five years. Referenced from the base year of 2018, the recommended planning year is 2043. The City of Molalla population projection for the year 2043 is 16,977.

1.4 Community Engagement

Community engagement provides the opportunity for the system owners (local citizens) to meaningfully participate in development and to provide guidance on implementation and management of their wastewater system.

Goals of community engagement include: 1) develop an understanding of the environmental issues; 2) define regulatory requirements; 3) present design development information; 4) collaborate in developing solutions; and 4) review funding/revenue strategies for a recommended plan.

Various community engagement opportunities occur during the planning process to inform and receive feedback about the project from the public, regulatory agencies and stakeholders. Goals are to identify community issues of concern, and share information utilized to develop recommendations. Feasible feedback from the stakeholders is incorporated into the management of the wastewater system. The community engagement opportunities include:

- Local agency and jurisdictional briefings.
- News releases in the local newspaper.
- Project fliers distributed during a monthly utility billing cycle.
- Articles posted on the City's web page.
- Hosting a public stakeholders meeting.
- Adoption of the WWFCSMP through a public Planning Commission meeting and City Council meeting.

Two advisory groups (Technical Advisory Committee and Project Advisory Committee) were also formed to facilitate the development of the plan and to ensure that the plan is developed in the best interests of the community. Representatives for the Technical Advisory Committee (TAC) and the Project Advisory Committee (PAC), along with the members of the project management team are listed below.

Technical Advisory Committee

- Dan Huff, City of Molalla
- Aldo Rodriguez, City of Molalla
- Andy Peters, City of Molalla
- Frank Schoenfeld, City of Molalla
- Karen Buerhig, Clackamas County
- Mike Pinney, Oregon DEQ
- Mike Penunuri, Molalla Fire District
- Matt Lacy, Molalla River School District
- Jennifer Donnelly, Oregon Department of Land Conservation and Development

Project Advisory Committee

- Elizabeth Klein, Molalla City Council
- Cindy Dragowski, Molalla City Council
- Rae Lynn Botsford, Molalla Planning Commission
- Bill Taylor, Molalla River Watch Council
- Anna Ranking, Pudding River Watershed Council
- Nathan Williams, Member

Project Management Team

- Gerald Fisher, City of Molalla
- Steve Major, The Dyer Partnership
- Ryan Quigley, The Dyer Partnership

SECTION 2:
EXISTING FACILITIES

SECTION 2: **EXISTING FACILITIES**

2.1 Location Map

The location of the City's major wastewater collection system components, including pump stations and force mains, is shown on Figures 2.3.1 and 2.3.2, on the following pages. The City's collection system consists of approximately 160,299 lineal feet of gravity collection pipes, 4,376 lineal feet of pressure sewer mains, 534 manholes, and five pump stations.

2.2 History

1955 The City of Molalla's original sewer system and wastewater treatment plant were constructed to replace malfunctioning individual septic systems. The wastewater treatment facility was located south of Toliver Road, and treated effluent was discharged to Bear Creek. Over time, the collection system was expanded to serve the City's growing population.

1980 Due to population growth and the overall age of the treatment facility, the original facility was abandoned and replaced with a new WWTP, located approximately half a mile east of the original facility.

2000 A new effluent pump station and effluent/irrigation force main was installed, along with a new emergency generator.

2002 Major Wastewater Treatment Plant (WWTP) upgrades included the construction of a new headworks, new transfer pump station, and the extension of irrigation supply lines.

2006 In response to increasing wastewater flows and insufficient flow to provide adequate dilution in Bear Creek (former Outfall 001), the original outfall was abandoned and a new outfall was relocated to the Molalla River at approximately River Mile (RM) 20.

2007 To address the ongoing issue with suspended solids, another Dissolved Air Flotation (DAF) unit was installed, and four new gravity filters were constructed to replace two older and problematic units. The chlorine contact basin was also relined.

2018 The City entered into a Mutual Agreement Order MAO with the Oregon Department of Environmental Quality (DEQ) for recurring permit violations. The MAO establised a schedule and interim compliance level for operating the WWTP while working to correct the system deficiencies.

Table 2.2.1 summarizes the age of major unit process components, as compared with the expected service life based on industry standards. Concrete structures at wastewater treatment facilities generally have a service life of 50 years. Mechanical and electrical components are typically assigned an expected life of 20 years.

TABLE 2.2.1
CITY OF MOLALLA WWTP COMPONENT AGE AND EXPECTED LIFE

Facility	Component	Year Installed	Age (years)	Expected Useful Life (years)
Headworks[1]	Structure	2002	15	50
	Mechanical Equipment	2002	15	20
	Electrical	2002	15	20
Aeration Basin	Asphalt-Concrete Liner	1980	37	50
	Mechanical Equipment	2017	0	20
	Electrical	1980	37	20
Transfer Pump Station	Structure	2002	15	50
	Mechanical Equipment	2002	15	20
	Electrical	2002	15	20
Dissolved Air Flotation Unit #1	Structure	1980	37	50
	Mechanical Equipment	1980	37	20
	Electrical	1980	37	20
Dissolved Air Flotation Unit #2	Structure	2007	10	50
	Mechanical Equipment	2007	10	20
	Electrical	2007	10	20
Gravity Filters	Structure	2007	10	50
	Mechanical Equipment	2007	10	20
	Electrical	2007	10	20
Effluent Pump Station	Structure	2000	17	50
	Mechanical Equipment	2000	17	20
	Electrical	2000	17	20
Standby Generator	Structure	2000	17	50
	Mechanical Equipment	2000	17	20
	Electrical	2000	17	20
Discharge Monitoring Structure	Structure	2006	11	50
	Mechanical Equipment	2006	11	20
	Electrical	2006	11	20
Chlorine Contact Basin	Liner	2007	10	50

1. The influent screen underwent a major rebuild during the development of this plan.

The following sections include more detailed descriptions and analyses of each component of the wastewater system, including capacity, performance, and operation and maintenance issues.

2.3 Condition of Existing Facilities

Existing Collection System

History

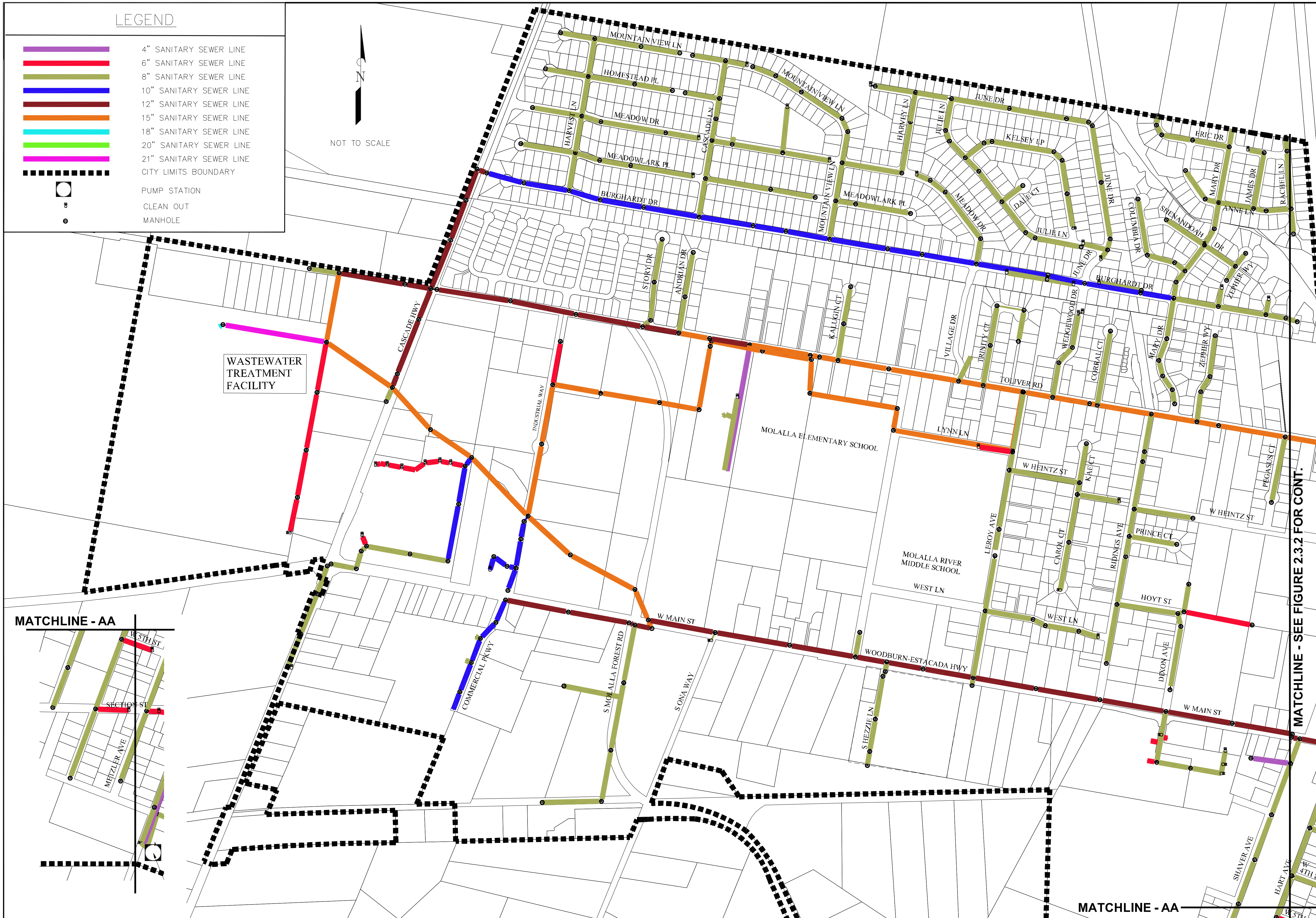
Prior to 1955, the City's sewer system had approximately 3,700 feet of 6-inch and 8-inch piping and 10 manholes. Before 1955 collection lines were manufactured out of open-jointed concrete pipe. In 1955, an additional 47,200 feet of 8-inch to 15-inch diameter piping (PVC and asbestos cement) was installed. The main trunk sewer to the original treatment plant was a 15-inch diameter line, primarily along Toliver Road.

When the existing treatment plant was constructed in 1980, the main trunk sewer line was extended along Toliver Road to the WWTP. The trunk line was predominantly 12-inch and 15-inch piping with a 21-inch diameter section immediately before the WWTP. In 1988, the 15-inch Bear Creek sewer interceptor was constructed from the upstream end of the 21-inch truck line southeast along Bear Creek. The interceptor sewer was extended in 1995 with a 12-inch line from Bear Creek east along Highway 211 to Molalla Avenue. The sewer south of Highway 211 and west of Grange Street was intercepted and routed along this trunk line. The remaining system continues to flow to the original trunk line along Toliver Road. Other improvements to the collection system, over time, mainly included the addition of 8-inch sewers and lift stations to serve new subdivisions.

During the late 1970s and 1980s, the City invested considerable funding towards eliminating Infiltration and Inflow (I/I). The work included video inspections, testing, grouting, replacing some services, and replacing some 8-inch collection lines. At the time, the City reported a short term reduction in wet weather flows. As time has elapsed, the City's collection system has continued to exhibit excessive infiltration and inflow.

Existing Collection System Inventory

Most of the collection system consists of standard gravity sewers. An inventory of the existing collection system is provided in Table 2.3.1. Existing collection system maps are shown in Figures 2.3.1 and 2.3.2, on the following pages.



WASTEWATER FACILITY AND COLLECTION SYSTEM MASTER PLAN
CITY OF MOLALLA, CLACKAMAS COUNTY, OREGON

EXISTING COLLECTION SYSTEM

FIGURE NO. **2.3.1**

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS

DATE: OCTOBER, 2017
PROJECT NO.: 100.26

PLOT DATE November 14, 2017
\\dyer2\H\dyer-part\AAprojects\100.00 Engineering, Misc\100.26 PDG – Molalla WW Fac & Coll Syst MP\dwg\City Sewer Map REV 11-03-17.dwg, 11/14/2017 2:18:38 PM

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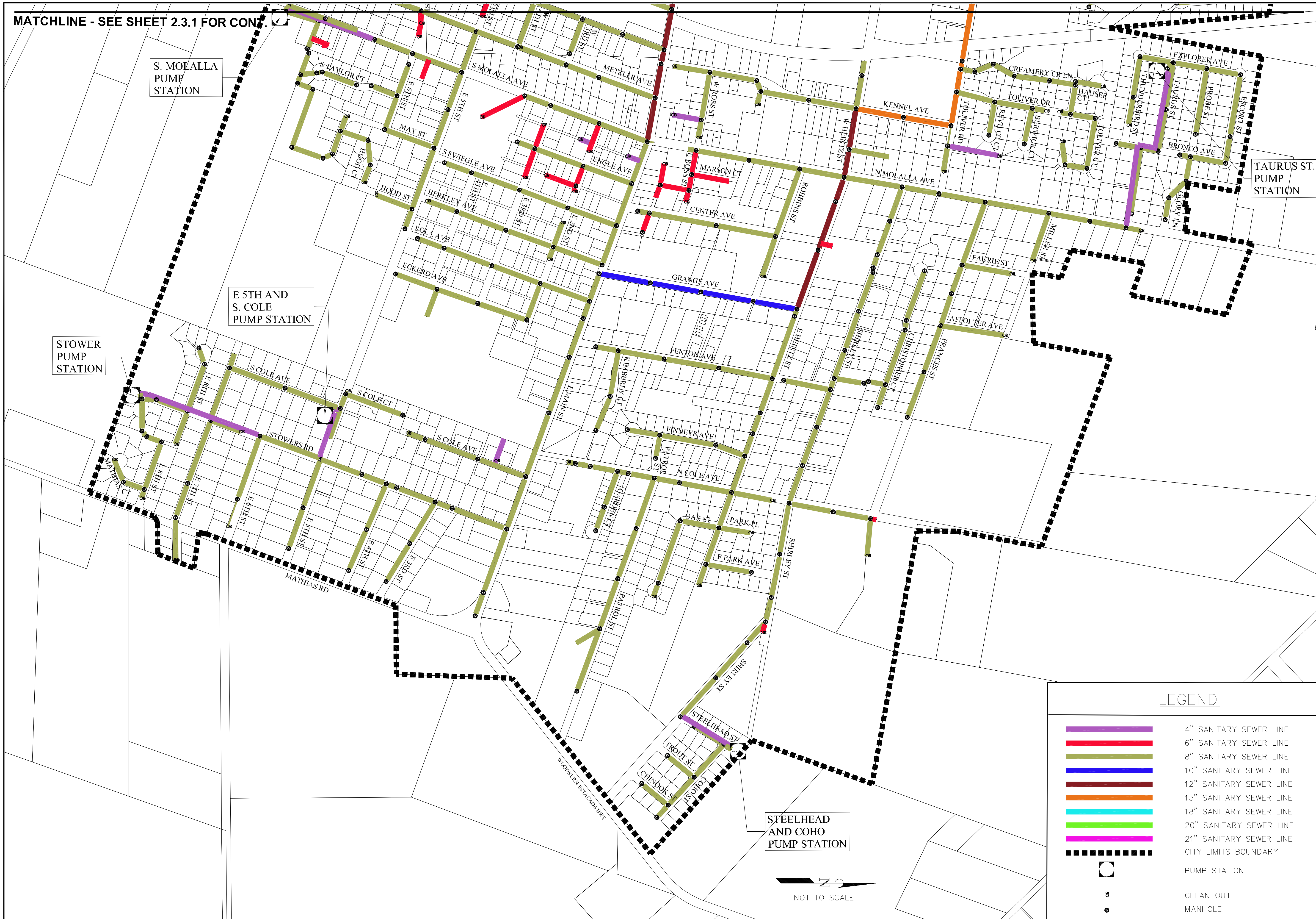


FIGURE NO. 2.3.2

WASTEWATER FACILITY AND COLLECTION SYSTEM MASTER PLAN
CITY OF MOLALLA, CLACKAMAS COUNTY, OREGON

EXISTING COLLECTION SYSTEM

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS

DATE: OCTOBER, 2017

PROJECT NO.: 100.26

TABLE 2.3.1
WASTEWATER COLLECTION SYSTEM INVENTORY, PIPE AGE, AND PIPE TYPE

Item	Item Description	Unit	Quantity[1]
1	4" Sanitary Sewer Line	FT	1,861
2	6" Sanitary Sewer Line	FT	8,104
3	8" Sanitary Sewer Line	FT	114,618
4	10" Sanitary Sewer Line	FT	8,490
5	12" Sanitary Sewer Line	FT	12,192
6	15" Sanitary Sewer Line	FT	14,291
7	18" Sanitary Sewer Line	FT	28
8	21" Sanitary Sewer Line	FT	715
9	24" Effluent Force Main	FT	27,158
10	Manholes	EA	534
11	Cleanouts	EA	95
12	Pump Stations	EA	5

1. Based on City GIS data (September 2017).

Pipe Age[2]					
< 10 yrs	10 – 20 yrs	20 – 30 yrs	30 – 40 yrs	40 – 50 yrs	> 50 yrs
8,046.7 ft	43,641 ft	29,340.9 ft	14,793.6 ft	15,568 ft	53,210.8 ft

Pipe Type[2]				
AC	ASTM D 3034 SDR 35	Concrete	CSP	Other PVC
4,182.5 ft	76,999 ft	70,101.9 ft	2,398.6 ft	10,919.1 ft

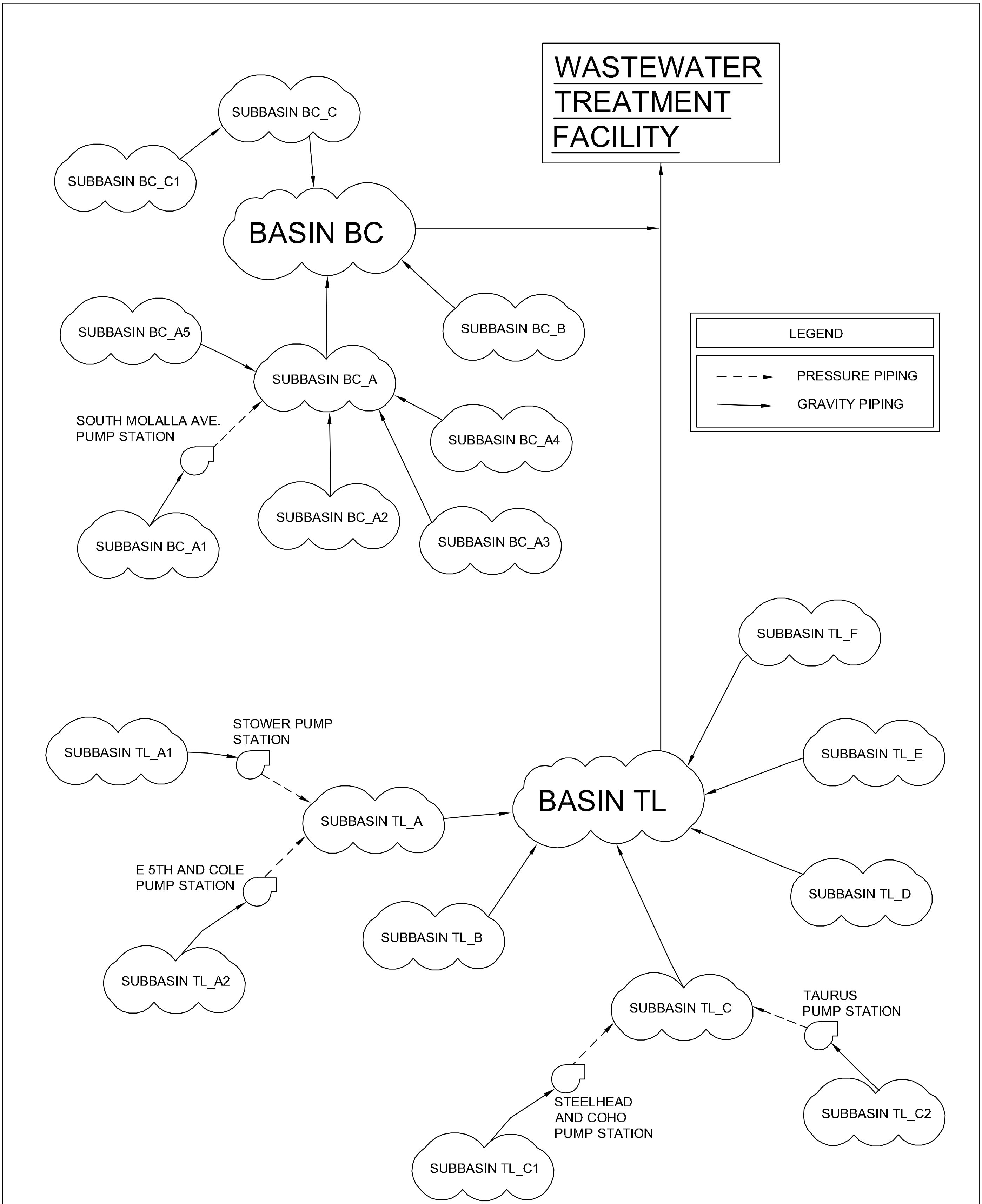
2. Based on City GIS data (April 2018).

Collection System Basins

The City's collection system is divided into two major basins; Toliver and Bear Creek. The Toliver Basin (TL) is located along Toliver Road, beginning from the WWTP, and includes the main trunk interceptor. The Bear Creek Basin (BC) originates at the WWTP, and follows Bear Creek until it intersects with Woodburn-Estacada Highway. Figure 2.3.3 and 2.3.4 illustrate the sewer basin map. Table 2.3.2 lists the number of manholes, number of cleanouts, and acres served for each basin.

TABLE 2.3.2
WASTEWATER COLLECTION SYSTEM BASIN DATA

Basin ID	Manhole Count	Cleanout Count	Acres Served
Toliver Trunk			
TL Basin	49	2	124.87
TL_Sub basins	27	5	63.93
TL TOTAL	**76**	**7**	**188.8**
TL_A Basin	31	3	110.72
TL_A1 Sub basin	10	3	10.25
TL_A2 Sub basin	8	3	22.27
TL_A TOTAL	**49**	**9**	**143.24**
TL_B	**32**	**4**	**81.6**
TL_C Basin	38	8	150.61
TL_C1 Sub basin	7	0	8.08
TL_C2 Sub basin	19	1	23.75
TL_C TOTAL	**64**	**9**	**182.44**
TL_D	**16**	**7**	**41.02**
TL_E	**10**	**3**	**12.92**
TL_F	**22**	**4**	**76.95**
Bear Creek Trunk			
BC Basin	26	8	45.21
BC TOTAL	**26**	**8**	**45.21**
BC_A Basin	47	7	115.85
BC_A1 Sub basin	16	3	14.45
BC_A2 Sub basin	2	3	5.47
BC_A3 Sub basin	21	12	41.02
BC_A4 Sub basin	5	0	7.63
BC_A5 Sub basin	5	0	6.14
BA_A TOTAL	**96**	**25**	**190.56**
BC_B	**20**	**1**	**31.35**
BC_C Basin	87	12	130.84
BC_C1 Sub basin	36	6	40.02
BC_C TOTAL	**123**	**18**	**170.86**
Grand Total	**534**	**95**	**1,164.95**



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THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	**WASTEWATER FACILITY & COLLECTION SYSTEM MASTER PLAN** **CITY OF MOLALLA, CLACKAMAS COUNTY, OREGON**	FIGURE NO.
DATE: OCTOBER 2017 PROJECT NO.: 100.26	**WASTEWATER COLLECTION SYSTEM SCHEMATIC**	**2.3.3**

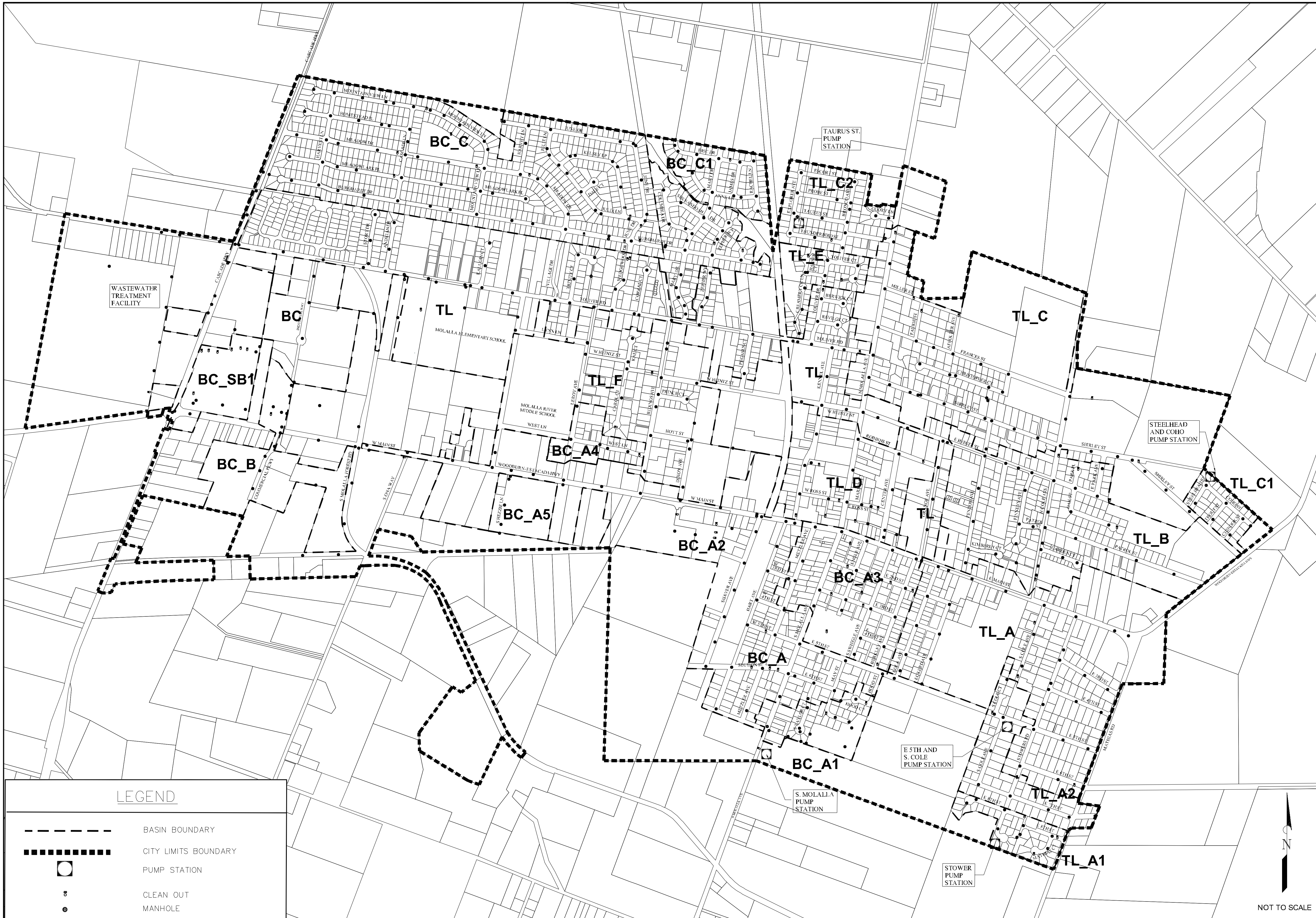


FIGURE NO.
2.3.4

WASTEWATER FACILITY AND COLLECTION SYSTEM MASTER PLAN
CITY OF MOLALLA, CLACKAMAS COUNTY, OREGON

SEWER BASIN MAP

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS

DATE: OCTOBER, 2017
PROJECT NO.: 100.26

Sub Basin TL_A
Sub basin TL_A is located in the southeast corner of town, and receives flow from sub basin TL_A1 and TL_A2. Sub basin TL_A conveys wastewater to the main trunk sewer along Toliver Road and extending to Grange Avenue. Sub basin TL_A has a total area of about 143 acres.

Sub basin TL_A1 serves the Alyssa Meadows subdivision, which consists of 21 residential lots. Wastewater from the Alyssa Meadows subdivision flows by gravity to the Alyssa Meadows pump station, where it is pumped to sub basin TL_A. Sub basin TL_A2 serves the Sunrise Acres subdivision, which consists of 32 residential lots. Wastewater from the Sunrise Acres subdivision is conveyed by gravity to the Sunrise Acres pump station, before being pumped to sub basin TL_A.

Sub Basin TL_B
Sub basin TL_B is located in the east side of town, and drains into the main truck sewer along Toliver Road that extends to Heintz Street. Sub basin TL_B is bound to the south by East Main Street, to the north by Shirley Street, and to the west by Grange Avenue. Sub basin TL_B serves a total area of approximately 82 acres.

Sub Basin TL_C
Sub basin TL_C is located in the northeast corner of town, and receives flow from sub basin TL_C1 and TL_C2. Sub basin TL_C conveys wastewater by gravity to the main trunk sewer along Toliver Road that extends to Heintz Street. Sub basin TL_C has a total area of about 182 acres.

Sub basin TL_C1 serves the Molalla River Estates, a subdivision consisting of 37 lots. Wastewater from Molalla River Estates flows by gravity to the Molalla River Estates Pump Station, where it is pumped to sub basin TL_C. Sub basin TL_C2 serves the Shel-Mar Acres subdivision, which consists of 98 residential lots. Wastewater from the Shel-Mar Acres subdivision is conveyed by gravity to the Shel-Mar Acres Pump Station, before being pumped to sub basin TL_C.

Sub Basin TL_D
Sub basin TL_D serves residences along Kennel Avenue and Molalla Avenue, and conveys raw wastewater to the main trunk sewer along Hientz Street. Sub basin TL_D encompasses a total area of about 41 acres.

Sub Basin TL_E
Sub basin TL_E is a small sub basin that serves an area along Creamery Creek Lane and Toliver Court. Sub basin TL_E conveys raw wastewater to the main trunk sewer along Toliver Road. This sub basin serves a total area of about 13 acres.

Sub Basin TL_F
Sub basin TL_F is located in the center of town and serves the area around Leroy Avenue and Ridings Avenue. Sub basin TL_F conveys raw wastewater by gravity to the main trunk sewer along Toliver Road. Sub basin TL_F is about 77 acres.

Sub Basin BC_A
Sub basin BC_A is located along Main Street, and receives wastewater from sub basin BC_A1, BC_A2, BC_A3, BC_A4, and BC_A5. Sub basin BC_A serves a total area of approximately 191 acres. Wastewater from users within sub basin BC_A1 flows by gravity to a pump station located at the south end of South Molalla Avenue. Wastewater from the South Molalla Avenue pump station is conveyed to sub basin BC_A. Sub basin BC_A2, BC_A3, BC_A4, and BC_A5 flow by gravity into sub basin BC_A.

Sub Basin BC_B
Sub basin BC_B is located in the southwest part of town, and conveys wastewater by gravity to the Bear

Creek interceptor sewer. Sub basin BC_B serves users along Industrial Way and Commercial Parkway. Sub basin BC_B has a total area of about 31 acres.

Sub Basin BC_C

Sub basin BC_C is located to the north of town, and receives wastewater from sub basin BC_C1. Sub basin BC_C is about 171 acres, and conveys wastewater directly to the Bear Creek interceptor sewer. Sub basin BC_C1 is about 40 acres. Wastewater from Sub basin BC_C1 flows by gravity into sub basin BC_C.

Infiltration and Inflow

Infiltration and Inflow (I/I) is a problem affecting many sanitary sewer systems. Inflow and infiltration is defined as groundwater and rainwater that enters a sanitary sewer collection system creating many wastewater related problems. Rain induced sewer flows hydraulically overload Molalla's wastewater treatment plant, increase the cost of operations, and cause regulatory compliance issues.

Infiltration and inflow can also cause flows to exceed the capacity of pipes, thereby compromising the collection system. Excess flows can wash out soil from around pipes, erode larger holes in the pipe walls, generate sinkholes, create rodent dens, precipitate line collapses, and cause service line backflow problems. Sand and rock washed into a collection system with I/I exacerbates collection system hydraulic problems by further reducing line capacities, creating line blockages, and increasing the wear on pumps that are relied upon to convey sewage to the treatment plant.

Infiltration and inflow can be an escalating problem that, left unchecked over time, will generate increasingly higher sewer flows. Eventually I/I can become so severe that lower system piping, pump stations, and treatment plants cannot adequately convey or handle the rainfall induced flows. Ultimately, raw wastewater is either exfiltrated or bypassed into the surrounding environment.

Smoke Testing

Smoke testing was performed by The Dyer Partnership Engineers & Planners, Inc. (October, 2017) to identify potential deficiencies that allow I/I into the collection system. A copy of the *Smoke Test Report* (October, 2017) is provided under separate cover. Smoke testing identifies several deficiencies that can contribute significantly to I/I rates, including: catch basins and roof drains tied to the sewer system, leaks in main and lateral sewer lines, leaky cleanouts, and faulty manholes.

Detailed, individual smoke test reports were developed to document each instance of smoke exiting from abnormal areas. Each smoke test report includes a photograph of the observed smoke, a hand drawn map of the location of the smoke, a written description of the source of the smoke, and other pertinent information. The ultimate and intended purpose of smoke testing is to assist the City in establishing prioritized repairs in problem areas that provide a high rate of return relative to I/I removal.

Smoke testing was performed from October 16 through October 18, 2017. The smoke testing was successful in identifying several areas of potential I/I. Table 2.3.3 lists the type and quantity of deficiencies that were identified by the presence of smoke. Table 2.3.4 correlates the types of deficiencies with the individual smoke test reports. Figure 2.3.5 illustrates the quantity and percentage of deficiency type. Tables and figures can be cross-referenced with the Smoke Testing Maps, provided in the Smoke Test Report, to show which sewer lines were tested, and the location of each deficiency discovered.

TABLE 2.3.3
SMOKE TESTING NUMBER AND TYPE OF DEFICIENCIES

Type of Deficiency	Deficiency Code	Number of Issues
Leaking Service Lateral	LSL	19
Leaking Main Line	LML	2
Catch Basin	CB	26
Leaking Manhole	LMH	44
Open Cleanout	OCO	107
Plugged House Vent	PHV	1
Roof Drain	RD	9
	TOTAL DEFICIENCIES	**208**

FIGURE 2.3.5
SMOKE TESTING RESULTS SUMMARY
NUMBER OF VIOLATIONS BY TYPE

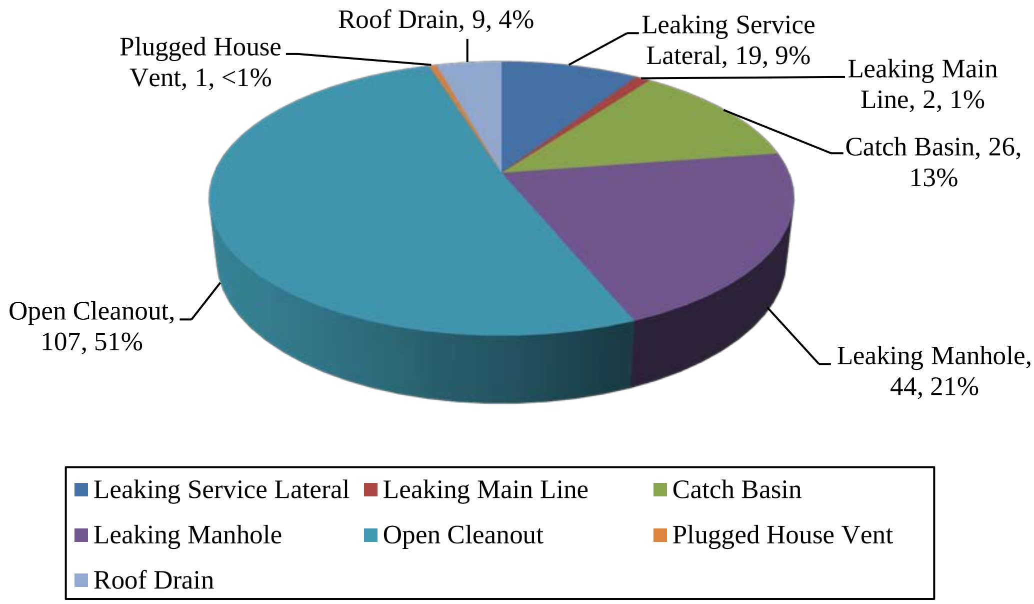


TABLE 2.3.4
REPORT NUMBERS ACCORDING TO DEFICIENCY TYPE

Deficiency Type	Deficiency Code	Smoke Test Report Number			
Plugged House Vent	PHV	3-20			
Catch Basin	CB	1-14	1-33	2-1	2-17
		2-19	2-31	2-42	2-45
		2-57	2-59	2-61	3-16
		4-17	4-33	4-35	
Leaking Main Line	LML	1-25	2-47		
Roof Drain	RD	1-23	1-40	1-55	2-18
		2-36	3-40	4-12	4-22
		4-29			
Leaking Manhole	LMH	1-1	1-2	1-4	1-5
		1-16	1-19	1-20	1-21
		1-22	1-26	1-29	1-30
		1-39	2-3	2-6	2-14
		2-16	2-21	2-24	2-29
		2-34	2-35	3-1	3-2
		3-3	3-8	3-15	3-18
		3-23	3-26	3-32	3-34
		3-35	4-1	4-2	4-3
		4-4	4-5	4-9	4-13
		4-18	4-19	4-23	4-24
Leaking Service Lateral	LSL	1-11	1-28	1-32	1-38
		1-42	1-48	1-50	1-52
		2-2	2-13	2-15	2-39
		3-7	3-39	3-42	4-14
		4-26	4-31	4-34	
Open Cleanout	OCO	1-3	1-6	1-7	1-8
		1-9	1-10	1-12	1-13
		1-15	1-17	1-24	1-27
		1-31	1-32	1-34	1-35
		1-36	1-37	1-38	1-41
		1-43	1-44	1-45	1-46
		1-47	1-49	1-50	1-51
		1-53	1-54	2-4	2-5
		2-7	2-8	2-9	2-10
		2-11	2-12	2-20	2-22
		2-23	2-25	2-26	2-27
		2-28	2-30	2-32	2-33
		2-37	2-38	2-40	2-41
		2-43	2-44	2-46	2-48
		2-49	2-50	2-51	2-52
		2-53	2-54	2-55	2-56
		2-58	2-60	2-62	2-63

TABLE 2.3.4 (CONT.)
REPORT NUMBERS ACCORDING TO DEFICIENCY TYPE

Deficiency Type	Deficiency Code	Smoke Test Report Number			
Open Cleanout	OCO	3-4	3-5	3-6	3-9
		3-10	3-11	3-12	3-13
		3-14	3-17	3-19	3-20
		3-21	3-22	3-24	3-25
		3-27	3-29	3-30	3-31
		3-33	3-36	3-37	3-38
		3-41	4-6	4-7	4-8
		4-10	4-11	4-15	4-16
		4-21	4-25	4-27	4-28
		4-30	4-32	4-36	

Other deficiencies, outside of the above categories, are summarized below:

- 1-18. Smoke was exiting from a communication box located in front of telephone pedestal #127.
- 3-28. Smoke was exiting from a vault in the parking lot west of car wash.
- 4-20. Floor drains at Les Schwab Tire Center were connected to the gravity sewer.

Flow Mapping

Field investigations were performed on January 29, 2018 to determine the quantity and sources of extraneous water that enters Molalla's sewer collection system. Potential sources of infiltration include: manhole joint failure, manhole channel defects, cracks in pipes, pipe joint failures, leaking pipe penetrations, and root intrusions. Potential sources of inflow include storm drains, roof drains, and contributions from manhole lids or open clean-outs.

Flow measurements consisted of instantaneous water depth recording using "Flow Poke" equipment at incoming pipe segments within manholes as well as general observations. Flow measurements were conducted by two crews of two persons each. Crews moved from manhole to manhole in as short a time as possible between 10:30 P.M. and 5:00 A.M. when domestic and commercial sewage contributions were negligible.

Flow measurements were taken at strategically selected manholes by using portable Flow Poke equipment. These meters allowed the flow mapping teams to take instantaneous measurements without physically entering the manhole. The flow meter measures water depth across a V-notch weir and can be used for pipes up to 12-inches in diameter. Accuracy is plus or minus five percent for flows up to 640 gallons per minute (gpm). This accuracy is considerably higher than having to physically measure the water depth, as was done prior to the invention of the portable flow meter. When flows were encountered that were less than 5 gpm, no further investigation was performed in the upstream collection system.

By determining the relative increases in measured flow between manhole sections, problem areas were identified and prioritized. The flow poking indicated a number of deficiencies that need to be addressed. The I/I Flow Mapping report, including flow mapping results are provided under separate cover. The findings are summarized as follows:

Flow Poking Findings

- Excess flow of 24 gpm along Fenton Avenue from TL_B_19 to TL_B_22, and including TL_B_21 to TL_B_24 along Kimberly Court.
- Excess flow of 32 gpm along Patrol St. from TL_B_2 to TL_B_27.
- Manhole TL_B_2 has leakage.
- Excess flow of 80 gpm from TL_5 to TLA_48 along Grange Avenue, from TL_A_48 to TL_A_30 along E Main Street, and along Lola Avenue from TL_A_33 to TL_A_22.
- Manhole TL_A_30 has leakage.
- Excess flow of 14 gpm from TL_A_22 on East 2nd to TL_A_18 on Eckerd Avenue.
- Excess flow of 18 gpm from TL_A_18 to TL_A_16 along Eckerd Avenue.
- Excess flow of 14 gpm along S. Swiegle from BC_A3_17 to BC_A3_7.
- Excess flow of 10 gpm along Berkley Avenue from BC_A3_12 to clean-out located south of BC_A3_14 near East 5th St.
- Excess flow of 18 gpm from BC_A3_18 on East Main Street, to BC_A3_12 on Berkley Avenue.
- Excess flow of 38 gpm from TL_A_28 to TL_A_26 along East Main Street.
- Excess flow of 23 gpm beginning at the S. Molalla Pump Station, continuing to manhole BC_A1_2, and terminating at the clean-out located east of manhole BC_A1_3. Additional smoke testing and TVing is recommended. A portion of this sewer line extends into an abandoned subdivision that presents a higher risk of infiltration and inflow.
- Excess flow of 16 gpm beginning at manhole BC_A3_21 and continuing south on Metzler to BC_A3_2, terminating at clean-out at the intersection of Metzler and West 4th Street.
- Excess flow of 14 gpm beginning at BC_A3_20 along S. Molalla Avenue, and continuing to BC_A3_3, and terminating at a clean-out located in the City Park. Includes service laterals extending east on 2nd Street.
- Excess flow of 12 gpm beginning at TL_A2_6, continuing south on S. Cole Avenue until TL_A2_4, and then continuing east on East 7th Street until TL_A2_3.
- Excess flow of 11 gpm starting at TL_A2_3 and terminating at the clean-out east of manhole TL_A2_5.
- Manhole TL_A2_6 has leakage.
- Excess flow of 10 gpm beginning at TL_B_2 along North Cole Avenue, and terminating at the clean-out south of TL_B_31, including TL_B_29 along Garden Court until TL_B_4.
- Excess flow of 15 gpm beginning at TL_B_8 along Oak Street, and continuing to clean-out east of TL_B_12.
- Excess flow of 10 gpm beginning at TL_B_8 on East Heintz Street to TL_B_9, continuing to TL_B_10 on East Park Avenue.
- Manhole TL_C_6 has leakage.
- Manhole TL_C_4 has leakage.
- Excess flow of 10 gpm beginning at BC_B_1 along South Molalla Forest Road to BC_B_18. Includes 8” sewer line extending west to BC_B_10.
- Excess flow of 10 gpm beginning at BC_C_71 along Meadowlawn Place to BC_C_59.
- Manhole TL_50 has leakage.
- Manhole TL_28 has leakage.
- Manhole TL_F_22 has leakage.
- Manhole BC_A_47 has leakage.
- Manhole BC_A_39 has leakage.
- Excess flow of 10 gpm beginning at TL_A1_5, continuing to TL_A1_1 on East 8th Street, continuing east on East 8th Street until TL_A1_6, and then terminating at the clean-out at the end

of Mathias Court. Additional inspections and TVing is required in subbasin TL_A1 to determine deficiencies.
- Manhole BC_A_45 has leakage.
- Excess flow of 10 gpm beginning at TL_C2_11 along Explorer Avenue, continuing to TL_C2_6 along Escort Street, continuing to TL_C2_5 along Bronco Avenue, and continuing along Glory Ln to TL_C2_1. Includes TL_C2_15 along Probe Street terminating at TL_C2_16. Additional inspections and TVing is required in subbasin TL_C2 to identify and isolate deficiencies.

Flow poking was not possible on the sewer pipes larger than 12 inches in diameter. However, based on visual inspections of numerous manholes, excess flow was present in the Bear Creek main, from manhole TL_40 to BC_A_45. Excess flow was also identified in the Toliver main, from manhole TL_46 continuing to TL_39 to TL_20 along Toliver Road, from TL_20 to TL_19 along Kennel Avenue, and from TL_19 to TL_2 along East Heintz Street. These lines require TV viewing to identify deficiencies, but after collection system improvement projects in upstream basins, particularly BC_A3 and TLA, are completed.

Manhole repairs can be performed without further investigation. High infiltration rates, as enumerated above, will likely require subsequent investigations performed by the City (i.e. television inspection), and possibly additional smoke testing of the system to refine the I/I repair projects scope of work.

Annual Infiltration and Inflow Report (2017)

Significant strides have been made by the City since the 2015 I/I Assessment and Reduction Plan was developed. Since that time, the City updated its Sewer Capital Improvement Plan, completed a Sewer System Development Charge Methodology and Fees update, completed a Sewer Utility Fee analysis, and raised sewer rates 27.13% in 2015, 6.48% in June 2017, and again with a 6.09% increase in November of 2017, with an effective date of July 1, 2018. The City has made a significant investment into the collection system infrastructure, to address I/I issues.

For the Fiscal Year 2017-2018, the City budgeted a total of $75,000 for infiltration and inflow repairs. The City is on track to expend all of the funds on repairs before the end of the fiscal year. A list and brief description of projects that the City completed in 2017 are summarized below:

- **Manhole Inspections.** Public works budgeted for the repair of 31 manholes that were identified to have significant infiltration, and another 29 manholes with minor infiltration.
- **System Assessment.** I/I work was identified on Fenton Avenue and Lola Avenue. Additionally, with the completion of the Smoke Test Report, the City identified several I/I related improvement projects.
- **Sewer Line Cleaning.** The City cleaned approximately 22,500 lineal feet of sanitary sewer mains.
- **CCTV Inspections.** As sewer lines were cleaned, information was relayed to Pacific Int-R-Tek to video inspect each cleaned line and report on the condition of the sanitary sewer lines. Pacific Int-R-Tek completed their contract of inspecting 22,500 lineal feet of sewer lines.
- **Vactor Truck Purchase.** The City made its final payment towards the purchase of its vactor truck. The truck is used to clean sewer lines and manholes for inspection and to help avoid occurrence of sanitary sewer overflows.
- **I/I Repairs.** Created a work order system and purchase order system to track I/I repairs and costs. Performed investigatory efforts for high priority work identified in the Smoke Test Report, including a possible storm to sewer connection on Toliver Road.

Pump Stations

The collection system includes five pump stations, listed below. This section provides an overview of each pump station, and summary of deficiencies, if present. Pump station locations are shown on the preceding inserted collection system maps, Figure 2.3.1 and 2.3.2.

- Stowers Pump Station
- South Molalla Pump Station
- Steelhead and Coho Pump Station
- Taurus Pump Station
- East 5th and South Cole Pump Station

Stowers Pump Station
The Stowers Pump Station is located in sub basin TL_A1, and pumps wastewater to sub basin TL_A. The pump station serves the Alyssa Meadows subdivision and is located at East 8th and Stowers. The pump station conveys raw wastewater through 869 lineal feet of 4-inch diameter PVC force main terminating at manhole number TL_A_4 at Stowers and East 6th Street. The pumps are adequately sized, perform reliably, and are not maintenance intensive. There are no major performance issues related to the Stowers Pump Station.

A drawdown test was performed on January 18, 2018. The flow rate for pump 1 and 2 was 170 and 188 gallons/minute (gpm), respectively. Pump run time data was also analyzed to determine the maximum pump run times recorded in 2017. The maximum pump run time for pump 1 and 2 was 6.73 hours/day and 4.05 hours/day, respectively. The minimum pump run time for pump 1 and 2 was 0.40 hours/day and 0.30 hours/day, respectively. Winter and summer pump run time data from 2017 is provided in Appendix D.

TABLE 2.3.5
STOWERS PUMP STATION & FORCE MAIN

Stowers Pump Station & Force Main	
Location	East 8th and Stowers
Date Built	2007
Type	Duplex submersible
Manufacturer	Flygt
Wet Well	Concrete, 7 ft diameter, 12 ft depth
Pump hp	2 @ 7.5 hp
Level Control	Floats
Standby Generator	Yes
Flow Measurement	Not included
Force Main	869 LF of 4" PVC
Discharge Location	Stowers and East 6th Street

FIGURE 2.3.6
STOWERS PUMP STATION

South Molalla Pump Station
The City's oldest pump station, South Molalla Pump Station, is located in sub basin BC_A1, and conveys wastewater to sub basin BC_A. The pump station is located at 701 South Molalla Avenue, immediately south of 7th Street, and immediately north of Bear Creek. The pump station discharges to a manhole (BC_A_15) located at 609 South Molalla, via 635 lineal feet of 4-inch diameter AC pipe. The control panel includes a phone dialer for alarm communication, and a generator receptacle that the City can connect to during loss of power.

Wet weather flows, induced by infiltration and inflow, hydraulically overload the South Molalla Pump Station. The pump station serves an older neighborhood that is plagued with high amounts of infiltration and inflow. The property located directly east and northeast of the pump station is the location of an abandoned subdivision where undocumented gravity sewer lines are installed, but residential structures were not. Additional investigatory work is necessary to identify and eliminate possible infiltration and inflow locations throughout this property.

The lift station floods occasionally, due to its elevation and proximity to Bear Creek. The concrete wet well has cracks and non-watertight penetrations that provide a pathway for infiltration when Bear Creek rises and surrounds the wet well.

A drawdown test was performed on January 18, 2018. The flow rate for pump 1 and 2 was 79 and 82 gpm, respectively. Pump run time data was also analyzed to determine the maximum pump run times recorded in 2017. The maximum pump run time for pump 1 and 2 was 7.9 hours/day and 9.35 hours/day, respectively. The minimum pump run time for pump 1 and 2 was 0.47 hours/day and 0.57 hours/day, respectively. Winter and summer pump run time data from 2017 is provided in Appendix D.

TABLE 2.3.6
SOUTH MOLALLA PUMP STATION & FORCE MAIN

South Molalla Pump Station & Force Main	
Location	701 South Molalla Avenue
Date Built	Unknown
Type	Duplex submersible
Manufacturer	Hydromatic
Wet Well	Concrete, 9 ft x 9 ft, 11 ft depth
Pump hp	2 @ 7.5 hp
Level Control	Ultrasonic
Standby Generator	Not included
Flow Measurement	Not included
Force Main	635 LF of 4" AC
Discharge Location	609 South Molalla

FIGURE 2.3.7
SOUTH MOLALLA PUMP STATION

Steelhead and Coho Pump Station

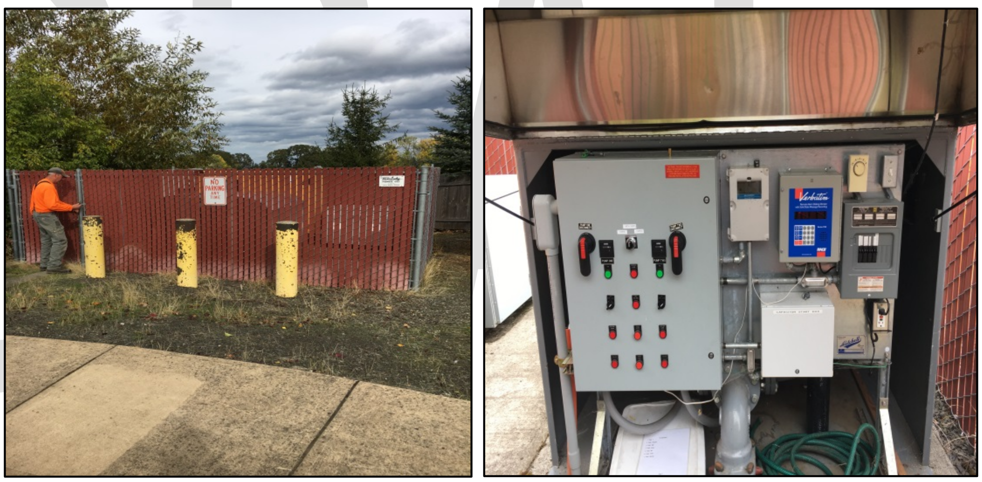
The Steelhead and Coho Pump Station is located in sub basin TL_C1 at the intersection of Coho Street and Steelhead Street. The Steelhead and Coho Pump Station serves the Molalla River Estates subdivision, and discharges wastewater, via a short (408-feet) section of 4-inch diameter force main, into manhole number TL_C_2 on Shirley Street in sub basin TL_C. The pump station was constructed in 2003, includes a backup generator, and a phone dialer for alarm communication. The pump station is serviced regularly and is in good condition.

A drawdown test was performed on January 18, 2018. The flow rate for pump 1 and 2 was 160 and 160 gpm, respectively. Pump run time data was also analyzed to determine the maximum pump run times recorded in 2017. The maximum pump run time for pump 1 and 2 was 2.6 hours/day and 2.6 hours/day, respectively. The minimum pump run time for pump 1 and 2 was 0.25 hours/day and 0.25 hours/day, respectively. Winter and summer pump run time data from 2017 is provided in Appendix D.

TABLE 2.3.7
STEELHEAD AND COHO PUMP STATION & FORCE MAIN

Steelhead and Coho Pump Station & Force Main	
Location	Coho and Steelhead
Date Built	2003
Type	Duplex submersible
Manufacturer	Hydromatic S4NRC/S4NVX
Pump Type	Constant speed vortex
Capacity (gpm)	160 gpm @ 35 ft TDH
Pump hp	2 @ 5 hp
EPA Reliability	Class I
Level Control	Ultrasonic transducer
Standby Generator	30 kW, diesel generator
Flow Measurement	Hydroranger 200
Force Main	408 LF of 4” PVC

FIGURE 2.3.8
STEELHEAD AND COHO PUMP STATION



Taurus Pump Station
The Taurus Pump Station is located in sub basin TL_C2 at the intersection of Taurus Street and Explorer Avenue. The Taurus Pump Station serves the Shel-Mar Estates subdivision, and discharges wastewater through a 1,250-feet section of 4-inch diameter force main, into sub basin TL_C via a manhole (TL_C_24) on North Molalla Avenue. The pump station was constructed in 2011. The control panel includes an automatic phone dialer for alarm call-outs, and is outfitted with a generator receptacle for portable generator connectivity during a loss of power.

Despite its relatively young age, the pump station is often hydraulically overloaded and inundated with high amounts of grease and oils. The station struggles to process wet weather flows due to excessive I/I in the surrounding area. High influent loads of oil and grease accumulate on floats and throughout the wet well, requiring manual removal and cleaning approximately every two weeks.

The pumps often lose their prime and can take hours to restore operability. The motors are costly to maintain, and require replacement approximately every two years. During operation, the duplex pumps are noisy, are insufficiently housed for sound attenuation, and routinely annoy nearby residents.

A drawdown test was performed on January 18, 2018. The flow rate for pump 1 and 2 was 167 and 187 gpm, respectively. Pump run time data was also analyzed to determine the maximum pump run times recorded in 2017. The maximum pump run time for pump 1 and 2 was 3.15 hours/day and 5.9 hours/day, respectively. The minimum pump run time for pump 1 was 0.30 hours/day. Excluding days when pump 2 was inactivated, the minimum pump run time was 0.50 hours/day. Winter and summer pump run time data from 2017 is provided in Appendix D.

TABLE 2.3.8
TAURUS PUMP STATION & FORCE MAIN

Taurus Pump Station & Force Main	
Location	Taurus Street and Explorer Avenue
Date Built	2011
Type	Duplex self-priming
Manufacturer	Hydromatic 40 MPV
Capacity	140 gpm @ 56 TDH
Pump hp	2 @ 5 hp
EPA Reliability	Class I
Level Control	Mercury float switches
Standby Generator	Not included
Flow Measurement	Hydroranger 200
Force Main	1,250 LF of 4” PVC

FIGURE 2.3.9
TAURUS PUMP STATION

A summary of deficiencies at the Taurus Pump Station is included below:

- The pump station is inadequately mixed and receives an abnormally high load of grease and oils from users within the subdivision. The excessive grease and oil load accumulates on slide rails, wet well walls, and other components, requiring frequent cleaning, and hindering maintenance activities.
- The pump station includes an auto dialer, but is not connected to the City’s Supervisory Control and Data Acquisition (SCADA) system.
- Limited sound attenuation considering close proximity to residences.

East 5th and South Cole Pump Station

The East 5th and South Cole Pump Station is located in sub basin TL_A2 at the intersection of South Cole Avenue and East 5th Street. The East 5th and South Cole Pump Station serves the Sunrise Acres subdivision, and discharges wastewater to manhole (TL_A_24) located at East 5th and Stowers. The control panel includes an automatic phone dialer and generator receptacle.

Overall, the pump station is dependable and is in good condition. The duplex pumps perform reliably and without frequent alarms, repairs, or replacement. The only notable problem is that the influent wastewater to the pump station contains high concentrations of grease and oil. Grease and oil buildup throughout the pump station requires manual removal with scrapers and a pressure washer.

A drawdown test was performed on January 18, 2018. The flow rate for pump 1 and 2 was 238 and 253 gpm, respectively. Pump run time data was also analyzed to determine the maximum pump run times recorded in 2017. The maximum pump run time for pump 1 and 2 was 2.4 hours/day and 2.55 hours/day, respectively. The minimum pump run time for pump 1 and 2 was 0.35 hours/day and 0.35 hours/day, respectively. Winter and summer pump run time data from 2017 is provided in Appendix D.

TABLE 2.3.9
EAST 5TH AND SOUTH COLE PUMP STATION & FORCE MAIN

East 5th and South Cole Pump Station & Force Main	
Location	East 5th and South Cole
Date Built	~ 1970
Type	Duplex submersible
Manufacturer	Ebara
Wet Well	FRP/Steel, 6 ft diameter, 12 ft depth
Pump hp	2 @ 2 hp
Level Control	Floats
Standby Generator	Not included
Flow Measurement	Not included
Force Main	635 LF of 4" AC
Discharge Location	5th and Stowers

FIGURE 2.3.10
EAST 5TH AND SOUTH COLE PUMP STATION

Collection System Summary

In general, the collection system is aging and hydraulically overloaded. The City's wastewater collection system is plagued with rainfall induced infiltration and inflow. Extraneous stormwater and groundwater unduly affects the capacity and operation of collection and treatment systems. Left unaddressed, collection system deficiencies will continue to deteriorate, ultimately causing sanitary sewer overflows, violations at the WWTP, and high capital and operational costs.

The Taurus Street and South Molalla pumps stations will require upgrades during the 20 year planning period. The Taurus Street pump station is maintenance intensive, noisy, and is often hydraulically overloaded during rain events. The South Molalla pump station is old and is also hydraulically overloaded during rain events.

Existing Treatment Facilities

History

The City's existing wastewater treatment plant was constructed in 1980 and located in the west end of the City immediately south of Toliver Road. Major upgrades to the WWTP occurred in 2002 and 2007. The existing wastewater treatment facility includes an influent fine screen, Parshall flume flow meter, aeration basin (i.e. aerated lagoon), transfer pump station, two facultative/storage lagoons, tertiary treatment by dissolved air flotation units and sand/anthracite gravity filters, calcium hypochlorite disinfection, effluent pump station, and dechlorination. A summary of component specifications is included in Table 2.3.10. The WWTP site plan is depicted in Figure 2.3.11 and 2.3.12.

The WWTP is operated under Waste Discharge Permit No. 101514 from the National Pollutant Discharge Elimination System (NPDES), a copy of which is included in Appendix A. From May 1st to October 31st, discharge to waters of the state is prohibited, and recycled water is land applied onto DEQ approved sites. The recycled water used for irrigation is treated to the same standards as effluent discharged to the Molalla River, except that effluent discharged to the river is dechlorinated using ascorbic acid (Vitamin C). From November 1st to April 30th, effluent is discharged to the Molalla River in accordance with the NPDES Permit.

TABLE 2.3.10
CITY OF MOLALLA WWTP COMPONENT DESIGN SPECIFICATIONS

Item	**Description / Design Data**	
Headworks	Mechanical Fine Screen	1/4-inch, screen washing, compaction
	Quantity	1
	Capacity	9.25 MGD
	Bypass	Bar screen - manually cleaned
	Parshall Flume	
	Throat Width	24-inches
	Capacity	21.4 MGD
	Influent Sampler	Issco
Aeration Basin	Basin Dimensions	
	Size (bottom of basin)	200 ft by 54 ft
	Side Slopes (horiz:vert)	2:1
	Maximum Side Water Depth	10 ft w/ 2 ft freeboard
	Basin Volume	1.3 MG
	Basin Liner	Asphalt concrete
	Aerators	
	Type	Aspirating
	Quantity	6
	Horsepower, each	10 hp
Transfer Pump Station	Pumps	
	Type	Centrifugal submersible w/ VFD
	Quantity	Three
	Horsepower, each	Two 110 hp, one 50 hp
	Capacity	11.23 MGD
	Discharge Force Main	
	Size, Qty	18-inch, 2
	Length	1,630-feet
Lagoon #1	Dimensions	
	Surface Area	11.4 acres at 6 ft water depth
	Maximum Depth	12 ft with 3 ft freeboard
	Working Depth	9 ft
	Volume	137 acre-feet (45 MG)
	Basin Liner	Native clay
	Outlet	
	Size	10-inch
	Type	Surface weir, fixed pipe on bottom

TABLE 2.3.10 (CONT.)
CITY OF MOLALLA WWTP COMPONENT DESIGN SPECIFICATIONS

Item	Description / Design Data	
Lagoon #2	Dimensions	
	Surface Area	13.6 acres at 6 ft water depth
	Maximum Depth	12 ft with 3 ft freeboard
	Working Depth	9 ft
	Volume	163 acre-feet (53 MG)
	Basin Liner	Native clay
	Outlet	
	Size	10-inch
	Type	Fixed pipes at two depths
Dissolved Air Flotation	Capacity Unit #1	
	Surface Area	750 square feet
	Maximum Loading Rate	2.59 gpm/sf, including recycle
	Hydraulic Capacity, each	2.8 MGD, including recycle
	Chemical Feed Rates	
	Polyaluminum Chloride	35 - 70 mg/L
	Operating Parameters	
	Pressurized Recycle Flow	350 to 700 gpm
	Operating Pressure	45 to 80 psi
	Solids to Air Ratio	0.03
	Maximum Horizontal Velocity	3.1 ft/s
	Maximum Daily Sludge	2290 lbs dry solids, 15,300 gallons
	Recycle Flow Meter	
	Type	Propeller
	Size	6-inch
	Range	0 - 2 MGD
	Influent Flow Meter	
	Type	Electromagnetic, Insertion Type
	Size	12-inch
	Range	0 - 10 MGD
	Capacity Unit #2	
	Surface Area	1,075 square feet
	Maximum Loading Rate	2 gpm/sf, including recycle
	Hydraulic Capacity, each	3.1 MGD, including recycle
	Chemical Feed Rates	
	Polyaluminum Chloride	35 - 70 mg/L

TABLE 2.3.10 (CONT.)
CITY OF MOLALLA WWTP COMPONENT DESIGN SPECIFICATIONS

Item	Description / Design Data	
Dissolved Air Flotation Cont.	Operating Parameters	
	Pressurized Recycle Flow	350 to 700 gpm
	Operating Pressure	125 psi
	Solids to Air Ratio	0.03
	Maximum Horizontal Velocity	3.1 ft/s
	Maximum Daily Sludge	1,670 lbs dry solids, 10,000 gallons
	Recycle Flow Meter	
	Type	Ultrasonic, Strap On
	Size	6-inch
	Range	0 - 2.5 MGD
	Influent Flow Meter	
	Type	Electromagnetic, Insertion Type
	Size	14-inch
	Range	0 - 14 MGD
Gravity Filters	Capacity	
	Number of Filters	4
	Surface Area, Total	573 square feet
	Maximum Loading Rate	4.85 gpm/square feet
	Capacity, each	1 MGD
	Media	
	Type	Gravel, sand, anthracite coal
	Depth	12-inches sand, 24-inches coal
	Backwash	
	Type	Automatic on time or pressure diff.
	Backwash Rate	20 gpm/sf
	Surface Wash Rate	103 gpm
	Air Scour Blower	
	Type	Rotary, positive displacement
	Size	15 hp
	Air Scour Rate	3 scfm/sf
	Air Scour Flow	429 scfm @ 4 psig
	Backwash Flow Meter	
	Type	Propeller
	Size	16-inch
	Range	0 - 17 MGD
	Filter Effluent Flow Meter	
	Type	Electromagnetic, Insertion Type
	Size	18-inch
	Range	0 - 23 MGD

TABLE 2.3.10 (CONT.)
CITY OF MOLALLA WWTP COMPONENT DESIGN SPECIFICATIONS

Item	**Description / Design Data**	
Disinfection	Type	Calcium Hypochlorite
	Residual, Minimum	2 mg/L
	Chlorine Contact	
	Sidewater Depth	4-feet, 1 foot of freeboard
	Volume	67,500 gallons
	Length to Width Ratio	24
Effluent Pump Station	Pumps	
	Type	Vertical turbine
	Quantity	2 + 1 Future
	Horsepower, each	300 hp w/ VFD
	Capacity, each	5 MGD
	Discharge Force Main	
	Size	24-inches
	Length	Five miles
Standby Power	Generator Set	
	Type	Diesel
	Size	750 kW
	Transfer Switch	Automatic
	Facilities Served	Entire WWTP (One Eff. Pump)
Controls	SCADA	Transfer Pump Station Effluent Pump Station Discharge Monitoring Station
Discharge Monitoring Structure	Dechlorination	
	Feed Solution	Ascorbic acid
	Chemical Feed Pumps	2 - 13 gph
	Feed Control	Flow and Cl_2 residual
	Effluent Sampler	
	Type	Flow paced
	Instrumentation	
	Type	Temp, DO, Chlorine
	Flow Measurement	
	Type	Electromagnetic
	Size	12-inch

TABLE 2.3.10 (CONT.)
CITY OF MOLALLA WWTP COMPONENT DESIGN SPECIFICATIONS

Item	Description / Design Data	
Molalla River Outfall	Material	HDPE
	Size	24-inch
	Length	23-feet
	Diffuser Design	
	Number of Ports, Type	3, Duckbill
	Diameter of Ports	8-inches
	Minimum Summer Submergence	1-inch
	Minimum Winter Submergence	12-inches

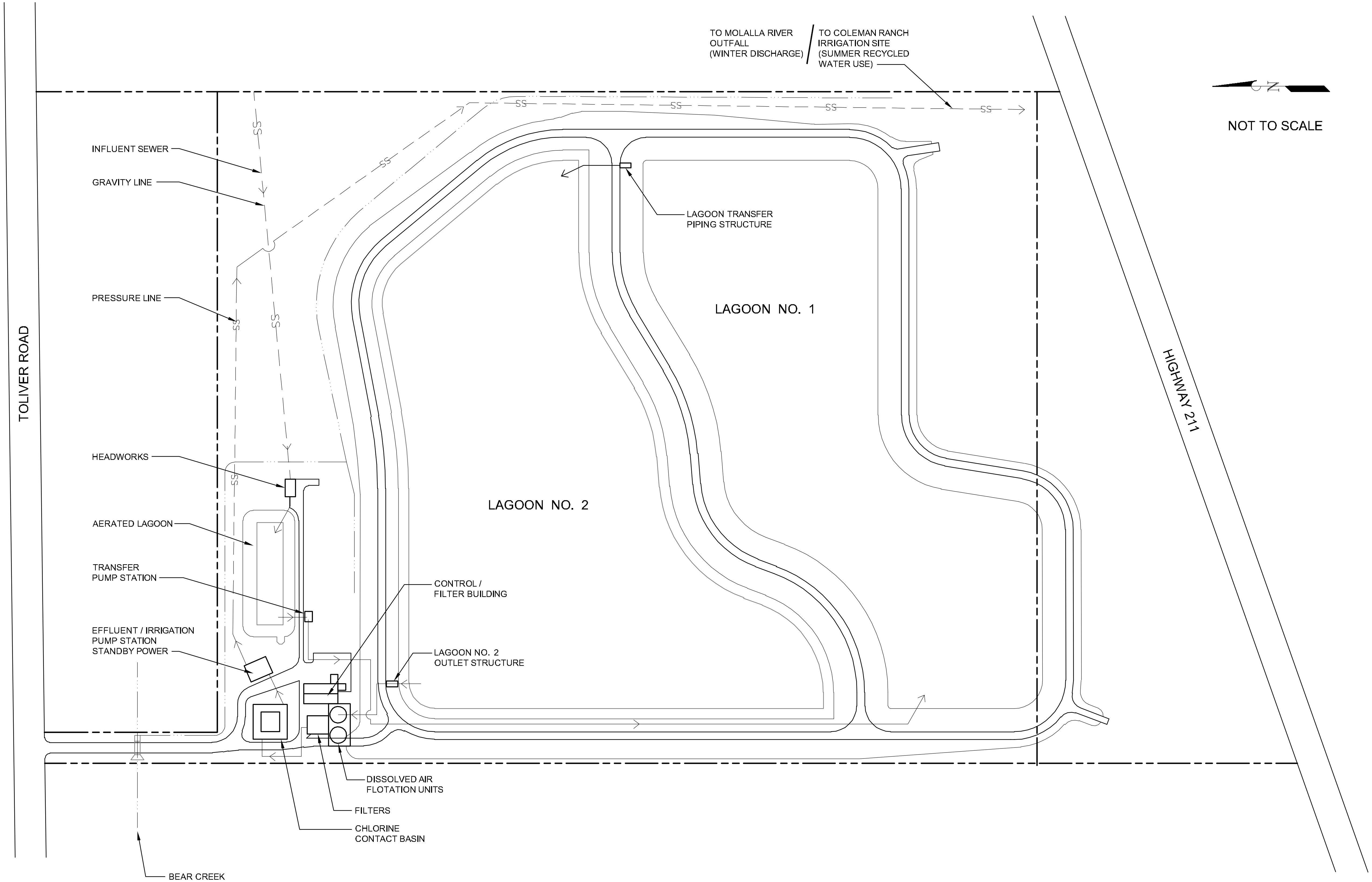


FIGURE NO.
2.3.11

CITY OF MOLALLA
WASTEWATER FACILITY AND COLLECTION SYSTEM MASTER PLAN

WWTP SITE PLAN

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS
DATE: MARCH 2018
PROJECT NO.: 100.26

THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	**WASTEWATER FACILITY & COLLECTION SYSTEM MASTER PLAN CITY OF MOLALLA, CLACKAMAS COUNTY, OREGON**	FIGURE NO.
DATE: MARCH 2018	**WASTEWATER TREATMENT FACILITY SITE PLAN**	**2.3.12**
PROJECT NO.: 100.26		

\\Dyer2\h\dyer-part\AAprojects\100.00 Engineering, Misc\100.26 PDG - Molalla WW Fac & Coll Syst MP\dwg\WWCS Master Plan.dwg, 3/9/2018 4:11:16 PM PLOT DATE July 13, 2018

Existing Treatment Process Description (Liquid Stream)

Raw wastewater flows by gravity to a headworks system consisting of an automated fine screen, mechanical bar screen, and Parshall flume for flow measurement. Screened raw sewage flows by gravity to a 1.3 MG asphalt-concrete lined aeration basin (i.e. aerated lagoon) designed with six aspirating aerators. Return Activated Sludge (RAS) is not returned to the aeration basin.

A transfer pump station, installed in 2002, conveys wastewater from the aeration basin to the first of two facultative lagoons installed in series, which provide both treatment and storage. Lagoon #1 is 11.4 acres and has a maximum volume of 45 MG at a 12 ft water level. Lagoon #2 is approximately 13.6 acres and has a total volume of 53 MG at a 12 ft water level.

Tertiary treatment is provided by two dissolved air flotation units and four media filters. After filtration, calcium hypochlorite is used for disinfection, immediately prior to entering the chlorine contact basin. Disinfected effluent flows by gravity to the effluent pump station, where it is either land applied or discharged to the Molalla River, depending upon the time of year. The existing WWTP process schematic is illustrated in Figure 2.3.13. A hydraulic profile of the WWTP is provided in Figure 2.3.14.

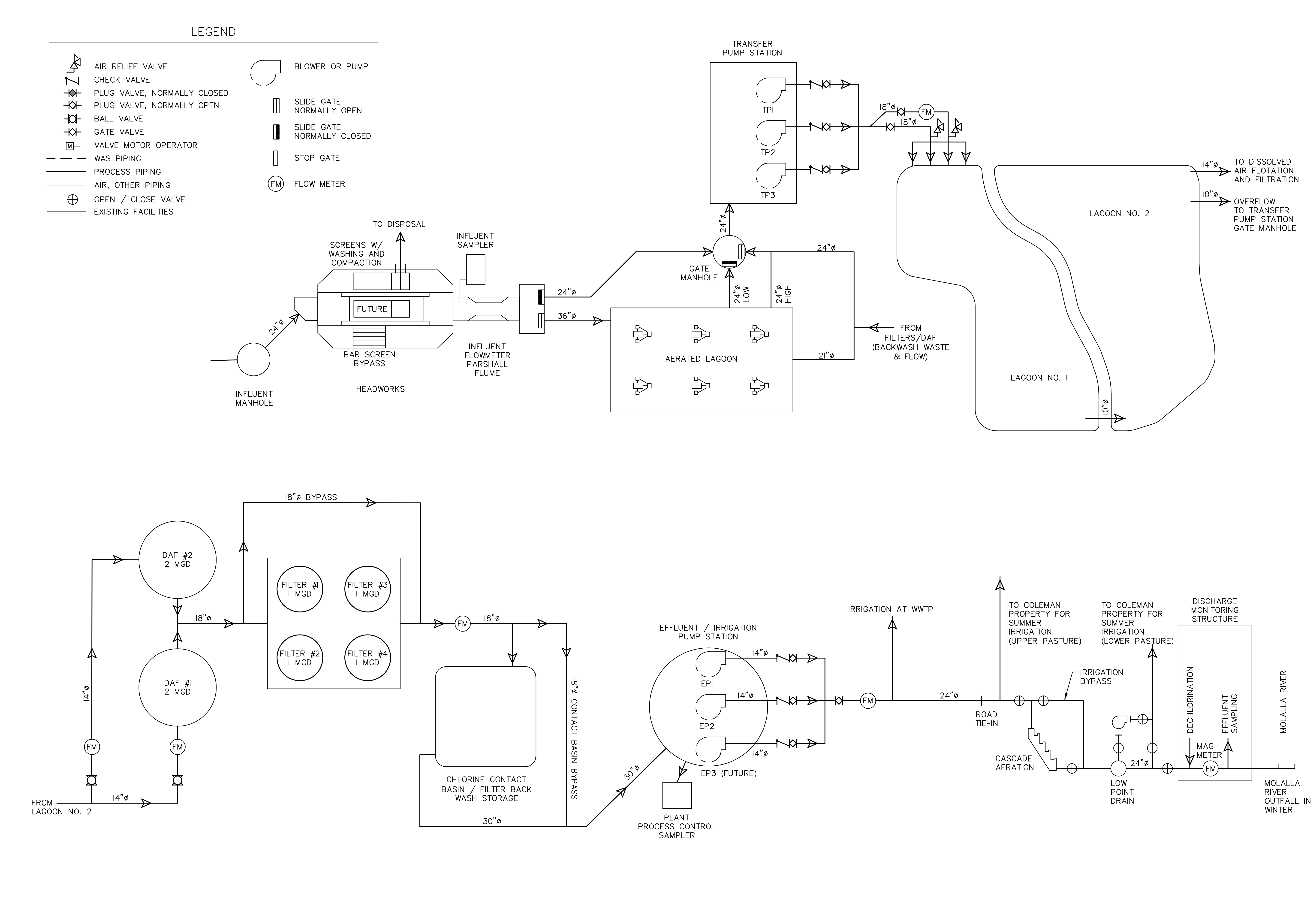


FIGURE NO. 2.3.13

CITY OF MOLALLA
WASTEWATER FACILITY AND COLLECTION SYSTEM MASTER PLAN

WASTEWATER TREATMENT PROCESS FLOW SCHEMATIC

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS
DATE: OCTOBER 2017
PROJECT NO.: 100.26

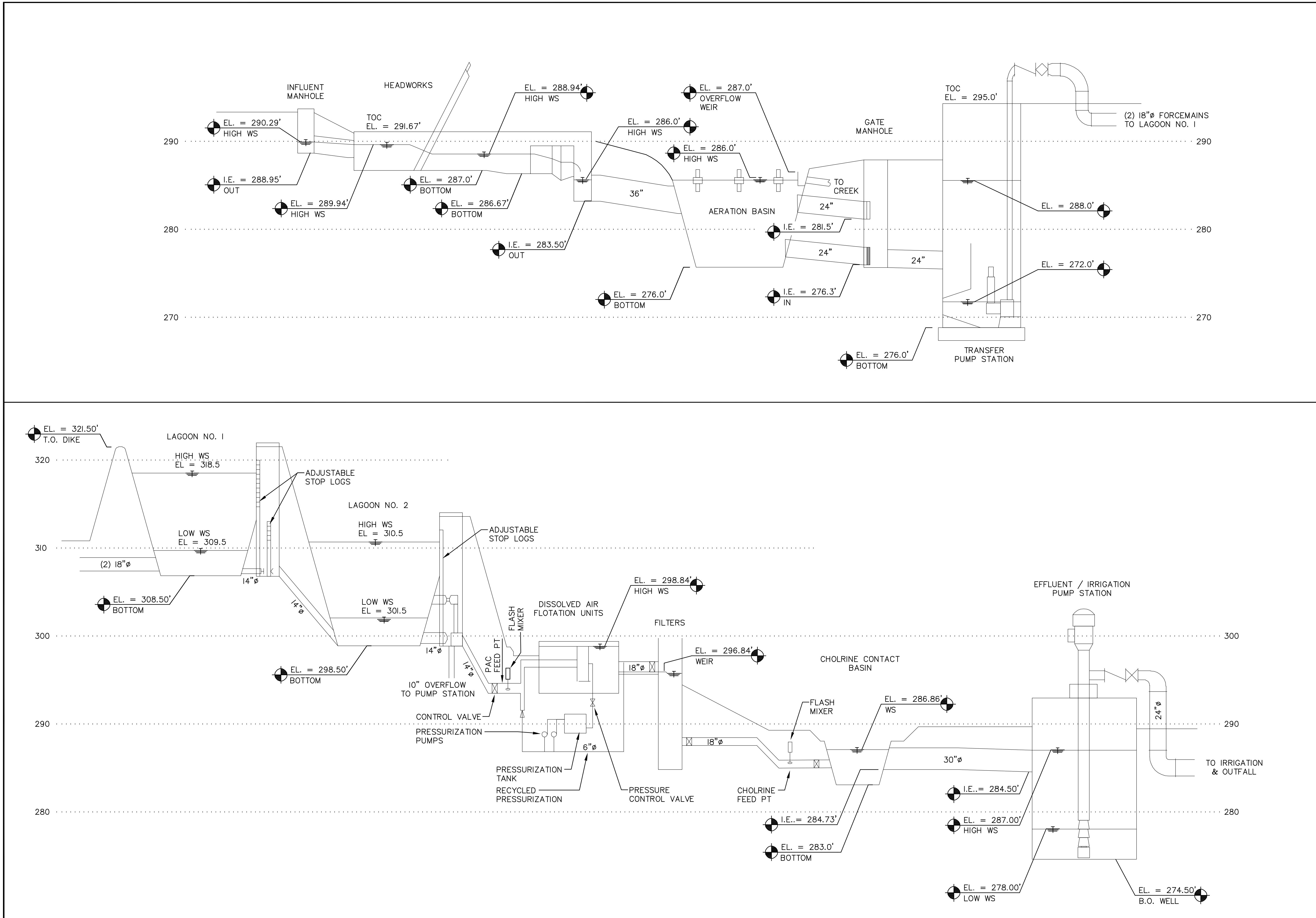


FIGURE NO. 2.3.14

CITY OF MOLALLA
WASTEWATER FACILITY AND COLLECTION SYSTEM MASTER PLAN

WASTEWATER TREATMENT HYDRAULIC PROFILE

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS
DATE: MARCH 2018
PROJECT NO.: 100.26

Existing Treatment Process Description (Solid Stream)

Solids are primarily stored, and undergo anaerobic digestion, at the inlet end of Lagoon #1. Sludge is kept within the process for years, and biosolids are infrequently wasted. The lagoons have adequate volume to store sludge for extended periods of time, but excess sludge accumulation in the lagoons contributes detrimentally to biological and hydraulic performance of the lagoons. When biosolids are removed, albeit infrequently historically, they are pumped from Lagoon #1, land applied onto DEQ approved sites, or shipped to a biosolids processing facility such as Heard Farms, Inc.

Treatment and management of the solids stream is low maintenance, as the lagoon system allows for long periods of time between solids removal, but not without problems or expense. Wind and rain agitate solids, seasonal overturn, and other factors, cause resuspension and the transfer of solids to downstream processes. As solids accumulate in the lagoons, they also displace the aerobic capacity of the lagoon, limit liquid storage capacity, overload tertiary processes, and can cause odors.

Current WWTP Design Flows

Design flows, based upon Discharge Monitoring Report (DMR) data analyzed from 2014 to 2017, are summarized in Table 2.3.11. Per capita flows are based upon the 2017 population of 9,939. Flows are further defined in Section 3.

TABLE 2.3.11
CITY OF MOLALLA WWTP EXISTING INFLUENT FLOW RATES

Parameter	Flow Values				Peaking Factor
Population	9,939				
Base Sewage	0.89	MGD	90	gpcd	
Base Infiltration	0.22	MGD	23	gpcd	
AAF	1.85	MGD	186	gpcd	1.7
ADWF	1.11	MGD	112	gpcd	1.0
AWWF	2.48	MGD	249	gpcd	2.2
$MMDWF_{10}$	1.91	MGD	192	gpcd	1.7
$MMWWF_5$	3.21	MGD	323	gpcd	2.9
Peak Average Week	4.51	MGD	454	gpcd	4.0
$PDAF_5$	6.62	MGD	666	gpcd	5.9
PIF	9.7	MGD	980	gpcd	8.7

WWTP Condition

The existing wastewater treatment plant has evolved to the point that it cannot consistently, under current conditions, perform in compliance with the discharge requirements. With the population projected to nearly double in the next twenty years, the wastewater treatment plant, in the absence of major upgrades, will violate NPDES Permit requirements at an ever increasing rate.

Based on the projected flows for the 2043 planning year, Total Maximum Daily Loads (TMDL) limits will require Biochemical Oxygen Demand/Total Suspended Solids (BOD_5/TSS) concentrations of approximately 5/5 mg/L, or less, to achieve NPDES Permit mass load limits. Facultative lagoons, even with the incorporation of tertiary treatment processes, are not designed to achieve < 5 mg/L BOD_5 and TSS, or even < 10/10 mg/L BOD_5/TSS.

The City's wastewater collection system has excessive infiltration and inflow. Due to I/I flow contributions during and immediately following storm events, and the existing TMDL, the facility regularly exceeds the mass load limits, specifically the monthly average TSS limit of 160 lbs/day.

High concentrations of algae are generated in the facultative lagoons. The bulk of suspended solids in the lagoon effluent are comprised of algae of various sizes, species, and concentration, depending on the season and other factors. Algal solids are difficult to effectively remove and manage, and are consequently continuously recycled within the system, and infrequently wasted. Removing algal solids from the waste stream to achieve turbidity requirements in accordance with Class A recycled water requirements, is impractical and unreliable.

Elevated solids throughout the system reduce the hydraulic capacity of tertiary treatment processes, create a bottleneck, and ultimately restrict the City's ability to discharge effluent at rates necessary to achieve liquid storage goals in the lagoons. This limits the City's ability to drawdown lagoons to levels that will allow sufficient equalization throughout the year.

The aerated and facultative lagoons are low maintenance, but inherently have limited operational control to achieve strict permit limits. Lagoon performance is influenced by factors outside of operator control, including; temperature, solar radiation, wind speed, loading, actual detention time, and other factors. Limited operational control, coupled with the presence of excess solids, prevent the City from consistently achieving discharge requirements and water recycling objectives.

Effluent disposal, specifically the land application of recycled water, is a major obstacle to facility operations. The City typically land applies recycled water five to six days per week from June to September, onto approximately 444.5 acres of DEQ approved land application sites. The City is unable to land apply recycled water, or store recycled water, to avoid discharging to waters of the state during the months of May and October, and sometimes June, in violation of the NPDES Permit.

A summary of the major WWTP deficiencies is provided in Table 2.3.12. More detailed explanations of each unit process at the WWTP are summarized throughout this section.

TABLE 2.3.12
SUMMARY OF WWTP DEFICIENCIES

Component	Deficiency
Headworks	Undersized for current and future flows (PIF)
	Excludes grit removal
	Slide gates are difficult to remove
Aeration Basin	Undersized to initiate appreciable treatment
	Excessive sludge and grit accumulation[1]
	Asphalt-concrete liner is cracked
	No RAS
	Limited operational control
	Energy inefficient
	Inadequate mixing
Transfer Pump Station	Undersized for future flows (PIF)
Facultative/Storage Lagoons[2]	Excessive solids accumulation

Component	Deficiency
Facultative/Storage Lagoons Cont.	Undersized to achieve treatment objectives
	Limited operational control to achieve discharge limits
	Limited level control and withdrawal options
	Dike erosion
	Undersized transfer line between Lagoons # 1 and # 2
	Inadequate storage for future flows
	Periodic odors
Dissolved Air Flotation	Undersized given existing solids and hydraulic loading
	DAF # 1 is in need of structural repairs
	O&M intensive
	No waste sludge treatment
Gravity Filters	Undersized given solids and hydraulic loading
	O&M intensive
	No waste sludge treatment
Disinfection	Tablet chlorination system safety concerns
	High operational costs
Chlorine Contact Basin	No redundancy
	Undersized based on current and future flows
	Short circuiting
Effluent Pump Station & Force Main	Undersized for future flows[3]
Outfall	Undersized
	Discharge monitoring location is O&M intensive
Land Application of Recycled Water	Fail to comply with Class A recycled water discharge limits[4]
	Insufficient liquid storage for existing flows
	Insufficient liquid storage and land area for future flows
Biosolids Management	Solids are rarely wasted and continuously stored at WWTP
	Dredging of solids is cumbersome
	Excess solids in aeration basin and lagoon #1[1]
	Disposing of solids is operationally intensive and expensive

1. Solids (215 dry tons) were removed from the aerated lagoon during the development of this plan.
2. Some solids (699 dry tons) were removed from lagoon #1 during the development of this plan.
3. Assumes no influent flow equalization.
4. RWUP (Dyer Partnership, 2018) received DEQ approval in September 2018, based on Class C recycled water.

Headworks

The headworks system was installed in 2002 and consists of an influent fine screen, a bypass screen, and flow measurement device. The total capacity of the headworks system is 9.25 MGD, but operational staff has reported that the headworks system struggles to process flows greater than 6 MGD. The headworks system is slightly undersized for current flows, and an upgrade is necessary to meet the projected PIF for the 2043 planning period.

The fine screen is an in-channel, perforated plate type screen (1/4-inch). The principal role of influent screening is to remove coarse materials from the waste stream. After fifteen years of continuous operation without a major upgrade, the influent mechanical headworks screen was rebuilt in 2017.

The headworks system has two bypass channels, one with a manually cleaned bar-screen. When the headworks structure was originally built, provisions were made to allow the addition of a second fine screen. The second channel is not in use at this time. Raw sewage can be diverted to the mechanical bar screen when operators are performing maintenance on the influent fine screen, or when influent flows exceed the capacity of the influent fine screen.

TABLE 2.3.13
HEADWORKS INFLUENT SCREEN CAPACITY

Unit Process	Basis for Capacity	Capacity[1]	Current Flow
Headworks (Fine Screen & Bar Screen)	PIF	9.25 MGD	9.7 MGD

1. Design capacity.

An ultrasonic transducer upstream of the influent fine screen initiates an auger mechanism within the screen, lifting the screenings from the channel. Screened material is washed, compacted, and conveyed into a plastic bag. The screenings are periodically deposited into a dumpster for collection and eventually transported to a land fill.

FIGURE 2.3.15
HEADWORKS

A Parshall flume, suitable for flows between 0.27 and 21.4 MGD, is used for influent flow measurement. Flow measurement is performed using an ultrasonic level sensor that is calibrated annually, or as required. The ultrasonic flow meter is located approximately 2/3rds up the 24-inch wide throat, but is not centered on the flume, and water is sometimes not quiescent. Therefore, the flow meter accuracy is uncertain.

Grit removal is not included. Instead, grit is allowed to pass through the headworks and accumulate in the aeration basin. The aeration basin has a large volume of accumulated and unmixed grit in unaerated areas.

Influent Sampler

The influent sampler is an Issco composite sampler. Composite samples are collected downstream of the Parshall flume on a time composite basis. No wastewater treatment plant recycle waters are introduced upstream of the influent composite sampler.

Aeration Basin

<u>Description</u>
The aerated lagoon (i.e. aeration basin), as shown in Figure 2.3.16, is located immediately downstream of the headworks. Treatment in the aerated lagoon is provided by both biological and physical processes. The aerated lagoon receives screened raw sewage as well as backwash water from the dissolved air flotation units and gravity filters.

FIGURE 2.3.16
AERATION BASIN

The aerated lagoon operates at a liquid depth of 10 ft, is approximately 1.3 million gallons, and is lined with asphalt-concrete to prevent erosion. The sides are sloped 2 to 1 (horizontal to vertical), and the bottom dimensions are 200 feet by 54 feet. The top dimensions are 248 feet by 102 feet. The asphalt-concrete liner is cracked and weathered.

<u>Aerated Lagoon Sizing</u>
Based on current wet weather flows, the aerated lagoon is undersized and only provides for a total of approximately ten hours of hydraulic detention time. Aerated lagoons are typical designed for a hydraulic detention time between three to six days, or more, depending on treatment objectives. Insufficient hydraulic detention time and mixing prevents appreciable biological treatment from occurring.

In complete mix aerated ponds the mixing requirements typically control the power input to the system. Proper aeration and mixing of lagoons is critical to properly treat influent wastewater pollutants. Textbook values for energy input are typically about 7.5 to 8.75 hp/MG, or as high as 30 hp/MG. For aeration and mixing purposes, the aerated lagoon was designed with six floating mechanical aspirators, 10 hp each. Based on visual observations, the wastewater is not sufficiently mixed. Several dead-zones exist throughout the lagoon. Additionally, the algae removed from the DAF units transfers a highly concentrated flow of algae into the aerated lagoon.

Solids
Return activated sludge is not returned to the lagoon, and solids are infrequently wasted and removed. Sludge and grit is either conveyed to Lagoon #1, or allowed to settle throughout quiescent zones in the aerated lagoon. Based on sludge judge measurements pulled in December 2017, there is approximately 150,000 gallons of sludge with a dry solids estimate between 2-4% in the aerated lagoon. A map depicting the results of the 2017 sludge judge measurements is included in Appendix B. In 2018, the aerated lagoon was dredged, and 215 dry tons of solids were removed and disposed of in accordance with state law.

Redundancy
There is only one aeration basin, and no redundancy. Without basin redundancy, maintenance requires the basin to be removed from service and raw sewage diverted directly into the facultative/storage lagoons. If maintenance were ever required, temporarily eliminating the aerated lagoon process from the WWTP would negatively impact, to some degree, facultative lagoon operation and performance.

Aerated Lagoon Performance
With limited operational data related to the aerated lagoon, the performance of the aerated lagoon is mostly unknown. Without proper mixing and adequate detention time during wet weather flows, the aerated lagoon likely doesn’t offer a great deal wastewater treatment. The aerated lagoon also has limited operational control. Since the lagoon isn’t sufficiently mixed and designed without RAS, the Dissolved Oxygen (DO) concentration and mixed liquor concentration varies throughout the basin, and throughout diurnal and seasonal hydraulic variations. The aerated lagoon’s performance varies based on influent flows, mixed liquor concentrations, dissolved oxygen (DO) concentrations, and other factors uninfluenced by operational adjustments.

Electrical Consumption
Mechanical aerators and photosynthesis both contribute to a DO typically between 1 mg/L and 9 mg/L. Variable Frequency Drives (VFDs) are not included with the aerators, and aeration is not supplied proportional to incoming wastewater loads. The mechanical aspirators are not energy efficient compared to contemporary aeration strategies. A significant amount of energy is wasted from over aeration and the type of aeration. Energy consumption is a major factor at wastewater treatment facilities. Electricity constitutes between 25 to 40 percent of a typical wastewater treatment plant’s operating budget. Aeration typically constitutes over half of the electricity consumed. Aerated lagoons are widely considered one of the more energy intensive secondary treatment processes.

Aerators
The original aerators were replaced in 2017. The aerators are periodically serviced, but removal of the aerators is cumbersome and time consuming. The operators use a backhoe to remove the aerators from the aerated lagoon.

Transfer Pump Station

The transfer pump station was installed in 2002, and conveys mixed liquor from the aeration basin, and backwash from the DAF units, to Lagoon #1. The transfer pump station consists of three submersible centrifugal pumps. Two pumps are 110 hp with a capacity of 5,800 gpm at 51 feet TDH. The jockey pump is 50 hp with a capacity of 2,500 gpm at 49 ft TDH (one force main). The pumps are installed in a rectangular wet well (13’6” x 17’3” x 25’ D). Check valves, isolation valves, and a magnetic flowmeter are all located above ground. The control panel is located in the Transfer pump Station Control Building (23’ x 11’), located approximately 30 ft west of the Transfer Pump Station.

TABLE 2.3.14
TRANSFER PUMP STATION CAPACITY

Unit Process	Basis for Capacity	Capacity	Current Flow
Transfer Pump Station	PIF	11.23 MGD	9.7 MGD

The transfer pump station is rated for a peak capacity of 11.23 MGD, and therefore is capable of processing current flows, but an upgrade will eventually be necessary based on the 2043 planning period, or if WWTP improvements increase the static lift beyond the capacity of the existing pumps. The magnetic flow meter was installed in 2016. The VFDs are incorporated into the station, and allow the pump output to match influent flows. The transfer pump station is hydraulically connected to the aeration basin.

FIGURE 2.3.17
TRANSFER PUMP STATION

The force main between the transfer pump station and Lagoon #1 was constructed in 2002, and consists of two HDPE lines, each 18-inch diameter. The force main is connected to a submerged outlet in Lagoon #1, consisting of 4-ports, 12-inch diameter each. A bypass line to Lagoon #2 is also provided, but seldom used because it results in short circuiting and incomplete treatment.

Facultative/Storage Lagoons

<u>Description</u>
The facultative/storage lagoons operate in series. The lagoons provide additional treatment, flow equalization, storage, and long-term solids retention and digestion. The lagoons are lined with native clay.

FIGURE 2.3.18
FACULTATIVE/STORAGE LAGOONS

Both lagoons are 12 feet deep. At a 12 ft water depth, Lagoon #1 is approximately 11.4 acres and Lagoon #2 is 13.6 acres. The total lagoon area is 25 acres. The total volume is approximately 98 million gallons. During the summer, the flows are stored in the lagoon and eventually land applied to DEQ approved recycled water sites. Year round, all of the effluent from Lagoon #2 is processed through the DAF units and gravity filters for tertiary treatment.

Facultative/Storage Lagoon Sizing
The design of lagoons is perhaps the least well defined of all biological wastewater treatment processes. Numerous methods have been proposed in literature, but considerable variability exists. A conservative approach, as outlined in the Environmental Protection Agency's (EPA) "*Municipal Wastewater Stabilization Ponds Design Manual*," is based on the surface loading rate (lb BOD_5/acre/day). Surface loading rates of 20 to 40 lb BOD_5/acre/day are suggested. Based on an average influent BOD_5 load between 1,600 to 2,300 lb BOD_5/day, the surface area required, for current loads, is at least 40 acres. The existing lagoon is undersized for current loads. This assumes negligible oxidation occurs in the aeration basin, due to insufficient hydraulic detention time and mixing. The actual biological capacity of the lagoon is also diminished considerably due to accumulated solids residing in the lagoons. Based upon sludge judge testing conducted in February of 2018, lagoon #1 had between 7.25 to 8.5 ft of sludge in the vicinity of the inlet, and an overall average sludge depth throughout the lagoon of approximately 6.5 to 7 feet. Sludge levels in lagoon #2 were measured in March of 2018 and were found to be less than 1 ft throughout the lagoon. Sludge depth and dry solids data is provided in Appendix B. In 2018, approximately 699 dry tons were removed from lagoon #1.

Facultative/Storage Lagoon Performance
The performance of the lagoons, with regard to suspended solids (algae, microorganisms, and residual suspended solids), is highly variable. Overall, suspended solids concentrations in the effluent are high year round, but do follow a seasonal pattern. Suspended solids are higher in the summer when algal growth is intensive, and also during the spring when overturn occurs and solids are re-suspended. Lagoon #1 receives influent from the aeration basin, which includes backwash algal-alum sludge from the DAF units. Highly concentrated backwash water from the DAF units, as well as solids in the influent wastewater, are continuously kept in the lagoon, and very infrequently wasted. As solids accumulate, they occupy volume in the lagoon, and accumulate to the point that they become problematic. Solids are sometimes disturbed by wind and rain, causing downstream solids migration, ultimately compromising

treatment performance and efficiency of tertiary treatment processes.

<u>Facultative/Storage Lagoon Piping and Dikes</u>
Effluent is transferred from Lagoon #1 to Lagoon #2 through a level control structure located on the east end of the lagoons. The normal mode of operation is to withdraw effluent from the surface of the lagoon using an overflow weir. A common problem with many facultative lagoons is erosion of interior slopes. Dike stability has likely been negatively affected by wind driven wave action, particularly when the lagoons are operated above 12 feet. Riprap is needed to stabilize the slopes. Additionally, during wet weather flows, because the existing 10-inch diameter transfer line between the lagoons is undersized, wastewater is sometimes pumped directly from Lagoon #1 to Lagoon #2. Pumping from Lagoon #1 to #2 has caused incomplete treatment from short-circuiting.

FIGURE 2.3.19
LEVEL CONTROL STRUCTURE

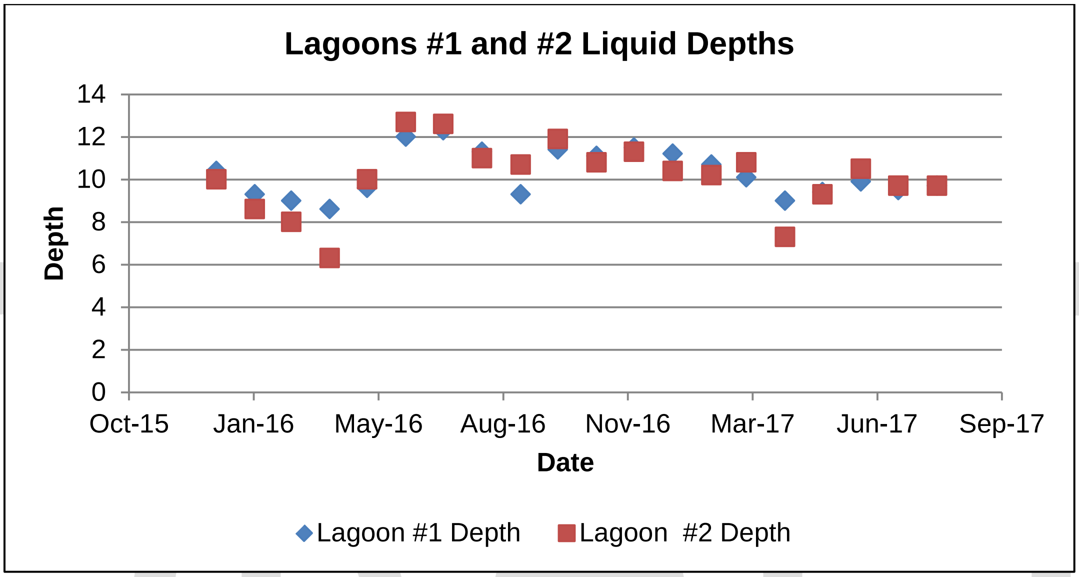
An outlet structure is located at the west end of Lagoon #2. Effluent is withdrawn from Lagoon #2 using an overflow weir. The elevation of Lagoon #2 is adjusted by adding or removing wooden boards. The lagoons do not allow water withdrawal from multiple locations of the lagoon water column, which restricts operational flexibility and system performance.

<u>Facultative/Storage Lagoon Flow Equalization</u>
For several reasons, the liquid storage and equalization volume available within the lagoons is severely limited. Adequate storage and equalization in the lagoons is critical to accomplish summertime irrigation objectives and avoid discharge to the Molalla River in the summer in accordance with permit requirements. Monthly average liquid depths for Lagoons #1 and #2, as recorded from the 2016 and 2017 DMRs, are illustrated in Figure 2.3.20. The City typically operates the lagoons between 7 and 12 ft. Variables that influence lagoon storage include:

- The facultative lagoons are undersized. Lowering the lagoons diminishes the biological capacity of the lagoons.
- High influent flows, due to excessive I/I, during and immediately following storm events.
- BOD_5 and TSS mass load limits (monthly, weekly, and daily max) are based on an average wet weather flow of 1.92 MGD, which restricts the City's ability to discharge flows at rates, during the winter months, necessary to satisfy a water balance.

- Capacity of the tertiary treatment processes (DAF, gravity filters) based on Lagoon #2 effluent quality. High influent solids loads, primarily as a consequence of infrequent wasting, limit the hydraulic capacity of the DAF and gravity sand filters.
- Solids accumulation within the lagoons, and necessity for water cap for odor control purposes.

FIGURE 2.3.20
LAGOON #1 AND LAGOON #2
MONTHLY AVERAGE LIQUID DEPTHS (2016 – 2017)



Since the City typically cannot irrigate in May and October, the maximum equalization (i.e. surge volume) requirements are primarily a function of the monthly influent flow in May and October. The most extreme design condition typically occurs when there is a high amount of precipitation in May or October. When there is a high amount of rainfall in May or October, rain induced Inflow and Infiltration (I/I) creates high wastewater flows, and wet conditions prevent land application of recycled water. Under these conditions, all of the influent wastewater received in May or October must be stored in the lagoons. For reference, historical monthly flows for October and May, from 2014 through 2016, are summarized in Table 2.3.15.

TABLE 2.3.15
HISTORICAL INFLUENT FLOWS – MAY AND OCTOBER

Year	Monthly Flow – May (MG)	Monthly Flow – October (MG)
2014	38	35
2015	47	21
2016	34	59
Average	40	38
Maximum	47	59

The total available equalization volume, or surge volume, of Lagoons #1 and #2 is established by the liquid level of Lagoons #1 and #2 at the beginning of May or October. Table 2.3.16 lists the equalization volume associated with various lagoon liquid depths, and the corresponding allowable influent flow for May or October, assuming that no irrigation occurs in May or October.

TABLE 2.3.16
ALLOWABLE MAY OR OCTOBER INFLUENT FLOW

Lagoon #1 and #2 Liquid Depth (feet)[1]	Equalization (feet)	Equalization Volume (acre-feet)	Allowable Influent Flow – May or October (MG)
9	3	75	24
8	4	100	33
7	5	125	41
6	6	150	49
5	7	175	57

1. Liquid depth of lagoons at beginning of May and October. Facultative lagoon performance deteriorates when the liquid level drops below seven to eight feet.

Based on an analysis of the 2014 through 2016 discharge monitoring reports, on average, the City can satisfy a water balance by lowering the Lagoons #1 and #2 to a liquid depth between seven and eight feet. This provides up to 125 acre-feet of equalization storage.

During wet months, more equalization is required because rain induced infiltration and inflow produce high flows, and rainfall prevents significant irrigation of recycled water. However, the lagoons operate optimally (biologically) at depths greater than 7 ft. Lowering the lagoon liquid depths increases the storage, but may diminish the biological capacity of the facultative lagoons and introduce excessive risk of permit violations. Consequently, under the current permit and during a wet May or October, the City is sometimes forced to discharge to the Molalla River outfall, in violation of the NPDES Permit.

Figure 2.3.21 and 2.3.22 illustrate, for the 2016 and 2017 irrigation seasons, respectively, the total monthly influent flow, total monthly recycled water irrigated, total monthly volume discharged to the Molalla River, and the resulting net gain/loss in facultative lagoon volume. As evident in Figure 2.3.21 and 2.3.22, the City can't lower the lagoons enough, and is consequently forced to store influent wastewater to the point that they eventually need to discharge to the Molalla River during the summer months, in violation of the permit. Data shown doesn't depict lagoon leakage.

FIGURE 2.3.21
FACULTATIVE LAGOON WATER BALANCE SUMMARY (2016)

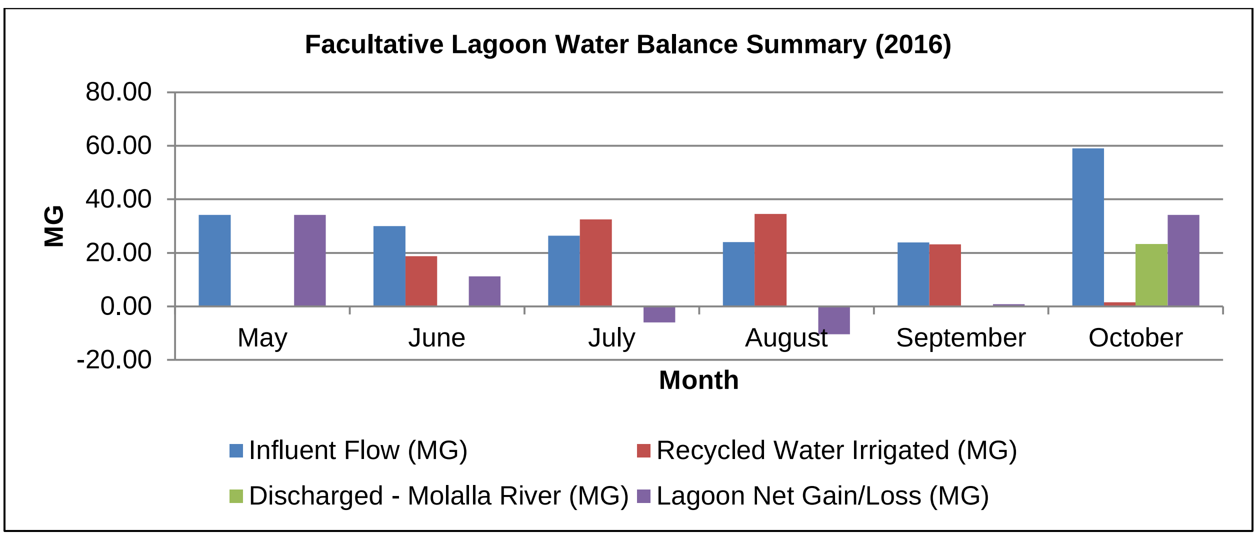
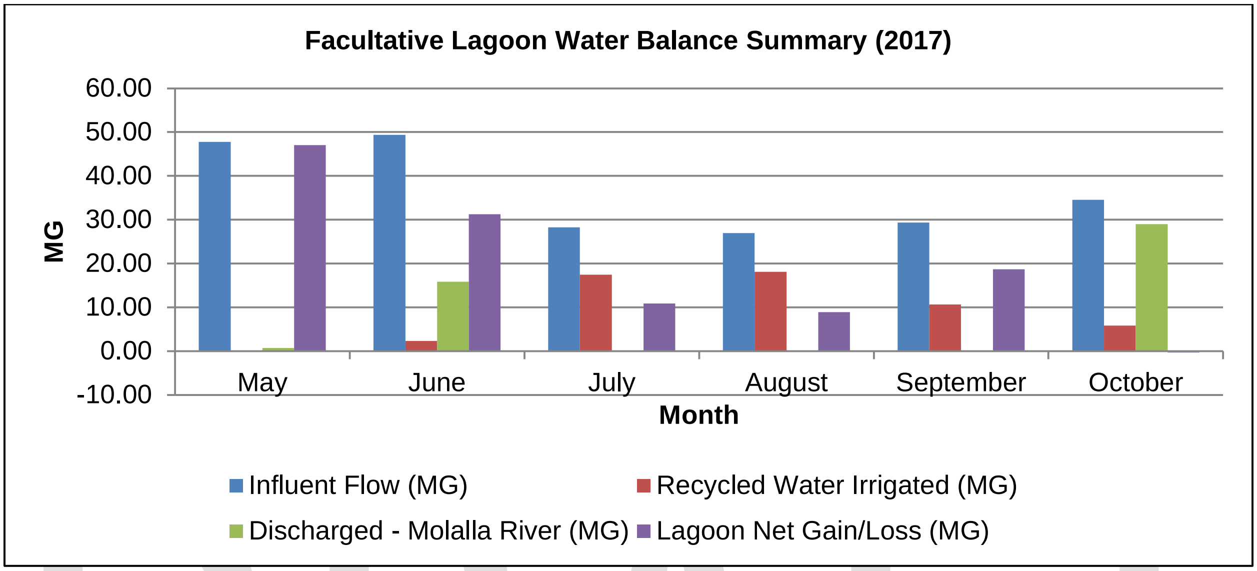


FIGURE 2.3.22
FACULTATIVE LAGOON WATER BALANCE SUMMARY (2017)



<u>Odors</u>
Facultative lagoons are often a source of odors. The odors are primarily caused by decaying algal mats and hydrogen sulfide. Hydrogen sulfide is formed from sulfates in wastewater that are reduced in an anaerobic environment. Elimination of odors is important given that the facultative lagoons are located in close proximity to residences.

<u>Facultative/Storage Lagoon Leak Testing</u>
Leak testing for the City of Molalla's wastewater lagoons was performed by The Dyer Partnership, Engineers and Planners, Inc. in July of 2017. The leak testing was conducted in accordance with the Oregon DEQ Guidelines for Estimating Leakage for Existing Sewer Lagoons. The guidelines for estimating leakage from existing sewage lagoons produced by the Oregon DEQ state that seepage rates as high as 1/8 of an inch per day or less are considered normal. Seepage exceeding ¼-inch per day indicates a seal failure, or absence of adequate initial seal. The lagoon leakage test did not exceed ¼-inch per day. The lagoon leakage test passed DEQ requirements.

Dissolved Air Flotation

Effluent from Lagoon #2 is conveyed to two DAF units; one installed in 1980 and another installed in 2007. The DAF unit (DAF #1) installed in 1980 is 31 feet in diameter. The DAF unit (DAF #2) installed in 2007 is 38 feet in diameter. The DAF units were originally designed for a total hydraulic capacity of 4 MGD, but due to high solids loading have difficulties achieving design flux rates. Based on the current flows and solids loading, the DAF system is undersized. An upgrade is necessary to meet current and future filtration needs.

Each DAF unit consists of a circular clarifier, a saturation tank, two recycle pumps (or pressurization pumps), and an influent flow meter. The primary purpose of the DAF units is to remove algae from the waste stream. Since algae and solids are continuously recycled within the treatment system, the DAF units are overtaxed. Effluent TSS concentrations from Lagoon #2 can approach, and sometimes exceed 200 mg/L. The load on the DAF units and downstream gravity filters is significant and maintenance intensive.

FIGURE 2.3.23
DAF UNITS

To aid in the removal of algae, Poly Aluminum Chloride (PAC) is injected into the lagoon effluent immediately upstream of the pressure vessel. The PAC is introduced to create a surface or a structure that can easily absorb or entrap air bubbles. In the units, compressed air is introduced into the pressure vessel, followed by a release atmospheric level.

Structurally, the concrete walls and floor of DAF Unit #1 are deteriorating, as shown in Figure 2.3.23. Left unaddressed, the structures will continue to breakdown and compromise the overall integrity and performance of the units.

Gravity Filters

Effluent from the DAF units is conveyed by gravity to a splitter box and then to four gravity filters, all installed in 2007. The primary purpose of the gravity filters is to provide additional solids removal to achieve wintertime TSS limits. The filters are rated for a total capacity of 4 MGD, but also struggle to perform at influent design flow rates due to excessive solids loading. The filters are currently undersized. An upgrade is necessary to meet current and future demands. The filters have a total surface area of 573 square feet, and a maximum loading rate of 4.85 gpm/ft^2. The filters contain a 12-inch layer of silica sand and a 24-inch layer of anthracite coal.

FIGURE 2.3.24
GRAVITY FILTERS

The filters are backwashed manually, or based on a pressure differential or time based interval. Backwash water is supplied from the chlorine contact basin. The backwash cycle duration is typically between four and five minutes, at a volume between 8,600 to 17,200 gallons. Air scour is provided via a rotary positive displacement blower, sized at 3 scfm/ft^2. Two flow meters are included; one to measure and log backwash flow and another to measure filter effluent flow.

The filters are operationally problematic. Influent flow variability, resulting from excessive I/I, requires increased operational oversight and causes performance stability issues. The hydraulic capacity of the filters is also often restricted due to excess solids loads from the DAF units. As solids loads are increased, operational staff has difficulty achieving discharge TSS requirements and discharging flows from the wastewater treatment at rates needed to satisfy lagoon storage and equalization objectives.

Disinfection

Effluent from the gravity filters is disinfected with a tablet chlorination (calcium hypochlorite – $Ca(ClO)_2$) system manufactured by Accu-Tab. The tablets dissolve in feed water, enter a solution tank, and then are injected into the waste stream. Calcium hypochlorite tablets are very reactive and quickly kill bacteria present in wastewater (99% of the bacteria kill takes place in the first ten minutes following contact). Just as important, calcium hypochlorite residual, present after disinfection, dissipates rapidly so that it will not damage the receiving environment.

The City is required to comply with E. coli standards from November 1st to April 30th, when discharging to the Molalla River. From May 1st through October 31st, the City is required to comply with a Total Coliform Limit (TCL) based on the type of beneficial recycled water produced.

FIGURE 2.3.25
TABLET CHLORINATION

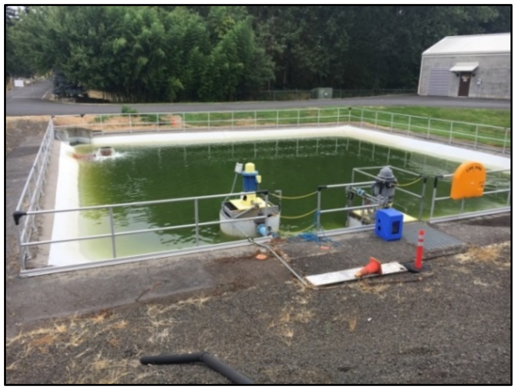
Due to insufficient contact time in the chlorine contact basin, disinfection is accomplished by higher chlorine doses. The theory is based on the use of the detention time-dose product. As the detention time is shortened, effective disinfection can be maintained by use of higher chlorine application rates.

The use of calcium hypochlorite causes an array of difficult handling and storage problems. The chlorine tablets are caustic and require careful handling. Protective gloves are required, and chlorine gas can accumulate in the tablet container, requiring a well ventilated area. The tablets can deteriorate rapidly in the presence of moisture. Calcium hypochlorite is also classified as a Class III oxidizer per code 430 of the NFPA (National Fire Protection Association). Calcium hypochlorite will liberate heat and oxygen as it decomposes, and can initiate spontaneous fires.

Chlorine Contact Basin

Effluent from the tablet chlorination system flows by gravity to the chlorine contact basin. The chlorine contact basin is 67,500 gallons, and has a length to width ratio of 1:1. There is no baffling in the basin to prevent short circuiting. Short circuiting makes it difficult to estimate the actual hydraulic detention time provided by the chlorine contact basin. The contact basin was relined as part of the 2007 WWTP Improvements project. The chlorine contact basin is undersized based on current flows but additional chlorine contact time is also provided in the effluent/recycled water force main. However, using the effluent/recycled water force main as chlorine contact time limits options for future expansion of recycled water irrigation sites.

FIGURE 2.3.26
CHLORINE CONTACT BASIN



Oregon DEQ guidelines for reliability for sewage treatment facilities require that disinfection systems be sized for peak hour flow with full redundancy. For chlorination systems, the contact chamber shall be sized for at least 15 minutes of contact time at the peak hour flow, 20 minutes at peak day flows, or 60 minutes at average dry weather flows, whichever results in the largest basin. A minimum of two contact units is required, and a minimum length to width ratio of 40:1 is required, with 72:1 preferred.

Effluent Pump Station and Force Main

Effluent from the chlorine contact basin flows by gravity to an effluent pump station, constructed in 2000. The pump station houses two vertical turbine pumps with a total capacity between 500 and 7,000 gpm. The effluent pump station is designed with provisions to add a third pump in the future. Each pump has a capacity of 3,500 gpm at approximately 280 feet of head at full speed (1780 rpm). The design maximum flow of 7,000 gpm is accomplished with two pumps operational and one redundant pump. The wet well is a precast reinforced concrete 12-foot inner diameter manhole. The pumps are VFD controlled. A pressure transducer is included for liquid level measurement.

Due to flow equalization in the facultative/storage lagoons, the pump station is sufficiently sized based on existing flows, but fails to comply with DEQ redundancy requirements. DEQ guidelines require redundancy in pumping capacity, with the pump system capable of conveying peak hourly flows with the largest pump out of service. Adding the third pump will provide the necessary expansion to satisfy redundancy requirements based on existing flows, but an expansion is necessary to accommodate future flows.

FIGURE 2.3.27
EFFLUENT PUMP STATION

Effluent is conveyed to the Molalla River outfall or recycled water sites via a 27,000-feet long, 24-inch diameter force main. The first 20,700 feet of the force main is PVC, whereas the last 6,700 feet is HDPE. The design capacity of the force main is 10.1 MGD. During the summer, all recycled water is land applied to DEQ approved recycled water sites. Summertime operation of the transfer pumps is based upon a pressure set point, typically between 100 to 104 psi. During the wintertime, all of the flows are discharged to the Molalla River, and the pump station is operated based upon a flow set point. A map showing the location of the force main, Molalla River outfall, and sub-irrigation mains is included in Appendix B.

Discharge Monitoring Station and Outfall

A discharge monitoring station is located immediately prior to discharging to the Molalla River (Outfall 001), approximately 700 feet from the outfall. For DO compliance, aeration of the effluent is accomplished by cascade aeration. The cascade aeration structure has a total fall of approximately 20 feet.

The discharge monitoring station also includes a flow meter, flow paced sampler, and instrumentation probes to monitor chlorine residual, dissolved oxygen, and temperature. The discharge monitoring station includes a standby generator located on the north side of the building. A chemical feed system injects 2 to 13 gph of ascorbic acid into the effluent for dechlorination. Chemical costs for dechlorination are significant. The outfall piping is capacity limited, and causes backups during high flows.

The discharge monitoring station is checked daily and also monitored via the SCADA system. As a result of the location of the discharge monitoring station, it requires additional oversight and attention. High river flows often threaten to flood the station.

Standby Power Generation

A standby power generator, installed in 2000, provides 750 kW of backup power to the facility. The generator utilizes a diesel fuel source. The 750 kW emergency generator is sized to power the entire WWTP, but with only one effluent/irrigation pump operating at a time. Normal operations of the emergency power equipment are controlled by the automatic transfer switch control panel and the generator control panel.

Operations Building

The Operations Building consists of office space, a meeting room, restrooms, and a laboratory. The building is in good condition and functional. The laboratory includes all of the necessary equipment for performing wastewater analyses. The Operations Building also houses the disinfection system and DAF equipment.

Flow Measurement

Flows are measured at multiple locations throughout the treatment facility. Influent flow is measured at the headworks using a 24-inch Parshall flume. Flow measurement locations and functions are listed in Table 2.3.17.

TABLE 2.3.17
FLOW METERS

Flow Meter Name/Number	Location	Type	Function
Influent	Headworks	Parshall Flume	Influent flow for DMR[1]
Transfer Pump Station	Transfer Pump Station	Electromagnetic	Flows to lagoons, lagoon leak testing
FM-1	Upstream of DAF #2	Ultrasonic - Doppler	Modulate flows to DAF Can control DAF chemical feed rate
FM-2	Upstream of DAF #1	Electromagnetic	Modulate Flows to DAF Can control DAF chemical feed rate
FM-3	DAF #2 Recycle	Propeller	Recycle indication and process control
DAF #1 Recycle	DAF #1 Recycle	Propeller	Recycle indication and process control
FM-4	Filter Effluent	Ultrasonic – Transit Time	Irrigation flows Controls chlorine dosage
FM-5	Downstream of Backwash Pump	Ultrasonic – Transit Time	Backwash flow indication Irrigation flows
Effluent	Discharge Monitoring Structure	Electromagnetic (Insertion)	Effluent flows for DMR Can control dechlorination dosage

1. DMR -Discharge Monitoring Report.

Effluent Disposal

Because the City can't discharge to the waters of the state from May – Oct, effluent disposal is a major problem for Molalla. Based on existing flows and the existing WWTP deficiencies, effluent disposal systems are undersized. A summary of effluent disposal systems is summarized in this section.

Molalla River Outfall (Outfall 001). Until 2007, the final effluent was discharged during the winter months to Bear Creek. Due to the limited assimilative capacity of Bear Creek, a five mile long pipeline project was completed in 2006 that resulted in the abandonment of the Bear Creek outfall and the addition of a new outfall to the Molalla River. From November 1st to April 30th, effluent is discharged to the Molalla River in accordance with NPDES Permit No. 101514. The outfall diffuser has three ports (duckbill), all 8-inch diameter, and provide a wintertime submergence of 12-inches and summertime submergence of 1-inch. The Molalla River is water quality impaired under DEQ's 303(d) inventory of impaired water bodies.

The City often violates the NPDES Permit by discharging to the Molalla River outfall in May, June, and/or October. Rain induced infiltration and inflow produce high flows, and rainfall precludes significant irrigation of recycled water. The WWTP does not have adequate liquid storage, nor is the existing NPDES Permit derived based on existing flows. The BOD_5 and TSS mass load limits (monthly, weekly, and daily max) are based on an average wet weather flow of 1.92 MGD, which is not representative of current flows. Based on the flow analysis summarized in Section 3, the current AWWF is 2.48 MGD, and the MMWWF is 3.21 MGD. The permitted average wet weather flow of 1.92 MGD ultimately restricts the City's ability to discharge flows at rates, during the winter months, necessary to satisfy a water balance. Table 2.3.18 summarizes the total volume of flow discharged to the Molalla River outfall in 2016 and 2017 during the summer months, in violation of the City's NPDES Permit.

TABLE 2.3.18
TOTAL FLOW (MG) DISCHARGED TO MOLALLA RIVER MAY – OCT (2016 & 2017)

Year	Effluent Flow Discharged to Molalla River May – Oct (MG)
2016	23.27
2017	45.59

Recycled Water (Outfall 002). Unless approved by a permit modification, the permittee is not allowed to discharge to the waters of the state from May 1st through October 31st. During this time period, effluent is required to be used beneficially by land application of recycled water on DEQ approved sites. Land application rates are dictated based on agronomic loading criteria, but also controlled by moisture block and piezometer data. The City of Molalla's recycled water use program is governed by Oregon Administrative Rule (OAR) 340-055 and guided by the DEQs Internal Management Directive (IMD); Implementing Oregon's Recycled Water Use Rules.

The City's Consolidated Recycled Water Use Plan (2015) required that the City produce Class A and B recycled water. The Consolidated Recycled Water Use Plan (2015) was amended in 2018 (Recycled Water Use Plan (The Dyer Partnership, 2018)) to reclassify the land application sites from Class A or B to C. The Recycled Water Use Plan (The Dyer Partnership, 2018) received DEQ approval on September 27, 2018. Recycled water is used for pasture and grass irrigation. Class A water is not required based on DEQ regulations, and imposes an unnecessary burden on the WWTP and the City. Moreover, the existing WWTP is unable to consistently produce Class A recycled water.

As outlined in the Recycled Water Use Plan, the City intends to land apply recycled water to the sites listed in Table 2.3.19. The NPDES Permit requires the effluent to be treated in accordance with Class A, B, or C requirements, depending on the land application site. The City's Recycled Water Use Plan is based on the use of Class C recycled water. The total acreage available for the land application of Class C recycled water is 444.5 acres.

TABLE 2.3.19
RECYCLED WATER LAND APPLICATION SITES

Site	Beneficial Purpose	Class of Water	Recycled Water Capacity, MG	Frequency[1]
Coleman Ranch Sites	Pasture irrigation (with some hay production)	C	196.4	May - October
Cemetery Site	Grass irrigation	C	1.55	May - October
WWTP Site	Pasture irrigation	C	3.53	May - October

1. City is usually unable to irrigate in May and October due to rainfall. If no irrigation occurs in May and October the total recycled water capacity of all sites is reduced to 182.3 MG.

Table 2.3.20 summarizes the useable acreage and recycled water capacity for each land application site. The total monthly capacity of the Coleman Ranch sites (North and South), Cemetery site, and WWTP site is summarized in Table 2.3.21.

TABLE 2.3.20
SUMMARY OF LAND APPLICATION SITES

Site	Useable Acreage (Acres)	Recycled Water Capacity (MG)
North Coleman Ranch Site	270	121.7
South Coleman Ranch Site	163	74.7
Cemetery Site	3.4	1.5
WWTP Site	8.1	3.5
Total	**444.5**	**201.5**

TABLE 2.3.21
MONTHLY CAPACITY OF LAND APPLICATION SITES

Site	May	June	July	Aug	Sept	Oct
North Coleman Ranch Site (MG)	9.6	22.1	43.1	34.3	11.2	1.4
South Coleman Ranch Site (MG)	7.0	13.3	26.0	20.7	6.8	0.8
Cemetery Site (MG)	0.13	0.28	0.54	0.43	0.14	0.02
WWTP Site (MG)	0.17	0.66	1.29	1.03	0.34	0.04
Total Monthly Capacity (MG)	**16.9**	**36.3**	**71.0**	**56.5**	**18.5**	**2.3**

Table 2.3.22 summarizes the quantity of recycled water that was applied to each land application site during the 2016 irrigation season, as well as the individual site capacities. For 2016 irrigation season, the total volume of recycled water accounted for 55% of the available capacity of land application sites.

TABLE 2.3.22
QUANTITY AND CAPACITY OF RECYCLED WATER BY SITE (2016)

Parameter	North Coleman Ranch Site	South Coleman Ranch Site	Cemetery Site	WWTP Site
Total Million Gallons (MG)	55.6	52.1	0	2.3
Site Capacity (MG)	121.7	74.7	1.5	3.5
% of Capacity	45.7%	69.7%	0%	65.7%

In 2015, from May through October, the total influent flow was 158 MG, but only 111 MG of recycled water was land applied. In 2016, from May through October, the total influent flow was around 197.5 MG, but only 110 MG of recycled water was land applied. In 2017, from May through October, the total influent flow was 216.34 MG, but only 54.3 MG of recycled water was land applied. The drastic decline in recycled water irrigated in 2017 is mainly attributed to an unusually wet spring and summer. Again, the City must expand its irrigation operations to enable the land application of recycled water at rates closer to influent flows. Table 2.3.23 summarizes the historical influent flow from May – October, as well as the total volume of recycled water land applied.

TABLE 2.3.23
TOTAL INFLUENT FLOW AND RECYCLED WATER IRRIGATED (MAY – OCT)

Year	Influent Flow May – Oct (MG)	Effluent Irrigated (MG)	Excess (MG)
2015	158	111	47
2016	197.5	110	87.5
2017	216.34	54.3	162.04

The difference between the influent dry weather flows and the actual quantity of recycled water irrigated was stored in the lagoons and eventually discharged, after further treatment and disinfection, to the Molalla River outfall. As previously noted, with the inability to land apply recycled water at rates necessary to satisfy lagoon equalization objectives, the City is frequently forced to discharge to waters of the state during the months of May and October, in violation of the NPDES Permit. Irrigation restrictions also prevent the City from managing lagoon liquid levels to facilitate equalization objectives, forcing the City to violate mass load requirements by discharging peak wastewater flows during the winter months.

Summaries of the 2016 and 2017 irrigation seasons are shown in Figures 2.3.28 and 2.3.29, respectively.

FIGURE 2.3.28
2016 IRRIGATION SEASON SUMMARY

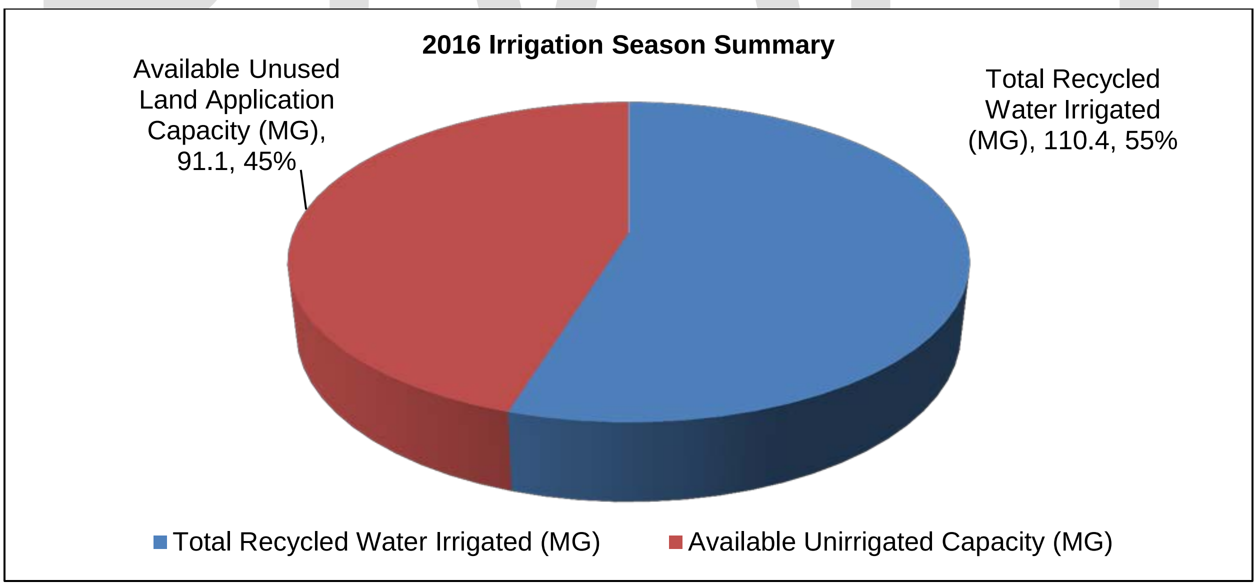


FIGURE 2.3.29
2017 IRRIGATION SEASON SUMMARY

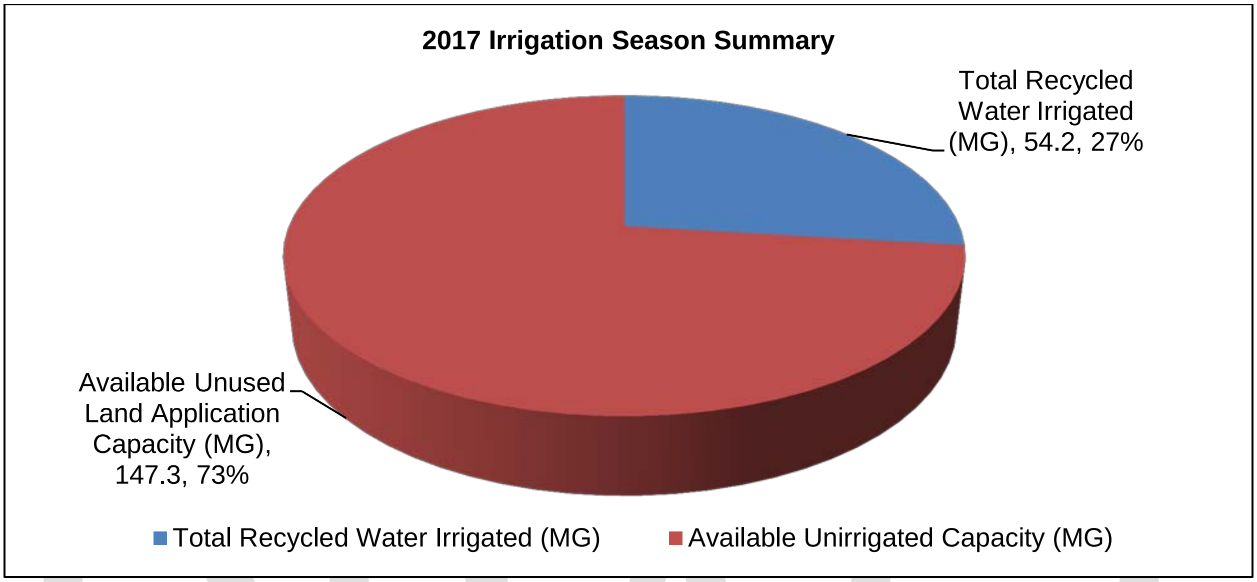


Figure 2.3.30 shows the monthly influent flows for 2015 - 2017, as well as the total monthly capacity of the irrigation sites. Figure 2.3.31 illustrates the monthly irrigation volume (MG) and the total monthly capacity of the irrigation sites, also for 2015 - 2017.

FIGURE 2.3.30
MONTHLY INFLUENT FLOWS AND MONTHLY CAPACITY OF LAND APPLICATION SITES

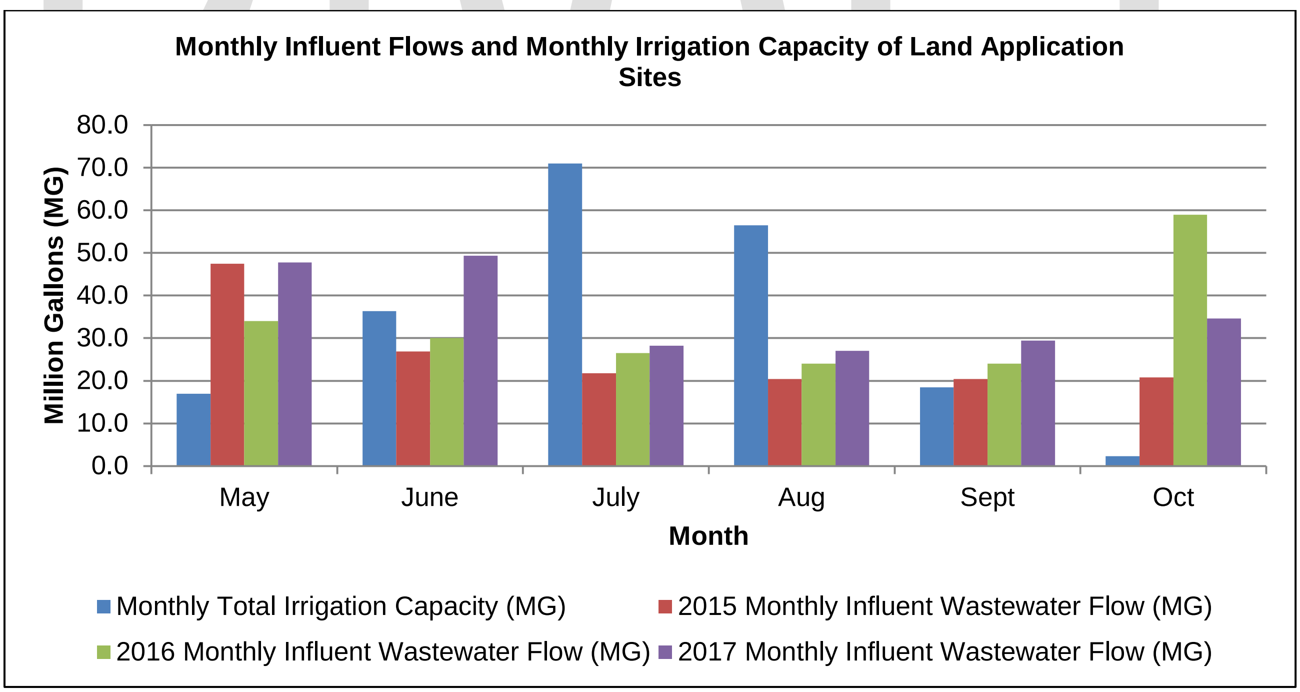
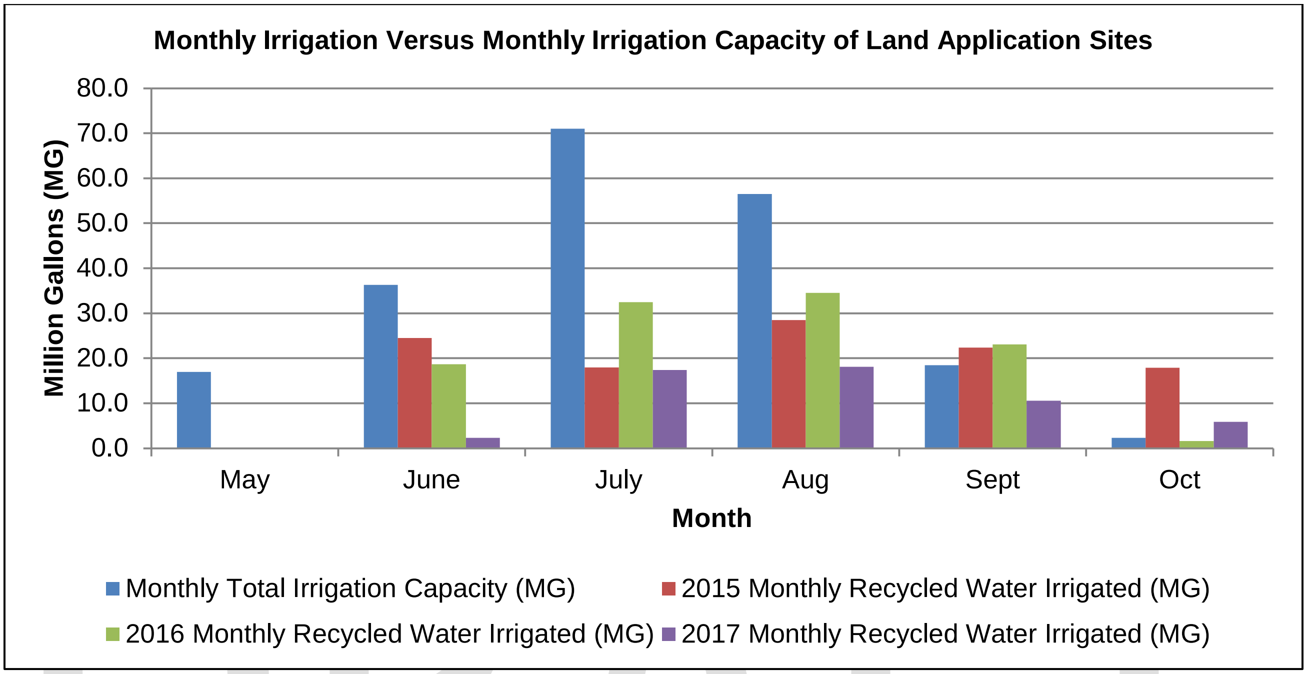


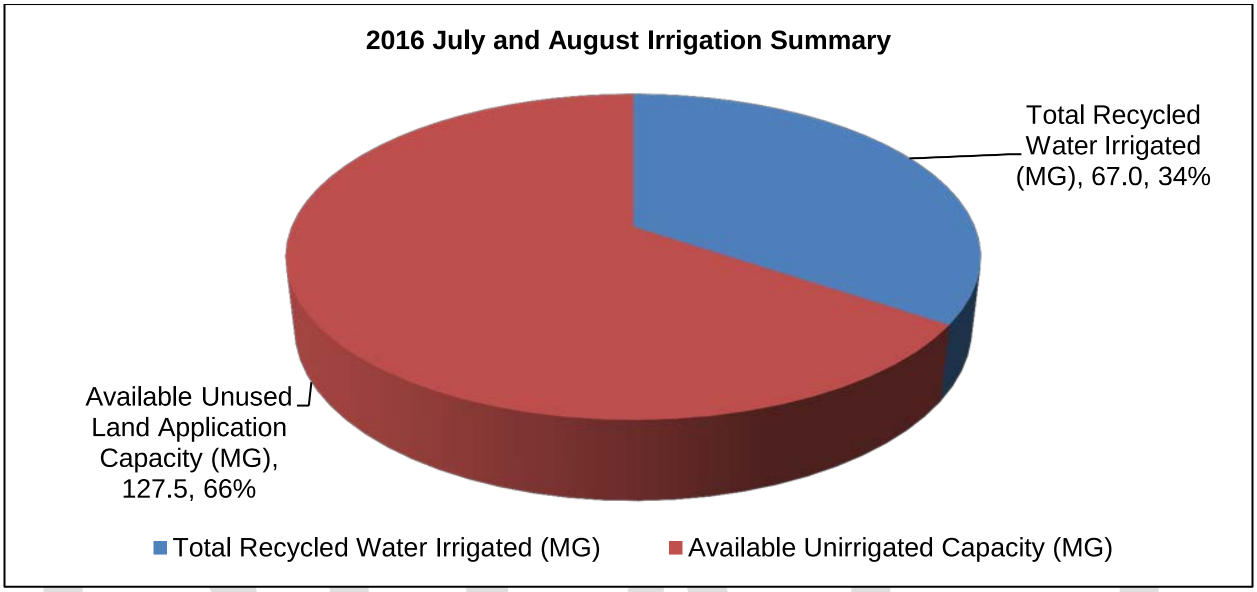
FIGURE 2.3.31
MONTHLY IRRIGATION AND MONTHLY CAPACITY OF LAND APPLICATION SITES



As previously noted, land application of recycled water is a major bottleneck to system operations. The City typically irrigates June to September, five to six days per week. Soil available water capacity (AWC), and rainfall, usually prevent land application of recycled water in May and October. Sometimes, rainfall in June prevents appreciable irrigation of recycled water.

July and August represent the months with the largest available capacity to dispose recycled water. As illustrated in Figure 2.3.32, the City is only irrigating about 34% of the recycled water that they could irrigate in July and August. Accordingly, the City must expand its irrigation systems and labor force to discharge more recycled water, especially in July and August.

FIGURE 2.3.32
2016 JULY AND AUGUST IRRIGATION SUMMARY



Biosolids Management

The City of Molalla's biosolids management program is governed by Oregon Administrative Code (OAR) 340-050 and the Code of Federal Regulations (CFR) Section 40, Part 503. As part of the permit requirements, the City is required to generate a Biosolids Management Plan (BMP). The City's most recent BMP was published on September 10, 2013. The City does not accept septage.

Sludge, including algal-alum sludge from the DAF backwash, mainly settles and accumulates in the facultative/storage lagoons. Some sludge also settles in quiescent zones in the aeration basin. Based on sludge judge measurements taken in December 2017, there is approximately 150,000 gallons of solids (2 – 4% dry solids) occupying approximately 11.5% of the aeration basin volume.

The majority of sludge settles near the inlet of lagoon #1, partially because the presence of polymer in the DAF backwash wastewater. Sludge resides in the lagoons for long periods of time, generally years, with little to no removal and disposal. While in the lagoons, sludge is passively and anaerobically digested, and gravity thickened. The biosolids are well digested and fairly inert.

For odor mitigation and to prevent hardening, sludge residing within the lagoons is kept submerged with a water cap. Lagoon #1 was sludge judged in February 2018. The sludge depths in lagoon #1 ranged from 7.25 feet to 8.5 feet near the inlet, and between 3 feet to 5.5 feet in the proximity of the lagoon transfer piping. Sludge depths in lagoon #2 were measured in March 2018, and found to be less than 1 ft throughout the lagoon. A map depicting the sludge depths in lagoon #1 and #2 is provided in Appendix B. Dry solids characteristics from the sludge is also included in Appendix B.

As a result of the solids retention time and anaerobic digestion, the WWTP produces Class B biosolids in accordance with 40 CFR Part 503 regulations. Per the 2013 BMP, pathogen reduction requirements are achieved through 40 CFR 503.32(b)(2), and vector attraction reduction requirements are achieved through 503.33(b)(2).

Based on the annual biosolids sampling, as outlined in the 2016 WWTP Biosolids Annual Report Form, the land applied biosolids were in compliance with the regulatory concentration limits. A summary of WWTP biosolids characteristics is summarized in Table 2.3.24 and Table 2.3.25.

TABLE 2.3.24
SUMMARY OF HEAVY METALS CONCENTRATIONS IN WWTP BIOSOLIDS (2016)

Metal	Concentration Limits (mg/kg) [1]		Concentration (mg/kg) in Sludge
	Cumulative	Ceiling	2016
Arsenic	41	75	0.168
Cadmium	39	85	0.22
Chromium	1,200	-	1.32
Copper	1,500	4,300	8.42
Lead	300	840	0.536
Mercury	17	57	0.0922
Molybdenum	18	75	0.675
Nickel	420	420	1.72
Selenium	100	100	< 0.200
Zinc	2,800	7,500	33

1. 40 CFR Part 503, Subpart B, ND – non-detected

TABLE 2.3.25
SUMMARY NUTRIENT CONCENTRATIONS IN WWTP BIOSOLIDS (2016)[1]

Nutrient	% Dry Weight[2]
TKN	3.61%
NO_3-N	<0.058%
NH_4-N	1.51%
PO_4	8.86%
K	0.07%
pH	7.4
Total Solids	4.3%
Vol. Solids	44.1%

1. Biosolids characteristics specified in the 2013 BMP were considerably different than the 2016 annual report.
2. 40 CFR Part 503, Subpart B, ND – non-detected

If and when the City land applies biosolids, the City uses contract haulers to land apply Class B biosolids to authorized sites. The biosolids are dredged from the lagoon and wet applied on the same day of removal. Between 1980 and 1999, no solids were removed from the facility. A futile attempt to remove biosolids occurred in 1989. In 1999, 712 dry tons of sludge was successfully dredged and removed from the Lagoon #1. In 2010, approximately 55 dry tons of solids were removed from the facility. In 2016, approximately 102 dry tons of solids were removed from the facility. The City did not remove solids in 2017. In 2018, after sludge judge valves were recorded, approximately 699 dry tons and 215 dry tons of solids were removed from lagoon #1 and the aerated lagoon, respectively. The sludge judge values included in this report do not take into account the volume of sludge removed from the aerated lagoon and facultative lagoon #1.

The City land applies biosolids to DEQ approved sites during the summer months. Application rates do not exceed 100 pounds of Plant Available Nitrogen (PAN) per acre per year. Prior to application of biosolids, the City verifies favorable soil conditions, and takes into consideration the biosolids application rate, commercial fertilizer applied, and the residual nutrients available in the soils. The City currently has two authorized sites for land application, as set forth in Table 2.3.26.

TABLE 2.3.26
BIOSOLIDS LAND APPLICATION SITES[1]

Field ID	Township Range & Section	Useable Acres
Johnson[2]	T4S R2E S32	28
Mount Hope Rd.[3]	T5S R1E S13	20.1

1. Jorgenson site listed in 2013 Biosolids Management Plan is no longer available to receive biosolids.
2. Site is pending in 2013 Biosolids Management Plan.
3. Site is not an authorized site according to 2013 Biosolids Management Plan but was used for land application in 2016. DEQ authorization is unknown.

2.4 Financial Status

For the 2018 budget year, the City forecasts that the wastewater utility will generate sufficient revenues from rates, charges and fees to satisfy obligations and produce an unappropriated ending balance in the Wastewater Operating Fund of $215,240. According to the Utilities Rate Study authored by Donovan Enterprises, Inc., "The wastewater utility is facing financial challenges. As of June 30, 2017, the utility has $3.8 million in outstanding principal on long term debt. This legacy debt consists of the 2010 sewer refunding bonds and the 2008 Clean Water State Revolving Fund (SRF) loan. These debts will not be retired until 2025 for the bonds, and 2028 for the loan. The total annual debt service on these two debt instruments is $502,000 per year." Applicable sections of the City's Utility Rate Study are included in Appendix D.

Financial Statement

Complete financial records for the wastewater collection and wastewater treatment system are included in Appendix D. These consist of detailed financial information extracted from the City's budget for 2017-2018. A summary of the resources and requirements for the wastewater system is shown below in Table 2.4.1.

As previously noted, the City is projected to end the year with a contingency of approximately $215,000. According to the 2017 Utilities Rate Study, this reserve represents approximately 35 days of wastewater system operating expenses, and is well below recommended reserve level of 60 days of operating expenses. Modeling estimates project a need to increase user rates over the next five years by approximately 6 % annually, to address this deficit.

TABLE 2.4.1
WASTEWATER RESOURCES AND REQUIREMENTS

Resources	$ Amount
Beginning Fund Balance	$380,021
Fees, Licenses, Permits	$2,106,000
Transfers In	-
All Other Resources	$27,000
Total	$2,513,021

Requirements	$ Amount
Personnel Service	$588,575
Material & Services – Maintenance	$679,919
Material & Services – Operations	$336,200
Capital Improvements	$66,652
Transfers Out	$626,435
Contingency	$215,240
Total	$2,513,021

Per ORS 223.311, System Development Charge (SDC) revenues are deposited in dedicated accounts and an annual accounting is prepared that identifies amounts collected, and amounts spend on qualified projects. The statute mandates that reimbursement fees may be expended on any capital improvements or associated debt service within the subject infrastructure. Improvement fees may only be spent on projects included in the Capital Improvement Plan (CIP) for each infrastructure, including associated debt service.

Several wastewater projects were identified for fiscal year 2017 to 2018 that will utilize SDC fees for increasing capacity and addressing deficiencies, including: 1) Wastewater Facility and Collection System Master Plan Update, 2) New WWTP headworks, 3) New WWTP headworks lift gate system, and 4) New WWTP monitoring wells. Table 2.4.2 summarizes sewer system development charges.

TABLE 2.4.2
SEWER SYSTEM DEVELOPMENT CHARGES

Item	$ Amount
Beginning Fund Balance	$711,701
Sewer SDC – Reimbursement Fee	$3,960
Sewer SDC – Improvement Fee	$90,040
Total	**$805,701**

Current Rate Schedule

The City completed a 5-year sanitary sewer CIP and rate study, and revised the user charges accordingly. The City adopted Resolution No. 2017 – 09, which establishes sanitary sewer rates and annual inflation adjustments, effective July 1, 2017. Billings for customers include two components: a fixed rate (base charge) and a volumetric rate (commodity charge). The base residential and commercial sewer rate is $35.95 per Equivalent Dwelling Unit (EDU). All residential and commercial users are billed the same base rate. Commercial and industrial users are all assigned one EDU, not multiple EDUs based on the hydraulic or organic contributions. Commercial and industrial users, however, are billed based on a volumetric basis. It is recommended that the City adjust the base rate for commercial users based on the number of EDUs of each commercial and industrial user.

The City's residential volumetric rates are based on winter water consumption. The variable fee is $3.56 per 100 cubic feet per month. The City has policies for customer accounts without water usage history or dwellings served by wells.

Annual inflationary adjustments for all sanitary sewer users are effective automatically each year on July 1^{st} based on the published values by the Bureau of Labor Statistics Portland-Salem for All Urban Consumers. The City raised sewer rates 27.13% in 2015, 6.48% in June 2017, and 6.09% in November of 2017, with an effective date of July 1, 2018.

TABLE 2.4.3
CURRENT AND PROJECTED WASTEWATER RATES

Wastewater Rate Component	2017	2018	2019	2020	2021	2022
Monthly Base Rate ($/EDU)	$35.95	$38.31	$41.06	$44.07	$46.88	$48.30
Volume Charge ($/100 cubic feet)	$3.56	$3.79	$4.06	$4.36	$4.64	$4.78

Based on a winter water consumption of 150 gpd/EDU, or approximately 600 cubic feet of monthly water use, the average residential sewer bill is approximately $57.31/month. The average wastewater rate (residential) as a percentage of the Median Household Income (MHI) $55,534 is 1.2%. This percentage is used as an affordability indicator for utilities, agencies, and other organizations. The EPA establishes the affordability capacity of utilities based on several factors. EPAs affordability criteria, as a percentage of MHI, is typically between one and two percent.

Tabulation of Users by Category

The City currently has 2,700 services (water meters) inside the City Limits, which also receive sewer service. Based on a Single Family Residence (SFR) usage rate, the City has 3,272 EDUs. Oregon Business Development Department Infrastructure Finance Authority (OBDD-IFA) EDUs are based on a usage rate of 7,500 gallons per month. The City has 3,418 EDUs based on OBDD-IFA guidelines. Infrastructure Finance Authority EDUs are used to evaluate user rates at a national level. Table 2.4.4 lists the user type and EDUs.

Based on analysis of historical billing records for the fiscal year 2015-2016, 94.0% of all accounts are single family residential, and 5.5% are large multifamily residential, light commercial. The remaining 0.5% of the City of Molalla population is classified as industrial.

TABLE 2.4.4
USER TYPES AND EQUIVALENT DWELLING UNITS (EDUs)

User Group	Number of Users	Total Usage (Gal./Year)	Usage Per User (Gal./Year)	EDUs (Per USDA - DEQ)	EDUs (Per OBDD - IFA)
Residential	2,529	237,777,841	94,020	2,529	2,642
Multifamily	-	-	-	-	-
Commercial	156	69,870,895	447,890	743	776
Industrial	15	-	-	-	-
Total	2,700	307,648,736	541,911	3,272	3,418

1. Based on 2015-2016 fiscal year water sales volumes.
2. Total usage, usage per user, and EDUs for commercial includes contributions from industrial users.

Based on the 2017 population of 9,939 people, and 3,272 EDUs, in accordance with USDA – DEQ procedures, the number of people per EDU is approximately 3 people/EDU. The future number of equivalent dwelling units based solely on a population 16,977 in 2043, is estimated at 5,659 EDUs, based on a population density of 3 people/EDU.

SECTION 3:

NEED FOR PROJECT

SECTION 3: **NEED FOR PROJECT**

3.1 Health Sanitation and Security

This section discusses relevant state and federal regulations. The Clean Water Act (CWA) prohibits discharges of wastewater to waters of the state without a National Pollutant Discharge Elimination System (NPDES) Permit. NPDES permits contain effluent limits that are developed to protect the beneficial uses. NPDES permits are generally renewed every five years, at which time any changes to the rules will be included in the renewed permit. The US Environmental Protection Agency (EPA) has delegated NPDES permitting authority for Oregon to the Oregon Department of Environmental Quality (DEQ).

A fundamental premise of the CWA is the maintenance and restoration of the chemical, physical, and biological integrity of the Nation's waters. The CWA requires states to develop water quality standards. Oregon Administrative Rules (OAR) Chapter 340 Division 41 contains Oregon's water quality standards. These standards are benchmarks established to assess whether the quality of Oregon's rivers and lakes are adequate for beneficial uses.

Water Quality Assessment

Section 305(b) of the CWA requires DEQ to assess water quality in Oregon and publish a report on the overall condition of waters known as an Integrated Report. The DEQ assigns an assessment status category to each water body where data are available to evaluate. Water bodies that do not meet water quality standards are water quality limited and are assigned Category 4 or 5. Water bodies in Category 5 are issued Total Maximum Daily Loads (TMDLs), and comprise the Section 303(d) list. The DEQs assessment of the water quality in Molalla River in the vicinity of Molalla's Outfall 001, at river mile 20, is summarized in Table 3.1.1.

TABLE 3.1.1
MOLALLA RIVER 303d LIST

River Mile	Parameter	Season	Status	Assessment Action
0 to 48.3	Alkalinity	Year Round	Cat 3B: Potential concern	No action
0 to 48.3	Ammonia	Year Around	Cat 2: Attaining some criteria/uses	No action
0 to 48.2	Arsenic	Year Round	Cat 2: Attaining some criteria/uses	Added to database
0 to 25	Atrazine	Year Round	Attaining	No action
0 to 48.3	Biological Criteria	Year Round	Cat 3B: Potential concern	Added to database
0 to 48.3	Cadmium	Year Round	Cat 2: Attaining some criteria/uses	Added to database
0 to 48.3	Chloride	Year Round	Cat 3: Insufficient data	No action
0 to 25	Chlorophyll a	Fall, Winter, Spring	Cat 3: Insufficient data	No action
0 to 25	Chlorophyll a	Summer	Cat 2: Attaining some criteria/uses	No action
0 to 48.2	Chromium	Year Round	Cat 2: Attaining some criteria/uses	Added to database

River Mile	Parameter	Season	Status	Assessment Action
0 to 48.2	Copper	Year Round	Cat 3B: Insufficient data, potential concern	Added to database
0 to 25	Cycloate	Year Round	Attaining	No action
0 to 16.8	Dissolved Oxygen	October 15 - May 15	Cat 2: Attaining some criteria/uses	No status change
18.2 to 48.3	Dissolved Oxygen	Year Round (Non-spawning)	Cat 3: Insufficient data	No status change
19.7 to 44.7	Dissolved Oxygen	August 15 – June 15	Cat 3: Insufficient data	No status change
0 to 25	E. Coli	Fall, Winter, Spring	Cat 4A: Water quality limited, TMDL approved	New Cat 4A: Water quality limited, TMDL approved
0 to 25	E. Coli	Summer	Cat 2: Attaining some criteria/uses	No action
0 to 25	EPTC	Year Round	Attaining	No action
0 to 25	Fecal Coliform	Summer	Attaining	No action
0 to 25	Flow Modification	Undefined	Water quality limited not needing a TMDL	No action
0 to 48.3	Iron	Year Round	Cat 2: Attaining some criteria/uses	No action
0 to 48.2	Lead	Year Round	Cat 5: Water quality limited, 303(d) list, TMDL needed	Added to database
0 to 48.3	Manganese	Year Round	Cat 3B: Potential concern	No action
0 to 48.3	Nickel	Year Round	Cat 2: Attaining some criteria/uses	Added to database
0 to 25	pH	Fall, Winter, Spring	Cat 2: Attaining some criteria/uses	No action
0 to 25	pH	Summer	Cat 2: Attaining some criteria/uses	No action
0 to 48.2	Phosphorus	Summer	Cat 2: Attaining some criteria/uses	No action
0 to 25	Sedimentation	Undefined	Insufficient data	No action
0 to 48.2	Selenium	Year Round	Cat 2: Attaining some criteria/uses	Added to database
0 to 48.2	Silver	Year Round	Cat 2: Attaining some criteria/uses	Added to database
0 to 25	Simazine	Year Round	Attaining	No action
18.2 to 48.3	Temperature	Year Round (Non-spawning)	Cat 4A: Water quality limited, TMDL approved	No action
0 to 48.2	Zinc	Year Round	Cat 2: Attaining some criteria/uses	Added to database

NOTES:
Category 1: All standards are met. (This category is not used.)
Category 2: Attaining - Some of the pollutant standards are met.
Category 3: Insufficient data to determine whether a standard is met.
3B: Potential concern - Some data indicate non-attainment of a criterion, but data are insufficient to assign another category.
Category 4: Water is water quality limited but a TMDL is not needed. This includes:

4A: TMDL approved - TMDLs needed to attain applicable water quality standards have been approved.
4B: Other pollution control requirements are expected to address all pollutants and will attain water quality standards.
4C: Impairment is not caused by a pollutant (e.g., flow or lack of flow is not considered a pollutant.)
Category 5: Water is water quality limited and a TMDL is needed, Section 303(d) list.

Of particular interest is the Dissolved Oxygen and Temperature standard. The year round water quality standard for Dissolved Oxygen, at river mile 20, is a minimum of 8 mg/L, or 90% of saturation. This standard is based on this section of river being designated as cold water habitat. Approximately two miles downstream, the dissolved oxygen standard changes to a minimum of 6.5 mg/L. The year round water quality standard for temperature, from river mile 18.2 to 48.3, is 16 degrees Celsius, based on a 7-day-average maximum. However, no heat load allocation was prescribed to the Molalla WWTP because it only discharges to the Molalla River during the winter months when there is negligible impact on river temperature.

Antidegradation

The statewide Antidegradation Policy is to guide decisions that affect water quality to prevent unnecessary further degradation from new or increased point and nonpoint sources of pollution, and to protect, maintain, and enhance existing surface water quality to ensure the full protection of all existing beneficial uses. The standards and policies set forth in OAR 340-041-0007 through 340-041-0350 supplement the Antidegradation Policy. Exceptions to the statewide antidegradation rule may be granted in accordance with 340-041-0004(9).

Total Maximum Daily Loads

There are two TMDLs that influence the water quality standards in the vicinity of the Molalla River outfall. The first, as set forth in 340-041-0344, is the *Pudding – Ammonia and BOD – October 18, 1993*. Presumably, this is genesis of the BOD_5 and TSS limits in the current NPDES Permit. The second TMDL is the *Molalla-Pudding Subbasin TMDL & WQMP – December, 2008*. Total Maximum Daily Loads were developed for most of the types of pollution causing impairment of beneficial uses in the Molalla-Pudding Subbasin. The TMDLs determine the amount of a given pollutant that a waterbody may receive without violating a water quality standard. The Molalla River is listed for bacteria and temperature impairment. During non-spawning periods, the temperature criterion that applies to the lower Molalla River is 18 deg C for rearing and migration. The waste load allocation for bacteria is based on a logarithmic average of 126 E.coli organisms per 100 milliliters and not one sample exceeding 406 E.coli organisms per 100 milliliters.

Basin Standards

For surface water discharge (Outfall 001), the City of Molalla is required to comply with OAR 340-041 Sections 340, 344, and 345 which pertain to the Willamette Basin. The Molalla River is a salmonid passage/rearing water, and the following standards apply:

- pH (hydrogen ion concentration). pH values may not fall outside 6.5 to 8.5;

- During the period of high stream flows (approximately November 1st to April 30th): A minimum of secondary treatment or equivalent control. Unless otherwise specifically authorized by the Department of Environmental Quality, operation of all waste treatment and control facilities should be at maximum practical efficiency and effectiveness so as to minimize waste discharges to public waters;

- Total Dissolved Solids. Guide concentrations listed may not be exceeded unless otherwise specifically authorized by DEQ upon such conditions as it may deem necessary to carry out the general intent of this plan and to protect the beneficial uses set forth in OAR 340-041-0340: Willamette River and Tributaries — 100 mg/l;

- Effluent BOD concentrations in mg/l, divided by the dilution factor (ratio of receiving stream flow to effluent flow) may not exceed one unless otherwise approved;

- Sewage wastes must be disinfected, after treatment, equivalent to thorough mixing with sufficient chlorine to provide a residual of at least one (1) part per million after 60 minutes of contact time unless otherwise specifically authorized by permit;

- Positive protection must be provided to prevent bypassing raw or inadequately treated sewage to public waters unless otherwise approved by the Department where elimination of inflow and infiltration would be necessary but not presently practicable.

The Molalla WWTP typically only discharges to the Molalla River during high stream flows (November 1st to April 30th). Molalla's NPDES Permit is more restrictive than the basin specific criteria for the Willamette Basin. The basis for the NPDES Permit requirement of 10/10 mg/L BOD_5/TSS during high stream flows is presumably a carry-over from when the City discharged to Bear Creek.

Beneficial Uses

Beneficial uses to be protected in the Molalla River are stipulated in Table 340A of OAR 340-041-340. Table 340A can be found in Appendix A. Included in Table 340A *Designated Beneficial Uses Willamette Basin* are:

- Public Domestic Water Supply
- Private Domestic Water Supply
- Industrial Water Supply
- Irrigation
- Livestock Watering
- Fish and aquatic life
- Water Contact Recreation
- Aesthetic Quality
- Hydro Power
- Commercial Navigation & Transportation
- Wildlife and hunting
- Fishing
- Boating

Mutual Agreement and Order (MAO)

On May 12, 2014, the DEQ issued NPDES Waste Discharge Permit Number 101514 (Permit) to the City of Molalla (Permittee). The Permit authorizes the Permittee to construct, install, modify or operate wastewater treatment, control and disposal facilities (facilities) and discharge adequately treated wastewaters into the Molalla River, waters of the state, in conformance with the requirements, limitations and conditions set forth in the Permit. The Permit expires on June 1, 2019.

The Permittee has violated the Permit as summarized in the following sections. DEQ and the Permittee recognize that until new or modified facilities are constructed and put into full operation, Permittee might continue to violate the seasonal discharge limit as well as the daily, weekly average, and monthly average Total Suspended Solids (TSS) limits of the permit at times during the period of the pending Mutual Agreement and Order.

A copy of the executed MAO is included in Appendix A. The major elements of the MAO are summarized below.

1) Development of a Wastewater Facility and Collection System Master Plan document that will comply with the applicable DEQ requirements for a facilities plan, as described in http://www.oregon.gov/deq/FilterDocs/FacilitiesPlansGuidelines.pdf.

2) The WWFCSMP must evaluate the removal of infiltration and inflow, removal of biosolids and expanded use of recycled water as both interim steps prior to any other plant upgrade or expansion and as ongoing activities to best manage the collection and treatment system and beneficial use of biosolids and recycled water.

3) Construction related to the final approved WWFCSMP must be completed no later than five years following DEQ approval of the final WWFCSMP.

4) Requiring the Permittee to meet the following interim effluent limitations, measured as specified in the Permit, until completions of the upgrades identified in the final WWFCSMP:

TABLE 3.1.2
INTERIM PERMIT LIMITS

	Units	Average Monthly	Average Weekly	Daily Maximum
TSS (November 1 – April 30)	mg/L	15	20	-
	lbs/day	240	300	480
	% removal	85	-	-

Current NPDES Permit Requirements

The City of Molalla operates its wastewater system under NPDES Permit No. 101514, issued May 12, 2014 by the DEQ. This permit expires June 1, 2019. The treatment system is a Level III. The collection system is a Level II. A summary of regulatory requirements within the NPDES Permit is provided below. A copy of the City's NPDES permit is included in Appendix A.

Outfall 001 is located on the Molalla River at approximately river mile 20. Discharge is only permitted to the Molalla River Outfall 001 from November 1st to April 30th. Effluent is land applied in accordance with permit requirements from May 1st through October 31st. Outfall 002 is the recycled water outfall for several DEQ approved land application sites. Prior to land application, wastewater must receive Class A, B, or C treatment based upon the approved application site.

The City once discharged to Bear Creek, but abandoned the outfall because effluent discharges frequently violated the dilution equation as specified in the last permit:

"Effluent BOD_5 concentration in mg/L, divided by the dilution factor (ratio of receiving stream to effluent flow) shall not exceed one."

Furthermore, the above dilution equation does not consider DEQ guidance requiring the use of only 25% to 35% of the creek flow at the discharge point for the regulatory mixing zone calculations. The above dilution equation uses the full creek flow to specify dilution. In either event, the Bear Creek outfall was abandoned due to the limited assimilative capacity of the creek.

Molalla River Outfall 001

From November 1st to April 30th, effluent discharge must meet the effluent limitations in Table 3.1.3 and 3.1.4. Mass load effluent limits for Biochemical Oxygen Demand (BOD_5) and Total Suspended Solids (TSS) are based on the average wet weather design flow to the facility which equaled 1.92 Million Gallons per Day (MGD) at the time the permit was issued.

TABLE 3.1.3
NPDES PERMIT (101514) BOD_5 AND TSS LIMITS
OUTFALL 001 (NOV 1 – APR 30)

Parameter	Average Effluent Concentrations		Monthly Average	Weekly Average	Daily Maximum
	Monthly	Weekly	lbs/day	lbs/day	lbs
BOD_5	10 mg/L	15 mg/L	160	240	320
TSS	10 mg/L	15 mg/L	160	240	320

TABLE 3.1.4
NPDES PERMIT (101514) ADDITIONAL PARAMETERS
OUTFALL 001 (NOV 1 – APR 30)

Parameter	Limits
BOD_5 and TSS Removal Efficiency	May not be less than 85% monthly average for BOD_5 and TSS
E. coli Bacteria	Monthly geometric mean may not exceed 126 organisms per 100 ml. No single sample may exceed 406 organisms per 100 ml.
pH	Must be within the range of 6.0 to 9.0 S.U.
Total Residual Chlorine	Monthly average concentration may not exceed 0.07 mg/L. Daily maximum concentration may not exceed 0.18 mg/L.
Ammonia (NH_3-N)	Monthly average concentration may not exceed 16.7 mg/L. Daily maximum concentration may not exceed 25.9 mg/L.
Dilution	Discharge may not commence until gauged stream flow exceeds 350 cfs and will cease when the average stream flow for the previous seven day period is less than 350 cfs.
Temperature	Effluent discharge will cease when the 7-day moving average effluent temperature exceeds 18°C.
Notes	No single E. coli sample may exceed 406 organisms per 100 mL; however, no violation has occurred if the permittee takes at least 5 consecutive re-samples at 4 hour intervals beginning within 28 hours after the original sample was taken and the log mean of the 5 re-samples is less than or equal to 126 E. coli organisms per 100 mL.

Additional requirements for Outfall 001 are outlined below:

- **Regulatory Mixing Zone**. No wastes may be discharged or activities conducted that cause or contribute to a violation of water quality standards in OAR 340-041 applicable to the Willamette

Basin except as provided for in OAR 340-045-0080 and the following regulatory mixing zone:

The allowable mixing zone is that portion of the Molalla River with boundary dimensions equal to the length of the effluent diffuser plus 10-feet on each end with the mixing zone extending 5-feet upstream and 50-feet downstream of the diffuser. The Zone of Immediate Dilution (ZID) is defined as that portion of the regulatory mixing zone within 5-feet of the diffuser.

- **Groundwater Protection**. The permittee may not conduct any activities that could cause an adverse impact on existing or potential beneficial uses of groundwater. All wastewater and process related residuals must be managed and disposed of in a manner that will prevent a violation of the Groundwater Quality Protection Rules (OAR Chapter 340, Division 040).

Understanding how, and when, the average wet weather flow was derived and etched into the NPDES Permit is important in that it dictates mass load allocations and sets into motion repeated violations. According to the DEQ Fact Sheet and NPDES Wastewater Discharge Permit Evaluation (12/18/2003) for the City of Molalla, "DEQ has calculated a design average wet weather flow (AWWF) = 1.92 MGD that applies to the new discharge location [at river mile 20 on the Molalla River]." Therefore, in 2003, mass load limits were established based on actual average wet weather flows, not future flows, and not max month flows. As additional background, based on the 2000 Wastewater Facilities Plan as prepared by Tetra Tech/KCM, the average wet weather flow in 1999 was 1.85 MGD, not drastically different than the flow established in the 2003 fact sheet. By defining the mass load limits based on historical, presumably pre-2003 flows, the City's WWTP was predestined for non-compliance. Either during max month flow events, or as a result of population growth, the City's WWTP was predisposed to eventually not comply with the discharge requirements. As a frame of reference, the City's population in 2000 was 5,962, compared to 9,939 in 2017. As the City's population grew, the mass load limits necessitated increasingly stringent and unrealistic discharge requirements with regard to BOD_5 and TSS.

Furthermore, Molalla's winter time BOD_5 and TSS concentration limits are considerably more stringent than the Willamette Basin design criteria and discharge permits throughout the State of Oregon. A brief survey of NPDES Permits in Oregon is summarized below.

- Tangent's WWTP discharges to Calapooia Creek during the winter. Winter limits are 30/50 mg/L BOD_5/TSS.
- Stayton's WWTP discharges to the North Santiam River during the winter. Winter limits are 30/30 mg/L BOD_5/TSS.
- Woodburn's WWTP discharges to the Pudding River during the winter. Winter limits are 25/30 mg/L BOD_5/TSS.
- Sheridan's WWTP discharges to the South Yamhill River during the winter. Winter limits are 30/50 mg/L BOD_5/TSS.
- Dallas' WWTP discharges to Rickreall Creek during the winter. Winter limits are 25/30 mg/L BOD_5/TSS.
- Independence's WWTP discharges to the Willamette River during the winter. Winter limits are 30/50 mg/L BOD_5/TSS.

At the time that the NPDES Permit was developed for the Molalla River outfall, again according to the 2003 DEQ Fact Sheet, "The Department proposes winter season concentration limits more stringent than the basin minimum design criteria. The limits are unchanged from the previous permit." The 10/10 mg/L BOD_5/TSS concentration limits were essentially carried over from the Bear Creek outfall. On January 26, 2018, DEQ furnished the following response concerning the permit inequity with the basin standards;

"In 2009, DEQ wrote a permit that reflected the settlement agreement that required Molalla produce Class A recycled water. This was carried into the 2014 permit because the limits were being met and the stated goal to DEQ was that Class A water would still be produced."

Independent of how the current discharge requirements were derived, the existing WWTP's violations are the end-product of a deficient average wet weather flow in combination with unnecessarily strict BOD_5/TSS concentration limits. Given the population growth, mass load limits, and concentration limits, the WWTP was prearranged to violate the discharge requirements.

Recycled Water Outfall 002

All recycled water is managed in accordance with the NPDES Permit and as described in the City's DEQ-approved Recycled Water Use Plan. Recycled water is applied at rates that do not adversely impact groundwater quality and in accordance with site management practices that ensure continued agricultural, horticultural, or silvicultural production that does not reduce the productivity of the sites. Use of Recycled Water (Outfall 002) is permitted according to the criteria listed in Table 3.1.5 and 3.1.6.

TABLE 3.1.5
NPDES PERMIT (101514) RECYCLED WATER MONITORING REQUIREMENTS
OUTFALL 002 (MAY 1 – OCT 31)

Item or Parameter	Minimum Frequency	Sample Type
Flow (MGD) or quantity irrigated (inches/acre)	Daily	Measurement
Flow meter calibration	Annually	Verification
Quantity chlorine used (lbs)	Daily	Measurement
Chlorine, total residual (mg/L)	Daily	Grab
pH	2/week	Grab
Total Coliform	Daily (Class A) 3/week (Class B) 1/week (Class C)	Grab
Turbidity	Hourly (Class A only)	Measurement
Nutrients (TKN, NO_2-N+NO_3-N, NH_3-N, Total Phosphorus)	Quarterly	Grab

TABLE 3.1.6
NPDES PERMIT (101514) RECYCLED WATER LIMITS
OUTFALL 002 (MAY 1 – OCT 31)

Class	Level of Treatment	Beneficial Uses
A	Oxidized, filtered, and disinfected. Before disinfection, turbidity may not exceed: • An average of 2 NTUs within a 24-hour period. • 5 NTUs more than five percent of the time within a 24-hour period. • 10 NTUs at any time. After disinfection, total coliform may not exceed: • A median of 2.2 organisms per 100 mL based on daily sampling over the last 7 days that analyses have been completed. • 23 organisms per 100 mL in any single sample.	• Class B, Class C, Class D, and non-disinfected uses. • Irrigation for any agricultural or horticultural use. • Landscape irrigation of parks, playgrounds, school yards, residential landscapes, or other landscapes accessible to the public. • Commercial car washing or fountains when the water is not intended for human consumption. • Water supply source for non-restricted recreational impoundments.
B	Oxidized and disinfected. Total coliform may not exceed: • A median of 2.2 organisms per 100 mL, based on the last 7 days that analyses have been completed. • 23 total coliform organisms per 100 mL in any single sample.	• Class C, Class D, and non-disinfected uses. • Stand-alone fire suppression systems in commercial and residential building, non-residential toilet or urinal flushing, or floor drain trap priming. • Water supply source for restricted recreational impoundments.
C	Oxidized and disinfected. Total coliform may not exceed: • A median of 23 total coliform organisms per 100 mL, based on results of the last 7 days that analyses have been completed. • 240 total coliform organisms per 100 mL in any two consecutive samples.	• Class D and non-disinfected uses. • Irrigation of processed food crops; irrigation of orchards or vineyards if an irrigation method is used to apply recycled water directly to the soil. • Landscape irrigation of golf courses, cemeteries, highway medians, or industrial or business campuses. • Industrial, commercial, or construction uses limited to: industrial cooling, rock crushing, aggregate washing, mixing concrete, dust control, nonstructural fire-fighting using aircraft, street sweeping, or sanitary sewer flushing.

Compliance with Current NPDES Permit Requirements

The City of Molalla has violated the NPDES Permit as follows:

1. On November 9, 2016, DEQ issued Permittee Notice of Civil Penalty Assessment and Order No. WQ/M-NWR-2016-163. The Notice assessed a $5,150 in civil penalties for failing to comply with turbidity and bacteria limits in recycled water. The Mutual Agreement and Order (MAO), amends the penalty amount in Notice of Civil Penalty Assessment and Order No. WQ/M-NWR-2016-163 to recognize the withdrawal of the violation related to the lagoon leak test.

2. From October 12 through October 31, 2016, Permittee discharged fully treated effluent to the Molalla River in violation of Schedule A, Condition 1; and ORS 468B.025(1)(a).

3. Failed to comply with TMDL planning and implementation requirements as described in Warning Letter with Opportunity to Correct No. 2016-WLOTC-1563, issued May 13, 2016.

4. From May 22 through June 1, 2017 Permittee discharged fully treated effluent to the Molalla River in violation of Schedule A, Condition 1 of the permit and ORS 468B.025(1)(a).

5. From June 14-28, 2017 Permittee discharged fully treated effluent to the Molalla River in violation of Schedule A, Condition 1 of the permit and ORS 468B.025(1)(a).

6. From October 12-31, 2017, the Permittee discharged fully treated wastewater to the Molalla River in violation of Schedule A, Condition 1 of the permit and ORS 468B.025(1)(a).

7. On September 6, 2017 violated ORS 468B.025(1)(b) when it discharged chlorinated effluent to Bear Creek that caused an exceedance of the acute toxicity water quality standard for chlorine.

8. In July, August, September and October of 2017, Permittee violated permit effluent limits for turbidity and total coliform bacteria in recycled water.

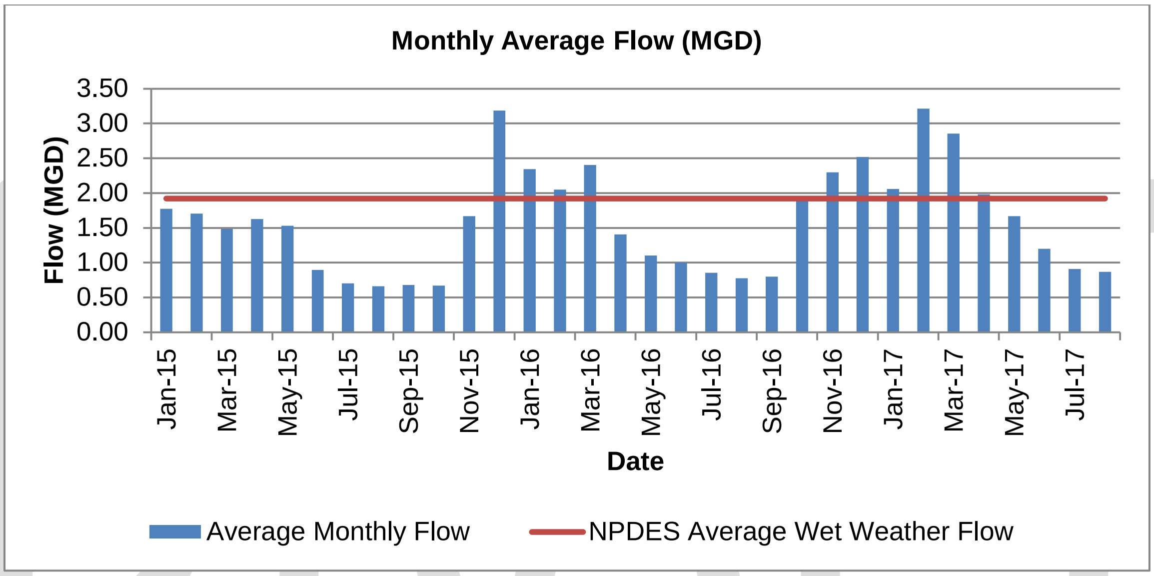
9. Permittee exceeded the monthly total suspended solids (TSS) average concentration limit of 10 mg/L by discharging effluent with the following monthly average TSS concentrations: November 2015 – 11 mg/L, December 2015 – 11 mg/L, January 2017, 12 mg/L.

10. For an unknown amount of time following the implementation of the Class A standard in the August 29, 2014 Recycled Water Use Plan and prior to April 2016, it is possible that Permittee's turbidimeter was not providing accurate information.

Molalla River Outfall 001

Influent Flows
The mass load limits established in the NPDES Permit are based on an average wet weather design flow of 1.92 MGD. Monthly flows were evaluated in comparison to the permitted average wet weather flow. A summary of the monthly average wet weather flows is provided in Figure 3.1.1. The wastewater treatment plant's influent flows, because of excessive infiltration and inflow and limited equalization ability of the facultative/storage lagoons, are unacceptably greater than the permitted average wet weather flow.

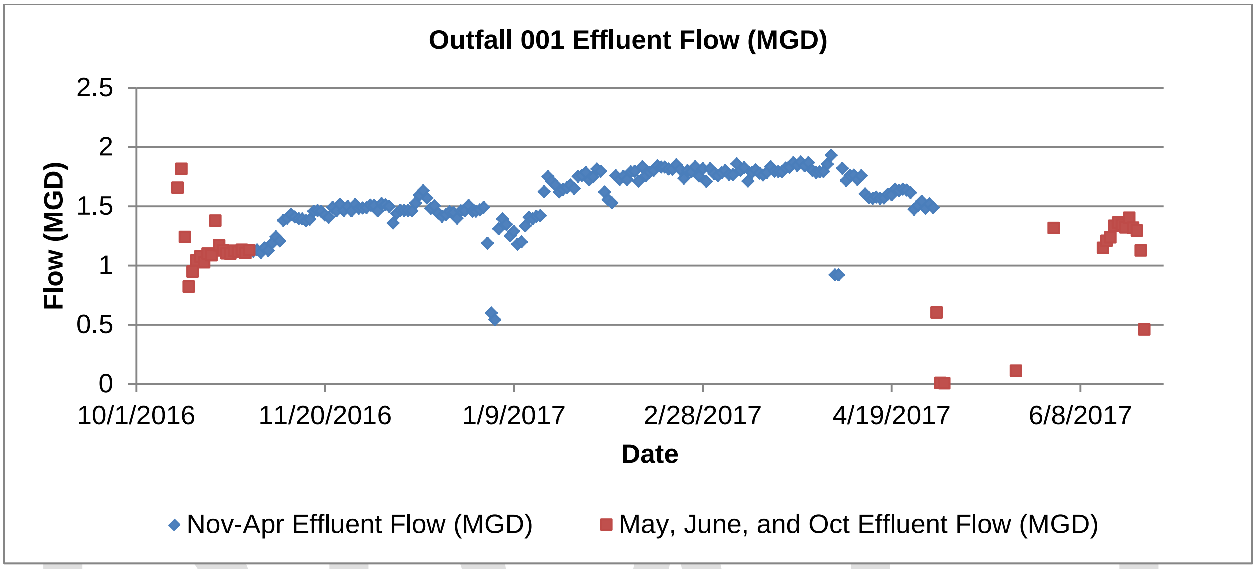
FIGURE 3.1.1
HISTORICAL INFLUENT FLOWS (2015-2017)



Effluent Flows
Molalla's WWTP is prohibited from discharging to the Molalla River outfall from May 1st to October 31st. Due to rain induced infiltration and inflow, limited equalization capacity of the facultative lagoons, and an inability to land apply recycled water in May and October, discharge to the Molalla River outfall sometimes occurs in May, June, and October. Figure 3.1.2 summarizes the WWTP's effluent flows to the Molalla River for the 2016-2017 time period. Data shown in red indicates a permit violation.

On May 4, 2018, the Oregon DEQ received a letter from the City of Molalla regarding "Molalla WWTP Corrected Flow and Laboratory QC Check Data." The letter detailed the discovery of improperly recorded and calculated flow data. The improperly recorded flow data occurred from November 2015 to February 2018. The effluent flow data, and corresponding mass loads, summarized in this WWFCSMP are based on the corrected discharge monitoring reports.

FIGURE 3.1.2
HISTORICAL EFFLUENT FLOWS OUTFALL 001 (2016 – 2017)



<u>Effluent BOD_5 Performance</u>
A summary of Molalla's WWTP effluent performance, with respect to effluent BOD_5 concentration and mass load, is provided in Figures 3.1.3 and 3.1.4, respectively. From the time period January 2015 to June 2017, the WWTP operated in compliance with effluent BOD_5 concentration and mass load limits. However, the WWTP did violate BOD_5 mass load limits in March and April of 2014. The WWTP also violated BOD_5 concentration limits in February 2013, December 2013, and January 2014.

FIGURE 3.1.3
HISTORICAL WWTP EFFLUENT BOD_5 PERFORMANCE (CONCENTRATION)

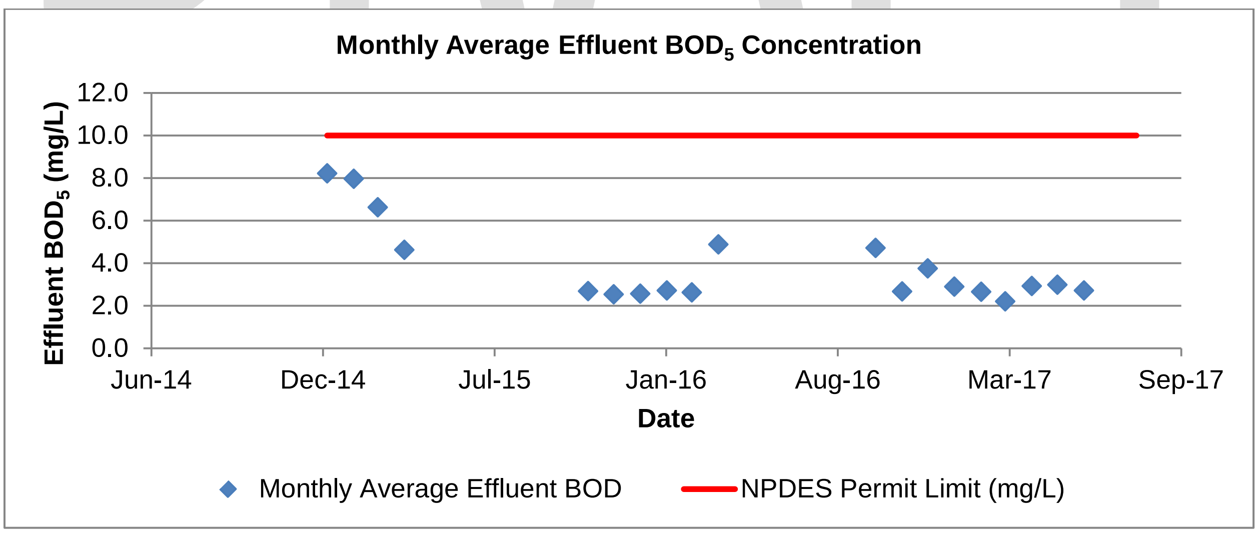
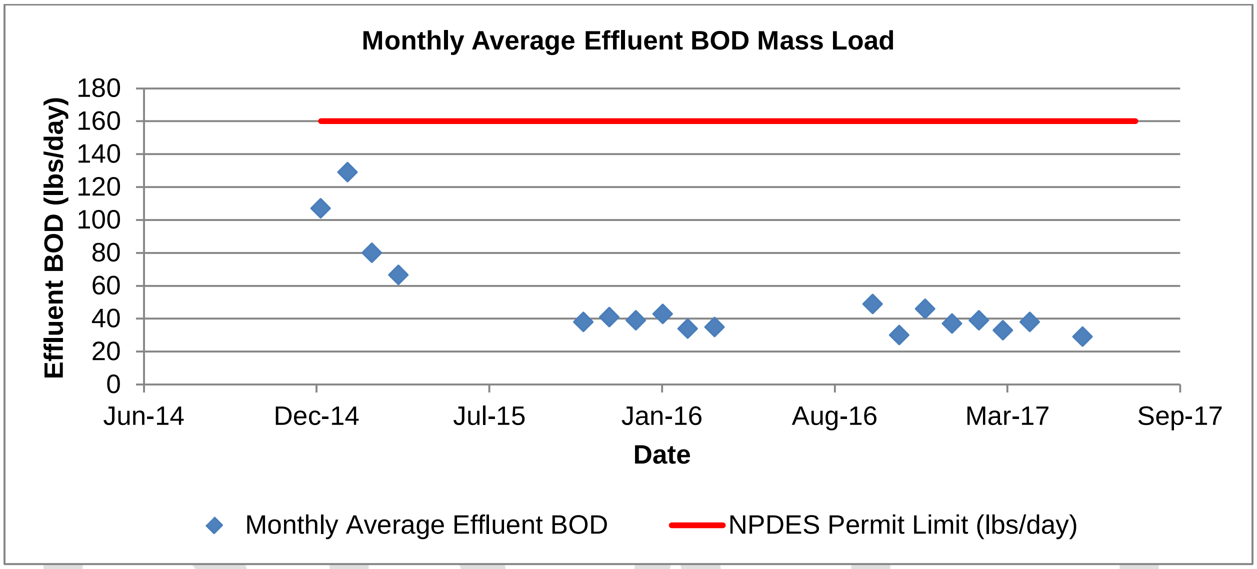


FIGURE 3.1.4
HISTORICAL WWTP EFFLUENT MONTHLY BOD_5 MASS LOAD (LBS/DAY)



Effluent TSS Performance
The existing facility has difficulty complying with effluent TSS concentration and mass load requirements during the winter when discharging to the Molalla River. Due to high wintertime flows and the established mass load limits, the City regularly exceeds wintertime mass load limits. Figures 3.1.5 and and 3.1.6 illustrate the consistent inability of the WWTP to comply with TSS limits. The WWTP is also unable, although not shown, to comply with the weekly average and daily maximum mass load requirements for TSS.

FIGURE 3.1.5
HISTORICAL WWTP EFFLUENT TSS PERFORMANCE (CONCENTRATION)

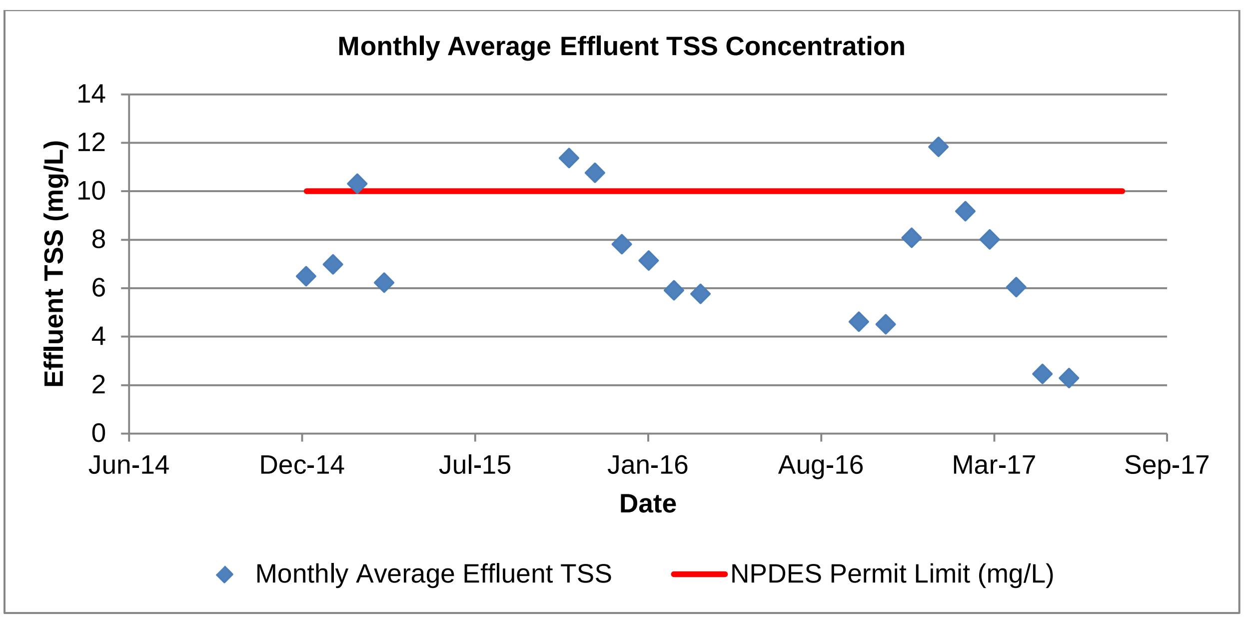
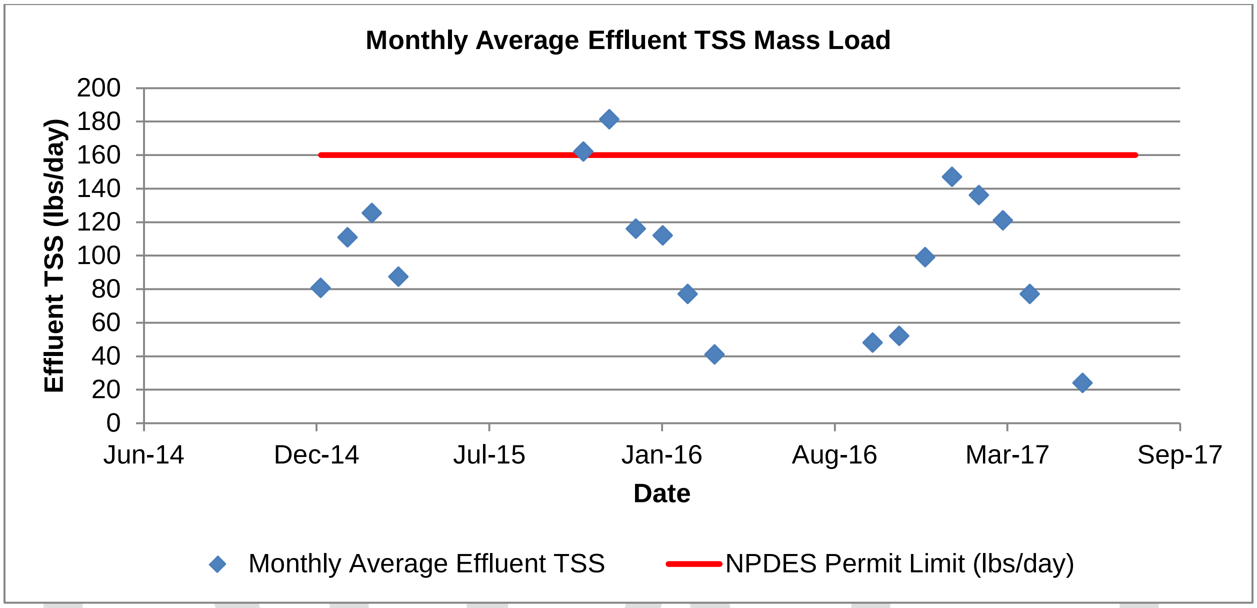


FIGURE 3.1.6
HISTORICAL WWTP EFFLUENT MONTHLY TSS MASS LOAD (LBS/DAY)



<u>Effluent Ammonia Performance</u>
Effluent ammonia data was evaluated to identify trends or compliance problems. For the period shown, the average monthly effluent ammonia was in compliance with the monthly average permit limit of 16.7 mg/L and the daily maximum limit of 25.9 mg/L. Effluent data from the WWTP is illustrated in Figure 3.1.7 and 3.1.8.

FIGURE 3.1.7
HISTORICAL WWTP EFFLUENT AMMONIA PERFORMANCE (MONTHLY)

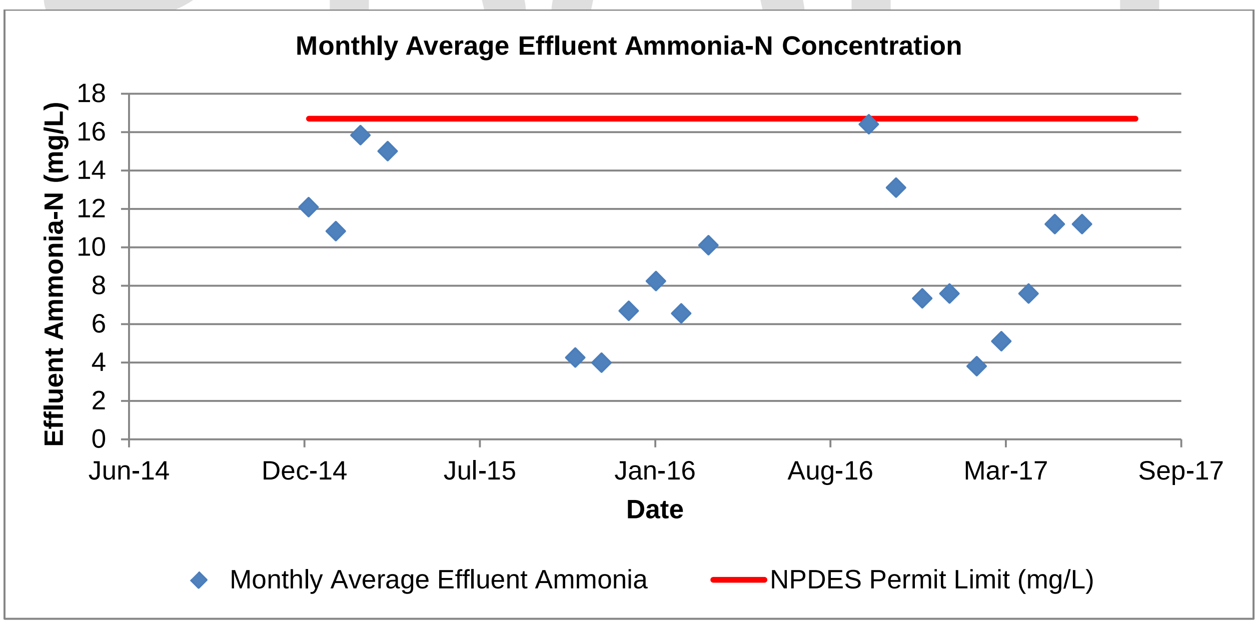
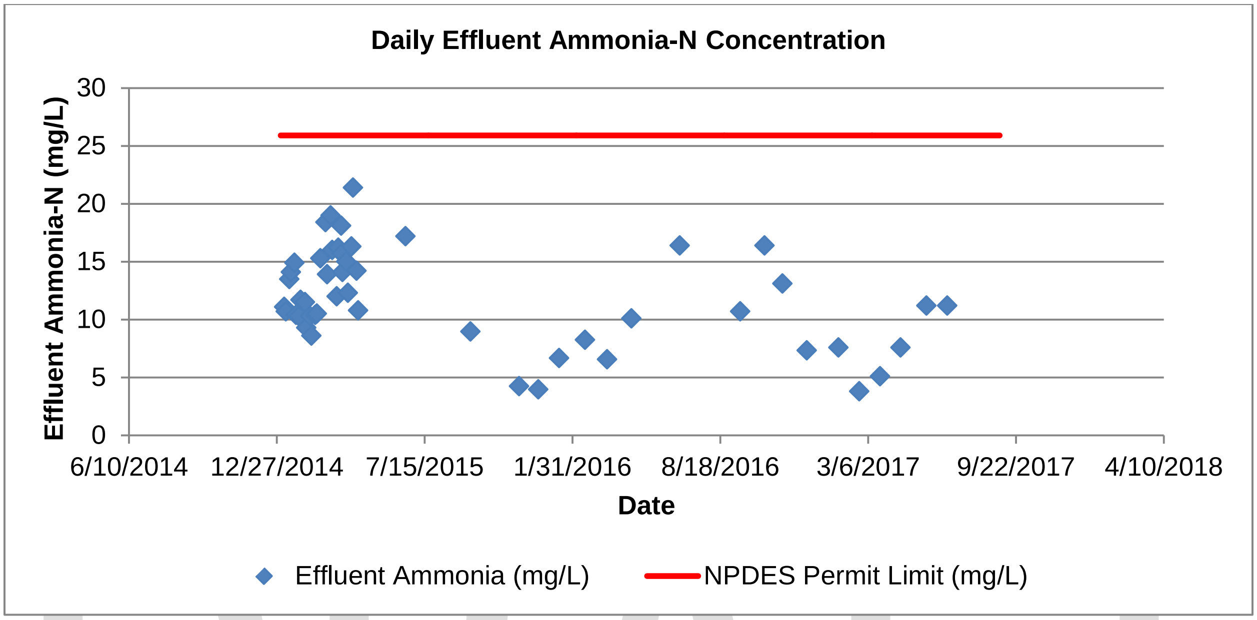


FIGURE 3.1.8
HISTORICAL WWTP EFFLUENT AMMONIA (NH_3-N) PERFORMANCE (DAILY)



<u>Effluent E. coli Performance</u>
Effluent E. coli data was analyzed to determine compliance with the NPDES Permit. Figure 3.1.9 shows that the monthly geometric mean E. coli is usually well below the monthly geometric mean not to exeed requirement of 126 organisms per 100 mL. Figure 3.1.10 illustrates E. coli performance with the daily requirement that no single sample exceed 406 organisms per 100 mL.

FIGURE 3.1.9
HISTORICAL WWTP EFFLUENT E. COLI PERFORMANCE (MONTHLY)

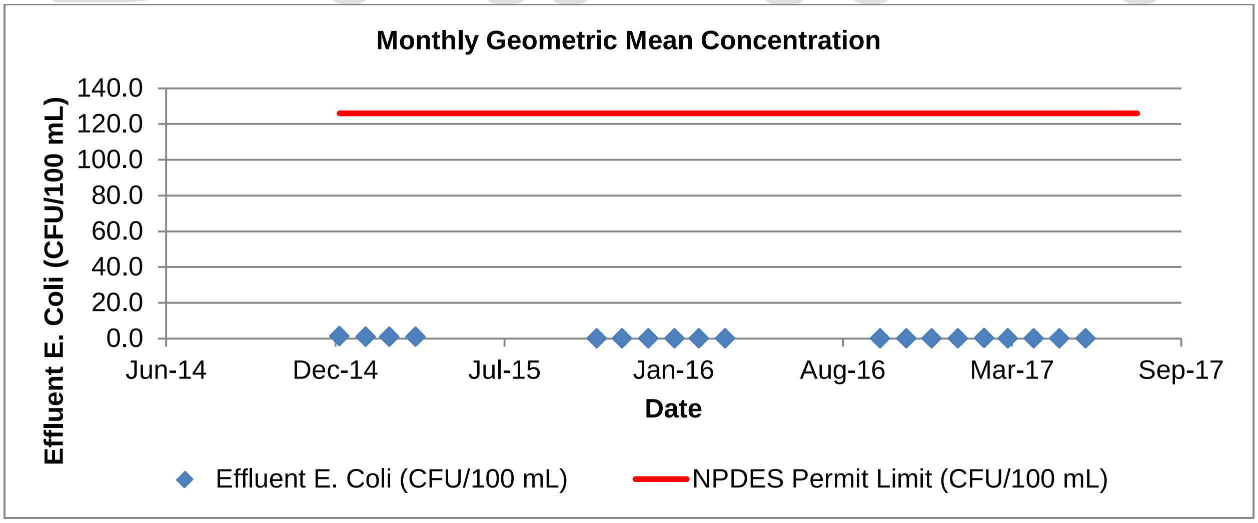
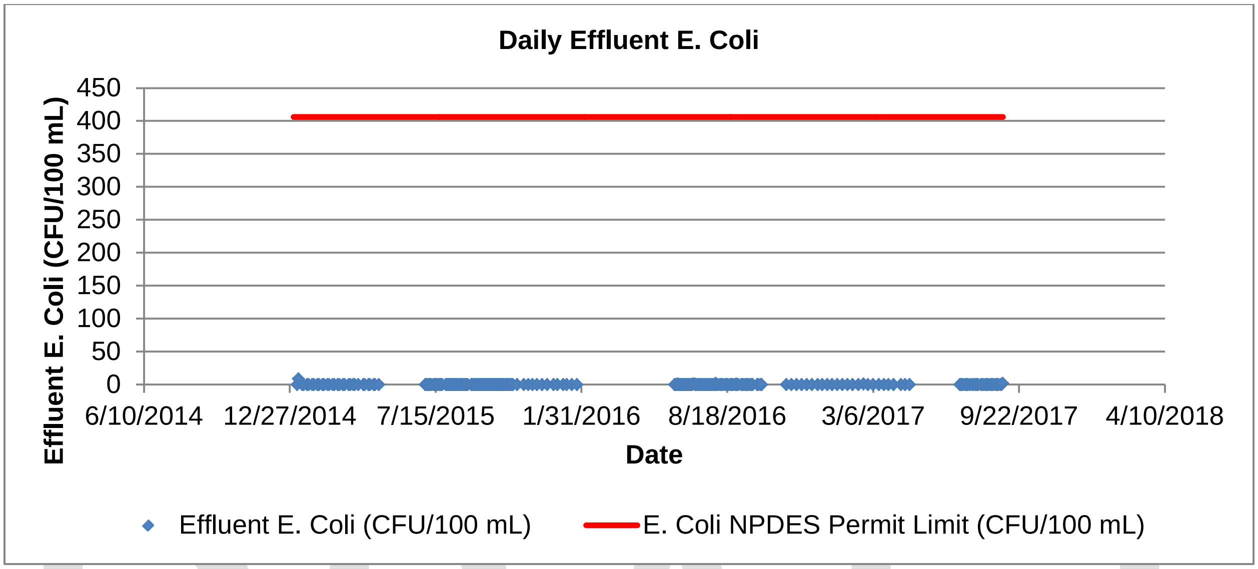


FIGURE 3.1.10
HISTORICAL WWTP EFFLUENT E. COLI PERFORMANCE (DAILY)



<u>Effluent pH and Temperature</u>
Effluent temperature and pH data is summarized in Figure 3.1.11 and 3.1.12, respectively. The daily effluent temperature has periodically exceeded the permit limit of 18 degrees C. The WWTP has had no problems operating in compliance with the pH range requirement of 6 to 9 S.U.

FIGURE 3.1.11
WWTP EFFLUENT TEMPERATURE

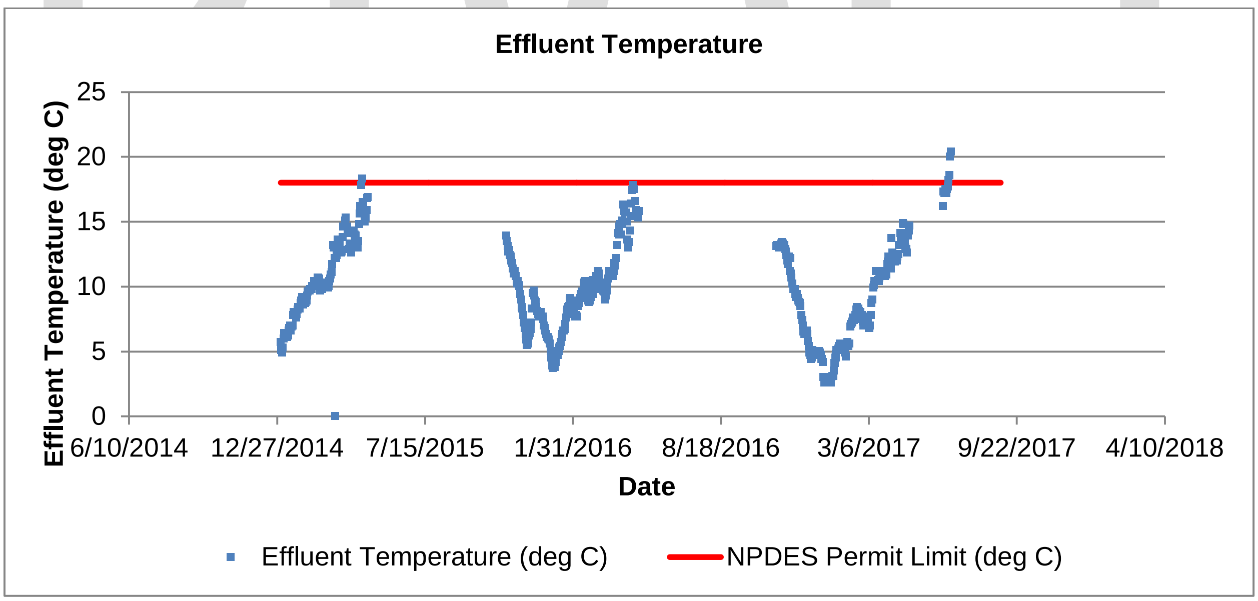
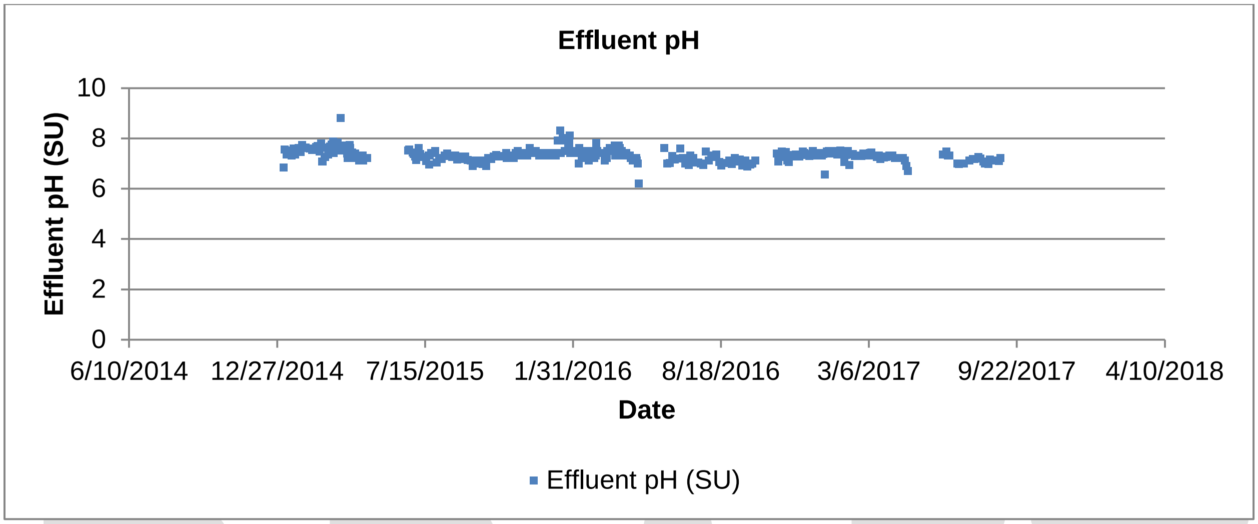


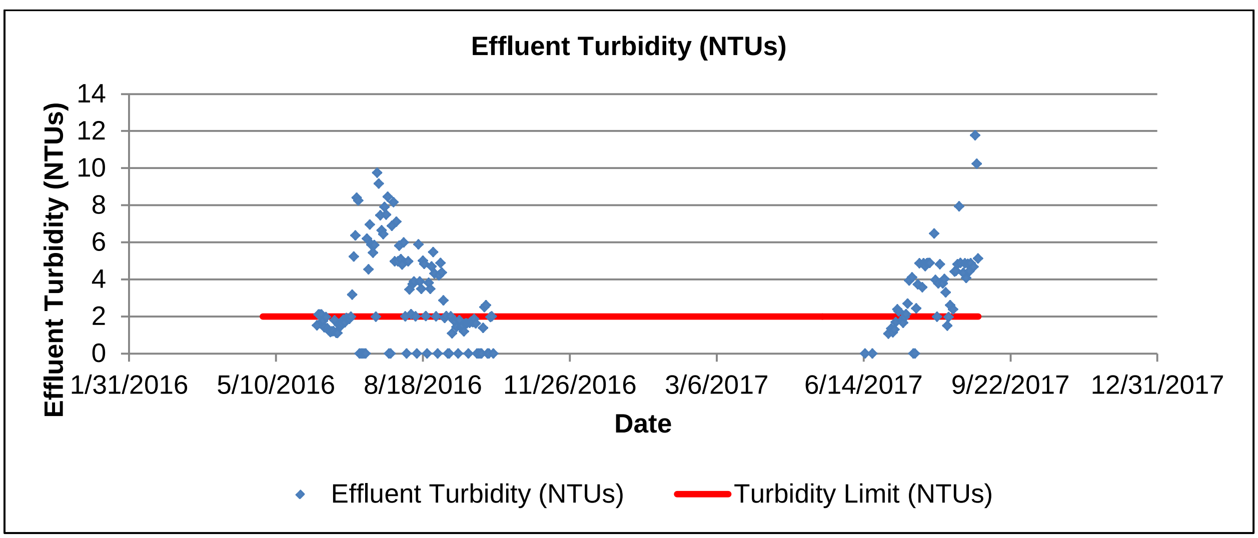
FIGURE 3.1.12
WWTP EFFLUENT PH



Recycled Water Outfall 002

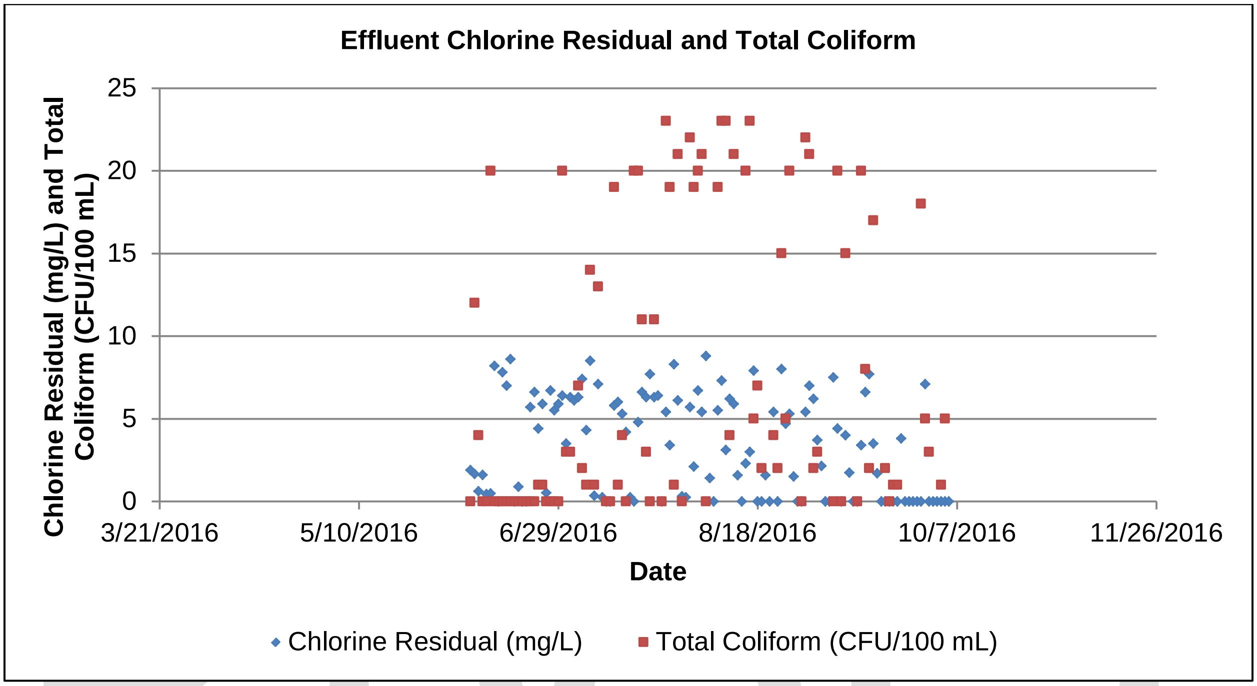
Effluent Turbidity Performance
From July 2015 to September 17, 2018, the City managed the disposal of recycled water in accordance with the NPDES Permit, the DEQ approved Consolidated Recycled Water Use Plan (Brown and Caldwell, July, 2015), and the Recycled Water Agreement between the City and Coleman Corrals, Inc. The 2015 Consolidated Recycled Water Use Plan and the Recycled Water Agreement with Coleman Corrals stipulate that the City shall meet Class A water requirements for the majority of water used beneficially. Class A recycled water must be filtered and the turbidity must not exceed an average of 2 NTUs in a 24-hour period, 5 NTUs more than five percent of the time, and 10 NTUs at any time. Figure 3.1.13 shows the inability of the WWTP to produce Class A effluent, with respect to effluent turbidity.

FIGURE 3.1.13
HISTORICAL WWTP EFFLUENT TURBIDITY (NTUs)



Effluent Total Coliform and Chlorine Residual Performance
Figure 3.1.14 shows historical effluent total coliform and chlorine residual. After disinfection, for Class A compliance, total coliform may not exceed a median of 2.2 organisms per 100 mL based on daily sampling over the last 7 days that analyses have been completed, or 23 organisms per 100 mL in any single sample. Effluent total coliform samples (CFU/100 mL) regularly exceed NPDES Permit requirements.

FIGURE 3.1.14
HISTORICAL WWTP EFFLUENT TOTAL COLIFORM AND CHLORINE RESIDUAL



Potential Future Regulatory Issues

This section discusses some of the potential future requirements that could become important to municipalities based on current regulatory trends. Future regulatory requirements cannot be thoroughly analyzed, since they are under development and have not yet been implemented. New effluent limits may be incorporated in the NPDES Permit at the time of renewal.

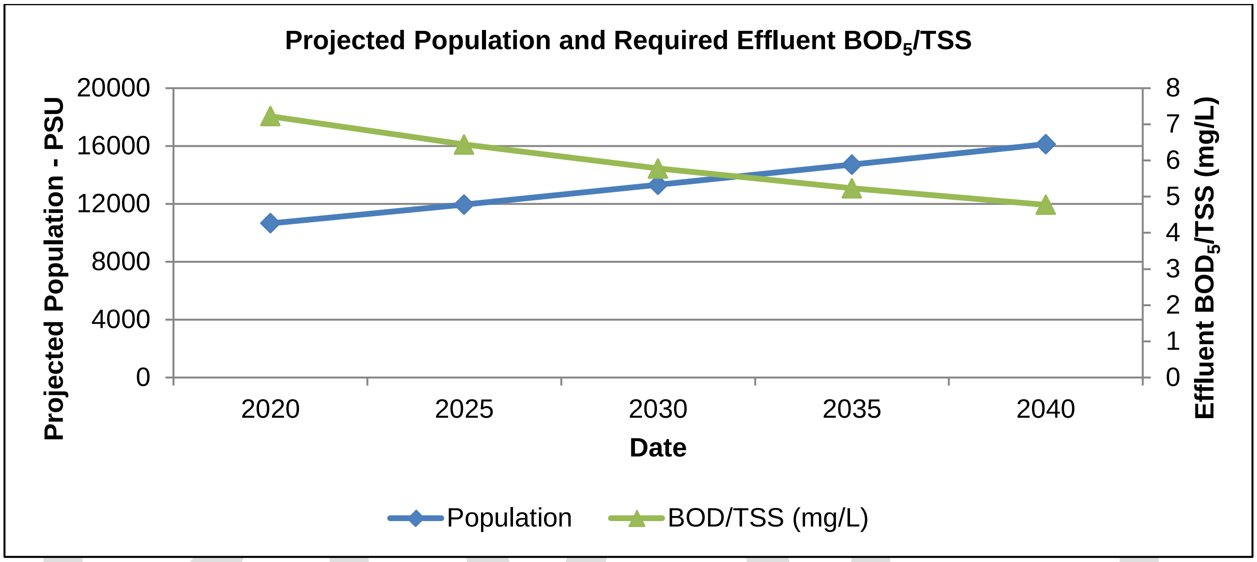
The EPA is committed to making greater progress towards accelerating the reduction of nitrogen and phosphorus loads to the Nation's waters. The current permit includes an Ammonia (NH_3-N) limit, but doesn't include a phosphorus limit. While it is not anticipated that near term permits will require a more stringent Ammonia (NH_3-N) limit and/or a phosphorus limit; provisions should be integrated into any facility designs to accommodate necessary infrastructure for additional Ammonia (NH_3-N) and/or phosphorus removal.

Of particular importance to Molalla is the desire to discharge to the Molalla River in May when river conditions allow. According to DEQ, the WWTP must not raise the river temperature by more than 0.2°C above the temperature standard of 13 deg C for salmon and steelhead spawning. The temperature criterion is calculated after completely mixing with 100% of the 7Q10 flow.

Future Mass Load Limits

Without a mass load increase, as flows continue to increase as a result of the anticipated population growth, the City will violate the permit at an increasing rate. At future wet weather flows, and the current monthly average TSS limit of 160 lbs/day, the wastewater system would be required to produce effluent BOD_5/TSS less than 5 mg/L, an unlikely ability of a lagoon process, even with tertiary treatment. Required WWTP effluent BOD_5/TSS concentration requirements, based on the current mass load limits, are illustrated in Figure 3.1.15.

FIGURE 3.1.15
FUTURE EFFLUENT BOD_5/TSS CONCENTRATION REQUIREMENTS



The City must negotiate with DEQ to adjust the mass load limits to match flows outlined in the 2007 WWTP Upgrade design documents and future flows. The mass load limits should take into account current and future wet weather flows, as well as any contributions from storing wastewater in the facultative/storage lagoons in the summer that is ultimately destined for discharge over the winter months.

3.2 Design Criteria and Considerations

Treatment planning must take into account existing and projected loadings and flows, and regulatory requirements. General design considerations incorporated in the development and evaluation of alternatives are discussed below. Design criteria for future conveyance system expansions are based on topography. Estimated future flows are discussed in Section 3.6.

Design Period

The design period must be long enough to ensure the new facilities will be adequate for future needs, but short enough to ensure effective use within their economic life. Collection system pump stations serving the properties within the Urban Growth Boundary (UGB) will be based on a design period of 20 years from the date of commissioning. Gravity collection line sizing will be based on ultimate build-out. Treatment facility recommendations will be based on a 20-year planning period from the date the improvements are commissioned.

Collection System

Gravity Sewers

Collection systems must be designed to consider natural ground slope, subsurface conditions, capacity requirements, minimum slope considerations, minimum flow velocities required to maintain solids suspension, and potential sulfide and odor generation. Collection sewers should be designed for ultimate development of areas.

Force Mains

The City currently operates 5 small pump stations and associated force mains. The DEQ guidelines for force mains are important to help ensure proper performance and longevity. The DEQ issued the current version of *Oregon Standards for Design and Construction of Wastewater Pump Stations* in May 2001, which includes guidelines for force main design.

Pump Stations

Design of pump (lift) stations is a critical element of sanitary sewer collection systems. New pump stations must be designed to meet the *Oregon Standards for Design and Construction of Wastewater Pump Stations*, issued in May 2001 by DEQ. The EPA *Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability* are to be used to determine the minimum number and sizing of components. Reliability Class I criteria are to be utilized in design.

Pump station must be able to handle the peak instantaneous flows in the system without overflowing. The pump stations should be designed without an increase to the total sulfide generation potential of the collection system. Contemporary design practice requires some wet well storage of wastewater plus retention in the force main; both of which tend to increase the potential sulfide generation when supplemental aeration is not provided. To minimize hydrogen sulfide generation, wet wells should be as small as possible while still allowing for future growth. Wet well detention times of 30 minutes or less are recommended to avoid hydrogen sulfide generation. When detention times in the pump station force main exceed 25 to 30 minutes, a system to control hydrogen sulfide generation and the accompanying odor and corrosion problems is recommended.

Pump stations should have redundant pump equipment and provisions for emergency generator operation. Power outage frequency and duration must be considered in pump station design to ensure that overflows do not occur due to power loss. In some cases, a portable generator connected to the pump station with a manual transfer switch will suffice. In larger pump stations, a permanent standby generator may be required. Level controls should include a redundant high wet well level sensor.

Wastewater treatment facilities, including pump stations, are also regulated under National Fire Protection Association (NFPA) 820, *Fire Protection in Wastewater Treatment and Collection Facilities*. The Occupational Safety and Health Administration (OSHA) Permit Required Confined Spaces Standard 29 CFR 1910.146 limits individual access to spaces that might trap a person or contain noxious atmospheres.

Wastewater Treatment Facility

Primary consideration will be given to the degree of treatment required to meet the discharge requirements set forth in the NPDES Permit, and to provide sufficient sizing of the facility to handle future projected peak hydraulic and organic loads.

Flexibility

Conveyance and treatment design should allow for flexibility in operation and maintenance. The treatment plant Operator must have the ability to alter plant flows around the major process units without significantly degrading effluent quality. This goal can be achieved by providing redundant units and multiple interconnections between units when appropriate. Conveyance and treatment equipment design should also be such that maintenance, both routine and emergency, can be performed without excessively loading other components. Flexibility is also needed to ensure that discharge requirements can be met during changing influent conditions and to allow construction and connection of new process units as needed.

Plant Reliability Criteria

Reliability of treatment processes depends on proper application of unit loading factors and conservative selection of equipment to ensure long life and minimum maintenance costs. Each unit process should be selected based on its capabilities to effectively treat the waste characteristics for the specific application. Capabilities of the treatment plant Operator and the community should also be considered. Processes that require a high degree of manual labor and specialized instrumentation should be avoided in most cases, especially for small communities. Redundancy is also a key factor in reliability. This proposed facility will be designed to meet EPA Reliability Class I standards because the facility discharges into a "public water supply, shellfish, or primary contact recreation waters, or as a result of its volume and/or character, could permanently or unacceptably damage or affect the receiving waters or public health if normal operations were interrupted."

For components included in the design of Reliability Class I, the following backup requirements apply:

- **Mechanically Cleaned Bar Screens.** A backup bar screen, designed for mechanical or manual cleaning, shall be provided. Facilities with only two bar screens shall have at least one bar screen designed to permit manual cleaning.

- **Pumps.** A backup pump shall be provided for each set of pumps performing the same function. The capacity of the pumps shall be such that, with any one pump out of service, the remaining pumps will have the capacity to handle the peak flow.

- **Comminution Facility.** If comminution of the total wastewater flow is provided, an overflow bypass with a manually installed or mechanically cleaned bar screen shall be provided. The hydraulic capacity of the comminutor overflow bypass should be sufficient to pass the peak flow with all comminution units out of service.

- **Primary Sedimentation (Clarifier) Basins.** The units should be sufficient in number and size so that, with the largest flow capacity unit out of service, the remaining units should have a design flow capacity of at least 50% of the total design flow.

- **Final Sedimentation (Clarifier) Basins.** The units shall be sufficient in number and size so that, with the largest flow capacity unit out of service, the remaining units shall have a design flow capacity of at least 75% of the total design peak day flow. These units are sized for peak day winter flows and large enough to treat Maximum Month Dry Weather Flows (MMDWF) with one out of service.

- **Aeration Blowers, Rotors or Mechanical Aerators.** There shall be a sufficient number of blowers or mechanical aerators to enable the design oxygen transfer to be maintained with the largest capacity unit out of service. It is permissible for the backup unit to be an uninstalled unit, provided that the installed units can be easily removed and replaced. However, at least two units shall be installed.

- **Air Diffusers.** The air diffusion system for each aeration basin shall be designed so that the largest section of diffusers can be isolated without measurably impairing the oxygen transfer capability of the system.

- **Disinfectant Contact Basins or Units.** The units shall be sufficient in number and size so that, with the largest flow capacity unit out of service, the remaining units shall have a design flow capacity of at least 50% of the total design flow.

- **Electrical Power Sources.** Two separate and independent sources of electric power shall be provided to the plant either from two separate utility substations or from a single substation and a works based generator located at the plant. As a minimum, the capacity of the backup power source for the treatment plant shall be sufficient to operate all vital components and critical lighting and ventilation during peak wastewater flow conditions.

Operability

Operation of a wastewater system entails considerable responsibility and cost while providing public health benefits. For these reasons, personnel assigned to operate and maintain a treatment facility must be trained appropriately. The more sophisticated the process or equipment, the greater the level of expertise needed. Qualified individuals are usually available in metropolitan areas, as is financial support for their employment. However, small communities often have a problem in finding the personnel and the money with which to pay them. Consequently, the selection of a treatment process and equipment should reflect the regional and local level of training of operations and maintenance.

Durability

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

Capacity

Individual treatment components must be capable of handling the hydraulic flow through the plant during peak wet weather periods and be capable of being sized to treat the mass loads projected for the facility. The following guidelines will be used in this plan:

- In general, all processes after the headworks are designed to operate for peak daily flow.

- Influent pump stations are designed to operate for peak instantaneous flow.

- The headworks should be sized for peak instantaneous flows.

- Primary clarifiers, when present, should be sized for peak daily flows.

- Aeration basins should be sized using modeling to generate desired treatment in the final effluent.
- Per DEQ, the secondary clarifiers should be sized for either the peak day with all clarifiers operational or the MMDWF with the largest clarifier off-line, whichever results in the greater treatment capacity. Overflow rates for the separate seasons should be used, e.g. 1200 for winter and 800 for summer.
- Per EPA, the secondary clarifiers should be able to handle 75% of peak daily flow with the largest unit out of service.
- The disinfection system should be sized for peak daily flow. The contact chamber should be sized for at least 15 minutes of contact time at the peak hour flow, 20 minutes at peak day, or 60 minutes at ADWF, whichever results in the largest basin.
- Sizing of the digester is based on the estimated volume of suspended solids of the incoming mixed liquor, in addition to the holding time required for the digesters. The assumption is made that sludge is held for a minimum of 60 days and that biosolids are removed at 2% solids.

Expandability

Expandability is a difficult factor for consideration in the design of wastewater treatment facilities. Designs are created that meet the current regulatory environment. Future regulatory requirements could have dramatic effects on the compliance of even the newest designs. Therefore, expandability is considered from a current regulatory compliance viewpoint. The treatment alternatives considered are expandable as long as specific design capacities of the system are not exceeded.

Miscellaneous

Consideration of site location, daily operational tasks, public perception, health and safety concerns, noise, access to equipment, human factors, and hazardous areas all have to be analyzed when assessing the conveyance and treatment alternatives.

3.3 Aging Infrastructure

Infiltration and Inflow

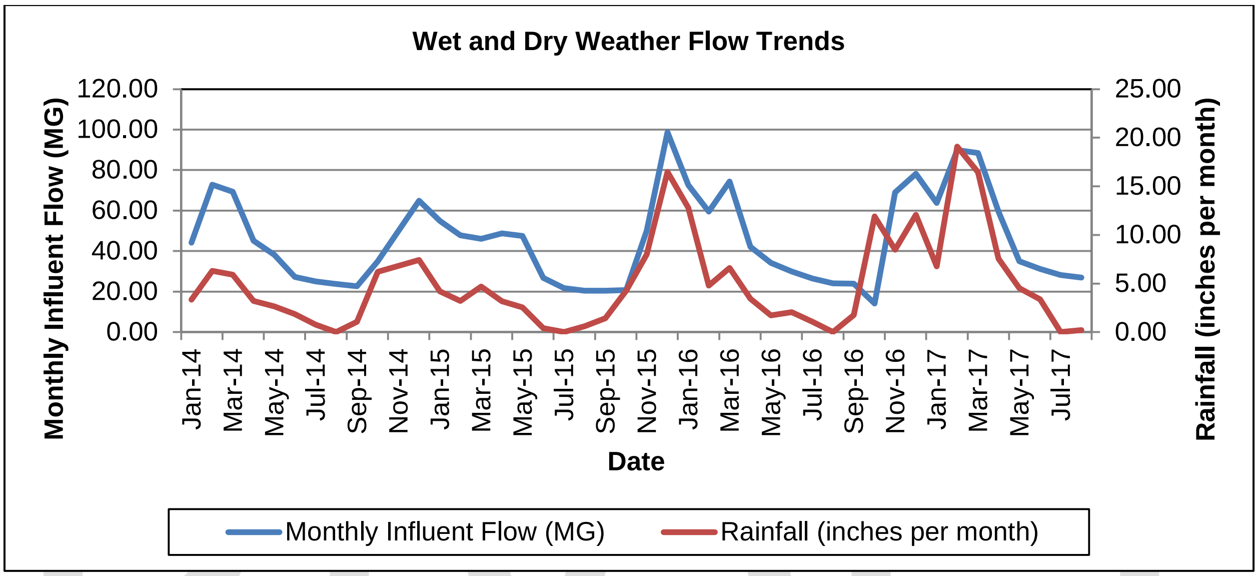
Infiltration and inflow is groundwater (infiltration) and surface rainwater (inflow) that leaks into the sanitary sewer collection system. During wet weather periods high ground water and surface flows enter the system through defects (holes, cracks, and failed pipe joints). Infiltration and inflow can cause wastewater flows to exceed the capacity of the pipes causing backups into buildings and overflowing manholes. Rain induced sewer flows can hydraulically overload a wastewater treatment plant, increase costs of sewer system operations, and require oversized treatment systems. Exfiltration (loss of wastewater into the surrounding soil) can erode the soil and in some cases cause sinkholes. Leakage of sewage into the surrounding soil can lead to groundwater and soil contamination.

Collection systems and wastewater facilities will continue to age and degrade. Pipe gaskets develop leaks. Pipes and manholes crack. Pumps wear out. Tanks must be painted. Grounds must be maintained. Aeration equipment has a limited life. Investment is required to perform wastewater Capacity Management with an Operations and Maintenance program (CMOM). An I/I study is a basis for a CMOM program.

Flow Trends

The City of Molalla receives very little rainfall from June through September. Monthly average flows at the WWTP for July are lower than in May, reflecting the reduction in rain and subsequent I/I. Wet weather flows are heavily influenced by rain and the condition of the collection system, with the highest flows typically occurring between November and April. The average wet weather monthly plant inflow volume has a strong correlation, as shown in Figure 3.3.1, to total monthly wet weather rainfall for the study period.

FIGURE 3.3.1
WWTP FLOW TRENDS (2014 – 2017)

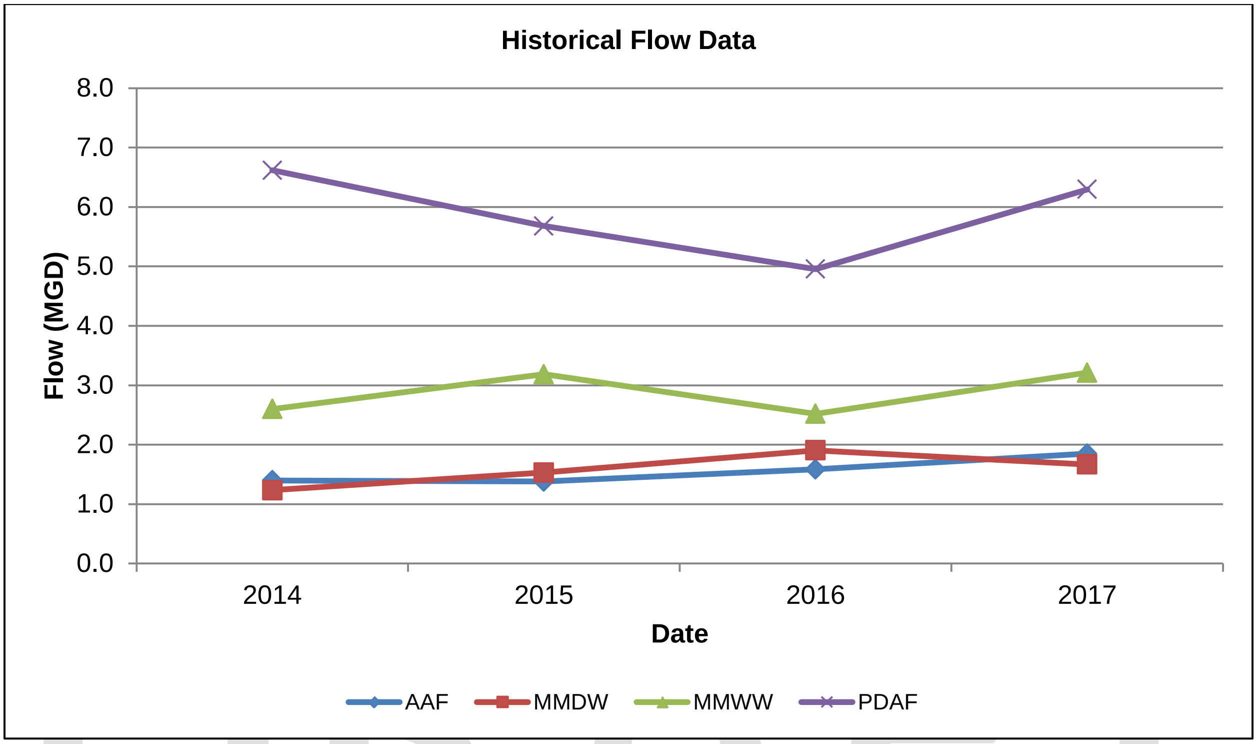


Influent flow measurements are taken from an influent Parshall flume flow meter. Monthly flow rates are at least two to three times higher in the winter months, compared to summer months.

Historical Flows

In order to predict the hourly, monthly, weekly and seasonal variability in flow, historical flow conditions were evaluated. Figure 3.3.2 illustrates the flows observed at the City of Molalla WWTP over the past four years. Table 3.3.1 summarizes historical flow data from January 2014 through August 2017.

FIGURE 3.3.2
WWTP HISTORICAL FLOWS (2014 – 2017)[1]



1. Flows for 2017 were evaluated from Jan-Aug.

TABLE 3.3.1
WWTP HISTORICAL FLOWS (2014 – 2017)

Year	AAF	MMDW	MMWW	PDAF
2014	1.4	1.2	2.6	6.6
2015	1.4	1.5	3.2	5.7
2016	1.6	1.9	2.5	5.0
2017	1.8	1.7	3.2	6.3

EPA Non-excessive Infiltration

The EPA guidelines (40 CFR 133.103) establish procedures on how to determine whether excessive I/I exists, and how to certify that excessive I/I has been sufficiently reduced through sewer rehabilitation. Infiltration occurs when groundwater enters a sewer system through broken pipes, defective pipe joints or illegal connections of foundation drains. System flows are analyzed under various conditions and compared to benchmarks that have been established for acceptable sanitary sewage flow rates.

Non-excessive infiltration is analyzed by investigating plant flows during periods of seasonal high groundwater with little sustained rainfall. Seven to fourteen day periods during winter months of high groundwater (December through May) were identified where little or no rainfall is measured. The average per capita flow for the system is calculated and compared to the EPA maximum flow criteria of 120 gallons per capita per day (gpcd). Under these conditions, all flows below 120 gpcd are considered to have a non-excessive infiltration component.

A fourteen day period with little or no rainfall occurred between February 11, 2015 and February 24, 2015. It is assumed that groundwater levels were high during this period. The highest flow day of that week was 2.28 MGD. Based on a 2017 population of 9,939, the resulting flow rate is calculated at 229 gpcd. Since the flow is more than 120 gpcd, the collection system has excessive infiltration.

EPA Non-excessive Inflow

Non-excessive inflow is analyzed by investigating plant flows during periods of intense winter rainfall. Major rainfall events and the resulting system flows during winter months are analyzed. Inflow is surface runoff that enters a sewer system through manhole covers, cleanout covers, cross connections between storm sewers and sanitary sewers, and illegal connections of roof drains, yard drains, or catch basins. The EPAs non-excessive inflow criteria are based on "the average daily flow during periods of significant rainfall (i.e. storm event that creates surface ponding and surface runoff; this can be related to a minimum rainfall amount for a particular geographic area)". The average per capita flow for the system is calculated and compared to the EPA maximum flow criteria of 275 gpcd. Flows can exceed EPA guidelines if the plant operation is not impeded by such flows. Under these conditions, provided the treatment plant does not experience hydraulic overloads during storm events, flows below 275 gpcd are considered to have a non-excessive inflow component.

For the City of Molalla, the average daily flow recorded during a period of significant rainfall occurred between February 2 and 9, 2017. Flows of 6.3 MGD were generated after receiving rainfall of 4.4 inches in one day. Under these conditions and based on a 2017 population of 9,939, the resulting system flows (combined infiltration and inflow) were determined to be 633 gpcd. Since the flow is over 275 gpcd, a cost effective analysis is needed to determine if the inflow is excessive.

The EPA I/I analysis is summarized in Table 3.3.2.

TABLE 3.3.2
I/I ANALYSIS SUMMARY

Description of Flow Condition	Flow Rate	EPA Criteria (Maximum Flow)
Base Sewage	89 gpcd	NA
Infiltration (High Ground Water)	229 gpcd	120 gpcd
Inflow (High Rainfall Levels)	633 gpcd	275 gpcd

Inflow in the system is greater than the EPA guidelines. An ongoing CMOM is required. A CMOM program typically includes video inspection of the entire collection system every five years and repair of collection system defects. In addition, a new Sanitary Sewer System Evaluation (SSE) should be performed in five-year intervals. An SSE typically includes line grit removal and cleaning, video inspection, physical inspection of manholes, performance of flow testing at structures, smoke testing of lines, evaluation of Daily Monitoring Reports (DMRs) and mapping of results. The first priority for the City is to repair deficiencies identified during smoke testing. As resources become available the infiltration deficiencies should be addressed.

3.4 Wastewater Flows

Future flow projections are determined by evaluating current sewage flow rates, current pollutant loads, and population growth forecasts. Flow and load projections are for a 20-year period from initiation of operations of new equipment. Daily flows and loads are determined from rainfall statistics and system flow records.

Flows and loads have specific recurrence intervals, or probabilities of occurrence, that utilize estimated future wastewater design flows and loads. Information regarding dry weather and wet weather flows as well as I/I are important in the design of wastewater collection, treatment and disposal facilities. The Maximum Month Dry Weather Flows (MMDWF) usually determines the maximum organic loading of the major treatment process units. The Maximum Monthly Wet Weather Flow (MMWWF) determines the size and hydraulic capacity of the major process units necessary to provide the desired degree of treatment. The Peak Instantaneous Flow (PIF) determines the hydraulic capacity of pipelines, pumps, channels, and inlet structures, and the reserve capacity of units such as clarifiers and disinfection facilities.

Unless noted otherwise, the flow data used for this report is taken from WWTP's influent flow meter from December 2014 through August 2017 DMRs for the WWTP. The City's wastewater system staff records the readings daily on the influent meter and rain gauge at the plant. Wastewater is sampled and five-day Biochemical Oxygen Demand (BOD_5) and Total Suspended Solids (TSS) tests are run approximately two to three times a week. Rain data for this analysis is from the daily readings of the rain gauge at the wastewater facility.

DEQ Guidelines for Flow Projections

Unless otherwise noted, all theoretical flow calculations were made using the DEQ *Guidelines for Making Wet Weather and Peak Flow Projections for Sewage Treatment in Western Oregon*, 1996 revision. A summary of the calculations is included at the end of this section.

Precipitation Rates for Calculations

In Western Oregon, there is a relationship between peak storm events, ground water elevations and seasonal sewage flows. To reduce the probability of plant failure, $MMDWF_{10}$, Maximum Month Wet Weather Flows ($MMWWF_5$), Peak Day Average Flow (PDAF) and Peak Instantaneous Flow (PIF) are utilized in the design process. The $MMDWF_{10}$ is the flow during a ten-year event (10% monthly probability of occurrence in May). The $MMWWF_5$ is the flow during a five-year event (20% monthly probability of occurrence in January). Monthly probability rainfall values were taken from the National Oceanic and Atmospheric Administration's (NOAA) for Oregon City, Oregon (See Appendix B). Peak design flows are based on a 24-hour (daily) rainfall event and are taken from NOAA isopluvial charts (See Appendix B). Rainfall events are summarized in Table 3.4.1.

TABLE 3.4.1
CITY OF MOLALLA STORM EVENTS

Source	20% Probability	10% Probability
NOAA - 24 hour Isopluvial	3.4" per day	4.0" per day
NOAA - Monthly Climatography	11.56" (Jan.)	4.42" (May)

Dry Weather Flow

AAF (Record)

Average Annual Flow (AAF) is the average of all flows over a year. The AAF was determined from analysis of treatment plant flow records for the years 2014 through 2017. Commercial and industrial contributions have been included in the total flow analysis, and AAF was determined to be 1.85 MGD or 186 gpcd (based on a 2017 population of 9,939). Figure 3.4.1 and Table 3.4.2 lists the AAF for 2014 through 2017. Data for the entire 2017 calendar year was unavailable, but the running annual average flow equaled approximately 1.8 MGD.

FIGURE 3.4.1
WWTP DAILY AND ANNUAL AVERAGE FLOWS

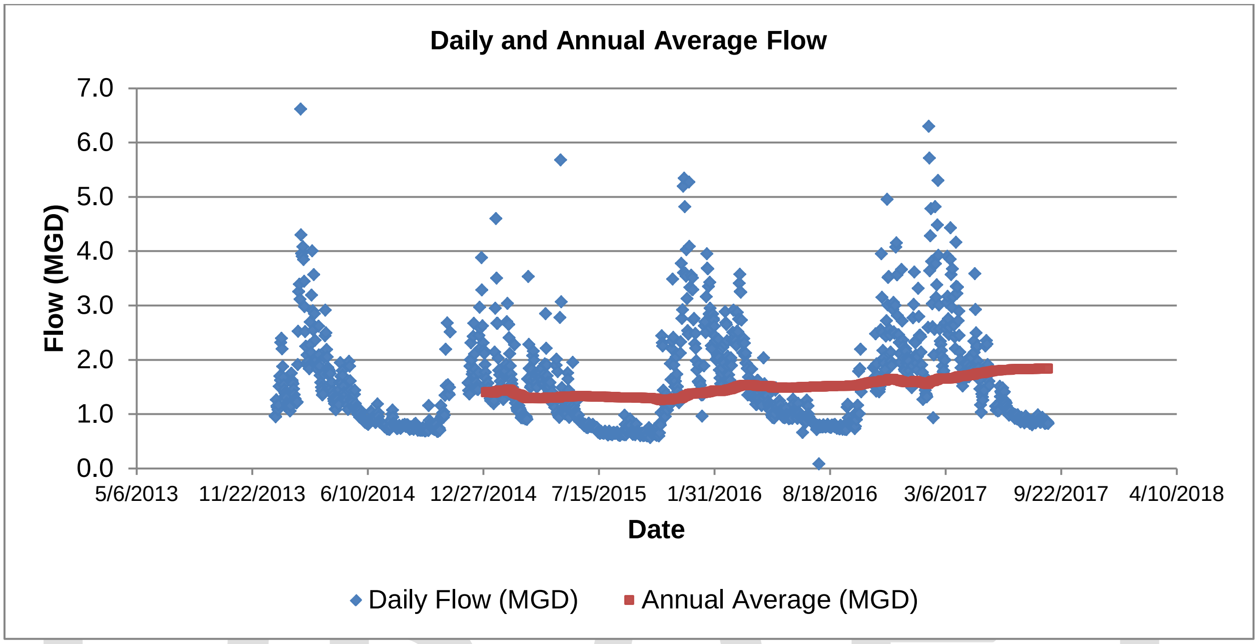


TABLE 3.4.2
AAF (MGD)

Year	AAF (MGD)
2014	1.40
2015	1.38
2016	1.59
2017	1.85

ADWF (Record)

The Average Dry Weather Flow (ADWF) was determined from analysis of treatment facility flow records for the months May through October. The ADWF was determined to be 1.11 MGD, or 112 gpcd. Table 3.4.3 summarizes ADWFs for 2014 through 2017.

TABLE 3.4.3
ADWF (MGD)

Year	ADWF (MGD)
2014	0.93
2015	0.86
2016	1.07
2017	1.11

The ADWF can be divided into two components: base sewage flows and base infiltration. The base sewage flow is the portion of the treatment plant flow attributed to sanitary sewage. Base sewage flows were determined to be the ADWF for the months of July, August, and September when groundwater is not present. The base sewage flow to the treatment plant is calculated to be 0.89 MGD. In determining projected flows, allowance must be made for unavoidable infiltration that is dependent upon such factors as the quality of materials and workmanship in the sewers and building connections, the character of maintenance, and elevation of the surrounding groundwater in relation to that of the sewers. The base infiltration is found by calculating the difference of the ADWF and the base sewage flow. Base infiltration is calculated (1.11-0.89) to be approximately 0.22 MGD or 22 gpcd.

MMDWF (Record)

The Maximum Monthly Dry Weather Flow (MMDWF) represents the maximum monthly average flow in the rainiest month of high groundwater. The MMDWFs for 2014-2017 are summarized in Table 3.4.4. The MMDWF for 2016 was 1.91 MGD (192 gpcd).

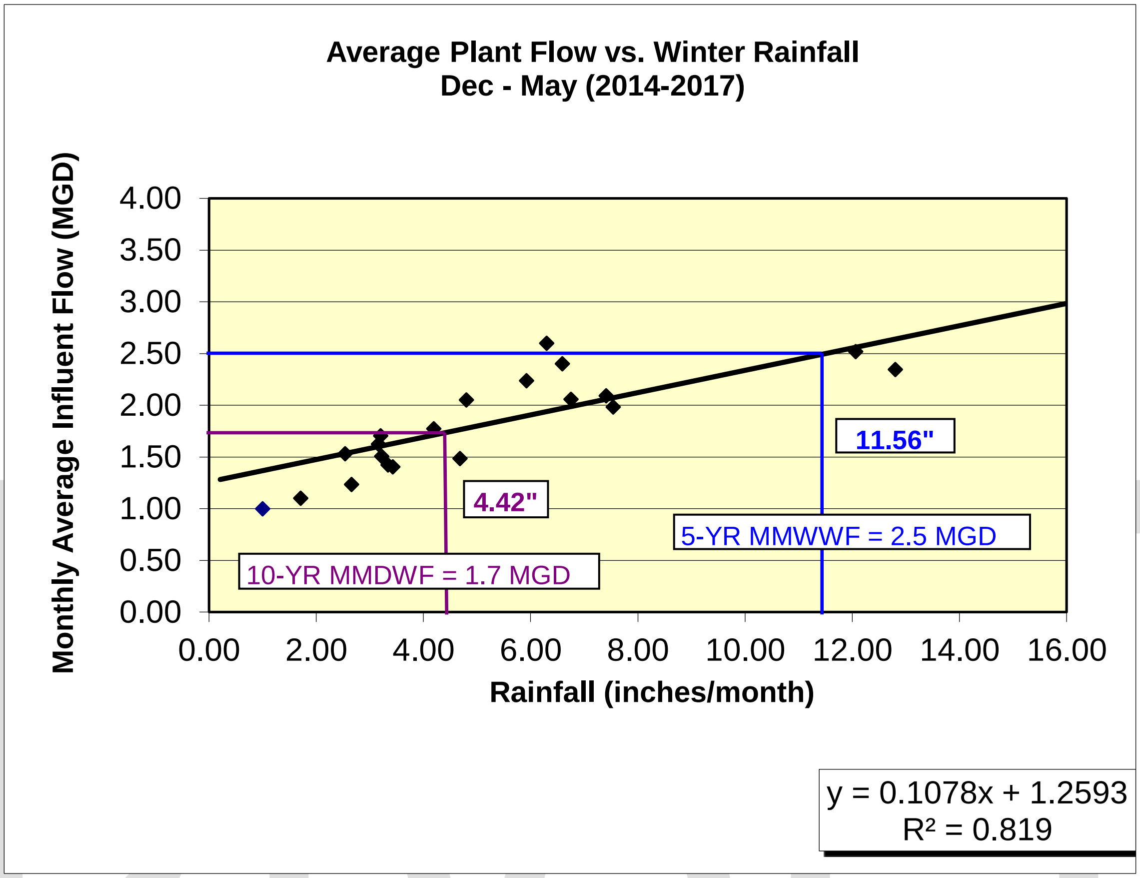
TABLE 3.4.4
MMDWF (MGD)

Year	MMDWF (MGD)
2014	1.23
2015	1.53
2016	1.91
2017	1.67

$MMDWF_{10}$ (Theoretical)

The Maximum Monthly Dry Weather Flow ($MMDWF_{10}$), defined as the flow recorded at the plant when total rainfall quantities are at ten percent probability of occurrence in any one year (usually in May), was calculated using DEQ guidelines. The $MMDWF_{10}$ was determined, following DEQ guidelines, by plotting January through May average plant flow versus monthly rainfall. This is illustrated in Figure 3.4.2 Average Plant Flow vs. Winter Rainfall. Linear regression was used to fit a line to the data. Ninety percent probability of May rainfall values were taken from the National Ocean and Atmospheric Administration's *Climatography of the United States No. 81, 1971-2000* for the City of Oregon City, Oregon. For the City of Oregon City May had approximately 90% of the rainfall total of 4.42 inches. The projected $MMDWF_{10}$ based on a 4.42 inch event for the City of Molalla is 1.7 MGD, or 175 gpcd.

FIGURE 3.4.2
AVERAGE PLANT FLOW VS. WINTER RAINFALL

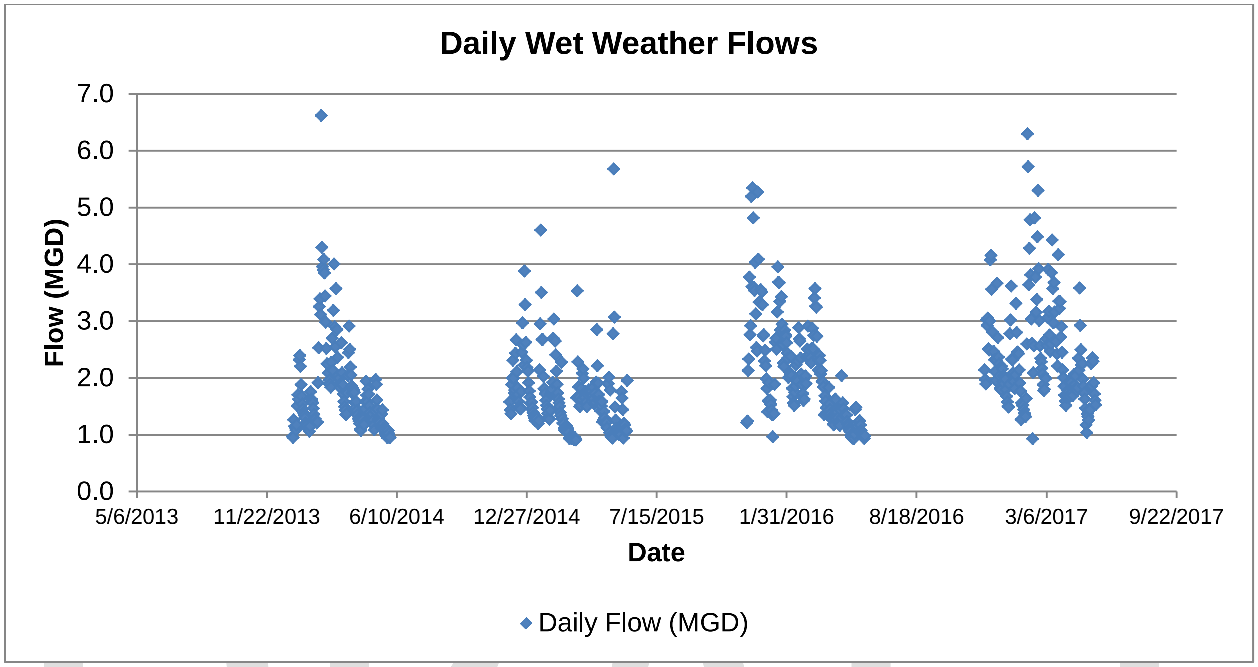


Wet Weather Flow

AWWF (Record)

The Average Wet Weather Flow (AWWF) is defined as the average flow at the WWTP during the wet weather season (November through April). The AWWF was determined from an analysis of the treatment plant flow records for the years 2014 through 2017. The AWWF was determined to be 2.48 MGD (249 gpcd). Figure 3.4.3 shows the WWTP's daily wet weather flows for the study period.

FIGURE 3.4.3
WET WEATHER FLOWS



MMWWF (Record)

The Maximum Monthly Wet Weather Flow (MMWWF) represents the highest monthly average flow attained during the winter period of high groundwater. The MMWWFs for 2014 through 2017 are summarized in Table 3.4.5. The MMWWF was determined to be 3.21 MGD (323 gpcd).

TABLE 3.4.5
MMWWF (MGD)

Year	MMWWF (MGD)
2014	2.60
2015	3.19
2016	2.52
2017	3.21

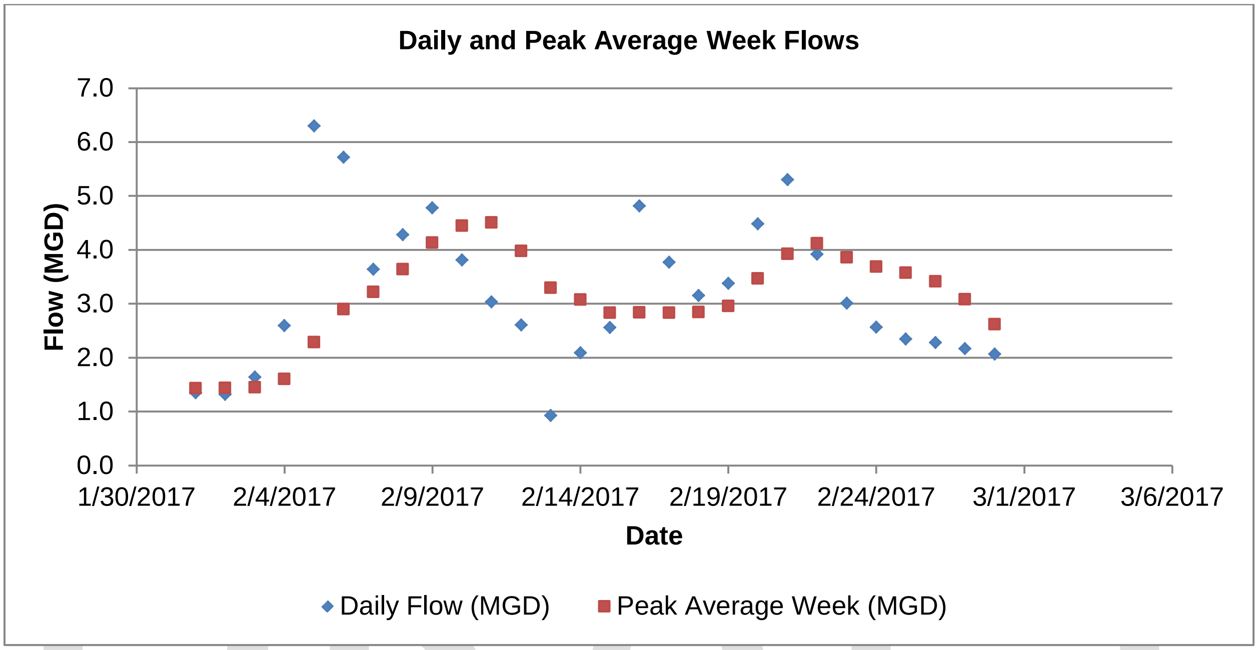
MMWWF$_5$ (Theoretical)

The Maximum Monthly Wet Weather Flow (MMWWF$_5$) was also calculated using DEQ guidelines, in a manner similar to the theoretical MMDWF$_5$. The results are illustrated Figure 3.4.2. The analysis period was from 2014 through 2017. With linear regression analysis of average monthly plant inflow versus monthly rainfall, a MMWWF$_5$ of 2.5 MGD was calculated. The DEQ guidelines suggest that the MMWWF$_5$ represents the highest monthly average flow attained during the winter high groundwater period, and has a 20% chance of occurring in any one year.

Peak Average Week (Record)

For this study, the Peak Average Week (PW) flow was taken as an average of the 2014 through 2017 flows and is the highest average daily flow rate during a seven-day wet weather data set. The peak week flow occurred in February 2017 at 4.5 MGD (or 454 gpcd). Figure 3.4.4 shows the daily and peak average week flows for February 2017.

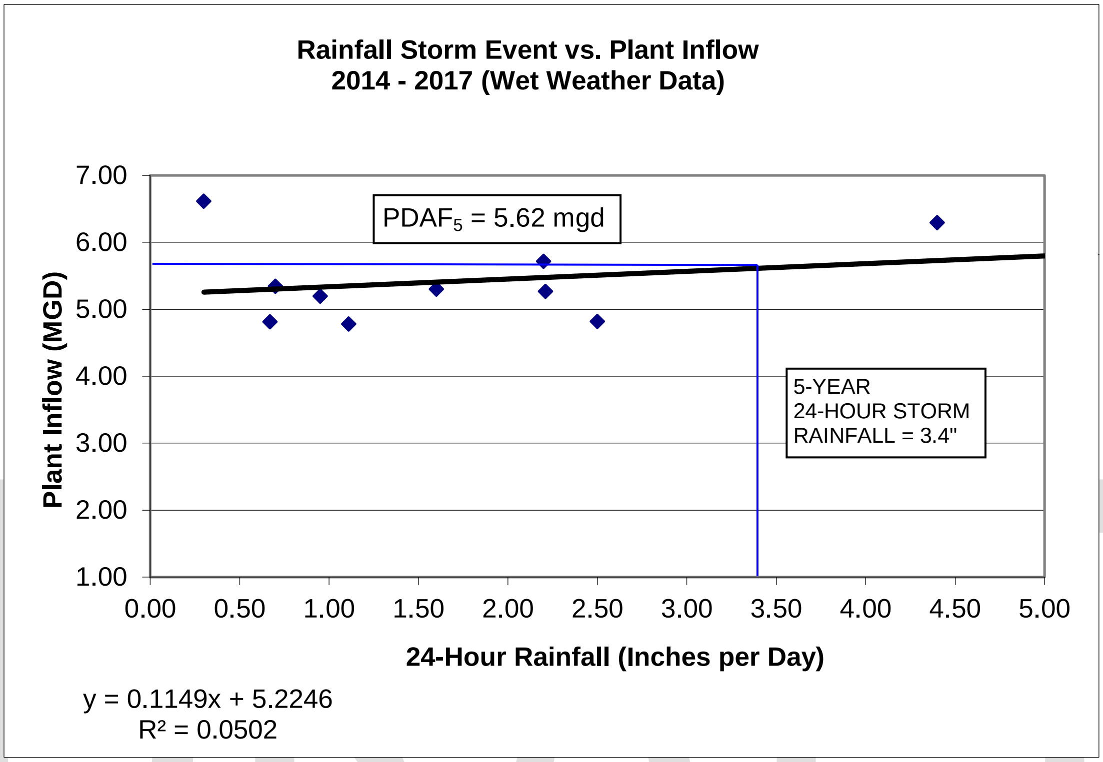
FIGURE 3.4.4
DAILY AND PEAK AVERAGE WEEK FLOWS



PDAF$_5$ (Theoretical)

The Peak Daily Average Flow associated with a five-year storm (PDAF$_5$) was estimated in accordance with DEQ guidelines. Daily plant flow data was searched in order to find available five-year storm event data. The five-year storm rainfall was approximated using Weather Bureau records in the document *NOAA Atlas 2*, Volume X Isopluvial Map. Daily plant inflows versus daily rainfall for selected storm events were plotted. Storms with rain exceeding the peak week flows established the DMR data set. The data period was from January through April for the years 2014 through 2017. DEQ recommends using 24-hour data to match plant flow data. Flows at the WWTP can be higher on the day after a high rainfall. The 24-hour rainfall for the first day was used for the rain quantity, and the higher of the two consecutive 24-hour flows (that day or the following day) was used for the flow. The five-year, 24-hour rainfall of 3.4 inches was used from the above-referenced Weather Bureau document, which is provided in Appendix B. The resulting PDAF$_5$ is 5.62 MGD. Refer to Figure 3.4.5.

FIGURE 3.4.5
RAINFALL STORM EVENT VERSUS PLANT INFLOW



PDAF (Record)

Peak Day flows from the DMR records (2014-2017) were also evaluated to determine the Peak Daily Average Flow (PDAF). The peak day (highest 24-hour flow) flow during the 2014-2017 time period occurred in 2014 and was 6.62 MGD.

TABLE 3.4.6
PDAF (MGD)

Year	PDAF (MGD)
2014	6.62
2015	5.68
2016	4.96
2017	6.30

PIF_5 (Theoretical)

The Peak Instantaneous Flow associated with a five-year storm event (PIF_5) was estimated by using the AAF, MMWWF, peak average weak, and PDAF values. These values were plotted on logarithmic probability paper, as outlined by DEQ. Such a projection is based on the principle that an average monthly flow is likely to occur 6/12 of the time or 50%, and a peak monthly flow occurs 1/12 of the time or 8.3%. Likewise, peak weekly flow will take place 1/52 of the time or 1.9%. Peak daily flow occurs once in 365 days or 0.27%. A peak hour flow happens once in 8,760 hours or 0.011%. Plotting these numbers against probability, and fitting a line to the data in excel, gives a current PIF of 9.7 MGD.
A summary of existing flow rates as developed from flow data from 2014 to 2017 is provided below in

Table 3.4.7 and Figure 3.4.6. Recorded flows for MMDWF, MMWWF, and PDAF were found to be higher than when calculated using DEQ procedures. The higher, historical based flows, were therefore used as the basis for planning.

FIGURE 3.4.6
CITY OF MOLALLA WWTP EXISTING INFLUENT FLOW RATES

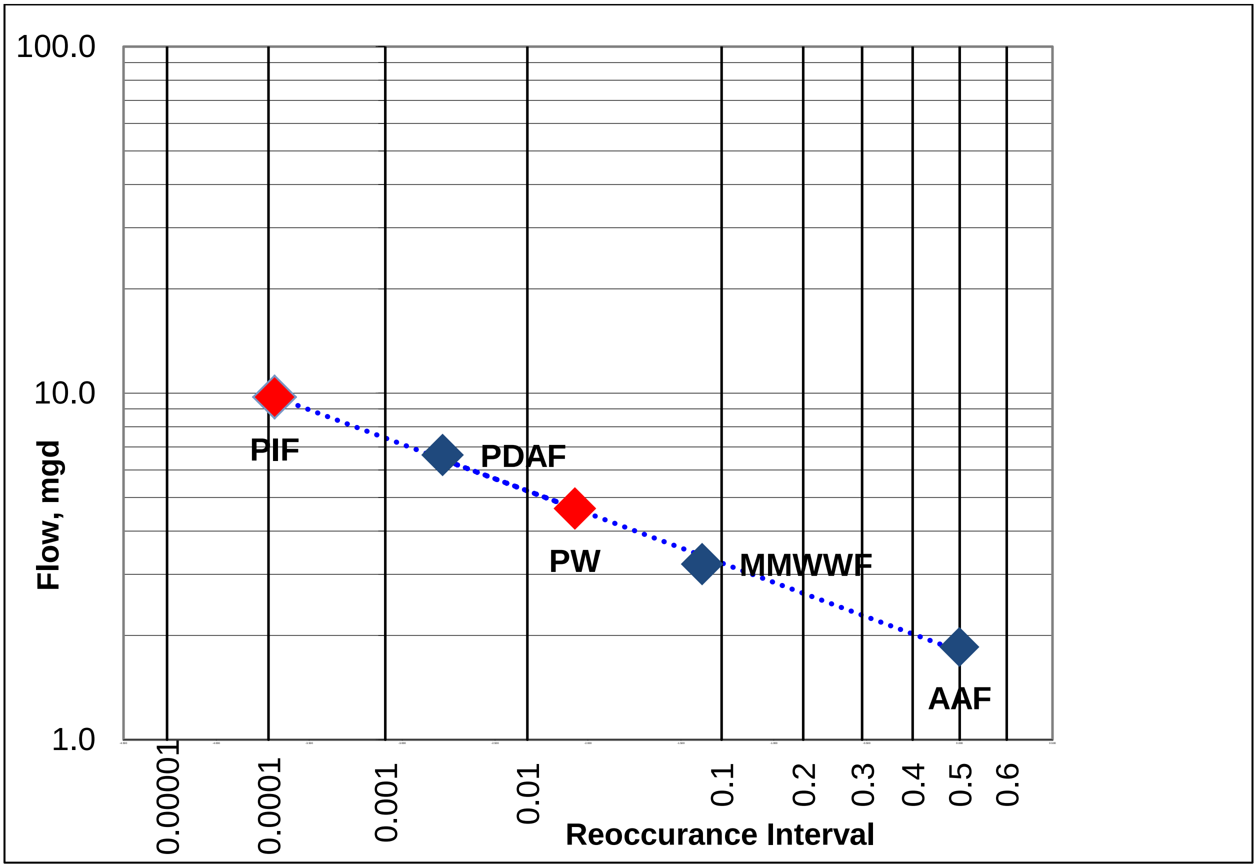


TABLE 3.4.7
CITY OF MOLALLA WWTP EXISTING INFLUENT FLOW RATES

Parameter	Flow Values				Peaking Factor
Population	9,939				
Base Sewage	0.89	MGD	90	gpcd	
Base Infiltration	0.22	MGD	23	gpcd	
AAF	1.85	MGD	186	gpcd	1.7
ADWF	1.11	MGD	112	gpcd	1.0
AWWF	2.48	MGD	249	gpcd	2.2
$MMDWF_{10}$	1.91	MGD	192	gpcd	1.7
$MMWWF_5$	3.21	MGD	323	gpcd	2.9
Peak Average Week	4.51	MGD	454	gpcd	4.0
$PDAF_5$	6.62	MGD	666	gpcd	5.9
PIF	9.7	MGD	976	gpcd	8.7

3.5 Wastewater Characteristics

Population growth and development will increase the organics and silts collected and conveyed to the treatment plant. All wastewater generated in the City of Molalla is domestic in quality. Wastewater is generated by residential, commercial and industrial sources. The wastewater composition and load from these separate sources cannot be ascertained, since they are not separately monitored for flows and composition. Monitoring results of influent wastewater represent wastewater combined from these sources. Treatment plant DMRs were reviewed for the years from 2014 to 2017 to determine the influent BOD_5 and TSS wastewater characteristics.

Analysis of Plant Records

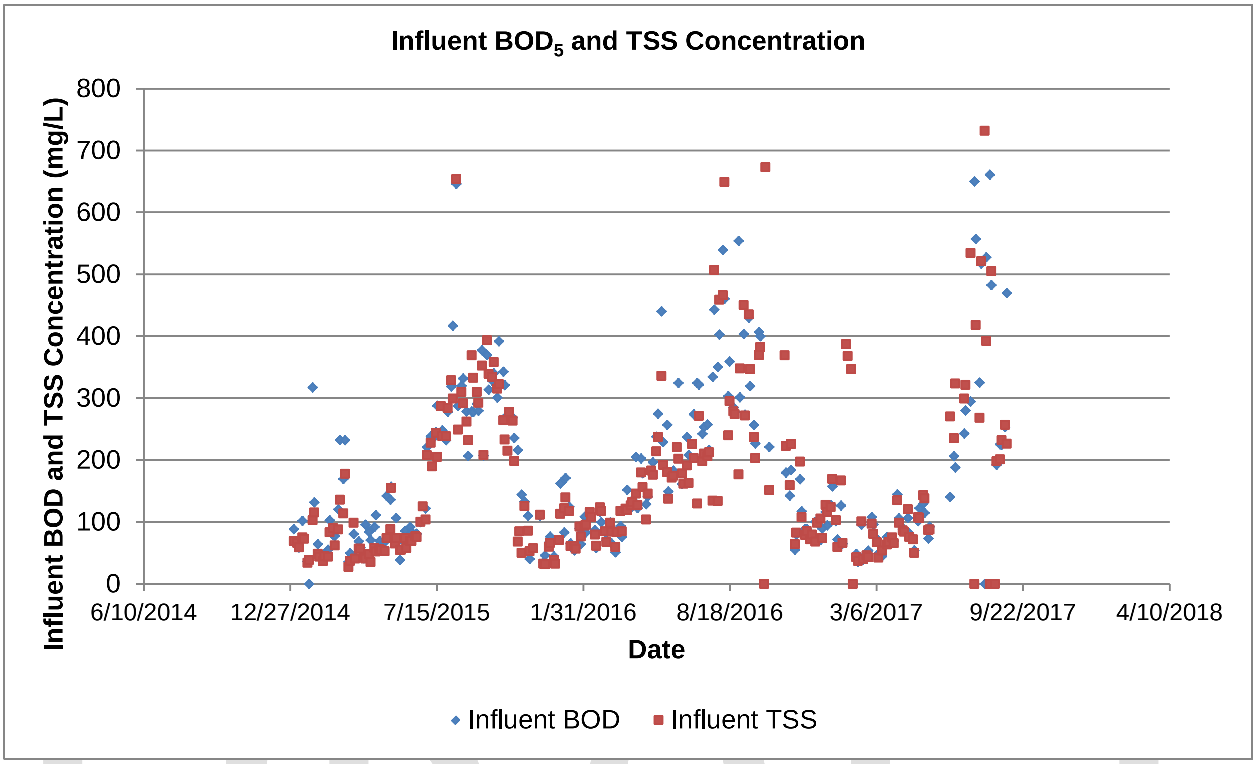
The BOD_5 and TSS influent concentration and loads are summarized in Table 3.5.1 and are based upon DMRs and a sewer population of 9,939 persons. The accuracy of the findings depends wholly upon the accuracy of the DMR reports themselves.

Typical BOD_5 per capita loads for domestic wastewater range from 0.11 to 0.26. Typical TSS per capita loads for domestic wastewater range from 0.13 to 0.33. In comparison, both the average BOD_5 and TSS concentrations in the City of Molalla influent wastewater are within the typical range during wet weather and dry weather periods. The average BOD_5 and TSS unit loading at the WWTP are within the normal ranges for similar communities.

TABLE 3.5.1
WWTP INFLUENT WW CONCENTRATIONS AND LOADS

Population: 9,939		**WET WEATHER**				**DRY WEATHER**			
PARAMETER		**Average**	**Range**			**Average**	**Range**		
BOD_5				-				-	
	mg/L	86	36	-	157	279	73	-	650
	ppd	1,592	1,230	-	5,436	2,282	1,363	-	4,868
	ppcd	0.16	0.12	-	0.55	0.23	0.14	-	0.49
TSS				-				-	
	mg/L	108	37	-	387	267	87	-	535
	ppd	1,832	1,079	-	6,155	2,264	1,404	-	4,110
	ppcd	0.18	0.11	-	0.62	0.23	0.14	-	0.41

FIGURE 3.5.1
WWTP INFLUENT WW CONCENTRATIONS (BOD_5 AND TSS)



Listed below, in Table 3.5.2, are average wastewater composition values based on the 2014-2017 study period data from plant records, with outliers removed.

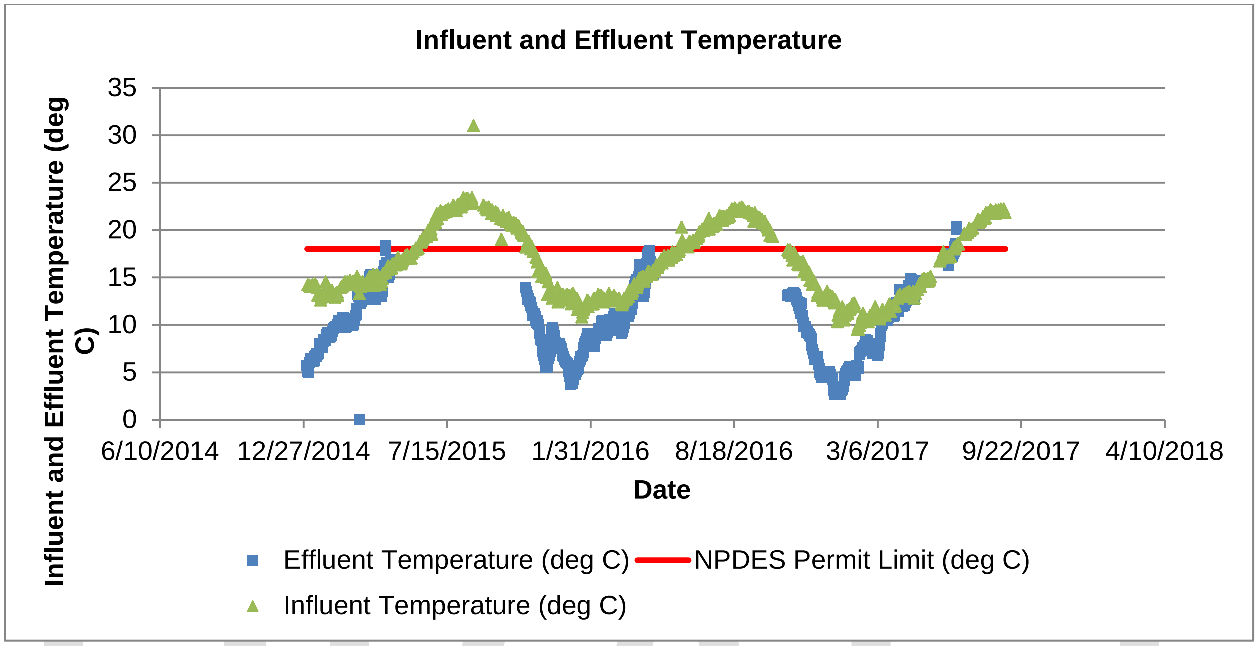
TABLE 3.5.2
WASTEWATER DESIGN COMPOSITION VALUES

PARAMETER	Avg. Values Based on DMR's	
BOD_5 Avg. Day	182	mg/L
BOD_5 Max. Ave. Month	255	mg/L
BOD_5 Max. Day	650	mg/L
TSS Avg. Day	187	mg/L
TSS Max. Ave. Month	203	mg/L
TSS Max. Day	535	mg/L

Wastewater Temperature

The NPDES Permit states that effluent discharge will cease when the 7-day moving average effluent temperature exceeds 18°C. The existing WWTP usually operates in compliance with the temperature requirement because effluent is typically only discharged to the Molalla River outfall during the winter months, and the wastewater loses heat during the winter while it resides in the lagoon. For future design purposes, influent and effluent temperature values are shown in Figure 3.5.2.

FIGURE 3.5.2
DAILY INFLUENT AND EFFLUENT WASTEWATER TEMPERATURE



3.6 Projected Wastewater Flows and Characteristics

Future sanitary sewer flows generated within the City come from a wide variety of collection system users. The average wastewater flows from these users are expected to grow at approximately the same rate as the overall population. Therefore, future sanitary flows are projected by applying the anticipated population growth rate to the current sanitary flows. Projections for ADWF, MMDWF and AAF were calculated using a unit design value method based on gpcd extrapolated from the DMRs.

Projections of future wet weather flows require additional consideration due to the variability of I/I rates among existing and future developments. When utilizing a straight unit design factor based on existing peaking factors, future peak flows are typically overestimated. Therefore, 2043 peak flows are estimated using current wet weather I/I rates for existing portions of the collection systems while using lower rates in areas with new sewers.

The current PIF of 9.7 MGD is greatly influenced by the presence of collection system deficiencies due to the age of the collection system. Older construction can be subject to poor or no joint gaskets, ridged pipe materials that develop cracking, and poor construction practices. Since improved construction materials and techniques in the new portions of the collection system will greatly reduce I/I sources, the projections of future peak wet weather flow must account for lower wet weather I/I rates in new developments. For the purposes of wet weather flow projections, new developments are assigned an EPA non-excessive I/I wet weather unit design factor of 395 gpcd (120 gpcd infiltration + 275 gpcd inflow).

Wet weather flows are estimated by interpolating a linear relationship between the PIF and the AAF on a semi-logarithmic flow probability chart. $MMWWF_5$ is calculated at 8.3% probability, peak week is based on a 1.9% probability and $PDAF_5$ is based on a 0.27% probability. A comparison of the 2017 and 2043 flow rates is shown in Table 3.6.1.

TABLE 3.6.1
WASTEWATER FLOWS (2017 & 2043)

PARAMETER	2017		2043			
Population	9,939		16,977			
Base Sewage	0.89	MGD	90	gpcd	1.52	MGD
Base Infiltration	0.22	MGD	23	gpcd	0.38	MGD
AAF	1.85	MGD	186	gpcd	3.16	MGD
ADWF	1.11	MGD	112	gpcd	1.90	MGD
AWWF	2.48	MGD	249	gpcd	4.24	MGD
$MMDWF_{10}$	1.91	MGD	192	gpcd	3.25	MGD
$MMWWF_5$	3.21	MGD	312	gpcd	5.30	MGD
Peak Average Week	4.51	MGD	401	gpcd	6.80	MGD
$PDAF_5$	6.62	MGD	524	gpcd	8.91	MGD
PIF	9.7	MGD	735	gpcd	12.48	MGD

Treatment unit design values are extrapolated from Tables 3.6.1 and 3.6.2. Table 3.6.2 summarizes the recommended design values for unit sizing. These values should be verified in the predesign report based on completion of I/I projects and updated influent flow data.

TABLE 3.6.2
WASTEWATER TREATMENT DESIGN VALUES (2043)

	Flow	BOD_5		TSS	
	MGD	mg/L	ppd	mg/L	ppd
AAF	3.16	126	3,310	133	3,500
$MMDWF_{10}$	3.25	144	3,900	143	3,870
$MMWWF_5$	5.30	60	2,630	68	3,020
PDAF	8.91	n/a	n/a	n/a	n/a
PIF	12.48	n/a	n/a	n/a	n/a

SECTION 4:

ALTERNATIVES CONSIDERED

SECTION 4: **ALTERNATIVES CONSIDERED**

An evaluation of the condition and capacity has been completed for the existing wastewater conveyance system, WWTP, and effluent disposal systems. The City faces issues with aging equipment and structures, WWTP capacity limitations, and increasingly more restrictive permit requirements triggered by Total Maximum Daily Loads associated with the Molalla River outfall. Upgrades to the WWTP are necessary to address plant operational longevity, environmental issues, and projected population growth. Modifications to the NPDES Permit are also recommended to address inconsistencies with Willamette Basin standards and extend the ability to discharge to the Molalla River during the summer months (typically May), when river conditions allow.

The primary objective of this section is to evaluate alternatives and recommend preferred alternatives that address the system conditions, performance, and capacity issues. Detailed construction cost estimates and present worth operation and maintenance cost estimates are provided in Appendix C.

The alternatives outlined in this section address multiple potential permit conditions. Concurrently, during the development of this WWFCSMP, the City was attempting to modify the NPDES Permit as follows:

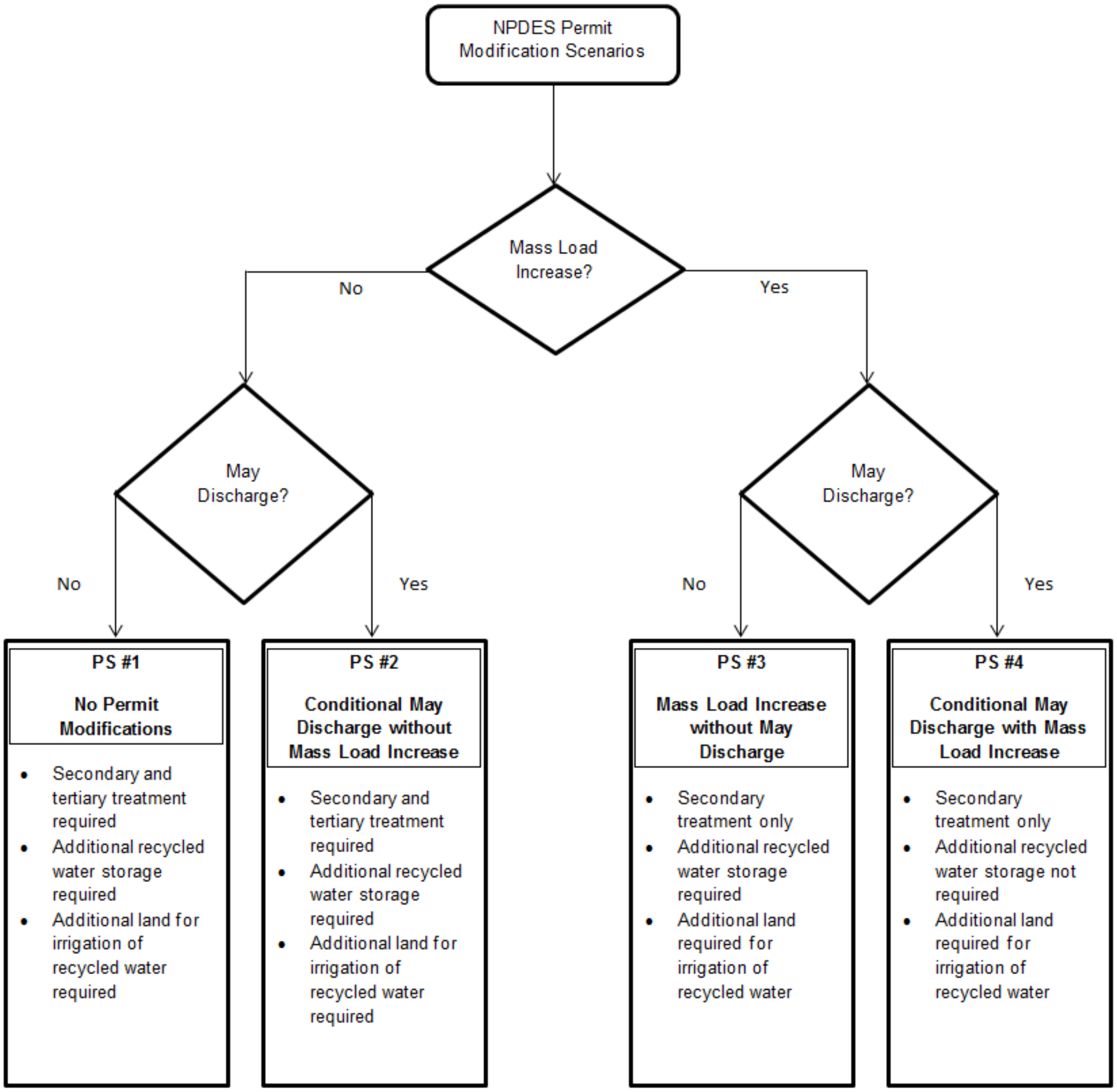
- Current river discharge period is November 1 to April 30. The overall objective is to extend this time period into May, when river conditions allow.

- Current BOD_5/TSS concentration limits for Outfall 001 are 10/10 mg/L (monthly) and 15/15 mg/L (weekly). Objective is to amend the NPDES Permit to allow 30/30 mg/L BOD_5/TSS limits congruent with Willamette Basin standards.

- The mass load limits for Outfall 001 are based on an average wet weather flow of 1.92 MGD. The current average wet weather flow is 2.48 MGD. The immediate objective is to adjust the mass load limits based on existing flows; as well as flow contributions from October and allowances for precipitation and evaporation impacting the lagoon surface. In the future, the City will also need to request an increased waste load allocation proportional to the projected flows for the 2043 planning period.

The outcome of the pending NPDES Permit modifications is uncertain and unpredictable, but will certainly have a profound impact on the WWTP and effluent disposal requirements and costs. Consequently, this WWFCSMP includes planning level content to address the four potential future permit conditions. The four possible Permit Scenarios (PS) are illustrated in Figure 4.0.1, below.

FIGURE 4.0.1
NPDES PERMIT SCENARIOS



The costs within the WWFCSMP were developed based on the Association of Cost Engineering International (AACEI) criteria for a Class 4 Estimate. A Class 4 Estimate is a conceptual-level estimate. Class 4 estimates are used to prepare planning-level cost scopes, evaluate alternatives, or develop long-term Capital Improvement Plans. Expected accuracy of Class 4 Estimates typically range from -30 percent to +50 percent, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination.

4.1 Conveyance System Alternatives

Extraneous water may enter sewers from unintended sources, either from surface water, groundwater, through defects or direct illicit connections. Sewer defects are pipe system deficiencies resulting from system aging, structural failure, lack of proper maintenance, and/or poor construction and design practices.

Molalla's collection system currently has excessive Inflow and Infiltration (I/I). In an effort to systematically and continuously address peak flows, I/I reduction projects should be identified, prioritized, and scheduled annually. Reducing I/I is critical to maintain the performance of the collection system, release trapped capacity, and minimize peak flows conveyed to the WWTP.

Currently, I/I in the City's collection system exceeds Environmental Protection Agency (EPA) guidelines. Depending upon further thorough investigations, I/I mitigation alternatives may include lining or replacing pipelines to repair separated joints and holes. In addition, manhole repairs are necessary in several cases to correct exfiltration/infiltration. Several deficient manholes were identified during smoke testing and flow mapping activities.

I/I Reduction

Additional I/I reduction projects are necessary to decrease peak flows in the collection system and at the WWTP. Accordingly, a continuous I/I monitoring and reduction program has been implemented by the City. Reducing I/I will release capacity occupied by I/I, help the performance of the collection system, as well as decrease future capital and operational expenditures at the WWTP.

The WWTP must implement the necessary improvements in order to adequately treat current and future collection system flows. Discharge Monitoring Reports (DMRs) show that influent flows consistently exceed treatment plant design capacity. One option for the mitigation of peak flows includes additional I/I construction projects. These projects may include catch basin disconnects, inversion lining or pipe replacement projects. In addition, manhole repair will be necessary to correct deficiencies.

Alternatives

No-Action
Infiltration and inflow can result in wastewater flows exceeding the capacity of the pipes, causing backups, and potentially causing sanitary sewer overflows. Rain-induced sewer flows can also hydraulically overload wastewater treatment plants, and ultimately require oversized, and energy intensive unit processes. Exfiltration can erode the soil and potentially lead to groundwater contamination. Some of the existing sewer lines are hydraulically overloaded. This alternative continues to allow extraneous water into the collection system, thereby overwhelming the capacity of the collection system and WWTP.

Continue Annual I/I Investigation and Reduction Projects
Conduct CCTV inspections based upon field results obtained from smoke testing and flow mapping. Perform remedial actions to reduce I/I. Focus on problems outlined in flow monitoring and smoke testing reports. Serious maintenance and repair issues will be corrected as funding sources become available.

Several proposed improvement projects were identified based on results from system evaluation survey methods; smoke testing and flow mapping. It is recommended that the proposed improvements be completed in three phases, based on the severity of the deficiencies and the City's budget. Phase 1 projects will be completed in the next five years. Phase 2 projects will be completed in years 5-10. Phase 3 projects will be completed in years 10-20. Note that when sewer pipe sizes will remain the same, rehabilitation should be considered as an alternative to replacement; when economically and technically feasible. Replacement versus rehabilitation should be evaluated on a case-by-case basis, early in the design phase. Conservatively, cost estimates provided herein are provided for complete replacement. The estimated cost for each project is shown in Table 4.1.1. Figures 4.1.1 through 4.1.4, on the following pages, illustrate the project locations. The proposed collection system improvement projects are prioritized as follows:

- **Phase 1**
  - **Project 1.** *Replace/Rehabilitate existing 8-inch sewer along Fenton Avenue from TL_B_19 to TL_B_20.*
  - **Project 2.** *Replace/Rehabilitate existing 8-inch sewer along Patrol St. from TL_B_2 to TL_B_27.*
  - **Project 3.** *Replace/Rehabilitate existing 8-inch sewer along Lola Avenue from TL_A_33 to TL_A_25.*
  - **Project 4.** *Replace/Rehabilitate existing 8-inch sewer from TL_A_22 to TL_A_21 along East 2nd to TL_A_16 on Eckerd Avenue.*
  - **Project 5.** *Replace/Rehabilitate existing 8-inch sewer along S. Swiegle from BC_A3_17 to BC_A3_7.*
  - **Project 6.** *Replace/Rehabilitate existing 8-inch sewer beginning at the S. Molalla Pump Station, continuing to manhole BC_A1_2, and terminating at the clean-out located east of manhole BC_A1_3. Additional smoke testing and TVing is recommended. A portion of this sewer line extends into an abandoned subdivision that presents a higher risk of infiltration and inflow.*
  - **Project 7.** *Replace/Rehabilitate existing 8-inch sewer along Fenton Avenue from TL_B_20 to TL_B_22.*

- **Phase 2**
  - **Project 8.** *Replace/Rehabilitate existing 8-inch sewer along East Main Street from TL_A_48 to TL_A_28.*
  - **Project 9.** *Replace/Rehabilitate existing 8-inch sewer along Berkley Avenue from BC_A3_18 to clean-out located south of BC_A3_14 near East 5th St.*
  - **Project 10.** *Replace/Rehabilitate existing 8-inch sewer beginning at manhole BC_A3_21 and continuing south on Metzler to BC_A3_2, terminating at clean-out at the intersection of Metzler and West 4th Street.*
  - **Project 11.** *Replace/Rehabilitate existing 8-inch sewer beginning at TL_B_21 and continuing east on Kimberly Ct until terminating at TL_B_24.*

- **Phase 3**
  - **Project 12.** *Replace/Rehabilitate existing 8-inch sewer beginning at BC_A3_16 along S. Molalla Avenue, continuing south to BC_A3_3, and continuing south until the clean-out in Fox Park (former High School site). Scope of work will include an evaluation of service laterals extending east on 2nd Street.*
  - **Project 13.** *Replace/Rehabilitate existing 8-inch sewer beginning at TL_A2_6, continuing south on S. Cole Avenue until TL_A2_4, and then continuing east on East 7th Street until terminating at the clean-out east of manhole TL_A2_5.*
  - **Project 14.** *Replace/Rehabilitate existing 8-inch sewer beginning at TL_B_2 along North Cole Avenue, and terminating at the clean-out south of TL_B_31.*
  - **Project 15.** *Replace/Rehabilitate existing 8-inch sewer beginning at TL_B_29 along Garden Court until TL_B_4.*
  - **Project 16.** *Replace/Rehabilitate existing 8-inch sewer beginning at TL_B_8 along Oak Street, and continuing to clean-out east of TL_B_12.*
  - **Project 17.** *Replace/Rehabilitate existing 8-inch sewer beginning at TL_B_8 on East Heintz Street to TL_B_9, continuing to TL_B_10 on East Park Avenue.*

- **Project 18.** *Replace/Rehabilitate existing 8-inch sewer beginning at BC_B_1 along South Molalla Forest Road to BC_B_18. Includes 8" sewer line extending west to BC_B_10.*
- **Project 19.** *Replace/Rehabilitate existing 8-inch sewer beginning at BC_C_71 along Meadowlawn Place to BC_C_59.*
- **Project 20.** *Replace/Rehabilitate existing 8-inch sewer beginning at TL_A1_5, continuing to TL_A1_1 on East 8th Street, continuing east on East 8th Street until TL_A1_6, and then terminating at the clean-out at the end of Mathias Court. Additional inspections and TVing is required in subbasin TL_A1 to determine ultimate scope of repairs/replacement work.*
- **Project 21.** *Replace/Rehabilitate existing 8-inch sewer beginning at TL_C2_11 along Explorer Avenue, continuing to TL_C2_6 along Escort Street, continuing to TL_C2_5 along Bronco Avenue, and continuing along Glory Ln to TL_C2_1. Scope of work shall also include replace/rehabilitate existing 8-inch sewer beginning at TL_C2_15 along Probe Street terminating at TL_C2_16. Additional inspections and TVing is required in subbasin TL_C2 to determine ultimate scope of repair/replacement work.*

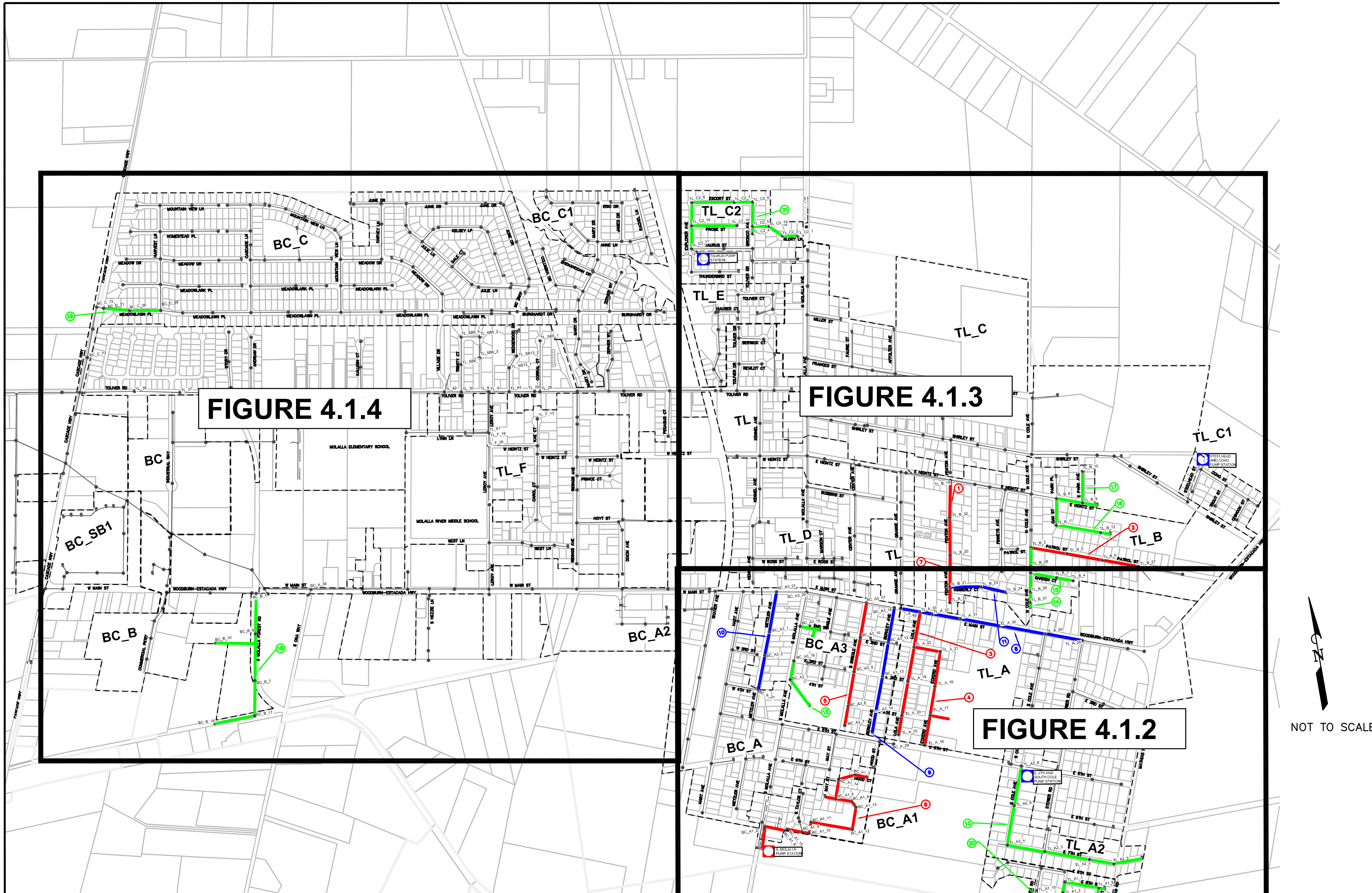
TABLE 4.1.1
COST ESTIMATES FOR SEWER MAIN REPLACEMENT/REHABILITATION PROJECTS

Project No.	Phase	Length (ft)	Construction Cost	Total Project Cost
1	1	850	$310,700.00	$425,700.00
2	1	1100	$432,200.00	$591,200.00
3	1	1300	$494,200.00	$676,200.00
4	1	1300	$448,200.00	$613,200.00
5	1	1300	$459,200.00	$627,200.00
6	1	2300	$840,200.00	$1,149,200.00
7	1	600	$217,200.00	$298,200.00
Subtotal Phase I	**$3,201,900.00**	**$4,380,900.00**		
8	2	1900	$752,200.00	$1,028,200.00
9	2	1350	$506,700.00	$693,700.00
10	2	1000	$373,200.00	$510,200.00
11	2	600	$238,200.00	$326,200.00
Subtotal Phase II	**$1,870,300.00**	**$2,558,300.00**		
12	3	700	$287,200.00	$394,200.00
13	3	2200	$760,200.00	$1,040,200.00
14	3	750	$287,700.00	$394,700.00
15	3	500	$225,200.00	$309,200.00
16	3	800	$303,200.00	$415,200.00
17	3	750	$278,700.00	$381,700.00
18	3	1800	$572,200.00	$782,200.00
19	3	600	$254,200.00	$348,200.00
20	3	1150	$461,700.00	$631,700.00
21	3	2500	$927,200.00	$1,267,200.00
Subtotal Phase III	**$4,357,500.00**	**$5,964,500.00**		
Total	**$9,429,700.00**	**$12,903,700.00**		

It is recommended that the City implement a TV program for the entire collection system over a five-year period (20% per year) and continue to repeat the TVing at five-year intervals. Table 4.1.2 lists the annual cost to fund the proposed CCTV program.

TABLE 4.1.2
ANNUAL TV PROGRAM COST ESTIMATE

Item	Total Cost
Annual CCTV Program	$65,000
Total	**$65,000**



LEGEND

(red line)	PHASE I	(red circle)	PUMP STATION - PHASE I
(blue line)	PHASE II	(blue circle)	PUMP STATION - PHASE II
(green line)	PHASE III		CLEAN OUT
	EXISTING SEWER		MANHOLE
	BASIN BOUNDARIES		

FIGURE NO. 4.1.1

CITY OF MOLALLA
CLACKAMAS COUNTY, OREGON

PUMP STATION AND I&I IMPROVEMENT PROJECTS

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS

DATE: JUNE, 2018

PROJECT NO.: 100.26

PLOT DATE July 6, 2018

Z:\dyer-part\AAprojects\100.00 Engineering, Misc\100.26 PDG -- Molalla WW Fac & Coll Syst MP\dwg\I&I Flow Map Phases\100.26 I-I Phase Map_Rev1.dwg, 6/16/2018 5:52:11 AM

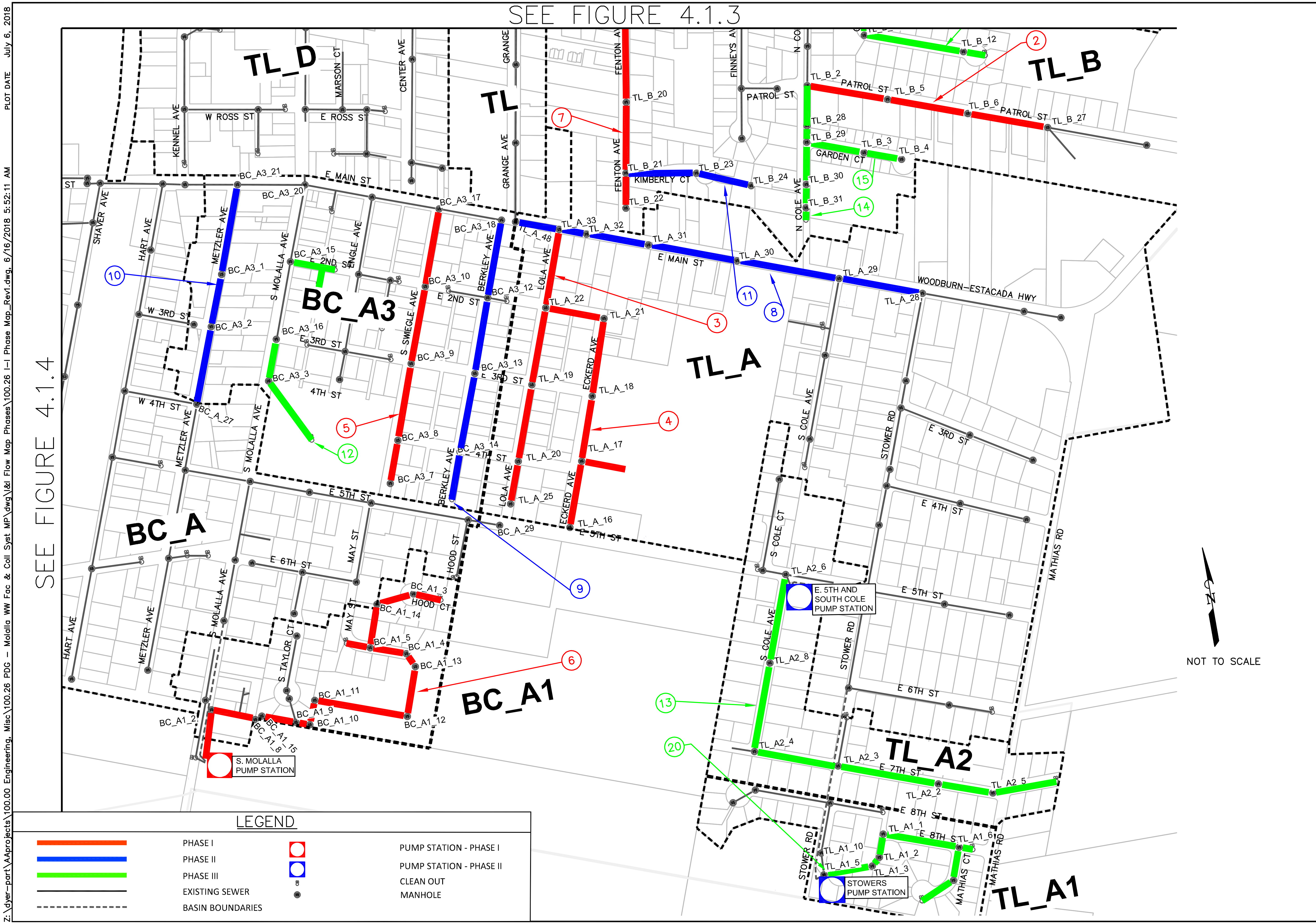


FIGURE NO. 4.1.2

CITY OF MOLALLA
CLACKAMAS COUNTY, OREGON

PUMP STATION AND I&I IMPROVEMENT PROJECTS

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS

DATE: JUNE, 2018
PROJECT NO.: 100.26

SEE FIGURE 4.1.4

SEE FIGURE 4.1.2

FIGURE NO. 4.1.3

CITY OF MOLALLA
CLACKAMAS COUNTY, OREGON

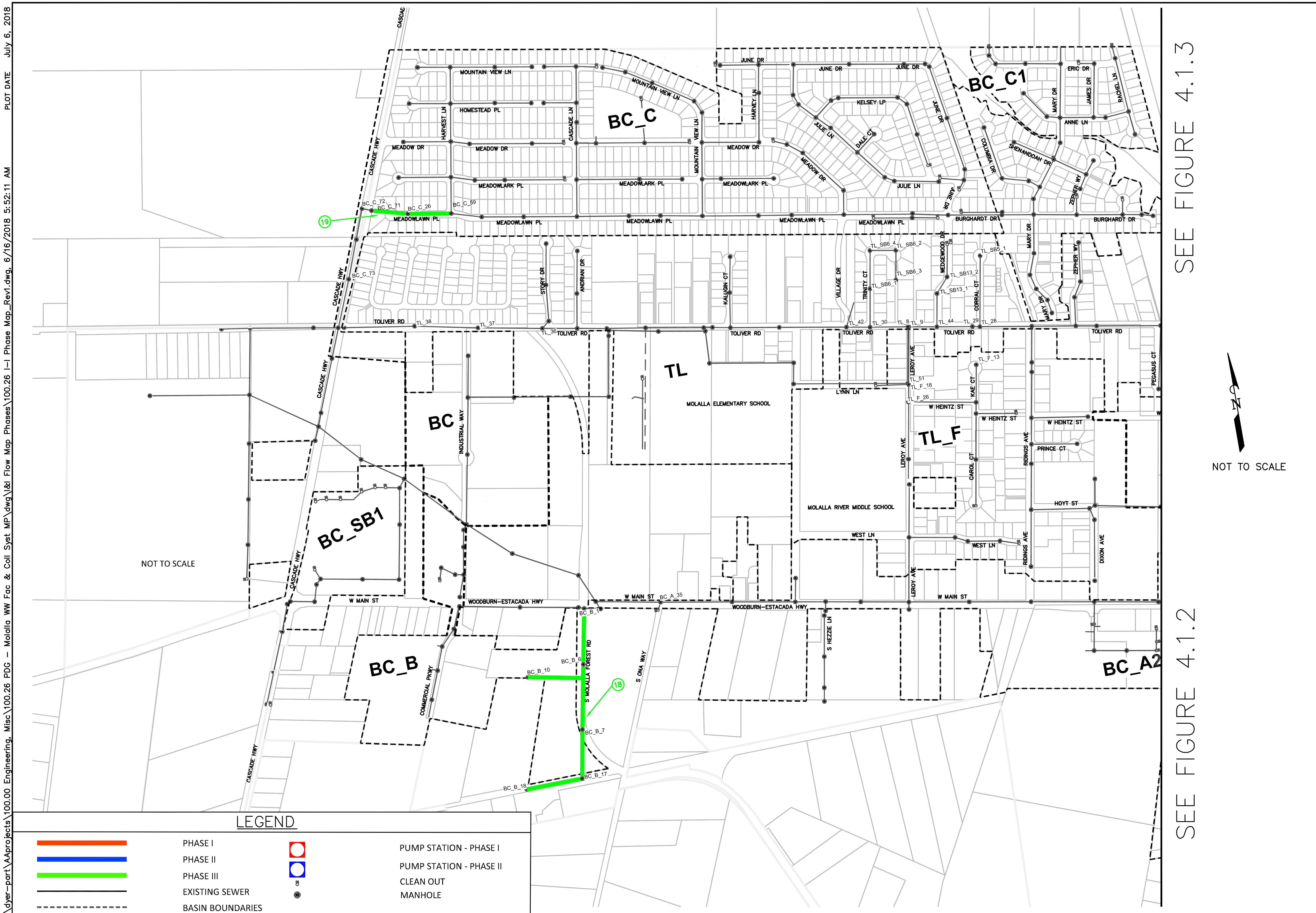
PUMP STATION AND I&I IMPROVEMENT PROJECTS

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS

DATE: JUNE, 2018
PROJECT NO.: 100.26

Z:\dyer-part\AAprojects\100.00 Engineering, Misc\100.26 PDG - Molalla WW Fac & Coll Syst MP\dwg\I&I Flow Map Phases\100.26 I-I Phase Map_Rev1.dwg, 6/16/2018 5:52:11 AM
PLOT DATE July 6, 2018

Z:\dyer-part\AAprojects\100.00 Engineering, Misc\100.26 PDG - Molalla WW Fac & Coll Syst MP\dwg\I&I Flow Map Phases\100.26 I-I Phase Map_Rev1.dwg, 6/16/2018 5:52:11 AM
PLOT DATE July 6, 2018



CITY OF MOLALLA
CLACKAMAS COUNTY, OREGON

PUMP STATION AND I&I IMPROVEMENT PROJECTS

FIGURE NO. 4.1.4

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS

DATE: JUNE, 2018

PROJECT NO.: 100.26

I/I Reduction Recommendation

It is recommended that the City continue to pursue the reduction of infiltration and inflow. The City should allocate funding for I/I construction projects in a phased approach, as outlined above. Following collection system improvements to reduce I/I, reassessment of the WWTPs influent wastewater flows, resulting from the I/I improvements should be performed. An amendment to the WWFCSMP flow projections is recommended as I/I abatement projects are completed and peak flows theoretically subside.

Collection System Expansion

An analysis of future expansion requirements for the collection system involved identifying likely areas of expansion and determining the probable impacts of expansion on the existing system. Future growth will occur within the City's Urban Growth Boundary (UGB). With its proximity to Salem and Portland, the City of Molalla is uniquely positioned to experience strong growth in the next twenty years. Future growth will occur within the City's UGB. Large tracts of developable land, well suited for new residential or commercial development, are not readily available within the City's UGB. New connections to the existing gravity sewer system will primarily occur by providing service to vacant lots dispersed throughout the UGB.

Alternatives

<u>No-Action</u>
This action prevents the expansion of the collection system by not providing sewer connections to new residential or commercial users.

<u>Provide Service as Required for Future Development</u>
This option allows expansion of the City's sewer system to new users located throughout the UGB. The areas of proposed service expansion are scattered throughout the City's UGB. New residential and commercial connections will be added as lots are developed.

Collection System Expansion Recommendation

It is recommended that the City provide sewer service as required for future development without further analysis because it is consistent with the City's Comprehensive Development Plan. Future collection system expansion elements will be constructed through private development and/or as funding becomes available through formation of Local Improvement Districts (LIDs), grants, System Development Charges (SDCs), and/or loans.

4.2 Existing Pump Station Improvements

The collection system includes five pump stations. Each pump station was analyzed to determine improvement requirements during the twenty year planning period. A summary of the recommended improvements to the pump stations is provided in this section.

Taurus Pump Station

The Taurus Pump Station consists of duplex self-priming hydromatic pumps. The pumps are undersized; rain events hydraulically overload the pump station. The duplex self-priming pumps require frequent oversight, repair, and replacement. Operational expenditures are disproportionate compared to similarly sized pump stations. Operational activities are inefficient, partly because the pump station is not connected to the City's Supervisory Control and Data Acquisition (SCADA) system. The pump station is located immediately adjacent to residences, is unsightly, emits excessive noise, and lacks the required sound attenuation equipment. Improvement alternatives evaluated included: 1. No-Action, and 2. New Submersible Pump Station.

Alternatives

No-Action
The Taurus Pump Station is incapable of conveying wet weather flows and is expensive to operate and maintain. Left unaddressed, the pumps will continue to require frequent repair and replacement work, and the opportunity for sewage overflows will remain negligently high. The pump station will remain noisy and a nuisance to neighbors.

New Submersible Pump Station
This alternative includes the demolition of the existing self-priming pumps, and the conversion of the pump station to submersible pumps. New duplex submersible pumps, controls, effluent piping and valve vault, as well as the integration of SCADA equipment will be installed. The submersible pumps are sized for redundancy based on peak instantaneous flows, in accordance with the Oregon Department of Environmental Quality (DEQ) guidelines. Substituting submersible pumps alleviates issues related to excessive noise emission from the existing pumps.

Table 4.2.1 summarizes the construction cost estimate for converting the station to a submersible pump system. Detailed cost estimates are included in Appendix C.

TABLE 4.2.1
SUBMERSIBLE PUMP SYSTEM UPGRADE COST ESTIMATE

Item	Cost Estimate
Construction	$269,000

The advantages and disadvantages of installing a new submersible pump station are summarized in Table 4.2.2 below.

TABLE 4.2.2
ADVANTAGES AND DISADVANTAGES

Advantages	Disadvantages
Reduced operation and maintenance costs.	High up-front capital costs compared to continued use of vacuum self-priming pumps.
Alleviates noise issues associated with existing pumps.	Space limitations of existing site.
Submersible pumps would be capable of processing existing wet weather flows.	Valve vault required.
SCADA integration improves operational efficiencies.	

Taurus Pump Station Recommendation

The existing pumps present significant operational and maintenance difficulties. Installing a new submersible pump station, while reusing the existing wet well, is recommended. Based on the City's budget and other priorities, upgrades to the Taurus Pump Station are classified as Phase 2 improvements. Phase 2 improvements are schedule to be completed in years 5-10. This alternative offers the lowest life-cycle costs, eliminates noise issues related to the existing pump station, increases operational efficiencies by integrating SCADA equipment, and provides pumps that are capable of processing wet weather flows.

South Molalla Pump Station

The South Molalla Pump Station is the City's oldest pump station, and is consequently approaching the end of its design life. The wet well has structural deficiencies, control systems are antiquated, and the pumps exhibit excessive operation and maintenance. The South Molalla Pump Station requires multiple upgrades in order to function properly and to decrease operating and maintenance costs. The goals of the pump station improvements include: reduction of system maintenance, improvement of system reliability, watertight and structurally sound wet well, and to provide automatic emergency power and alarms. The alternatives that were evaluated included: 1. No-Action, 2. Rehabilitation, and 3. New Submersible Pump Station.

Alternatives

<u>No-Action</u>
Under this option, current pumping capacity, operational difficulties, non-watertight wet well and other deficiencies present high operational costs and risks for the City. Costs and risks are anticipated to accelerate over time under the no-action alternative. The no-action introduces excessive risk of catastrophic failure and sewage overflows into Bear Creek. Therefore, the no-action alternative is not recommended.

<u>Rehabilitation</u>
Another option is to salvage and rehabilitate the existing wet well. However, the wet well is in poor condition, with visible cracks, access limitations, and leaky penetrations. Extensive modifications would be required to the piping and structural elements. Rehabilitating the pump station is therefore not recommended.

<u>New Submersible Pump Station</u>
Construction of a new South Molalla Pump Station would include demolition of the existing pump station, installation of new duplex submersible pumps, new wet well, a permanently mounted generator for standby power with automatic transfer switch, new control panel, new level control, valve vault, SCADA system, new force main, and other work. The submersible pumps would be sized for redundancy based on peak instantaneous flows, in accordance with DEQ guidelines.

Table 4.2.3 summarizes the construction cost estimate for converting the station to a submersible pump system. Detailed cost estimates are included in Appendix C.

TABLE 4.2.3
SUBMERSIBLE PUMP SYSTEM UPGRADE COST ESTIMATE

Item	Cost Estimate
Construction	$491,500

South Molalla Pump Station Recommendation

The South Molalla Pump Station is old and operationally problematic. Continuing to operate the pump station in its current condition presents excessive risk of failure and increased frequency of sewage overflows. Installing a new submersible pump station is therefore recommended. Upgrades to the South Molalla Pump Station are classified as Phase 1 improvements, and scheduled to be completed within the next five years.

Stowers, Steelhead & Coho, and East 5th & South Cole Pump Stations

Improvements to the Stowers, Steelhead & Coho, and East 5th & South Cole Pump Stations will also be required during the planning period. The pumps will eventually need to be replaced, and controls will require upgrades and SCADA integration to improve operational efficiencies. Each wet well should be inspected to establish rehabilitation requirements, if any. For budgetary purposes, the cost estimates assume that each wet well will require rehabilitation work. These upgrades are classified as Phase 2 improvements, and planned to occur in years 5-10.

Table 4.2.4 summarizes the construction cost estimate for miscellaneous improvements to the Stowers, Steelhead & Coho, and East 5th & South Cole Pump Stations. Detailed cost estimates are included in Appendix C.

TABLE 4.2.4
STOWERS, STEELHEAD & COHO, AND EAST 5TH & SOUTH COLE
PUMP STATION IMPROVEMENTS
CONSTRUCTION COST ESTIMATES

Item	Cost Estimate
Stowers Pump Station Improvements	$150,000
Steelhead & Coho Pump Station Improvements	$150,000
East 5th & South Cole Pump Station Improvements	$150,000

4.3 Wastewater Treatment Facility Improvements

General Assessment

The aerated and facultative lagoons are the main biological processes used for treatment of the City's wastewater. The aeration basin (i.e. aerated lagoon) and facultative lagoons are 37 years old, hydraulically undersized and organically overloaded, all based on existing loads. Insufficient hydraulic detention time in the aerated lagoons prevents significant oxidation of biodegradable constituents. Deficient hydraulic detention time in the facultative lagoons inhibits proper biological treatment, but also impedes the City's ability to store recycled water during the summer months. The environment created by facultative lagoons is also prone to the development of algae. Algae blooms overload tertiary treatment systems, and ultimately cause repeated permit violations.

In response to elevated effluent suspended solids concentrations and population growth, the WWTP underwent a major upgrade in 2007, in which the DAF system was expanded, and four new gravity sand filters were installed. The expansion of tertiary systems offered temporary reprieve from permit violations, but left the root cause of the excess solids unaddressed. At that time, the aerated and facultative lagoons remained untouched, and biosolids management systems continued to be absent from the WWTP. Properly sized, lagoons offer low O&M requirements and costs, but present many challenges related to compliance with suspended solids requirements of the City's discharge permit.

Considering a population projection of 16,977 in 2043, a major WWTP improvement and expansion project is required. The WWTP improvements and expansion must not only address existing deficiencies, but also serve the projected population increase of 71% over the next twenty years. The WWTP frequently violates suspended solids concentration and mass load limits, and often discharges to the Molalla River during the summer months, in violation of the current NPDES Permit. Short of a major upgrade, the existing WWTP will continue to regularly violate the NPDES Permit.

With major WWTP upgrades imminent, the primary objective of future improvements is compliance with the NPDES Permit. Effluent disposal options will dictate discharge requirements and have a tremendous impact on the viability of WWTP improvement and expansion alternatives. The WWTP expansion must reliably produce less than 10/10 mg/L BOD_5 and Total Suspended Solids (TSS), or lower depending on the outcome of pending permit modification applications. Ideally, the WWTP must also nitrify to achieve less than 5 mg/L ammonia, even though the current permit is less restrictive. Wastewater treatment technologies that are predisposed to have difficulties achieving low suspended solids or ammonia concentrations were avoided.

Future recycled water storage requirements will also have a profound impact on feasible wastewater treatment alternatives. The current permit requires that recycled water must be land applied (or stored in the lagoons) between May 1 through October 31; and discharge to waters of the state is prohibited. Due to restrictions associated with the land application of recycled water and the necessity to maintain the biological capacity of the facultative lagoons, the existing WWTP lacks adequate recycled water storage based on existing and future flows. The lagoons are a considerable asset to the City, and provide a significant opportunity for the storage of recycled water. WWTP technologies are available that enhance lagoon processes, usually with the addition of aeration systems. This provides higher volumetric capacity and removal rates within the existing lagoons, but may diminish the volume available for storage of recycled water. For this reason, in addition to verifying that improvement and expansion options can consistently comply with discharge requirements, upgrades must take into account impacts on recycled water storage infrastructure.

This section summarizes WWTP improvement requirements during the planning period. Tables 3.6.1 and 3.6.2 were used as the basis of design for each unit process evaluation and improvement recommendations.

City of Molalla, Wastewater Facilities Plan (April, 2000)

For contextual purposes, a brief summary of the recommendations contained in the Wastewater Facilities Plan (WWFP) prepared by Tetra Tech/KCM, Inc. in April 2000 are provided below. At the time, among other objectives, the 2000 WWFP reviewed treatment options and provided recommendations for improvements. The 2000 WWFP recommended WWTP improvements in two phases. The Phase 1 and 2 WWTP improvement recommendations are summarized below:

<u>Phase 1</u>

- Preliminary Treatment – Installation of facilities for fine screening with washing, compaction, and flow measurement.
- Transfer Pumping – New pump station with vertical turbine solids handling pumps.
- Secondary Treatment – Construction of two aeration basins within the existing Lagoon #1 and installation of aeration equipment.

- Advanced Treatment – Upgrade and expansion of the dissolved air flotation and gravity sand filters.
- Effluent Disinfection – Upgrade of chemical equipment and addition of a chlorine scrubber at the existing plant site.
- Other – Miscellaneous improvements to office and laboratory.
- Solids Management – Construction of diking in the existing Lagoon #1 for the Phase 2 facultative sludge lagoon to be completed as part of the Phase 2 improvements.

Phase 2

- Secondary Treatment – Add secondary clarification and Returned Activated Sludge (RAS) and Waste Activated Sludge (WAS) facilities. Add additional aeration to the aeration basins.
- Solids Management – Install a liner and associated piping in the facultative sludge lagoon.

Since the development of the 2000 Wastewater Facilities Plan, the following major upgrades have been implemented:

- In 2000, a new effluent pump station and effluent/irrigation force main was constructed.
- In 2002, a new headworks system, transfer pump station, and irrigation supply lines were constructed.
- In 2006, the Bear Creek outfall was abandoned and a new outfall to the Molalla River was permitted and installed. The force main used for irrigation was extended to the current Molalla River outfall.
- In 2007, another (Dissolved Air Flotation) DAF unit and four new gravity sand filters were installed. The chlorine contact basin was also relined.

Despite the recommendations of the 2000 WWFP, solids management systems and secondary treatment improvements were never implemented. The existing WWTP still relies on the undersized lagoons (aerated and facultative) for secondary treatment, and solids are allowed to settle throughout the lagoons. Not surprisingly, the existing WWTP secondary treatment processes are undersized, and the City struggles to adequately manage solids.

Influent Fine Screen

Influent fine screening is a physical unit process by which solids are removed from the waste stream. Fine screening removes solids that could, if not removed, damage or clog wastewater process equipment or decrease treatment reliability and efficiency. Fine screens are also commonly used to replace primary treatment at small WWTPs and can remove both influent TSS and BOD_5. Fine screens are classified as screens with openings that range from 0.02 inch to 0.25 inch.

The existing headworks system was designed with one fine screen that has a design capacity of 9.25 MGD. Operator feedback has suggested that the existing fine screen is incapable of processing flows greater than 6 MGD. The influent fine screen is currently undersized for existing flows, and an expansion is necessary to meet the projected Peak Instantaneous Flow (PIF) for the 2043 planning period.

Alternatives

No-Action
The existing fine screen is not capable of processing existing peak hourly flows. Neglecting to expand the facility will result in bypassing solids to downstream treatment equipment and processes. Solids will

accumulate in downstream wastewater processes, clog mechanical equipment, and lead to an unreasonable risk of premature equipment failure or even overflows.

Construct a New Fine Screen
This alternative includes the addition of another fine screen, in parallel with the existing fine screen. The existing screen is a Kusters Water Model FBS unit 1000 x 75/6, with ¼ inch clear openings. The additional fine screen would be rated at 9.25 MGD. In addition to the second screen, the conveyor that transports the compacted screenings to the dumpster must be increased in length to accommodate the second screen.

Table 4.3.1 summarizes the cost estimate for adding another fine screen, identical to the existing screen, in the currently unused channel. By adding the second screen, the fine screen system would be capable of processing existing and future flows. Detailed cost estimates are included in Appendix C.

TABLE 4.3.1
FINE SCREEN EXPANSION COST ESTIMATE

Item	Cost Estimate
Construction	$485,355

Influent Fine Screen Recommendation

Constructing a new influent fine screen is recommended. This alternative provides fine screening capacity for existing and future flows. Upgrades also include integration into the SCADA system, thereby improving operational efficiencies. This recommendation is independent of the future permit condition (PS #1 – PS #4).

Grit Removal

Grit removal is not included at the existing wastewater treatment facility. Instead, grit is allowed to pass through the headworks and accumulate in the aerated lagoon. Grit removal is infrequent and burdensome. Grit in wastewater consists of sand, gravel, or other heavy solid material. Grit removal is required to reduce accumulation of heavy deposits in aeration basins, pipes, channels, and to avoid excessive wear on mechanical equipment caused by abrasion. Grit removal consists of the following processes: 1. Grit separation, 2. Grit washing, and 3. Grit dewatering.

Alternatives

No-Action
The WWTP does not currently include grit removal. Continuing to allow grit to collect and accumulate in the existing aeration basin (i.e. aerated lagoon) will decrease the efficiency of wastewater unit processes. Grit will also increase wear on mechanical equipment.

Construct Grit Removal System
A vortex grit removal system would be constructed immediately prior to the Transfer Pump Station. Grit collected in the system would be cleaned and disposed of in a bagger system located within a small dumpster. The grit removal system will have a capacity of 12.5 MGD.

Table 4.3.2 summarizes the cost estimate for adding a grit removal system. Detailed cost estimates are included in Appendix C.

TABLE 4.3.2
GRIT REMOVAL SYSTEM COST ESTIMATE

Item	Cost Estimate
Construction	$901,000

Grit Removal System Recommendation

Constructing a new grit removal system is recommended to sustain the longevity of wastewater process equipment as well as maintain optimum efficiency of downstream treatment processes. This alternative provides grit removal suitable for future flows. Upgrades also include integration into the SCADA system, thereby improving operational efficiencies. This recommendation is independent of the future permit condition (PS #1 – PS #4).

Influent Flow Equalization

The City of Molalla's collection system has excessive I/I. To decrease the size of downstream wastewater facilities, half of the existing aeration basin (i.e. aerated lagoon) will be repurposed to serve as an influent flow equalization/surge basin. The remaining volume will be decommissioned and filled in. The volume dedicated to flow equalization will be approximately 650,000 gallons. Peak flows will be conveyed, via overflow piping, from the transfer pump station to the existing aeration basin. The transfer pump station will meter flows to the downstream processes. Because the asphalt-concrete liner is cracked, the proposed upgrades include the installation of a new concrete basin. This recommendation is independent of the future permit condition (PS #1 – PS #4).

TABLE 4.3.3
FLOW EQUALIZATION BASIN COST ESTIMATE

Item	Cost Estimate
Construction	$1,190,000

Transfer Pump Station and Force Main

The Transfer Pump Station is an essential component of the WWTP. Based on the biological treatment recommendation, the Transfer Pump Station will undergo improvements to allow for conveyance of raw sewage to the new WWTP. By using the existing aerated lagoon as an influent flow equalization basin, the existing force main from the Transfer Pump Station to the inlet of the new WWTP, could be reused. The existing Transfer Pump Station Controls Building will house the new control panel for the new pumps.

The wet well levels, after the aeration basin is converted to an influent flow equalization basin, will change to a maximum and minimum water surface elevation of 275 feet and 272 feet, respectively.

The DEQ defines a pump station's capacity as the pumping capacity of the pump station with the largest pump out of service. By incorporating flow equalization into the design, the pump station must have the capacity of 6,187 gpm. In addition to conveying future peak daily flows, the pump station must also be designed to meet future average dry weather flows of approximately 1,319 gpm. Variable speed drives will be used to match pump output to actual flows, but also modulate peak flows.

The velocity in the pump discharge piping should be maintained between 3 and 10 ft/s. Velocities less than 3 ft/s induce solids deposition, while velocities greater than 10 ft/s generate excessive head loss within the pipe.

To process peak flows, the Transfer Pump Station will convey raw wastewater through both parallel 18-inch diameter force mains. During the summer months, only one 18-inch diameter force main will be used. Intermittent dual pump operational cycles can be implemented to ensure cleaning velocities are achieved during the summertime, if necessary. Table 4.3.4 summarizes the construction cost estimate for installing new pumps and controls. This recommendation is independent of the future permit condition (PS #1 – PS #4).

TABLE 4.3.4
TRANSFER PUMP STATION IMPROVEMENTS COST ESTIMATE

Item	Cost Estimate
Construction	$844,000

Biological and Tertiary Treatment

The City of Molalla's WWTP will require numerous upgrades to address existing deficiencies, regain permit compliance, and provide capacity for future population growth. Several wastewater treatment alternatives were evaluated for their suitability and applicability, given existing and future flows, as well as discharge requirements and recycled water storage impacts. Initially, a preliminary analysis was conducted that eliminated all but four alternatives. The following treatment improvement concepts were reviewed as initial alternatives:

1. Wetlands
2. Lagoon Enhancement Processes
3. I/I Reduction Only (no improvement of existing WWTP)
4. No-Action
5. Sequencing Batch Reactor (SBR) and SBR with Tertiary Filtration
6. Conventional Activated Sludge
7. Oxidation Ditch (with Primary Clarification)
8. Membrane Bioreactor (MBR)

Design parameters used as a basis for evaluation of alternatives, including flow and load projections for the 2043 planning period and NPDES Permit requirements, were established in Section 3.

Preliminary Analysis

Wetlands
Wetland systems use aquatic plants and animals for the treatment of municipal wastewater. The two main types of wetland systems include;

1. Free-water surface (FWS) constructed wetlands

2. Subsurface flow (SF) constructed wetlands

With a free-water surface system, vegetation is flooded to a depth from 4 to 18 inches. The FWS system typically consists of channels or basins with a natural or constructed impermeable barrier to prevent seepage into groundwater. Treatment occurs by attached bacteria and by physical and chemical processes. In a subsurface-flow constructed wetland the wastewater is treated as it flows laterally through the porous medium. Vegetation is planted in the medium, typically coarse gravel to sand. Depths range from 1.5 to 3 ft.

Pretreated wastewater is typically applied to FWS and SF systems. A minimum of primary treatment is required. In many cases, wetland systems are preceded by secondary treatment facilities, and designed to further polish the effluent to meet more stringent regulatory requirements.

Performance expectations for FWS and SF constructed wetland systems depends on design criteria, influent wastewater characteristics, and operations. In general, the performance of wetland type treatment systems is more variable than mechanical treatment facilities. Observed BOD_5 removal rates are typically between 60 to 80%, and 50 to 90% for TSS.

Using constructed wetlands for complete secondary treatment introduces several concerns. The expected effluent concentration from constructed wetlands is typically < 30/30 mg/L BOD_5/TSS, and ammonia removal is inconsistent. Effluent quality from constructed wetlands is also highly variable and largely uncontrollable. The existing permit requires < 10/10 mg/L BOD_5/TSS (monthly average) and < 16.7 NH_3-N (monthly average). Additionally, the land area required for a constructed wetland sized to provide complete secondary treatment is excessive (~ 220 acres). The liability of wetland failure and understanding rehabilitation requirements of wetlands is also important. Unlike mechanical wastewater treatment facilities, wetlands are inherently difficult to rehabilitate in the event of failure. This presents a significant liability to the City. For these reasons, using wetlands to provide secondary treatment is not recommended.

The applicability of constructed wetlands is often to provide tertiary treatment, mainly to assist with cooling the wastewater to maintain compliance with temperature limits, and removal of residual BOD_5/TSS. Initially, an evaluation of the ability to use wetlands following the existing facultative lagoons was conducted. First, the existing lagoons and tertiary systems are organically and hydraulically undersized based on existing flows and loads. Second, according to Constructed Wetlands Treatment of Municipal Waters (EPA, 2000) and Wastewater Engineering, Treatment, Disposal, and Reuse, the use of oxidation ponds or lagoons that generate high concentrations of algae should be avoided prior to wetlands treatment. While the existing tertiary systems (Dissolved Air Flotation and Gravity Filters) provide some algae removal, they are undersized for future flows and maintenance intensive, and have difficulty removing algae.

An analysis of the suitability of wetlands for providing tertiary treatment following a new mechanical treatment facility was also conducted. Using wetlands with a new mechanical treatment facility during the winter time would not be necessary, as a mechanical plant (with tertiary treatment if required) would be designed to produce effluent quality better than permit requirements.

Wetlands could be used as an indirect discharge method - to the Molalla River - during the summer months, to augment the City's effluent disposal options. At this time, the City relies on recycled water reuse for land application of recycled water. A few additional considerations, related to the use of wetlands for tertiary treatment and indirect discharge during the summer months, are summarized below.

- Land area required for a constructed wetland for effluent polishing could require approximately 65 acres located adjacent to the Molalla River, additional modeling and studies to determine applicability of wetlands for polishing and complying with the temperature TMDL, and modifications to the existing NPDES permit.

- The City already has 444.5 acres of land available for application of recycled water. Additional sites have been identified as potential candidates, all of which require further evaluation to determine suitability.

- If a mass load increase is approved, and depending on the actual load allocated, the City could plan on storing some summertime flows for eventual discharge to the Molalla River during the winter months. This further reduces the land area required for application of recycled water.

- The City is attempting to modify the NPDES permit to allow for more flexibility in discharging to the Molalla River, when river conditions allow, typically in May, and sometimes even June. This further reduces the need to land apply recycled water during the summer months.

Lagoons
The existing WWTP consists of a diminutive aeration basin (i.e. aerated lagoon) followed by two undersized facultative lagoons. The existing lagoon processes lack the volume and aeration to provide the requisite oxidation of influent organic and nitrogenous loads. Several possibilities exist for the expansion of the existing aerated lagoon and facultative lagoon process. A complete mix/partial mix upgrade is one option for enhancing and expanding the existing lagoon process.

A complete mix/partial mix upgrade would consist of installing a new, properly sized, aeration system, typically in the form of submerged diffusers, in the existing aerated lagoon. The aerated lagoon would operate without a return activated sludge loop, operate as a low rate activated sludge process, and convey mixed liquor to Lagoon #1.

Lagoon #1 would be converted to a partial mix lagoon. An aeration grid would be added to Lagoon #1 to provide additional Dissolved Oxygen (DO) for removal of organic matter and nitrification of ammonia. In partial mixed lagoons, the energy input is typically only sufficient to transfer the amount of oxygen necessary for biological treatment, not to maintain solids suspension and proper mixing. Since the energy input is inadequate for solids suspension, solids will continue to settle in the lagoons and require periodic removal and management.

Complete mix/partial mix lagoons are low maintenance and often well suited for small communities. Complete mix/partial mix lagoons are inherently easy to operate when compared to conventional activated sludge facilities, are designed without return activated sludge, and generally require minimal oversight. A major disadvantage, however, is that they come with limited operational control. Without the addition of tertiary processes, the performance expectation of lagoons is typically less than 30/30 BOD_5/TSS. Based upon the limited control to manage events in lagoons, particularly the production of algae, along with the ongoing trends of state and federal agencies to require more stringent discharge requirements, the use of lagoons has diminished nationally.

Effluent filtration is required with lagoon processes to remove solids from the waste stream. Outfitting a lagoon process with a filtration process to achieve less than 10 mg/L TSS presents many challenges. Algal matter usually proliferates in lagoon facilities, and is fundamentally difficult to remove from the waste stream. The existing system is probative evidence of the problems associated with using tertiary processes to achieve low TSS effluent concentrations. The City of Molalla's NPDES Permit is beyond the reasonable capability of lagoon processes, even with tertiary filtration packages incorporated. Continuing to rely on a lagoon process for providing the majority of treatment introduces unreasonable risk of noncompliance.

The volume required for recycled water storage poses another challenge to lagoon upgrade options. Recycled water storage is necessary to balance the differences that occur in the generation and use of recycled water. The City cannot discharge to waters of the state between May 1 through October 31, and they typically can't land apply recycled water in May or October due to rainfall. The City does not currently have enough storage for recycled water to satisfy requirements for the 2043 planning period. Partial mix lagoons must maintain a liquid depth of 10 to 12 feet to provide the required volume for biological treatment of wastewater. Lowering the lagoon liquid levels to enable flow equalization, within the lagoons, diminishes the treatment capacity of the lagoons. Lagoon upgrade options essentially force the City to purchase additional land for the storage of recycled water, or excavate and deepen the lagoons.

Due to the difficulties of lagoon based processes with achieving less than 10 mg/L BOD_5 and less than 10 mg/L TSS, and the problems associated with recycled water storage, lagoon based treatment technologies are not considered a long-term viable option for biological treatment, even with PS #4.

I/I Reduction Only

One alternative is to only conduct I/I reduction projects without a plan for major improvements to the existing wastewater treatment facilities. During smoke testing and flow mapping endeavors, several collection system deficiencies were identified. I/I mitigation projects could have a tremendous impact on reducing wet weather flows. However, the existing unit processes are drastically undersized based on existing and future flows. Even with a considerable reduction in infiltration and inflow and permit modifications, major WWTP improvements will not be averted.

I/I control efforts present a significant challenge. As cracks and leaks in one part of the system are corrected, groundwater migrates through bedding to adjacent deficiencies. Identifying and repairing public sewer deficiencies is often not enough. A portion of the I/I is typically isolated to the private service laterals. More often, utilities and regulatory agencies recognize the need to combat I/I in a holistic approach that addresses both public collection system components and private sources. The privately owned portions of the sewer system have the potential to contribute significantly to I/I flows. In some cities, it is estimated that as much as 60% of the I/I flows originate from service laterals (US Environmental Protection Agency, 1996). According to a 2015 Water Environment Federation (WEF) I/I survey, 31% of the respondents noted private I/I sources contributing 50 to 75% of the I/I, and 36% of the respondents contributing 20 to 50%. As a relatively local example, the City of McMinnville, Oregon estimates that approximately 60% of the City's I/I originates from their private sewer laterals.

Collection system improvements are necessary and recommended to address excessive I/I. Avoiding major wastewater treatment upgrades based entirely on collection system improvement projects is highly improbable. Alternatively, a common approach is to first implement collection system improvement projects, and then re-analyze flows prior to authorizing wastewater treatment plant improvement projects. Under this approach and methodology, collection system improvement projects will likely reduce peak wastewater flows, resulting in comparatively smaller and more affordable WWTP improvements.

No-Action

Under the No-Action alternative, no improvements would be made to the existing collection system or WWTP. The WWTP has numerous critical process units that are undersized for existing and future flows. Continuing to operate the existing wastewater treatment plant without any expansions would result in continued noncompliance with current or modification permit and recurrent exposure to fines. Without collection system improvements, I/I will continue to increase and overload pump stations and the WWTP. This alternative is not recommended.

<u>Convert the Existing WWTP to a MBR, SBR, SBR with Tertiary Filtration, Conventional Activated Sludge, or Oxidation Ditch (with Primary Clarification) Facility</u>
For these alternatives, the WWTP improvements would include the construction of a new mechanical wastewater treatment plant and the abandonment of the facultative lagoons as the main biological treatment process. Existing tertiary treatment and disinfection processes will be evaluated to determine whether they are needed, and the efficiency of reusing existing systems versus constructing new systems. By installing a new mechanical WWTP, the existing facultative lagoons would be repurposed to serve as recycled water storage. Recycled water storage systems will be evaluated, and expansion requirements will be determined based on future permit scenarios (PS #1, PS #2, PS #3, and PS #4).

<u>Summary of Preliminary Analysis</u>
All of the above alternatives were evaluated based on several factors, including; footprint, ability to achieve discharge limits, capital costs, operational costs, impact on recycled water storage availability, and several other factors. After an initial screening of concepts, all but four alternatives were evaluated in detail, and a life-cycle cost analysis was developed for each. The four secondary treatment system alternatives that were evaluated in detail were: 1. SBR (and SBR with tertiary filtration), 2. MBR, 3. Conventional Activated Sludge, and 4. Oxidation Ditch with Primary Clarification. Multiple manufacturers were evaluated, including but not limited to; Xylem (Sanitaire), Parkson, Kubota USA, Aeromod, Westech, Evoqua, Aqua Aerobics, and others. These alternatives are assessed in more detail in subsequent sections.

Liquid-Stream Treatment Alternatives

In this section, each of the alternatives that remained feasible after the initial screening of alternatives are evaluated in more detail to determine the most cost-effective and suitable alternative for the City of Molalla.

The requirements of the liquid stream alternatives is predominantly a function of whether or not a mass load increase is granted, and to what degree. Section 4.5 evaluates and provides recommendations for liquid stream alternatives to determine if a mass load increase is or isn't approved.

<u>Sequencing Batch Reactor (SBR)</u>
Treatment in a SBR system is accomplished in a single reactor compared to what is done spatially in a flow-through activated sludge system and separate independently designed secondary clarifier. A typical operation sequence consists of four steps: fill, react, settle, and decant. The treatment sequence begins with the introduction of wastewater into a partially filled tank containing settled mixed liquor from a previous cycle (fill phase). In the react phase, aeration and mixing are provided for a length of time sufficient to produce an effluent of the desired quality. With some SBR units, the fill and react phases are combined in an aerated fill step. After the react phase, the mixed liquor is then allowed to operate in a quiescent settling phase, after which the clear supernatant liquid is then subsequently decanted as effluent. Once the decant phase is completed, the system is ready for refilling. During the settle and decant phases in one tank, the other tank is undergoing the fill and react phases. Since the process continually runs through cycles, automated controls are utilized to operate the treatment process.

Key advantages of the SBR process include its simplicity and reliability, high operational flexibility, capability of very high and consistent effluent quality due to quiescent batch settling (less than 10 mg/L BOD_5, TSS), requirement of less Operator attention than most other mechanical systems, and ideal suitability to wide flow variations. With a SBR, based on discharge requirements of 10/10 mg/L BOD_5/TSS, tertiary treatment systems would not be required. If the mass load limits are not increased in accordance with future flows and Willamette Basin standards, the SBR would require tertiary filtration to comply with permit limits. An SBR with a tertiary filter can achieve, with a relatively high level of confidence, less than 4 to 5 mg/L BOD_5/TSS. The tertiary filter will include turbidimeter(s) to measure turbidity real-time. In the event that effluent turbidity is too high (and effluent BOD/TSS is above permit values), an actuated valve will be activated to temporarily divert effluent to storage ponds.

After preliminary treatment, the wastewater would then flow by gravity to a flow splitter that would divide the flow entering the SBR basins. The four-cell design under consideration is based on the type of SBR that contains a baffled inlet, which allows inlet flow even during the settling cycle without impairing treatment effectiveness. For maintenance purposes, all the inlet flows can be diverted to the other basins. There are a number of SBR vendors in the United States, some of which use a pure batch system and others that are designed for continuous feed.

Each SBR basin would consist of a concrete rectangular structure with a top water and bottom water level of 18 and 12.5 feet (approximate), respectively. In each basin, there would be a pre-react zone and mixers to inhibit filamentous growth that causes sludge bulking. Since each basin acts as an aeration basin and clarifier, no return activated sludge equipment is required. Scum would be removed by floating skimmers in each basin and sent back to the preliminary treatment process for dewatering and compaction. The waste sludge is pumped and measured from each basin to the biosolids management systems with small submersible pumps. Common wall construction would be utilized to minimize the SBR footprint and construction costs.

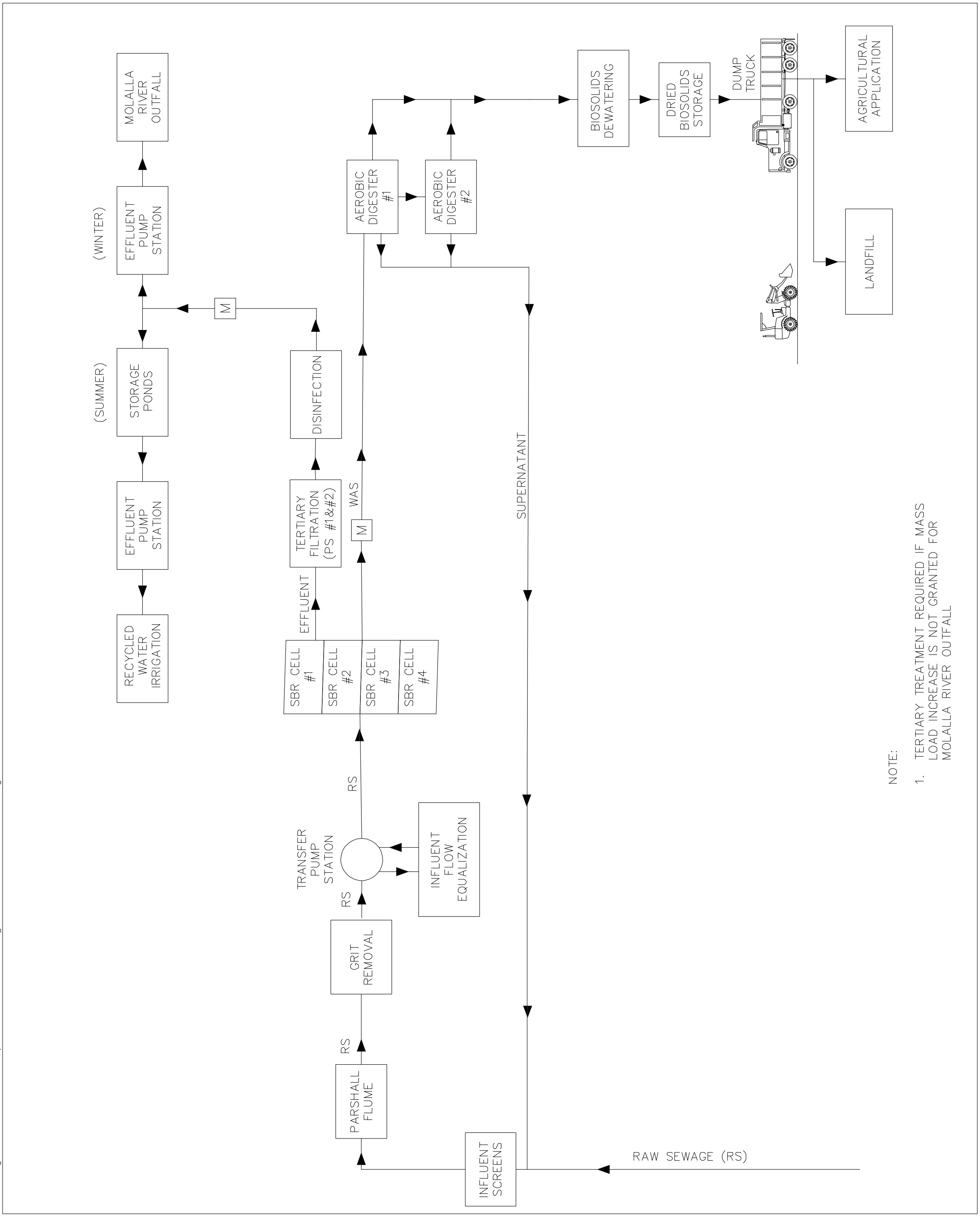
Since the SBR is a batch or semi-batch process, the effluent flow rate during a decant cycle is greater than the influent flows. The use of four cells provides adequate equalization allowing uniform downstream flows. The internal dimensions for each SBR basin is 113 feet long by 38 feet wide by 21.5 feet high for each of the four units. Compared with the other biological alternatives investigated, SBRs eliminate the need for RAS/WAS pumping facilities, separate clarifiers, and associated yard piping.

A summary of preliminary design data is listed in Table 4.3.5.

TABLE 4.3.5
SBR PRELIMINARY DESIGN DATA

Item	Specification
Operating Basins	4
Basin Dimensions (Internal – L x W x SWD), ft	113’ x 38’ x 18’
HRT, days	0.7
Blowers, quantity	3
Air Demand/Basin, scfm @ 8.1 psig	890
MLSS, mg/L	3,676
Normal Decant Rate, GPM	3,475
Peak Decant Rate, GPM	7,427
WAS Pump, quantity	4
WAS Pump, capacity (gpm)	110
WAS, lb/day	3,114
WAS, gal/day	43,900
Effluent BOD_5, mg/L	< 10 mg/L
Effluent TSS, mg/L	< 10 mg/L
Effluent NH_3-N, mg/L	< 2 mg/L

C:\Users\gellis.DYERPART\Desktop\Molalla\DWG\WWFC Fig 4.3.1, 4.3.3, 4.3.5, & 4.3.7.dwg



THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF MOLALLA*** ***WASTEWATER FACILITY & COLLECTION SYSTEM MASTER PLAN***	FIGURE NO. ***4.3.1***
DATE: OCTOBER 2018 PROJECT NO.: 100.26	***SBR OPTION PROCESS DIAGRAM***	

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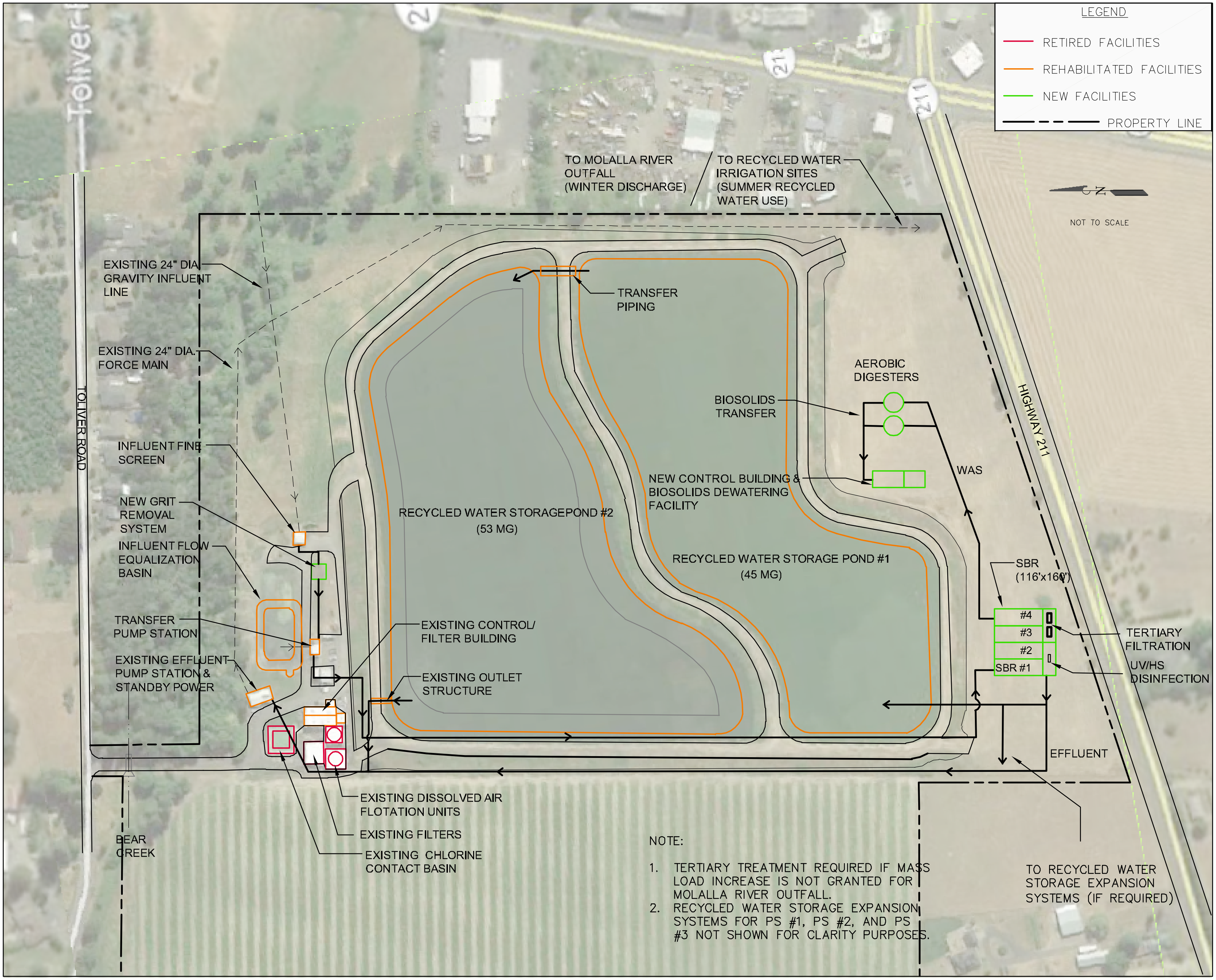


NOTE:

1. TERTIARY TREATMENT REQUIRED IF MASS LOAD INCREASE IS NOT GRANTED FOR MOLALLA RIVER OUTFALL.
2. RECYCLED WATER STORAGE EXPANSION SYSTEMS FOR PS #1, PS #2, AND PS #3 NOT SHOWN FOR CLARITY PURPOSES.

THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	CITY OF MOLALLA WASTEWATER FACILITY & COLLECTION SYSTEM MASTER PLAN	FIGURE NO.
DATE: OCTOBER 2018 PROJECT NO.: 100.26	SBR OPTION SITE PLAN	4.3.2

The cost estimate of a SBR is provided in Table 4.3.6. Detailed cost estimates are included in Appendix C. The total present worth estimate assumes a 20 year term and 3.2% interest.

TABLE 4.3.6
SBR COST ESTIMATE

Item	Cost Estimate
Construction	$6,707,000
Annual O&M	$159,440
Salvage Value	($50,000)
Total Present Worth	$8,986,000

Conventional Activated Sludge
A more conventional extended aeration activated sludge solution was also evaluated. This approach consists of suspended growth microbial reactors, followed by separate secondary clarifiers and solids recycle and wasting systems. The extended aeration activated sludge mode of operation offers relatively long Hydraulic Retention Time (HRT), typically 18 to 26 hours based on forward flow, and relatively high Mean Cell Residence Time (MCRT), typically between 15 to 25 days.

The specific extended aeration activated sludge system evaluated uses diffused aeration to supply oxygen and uses alternating aerated/unaerated conditions to achieve aerobic treatment (carbonaceous removal) and nutrient removal. The reactors are long and narrow; resulting in plug flow conditions. The system is designed to be mechanically and operationally simple while providing extensive operational flexibility. It requires no submerged moving parts. All motive energy (mixing and pumping) is provided with process air. The main mechanical items are blowers and compressors.

Influent to the plant first enters a selector tank where it is mixed with the Return Activated Sludge (RAS) from the secondary clarifier. One purpose of the selector tank is to limit growth of filamentous organisms. Excessive growth of filamentous organisms makes clarification difficult. Mixing RAS with raw wastewater is a proven method for controlling growth of filamentous organisms. Another purpose of the selector tank, when designed and operated to achieve anaerobic conditions, is to develop phosphorus accumulating organisms. Under anaerobic conditions, and if readily degradable BOD_5 is available, Polyphosphate Accumulating Organisms (PAOs) will release phosphorus by breaking high-energy phosphate bonds in molecules stored in their cells and use that energy to take BOD_5 into their cells. When an anaerobic selector tank is used the hydraulic residence time in the selector tank is not long enough for odorous compounds, like hydrogen sulfide, to form.

The mixed flow (mixed liquor) from the selector tank splits into two first stage aeration basins. The first stage aeration basins typically operate with alternating aeration; while one basin is being aerated the other in unaerated. Normally the aeration switches every two hours. The frequency of this change is Operator-adjustable.

Mixed liquor flows from the first stage aeration basin into the second stage aeration basins, to which it is hydraulically connected. These second stage aeration basins also operate with alternating aeration. As with the first stage aeration basins, aerobic reactions occur during the “air on” period and anoxic reactions occur during the “air off” period.

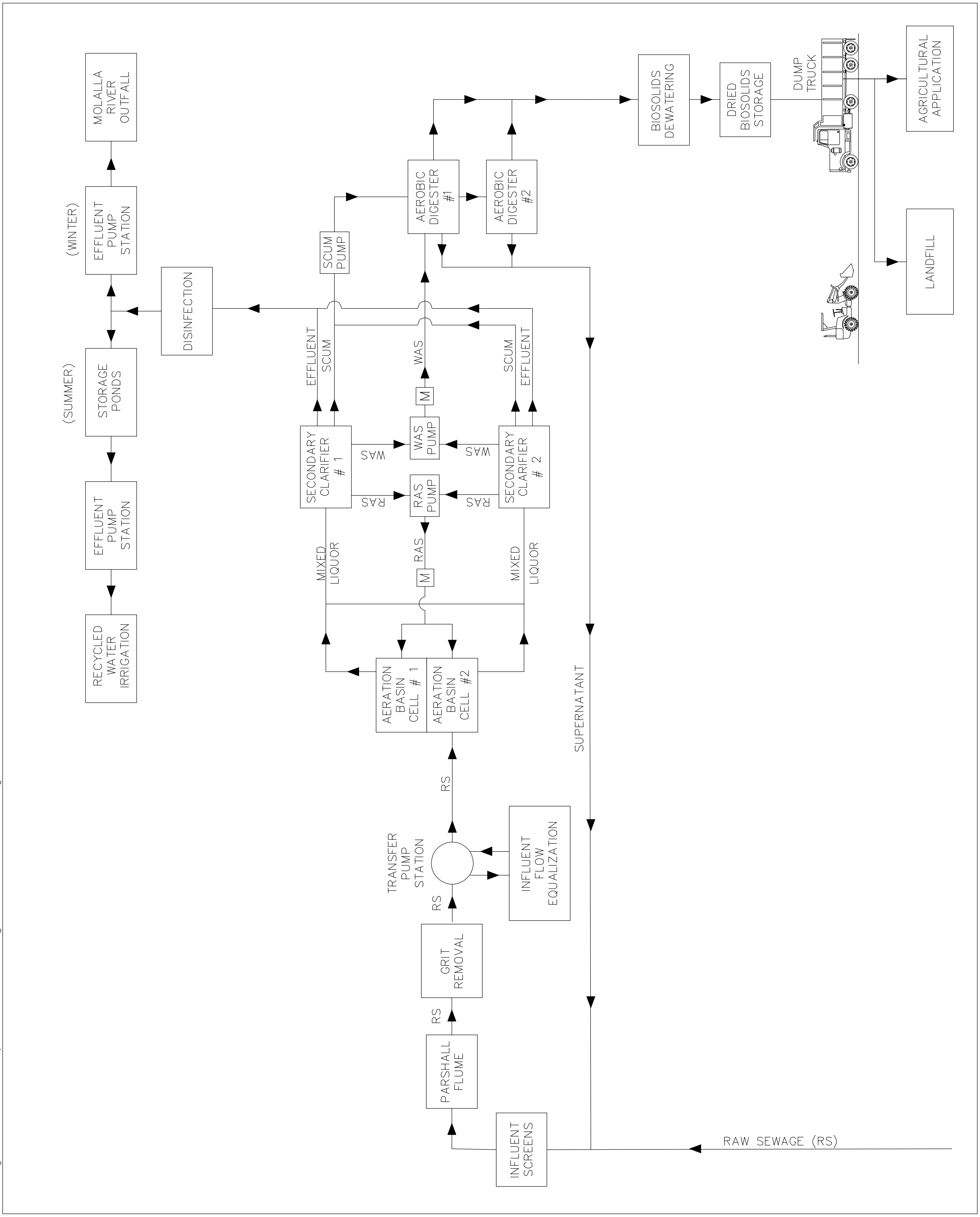
Mixed liquor from the second stage aeration basins is conveyed to two secondary clarifiers, installed in parallel. RAS is returned to the selector tank. Biological wastewater treatment produces sludge continuously and “excess sludge” must be removed. Waste activated suldge is removed from the process using airlift pumps.

Key advantages of conventional activated sludge systems include their widespread use – and thus familiarity – and flexibility. Conventional activated sludge systems are capable of producing BOD_5 and TSS of less than 10 mg/L, depending upon the specific process train and operational strategies. A disadvantage of these systems is the initial capital cost and operational costs associated with the redundant treatment components (two primary/secondary clarifiers, two aeration basins). Common wall construction is utilized to minimize the footprint and construction costs of this alternative.

A summary of preliminary design data is listed in Table 4.3.7.

TABLE 4.3.7
CONVENTIONAL ACTIVATED SLUDGE
PRELIMINARY DESIGN DATA

Item	Specification
Aeration Basin HRT, hours	17
Aeration Basin Volume, MG	2.26
MCRT, days	16
MLSS, mg/L	2,438
Blower, quantity	4
Blower, hp	125
Organic Loading, lb BOD_5/1000 cf/day	11
Solids Yield, lb TSS/lb BOD_5	0.86
WWTP Tank Dimensions, ft	319’ x 147’ x 14’
WAS Pump (Airlift), quantity	4
WAS, lb/day	2,871
WAS, gal/day	141,181
Clarifier Surface Volume, gal	517,018
Clarifier Surface Area, ft^2	5,760
Effluent BOD_5, mg/L	< 10 mg/L
Effluent TSS, mg/L	< 10 mg/L
Effluent NH_3-N, mg/L	< 5 mg/L



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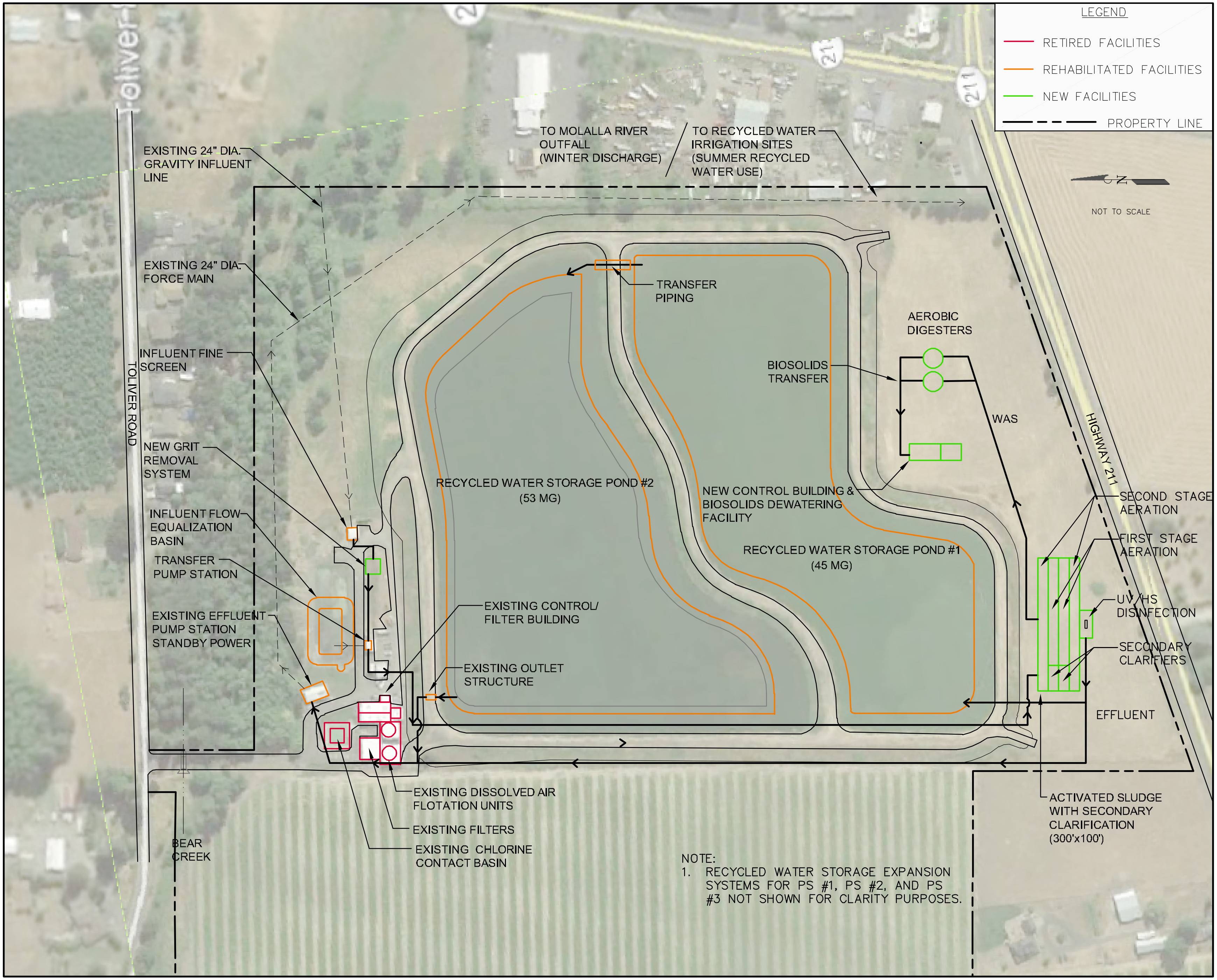
THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	CITY OF MOLALLA **WASTEWATER FACILITY & COLLECTION SYSTEM MASTER PLAN**	FIGURE NO.
DATE: OCTOBER 2018	**CONVENTIONAL ACTIVATED SLUDGE OPTION PROCESS DIAGRAM**	**4.3.3**
PROJECT NO.: 100.26		



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ENGINEERS & PLANNERS, INC.

DATE: OCTOBER 2018
PROJECT NO.: 100.26

CITY OF MOLALLA
WASTEWATER FACILITY & COLLECTION SYSTEM MASTER PLAN

CONVENTIONAL ACTIVATED SLUDGE SITE PLAN

FIGURE NO.
4.3.4

The cost estimate for the conventional activated sludge alternative is provided in Table 4.3.8. Due to the uniqueness of the conventional activated sludge system depicted in the previous figures, costs were also developed, and deemed similar, for a non-proprietary conventional activated sludge facility with separate secondary clarifiers. Detailed cost estimates are included in Appendix C. The total present worth estimate assumes a 20 year term and 3.2% interest.

TABLE 4.3.8
CONVENTIONAL ACTIVATED SLUDGE COST ESTIMATE

Item	Cost Estimate
Construction	$8,099,000
Annual O&M	$189,634
Salvage Value	($50,000)
Total Present Worth	$10,819,000

Membrane Bioreactor (MBR)

A Membrane Bioreactor (MBR) system employs a combination of activated sludge with physical filtration. Several types of membranes have been developed: Microfiltration (MF), Ultrafiltration (UF), Nanofiltration (NF), and Reverse Osmosis (RO). The membranes may be flat plate (plate and frame) or pleated membranes or hollow fiber membranes, depending upon the geometry of the membrane itself. The membrane can be pressure-driven as a side stream configuration or it may be vacuum-driven and immersed in the activated sludge aeration basin itself.

Membrane bioreactors provide a suspended microorganism biomass to convert biodegradable organic compounds and nutrients in wastewater to more biomass. Typically with a mixed liquor of around 11-12,000 mg/L. The biomass is separated from the wastewater using a membrane filter, rather than using a secondary clarifier for gravity settling.

Since the 1980s, MBR facilities have been installed throughout the world and the United States. For the past thirty years, manufacturers have refined and improved the product, largely to address electrical consumption and fouling deficiencies. Currently, as a result of technological advancements, MBRs are being selected for projects that would have traditionally used conventional activated-sludge processes.

Based upon City of Molalla's design parameters, an MBR facility would include a 2 mm influent fine screen to protect the membranes, anoxic zone, pre-aeration zone, four MBR tanks, and 72 submerged MBR units. A flat sheet membrane sheet, with an average pore size of 0.2 micron, is used as a basis for planning purposes. Influent fine screening greatly decreases maintenance and recovery cleaning requirements and help maintain target flux rates – which are significantly affected by biomass buildup and fouling. Adequate preliminary treatment is essential to improving overall treatment cost-effectiveness and to extending membrane life expectancy, by decreasing the membrane's failure rate and exposure time to chlorine and other cleaning chemicals. Preliminary MBR design data is summarized in Table 4.3.9.

TABLE 4.3.9
MBR PRELIMINARY DESIGN DATA

Item	Specification
Secondary Fine Screens	2 mm
Number of MBR Tanks	4
Total Number of Submerged MBR Units	72
Design MLSS, mg/L	11,000
MBR Tank Volume, gal	555,200
WAS Pump, quantity	4 duty
WAS Pump, capacity (gpm)	106
Permeate Pump, quantity	4 duty + 1 standby
Permeate Pump, capacity (gpm)	1,777
MBR Blower, quantity	4 duty + 1 standby
MBR Blower, capacity scfm @10.2 psig	1,774
Clean-In-Place System	1
Control Panel, HMI, SCADA	1
WAS, lb/day	2,340
WAS, gal/day	25,500
Effluent BOD_5, mg/L	< 4-5 mg/L
Effluent TSS, mg/L	< 4-5 mg/L
Effluent NH_3-N, mg/L	< 2 mg/L

By eliminating the need for the secondary clarification process, MBRs are in some respects easier to operate when compared to conventional activated sludge processes. Effluent quality is less sensitive to operations, and precise control of the sludge residence time, mixed liquor suspended solids/food to microorganisms ratio, is not as important. There is no concern of sludge bulking that could result in violation of discharge requirements.

The footprint of MBR facilities is often a fraction of other wastewater treatment technologies. By operating MBRs at a mixed liquor around 11-12,000 mg/L, and due to the elimination of the secondary clarifier, MBR systems often require a 50% smaller footprint when compared to activated sludge facilities. Operating the system at elevated mixed liquor concentrations also gives the system increased ability to withstand influent load fluctuations.

The MBR technology produces a very high quality effluent that lends itself well to meeting possible future stringent regulations. The MBR would also comply with the permit limits in the event that the mass load limits are not increased. Membrane bioreactors also introduce a much greater distance between reclamation and the risk of microbial disease. Pathogens are not just reduced by a highly selective chemical or photochemical reaction; they are rejected by size exclusion. The MBRs also improve disinfection processes by particle size reduction, again, when compared to other wastewater treatment processes.

One of the disadvantages of MBRs is their inability to cost effectively process peak flows. The required membrane area and bioreactor tank volume – relative to the membrane’s flux capacity – is directly proportional to the fluctuations between average sustained flows and peak flow events or diurnal flow events. It’s often not cost-effective to install enough membrane surface area to accommodate peak flows, especially when the peaking factor (peak flow divided by average flow) is high. Generally, if the peaking factor is greater than 1.5, it’s more economical to install a flow equalization tank instead of increasing the size of the bioreactor and the number of membrane modules (Park, Chang, and Lee 2015, 301). The City of Molalla's gravity collection system is plagued with high infiltration and inflow. The projected peak daily flow is over 4.5 times greater than the average dry weather flows. To improve the cost competitiveness, the MBR system for the City of Molalla assumes, like the other WWTP alternatives, that part of the existing aeration basin (i.e. aerated lagoon) will be repurposed to serve as an influent flow equalization basin.

In certain applications, electrical consumption of MBRs can be a disadvantage. In the absence of stringent discharge requirements, the operational costs (energy, chemical requirements, etc.) of MBRs, due to aeration (bioprocess and scouring) demands, can be considerably higher than other wastewater treatment alternatives. When discharge limits are stringent, MBRs are often more cost competitive when compared to other wastewater treatment technologies.

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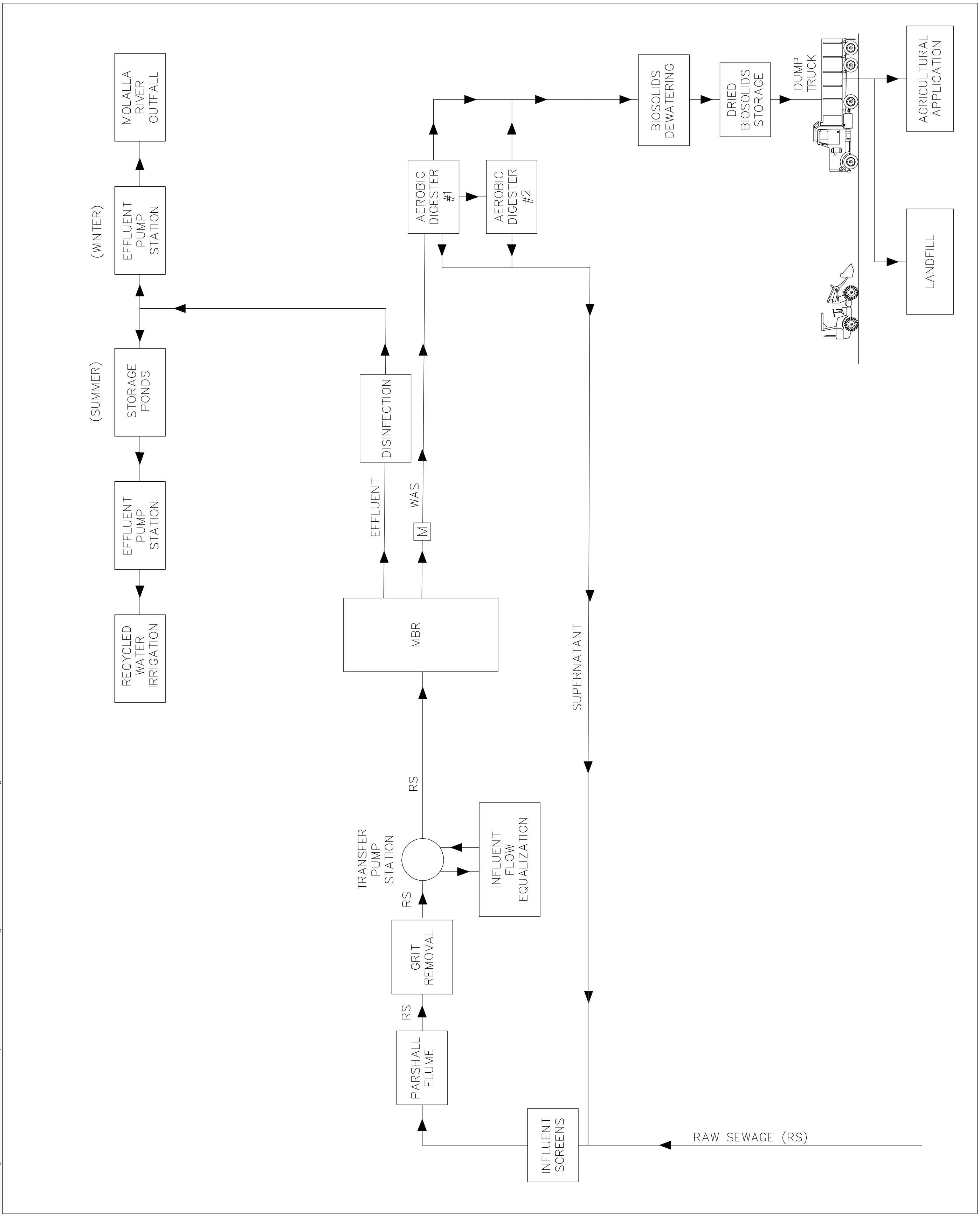

THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF MOLALLA*** ***WASTEWATER FACILITY & COLLECTION SYSTEM MASTER PLAN***	FIGURE NO.
DATE: OCTOBER 2018 PROJECT NO.: 100.26	***MBR OPTION PROCESS DIAGRAM***	***4.3.5***

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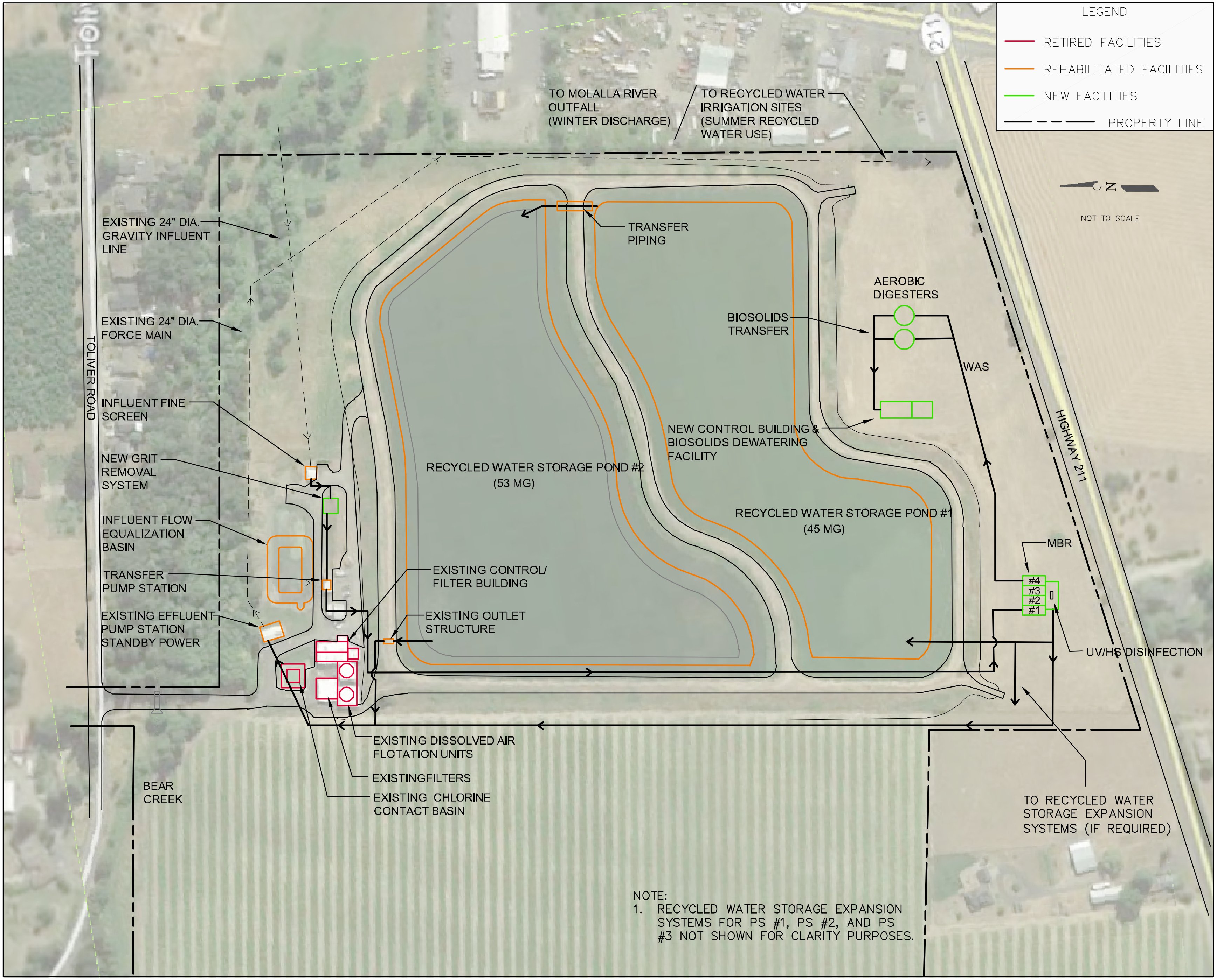


THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

DATE: OCTOBER 2018

PROJECT NO.: 100.26

CITY OF MOLALLA

WASTEWATER FACILITY & COLLECTION SYSTEM MASTER PLAN

MBR OPTION SITE PLAN

FIGURE NO.

4.3.6

The capital cost estimate and annual O&M estimate for an MBR facility is provided in Table 4.3.10. Detailed cost estimates are included in Appendix C. The annual O&M estimate includes electrical consumption costs, equipment repair and replacement requirements, chemical costs, and O&M labor estimates. The equipment repair and replacement cost estimate, projected over the 20 year life of the facility, assumes periodic replacement of the MBR blower intake filter, periodic replacement of drive shaft seal and belts, and replacement of the membrane modules (one event per twenty years). The total present worth estimate assumes a 20 year term and 3.2% interest.

TABLE 4.3.10
MBR COST ESTIMATE

Item	Cost Estimate
Construction	$12,610,000
Annual O&M	$328,330
Salvage Value	($50,000)
Total Present Worth	$17,356,000

Oxidation Ditch

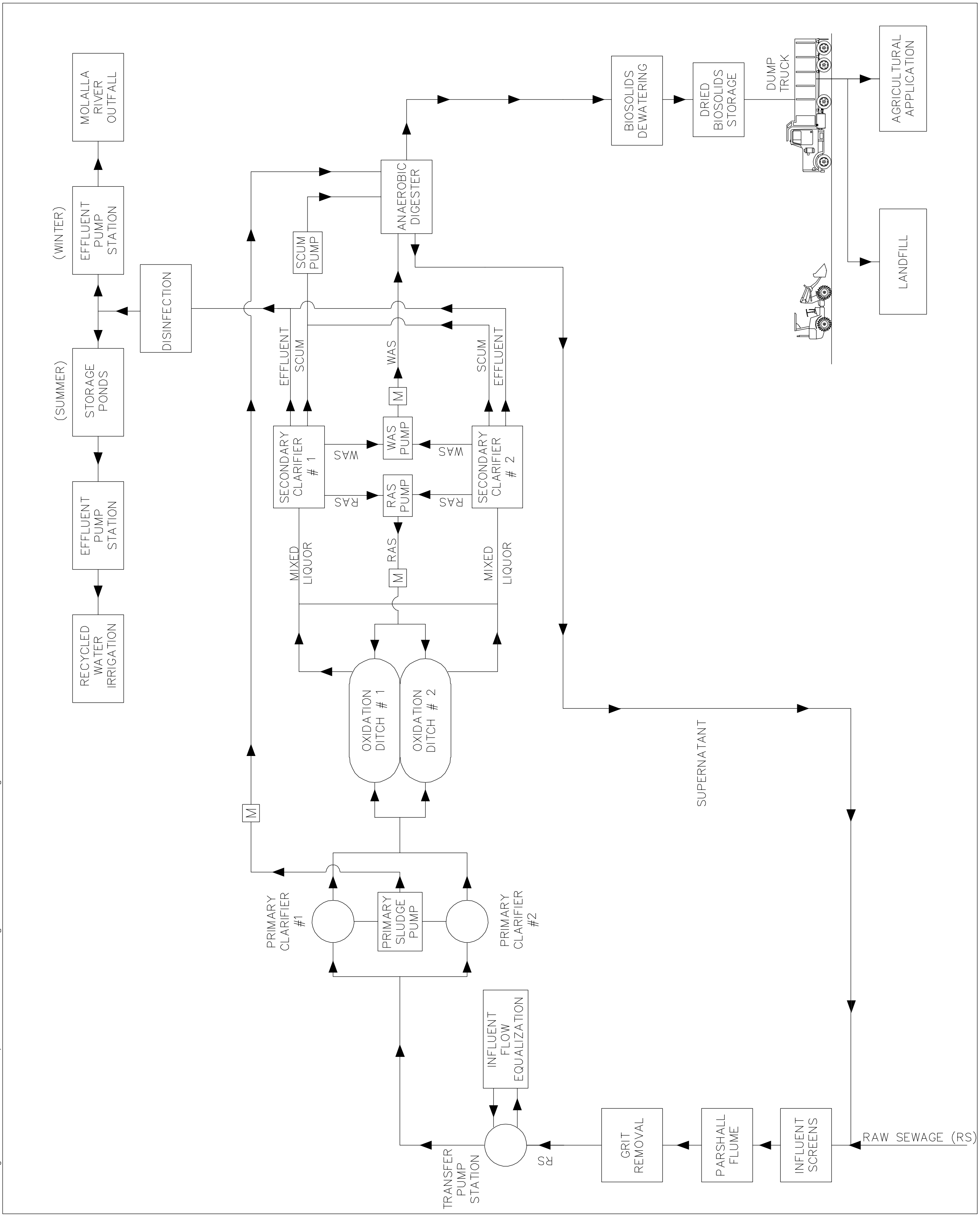
An oxidation ditch is a modified form of extended aeration. The process utilizes long solids retention times to remove biodegradable organics. A typical oxidation ditch treatment system consists of a single or multi-channel configuration with a ring, oval or horseshoe-shaped basin. Horizontally or vertically mounted aerators provide circulation, oxygen transfer and aeration in the ditch. With this option, a primary clarifier is installed upstream of the oxidation ditch. Primary clarified solids are conveyed to the downstream digester. Secondary clarifiers are used downstream of the oxidation ditch to remove solids. Return activated sludge from the secondary clarifiers is reintroduced to the oxidation ditch. Waste activated sludge is conveyed to the digester.

The tank design and aeration ensure that the mixed liquor travels at a velocity between 0.8 to 1.0 ft/s in the channel, to maintain solids suspension. The mixed liquor typically has a travel time of 5 to 15 minutes, and the channel flow dilutes the influent flow by a factor between 20 to 30%, approximately. The process kinetics approaches that of a complete mix reactor, but with plug flow channels. Denitrification is possible, depending on flows and wastewater chemistry, due to the depletion of DO as the wastewater travels down the ditch.

A summary of the preliminary design data is listed in Table 4.3.11.

TABLE 4.3.11
OXIDATION DITCH
PRELIMINARY DESIGN DATA

Item	Specification
Number of Primary Clarifiers	2
Primary Clarifier Diameter, feet	95
Primary Clarifier Side Water Depth, feet	13
Number of Oxidation Ditches	2
Oxidation Ditch Liquid Depth, feet	10.5
Oxidation Ditch Channel Width, feet	21
Oxidation Ditch Straight Length, feet	134
Aerators, quantity	4
Aerator, hp	30
Number of Secondary Clarifiers	2
Secondary Clarifier Diameter, feet	80
Secondary Clarifier Side Water Depth, feet	14
Effluent BOD_5, mg/L	< 10 mg/L
Effluent TSS, mg/L	< 10 mg/L
Effluent NH_3-N, mg/L	< 15 mg/L



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THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF MOLALLA*** ***WASTEWATER FACILITY & COLLECTION SYSTEM MASTER PLAN***	FIGURE NO.
DATE: OCTOBER 2018	***OXIDATION DITCH OPTION PROCESS DIAGRAM***	***4.3.7***
PROJECT NO.: 100.26		

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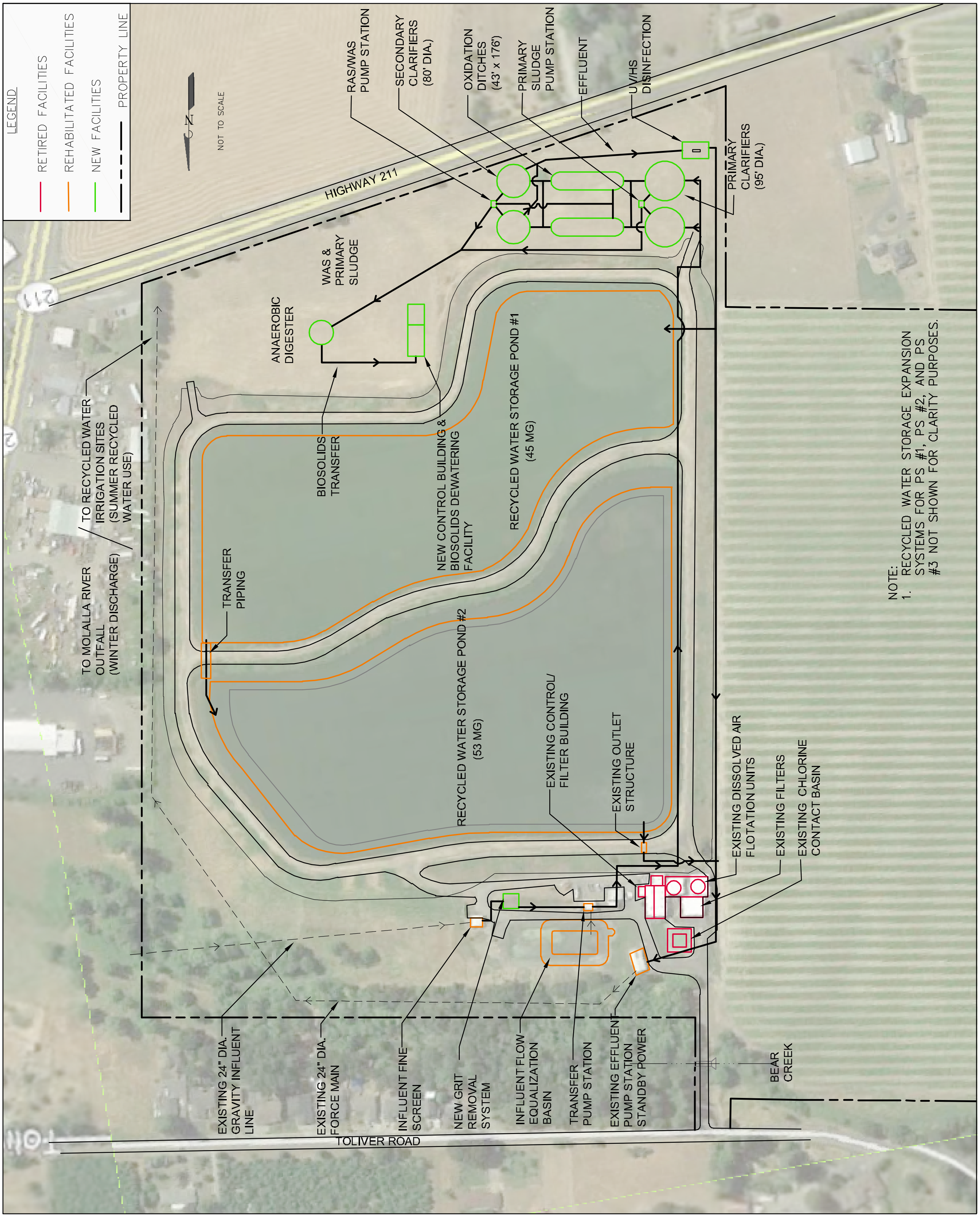


THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	CITY OF MOLALLA WASTEWATER FACILITY & COLLECTION SYSTEM MASTER PLAN	FIGURE NO.
DATE: OCTOBER 2018 PROJECT NO.: 100.26	OXIDATION DITCH OPTION SITE PLAN	4.3.8

The advantages of this system include its reliability and performance with respect to hydraulic surges and shock loads. This is due to the system's characteristic flow attenuation due to volume and complete mix characteristics. The system is also reasonably energy efficient with respect to conventional activated sludge processes. A major disadvantage is the large land area required compared to other wastewater treatment processes.

There are various types of aeration and drive equipment available for oxidation ditches. The two-cell design considered for purposes of comparison in this study is based on an impeller driven device. For maintenance purposes, all the inlet flow can be diverted to one of the cells during the lower flow season.

Each oxidation ditch cell would consist of an elongated concrete basin structure with a side water depth of approximately 10.5 feet. An approximate footprint of each basin is 178 feet long by 43 feet wide. Waste activated sludge is pumped and measured from each basin to solids management systems with small submersible pumps.

The capital cost estimate and annual O&M estimate for an oxidation ditch facility is provided in Table 4.3.12. Detailed cost estimates are included in Appendix C. The total present worth estimate assumes a 20 year term and 3.2% interest.

TABLE 4.3.12
OXIDATION DITCH COST ESTIMATE

Item	Cost Estimate
Construction	$11,655,600
Annual O&M	$164,961
Salvage Value	($50,000)
Total Present Worth	$14,014,600

Tertiary Treatment Alternatives

If a suitable mass load increase is not approved by DEQ (PS #1 or PS #2), the WWTP will need to comply with stringent BOD_5 and TSS concentration limits when discharging to the Molalla River during the winter months. The existing monthly average, weekly average, and daily maximum mass load limits are 160 lbs/day, 240 lbs/day, and 320 lbs/day, respectively.

In the absence of a mass load increase, the 2017 BOD_5/TSS concentration limits would be some of the most restrictive in Oregon, and the 2043 BOD_5/TSS concentration limits would be some of the most restrictive in the United States. The concentration limits are attainable, but with high capex and opex.

To achieve the stringent BOD_5/TSS concentration limits, activated sludge technologies require tertiary filtration. The MBR process, without unit process additions, will comply with BOD_5/TSS limits for future 2043 design conditions.

During the evaluation of tertiary filtration systems, performance data was obtained and reviewed to determine the efficacy of tertiary filtration systems in achieving the mass load limits based on future flow conditions. Appropriately designed and operated, tertiary treatment system manufacturers can guarantee less than 4 to 5 mg/L TSS, with effluent performance data usually less than 2 to 3 mg/L TSS. Future TSS concentration limits, resulting from the existing mass load restrictions, are less than 4.5 mg/L TSS, and are therefore theoretically attainable with a relatively high confidence level. However, the BOD_5/TSS concentration limits, without a mass load increase, are increasingly challenging and encroach on the performance capabilities of biological and tertiary treatment technologies. As an insurance policy, the existing effluent/recycled water storage lagoons could provide temporary storage in the event that the effluent quality exceeds permit requirements, with the aid of real-time process instrumentation.

This section evaluates tertiary treatment alternatives for PS #1 and PS #2 conditions. Multiple options are available for tertiary filtration. The principal unit process options that are available for the removal of residual matter include:

1. Depth filtration (Upflow Sand Filter)
2. Surface filtration (Disk Filter)
3. Refurbish existing DAF units and gravel filters
4. Membrane filtration

Depth filtration consists of passing the liquid through a filter bed comprised of a granular or compressible filter medium. Surface filtration is the removal of particulate material suspended in a liquid by mechanical filtration through a sieve. Membrane filtration is accomplished by passing the liquid through a porous material to exclude particles ranging in size from 0.005 to 2 µm.

The performance of tertiary filtration systems is a function of the type of treatment technology that precedes tertiary filtration, mode of operation, biological floc strength, influent wastewater characteristics, hydraulic loading rate, and other factors. Tertiary filtration systems summarized herein are sized in accordance with state and federal reliability requirements. Tertiary filtration systems following SBRs are sized based upon the anticipated decant rate. Table 4.3.13 lists the design parameter assumptions for all tertiary filtration alternatives.

TABLE 4.3.13
TERTIARY FILTRATION DESIGN PARAMETERS

Parameter	Value
Peak Daily Flowrate, MGD	8.9
Maximum Influent TSS, mg/L	≤ 20
Daily Average Influent TSS, mg/L	≤ 10
Maximum Effluent TSS, mg/L	≤ 10
Monthly Average Effluent TSS[1], mg/L	≤ 4 to 5

1. Process guarantee shall be included from manufacturer.

Depth Filtration (Upflow Sand Filter)

With depth filtration, wastewater to be filtered is introduced into the bottom of the filter where it is distributed uniformly into a sand bed. The wastewater then flows upward through the moving sand. Clean filtrate exits from the sand bed, overflows a weir, and exits the filter. The sand particles, with trapped solids, are drawn downward into the inlet of an airlift device. A small volume of compressed air conveys the sand, solids, and water upwards. With the assistance of turbulent flow, impurities are scoured from the sand particles. At the top of the airlift, the dirty water spills over into the reject compartment. The sand has a higher settling velocity and is not carried out of the filter. The sand is reintroduced to the top of the filter bed, allowing for continuous operation of filtrate and reject water.

Depth filtration following activated sludge process typically produce effluent in the range of 2 to 5 mg/L TSS and turbidity 0.5 to 4 NTU. For the condition that the mass load limits will remain as-is, an effluent TSS of less than 4 to 5 mg/L was targeted.

Depth filtration has been around for decades and is a proven technology. The main operational problems associated with depth filtration are:

1. Mudball formation
2. Buildup of emulsified grease
3. Development of cracks and contraction of the filter bed
4. Loss of filter media
5. Gravel mounding

Mudballs are an agglomeration of biological floc, dirt, and filter medium. They grow in mass, and often sink to the bottom of the filter bed. As they grow and accumulate more mass, they diminish filtration effectiveness. Loss of filter media can occur over time. Material is lost during backwashing. Gravel mounds can develop when the various layers of gravel are disrupted during excessive backwash flow rates.

The cost estimate for an upflow sand filter alternative is provided in Table 4.3.14. Detailed cost estimates are included in Appendix C.

TABLE 4.3.14
UPFLOW SAND FILTER COST ESTIMATE

Item	Cost Estimate
Construction Cost Estimate	$2,861,000
Annual O&M Estimate	$34,931

<u>Surface Filtration (Disk Filter)</u>
Surface filtration involves the removal of particulate matter suspended in a liquid by passing the liquid through a filter material. Surface filter mediums typically have openings in the size range from 5 to 30 µm.

In surface filtration systems, the influent flows by gravity into the filter discs from the center drum. Solids are separated from the water by the filter media mounted on the two sides of the discs, which are partially submerged. With this arrangement, the solids are retained within the filter discs while only the clean water flows to the outside of the discs and into the collection tank. This allows for the effective removal of large solids and floatable material.

Maintenance is reduced since there is no accumulation of solids in the tank. During normal operation, the discs remain static until the water level in the inlet channels rises to a specific point, which then automatically initiates the backwash cycle. The filtered effluent provides a perfect source of backwash water, eliminating the need for a separate source of cleaning water or an additional clean water collection tank. Clean effluent is pumped to the backwash spray header and nozzles, washing solids into the collection trough as the discs rotate.

Surface filters will typically produce a filtrate with TSS less than 4 to 5 mg/L and turbidity less than 2 NTU. Surface filters, in comparison to depth filtration in filtering secondary effluent (Riess et al., 2001 and Olivier et al., 2003), perform as well or better than depth filtration in removing turbidity and the number and size of particles. Surface filtration systems were developed in the 1990s, and have a proven track record of performance. When compared to depth filtration, they provide a more compact footprint, low backwash requirements, and reduced operation and maintenance requirements.

The cost estimates for a disk filter alternative is provided in Table 4.3.15. Detailed cost estimates are included in Appendix C.

TABLE 4.3.15
DISK FILTER COST ESTIMATE

Item	Cost Estimate
Construction Cost Estimate	$2,387,000
Annual O&M Estimate	$17,056

Rehabilitate Existing DAF Units and Gravity Sand Filters
With the objective of using as much of the existing equipment as possible in pursuit of system affordability, an evaluation of the ability to use the existing DAF units and sand filters was performed.

First, the age of the existing systems was analyzed. One DAF was installed in 1980, and the other was installed in 2007. The average life-expectancy of the DAF units is less than 20 years. Hence, DAF #1 needs replaced. After ten years of continuous operation, DAF #2 is due for major upgrades.

In the event of the abandonment of the facultative lagoon process, considering the need for recycled water storage, and with the introduction of a new mechanical WWTP, the existing tertiary treatment processes are undersized for existing flows. Therefore, with a new mechanical WWTP, an expansion of the existing systems, DAF and gravity sand filters, would be required to process existing flows.

The DAF units were originally designed for a total hydraulic capacity of 4 MGD. Mainly due to the solids loading (i.e. algae) from the facultative lagoons, the actual capacity of the units is historically considerably less than 4 MGD. Nevertheless, to process future peak daily flows, DAF #1 requires a complete overhaul or replacement, and additional DAF units are required to expand the capacity to future peak daily flow projections.

The gravity sand filters were all installed in 2007, but also are only rated for a total flow of 4 MGD. To process future flows, additional units are required, and the existing filters must be rehabilitated or replaced. The ability of the DAF and gravity sand filters to achieve less than 4 to 5 mg/L TSS is also questionable.

In addition, the DAF and gravity sand filters do not include treatment systems for waste sludge. Waste sludge is currently conveyed to the aerated lagoon, and eventually accumulates in the inlet end of Lagoon #1.

The DAF units and gravity sand filters are operationally problematic. The units are undersized and would require major rehabilitation and additional units to process existing and future flows. The DAF units require daily oversight, and have a higher cost of ownership when compared to depth or surface filtration systems. The DAF and gravity systems do not include waste treatment systems. The DAF units are principally used for treating lagoon effluents containing algae and for low density particles that are difficult to remove by gravity settling. The applicability of DAF for post activated sludge residual solids removal is overkill and will result in unnecessarily high life-cycle costs.

Membrane Filtration
Membrane filtration involves the passage of wastewater, usually after biological treatment, through a thin membrane with the objective of removing particulate matter, pathogens, organic matter, and dissolved

substances. Membrane filtration processes include Microfiltration (MF), Ultrafiltration (UF), Nanofiltration (NF), Reverse Osmosis (RO), dialysis, and Electrodialysis (ED). Microfiltration (0.08 to 2.0 µm) and UF (0.005 to 0.2 µm) are usually used for filtration of secondary effluent in place of depth or surface filtration. Different types of membranes are available, including: hollow fiber, tubular, and flat sheets. The MF and UF systems have both been used extensively for the filtration of effluent from conventional activated sludge facilities.

Membrane filtration, in comparison to depth or surface filtration, remove large organic molecules, large colloidal particles, and many microorganisms. Membrane filtration systems have smaller footprint requirements, reduced labor requirements, and can reduce the amount of treatment chemicals needed. Disadvantages of membrane filtration, when compared to depth or surface filtration, includes: higher capex, higher energy consumption, requires periodic replacement of membranes, and flux rate can decline over time. Effluent quality from membrane filtration systems is a function of influent wastewater characteristics, but is typically less than 5 mg/L TSS and turbidity is less than 1 NTU. Due to the capital and operational costs of membrane filtration, and the peak flows in the City of Molalla, it is not considered a viable tertiary treatment alternative.

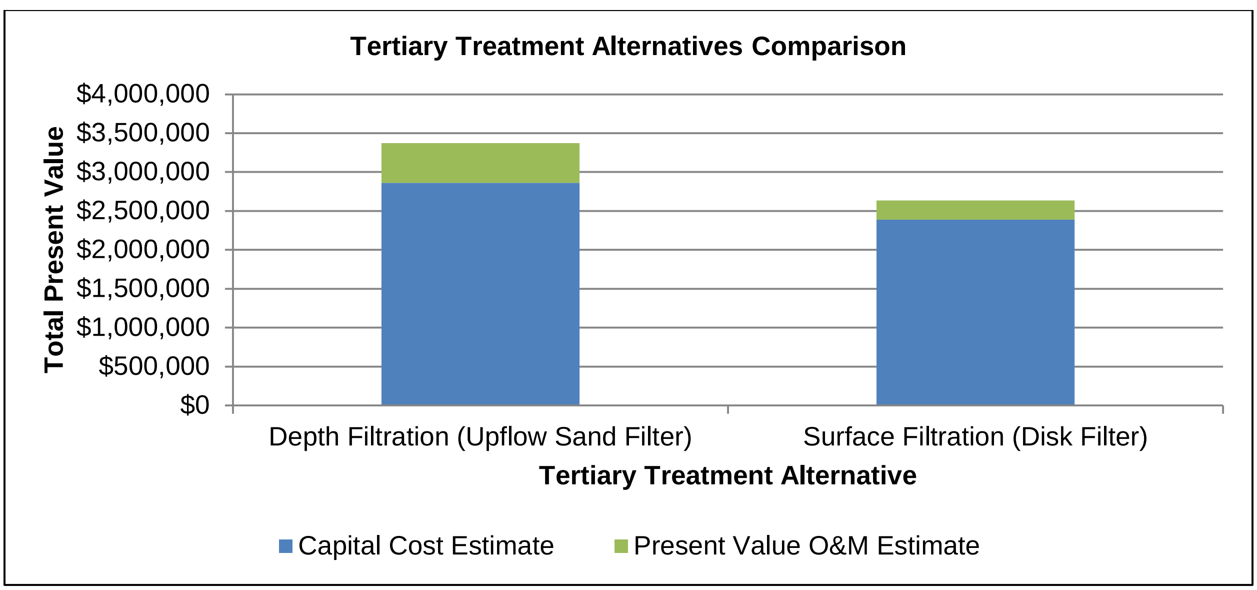
Present Worth Analysis

Present worth cost comparisons for the tertiary treatment options are presented in Table 4.3.16 and Figure 4.3.9. Present worth costs are based on 3.2 % interest, and a 20 year term.

TABLE 4.3.16
PRESENT WORTH COSTS FOR TERTIARY TREATMENT ALTERNATIVES

System	Capital Cost Estimate	Annual O&M	Present Value O&M Estimate	Total Present Worth
Depth Filtration (Upflow Sand Filter)	$2,861,000	$34,931	$510,000	$3,371,000
Surface Filtration (Disk Filter)	$2,387,000	$17,056	$249,000	$2,636,000

FIGURE 4.3.9
PRESENT WORTH COSTS FOR TERTIARY TREATMENT ALTERNATIVES



Matrix Evaluation

A subjective matrix rating system was employed to compare the tertiary treatment alternatives. This rating system consists of a three-point scale; three being the best and one the worst. The ratings are subjective evaluations. Two or more alternatives may have the same rating for a particular parameter. The ratings for the matrix evaluation are summarized in Table 4.3.17.

The parameters that were considered are described as follows:

- **Flexibility.** The ability to adapt to highly variable flow conditions is an important parameter when evaluating tertiary treatment systems. The surface filtration (disk filter) option provides more flexibility due to the small footprint and expandability features.

- **Capacity.** The proposed depth filtration and surface filtration options were sized based on influent flows and loads, and therefore have the same rated capacity.

- **Reliability.** Operational requirements of the depth filtration option are more demanding than the disk filter option, thereby negatively impacting process variability and effluent quality stability.

- **Operability.** The depth filtration system requires more operational oversight and has higher power consumption.

- **Ability to Construct.** The depth filtration option requires more equipment and a larger footprint.

- **Environmental Factors.** The depth filtration option and the surface filtration option are designed to produce equivalent effluent quality, in compliance with NPDES Permit limits with a reasonably high confidence level. The depth filtration option involves greater power consumption.

- **Community Impact.** No significant differences in community impact are readily apparent.

TABLE 4.3.17
MATRIX EVALUATION OF TERTIARY TREATMENT ALTERNATIVES

Parameter	Depth Filtration	Surface Filtration
Flexibility	2	3
Capacity	3	3
Reliability	2	3
Operability	2	3
Ability to Construct	1	3
Environmental Factors	3	3
Community Impact	3	3
Total	**16**	**21**

Tertiary Treatment System Recommendation

Reusing the existing DAF units and gravity sand filters introduces unknowns, additional risk, and considerable expense. The existing units would require major repairs and upgrades. To process future flows, additional DAF units and gravity sand filters are required. Anticipated life-cycle costs are estimated to be considerably greater than the other alternatives. Rehabilitation of the existing DAF and gravity sand filters is not recommended. Based on the capital cost estimate and annual O&M estimates for disk filtration and upflow sand filters, the anticipated life-cycle costs for the disk filtration option is the preferred alternative. The disk filtration option offers a more compact system and lower O&M requirements and costs. In the event that DEQ does not endorse a mass load increase (PS #1 and PS #2) commensurate with future flows, the disk filtration option is recommended.

Biological and Tertiary Treatment System Present Worth Analysis

Many factors are involved in the selection of a suitable wastewater treatment process, including both economic and non-economic considerations. Upfront and long term costs are usually the primary factors in determining the most appropriate solution, with the understanding that all options under consideration will perform in compliance with permit requirements for the planning period. Economic evaluations should consider not only the initial capital cost of the facility, but the present value of the projected O&M costs as well.

Present worth costs and comparisons for biological and tertiary treatment systems were analyzed for the various permit scenarios (PS #1, PS #2, PS #3, and PS #4). Biological and tertiary treatment system requirements are a function of whether or not a mass load increase is approved by DEQ. Therefore, two analyses were conducted; one for PS #1 and PS #2, and another for PS #3 and PS #4.

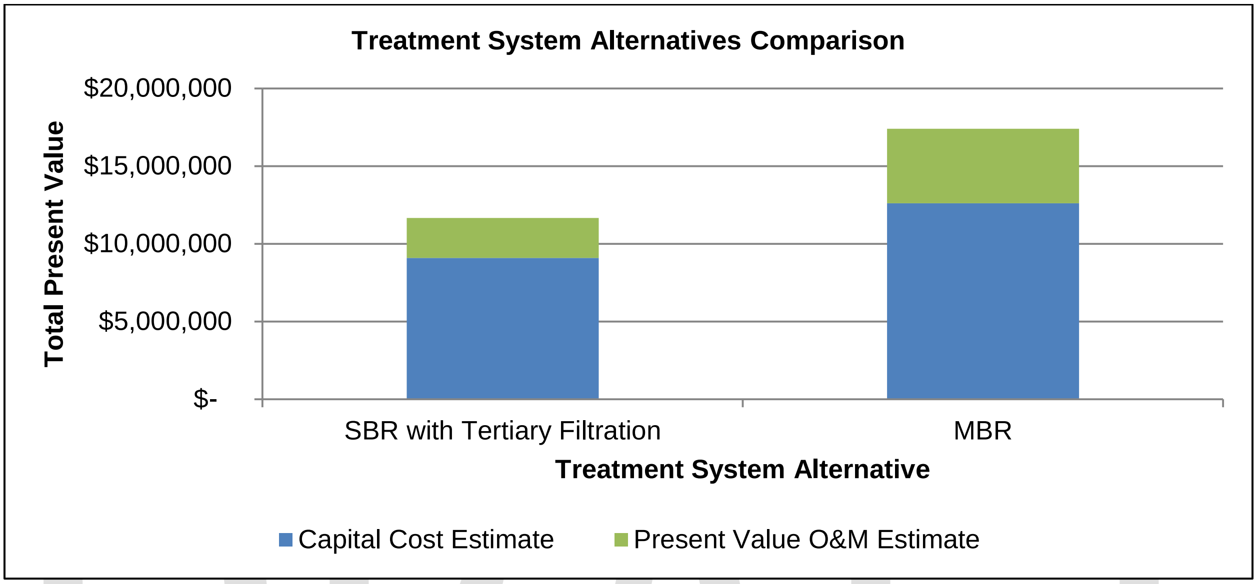
<u>Present Worth Analysis for PS # 1 and PS #2</u>
Due to the outcome of the present worth analysis for PS #3 and PS #4, only a SBR with tertiary filtration and an MBR were evaluated for PS #1 and PS #2 conditions. The PS #1 and PS #2 analysis assumes that a mass load increase is not granted. Without a mass load increase, the resulting concentration limits prompt the need for tertiary filtration for the SBR option. Life-cycle cost comparisons for liquid stream treatment alternatives are summarized and presented in Table 4.3.18 and Figure 4.3.10. Present worth calculations are based on a 20 year term and 3.2% interest rate.

TABLE 4.3.18
PRESENT WORTH COSTS
BIOLOGICAL & TERTIARY TREATMENT ALTERNATIVES
PS #1 AND PS #2

System	Capital Cost Estimate	Present Value O&M Estimate[1]	Salvage Value	Total Present Worth
SBR w/Tertiary Filter	$9,094,000	$2,578,000	($50,000)	$11,622,000
MBR	$12,610,000	$4,796,000	($50,000)	$17,356,000

1. Includes reserve fund for short lived assets.

FIGURE 4.3.10
PRESENT WORTH COSTS
BIOLOGICAL & TERTIARY TREATMENT ALTERNATIVES
PS #1 AND PS #2



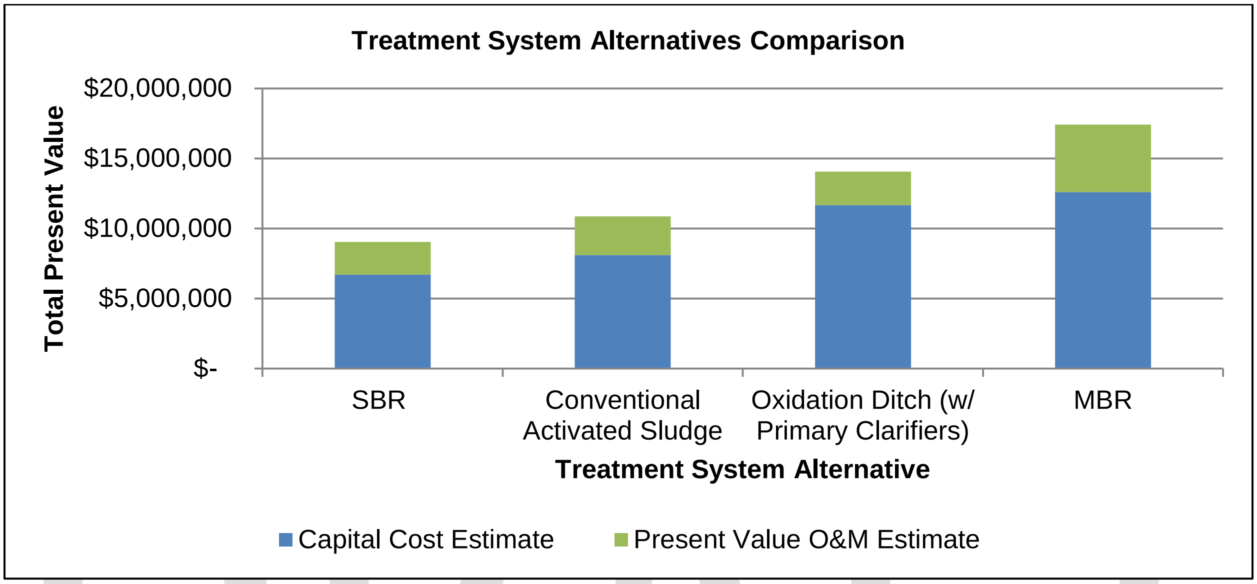
<u>Present Worth Analysis for PS # 3 and PS #4</u>
With PS #3 and PS #4, no tertiary filtration is required to achieve concentration and mass load limits. Life-cycle cost comparisons for liquid stream treatment alternatives are summarized and presented in Table 4.3.19 and Figure 4.3.11. Present worth calculations are based on a 20 year term and 3.2% interest rate.

TABLE 4.3.19
PRESENT WORTH COSTS
BIOLOGICAL TREATMENT ALTERNATIVES
PS #3 AND PS #4

System	Capital Cost Estimate	Present Value O&M Estimate[1]	Salvage Value	Total Present Worth
SBR	$6,707,000	$2,329,000	$(50,000)	$8,986,000
Conventional Activated Sludge	$8,099,000	$2,770,000	$(50,000)	$10,819,000
Oxidation Ditch	$11,655,600	$2,409,000	$(50,000)	$14,014,600
MBR	$12,610,000	$4,796,000	$(50,000)	$17,356,000

1. Includes reserve fund for short lived assets.

FIGURE 4.3.11
PRESENT WORTH COSTS
BIOLOGICAL TREATMENT ALTERNATIVES
PS #3 AND PS #4



Matrix Evaluation

For the matrix evaluation, a rating system was employed to compare the alternatives. This rating system consists of a three-point scale; three being the best and one the worst. Two or more alternatives may have the same rating for a particular parameter. The ratings are subjective. The ratings for the matrix evaluation are summarized in Table 4.3.20. Table 4.3.21 lists additional comparison considerations.

- **Flexibility.** Flexibility is an important characteristic of liquid stream alternatives, since large variations in flow may be encountered during the wet weather season. A SBR system eliminates the need for a return activated sludge system, since it is not needed in the process. The SBR system provides treatment and settling within a single tank, which is a distinct flexibility advantage over other considered alternatives. The hallmark of SBR design is its inherent flexibility of cyclic phasing. The cycle format can be easily modified at any time to offset changes in process conditions, influent characteristics or effluent objectives. The MBR and SBR with tertiary filtration options offer very high quality effluent (less than 4-5 mg/L BOD_5/TSS).

- **Reliability.** The oxidation ditch, conventional activated sludge, and the SBR are considered the most reliable, requiring less moving parts and simpler infrastructure. However, all processes were evaluated in accordance with complying with discharge permit requirements.

- **Operability.** Each alternative uses equipment and processes that are familiar to the plant Operators. The oxidation ditch is considered to be the simplest to operate, but operational requirements of the SBR are similar to the oxidation ditch. The current WWTP staff has the required skill level for either operation.

- **Ability to Construct.** The oxidation ditch requires the largest amount of usable land and a larger footprint. The SBR is considered the simplest to construct. The MBR process is the most complicated system to install.

- **Environmental Factors.** Each alternative poses equal potential for environmental impacts.

- **Community Impact.** There is no real difference between these options.

- **Expandability.** The SBR is the most expandable alternative, as common walls may be utilized for expansion.

TABLE 4.3.20
MATRIX EVALUATION OF LIQUID STREAM TREATMENT ALTERNATIVES

Parameter	SBR	SBR with Tertiary Filtration	Conventional Activated Sludge	Oxidation Ditch	MBR
Flexibility	3	3	2	2	3
Reliability	3	3	3	3	2
Operability	2	2	3	3	2
Ability to Construct	3	3	2	2	1
Environmental Factors	2	2	2	2	2
Community Impact	3	3	3	3	3
Expandability	3	3	1	1	2
Total	**19**	**19**	**16**	**16**	**15**

TABLE 4.3.21
COMPARISON OF LIQUID STREAM TREATMENT ALTERNATIVES

Parameter	SBR	SBR with Tertiary Filtration	Conventional Activated Sludge	Oxidation Ditch	MBR
Effluent Quality	Good	Very Good	Average	Average	Very Good
Process Stability	Very Good	Very Good	Average	Average	Very Good
Pretreatment Requirement	Influent Screening	Influent Screening	Influent Screening	Influent Screening	< 2 mm Fine Screen
Secondary Clarification	Aeration Basin Acts as Clarifier	Aeration Basin Acts as Clarifier	Separate Clarifier Needed	Separate Clarifier Needed	Clarifier Replaced by Membrane Filtration
Operational Complexity	Relatively Simple	Relatively Simple	Relatively Simple	Relatively Simple	Skilled Operations
Reliability	Very Good	Very Good	Average	Average	Very Good
Capital Cost	Low	Moderately Low	Average	High	Very High
Operational Cost	Low	Moderately Low	Average	High	Very High
Space Requirement	Low	Moderately Low	High	Very High	Low

Biological and Tertiary Treatment System Recommendation

Biological and tertiary treatment system recommendations are provided for if a mass load increase is DEQ approved, or if the existing mass load limits will remain in the NPDES Permit.

Biological Treatment System Recommendation for PS #1 and PS #2
The results above indicate that the SBR with tertiary filtration is recommended based on both economic and non-economic considerations. A performance guarantee, with a reasonable confidence level, will be included with the SBR and tertiary filtration option, to guarantee compliance with the existing mass load limits when discharging to the Molalla River.

Biological and Tertiary Treatment System Recommendation for PS #3 and PS #4
The results above indicate that the SBR is recommended based on both economic and non-economic considerations. A SBR facility will reliably produce high quality effluent (less than 10/10 mg/L BOD_5/TSS), is a proven technology, and offers the lowest life-cycle cost.

Disinfection Improvements

When discharging to the Molalla River outfall, the monthly *E. coli* geometric mean may not exceed 126 organisms per 100 mL; and no single sample may exceed 406 organisms per 100 mL. The new WWTPs disinfection systems will disinfect the effluent to Class A and B standards. This gives the City flexibility to amend the Recycled Water Use Plan, if desired in the future, to increase the land available for land application of recycled water, with respect to disinfection requirements only. Class A and B recycled water must not have Total Coliform exceed; a median of 2.2 Total Coliform organisms per 100 mL, based on results of the last seven days that analyses have been completed, or 23 Total Coliform organisms per 100 mL in any two consecutive samples. Disinfection system recommendations are identical regardless of permit conditions.

Four alternatives were evaluated for disinfection of effluent/recycled water:

1. No-Action
2. Chlorine disinfection with dechlorination.
3. Year-round Ultraviolet (UV) disinfection.
4. Summertime chlorine disinfection and wintertime UV disinfection.

In accordance with DEQ reliability requirements, the disinfection systems summarized in this section are sized for peak hourly flow, peak daily flow, and average dry weather flow. Two units are required for redundancy, and operation in series is recommended.

TABLE 4.3.22
DISINFECTION SYSTEMS DESIGN PARAMETERS[1]

Parameter	Value
Peak Hourly Flowrate, MGD	12.48
Peak Daily Flowrate, MGD	8.91
Average Dry Weather Flow, MGD	1.9

1. Flow equalization will occur upstream of disinfection systems, and limit the peak flow to 8.91 MGD. Disinfection systems following SBR are sized for peak decant rate.

For UV systems, sizing is based on a minimum UV dose of 30 mJ/cm^2 at peak hour flow with all units operational, or at max dry weather flow with the largest unit offline, whichever results in the larger design. UV transmittance and intensity meters are required, per DEQ guidelines.

For chlorine based disinfection systems, minimum chlorine contact times, based on DEQ guidelines, are 15 minutes at Peak Instantaneous Flow (PIF) and 20 minutes at Peak Daily Average Flow (PDAF) and 60 minutes at the Average Dry Weather Flow (ADWF), whichever results in the greater treatment capacity. For chlorine contact basins, a minimum length to width ratio of 40:1 is required.

Alternatives

<u>No-Action</u>
With this alternative the effluent will continue to be disinfected via the existing tablet chlorination system and chlorine contact time will occur in the chlorine contact basin and effluent/recycled water force main. The chlorine contact basin is 67,500 gallons, and has a length to width ratio of 1:1. There is no baffling in

the basin to prevent short circuiting, nor is there complete redundancy in accordance with DEQ regulations. Short circuiting will continue to occur in the chlorine contact basin.

The existing tablet chlorination system is able provide adequate disinfection in accordance with discharge requirements, but only because flow equalization occurs in the facultative/storage lagoons, and additional contact time is provided in the effluent/recycled water force main. Without the aid of flow equalization upstream of the disinfection process, the existing tablet chlorination system is undersized for existing and future flows.

Tablet chlorination uses a harmful chemical with stringent safety requirements, risk management, and hazardous training and reaction protocol. The disinfection system also has unreasonably high operational costs and oversight requirements. Calcium hypochlorite also loses its strength when stored, and because it must be dissolved before being used, introduces difficulties for large installations. Calcium hypochlorite is generally limited to small installations, where handling is relatively easy for Operators.

Hypochlorite Disinfection System
This alternative consists of the injection of a Hypochlorite Solution (HS) into the effluent at an appropriate dosage. Hypochlorite solution is either purchased in bulk and stored onsite in tanks, or is manufactured by On-Site Generation (OSG) as an oxidant solution. It is acquired as a liquid in the form of sodium hypochlorite (NaOCl), which is bleach. It may be obtained in bulk delivery. In this form it is available in concentrations of 12.5% and 15%. Sodium hypochlorite decomposes during storage. The rate of decomposition is impacted by concentration, temperature, pH, light, and the presence of metallic contaminants in the solution. In general, 12.5% sodium hypochlorite should be stored for no more than 30 to 60 days. The solution strength will decrease by 20% over 30 days at 80 degrees Fahrenheit (F).

Sodium hypochlorite may also be generated onsite from the electrolysis of salt, (NaCl). In this form it is available in concentrations of approximately 0.7% to 0.9%. The process of onsite generation uses salt, water, and power to create a chlorine-based disinfectant (or oxidant), thereby eliminating the transport and storage of hazardous chemicals. The salt feedstock is fully converted, resulting in negligible addition of sodium to the treated water and no negative impact to irrigated landscapes. A disadvantage of onsite generation systems is that they are more complex and have high power consumption.

A hypochlorite solution or OSG oxidant solution is typically injected directly into the effluent stream as it enters a new chlorine contact basin. Sodium hypochlorite reacts with water to form hypochlorous acid and sodium hydroxide. Once chlorine is injected into the flow stream and mixed, the effluent is conveyed into a chlorine contact basin. This is a tank designed to provide adequate detention time (contact time) to assure thorough reaction of chlorine to pathogens. The chlorine contact basin design is of critical importance to maximize the detention time through the basin, and minimize short-circuiting. Baffling within the basins helps minimize short circuiting and aids in mixing.

Typically when a WWTP uses bulk sodium hypochlorite, dechlorination with bulk sodium bisulfite ($NaHSO_3$) or sulfur dioxide is required. Sodium hypochlorite is typically delivered by tanker truck and stored in bulk tanks as a concentrated aqueous solution. Common delivery concentration is 38% sodium bisulfite. This concentrated solution is either diluted in mixing tanks and then fed to the system with metering pumps or fed directly with metering pumps. Since sodium bisulfite is a liquid solution, it is considered safer than sulfur dioxide, and the storage and feed systems are relatively simple.

The chlorine contact basin, a serpentine plug flow structure, would be divided into two halves, for redundancy, so that one half could be used while the other is out of service for maintenance. The tank would also include flexibility to operate both halves in series. Sufficient chlorine contact volume would provide 15 minutes at Peak Instantaneous Flow (PIF) and 20 minutes at Peak Daily Average Flow (PDAF) and 60 minutes at the Average Dry Weather Flow (ADWF).

During the summer months, when recycled water is land applied, recycled water will be stored in the existing lagoons (and expansion lagoons for PS #1, PS #2, and PS #3), and serve as open storage ponds. Only highly secondary treated and disinfected effluent will be conveyed to the storage pond(s), thereby inhibiting offensive growth. With that said, chlorine residual can have a positive impact on storage pond water quality. Table 4.3.23 lists the advantages and disadvantages associated with sodium hypochlorite disinfection.

TABLE 4.3.23
ADVANTAGES AND DISADVANTAGES

Advantages	Disadvantages
Improved Operator safety when compared to gaseous chlorine systems.	Disadvantages of bulk purchasing of HS are cost and storage. For affordability, large volumes should be purchased.
Proven technology. Reliable and flexible.	OSG require soft water for generation of the disinfectant solution. Soft water, however, causes electrochemical cells to develop scales over time, impeding the ability of the cells to generate chlorine, which could eventually destroy the electrodes.
OSG systems produce a non-hazardous oxidant solution due to the lower chlorine concentration.	HS strength degrades over time.
OSG systems typically produce a disinfection solution at a much lower long-term cost than the purchase of HS.	Good ventilation is required.
Chlorine residual is effective in reducing biofilm deposits on pipe walls and improves recycled water quality.	Organic compounds, depending on their chemical structure, that comprise BOD_5 and COD can exert a chlorine demand.
	Chlorine reacts with organic constituents in wastewater to produce byproducts some of which are known to be carcinogenic.

Table 4.3.24 and 4.3.25 summarize the cost estimate for constructing a hypochlorite disinfection system, both with and without onsite generation. Detailed cost estimates are included in Appendix C. The total present worth estimate assumes a 20 year term and 3.2% interest.

TABLE 4.3.24
HYPOCHLORITE DISINFECTION COST ESTIMATE

Item	Cost Estimate
Construction	$1,729,000
Annual O&M	$45,274
Total Present Worth	$2,390,000

TABLE 4.3.25
HYPOCHLORITE DISINFECTION WITH OSG COST ESTIMATE

Item	Cost Estimate
Construction	$2,169,000
Annual O&M	$33,577
Total Present Worth	$2,659,000

UV Disinfection System

Ultraviolet disinfection (UV) is a process by which ultraviolet energy is introduced into water or wastewater for the destruction of microorganisms. An ultraviolet system would consist of a concrete or stainless steel channel, ultraviolet lighting banks and weirs or weighted control gates to ensure that the lighting banks are always submerged.

The effectiveness of this process is dependent upon the penetration of the UV rays into water. Wastewater characteristics such as transmittance, suspended solids concentration, and presence of constituents that can absorb UV light decrease the intensity of light within the reactor and hence adversely affect performance.

The amount of UV light energy applied to water flowing through a UV reactor is called the dose rate, and is expressed in units of $\mu W \cdot s/cm^2$, $mW \cdot s/cm^2$, or mJ/cm^2. UV dose varies throughout a UV reactor as a function of equipment design, equipment maintenance, water quality, and reactor hydraulics. For summertime compliance with the Total Coliform discharge limits, a UV disinfection dose of 100 mJ/cm^2 is required. For wintertime compliance, a UV disinfection dose of 30 mJ/cm^2 is required. Table 4.3.26 lists preliminary design data for a UV system.

TABLE 4.3.26
UV DISINFECTION SYSTEMS PRELIMINARY DESIGN DATA

Item	Value
Number of Reactors	1
Type	Low Pressure
Number of Banks/Reactor	6
Number of Lamps	96
UV Transmittance, % UVT	65
UV Disinfection Dose (summer), mJ/cm^2	100

The key advantages of UV disinfection are that no residual is left in the treated effluent that could affect aquatic life in the receiving waters, and there are no hazardous materials for Operators to handle. The retention time required to achieve disinfection ranges from a few seconds compared to several (greater than 30) minutes for chlorine disinfection. This eliminates the need for large chlorine contact chambers, thereby reducing the required footprint and cost of installation. A disadvantage is that the performance of UV disinfection can be affected by characteristics of the wastewater stream such as color, suspended and colloidal solids, and chemical compounds (e.g. iron). Another disadvantage in association with pond storage of UV-treated effluent is the lack of chlorine residual.

The main components of a UV disinfection system include mercury arc lamps, a reactor, and ballast. The source of UV radiation is either from low-pressure or medium-pressure mercury arc lamps. The optimum wavelength to effectively inactivate microorganisms is in the range of 250 to 270 nanometers (nm). Low-pressure lamps, which are mostly used at small facilities, emit essentially monochromatic light at a wavelength of 253.7 nm. Medium-pressure lamps are generally used for large facilities and have approximately 15 to 20 times the germicidal UV intensity of low-pressure lamps. However, the medium-pressure lamps are more costly and operate at higher temperatures with higher energy consumption.

Other differences between low-pressure and medium-pressure lamp systems include methods of installation and cleaning. Low-pressure lamp systems are installed in concrete or fabricated steel open channels. Medium-pressure systems can either be installed in open channels or closed vessels (horizontal or vertical). Automatic lamp cleaning is possible with medium lamp systems, which reduces the labor costs as compared to manual cleaning for low-pressure systems. The advantages and disadvantages of year-round UV are summarized in Table 4.3.27.

TABLE 4.3.27
ADVANTAGES AND DISADVANTAGES

Advantages	Disadvantages
UV does not create any disinfection byproducts and can disinfect chlorine-resistant microorganisms like Cryptosporidium and Giardia.	No chlorine residual that could discourage algae growth in recycled water storage ponds.
Lowest life-cycle cost for wintertime disinfection. Capital and operational costs are higher for summertime Total Coliform dose.	Performance of UV disinfection is negatively influenced by color, suspended and colloidal solids, and chemical compounds present in the effluent.
Disinfection not affected by temperature or pH.	Electrical Consumption

Table 4.3.28 summarizes the capital and O&M cost estimate for a UV disinfection system, assuming year-round design and operation. Detailed cost estimates are included in Appendix C. The total present worth estimate assumes a 20 year term and 3.2% interest.

TABLE 4.3.28
UV DISINFECTION COST ESTIMATE

Item	Cost Estimate
Construction	$1,622,000
Annual O&M	$48,362
Total Present Worth	$2,328,000

<u>Combined HS and UV Disinfection System</u>
The fourth alternative is the application of UV disinfection in the wintertime when discharging to the Molalla River, and either a HS or OSG during the summertime, when recycled water is land applied. During the summertime, the HS or OSG disinfection solution would be injected directly into the recycled water storage pond(s), thus eliminating the need for the chlorine contact chambers.

By relying on UV disinfection in the winter months, this solution also allows a considerable reduction in the UV disinfection dose, and corresponding capex and opex, because the UV system would only operate during the winter months and therefore would only have to comply with the less restrictive *E. coli* limits. The disinfection dose for wintertime *E. coli* compliance is 30 mJ/cm^2, and facilitates a considerable reduction in the size and power consumption costs of the UV system. The advantages and disadvantages of a combined HS and UV disinfection system are summarized in Table 4.3.29.

TABLE 4.3.29
ADVANTAGES AND DISADVANTAGES

Advantages	Disadvantages
Capitalize on benefits of chlorine disinfection for summertime recycle water, and UV disinfection for wintertime surface water discharge.	Operation and maintenance costs of two disinfection systems.
Mitigate some algae growth in storage pond.	
Smaller UV disinfection system, when sized for *E. coli* limits associated with wintertime discharge to the Molalla River.	
No chemical residual when discharging to the Molalla River.	

Table 4.3.30 summarizes the capital and O&M cost estimate for a combination HS and UV disinfection system. Detailed cost estimates are included in Appendix C. Present worth costs are based on 3.2 % interest, and a 20 year term.

TABLE 4.3.30
COMBINED HS AND UV DISINFECTION COST ESTIMATE

Item	Cost Estimate
Construction	$1,460,500
Annual O&M	$41,364
Total Present Worth	$2,064,500

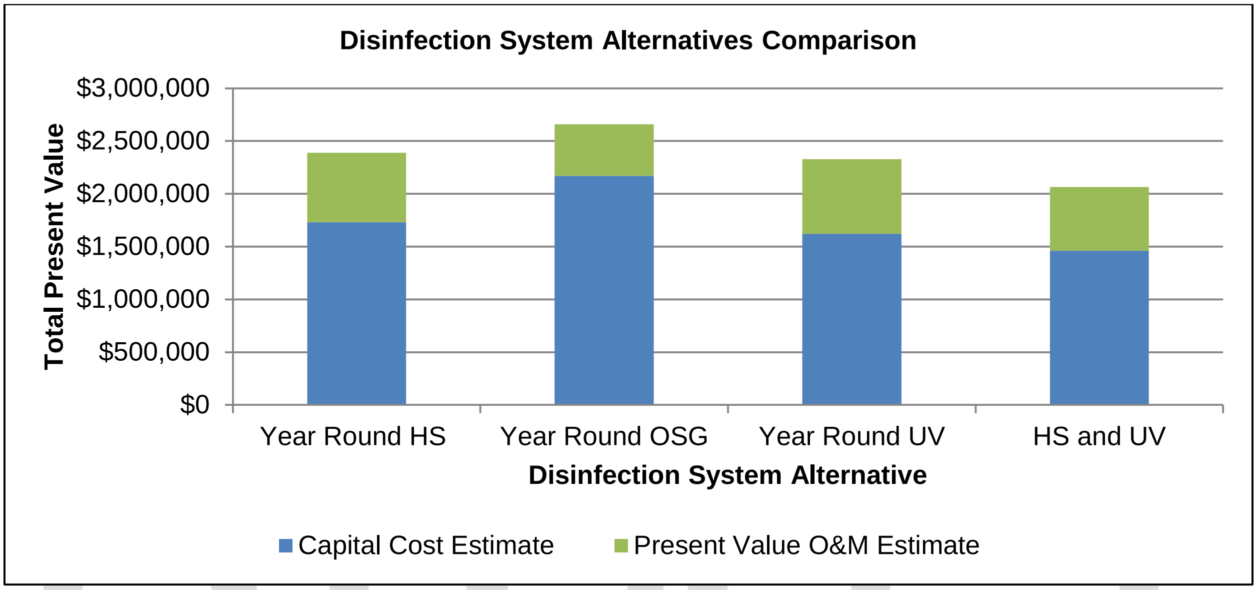
Present Worth Analysis

Present worth cost comparisons for the disinfection options are presented in Table 4.3.31 and Figure 4.3.12. Present worth costs are based on 3.2 % interest, and a 20 year term.

TABLE 4.3.31
PRESENT WORTH COSTS FOR DISINFECTION ALTERNATIVES

System	Capital Cost Estimate	Annual O&M	Present Value O&M Estimate	Total Present Worth
Year Round HS	$1,729,000	$45,274	$661,000	$2,390,000
Year Round OSG	$2,169,000	$33,577	$490,000	$2,659,000
Year Round UV	$1,622,000	$48,362	$706,000	$2,328,000
HS and UV	$1,460,500	$41,364	$604,000	$2,064,500

FIGURE 4.3.12
PRESENT WORTH COSTS FOR DISINFECTION ALTERNATIVES



Matrix Evaluation

A subjective matrix rating system was employed to compare the alternatives. This rating system consists of a three-point scale; three being the best and one the worst. These ratings are subjective evaluations. Two or more alternatives may have the same rating for a particular parameter. The ratings for the matrix evaluation are summarized in Table 4.3.32.

The parameters that were considered are described as follows:

- **Flexibility.** Flexibility is an important characteristic of disinfection alternatives, since large variations in flow may be encountered during the wet weather season and effluent storage is required during the summertime. Hypochlorite solution (or OSG) disinfection is effective and easily adjusted for varying conditions. The UV disinfection systems can also vary the dose based on flows and water chemistry. The combination UV/HS option offers considerable flexibility by offering a low cost UV option for wintertime flows, and chlorine disinfection for summertime Total Coliform limits.

- **Capacity.** Hypochlorite disinfection may be easily adjusted for varying flow rates. The UV systems can also adjust the dosage based upon real-time demands.

- **Reliability.** UV disinfection is reliable, but effectiveness of UV systems is dependent upon the effluent turbidity and flow rate. Chlorine disinfection is proven and reliable, but can be influenced by chemical structure of BOD_5 and Chemical Oxygen Demand (COD).

- **Operability.** A UV system requires more operational oversight and cleaning, but the chemical costs associated with hypochlorite systems are comparatively high. Hypochlorite solution disinfection requires more testing. The UV dose for summertime achieving Total Coliform compliance is high, resulting in high capital and operational costs.

- **Ability to Construct.** Wintertime hypochlorite (or OSG) disinfection requires the construction of a dual channel chlorine contact chamber. A chlorine contact chamber has baffling, interior concrete channel walls, requires twice the size due to redundancy and is therefore more difficult to construct. The UV and OSG systems are more sophisticated, also requiring more effort during construction. A UV system is compact and the easiest to construct.

- **Environmental Factors.** Hypochlorite disinfection systems are increasingly scrutinized regarding their impact on the environment, including byproducts produced and potential residuals in receiving streams. However, hypochlorite based systems with chlorine residual help control algae growth and vectors in the storage ponds. The UV systems do not require chemical handling and effluent is considered more environmentally friendly to receiving streams.

- **Community Impact.** The UV systems have fewer impacts to the community, as discussed in environmental factors section (above).

TABLE 4.3.32
MATRIX EVALUATION OF DISINFECTION ALTERNATIVES

Parameter	HS or OSG Disinfection	UV Disinfection	OSG/UV Disinfection	HS/UV Disinfection
Flexibility	3	3	3	3
Capacity	3	3	3	3
Reliability	3	3	2	3
Operability	2	2	2	3
Ability to Construct	2	3	2	2
Environmental Factors	2	3	3	3
Community Impact	2	2	3	3
Total	**17**	**19**	**18**	**20**

Disinfection System Recommendation

Year-round HS or OSG disinfection is not considered a viable option due to estimated capital and O&M costs, as well as the land area required for redundant chlorine contact basins. Life-cycle costs for year-round UV disinfection and a combination HS/UV solution are somewhat similar. The HS/UV option provides the added benefit of having a positive impact on water quality of the storage pond(s). The recommended alternative is the combination HS/UV option. The UV disinfection during the wintertime and chlorine disinfection during the summertime offer a low cost option for wintertime *E. coli* compliance with UV and summertime Total Coliform compliance (Class A or B recycled water standards) with chlorine.

Effluent Pump Station Expansion

The effluent pump station houses two vertical turbine pumps with a total capacity between 500 and 7,000 gpm. The pumps were installed in 2000 and are approaching the end of their design life. The effluent pump station is also designed with provisions to add a third pump in the future. The effluent pump station is rated for a peak capacity of 10.1 MGD. By using the existing aerated lagoon as an influent flow equalization basin, the effluent pump station is adequately sized based on existing and projected 2043 flows. The two existing pumps will be replaced and a third pump will be added for redundancy purposes. The estimated construction cost for installing two new pumps and adding an additional pump is $697,000.

Standby Power

With the new WWTP, a new standby generator is required to provide power sufficient to provide full treatment during a power outage. The new generator would be sized and the electrical system would be designed such that the new SBR, tertiary system (PS #1 and #2), and disinfection systems would be powered by the new generator. The new generator will be designed so that all wastewater treatment processes required to meet effluent limitations are powered. The existing 750 kW generator is approaching the end of its useful life, and will therefore be replaced and provide power to the effluent pump station, influent screen, and new grit removal system.

Preliminarily, a 500 kW generator is required for the new facilities. The assumptions for cost estimating presume that the new generator is pad-mounted in a self-contained and sound-attenuated enclosure. The capacity of the standby generator is based on requirements from similarly sized projects. A more detailed evaluation of the generator sizing should be conducted during predesign. The estimated constructed cost for installing a new 500 kW generator is $250,000. The estimated construction cost to install a new 750 kW generator is $350,000.

WWTP Site Facilities

A new Controls Building will be required to house the blowers and controls for the new WWTP, including biosolids management controls and systems. The existing laboratory will also be remodeled and undergo improvements. Table 4.3.33 summarizes WWTP site facilities cost estimate.

TABLE 4.3.33
WWTP SITE FACILITIES COST ESTIMATE

Item	Cost Estimate
Construction	$1,170,000

Recycled Water Storage

Adequate storage and equalization is critical to accomplish summertime irrigation objectives and avoid discharging to the Molalla River in accordance with permit requirements. The liquid storage and equalization volume available within the existing lagoons is severely limited, partly because the facultative lagoons currently serve the dual purpose of operating as facultative lagoons and storage basins.

The future volume required for recycled water storage is highly dependent on the pending permit modification applications. Independent of any permit modifications, upon commissioning of the new WWTP, the existing facultative lagoons will serve as recycled water storage. A total of 98 MG of storage will become available.

During the summer months, the storage ponds (i.e. existing facultative/storage lagoons) will receive disinfected effluent from the WWTP. Recycled water will be stored in the ponds, before eventually being conveyed to the effluent pump station, as needed, based on land application plans for each recycled water site.

The upgrades to the existing facultative lagoons will require lining with a new hypalon liner, and dike stabilization to address dike erosion that compromises the integrity of the ponds. Table 4.3.34 summarizes the construction cost estimate for recycled water storage improvements related to the existing Lagoons #1 and #2. The accumulated solids within the lagoons will be removed prior to converting the ponds to recycled water storage. Cost estimates for dredging and disposing of lagoon solids are estimated in Section 4.4.

TABLE 4.3.34
RECYCLED WATER STORAGE POND IMPROVEMENTS (LAGOON #1 & #2)
COST ESTIMATE

Item	Cost Estimate
Lagoon #1 and #2 Dike Stabilization & Improvements	$3,348,857

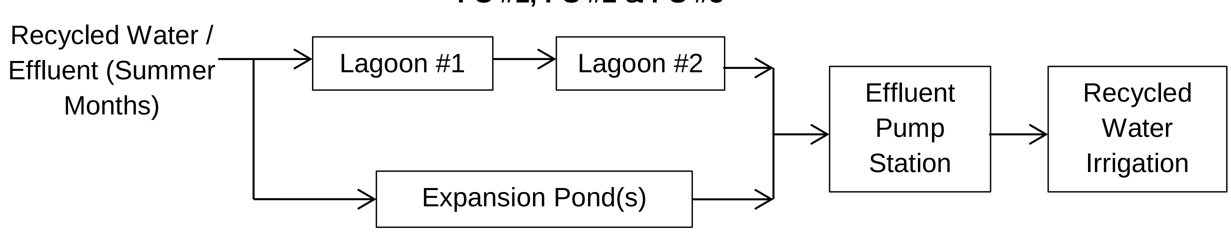
A water balance for the recycled water storage system requirements was prepared for each permit scenario, based on the following criteria:

- Future dry weather flows.
- Precipitation data derived from the City of Molalla's National Oceanic and Atmospheric Administration (NOAA) station.
- Evaporation data based on historical means for Corvallis in the Climatology Handbook (1969).

For PS #4, the existing Lagoons #1 and #2 provide adequate storage capacity to satisfy a water balance. However, if the permit is not modified, in whole or part, additional recycled water storage is required. For PS #1, PS #2, and PS #3, recycled water storage systems will be expanded by constructing ponds, sized to satisfy a water balance for each permit scenario. The new storage ponds will be located immediately west of the existing Lagoons #1 and #2, at 12329 S Hwy 211. The tax lot is 55 acres, and provides the acreage necessary for PS #1, PS #2, or PS #3. For planning purposes, the entire 55 acres would be purchased for PS #1, PS #2, or PS #3. The topography permits gravity flow from the proposed new WWTP to the recycled water expansion ponds, and gravity flow to the existing effluent pump station. A preliminary hydraulic profile is included in subsequent sections for planning level purposes.

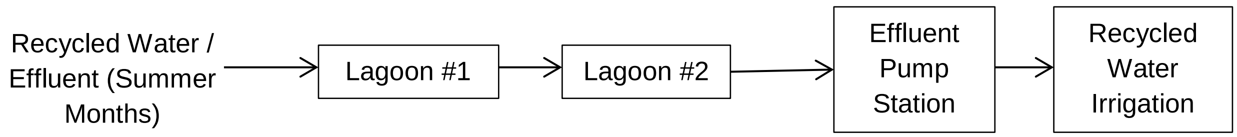
A preliminary process schematic depicting recycled water storage expansion systems for PS #1 to PS #3 is provided in Figure 4.3.13. A preliminary process schematic illustrating recycled water systems for PS #4 is provided in Figure 43.14. Subsequent sections outline specific recycled water storage improvements for each permit scenario.

FIGURE 4.3.13
RECYCLED WATER STORAGE EXPANSION PROCESS SCHEMATIC
PS #1, PS #2 & PS #3[1]



1. For some permit scenarios, some recycled water/effluent will be stored in the existing lagoons (i.e. recycled water storage ponds) and eventually discharged to the Molalla River during the winter months.

FIGURE 4.3.14
RECYCLED WATER STORAGE PROCESS SCHEMATIC
PS #4[1]



1. Some recycled water/effluent will be stored in the existing lagoons (i.e. recycled water storage ponds) and eventually discharged to the Molalla River during the winter months.

Recycled Water Storage PS #1

Permit Scenario #1 is the most restrictive condition and requires a significant expansion to recycled water storage and irrigation systems. With this scenario (PS #1), a large expansion to the recycled water storage systems is required. Recycled water storage systems must be sized to store the majority of flows during May and October, due to unfavorable conditions for the application of recycled water. Design assumptions assume that the storage systems will allocate satisfactory volume for maximum month dry weather flows, typically occurring in May. Additionally, because it would amplify stress onto the Molalla River outfall and mass load limits, this condition prohibits the ability to store excess flows that accumulate in recycled water storage systems (during the summary months) for eventual discharge into the Molalla River during the winter months.

A total of 35 additional acres (approximate total pond surface area), allocated for the purpose of recycled water storage, is necessary to accommodate water balance requirements during the planning period. Table 4.3.35 lists recycled water storage requirements for PS #1. A cost estimate is provided in Table 4.3.36. A water balance summarizing this condition (PS #1) is provided in Appendix D.

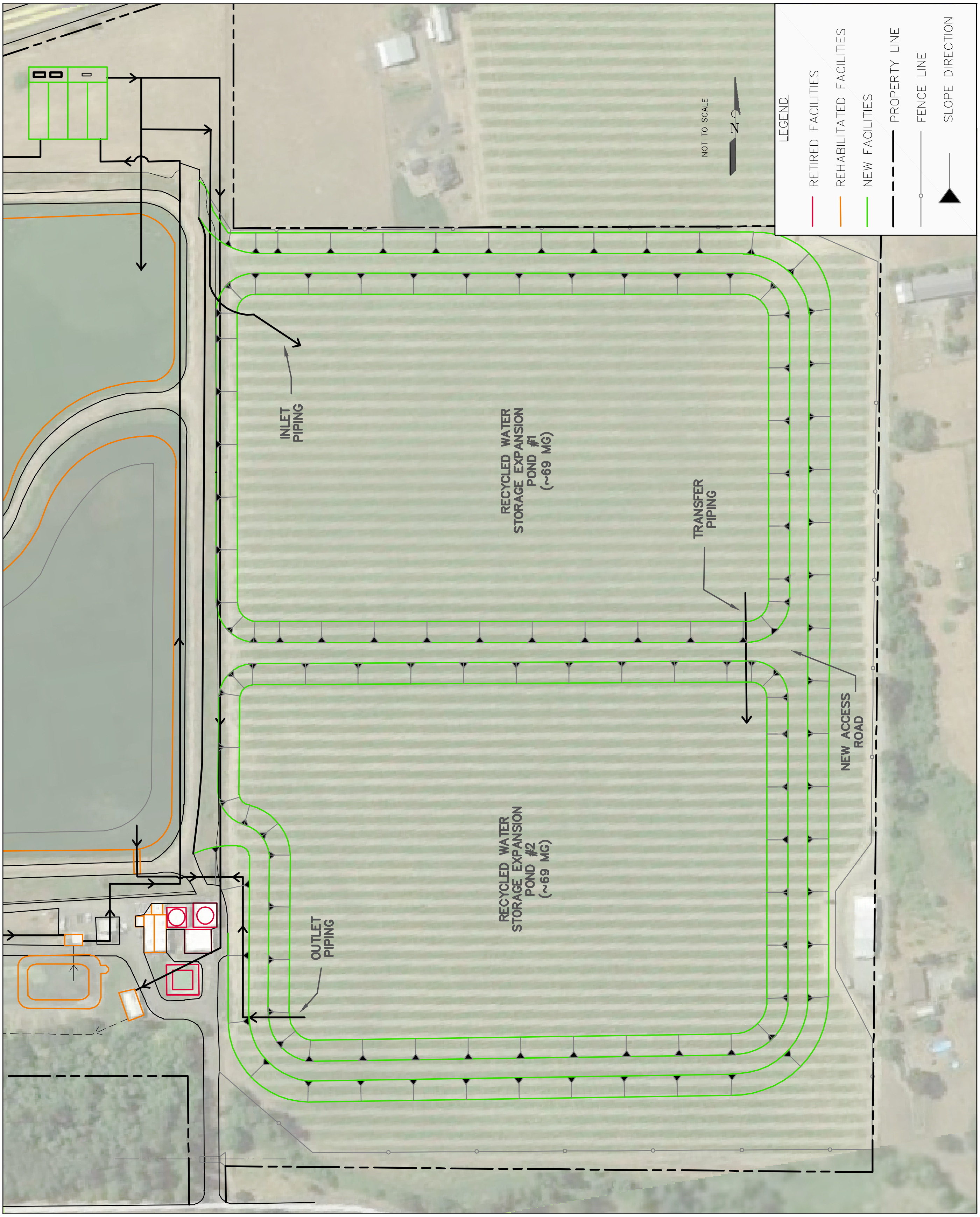
TABLE 4.3.35
RECYCLED WATER STORAGE POND REQUIREMENTS (PS #1)

Item	Value
Existing Recycled Water Storage, Acres	25
Additional Recycled Water Storage Required, Acres	35
Total Storage Capacity, MG	235
Available Surge Capacity, MG	176

Cost estimates include land acquisition for storage systems, access road, inlet/outlet structures, lining, earthwork, drainage, fencing, and ancillary systems.

TABLE 4.3.36
RECYCLED WATER STORAGE POND IMPROVEMENTS (PS #1)
COST ESTIMATE

Item	Cost Estimate
Lagoon #1 and #2 Dike Stabilization & Improvements	$3,348,857
Recycled Water Storage Expansion Systems	$13,478,000
Total	**$16,826,857**



THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	**_CITY OF MOLALLA_** **_WASTEWATER FACILITY & COLLECTION SYSTEM MASTER PLAN_**	FIGURE NO.
DATE: OCTOBER 2018	**_RECYCLED WATER EXPANSION PONDS SITE PLAN - PS #1_**	**_4.3.15_**
PROJECT NO.: 100.26		

Recycled Water Storage PS #2

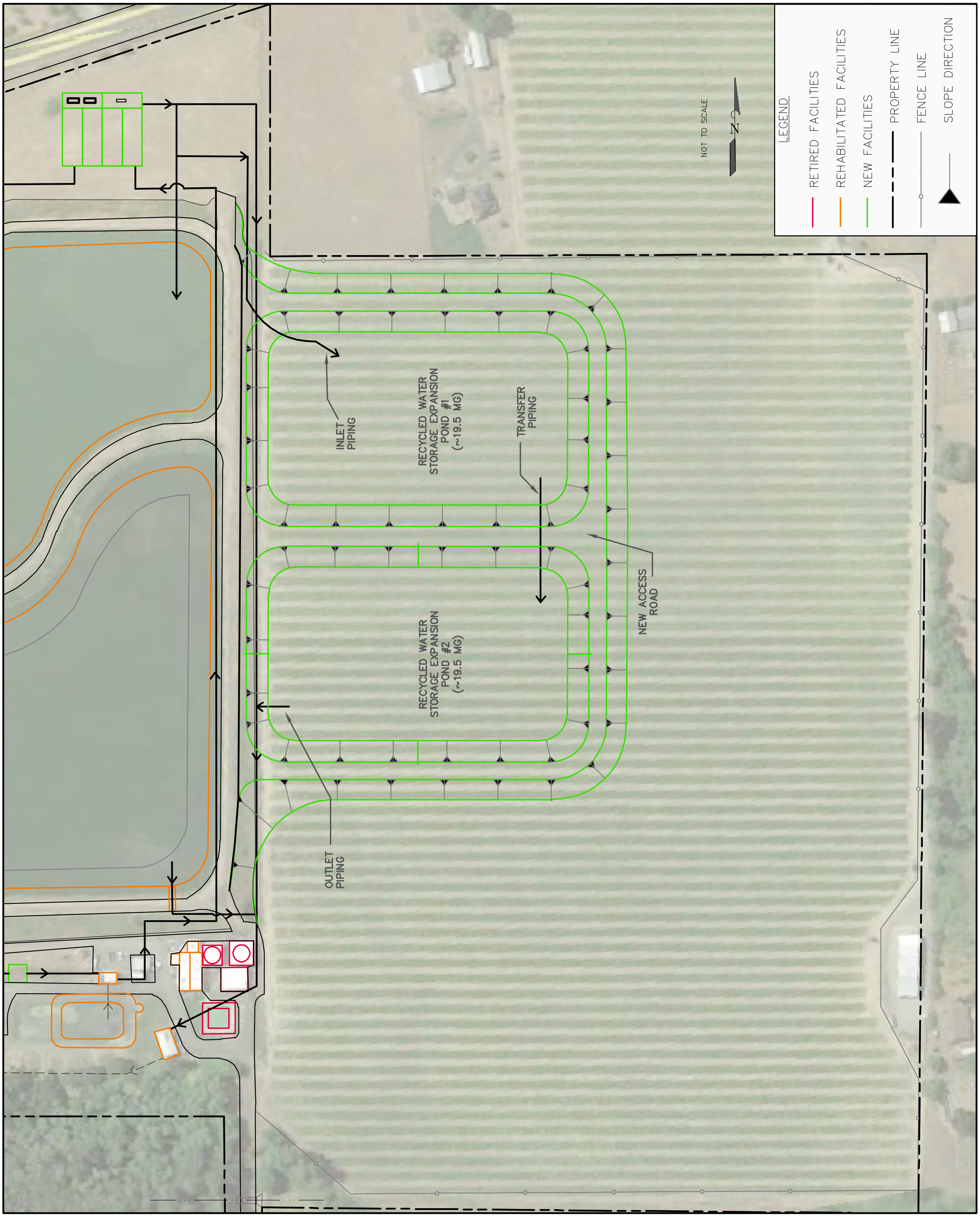
If a mass load increase is not approved, but discharge to the Molalla River is allowed during the summer months when conditions allow, additional recycled water storage is required, but the amount is less than condition PS #1. This is in addition to converting the existing facultative Lagoons #1 and #2 to recycled water storage ponds. This condition assumes that the adjacent 55 acre parcel will be purchased to provide acreage needed for expansion systems. A total of 10 acres (approximate total pond surface area) is required. Table 4.3.37 lists recycled water storage requirements for PS #2. A cost estimate is provided in Table 4.3.38. A water balance summarizing this condition (PS #2) is provided in Appendix D.

TABLE 4.3.37
RECYCLED WATER STORAGE POND REQUIREMENTS (PS #2)

Item	Value
Existing Recycled Water Storage, Acres	25
Additional Recycled Water Storage Required, Acres	10
Total Storage Capacity, MG	137
Available Surge Capacity, MG	103

TABLE 4.3.38
RECYCLED WATER STORAGE POND IMPROVEMENTS (PS #2)
COST ESTIMATE

Item	Cost Estimate
Lagoon #1 and #2 Dike Stabilization & Improvements	$3,348,857
Recycled Water Storage Expansion Systems	$4,356,000
Total	**$7,704,857**



THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

DATE: OCTOBER 2018
PROJECT NO.: 100.26

CITY OF MOLALLA
WASTEWATER FACILITY & COLLECTION SYSTEM MASTER PLAN

RECYCLED WATER EXPANSION PONDS SITE PLAN - PS #2 & PS #3

FIGURE NO.
4.3.16

Recycled Water Storage PS #3

If a mass load increase is approved, but discharge to the Molalla River is not allowed between May 1 and October 31, as per the existing NPDES permit, then additional recycled water storage is required. Recycled water storage expansion requirements are identical to PS #2. Table 4.3.39 lists recycled water storage requirements for PS #3. A cost estimate is provided in Table 4.3.40. A water balance summarizing this condition (PS #3) is provided in Appendix D.

TABLE 4.3.39
RECYCLED WATER STORAGE POND REQUIREMENTS (PS #3)

Item	Value
Existing Recycled Water Storage, Acres	25
Additional Recycled Water Storage Required, Acres	10
Total Storage Capacity, MG	137
Available Surge Capacity, MG	103

TABLE 4.3.40
RECYCLED WATER STORAGE POND IMPROVEMENTS (PS #3)
COST ESTIMATE

Item	Cost Estimate
Lagoon #1 and #2 Dike Stabilization & Improvements	$3,348,857
Recycled Water Storage Expansion Systems	$4,356,000
Total	**$7,704,857**

Recycled Water Storage PS #4

If DEQ allows a mass load increase commensurate with Willamette Basin standards and future flows, and also allows discharge to the Molalla River, when river conditions allow, typically permitting discharge to the Molalla River to occur in May, the existing Lagoons #1 and #2 provide adequate storage for the planning period.

With PS #4, after the new WWTP is constructed, the existing facultative lagoons will be used to store recycled water. A total of 98 million gallons of storage will be provided. With a mass load increase associated with the Molalla River outfall, and conditional discharge allowance in May, converting the existing facultative/storage lagoons to recycled water storage satisfies recycled water storage requirements for the planning period. Dike stabilization improvements are, however, required to stabilize the dikes to maintain the integrity of the berms. Lining with a hypalon liner, along with improvements to the transfer piping are also required.

Table 4.3.41 lists recycled water storage requirements for PS #4. A cost estimate is provided in Table 4.3.42. A water balance summarizing this condition (PS #4) is provided in Appendix D.

TABLE 4.3.41
RECYCLED WATER STORAGE POND REQUIREMENTS (PS #4)

Item	Value
Existing Recycled Water Storage, Acres	25
Additional Recycled Water Storage Required, Acres	0
Total Storage Capacity, MG	98
Available Surge Capacity, MG	73

TABLE 4.3.42
RECYCLED WATER STORAGE POND IMPROVEMENTS (PS #4)
COST ESTIMATE

Item	Cost Estimate
Lagoon #1 and #2 Dike Stabilization & Improvements	$3,348,857

Recycled Water Storage Summary

A summary of the recycled water storage requirements for the various permit scenarios (PS #1, PS #2, PS #3, and PS #4) is provided in Table 4.3.43, below.

TABLE 4.3.43
RECYCLED WATER STORAGE REQUIREMENTS[1]

Item	Permit Scenario			
	PS #1	**PS #2**	**PS #3**	**PS #4**
Facultative Lagoon #1 and #2 (MG)	98	98	98	98
Facultative Lagoon #1 and #2 (Acres)	25	25	25	25
Recycled Water Storage Expansion (MG)	137	39	39	0
Recycled Water Storage Expansion (Acres)	35	10	10	0
Total Volume (MG)	**235**	**137**	**137**	**98**
Total Acreage Required (Acres)	**60**	**35**	**35**	**25**

1. Lagoon area is based on actual surface area of water surface at average depth.

Discharge Monitoring Station

The discharge monitoring station piping is capacity limited, and causes backups during high flows. Improvements are required to increase the peak conveyance capacity. Additional piping, along with valves, flow meter, electrical and controls will be installed. Table 4.3.44 summarizes the construction cost estimate for discharge monitoring station improvements.

TABLE 4.3.44
DISCHARGE MONITORING STATION IMPROVEMENTS
COST ESTIMATE

Item	Cost Estimate
Construction	$415,000

4.4 Biosolids Treatment, Storage and Disposal Alternatives

Biosolids refers to any sludge that has been stabilized to meet the criteria in the U.S. Environmental Protection Agency's 40 CFR 503 regulations and can be used beneficially. The sources of sludge generated at a treatment plants varies according to the type facility and mode of operation. The primary sources of sludge from wastewater treatment plants include primary sedimentation and waste activated sludge.

Management of solids from WWTPs includes several processes: sludge treatment, volume reduction by thickening or dewatering, sludge storage, and disposal. All components must adhere to standards set forth in the Code of Federal Regulations (40 CFR Part 503). Biosolids management costs can represent a significant expenditure at WWTPs, and therefore require thorough analysis to select suitable and low life-cycle cost alternatives.

At the existing WWTP, sludge is collected in the lagoons, primarily the inlet end of Lagoon #1, where it undergoes anaerobic digestion and gravity thickening over long detention times. Biosolids are periodically removed; infrequently due to difficulties with dredging and disposal. Portions of biosolids were removed in 1999, 2010, 2016, and 2018. The existing infrastructure used for biosolids treatment, storage, and disposal is inadequate based on current and future loads.

The evaluation of the biosolids management systems is based on the recommendation for the liquid stream treatment alternatives and is recommended for all permit scenarios (PS #1 – PS #4). The various biosolids management alternatives evaluated included:

1. Facultative sludge lagoon
2. Aerobic digestion and sludge drying beds
3. Aerobic digestion and dewatering press
4. Aerobic digestion with Membrane Thickener (MBT) and dewatering press
5. Aerobic digestion and tank storage
6. Anaerobic digestion and dewatering press

Sizing of biosolids management systems is based on the minimum mean cell residence time determined by the following formula: (Time @ T°C)/(40d) = 1.08(2—T). This evaluation utilizes a 60-day mean residence time for comparison purposes. Selection of the most viable biosolids stabilization alternative is dependent upon the selected ultimate use and disposal of the biosolids. The following is a discussion of the biosolids stabilization and ultimate use/disposal alternatives.

Lagoon Dredging and Biosolids Disposal

Lagoon #1 has a considerable amount of accumulated sludge that occupies biological capacity and limits recycled water storage capacity. Lagoon dredging, dewatering, and disposal are recommended immediately and eventually as part of future WWTP improvements.

Since the City does not have satisfactory dredging and dewatering equipment, procuring the services of a dredging company is recommended. Desludging of the lagoons requires that the quantity and characteristics of sludge be determined, the selection of a suitable land application site (or other DEQ approved disposal method), and the procurement of the services of a lagoon dredging and disposal company.

Based on sludge judge measurements pulled in December 2017, there is approximately 150,000 gallons of solids (2 to 4% dry solids) in the aeration basin. Aeration basin solids are a mixture of vactor truck spoils, grit, raw wastewater solids, DAF backwash, and gravity sand filter backwash.

The majority of solids at the WWTP settle, and are anaerobically digested, in Lagoon #1. Based on sludge judge measurements taken in February 2018, there is approximately 27 MG of solids in Lagoon #1. Sludge judge measurements were taken from Lagoon #2 in March 2018. The total estimated volume of solids in Lagoon #2 is 3.5 MG, based on an estimated average 0.75 ft sludge depth. The total volume of biosolids currently residing in Lagoons #1 and #2 is approximately 30.5 MG. Based on available data, the solids concentration in Lagoon #1 is between 4 and 11%. The estimated average solids concentration in Lagoon #2 is estimated at about 2.5 to 3%. Table 4.4.1 summarizes the estimated volume and dry tons of solids in the aerated lagoon and facultative lagoons.

TABLE 4.4.1
LAGOON BIOSOLIDS ESTIMATES

Item	Amount
Aeration Basin Solids Volume, gal	150,000
Lagoon #1 Solids Volume, MG	27
Lagoon #2 Solids Volume, MG	3.5
% Dry Solids, Aeration Basin	2-4%
% Dry Solids, Lagoon #1	4-11%
% Dry Solids, Lagoon #2	2.5 to 3%
Dry tons, Aeration Basin	215
Dry tons, Lagoon #1	9,000
Dry tons, Lagoon #2	407

In 2018, the City contracted with River City Environmental to remove solids from the aerated lagoon and some solids from Lagoon #1. In total, 699 dry tons were removed from Lagoon #1, and 215 dry tons were removed from the aerated lagoon. The biosolids estimates listed above, and survey results in the appendix, do not take into account the solids removed in 2018.

Cost Estimate

The cost estimate for dredging the lagoons, dewatering the solids, and transporting the solids to a designated disposal site is summarized in Table 4.4.2. Detailed cost estimates are included in Appendix C.

TABLE 4.4.2
DREDGING AND DISPOSAL COST ESTIMATE

Item	Cost Estimate
Aerated Lagoon Dredging & Disposal	$125,000
Facultative Lagoons Dredging & Disposal	$3,750,000

Biosolids Stabilization

Biosolids stabilization is a treatment process which converts sludge generated in the liquid stream treatment process to a stable product for ultimate disposal or use. This process reduces pathogens and vector attraction in the sludge and produces a less odorous product. The most common biosolids stabilization processes used in small communities are: facultative sludge lagoons, aerobic digestion, anaerobic digestion, and lime stabilization. While not typically utilized in small communities, composting is considered a potential stabilization alternative. Lime stabilization requires a large amount of lime per unit weight of sludge, and necessitates high operational costs. Lime stabilization is typically limited to small wastewater treatment facilities and is not considered an affordable and feasible option for the City of Molalla.

Alternatives

<u>Aerobic Digestion</u>
Aerobic digestion is defined as the biological oxidation of organic sludges under aerobic conditions (in the presence of O_2). Aerobic digestion is one of the processes defined to meet requirements for Class B biosolids. To meet Class B biosolids requirements the regulations state that the solids retention time must be at least 60 days at 15°C. Aerobic digestion is used to reduce the quantity of sludge for disposal.

Advantages of aerobic digesters include: fewer operational problems, less daily maintenance, lower BOD_5 concentrations in supernatant liquor, produces an odorless and biological stable product, easy to construct and readily available parts, no risk for explosions, and lower capital costs, all compared to anaerobic digestion. Disadvantages include: higher energy consumption, digested biosolids have poorer mechanical dewatering characteristics and the useful byproduct such as methane is not recovered.

Table 4.4.3 summarizes preliminary design data for the proposed aerobic digester. Aerobic digester volume is based on an 80% sludge yield from the secondary treatment facility, 2% dry solids concentration, and an 18 ft solids depth. In general, 18 ft Side Water Depth (SWD) is ideal for fine bubble aeration. The air demand is based on 30 SCFM per 1,000 ft^3 of aerobic digester volume. At a 60 day Solid Retention Time (SRT), the aerobic digester would consist of two tanks with a total volume of approximately 0.85 MG. This includes an additional 25% volume for decanting. Additional storage, beyond the 60 day SRT requirement, is incorporated into the recommended design to allow for more flexible operations of digestion and dewatering systems.

TABLE 4.4.3
AEROBIC DIGESTER
PRELIMINARY DESIGN DATA

Item	Specification
WAS, gal/day	43,900
WAS, lb/day	3,114
WAS, % dry solids	0.85%
Aerobic Reactors, quantity	2
Total Aerobic Digester Volume, MG	1.2
Blowers, quantity	4 duty + 1 standby
Blower, capacity (scfm @ 9.75 psig)	1,206
Mixed Liquor Volatile Suspended Solids, %	75%
Volatile Solids Reduction in Aerobic Digester[1], %	45%

1. Temperature, solids characteristics, DO, and detention time dependent.

Capital and O&M cost estimates for an aerobic digester is provided in Table 4.4.4. Detailed cost estimates are included in Appendix C. Present worth costs are based on 3.2 % interest, and a 20 year term.

TABLE 4.4.4
AEROBIC DIGESTER COST ESTIMATE

Item	Cost Estimate
Construction	$3,332,000
Annual O&M	$105,236
Total Present Worth	**$4,869,081**

Aerobic Digestion with MBT

Aerobic digestion with membrane thickening was also evaluated. This process includes a Membrane Thickening (MBT) tank and two aerobic digesters. By thickening the solids, the volume of the aerobic digesters can be reduced considerably. With this system, the digesters are operated in a batch mode wherein one is fed waste activated sludge and operated in-loop with the MBT tank for approximately 30 days. After that time the digester is isolated and allowed to continue with volatile solids destruction. The other digester then comes out of isolation and begins the feeding/thickening cycle. The MBT will thicken sludge by pulling clean water through the membranes, leaving solids behind. The thickened sludge flows by gravity back to the in-loop digester, where the coarse bubble diffusers provide oxygen for digestion while mechanical mixers provide energy for mixing the sludge.

By eliminating the need for decanting, the MBT is able to thicken sludge to the desired concentration regardless of the settling characteristics of the raw sludge. This means that the sludge concentration can be fine-tuned to the optimal level to maximize the performance of downstream dewatering equipment. The proposed design assumes that the aerobic digesters will be operated at approximately 3.5% dry solids. This alternative also optimizes energy efficiency by decoupling the mixing energy of the digesters from the oxygen required for volatile solids destruction. By separating these two components, Operators can provide precisely the amount of oxygen needed for digestion as the solids loading to the digesters changes over time. Utilizing mechanical mixing allows the digesters to keep solids in suspension during periods when the aeration is insufficient for this purpose or when trying to achieve denitrification.

Table 4.4.5 summarizes the preliminary design data for the proposed aerobic digester and MBT system.

TABLE 4.4.5
AEROBIC DIGESTER WITH MBT
PRELIMINARY DESIGN DATA

Item	Specification
WAS, gal/day	43,900
WAS, lb/day	3,114
WAS, % dry solids	0.85%
Aerobic Reactors, quantity	2
Aerobic Digester Diameter, ft	50
Aerobic Digester SWD, ft	16
MBT Tank Dimensions (Internal – L x W x SWD), ft	15' x 11' x 16'
Submerged Membrane Units, quantity	3
Membrane Surface Area (per unit), ft^2	3,112
SRT, days	69
Permeate Pump, hp	5
Permeate Pump, quantity	2
MBT Air Scour Blower, hp	20
MBT Air Scour Blower, scfm	318
Hyperbolic Mixer, quantity	2
Hyperbolic Mixer, hp	30
Digester Blower, quantity	3
Digester Blower, scfm	100
Chemical Holding Tank, gallons	320
Clean-In-Place Pump, gpm	16
MBT Plant Controls	PLC

Capital and O&M cost estimates for an aerobic digester with MBT is provided in Table 4.4.6. Detailed cost estimates are included in Appendix C. Present worth costs are based on 3.2% interest, and a 20 year term. Annual O&M costs include equipment repair and replacement requirements, including membrane replacement at a twelve year interval.

TABLE 4.4.6
AEROBIC DIGESTER WITH MBT COST ESTIMATE

Item	Cost Estimate
Construction	$4,109,000
Annual O&M	$148,617
Total Present Worth	**$6,279,706**

Anaerobic Digestion

Anaerobic digestion is the biological conversion of organic matter by fermentation in a heated reactor to produce methane gas and carbon dioxide. Fermentation occurs in the absence of oxygen. The process requires skilled operation as it may be susceptible to upsets and recovery is slow. Anaerobic digesters are relatively complex, have higher capital costs, have higher operational requirements when compared to other options, but provide very low electrical consumption when compared to aerobic digesters. Anaerobic digesters provide a higher Volatile Suspended Solids (VSS) destruction when compared to aerobic digesters. Anaerobic digestion systems typically require daily maintenance, partly due to the gas characteristics and associated condensation. Uniform feeding is also very important to help maintain constant conditions in the reactor.

The performance of anaerobic digesters is dependent on the solids retention time, hydraulic detention time, temperature, pH, alkalinity, the presence of inhibitory substances, reliable carbon source, and the bioavailability of nutrients and trace elements. Temperature is important because it determines the rate of digestion. Most anaerobic digesters are designed to operate in the mesophilic temperature range, between 85 to 100°F. Anaerobic digesters are sized to provide sufficient time to allow significant reduction in VSS. Most WWTPs employing anaerobic digestion use a mixture of primary and secondary solids. An anaerobic digester would consist of process tankage, digester covers, boiler and heat exchanger, gas safety equipment, and digester mixing equipment. The overall objective of digester operation is to develop an environment that promotes organic decomposition. This is accomplished primarily by maintaining a certain temperature and ensuring sufficient mixing. Numerous methods are available to maintain digester contents in suspension, including pumping from one location within the tank to another. Mechanical mixing via an impeller or linear motion mechanism located within the tank or gas injections are other mixing methods.

Solids blending (combining primary sludge and waste activated sludge into one feedstock) and temporary storage in a holding tank may also be designed upstream of the anaerobic digestion process. Blending and storage produces a more homogeneous and steady state loading and minimizes digester feed flow variability. An additional intermediate step prior to digestion may include solids thickening. In this process, the water content of primary and/or waste activated sludge is reduced. Process examples include gravity thickening, rotary drum thickening, and gravity belt thickening. Thickening may reduce the equipment and tankage capacity required for digestion, conveyance, or storage, as well as the energy required for digester heating, and chemical use for additional conditioning (WERF: Anaerobic Digestion Fundamentals, 2017).

Disadvantages of anaerobic digestion for wastewater treatment facilities less than 10 MGD, include:

- Gas production is not balanced to demand is flared or wasted
- Typical target production of methane is 60% saturation, which requires operator diligence and steady feedstock to achieve
- Supplemental propane or natural gas required
- Odor is a critical issue that requires constant operator attention
- Significant maintenance and associated costs

Table 4.4.7 summarizes the preliminary design data for the proposed anaerobic digester system.

TABLE 4.4.7
ANAEROBIC DIGESTER
PRELIMINARY DESIGN DATA

Item	Specification
0.75 MBTU/hr Heat Exchanger, quantity	1
Anaerobic Digester Tank Diameter, feet	60
Anaerobic Digester Tank Volume, gallons	627,600
Anaerobic Digester High Liquid Level, feet	28
Gas Storage, ft^3	16,100
Number of Sludge Mixers	2
Mixer, hp	15
Gas Safety Equipment, quantity	1
Radial Beam Gasholder Cover Diameter, feet	60
Mixed Liquor Volatile Suspended Solids, %	75%
Volatile Solids Reduction in Anaerobic Digester[1], %	50%[2]

1. Reduction is greatly affected by operating conditions and solids feed variation.
2. Design of Municipal Wastewater Treatment Plants (Manual of Practice No. 8)

Capital and O&M cost estimates for an anaerobic digester is provided in Table 4.4.8. Detailed cost estimates are included in Appendix C.

TABLE 4.4.8
ANAEROBIC DIGESTER COST ESTIMATE

Item	Cost Estimate
Construction	$4,932,000
Annual O&M	$74,610
Total Present Worth	**$6,021,755**

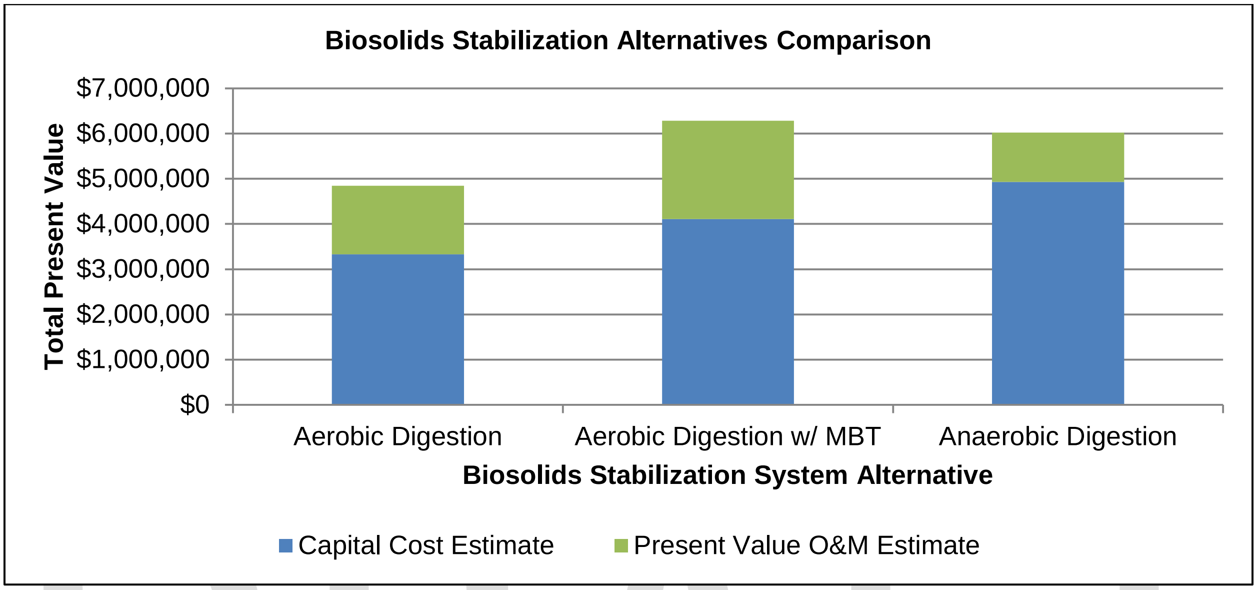
Present Worth Analysis

Present worth cost comparisons for the biosolids stabilization options are presented in Table 4.4.9 and Figure 4.4.1. Present worth costs are based on 3.2 % interest, and a 20 year term.

TABLE 4.4.9
BIOSOLIDS STABILIZATION PRESENT WORTH COST ESTIMATES

System	Capital Cost Estimate	Annual O&M	Present Value O&M Estimate	Total Present Worth
Aerobic Digestion	$3,332,000	$103,803	$1,516,146	$4,869,081
Aerobic Digestion w/ MBT	$4,109,000	$148,617	$2,170,706	$6,279,706
Anaerobic Digestion	$4,932,000	$74,610	$1,089,755	$6,021,755

FIGURE 4.4.1
PRESENT WORTH COSTS FOR BIOSOLIDS STABILIZATION ALTERNATIVES



Matrix Evaluation

When reviewing biosolids stabilization alternatives, several considerations are important, including:

- Footprint
- Capital costs
- O&M costs
- Disposal costs for the biosolids
- Strength of the wastewater (the higher the chemical oxygen demand/biochemical oxygen demand, the more the pendulum swings toward anaerobic digestion)

A matrix rating system was employed to compare the biosolids stabilization alternatives. This rating system consists of a three-point scale; three being the best and one the worst. Two or more alternatives may have the same rating for a particular parameter. The ratings for the matrix evaluation are summarized in Table 4.4.10.

TABLE 4.4.10
MATRIX EVALUATION BIOSOLIDS STABILIZATION ALTERNATIVES

Parameter	Aerobic Digestion	Aerobic Digestion w/MBT	Anaerobic Digestion
Flexibility	3	3	2
Reliability	3	2	2
Operability	3	2	1
Ability to Construct	3	2	2
Environmental Factors	2	3	3
Community Impact	2	2	2
Expandability	2	2	2
Total	**18**	**16**	**14**

Biosolids Stabilization Recommendation

Compared to anaerobic digestion, aerobic digestion is a relatively simple process to operate and maintain. However, anaerobic digestion is comparatively more energy efficient. Anaerobic digestion is typically applied to larger municipalities with significant contributions from industrial constituents with high organic discharges. Aerobic digestion with MBT has the highest life-cycle cost. Aerobic digestion offers the lowest up-front and lowest present worth over the 20 year period, and is therefore the recommended alternative for all permit scenarios (PS #1 through PS #4).

Biosolids Storage

Biosolids can be stored within the wastewater treatment process units, biosolids treatment process units, or in separate specially designed tanks. Wastewater treatment units can store biosolids for short-term storage (a few hours to 24 hours). For longer detention times, biosolids treatment units, such as aerobic or anaerobic digesters, and facultative sludge lagoons are used for storage. Separate tanks are usually used for obtaining longer detention times. These separate holding tanks often use mixing and/or aeration to prevent septicity, odors, and to maintain solids suspension. Mixing may be accomplished using diffused air and top-entry or submersible mechanical mixers. Other odor control measures include either chemical addition of chlorine, hydrogen peroxide or iron salts, and maintenance of an aerobic surface layer (e.g. facultative sludge lagoon). Long-term storage of biosolids that are not completely dried can create serious odor problems.

Storage is required to hold biosolids until biosolids disposal takes place. Disposal by land application typically occurs between the months of May through October, but is dependent on weather. Land use, such as harvesting hay, and rainfall can reduce this window to August through October. For purposes of this study, storage facilities are required for a minimum of nine months.

Alternatives

<u>Facultative Sludge Lagoons (FSL)</u>
An FSL is a retention pond or lagoon that stores biosolids for an extended period of time. Anaerobic and aerobic treatment zones are established in the lagoons. Over time, solids are anaerobically digested within the bottom layer of the lagoon. The FSLs can provide volatile solids digestion rates up to 50%. The FSLs produce Class B biosolids. The biosolids are also thickened by gravity as they reside in the lagoon.

The FSLs typically have a liquid depth of 10 to 15 ft, with the top 3 to 4 ft reserved as a water cap for odor mitigation. The FSLs are designed for a detention time of two or more years, depending on land availability and solids removal objectives. Many communities that have FSLs store solids for years or even decades without dredging or disposal events.

Facultative sludge lagoons are typically loaded at between 10 to 30 lbs of VSS per day per 1,000 ft^2. Depending on sludge treatment objectives and the target removal frequency, the area required for an FSL suitable for the City of Molalla is between 3 to 5 acres, or more.

The FSLs are low maintenance and offer a very effective solution that is ideally suited for small communities with limited operational resources. The main disadvantage of FSLs is the large land area required. Since the FSL option consumes valuable recycled water storage; and due to a lack of appropriate sites and lack of available property in the vicinity of the treatment plant, the use of a facultative sludge lagoon in the City of Molalla for biosolids is not considered viable.

Drying Beds

Sludge drying beds are one of the most common dewatering technologies throughout the United States. Sludge drying beds are contained structures with the floor sloping to a drain system. A layer of gravel is built up over the drains, and a layer of sand is applied over the gravel; the surfaces of the beds are flooded with digested biosolids. The liquid content of the biosolids drains through sand and gravel and is returned to the headworks of the plant. Dewatered biosolids are scraped off after each application, along with the top layer of the sand, using a small front-end loader.

The biosolids are hauled by dump truck and disposed of by landfill or land applied. The solids content of the finished biosolids may vary from 15% to 70%, with 16% used as an estimate for study purposes. Covered beds would be required due to the volume and duration of rainfall in the City of Molalla**.**

The principal disadvantages of drying beds are: the land area required, effects of rainfall, labor-intensive biosolids removal, vector attraction, and odors. Disadvantages also include multiple handling of the material; it must be spread, scraped up, loaded into a truck, and then tilled in at the land application site. Use of the drying beds also requires access to a small front-end loader, dump truck ,and manure spreader. Drying beds are less efficient in the City of Molalla’s wet climate. Advantages are low cost and minimal operation attention required.

Typical area requirements for sludge drying beds for dewatering waste activated sludge ranges from 2 to 2.5 ft^2/person. Assuming a future population of 16,977, the City of Molalla would require 42,443 ft^2 of covered sludge drying beds. This would require a footprint of approximately 210 feet by 210 feet.

The capital cost and O&M cost estimates for biosolids drying beds is provided in Table 4.4.11. Present worth costs are based on 3.2 % interest, and a 20 year term.

TABLE 4.4.11
DRYING BEDS CAPITAL & O&M COST ESTIMATE

Item	Cost Estimate
Construction	$3,065,700
O&M Present Worth	$624,000

Dewatering Press

A dewatering press is used to decrease the total volume and moisture content of sludge, reducing the required storage space and the number of trips eventually necessary to haul biosolids offsite, either for land application or landfill disposal. Digested sludge is treated with polymer to allow flocculation and easier dewatering.

Assuming aerobically digested sludge, the press produces liquid pressate, which is pumped back to the headworks for further treatment, and a dewatered sludge with a solids content of approximately 14% to 18% solids. For anaerobically digested sludge, assuming 60% WAS and 40% primary sludge by dry weight into a mesophilic, single stage, anaerobic digester, dewatered sludge is estimated at 22% solids.

A storage area for the thickened biosolids would be required. Removal of the thickened sludge would require a front loader, or other mechanical means of loading, and a manure spreader for land application, or land fill disposal. Landfill disposal is not weather-dependent and can occur year-round.

A press suitable for a community the size of the City of Molalla, assuming aerobically digested sludge, can process sludge at approximately 360 pounds of dry solids per hour. The projected 2043 solids load for the WWTP is about 2,061 pounds per day at 2% dry solids, depending on the biological process selected. A dewatering press would need to run approximately 40 hours per week.

The resulting "cake" could then be stored in a sludge press building until disposal is possible. Press operation is considered reliable, but is dependent on the level of maintenance and skill of the Operator. In the case of the City of Molalla, the liquid sludge storage prior to dewatering greatly increases the reliability of the process. If a dewatering press is not provided, additional liquid sludge storage is required.

The capital cost and O&M cost estimate for the dewatering press and dry storage is provided in Table 4.4.12. Present worth costs are based on 3.2 % interest, and a 20 year term.

TABLE 4.4.12
DEWATERING PRESS CAPITAL & O&M COST ESTIMATE

Item	Cost Estimate
Construction	$1,867,000
O&M Present Worth	$402,000

Tank Storage and Liquid Disposal
Tanks for storing digested biosolids should be sized to provide storage between land application seasons. For the City of Molalla, the recommended solids retention time for storage is nine months. To provide a total of nine months of storage a large volume of storage is required, assuming a dry solids concentration of 2%.

An advantage of tank storage of liquid sludge is that there is minimal labor involved in the use of a storage tank and aeration equipment; and a certain amount of aerobic digestion would ensue. A disadvantage of tank storage is the volume of material to be managed, the larger amount of aeration required to maintain storage, and hauling cost for disposal of large volumes of liquid biosolids. Even with the use of a large tanker truck, an excessively high number of trips would be required. Based on the quantity of liquid biosolids and transportation requirements, tank storage, and liquid disposal is not considered a viable option for the City of Molalla.

Disposal of Biosolids

Disposal alternatives for WWTP biosolids were evaluated with respect to regulatory requirements for pollutant limits (i.e. 40 CFR Part 503, Subpart B) and to agronomic rates for the onsite vegetation (i.e. nitrogen). The Part 503 rule requires that biosolids be land applied at a rate that is equal to or less than the agronomic rate for nitrogen at the application site. Additional Part 503 requirements include the following (EPA 1995):

- Biosolids cannot be land applied unless trace element concentrations in the sludge are below ceiling concentrations specified in Part 503.

- Biosolids must meet either (1) the pollutant concentration limits specified in Table 3 of Part 503 or (2) the Part 503 Cumulative Pollutant Loading Rate (CPLR) limits for bulk biosolids.

The ultimate end use or disposal of biosolids is often the area of greatest uncertainty in sludge handling because of its dependency on solids marketability, land availability, and regulatory requirements. Another important consideration of the potential end use or disposal option is public acceptance. The reluctance of the public to accept a biosolids disposal or processing facility in their area generally stems from concerns about odors and adverse health impacts. Potentially viable options for use and disposal of biosolids include disposal at a landfill, land application, and distribution by marketing. The WWTP improvements proposed will provide the opportunity to use digestion tankage for biosolids storage.

Land Application

Land application refers to any beneficial use project that applies biosolids to the land. Such land sites include primary agricultural land, pastures, tree farms, and old mines. Any biosolids to be land applied must be classified as non-hazardous and meet criteria for maximum allowable concentrations of trace metals (e.g. cadmium, copper, lead, nickel and zinc). For application to agricultural lands, all biosolids must undergo treatment by a process to significantly reduce pathogens. In addition to evaluating biosolids with respect to environmental suitability, a land application program will depend on the nutrient content of the biosolids, the land to which it will be applied, and the crops to be grown on the land. For most biosolids produced and land applied, the limiting factor is the nutrient content of the biosolids when it is applied as a fertilizer for a particular crop.

Land application is dependent on site conditions and weather. Prolonged heavy rains could greatly reduce the flexibility of liquid land application. The dry sludge land application alternative is relatively unlimited and offers the most flexibility. In addition, land application sites are becoming more difficult to locate and maintain as long-term disposal sites.

The anticipated land application program would operate for a minimum of three months and land applies approximately 4,511,400 gallons of liquid biosolids per year. With the dewatering screw press, assuming aerobically digested solids, and an estimated dry solids content of 14%, the resulting volume of biosolids cake is approximately 644,283 gallons/year. At 18% the volume of biosolids is reduced even further.

The City does not currently have adequate land available for application of biosolids. In the short term, the City of Molalla could contract out the solids hauling and disposal operations, land apply biosolids on existing sites, and dispose of dewatered biosolids at a landfill. In the long term, the City should identify additional sites for land applying biosolids. Prior to using any site for land application, the City of Molalla is required to receive a written site authorization letter from DEQ. The following site conditions should be considered when determining the suitability of a site for land application:

- All sites will be located on agricultural or forestland.

- A site should be on a stable geologic formation not subject to flooding or excessive run-off from adjacent land.

- Minimum depth to permanent groundwater should be four feet and the minimum depth to temporary groundwater should be one foot at the time when application of liquid biosolids occurs.

- Topography should be suitable for normal agricultural operations. Liquid biosolids should not be land applied on bare soils when the slope exceeds 12 %. Dewatered or dried biosolids may be land applied on well-vegetated slopes up to 30%.

- Soil should have a minimum rooting depth of 24 inches.

The land area required for applying liquid biosolids is based on several factors. In almost all cases, nitrogen controls the biosolids application rate. It is recommended that the City update their Biosolids Management Plan (BMP) based on WWTP improvements to ultimately dictate the facility’s solids operations and biosolids land application activities. The City prepared a Biosolids Management Plan in 2013. Based on the 2043 planning year and a biosolids application rate of approximately 2 to 2.5 dry tons per acre, about 150 to 200 usable acres are required for land application of biosolids. With setback requirements taken into consideration, additional land is required. The key advantages of local land application are the ability to utilize wastewater biosolids for a beneficial use. The major disadvantage is that suitable land is difficult to identify and manage. To expand land application sites, permittees intending to land apply Class B biosolids to a new site must meet the following requirements prior to land application.

- Submit site authorization request with supporting documentation and data to the appropriate DEQ regional biosolids specialist.
- Document that all newly proposed land application sites meet relevant site selection criteria that have been identified in the approved Biosolids Management Plan.
- Document that the public notification process for proposed biosolids land application activity is in place. The process should include to whom notification was made and when. Documentation regarding notification and the process should be kept on file and available upon request from the DEQ.
- Receive written site authorization from DEQ.

Landfill Disposal

Landfill disposal is a generally less desirable alternative when compared to land application for beneficial use. If a suitable site is convenient, a commercial facility may be used for the disposal of biosolids if facility Operator and regulatory officials permit this practice. The economics of hauling biosolids usually indicates that the dewatering for volume reduction will result in justifiable savings. While this process is generally more expensive and does not take advantage of the beneficial uses of biosolids, disposal at a landfill is a viable option when weather conditions or regulatory requirements limit land application. Landfill disposal also offers a temporary option for disposal while additional land application sites are identified and expanded.

Provided the digested biosolids are dewatered and meet certain testing criteria, the City can haul to the Coffin Butte landfill located in Corvallis, Oregon. The disposal fee is typically around $65 per ton, with an environmental fee of approximately $17 per load.

Distribution and Marketing of Biosolids

Compost and heat-dried (Class A) biosolids may be distributed and marketed to end-users such as the agricultural and horticultural industries, landscape contractors, and homeowners. Each municipality must develop its particular distribution and marketing strategy based on surveys of potential users and competing products. Some municipalities have chosen to market the product through a broker or distributor. Items such as product quality, selling price, storage, responsibility for unsold product, and other risk-sharing decisions should be included in any contracts. Promotional and demonstration programs are usually required to promote public attention and acceptance, and inform potential users of the product's potential use and availability.

The distribution and marketing of processed wastewater biosolids is usually only done by larger municipalities (e.g. Portland, Newberg) that produce considerable amounts of biosolids. These municipalities usually have the resources to successfully develop a product market. The City of Molalla currently produces Class B biosolids and would need to further process the waste to achieve Class A. Class A material could be used directly by the City for fertilizing plantings in parks, at local schools and on other municipal property. Surplus could be given away to the public or farmers.

EPA-approved methods of achieving Class A biosolids include composting, irradiation and heat treatment. The City of Molalla lacks adequate space for composting, the public acceptance for irradiation, or an inexpensive energy source for heat treatment. With the current economic and regulatory climate, producing Class A biosolids is not cost-effective and this method is excluded from further consideration.

Present Worth Analysis

Estimated capital and O&M costs are compiled for biosolids storage, dewatering, holding, and disposal in Table 4.4.13.

TABLE 4.4.13
PRESENT WORTH COSTS FOR BIOSOLIDS MANAGEMENT ALTERNATIVES

	Drying Beds	Class B Dewatering Screw Press
Capital	$3,065,700	$1,867,000
O&M Present Worth	$624,000	$402,000
Salvage Value	($30,000)	($15,000)
Disposal Present Value[1]		
Land Fill	$3,900,000	$3,900,000
Total Present Worth	**$7,559,700**	**$6,154,000**

1. Expansion of the City's land application sites is recommended to reduce disposal costs.

Matrix Evaluation

A matrix rating system was employed to compare the alternatives. This rating system consists of a three-point scale; three being the best and one the worst. Two or more alternatives may have the same rating for a particular parameter. The ratings for the matrix evaluation are summarized in Table 4.4.14.

TABLE 4.4.14
MATRIX EVALUATION BIOSOLIDS DISPOSAL ALTERNATIVES

Parameter	Drying Beds	Dewatering Press
Flexibility	2	3
Reliability	2	3
Operability	2	2
Ability to Construct	2	3
Environmental Factors	1	2
Community Impact	2	3
Expandability	2	2
Total	**13**	**18**

Biosolids Treatment, Storage, and Disposal Recommendation

Based on the above analysis, the screw press with dry storage, with the option for land application and/or landfill option, is considered the highest-ranking alternative. Upon installation of the above recommendations, the City's Biosolids Management Plan (BMP) should be updated. The City's most recent BMP was developed in 2013. Biosolids production rates will increase over time as the City's population grows. A long-term plan for disposing of the biosolids must be developed. Application sites will need to be identified and expanded. When evaluating application sites, the topography, proximity to the WWTP, soils, vegetation, water resources, and other factors require close examination. Regulations pertaining to application sites and the land application of biosolids are available in OAR 340-050.

4.5 Summary of Complete WWTP Alternatives

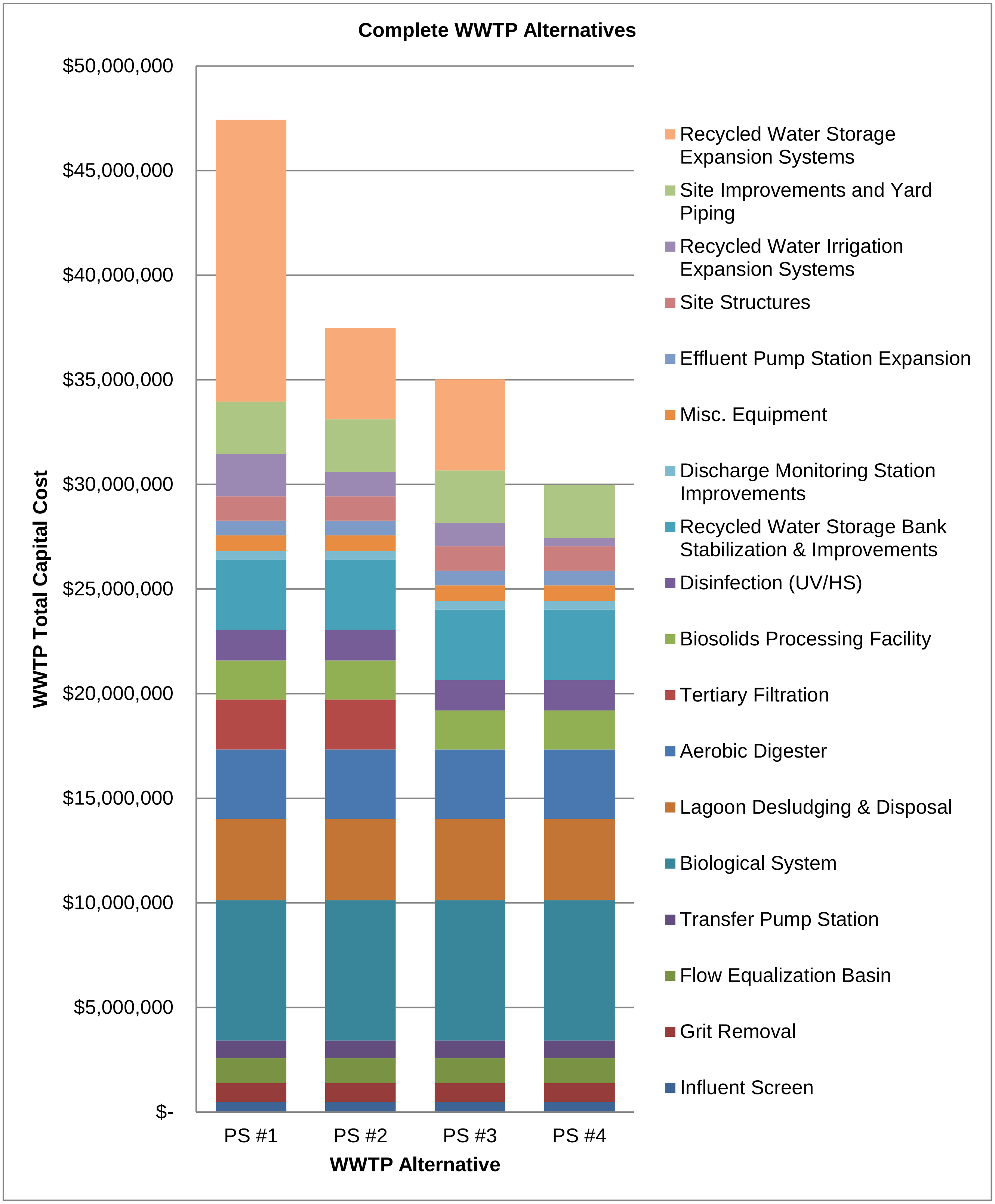
WWTP and effluent disposal system improvements include upgrades to the influent screen, new grit removal system, conversion of part of the aerated lagoon to an influent flow equalization basin, upgrades to the transfer pump station, new four-cell SBR, lagoon sludge removal, disinfection systems, aerobic digester, biosolids processing facility, recycled water system improvements, and various other ancillary improvements. Tertiary filtration systems are required for the SBR option if a mass load increase is not approved (PS #1 and PS #2). Additional land for recycled water storage is required for potential permit scenarios PS #1, PS #2, and PS #3. A summary of capital costs for the complete WWTP alternatives, for each permit scenario, is included in Table 4.5.1 and Figure 4.5.1. Figure 4.5.1 illustrates total construction costs only.

TABLE 4.5.1
COMPLETE WWTP ALTERNATIVES

Item	Total Cost PS #1	Total Cost PS #2	Total Cost PS #3	Total Cost PS #4
Influent Screen	$485,355	$485,355	$485,355	$485,355
Grit Removal	$901,000	$901,000	$901,000	$901,000
Flow Equalization Basin	$1,190,000	$1,190,000	$1,190,000	$1,190,000
Transfer Pump Station	$844,000	$844,000	$844,000	$844,000
SBR	$6,707,000	$6,707,000	$6,707,000	$6,707,000
Tertiary Filtration	$2,387,000	$2,387,000	-	-
Lagoon Desludging & Disposal	$3,875,000	$3,875,000	$3,875,000	$3,875,000
Aerobic Digester	$3,332,000	$3,332,000	$3,332,000	$3,332,000
Biosolids Processing Facility	$1,867,000	$1,867,000	$1,867,000	$1,867,000
Disinfection (HS/UV)	$1,460,500	$1,460,500	$1,460,500	$1,460,500
Recycled Water Storage Improvements	$3,348,857	$3,348,857	$3,348,857	$3,348,857
Recycled Water Storage Expansion	$13,478,000	$4,356,000	$4,356,000	-
Recycled Water Irrigation Expansion	$2,010,000	$1,170,000	$1,110,000	$413,000
Discharge Monitoring Station	$415,000	$415,000	$415,000	$415,000
Misc. Equipment	$750,000	$750,000	$750,000	$750,000
Effluent Pump Station Upgrade and Expansion	$697,000	$697,000	$697,000	$697,000
Site Structures	$1,170,000	$1,170,000	$1,170,000	$1,170,000
Site Improvements and Yard Piping	$2,519,000	$2,519,000	$2,519,000	$2,519,000
WWTP Construction Estimate Total	**$47,437,000**	**$37,475,000**	**$35,028,000**	**$29,975,000**
Engineering - Design - Bidding Services	$4,744,000	$3,748,000	$3,503,000	$2,998,000
Engineering - Construction Services	$4,744,000	$3,748,000	$3,503,000	$2,998,000
Land Acquisition	$1,500,000	$1,500,000	$1,500,000	-
Value Analysis and Value Engineering	$225,000	$225,000	$225,000	$225,000
Contingency (15%)	$7,116,000	$5,622,000	$5,255,000	$4,497,000
Environmental Report	$125,000	$125,000	$125,000	$100,000
Wetland Mitigation	$100,000	$100,000	$100,000	$100,000
Review Fees	$15,000	$15,000	$15,000	$15,000
Permitting	$150,000	$150,000	$150,000	$150,000
Administration & Legal	$300,000	$300,000	$300,000	$150,000
WWTP Total Project Estimate	**$66,456,000**	**$53,008,000**	**$49,704,000**	**$41,208,000**

1. Recycled water irrigation system costs are defined in Section 4.6.
2. Land acquisition to accommodate recycled water storage expansion systems.

FIGURE 4.5.1
COMPLETE WWTP ALTERNATIVES



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THE DYER PARTNERSHIP ENGINEERS & PLANNERS DATE: OCTOBER 2018 PROJECT NO.: 100.26	**CITY OF MOLALLA** **WASTEWATER FACILITY & COLLECTION SYSTEM MASTER PLAN** **PS #1 PRELIMINARY SITE PLAN**	FIGURE NO. **4.5.2**

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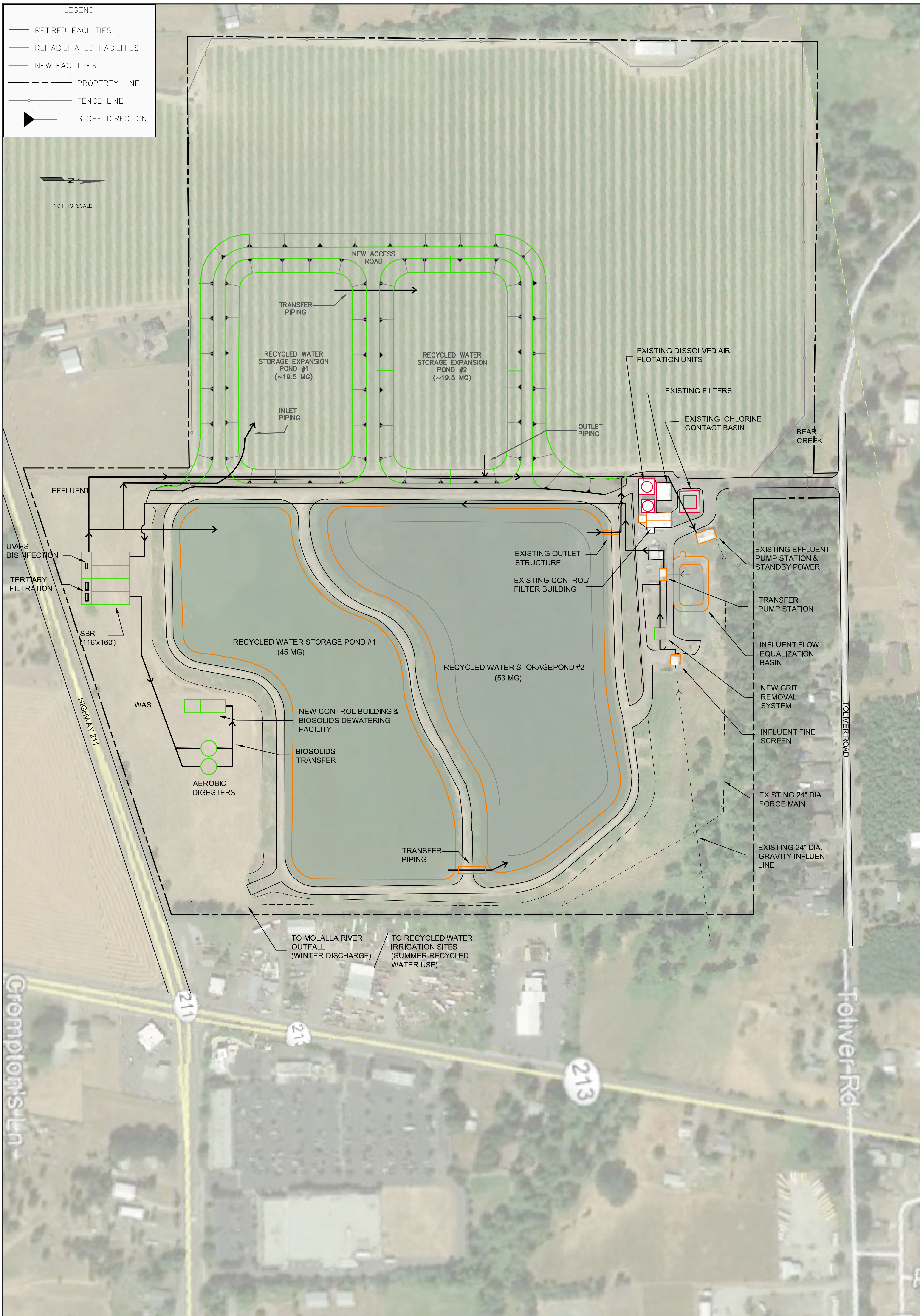

THE DYER PARTNERSHIP ENGINEERS & PLANNERS	CITY OF MOLALLA WASTEWATER FACILITY & COLLECTION SYSTEM MASTER PLAN	FIGURE NO.
DATE: OCTOBER 2018 PROJECT NO.: 100.26	**PS #2 & #3 PRELIMINARY SITE PLAN**	**4.5.3**

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THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	**CITY OF MOLALLA** **WASTEWATER FACILITY & COLLECTION SYSTEM MASTER PLAN**	FIGURE NO.
DATE: OCTOBER 2018	**PS #4 PRELIMINARY SITE PLAN**	**4.5.4**
PROJECT NO.: 100.26		

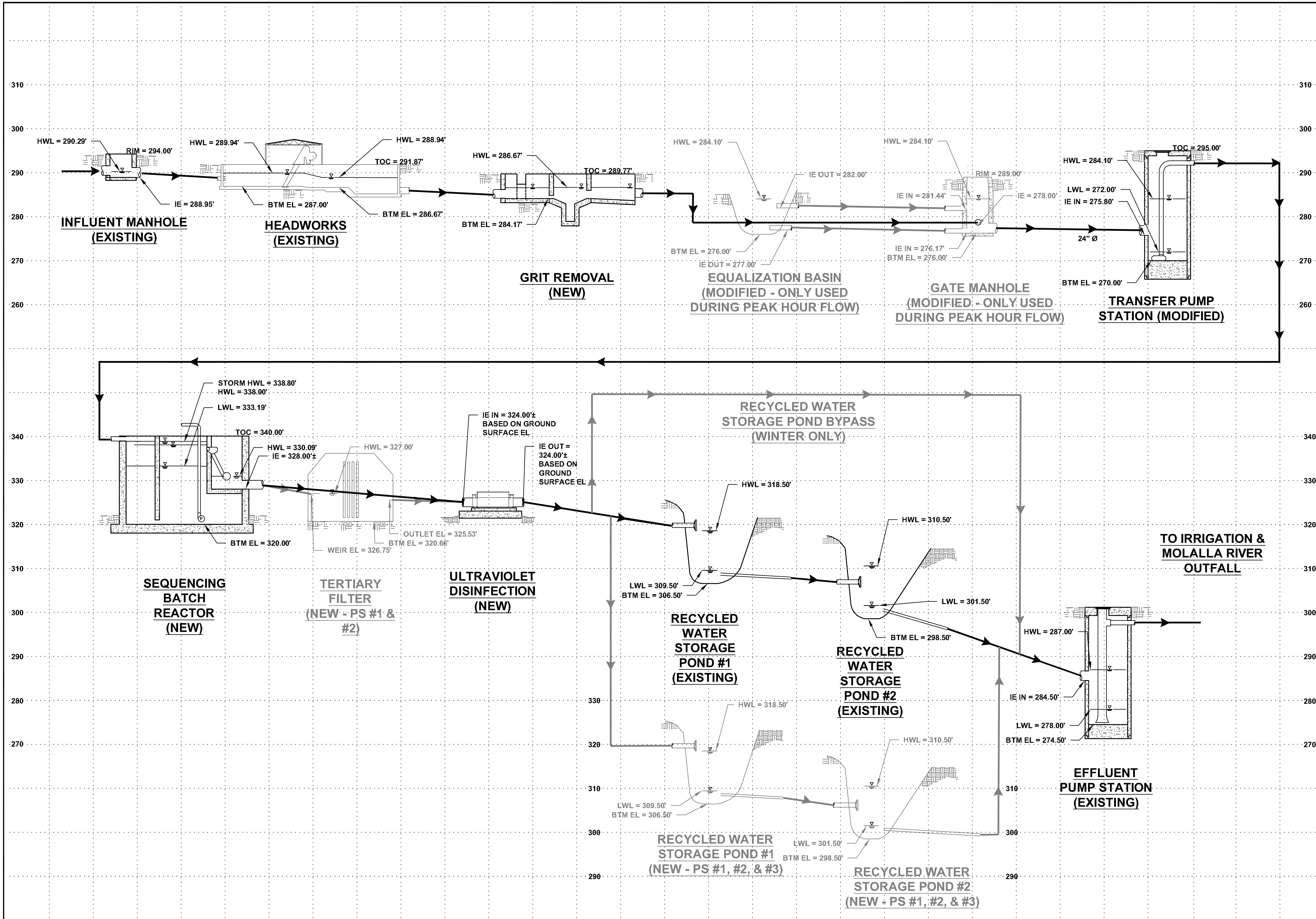

FIGURE NO. 4.5.5

CITY OF MOLALLA
WASTEWATER FACILITY & COLLECTION SYSTEM MASTER PLAN

HYDRAULIC PROFILE

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS

DATE: OCTOBER 2018

PROJECT NO.: 100.26

PLOT DATE October 30, 2018

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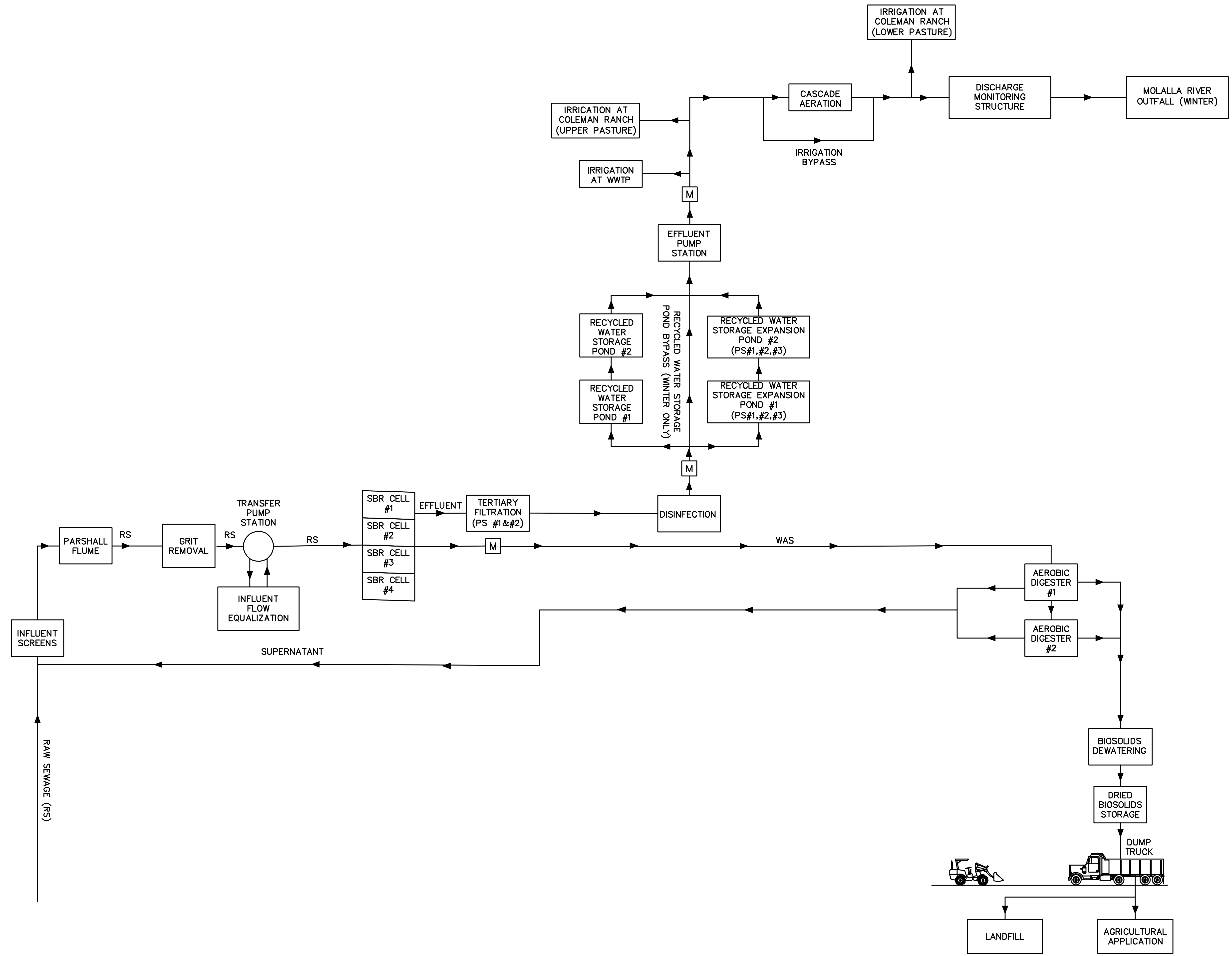


FIGURE NO. **4.5.6**

CITY OF MOLALLA
WASTEWATER FACILITY & COLLECTION SYSTEM MASTER PLAN
WASTEWATER TREATMENT PLANT PROCESS SCHEMATIC

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS

DATE: OCTOBER 2018

PROJECT NO.: 100.26

<u>4.6 Effluent Disposal</u>

The method of effluent disposal is one of the most important issues facing the City of Molalla. The City must resolve effluent disposal capacity limitations and establish a long term plan for disposing of flows that are projected to almost double in the next 20 years. In the wintertime, the City frequently violates mass load restrictions when discharging to the Molalla River. During the summer, the City is unable to irrigate recycled water at rates necessary to satisfy a water balance.

Effluent disposal recommendations summarized in this section are prepared for Permit Scenario (PS) #1, PS #2, PS #3, and PS #4.

Future Quantity of Recycled Water

The future quantity of recycled water has a tremendous impact on the viability of effluent disposal expansion options, and is consequently quantified herein. In 2043, average dry weather flows are projected to be approximately 1.9 MGD. Figure 4.6.1 illustrates the future quantity of dry weather flows (May – October).

FIGURE 4.6.1
FUTURE QUANTITY OF RECYCLED WATER

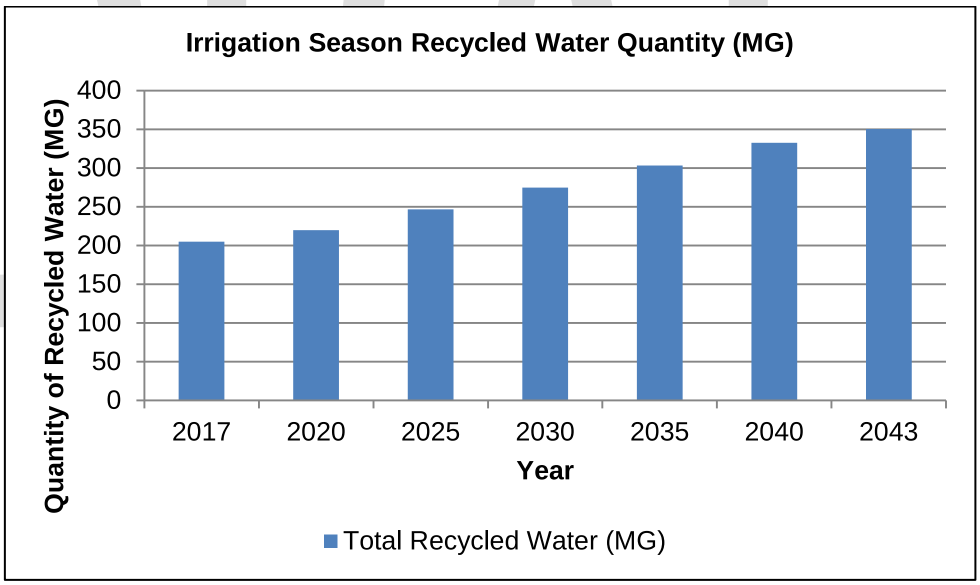
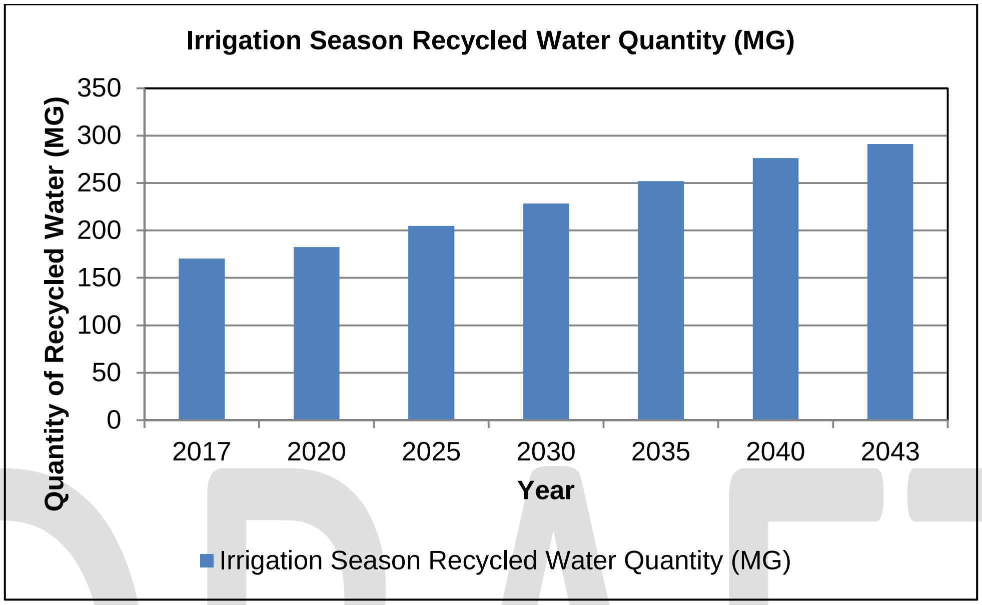


Figure 4.6.2 shows the future quantity of recycled water, assuming that recycled water generated in October is stored in the facultative/storage lagoons and eventually discharged to the Molalla River during the winter months. This strategy is only pursuable if an appropriate mass load increase is approved.

FIGURE 4.6.2
FUTURE QUANTITY OF RECYCLED WATER (OCTOBER HOLDING AND DISCHARGE)[1]



1. Total quantity of recycled water generated from May 1 to September 31. Assumes treated wastewater is stored in lagoons in October and discharged to the Molalla River during the winter months.

With an ability to discharge to the Molalla River in May (PS #2 and PS #4), when river conditions allow, the quantity of recycled water destined for land application is reduced even further.

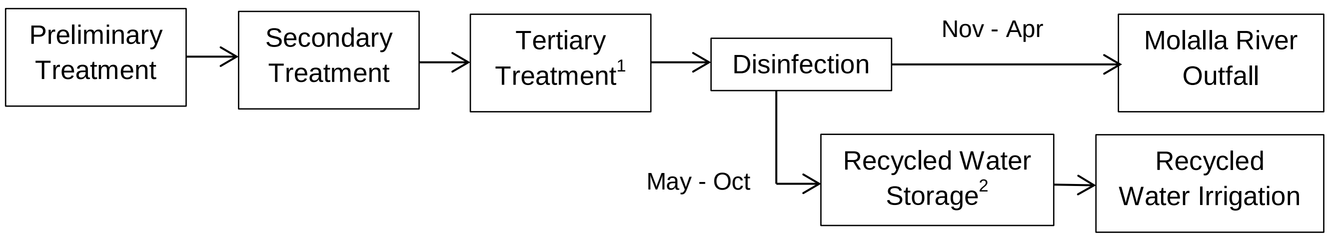
Recycled Water Land Application Area Requirements

Recycled water land application area requirements are dependent on the pending NPDES Permit modification applications, and site characteristics, including, but not limited to: soil type, topography, depth to groundwater, land use, efficiency of irrigation operations, climate, and many other factors. Preliminary estimates for land application area requirements are further explored and defined in this section. Costs in this section are based on average land area requirements based on future flow conditions.

Land Application Area PS #1

This strategy assumes that all influent wastewater from May to October is destined for land application after treatment. PS #1 assumes that a mass load increase is not approved; therefore, excess water cannot be stored during the summer for eventual discharge to the Molalla River during the winter months, due to mass load restrictions. This scenario would require additional recycled water storage (approximately 35 acres of pond surface area), as well as additional land area for recycled water irrigation (approximately 400 to 650 acres) to accommodate future flows. Figure 4.6.3 illustrates the effluent disposal strategy for PS #1.

FIGURE 4.6.3
EFFLUENT DISPOSAL PROCESS SCHEMATIC
PS #1



1. Required when discharging to Molalla River if suitable mass load increase is not approved.
2. Existing Lagoons #1 and #2 plus recycled water storage expansion systems.

Cost estimates for expanding force main systems to future irrigation sites, and installing irrigation equipment, are estimated in Table 4.6.1. Future costs of irrigation expansion systems are highly variable based on actual locations of recycled water irrigation sites, method of irrigation, site characteristics, and other factors. Cost estimates herein assume that recycled water force mains are extended to Site # 2, 3, 4, 5, 6, 9, and 10, as illustrated in Figure 4.6.7. If different sites are selected or required, additional costs would be incurred.

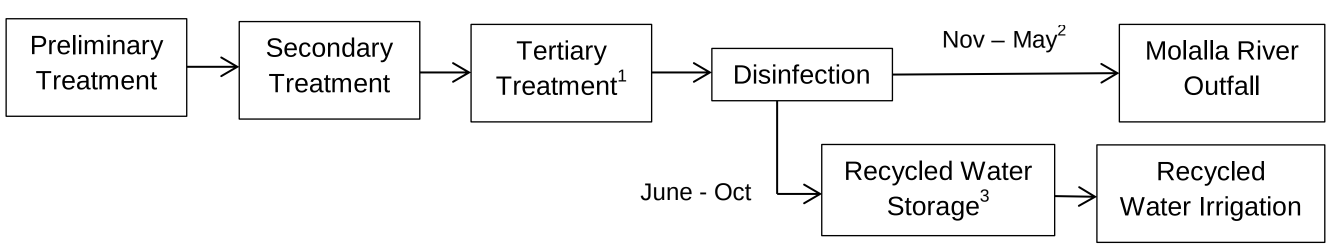
TABLE 4.6.1
RECYCLED WATER IRRIGATION EXPANSION SYSTEMS
PS #1

Item	Cost Estimate
Force Main & Irrigation System Expansions	$2,010,000

Land Application Area PS #2

This strategy is similar to the effluent disposal strategy adopted for PS #1, but takes into account the ability to discharge conditionally to outfall 001 during May. Discharging flows to the river during May reduces the overall area required for land application of recycled water and the future volume of recycled water storage. Based on 2043 flows, approximately 150 to 275 acres of additional land is required, along with an additional 10 acres (approximate surface area of expansion pond) of recycled water storage. Figure 4.6.4 illustrates the effluent disposal strategy for PS #2.

FIGURE 4.6.4
EFFLUENT DISPOSAL PROCESS SCHEMATIC
PS #2



1. Required when discharging to Molalla River outfall if suitable mass load increase is not approved.
2. Discharge in May dependent on acceptable river conditions.
3. Existing Lagoons #1 and #2 plus recycled water storage expansion systems.

Cost estimates for expanding force main systems to future irrigation sites, and installing irrigation equipment, are estimated in Table 4.6.2. Cost estimates assume that recycled water force mains are extended to site # 3, 4, and 5, as illustrated in Figure 4.6.7. Additional costs would be incurred if alternative sites are selected, or if the selected sites require significant setbacks, or result in unusable area.

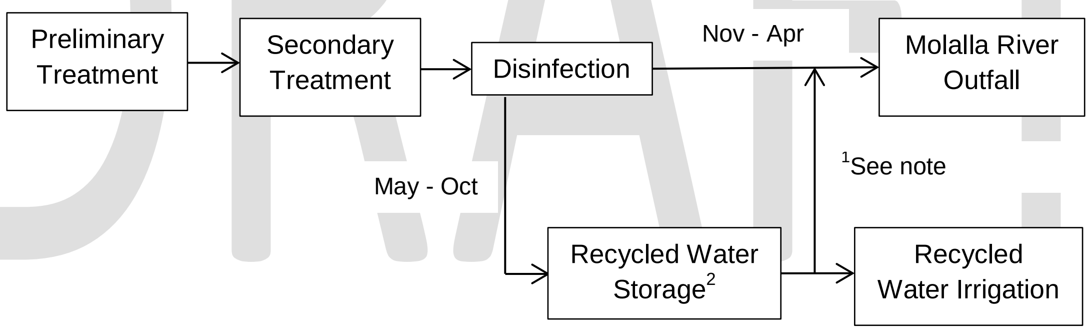
TABLE 4.6.2
RECYCLED WATER IRRIGATION EXPANSION SYSTEMS
PS #2

Item	Cost Estimate
Force Main & Irrigation System Expansions	$1,170,000

Land Application Area PS #3

This effluent disposal scenario assumes that DEQ authorizes a mass load increase for the Molalla River outfall, but discharge to the Molalla River is only allowed November - April. The exact mass load adjustment is unknown, but it is assumed that the mass load allocation is in alignment with Willamette Basin standards as well as future flow projections and additional flow contributions resulting from summer storage of effluent. Figure 4.6.5 illustrates the effluent disposal strategy for PS #3.

FIGURE 4.6.5
EFFLUENT DISPOSAL PROCESS SCHEMATIC
PS #3



1. Some flows are stored over the summer for eventual discharge to the Molalla River outfall during the winter months.
2. Existing Lagoons #1 and #2 plus recycled water storage expansion systems.

This option assumes a sensible expansion of area for land application of recycled water, along with some summer holding and eventual surface water discharge during the winter months. Estimated lagoon (i.e. recycled water storage) area and additional irrigation area requirements are projected for the planning period in Table 4.6.3.

TABLE 4.6.3
PROJECTED RECYCLED WATER STORAGE AND IRRIGATION AREA (2043)

Additional Storage Area	Additional Irrigation Area[1]	Molalla River Outfall
(Acres)	(Acres)	(MGD)
0	NP[2]	NP
5	> 200	4.8
10	> 100	5
15	> 50	5.2
20	0	5.3

1. Area based on ideal conditions. More area required to account for irrigation inefficiencies, setbacks, irrigation output during border months, etc.
2. NP = not possible.

The recommended alternative for PS #3 assumes the addition of 10 acres of land (approximate surface area of expansion pond) for recycled water storage, and between 100 to 250 acres for recycled water irrigation. Ranges are provided for land area requirements to take into account variability in irrigation efficiency, inconsistency in irrigation amounts during the border months, useable acreage based on setbacks, and other factors. Water balance calculations are included in Appendix D. A summary of the existing and future water balance is provided in Table 4.6.4.

TABLE 4.6.4
WATER BALANCE SUMMARY
PS #3

Year	Flows (MGD)		Molalla River Discharge[1]	Facility Requirements (Acres)[2]			
	ADWF	AWWF	(MGD)	Irrigation (ex)	Irrigation (add)	Storage (ex)	Storage (add)
2017	1.1	2.48	2.9	444.5	0	25	0
2025	1.34	2.98	3.4	444.5	0	25	0
2035	1.65	3.67	4.4	444.5	~50 to 125	25	5
2043	1.90	4.24	5.0	444.5	~100 to 250	25	10

1. Molalla River discharge assumes that October flows (or excess summer time flows) are stored in the lagoon and discharged over the winter months.
2. Storage area (acres) represents total area at average water depth. Existing storage area indicated by (ex). Assumes existing lagoons are dredged and lined.

Cost estimates for expanding force main systems to future irrigation sites, and installing irrigation equipment, are estimated in Table 4.6.5. Cost estimates assume that recycled water force mains are extended to site # 3, 4, and 5, as illustrated in Figure 4.6.7. Additional costs are anticipated if different sites are selected or required.

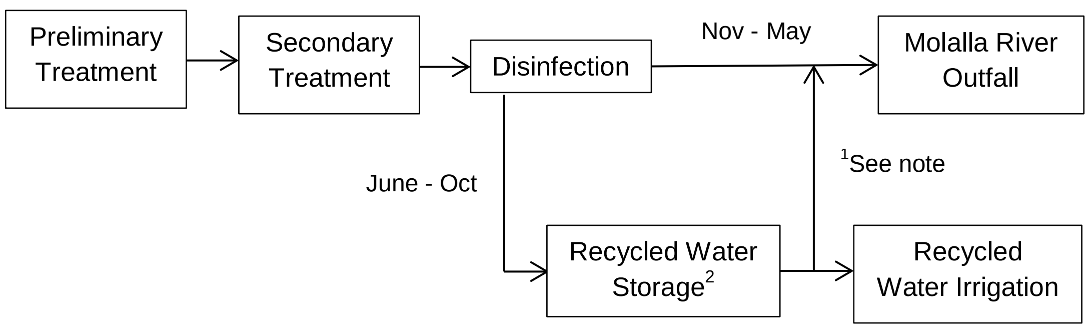
TABLE 4.6.5
RECYCLED WATER IRRIGATION EXPANSION SYSTEMS
PS #3

Item	Cost Estimate
Force Main & Irrigation System Expansions	$1,110,000

Land Application Area PS #4

Ideally, the City is successful in securing all pending permit modifications to the NPDES Permit. With condition PS #4, the City will normally be able to discharge to the Molalla River from November through May (when river conditions allow); in all except the driest of years. River conditions in October are generally unfavorable for discharge, and also for land application of recycled water. Thus, to reduce labor associated for recycled water irrigation, final effluent generated in October will be stored in the storage ponds and discharged to the Molalla River over the winter months. Figure 4.6.6 summarizes the proposed effluent disposal strategy for PS #4.

FIGURE 4.6.6
EFFLUENT DISPOSAL PROCESS SCHEMATIC
PS #4



1. October flows (or excess summertime flows) are stored in the storage ponds and eventually discharge to the Molalla River outfall during the winter months.
2. Existing Lagoon #1 and #2.

Given the above strategy, the projected facility requirements are summarized in Table 4.6.6. Water balance calculations are provided in Appendix D.

TABLE 4.6.6
WATER BALANCE SUMMARY
PS #4

Year	**Flows (MGD)**		**Molalla River Discharge: Nov-May[1]**	**Facility Requirements (Acres)[2]**			
	ADWF	AWWF	(MGD)	Irrigation (ex)	Irrigation[3] (add)	Lagoon (ex)	Lagoon (add)
2017	1.1	2.48	2.7	444.5	0	25	0
2025	1.34	2.98	3.3	444.5	0	25	0
2035	1.65	3.67	4.0	444.5	~50	25	0
2043	1.90	4.24	4.6	444.5	~100	25	0

1. Molalla River discharge assumes that October flows (or excess summertime flows) are stored in the lagoon and discharged over the winter months.
2. Lagoon areas (acres) represent total area at average water depth. Existing lagoon area indicated by (ex). Assumes existing lagoons are dredged and lined. Irrigation acres are minimum based on estimates.
3. City should secure land greater than values listed to introduce factor of safety into effluent disposal systems.

To account for the anticipated flows during the 2043 planning period, the City will need to add another 100 acres (approximately) of land for irrigation of recycled water. This assumes that May flows are discharged to the Molalla River, and October flows are stored in the lagoons and eventually discharged to the Molalla River during the winter months. Additional land reserves should be identified and secured, beyond the above requirements, to provide a contingency, redundancy, and to facilitate irrigation of recycled water in May during the driest of years when discharge to the Molalla River is not permitted.

Cost estimates for expanding force main systems to future irrigation sites, and installing irrigation equipment, are estimated in Table 4.6.7. Cost estimates assume that recycled water force mains are extended to Site # 4 as illustrated in Figure 4.6.7. If different sites are selected or required, additional costs would be incurred.

TABLE 4.6.7
RECYCLED WATER IRRIGATION EXPANSION SYSTEMS
PS #4

Item	Cost Estimate
Force Main & Irrigation System Expansions	$413,000

Future Land Application Area

An overview of existing land application sites and future potential land application sites is provided in this section.

The City will land apply recycled water in accordance with the DEQ approved RWUP. The City submitted an amended RWUP (The Dyer Partnership, 2018) to DEQ in 2018, based on Class C requirements. The DEQ approved the RWUP (The Dyer Partnership, 2018) on September 27, 2018. Table 4.6.8 summarizes the existing useable acreage and recycled water capacity for each land application site; all based on Class C setbacks.

TABLE 4.6.8
SUMMARY OF LAND APPLICATION SITES (CLASS C)

Site	Useable Acreage (Acres)	Recycled Water Capacity (MG)
North Coleman Ranch Site	270	121.7
South Coleman Ranch Site	163	74.7
Cemetery Site	3.4	1.5
WWTP Site	8.1	3.5
Total	**444.5**	**201.5**

The City will continue to apply Class C recycled water, even after the new WWTP is constructed, but will have an option for converting existing sites to Class B, in the future if desired. The new WWTP will be designed to target Class B standards (at minimum). Targeting the production of Class B recycled water reduces setbacks requirements, and increases the capacity of existing land application sites. Assuming Class B setbacks; the useable acreage increases to almost 500 acres, and the resulting capacity is 223 MG, assuming minimal irrigation occurs in May and October. Table 4.6.9 summarizes the useable acreage and corresponding recycled water capacity of existing land application sites, assuming the production and application of Class B recycled water.

TABLE 4.6.9
SUMMARY OF LAND APPLICATION SITES (CLASS B)

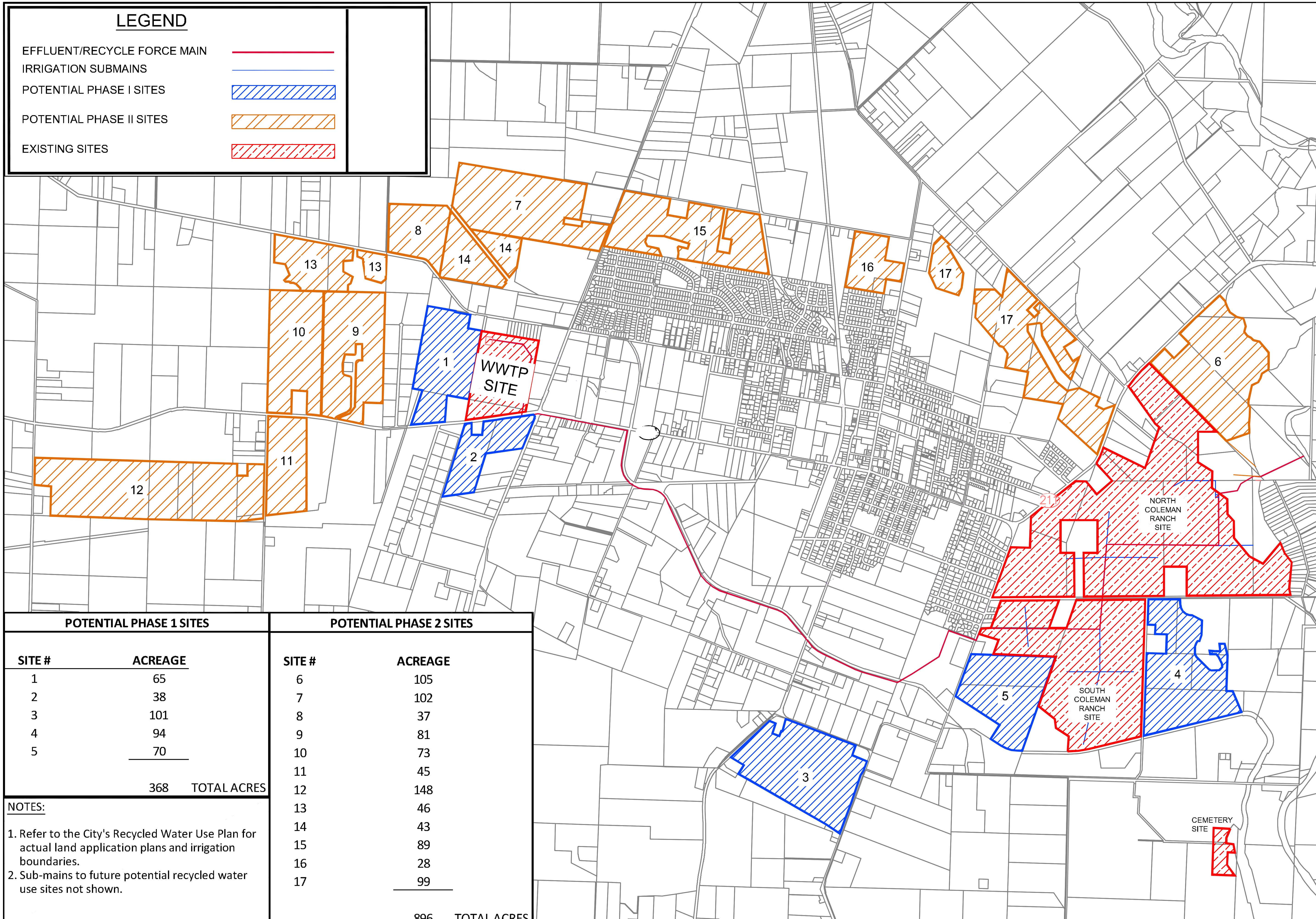
Site	Useable Acreage (Acres)	Recycled Water Capacity (MG)
North Coleman Ranch Site	287	129.4
South Coleman Ranch Site	185	84.8
Cemetery Site	6.6	3
WWTP Site[1]	14	6.1
Total	**492.6**	**223.3**

1. Useable irrigation area at the WWTP will be reduced after construction of the new WWTP.

As shown in the above tables, the majority of existing recycled water is land applied on to Coleman Ranch. While this is convenient and cost effective, if the agreement dissolves, or if problems arise with any of the irrigation sites that restrict or suspend irrigation amounts, the City lacks an insurance policy to ensure satisfactory disposal of effluent. Therefore, immediately expanding effluent disposal systems is absolutely necessary.

Figure 4.6.7 illustrates locations of potential future recycled water irrigation sites. Existing irrigation sites are shown for planning level purposes. For actual land application plans pertinent to existing DEQ approved land application sites, refer to the approved RWUP. Preliminary (potential) sites were selected based on their proximity to the WWTP and/or existing effluent/recycled water force main. Site selections summarized herein are not intended to imply site suitability and acceptability. Additionally, useable acreage values specified are preliminary, and prepared without an analysis of existing site conditions. Each site requires further investigatory work to determine suitability and actual useable acreage available for land application of recycled water. Factors that influence site selection include, but are not limited to: topography, geology, soils, depth to groundwater, land use, and several other factors. Future potential irrigation sites are separated into two phases, based solely on their location to existing recycled water infrastructure. Future submains are not shown in Figure 4.6.7, and will require further planning and design after sites are selected for use.

In order to ensure the long-term sustainability of the City’s effluent disposal systems, the City should also weigh the pros and cons of purchasing property for irrigation of recycled water. Property ownership increases the long-term security and dependability of effluent disposal systems; and eliminates the potential loss of property arising from changes in private landowner land use objectives. The primary disadvantage of property ownership is the capital costs associated with property acquisition. Historical and comparable sales records from Clackamas County were analyzed to develop a planning level cost estimate for property acquisition. Parcels ranging from 40 to 100 acres in the proximity of the WWTP and/or recycled/effluent force main, although highly variable, recently sold for $10,000 to $14,000 per acre.



POTENTIAL PHASE 1 SITES

SITE #	ACREAGE
1	65
2	38
3	101
4	94
5	70
	368 TOTAL ACRES

POTENTIAL PHASE 2 SITES

SITE #	ACREAGE
6	105
7	102
8	37
9	81
10	73
11	45
12	148
13	46
14	43
15	89
16	28
17	99
	896 TOTAL ACRES

NOTES:

1. Refer to the City's Recycled Water Use Plan for actual land application plans and irrigation boundaries.
2. Sub-mains to future potential recycled water use sites not shown.

FIGURE NO. **4.6.7**

CITY OF MOLALLA
WASTEWATER FACILITY & COLLECTION SYSTEM MASTER PLAN
FUTURE POSSIBLE RECYCLED WATER LAND APPLICATION SITES

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS

DATE: OCTOBER 2018
PROJECT NO.: 100.26

Winter Surface Water Discharge (Molalla River)

The NPDES Permit will require two permit modification applications; one of which is currently undergoing DEQ review, and a future permit modification application that will be submitted to DEQ when the new WWTP is constructed based on future flows.

Proposed Permit Modification Application #1

The City recently submitted an NPDES Permit modification application based on the Willamette Basin standards and flow data from the existing WWTPs 2007 design documents. The NPDES Permit should be based on the Willamette Basin standards of 30 mg/L BOD_5/TSS (monthly) and 45 mg/L BOD_5/TSS (weekly). Flows from the 2007 design documents are presented in Table 4.6.10.

TABLE 4.6.10
2007 DESIGN DOCUMENT FLOWS

Parameter	2005 (MGD)	2015 (MGD)	2025 (MGD)
ADWF	0.8	1.1	1.4
MMDWF	1.28	1.7	2.3
AWWF	1.3	2.3	3.0
MMWWF	2.04	3.1	4.1
PDF	7.06	8.5	10.3

1. Derived from Tetra Tech/KCM 2007 Wastewater Treatment Plant Improvements Drawings.

The interim permit limits should be based on the following:

1. May 1 through October 31: During this period the permittee must comply with the limits in Table 4.6.7 while discharging to waters of the state. Discharge may not commence until gauged stream flow exceeds 350-cfs and will cease when the average stream flow for the previous seven-day-period is less than 350-cfs.

2. November 1 through April 30: During this time period the permittee must comply with the limits in Table 4.6.11 while discharging to waters of the state.

3. During the term of this permit, the effluent quality must comply with the limits in the following table:

TABLE 4.6.11
PROPOSED NPDES PERMIT LIMITS

Parameter	Units	Average Monthly	Average Weekly	Daily Maximum
BOD_5 (May 1 – October 31)	mg/L	10	15	-
	lbs/day	190	290	380
	% removal	85	-	-
TSS (May 1 – October 31)	mg/L	10	10	-
	lbs/day	190	290	380
	% removal	85	-	-
BOD_5 (November 1 – April 30)	mg/L	30	45	-
	lbs/day	1000	1500	2000
	%	85	-	-
TSS (November 1 – April 30)	mg/L	30	45	-
	lbs/day	1000	1500	2000
	%	85	-	-
pH[b]	SU	Between 6.0 and 9.0		
Design Effluent Flow Dry Season	MGD	2.30	-	-
Design Effluent Flow Wet Season	MGD	4.10		
Total Residual Chlorine[c]	mg/L	0.07	-	0.18
E. coli[ad]	MPN/100 ml	126	-	406
Ammonia	mg/L	16.7	-	25.9
Excess Thermal Load (May)	Shall not exceed a 7-day moving average of the daily excess thermal loads of 77.95 million kcals/day.			
Excess Thermal Load (June)	Shall not exceed a 7-day moving average of the daily excess thermal loads of 72.38 million kcals/day.			
Excess Thermal Load (July, August, September)	No Thermal Load Available – Effluent temperature must be less than 16°C.			
Excess Thermal Load (October)	Shall not exceed a 7-day moving average of the daily excess thermal loads of 42.43 million kcals/day.			
Dilution	Discharge may not commence until gauged stream flow exceeds 350-cfs and will cease when the average stream flow for the previous seven-day-period is less than 350-cfs.			

Notes:

a. No single *E. coli* sample may exceed 406 organisms per 100 mL. The permittee may take at least 5 consecutive re-samples at 4-hour intervals beginning within 48 hours after the original sample was taken and the geometric mean of the 5 re-samples is less than or equal to 126 *E. coli* organisms/100 mL to demonstrate compliance with the limit.

b. May not be outside the range of 6.0 to 9.0 S.U.

c. DEQ has established a minimum Quantitation Limit of 0.05 mg/L for Total Residual Chlorine. In cases where the average monthly or maximum daily limit for Total Residual Chlorine is lower than the Quantitation Limit, DEQ will use the reported Quantitation Limit as the compliance evaluation level.

d. Reported as a monthly geometric mean.

4. Additional information for the limits in the previous table.

    a. The BOD_5 concentration limits are considered equivalent to the minimum design criteria for BOD_5 specified in OAR Chapter 340, Division 41.

    b. Mass Load limits for winter time discharge are based on 4.10 MGD. Mass load limits for the summer time are based on 2.3 MGD.

Proposed Permit Modification Application #2

Critical elements of the proposed future permit, based upon future flows, are summarized below and in Table 4.6.12.

1. May 1 through October 31: During this period the permittee must comply with the limits in Table 4.6.12 while discharging to waters of the state. Discharge may not commence until gauged stream flow exceeds 350-cfs and will cease when the average stream flow for the previous seven-day-period is less than 350-cfs.
2. November 1 through April 30: During this time period the permittee must comply with the limits in Table 4.6.12 while discharging to waters of the state.
3. During the term of this permit, the effluent quality must comply with the limits in the following table:

TABLE 4.6.12
FUTURE POTENTIAL NPDES PERMIT

Parameter	Units	Average Monthly	Average Weekly	Daily Maximum
BOD_5 (May 1 – October 31)	mg/L	10	15	-
	lbs/day	271	407	542
	% removal	85	-	-
TSS (May 1 – October 31)	mg/L	10	10	
	lbs/day	271	407	542
	% removal	85	-	-
BOD_5 (November 1 – April 30)	mg/L	30	45	-
	lbs/day	1326	1989	2652
	%	85	-	-
TSS (November 1 – April 30)	mg/L	30	45	-
	lbs/day	1326	1989	2652
	%	85	-	
pH[b]	SU	Between 6.0 and 9.0		
Design Effluent Flow Dry Season	MGD	3.25	-	-
Design Effluent Flow Wet Season	MGD	5.30	-	-
Total Residual Chlorine[c]	mg/L	0.07	-	0.18
E. coli[ad]	MPN/100 ml	126	-	406
Ammonia	mg/L	16.7	-	25.9
Excess Thermal Load (May)	Shall not exceed a 7-day moving average of the daily excess thermal loads of 77.95 million kcals/day.			
Excess Thermal Load (June)	Shall not exceed a 7-day moving average of the daily excess thermal loads of 72.38 million kcals/day.			
Excess Thermal Load (July, August, September)	No Thermal Load Available – Effluent temperature must be less than 16°C.			
Excess Thermal Load (October)	Shall not exceed a 7-day moving average of the daily excess thermal loads of 42.43 million kcals/day.			
Dilution	Discharge may not commence until gauged stream flow exceeds 350-cfs and will cease when the average stream flow for the previous seven-day-period is less than 350-cfs.			

Notes:

a. No single *E. coli* sample may exceed 406 organisms per 100 mL. The permittee may take at least 5 consecutive re-samples at 4-hour intervals beginning within 48 hours after the original sample was taken and the geometric mean of the 5 re-samples is less than or equal to 126 *E. coli* organisms/100 mL to demonstrate compliance with the limit.
b. May not be outside the range of 6.0 to 9.0 S.U.
c. DEQ has established a minimum Quantitation Limit of 0.05 mg/L for Total Residual Chlorine. In cases where the average monthly or maximum daily limit for Total Residual Chlorine is lower than the Quantitation Limit, DEQ will use the reported Quantitation Limit as the compliance evaluation level.
d. Reported as a monthly geometric mean.

4. Additional information for the limits in the above table.

   a. The BOD_5 concentration limits are considered equivalent to the minimum design criteria for BOD_5 specified in OAR Chapter 340, Division 41.

   b. Mass load limits for summer time discharge are based on 3.25 MGD.

   c. Mass load limits for winter time discharge are based on 5.30 MGD.

4.7 Phasing

The City of Molalla's population is projected to steadily increase, generally in congruence with historical trends, over the next twenty years. To more closely align the capital improvements with the population trajectory, the recommended collection and WWTP improvements were evaluated on their ability to incorporate phasing into their construction sequencing. Phasing options will be contingent upon the outcome of the permit modification application. Preliminary phasing considerations are summarized below.

- Lagoon Dredging, Dewatering, and Disposal

  Lagoon dredging should begin immediately, based on financial capabilities, to address severe storage deficiencies and treatment limitations. Dredging will also be required once the lagoons are converted to recycled water storage ponds.

- Collection System Improvements

  I/I reduction can be phased based on identified needs and as funding is allocated. Collection system improvements can be phased over the next several years. Collection system improvement projects are separated into three phases and prioritized based on severity of deficiencies.

- WWTP Improvements

  The influent fine screen expansion can be completed immediately based on funding availability. The grit removal system, influent flow equalization conversion, transfer pump station upgrades, SBR, tertiary filtration (PS #1 or PS #2), disinfection systems, aerobic digester, biosolids dewatering facilities, all have limited phasing opportunities. The improvements would likely consist of a comprehensive WWTP upgrade project.

- Recycled Water Storage

  Conversion of lagoon #1 and #2 into recycled water storage systems will occur during the WWTP improvements project. Recycled water expansion systems, for PS #1, PS #2, and PS #3, can be phased in based on actual flows, impacts of collection system improvement projects, and actual population growth. However, land acquisition, to accommodate recycled water storage expansion systems for PS #1, PS #2, and PS #3, should commence prior to actual construction of the WWTP improvement projects.

- Recycled Water Land Application Sites

  Regardless of the future permit condition (PS #1 – PS #4), the City should begin to immediately evaluate and secure land for the application of recycled water. The amount of land required, and the rate at which land is identified and allocated, is directly proportional to the land required as specified in previous sections. In general, for all permit scenarios, eventually the rate of recycled water land expansion should outpace but follow the population trajectory.

- Biosolids Land Application

  The City's Biosolids Management Plan should be updated to expand land available for biosolids application. To reduce biosolids disposal costs, land area should be expanded immediately, as available land is currently deficient. Eventually, however, the expansion of land application sites could follow demand due to population growth.

4.8 Operation and Maintenance

Preliminary O&M cost estimates for the recommended collection and WWTP improvements were developed for the 2043 planning year. Successful completion of I/I reduction projects will theoretically result in reduced wastewater flows, correlating to a decrease in electrical and operational costs associated with collection system and WWTP systems. O&M costs for the influent fine screen expansion, grit removal, SBR, tertiary treatment systems (if required) disinfection systems, aerobic digester, biosolids management systems, are summarized in Table 4.8.1, below.

The existing tertiary treatment systems, disinfection systems, and aerated lagoon aerators will be abandoned and demolished as part of the WWTP improvements. Accordingly, the O&M costs associated with these systems will be deducted from the City's current expenditures. O&M cost estimates are for preliminary purposes. Costs include equipment repair and replacement expenditures for short lived assets.

TABLE 4.8.1
SUMMARY OF ANNUAL O&M COST ESTIMATES (2043)

Item	Annual Cost PS #1	Annual Cost PS #2	Annual Cost PS #3	Annual Cost PS #4
Influent Screen	$20,000	$20,000	$20,000	$20,000
Grit Removal	$14,000	$14,000	$14,000	$14,000
Transfer Pump Station	$44,012	$44,012	$44,012	$44,012
SBR	$159,000	$159,000	$159,000	$159,000
Tertiary Filters	$17,000	$17,000	-	-
Effluent Pump Station	$136,756	$136,756	$136,756	$136,756
Aerobic Digester	$105,000	$105,000	$105,000	$105,000
Biosolids Processing Facility	$28,000	$28,000	$28,000	$28,000
Disinfection (HS/UV)	$41,000	$41,000	$41,000	$41,000
Biosolids Disposal	$267,038	$267,038	$267,038	$267,038
Effluent Disposal / Land Application	$350,000	$300,000	$300,000	$250,000
WWTP Annual O&M Estimate Total	**$1,182,000**	**$1,132,000**	**$1,115,000**	**$1,065,000**
WWTP 20 Yr Present Worth (3.2%)	**$17,264,000**	**$16,534,000**	**$16,286,000**	**$15,555,000**

Future O&M expenditures for land application/irrigation systems are a function of the NPDES permit and the amount of recycled water that must be land applied. Generally, as the area of land required is increased, O&M costs follow suit. O&M expenditures will vary based on the location of land application sites, irrigation methods, and other variables. City staff estimates that current O&M expenditures during the irrigation season are approximately $90,000 per year, excluding disinfection costs (chemical costs). However, the costs are provided with the caveat that they are not entirely inclusive because in past years the City has not always irrigated at amounts necessary to satisfy a water balance. With that in mind, cost estimates for irrigation O&M are provided at a lower confidence level and based entirely on historical dollars per volume of recycled water irrigated.

4.9 Short Lived Assets

A reserve fund should be established to fund equipment repair and replacement needs over the anticipated twenty-year life of the WWTP. Estimated equipment repair, rehabilitation, and replacement expenditures for a twenty-year planning period are summarized in Table 4.9.1. Items listed include existing wastewater treatment plant systems. Long-term capital financing facilities are excluded from the estimates. Refer to Appendix C for a detailed breakdown of short lived assets.

TABLE 4.9.1
SUMMARY OF SHORT LIVED ASSETS

Item	Annual Cost PS #1 & PS #2	Annual Cost PS #3 & PS #4
Influent Screen	$6,000	$6,000
Grit System	$8,567	$8,567
Transfer Pump Station	$4,600	$4,600
SBR	$18,733	$18,733
Tertiary Filtration (PS #1 & PS #2)	$7,630	-
UV/HS Disinfection	$6,467	$6,467
Effluent Pump Station	$10,333	$10,333
Aerobic Digesters	$3,033	$3,033
Biosolids Screw Press Systems	$5,000	$5,000
Misc. Instrumentation and Controls	$20,133	$20,133
WWTP Annual Short Lived Asset Total	**$90,000**	**$82,000**

SECTION 5:

RECOMMENDED PLAN

SECTION 5: **RECOMMENDED PLAN**

This section summarizes the recommended improvements to provide adequate conveyance, treatment, and effluent disposal capacity to serve the City of Molalla's needs through the year 2043. The project descriptions, costs, and timing are intended to serve as the basis for a Capital Improvement Plan (CIP) for implementing the necessary improvements.

Wastewater collection and treatment system improvements are scheduled in three phases. Phase 1 improvements will consist of high priority collection system improvement projects and Wastewater Treatment Plant (WWTP) improvements to ultimately establish compliance with the City's NPDES Permit. Phase 2 and Phase 3 improvements will be comprised of collection system Inflow and Infiltration (I/I) repair projects, increasing conveyance capacity, upgrading pump stations, expanding effluent disposal systems, and expanding biosolids disposal sites.

With the pending permit modification applications, the recommended plans summarized herein, are developed for four potential Permit Scenarios (PS #1, PS #2, PS #3, and PS #4), as previously depicted and defined in Section 4 and Figure 4.0.1.

5.1 Future Flow and Load Projections

The future flows and loadings are presented in Table 5.1.1, below. For comparative purposes, the table also includes the current facility's design flows.

TABLE 5.1.1
WASTEWATER FLOWS AND LOADS

PARAMETER	2017	2043	
Population	9,939	16,977	
Base Sewage	0.89 MGD	90 gpcd	1.52 MGD
Base Infiltration	0.22 MGD	23 gpcd	0.38 MGD
AAF	1.85 MGD	186 gpcd	3.16 MGD
ADWF	1.11 MGD	112 gpcd	1.90 MGD
AWWF	2.48 MGD	249 gpcd	4.24 MGD
$MMDWF_{10}$	1.91 MGD	192 gpcd	3.25 MGD
$MMWWF_5$	3.21 MGD	312 gpcd	5.30 MGD
Peak Average Week	4.51 MGD	401 gpcd	6.80 MGD
$PDAF_5$	6.62 MGD	524 gpcd	8.91 MGD
PIF	9.7 MGD	735 gpcd	12.48 MGD

TABLE 5.1.2
WASTEWATER TREATMENT DESIGN VALUES (2043)

	Flow	BOD_5		TSS	
	MGD	mg/L	ppd	mg/L	ppd
AAF	3.16	126	3,310	133	3,500
$MMDWF_{10}$	3.25	144	3,900	143	3,870
$MMWWF_5$	5.30	60	2,630	68	3,020
PDAF	8.91	n/a	n/a	n/a	n/a
PIF	12.48	n/a	n/a	n/a	n/a

5.2 Existing Collection System Improvements

Smoke testing was performed by The Dyer Partnership Engineers & Planners, Inc. (October, 2017) to identify potential deficiencies that allow I/I into the collection system. Flow mapping was also conducted (January, 2018) to determine the quantity and sources of extraneous water that enters the sewer collection system.

Analysis of the results from smoke testing and flow mapping revealed several locations where improvements to the collection system are required to enable the collection and treatment system to handle current and future flows. Successful resolution of deficiencies should reduce collection system peak flows and help minimize future WWTP capital and operational expenditures. It is recommended that the City continue to identify and correct I/I in the existing collection system, in accordance with the procedures outlined below.

1. The City should implement a TV program for the entire collection system over a five-year period (20% per year) and continue to repeat the TVing at five-year intervals.

2. Serious maintenance and repair issues should be identified in the I/I inspection program and be corrected as funding becomes available. Collection system improvement projects are categorized into three phases (summarized below).

3. A new Sewer System Evaluation survey (SSE) should be completed at least every ten years. A SSE should include: line grit removal and cleaning, inspection of the lines with TV camera, physical inspection of manholes, performance of flow testing at structures, smoke testing of lines, mapping of results, development of I/I repair capital improvement projects and performance of a cost-effective analysis.

It is recommended that the proposed collection system improvement projects be completed in three phases, based on the severity of the deficiencies. Phase 1 projects will be completed in the next five years. Phase 2 projects will be completed in years 5-10, and Phase 3 projects will be scheduled to occur in years 10-20. A summary of the proposed projects is provided below. Cost estimates are summarized in Section 5.8. The I/I removal projects assume complete sanitary sewer replacement, including piping, manholes, and service laterals, all to ensure that all sources of I/I are addressed.

- **Phase 1**
  - **Project 1.** *Replace/Rehabilitate existing 8-inch sewer along Fenton Avenue from TL_B_19 to TL_B_20.*
  - **Project 2.** *Replace/Rehabilitate existing 8-inch sewer along Patrol St. from TL_B_2 to TL_B_27.*
  - **Project 3.** *Replace/Rehabilitate existing 8-inch sewer along Lola Avenue from TL_A_33 to TL_A_25.*
  - **Project 4.** *Replace/Rehabilitate existing 8-inch sewer from TL_A_22 to TL_A_21 along East 2nd to TL_A_16 on Eckerd Avenue.*
  - **Project 5.** *Replace/Rehabilitate existing 8-inch sewer along S. Swiegle from BC_A3_17 to BC_A3_7.*
  - **Project 6.** *Replace/Rehabilitate existing 8-inch sewer beginning at the S. Molalla Pump Station, continuing to manhole BC_A1_2, and terminating at the clean-out located east of manhole BC_A1_3. Additional smoke testing and TVing is recommended. A portion of this sewer line extends into an abandoned subdivision that presents a higher risk of infiltration and inflow.*

- **Project 7.** *Replace/Rehabilitate existing 8-inch sewer along Fenton Avenue from TL_B_20 to TL_B_22.*

- **Phase 2**
  - **Project 8.** *Replace/Rehabilitate existing 8-inch sewer along East Main Street from TL_A_48 to TL_A_28.*
  - **Project 9.** *Replace/Rehabilitate existing 8-inch sewer along Berkley Avenue from BC_A3_18 to clean-out located south of BC_A3_14 near East 5^{th} St.*
  - **Project 10.** *Replace/Rehabilitate existing 8-inch sewer beginning at manhole BC_A3_21 and continuing south on Metzler to BC_A3_2, terminating at clean-out at the intersection of Metzler and West 4^{th} Street.*
  - **Project 11.** *Replace/Rehabilitate existing 8-inch sewer beginning at TL_B_21 and continuing east on Kimberly Ct until terminating at TL_B_24.*
- **Phase 3**
  - **Project 12.** *Replace/Rehabilitate existing 8-inch sewer beginning at BC_A3_16 along S. Molalla Avenue, continuing south to BC_A3_3, and continuing south until the clean-out in Fox Park (former High School site). Scope of work will include an evaluation of service laterals extending east on 2^{nd} Street.*
  - **Project 13.** *Replace/Rehabilitate existing 8-inch sewer beginning at TL_A2_6, continuing south on S. Cole Avenue until TL_A2_4, and then continuing east on East 7^{th} Street until terminating at the clean-out east of manhole TL_A2_5.*
  - **Project 14.** *Replace/Rehabilitate existing 8-inch sewer beginning at TL_B_2 along North Cole Avenue, and terminating at the clean-out south of TL_B_31.*
  - **Project 15.** *Replace/Rehabilitate existing 8-inch sewer beginning at TL_B_29 along Garden Court until TL_B_4.*
  - **Project 16.** *Replace/Rehabilitate existing 8-inch sewer beginning at TL_B_8 along Oak Street, and continuing to clean-out east of TL_B_12.*
  - **Project 17.** *Replace/Rehabilitate existing 8-inch sewer beginning at TL_B_8 on East Heintz Street to TL_B_9, continuing to TL_B_10 on East Park Avenue.*
  - **Project 18.** *Replace/Rehabilitate existing 8-inch sewer beginning at BC_B_1 along South Molalla Forest Road to BC_B_18. Includes 8" sewer line extending west to BC_B_10.*
  - **Project 19.** *Replace/Rehabilitate existing 8-inch sewer beginning at BC_C_71 along Meadowlawn Place to BC_C_59.*
  - **Project 20.** *Replace/Rehabilitate existing 8-inch sewer beginning at TL_A1_5, continuing to TL_A1_1 on East 8^{th} Street, continuing east on East 8^{th} Street until TL_A1_6, and then terminating at the clean-out at the end of Mathias Court. Additional inspections and TVing is required in subbasin TL_A1 to determine ultimate scope of repairs/replacement work.*
  - **Project 21.** *Replace/Rehabilitate existing 8-inch sewer beginning at TL_C2_11 along Explorer Avenue, continuing to TL_C2_6 along Escort Street, continuing to TL_C2_5 along Bronco Avenue, and continuing along Glory Ln to TL_C2_1. Scope of work shall also include replace/rehabilitate existing 8-inch sewer beginning at TL_C2_15 along Probe Street terminating at TL_C2_16. Additional inspections and TVing is required in sub basin TL_C2 to determine ultimate scope of repair/replacement work.*

After substantial completion of high-priority I/I reduction work, the City should re-evaluate influent WWTP flows and amend the flows in this Wastewater Facility and Collection System Master Plan (WWFCSMP), as necessary, based on the results of the I/I improvement work.

5.3 Pump Station Improvements

The collection system includes five small pump stations. An analysis of each pump station was conducted to identify deficiencies and recommend improvements, if necessary, during the planning period. Based on pump station assessments summarized in Section 2, future improvements are necessary for all of the pump stations. Costs for pump station improvements are summarized in Section 5.8.

South Molalla Pump Station

The South Molalla Pump Station is old and introduces an increasing risk of failure and subsequent overflows to Bear Creek. The wet well is structurally deficient. The pump station is hydraulically overloaded. Constructing a new pump station, with a new wet well and new force main, is recommended as Phase 1 improvements. Phase 1 improvements are schedule to occur within the next five years.

Taurus Street Pump Station

The existing pumps introduce significant operational and maintenance difficulties and operational expenditures. Installing a new submersible pump station is recommended. The existing wet well will be re-used. Based on the City's budget and other priorities, upgrades to the Taurus Pump Station are classified as Phase 2 improvements, schedule to occur between years 5-10.

Stowers, Steelhead & Coho, and East 5th & South Cole Pump Stations

Pump station improvements to the Stowers, Steelhead & Coho, and East 5th & South Cole Pump Stations will also be required during the planning period. The pump stations will require new pumps, control upgrades, Supervisory Control and Data Acquisition (SCADA) systems, and wet well rehabilitation work. Improvements to these pump stations are considered Phase 2, and planned for years 5-10.

5.4 Collection System Expansion

An analysis of future expansion requirements of the collection system involved identifying likely areas of expansion and determining the probable impacts of expansion on the existing system. Future growth will occur within the City's Urban Growth Boundary (UGB). The City is currently void of large tracts of developable land within the UGB. New connections to the existing gravity sewer system will primarily occur by providing service to vacant lots dispersed throughout the UGB. It is recommended that the City provide sewer service as required for future development without further analysis because it is consistent with the City's Comprehensive Development Plan.

5.5 WWTP Improvements and Expansion

The existing flows and loads exceed the capacity of the existing WWTP, and the WWTP cannot meet current NPDES Permit requirements on a consistent basis. The recommendation is to construct a new WWTP with the capacity to meet current and future projected flows for the year 2043.

Improvements to the WWTP are contingent upon the pending permit modification applications. If a mass load increase is approved (PS #3 and PS #4), the WWTP improvements will consist of a new influent fine screen, new grit removal system, new influent flow equalization basin (the existing aerated lagoon would be modified and serve as an Equalization Basin (EQ) basin), new Sequencing Batch Reactors (SBR) biological treatment system, new aerobic digester, new biosolids screw press, and a new

Ultraviolet/Hypochlorite Solution (UV/HS) disinfection system. If a mass load increase is not approved (PS #1 and PS #2) by Oregon Department of Environmental Quality (DEQ), in addition to the previously listed process items, a tertiary filtration system will be installed to facilitate Biochemical Oxygen Demand (BOD_5) and Total Suspended Solids (TSS) concentration limits to avoid mass load exceedances.

Recycled water storage and land application system requirements will vary tremendously based on the outcome of the pending permit modification applications. If DEQ allows the City to discharge to the Molalla River during the summer months when river conditions allow, typically in May, then using the existing facultative lagoons for recycled water storage will satisfy storage requirements. Under this scenario, the existing facultative Lagoons #1 and #2 will serve as recycled water storage ponds, to balance difference between the generation and use of recycled water. If the permit remains in its current condition, in that discharging to the Molalla River is only allowed between November 1 and April 30, then additional storage for recycled water is required.

Plan views of the proposed wastewater treatment plant expansion scenarios were previously provided in Section 4. A more detailed summary of each improvement is summarized below, and in Tables 5.5.1, 5.5.2, and 5.5.3.

TABLE 5.5.1
PLANNING LEVEL DESIGN DATA

Item	**Description / Design Data**	
Influent Fine Screen	Mechanical Fine Screen	1/4-inch, screen washing, compaction
	Quantity	2 (1 existing, 1 new)
	Capacity, Each	9.25 MGD
	Bypass	Bar screen - manually cleaned
	Flow Measurement	Parshall Flume
	Influent Sampler	Issco
Grit Removal	Vortex Grit Removal	12.5 MGD (360 deg chamber)
	Upper Chamber Diameter	12’
	Upper Chamber Depth	6’-8”
	Lower Chamber Diameter	5’ (minimum)
	Lower Chamber Depth	6’-8” (minimum)
	Inlet & Outlet Channel Width	3’
	Grit Pump	250 GPM
Influent Flow EQ[1]	Basin Dimensions	
	Size (bottom of basin)	100 ft by 54 ft
	Side Slopes (horiz:vert)	2:1
	Maximum Side Water Depth	10 ft w/ 2 ft freeboard
	Basin Volume	0.65 MG
	Basin Liner	Concrete (new)
Transfer Pump Station	Pumps	
	Type	Centrifugal submersible w/ VFDs
	Quantity	Three
	Horsepower, each	85 hp
	Capacity	8.9 MGD
	Discharge Force Main	
	Size, Qty	18-inch, 2
	Length	2,200-feet[2]
SBR	Four Basins	8.9 MGD (Total Capacity)
	Basin Dimensions (Internal)	113’ x 38’ x 18’ (Qty 4)
	Blowers, Qty	Three
	Blowers, scfm	890 scfm @ 8.91 psig
	WAS Pumps, Qty	Four
	WAS Pumps, capacity	110 GPM

TABLE 5.5.1
PLANNING LEVEL DESIGN DATA (CONT.)

Item	Description / Design Data	
Recycled Water Storage[3] Lagoon #1	Dimensions	
	Surface Area	11.4 acres at 6 ft water depth
	Maximum Depth	12 ft with 3 ft freeboard
	Working Depth	9 ft
	Volume	137 acre-feet (45 MG)
	Basin Liner	Hypalon Liner (new)
	Outlet	
	Size	10-inch
	Type	Adjustable
Recycled Water Storage[3] Lagoon #2	Dimensions	
	Surface Area	13.6 acres at 6 ft water depth
	Maximum Depth	12 ft with 3 ft freeboard
	Working Depth	9 ft
	Volume	163 acre-feet (53 MG)
	Basin Liner	Hypalon Liner (new)
	Outlet	
	Size	10-inch
	Type	Adjustable
Disinfection	Winter Disinfection	UV (low pressure, high intensity)
	Summer Disinfection	Sodium Hypochlorite
Effluent Pump Station	Pumps	
	Type	Vertical turbine
	Quantity	3 new
	Horsepower, each	300 hp
	Capacity, each	5 MGD
	Discharge Force Main	
	Size	24-inches
	Length	Five miles
Controls	SCADA	Entire WWTP
Standby Power	Generator Sets	
	Type	Diesel
	Size	750 kW (new), 500 kW (new)
	Transfer Switch	Automatic

TABLE 5.5.1
PLANNING LEVEL DESIGN DATA (CONT.)

Item	Description / Design Data	
Discharge Monitoring Station	Effluent Sampler	
	Type	Flow paced
	Instrumentation	
	Type	Temp, DO
	Flow Measurement	
	Type	Electromagnetic
	Size	12-inch
Molalla River Outfall	Material	HDPE
	Size	24-inch
	Length	23-feet
	Diffuser Design	
	Number of Ports, Type	3, Duckbill
	Diameter of Ports	8-inches
	Minimum Summer Submergence	1-inch
	Minimum Winter Submergence	12-inches

1. Existing aerated lagoon to be converted to influent flow equalization basin.
2. Transfer pump force main will be extended to new WWTP. Exact length and hydraulics to be determined during pre-design.
3. Existing lagoons will be dredged and lined prior to using them for recycled water storage.

If a suitable mass load increase is not approved, then a tertiary filter is required to achieve effluent BOD_5 and TSS concentration limits. Table 5.5.2 lists planning level design data for a tertiary filtration system sized for complete redundancy.

TABLE 5.5.2
PLANNING LEVEL DESIGN DATA
TERTIARY FILTRATION
PS #1 AND PS #2

Item	Description / Design Data	
Tertiary Filtration	Tertiary Filtration	
	Type	Rotating Disk filter
	Number	2 (1 duty/1 standby)
	Capacity, each	10.7 MGD
	Total Filter Area Per Unit, ft^2	1,800
	Number Discs Per Unit	22
	Media Pore Size, µm	10
	Level Control	Yes
	Turbidimeters	Yes
	Effluent Quality	< 4 - 5 mg/L TSS

If the City is unable to secure an ability to discharge to the Molalla River when river conditions allow, or if a mass load increase is not granted, then additional recycled water storage is necessary to satisfy a water balance. River conditions in May, due to frequent rainfall and snowmelt, are usually adequate to support discharge without adversely impacting water quality. Table 5.5.3 provides planning level design data for expanding recycled water storage systems if the permit continues to not allow discharge to the Molalla River during the summer months.

TABLE 5.5.3
PLANNING LEVEL DESIGN DATA
RECYLCED WATER STORAGE EXPANSION SYSTEMS
PS #1, PS #2, AND PS #3

Item	Description / Design Data	
Recycled Water Storage Expansion (PS #1)	Dimensions	
	Surface Area[1]	35 acres
	Maximum Depth	12 ft with 3 ft freeboard
	Working Depth	9 ft
	Volume	420 acre-feet (137 MG)
	Basin Liner	Hypalon Liner
Recycled Water Storage Expansion (PS #2 & PS #3)	Dimensions	
	Surface Area[1]	10 acres
	Maximum Depth	12 ft with 3 ft freeboard
	Working Depth	9 ft
	Volume	120 acre-feet (39 MG)
	Basin Liner	Hypalon Liner

1. Storage pond surface area based on average water depth.

Lagoon Dredging, Dewatering, and Disposal

The existing aerated Lagoons #1 and Lagoon #2 have accumulated sludge for years. To restore the biological and equalization functionality, dredging, dewatering, and disposal of biosolids is recommended immediately. Lagoon #1 has over 8-feet of sludge in some locations. The sludge reduces the biological capacity of the facultative lagoons, and hampers recycled water storage. Due to the absence of suitable dredging, dewatering, and disposal systems, it’s recommended that the City procure the services of a professional dredging and disposal company to remove and dispose of the solids. During the development of this plan, the City removed 699 dry tons of solids from Lagoon #1, and 215 dry tons of solids from the aerated lagoon. Since design and construction of the WWTP improvements project will take multiple years to develop, dredging, dewatering, and disposal of biosolids will also be required immediately prior to the construction and commissioning of the new WWTP. With the new WWTP, the existing facultative/storage lagoons will be converted to recycled water storage ponds, and the existing aeration basin (aerated lagoon) will be converted to an influent flow equalization basin.

Influent Fine Screen

The existing influent fine screen system consists of one fine screen. Operators state that the existing fine screen is incapable of processing flows greater than 6 MGD. The influent fine screen is currently undersized for existing flows, and an expansion is necessary to meet the projected Peak Instantaneous Flow (PIF) for the 2043 planning period. A new fine screen, in parallel with the existing screen, will be constructed as part of the WWTP improvements. With the additional fine screen, the WWTP will have adequate capacity for existing and future flows. Upgrades also include integration into the SCADA system, thereby improving operational efficiencies.

Grit Removal

Grit removal is not currently included in the WWTP. Grit is allowed to pass through the headworks and accumulate in the aerated lagoon. A new grit removal system sized at 12.5 MGD will be constructed to serve projected future flows. Grit removal is recommended to sustain the longevity of wastewater process equipment as well as maintain optimum efficiency of downstream treatment processes. Upgrades also include integration into the SCADA system.

Influent Flow Equalization

The City of Molalla's collection system has excessive I/I. To decrease the size of downstream facilities, approximately half of the existing aerated lagoon will be repurposed to serve as an influent flow equalization/surge basin. The volume available for equalization is approximately 0.65 MG. Peak flows will be conveyed from the transfer pump station to the equalization basin. As part of the WWTP improvements, the basin will be dredged and a new concrete structure (due to high groundwater conditions) will be constructed.

Transfer Pump Station and Force Main

The transfer pump station will undergo improvements to allow it to convey raw sewage to the new WWTP. The existing Transfer Pump Station Controls Building will house the new control panel and Variable Frequency Drives (VFDs) for the new pumps. To process peak flows, the Transfer Pump Station will convey raw wastewater through both parallel 18-inch diameter force mains. During the summer months, only one 18-inch diameter force main will be used. The force mains will be extended from the existing point of entry into Lagoon #1, to the ultimate location of the new SBR.

SBR

A new four-cell SBR system will be constructed. The use of four cells provides adequate equalization allowing uniform downstream flows. Preliminarily, the internal dimensions, for each of the four units, SBR basin are 113 feet long by 38 feet wide by 21.5 feet high. The SBR will include fine bubble diffusers, blowers, controls, and SCADA system. The WWTP will be designed to produce effluent less than 10 mg/L BOD_5, less than 10 mg/L TSS, and less than 2 mg/L NH_3-N.

Tertiary Filtration

Tertiary filtration is required if the City is unable to secure a suitable mass load increase associated with the Molalla River outfall. The tertiary filtration system will be sized to accommodate the peak decant rate from the SBR, and an average influent TSS concentration of 10 mg/L. Target effluent concentration from the tertiary filtration system is less than 4-5 mg/L TSS. The tertiary filtration system will consist of two units. The tertiary systems will be rotating disk filter packages, and installed in parallel.

Disinfection

A new sodium hypochlorite disinfection system will be installed for disinfecting the effluent during the summer months, when recycled water is land applied to DEQ approved sites. During the summertime, disinfected effluent will be conveyed to recycled water storage ponds, before being conveyed to the effluent pump station. When discharging to the Molalla River, a new UV disinfection system will be constructed for disinfecting the effluent during the winter months. When discharging to the Molalla River, disinfected effluent would normally be conveyed from the UV system directly to the effluent pump station.

Recycled Water Storage

The existing WWTP is currently deficient in recycled water storage capacity. Based on the existing conditions, the City is sometimes forced to discharge to the Molalla River during the summer months. Future recycled water storage requirements are a function of whether or not discharging to the Molalla River during May is allowed, and also whether or not a mass load increase is granted.

With PS #1, PS #2, PS #3, and PS #4, after the new WWTP is constructed, the existing facultative lagoons will be used to store recycled water. Dike stabilization improvements are, however, required to stabilize the dikes to maintain the integrity of the berms. Lining with a hypalon liner, along with improvements to the transfer piping are also required. A total of 98 million gallons of storage will be provided.

With a mass load increase associated with the Molalla River outfall, and conditional discharge allowance in May, converting the existing facultative/storage lagoons to recycled water storage satisfies recycled water storage requirements for the planning period. For PS #1, PS #2, and PS #3, additional recycled water is required beyond converting the existing facultative Lagoons #1 and #2 into recycled water storage ponds.

Storage requirements based on the four main permit scenarios (PS #1, PS #2, PS #3, and PS #4), are summarized in Table 5.5.4 below. As previously stated, acres are for approximate surface area of storage ponds.

TABLE 5.5.4
RECYCLED WATER STORAGE REQUIREMENTS

Item	Permit Scenario			
	PS #1	PS #2	PS #3	PS #4
Facultative Lagoon #1 and #2 (MG)	98	98	98	98
Facultative Lagoon #1 and #2 (Acres)	25	25	25	25
Recycled Water Expansion (MG)	137	39	39	0
Recycled Water Expansion (Acres)	35	10	10	0
Total Volume (MG)	**235**	**137**	**137**	**98**
Total Acreage (Acres)	**60**	**35**	**35**	**25**

Effluent Pump Station Expansion

The effluent pump station houses two existing VFD driven vertical turbine pumps, each of which have a total capacity between 500 and 7,000 gpm. The existing effluent pump station is designed with provisions to add a third pump in the future. The third pump will be installed in the effluent pump station as part of the WWTP improvements project. The existing pumps are nearly twenty years old and will also be replaced.

Discharge Monitoring Station

The discharge monitoring station piping is capacity limited, and causes backups during peak flows. The discharge monitoring piping will require improvements to provide capacity for conveying existing and future flows.

Aerobic Digester

Biosolids are currently not managed efficiently or proactively at the existing WWTP. A new aerobic digester will be constructed as part of the proposed WWTP improvements. The aerobic digester will be sized greater than 60 days Solids Retention Time (SRT) and include a diffused aeration grid, blowers, and ancillary equipment. The aerobic digester will accept influent Waste Activated Sludge (WAS) from the SBR, and direct stabilized biosolids to the dewatering screw press via biosolids transfer pumps.

Biosolids Dewatering and Storage

A biosolids dewatering screw press, sized to process 360 lbs/hour, will be constructed. The screw press will receive stabilized biosolids from the aerobic digester at roughly 2% dry solids, and dewater to approximately 14% or higher. Dewatered biosolids will be stored inside a bay immediately adjacent to the dewatering screw press. The biosolids will eventually be land applied or disposed of at a nearby landfill.

WWTP Site Facilities and Miscellaneous Improvements

A new Controls Building will be constructed to house the blowers and controls for the new SBR, including biosolids management controls and systems. A new standby generator and automatic transfer switch will be installed to serve the SBR, tertiary system (PS #1 and PS #2), disinfection systems, and critical ancillary facilities to ensure permit compliance during a power outage. Civil site work, including plumbing, grading, drainage, paving, landscaping, and restoration, to support the improvements listed above, are also required.

5.6 Biosolids Disposal

The City does not currently have adequate sites for the land application of Class B biosolids. A balanced combination of strategies needs to be employed to address biosolids disposal options. The recommended upgrades include the construction of a new aerobic digester, a new biosolids dewatering screw press, and dry storage in a bay adjacent to the proposed building.

The improvements will be enough to avoid wet-weather application of sludge under any circumstances. The City will need to update their Biosolids Management Plan (BMP), continue to expand their land application program, and use landfill disposal as necessary in the interim. The City's most recent BMP was developed in 2013. Biosolids production rates will increase over time as the City's population grows. A long-term plan for disposing of the biosolids must be developed.

5.7 Effluent Disposal

Effluent disposal is a major problem for the City. Recommendations for expanding effluent disposal systems and addressing NPDES Permit limitations are summarized in this section.

Molalla River Outfall 001

The existing NPDES permit is inconsistent with Willamette Basin standards and existing flows. In response to the inconsistencies, the City is currently in the process of attempting to modify the permit, and has submitted a permit modification with supporting justification. The proposed permit conditions for this initial application are summarized in this section. Another permit modification application will need to be submitted to DEQ when the new WWTP is constructed, based on future flows (2043). The proposed permit limits summarized herein are subject to DEQ review and approval.

Proposed Permit Modification Application #1

The City recently submitted an NPDES Permit modification application based on the Willamette Basin standards and flow data from the existing WWTPs 2007 design documents. The NPDES Permit should be based on the Willamette Basin standards of 30 mg/L BOD_5/TSS (monthly) and 45 mg/L BOD_5/TSS (weekly).

The permit limits should be based on the following:

1. May 1 through October 31: During this period the permittee must comply with the limits in Table 5.7.1 while discharging to waters of the state. Discharge may not commence until gauged stream flow exceeds 350-cfs and will cease when the average stream flow for the previous seven-day-period is less than 350-cfs.

2. November 1 through April 30: During this time period the permittee must comply with the limits in Table 5.7.1 while discharging to waters of the state.

3. During the term of this permit, the effluent quality must comply with the limits in the following table:

TABLE 5.7.1
PROPOSED NPDES PERMIT LIMITS

Parameter	Units	Average Monthly	Average Weekly	Daily Maximum
BOD_5 (May 1 – October 31)	mg/L	10	15	-
	lbs/day	190	290	380
	% removal	85	-	-
TSS (May 1 – October 31)	mg/L	10	10	-
	lbs/day	190	290	380
	% removal	85	-	-
BOD_5 (November 1 – April 30)	mg/L	30	45	-
	lbs/day	1000	1500	2000
	%	85	-	-
TSS (November 1 – April 30)	mg/L	30	45	-
	lbs/day	1000	1500	2000
	%	85	-	-
pH[b]	SU	Between 6.0 and 9.0		
Design Effluent Flow Dry Season	MGD	2.30	-	-
Design Effluent Flow Wet Season	MGD	4.10		
Total Residual Chlorine[c]	mg/L	0.07	-	0.18
E. coli[a,d]	MPN/100 ml	126	-	406
Ammonia	mg/L	16.7	-	25.9
Excess Thermal Load (May)	Shall not exceed a 7-day moving average of the daily excess thermal loads of 77.95 million kcals/day.			
Excess Thermal Load (June)	Shall not exceed a 7-day moving average of the daily excess thermal loads of 72.38 million kcals/day.			
Excess Thermal Load (July, August, September)	No Thermal Load Available – Effluent temperature must be less than 16°C.			
Excess Thermal Load (October)	Shall not exceed a 7-day moving average of the daily excess thermal loads of 42.43 million kcals/day.			
Dilution	Discharge may not commence until gauged stream flow exceeds 350-cfs and will cease when the average stream flow for the previous seven-day-period is less than 350-cfs.			

Notes:

a. No single *E. coli* sample may exceed 406 organisms per 100 mL. The permittee may take at least 5 consecutive re-samples at 4-hour intervals beginning within 48 hours after the original sample was taken and the geometric mean of the 5 re-samples is less than or equal to 126 *E. coli* organisms/100 mL to demonstrate compliance with the limit.

b. May not be outside the range of 6.0 to 9.0 S.U.

c. DEQ has established a minimum Quantitation Limit of 0.05 mg/L for Total Residual Chlorine. In cases where the average monthly or maximum daily limit for Total Residual Chlorine is lower than the Quantitation Limit, DEQ will use the reported Quantitation Limit as the compliance evaluation level.

d. Reported as a monthly geometric mean.

4. Additional information for the limits in the previous table.

    a. The BOD_5 concentration limits are considered equivalent to the minimum design criteria for BOD_5 specified in OAR Chapter 340, Division 41.

    b. Mass load limits for wintertime discharge are based on 4.10 MGD. Mass load limits for the summertime are based on 2.3 MGD.

Proposed Permit Modification Application #2

When the WWTP is upgraded, the NPDES Permit will require a permit modification application with supporting justification based on the future flows previously summarized. Critical elements of the proposed future permit, based upon future flows, are summarized below and in Table 5.7.2.

1. May 1 through October 31: During this period the permittee must comply with the limits in Table 5.7.2 while discharging to waters of the state. Discharge may not commence until gauged stream flow exceeds 350-cfs and will cease when the average stream flow for the previous seven-day-period is less than 350-cfs.
2. November 1 through April 30: During this time period the permittee must comply with the limits in Table 5.7.2 while discharging to waters of the state.
3. During the term of this permit, the effluent quality must comply with the limits in the following table:

TABLE 5.7.2
FUTURE POTENTIAL NPDES PERMIT

Parameter	**Units**	**Average Monthly**	**Average Weekly**	**Daily Maximum**
BOD_5 (May 1 – October 31)	mg/L	10	15	-
	lbs/day	271	407	542
	% removal	85	-	-
TSS (May 1 – October 31)	mg/L	10	10	
	lbs/day	271	407	542
	% removal	85	-	-
BOD_5 (November 1 – April 30)	mg/L	30	45	-
	lbs/day	1326	1989	2652
	%	85	-	-
TSS (November 1 – April 30)	mg/L	30	45	-
	lbs/day	1326	1989	2652
	%	85	-	
pH[b]	SU	Between 6.0 and 9.0		
Design Effluent Flow Dry Season	MGD	3.25	-	-
Design Effluent Flow Wet Season	MGD	5.30	-	-
Total Residual Chlorine[c]	mg/L	0.07	-	0.18
E. coli[ad]	MPN/100 ml	126	-	406
Ammonia	mg/L	16.7	-	25.9
Excess Thermal Load (May)	Shall not exceed a 7-day moving average of the daily excess thermal loads of 77.95 million kcals/day.			
Excess Thermal Load (June)	Shall not exceed a 7-day moving average of the daily excess thermal loads of 72.38 million kcals/day.			
Excess Thermal Load (July, August, September)	No Thermal Load Available – Effluent temperature must be less than 16°C.			
Excess Thermal Load (October)	Shall not exceed a 7-day moving average of the daily excess thermal loads of 42.43 million kcals/day.			
Dilution	Discharge may not commence until gauged stream flow exceeds 350-cfs and will cease when the average stream flow for the previous seven-day-period is less than 350-cfs.			

Notes:

a. No single *E. coli* sample may exceed 406 organisms per 100 mL. The permittee may take at least 5 consecutive re-samples at 4-hour intervals beginning within 48 hours after the original sample was taken and the geometric mean of the 5 re-samples is less than or equal to 126 *E. coli* organisms/100 mL to demonstrate compliance with the limit.

b. May not be outside the range of 6.0 to 9.0 S.U.

c. DEQ has established a minimum Quantitation Limit of 0.05 mg/L for Total Residual Chlorine. In cases where the average monthly or maximum daily limit for Total Residual Chlorine is lower than the Quantitation Limit, DEQ will use the reported Quantitation Limit as the compliance evaluation level.

d. Reported as a monthly geometric mean.

4. Additional information for the limits in the above table.

   a. The BOD_5 concentration limits are considered equivalent to the minimum design criteria for BOD_5 specified in OAR Chapter 340, Division 41.

   b. Mass load limits for summertime discharge are based on 3.25 MGD.

   c. Mass load limits for wintertime discharge are based on 5.30 MGD.

Recycled Water Outfall 002

Regardless of the future potential permit condition, the City needs to expand its recycled water disposal systems. The projected effluent disposal requirements, however, are contingent upon the outcome of pending permit modifications. Recycled water disposal system requirements are defined in this section for the four main Permit Scenarios (PS #1, PS #2, PS #3, and PS #4).

Recycled Water Irrigation Infrastructure and Land Application Sites

To accommodate future flows resulting from population projections and integrate reserves and redundancy into effluent disposal systems, the City must begin to actively identify additional agricultural lands, ideally near the WWTP or existing disposal sites that could be used for recycled water application.

The City will apply Class C recycled water, in accordance with the DEQ approved Recycled Water Use Plan (The Dyer Partnership, 2018), even after the new WWTP is constructed. However, the new WWTP will be designed (at minimum) to produce Class B recycled water, which provides an option for converting existing sites to Class B, in the future, if desired. When compared to Class C setbacks, converting the existing sites to Class B increases the useable acreage by approximately 48 acres. For conditions PS #1 and PS #2, tertiary filtration will be incorporated into the WWTP design and have the ability to produce Class A recycled water.

The land area required for application of recycled water depends on the NPDES permit, and whether the permit applications are approved, in whole or part. Table 5.7.3 summarizes existing and additional land area requirements based on future (2043) conditions.

TABLE 5.7.3
LAND APPLICATION AREA REQUIREMENTS
EXISTING AND FUTURE ADDITIONAL AREA

Item	Permit Scenario			
	PS #1	**PS #2**	**PS #3**	**PS #4**
Existing Irrigation Area (Acres)	444.5	444.5	444.5	444.5
Additional Irrigation Area (Acres)	~400 to 650	~150 to 275	~100 to 250	~0 to 100
Total Acreage (Acres)	**~844.5 to 1,095.5**	**~594.5 to 719.5**	**~544.5 to 694.5**	**~444.5 to 544.5**

The City also needs to expand its irrigation output during the summer. Historically, the City has not irrigated at sufficient rates during the summer months. Some of the irrigation restrictions were due to unnecessary requirements imposed by the City's previous Recycled Water Use Plan (RWUP), Consolidated Recycled Water Use Plan (2015), and its requirement for the production of Class A recycled water. The City's DEQ approved RWUP (The Dyer Partnership, 2018) is based on Class C water, in accordance with the NPDES Permit and DEQ guidelines.

July and August represent the two months by which the City can dispose of the greatest amount of recycled water. The City must expand its labor and irrigation systems to facilitate the application of recycled water throughout the summer months, especially in July and August. A more thorough analysis of the City's irrigation procedures and identification of irrigation restrictions is required. Increasing labor allocation and/or automation of irrigation systems with pivot irrigation systems is recommended for further evaluation.

Additional land reserves should be identified secured, beyond the above requirements. The majority of existing recycled water is land applied on to Coleman Ranch. While this is cost effective, the City needs to build redundancy into effluent disposal systems. Possible land application sites are identified in Section 4.

5.8 Project Cost Summary

Cost estimates for the proposed collection, WWTP, and effluent disposal systems are summarized in this section. Detailed cost estimates are included in Appendix C. All cost estimates are in 2018 dollars. Total project costs include construction costs, contingencies, engineering, legal, and administrative costs.

Collection System Improvements

It is recommended that collection system improvement projects be completed in three phases. Phase 1 projects will be completed in the next five years. Phase 2 projects will be completed in years 5-10. Phase 3 projects are schedule to occur between years 10-20. All costs assume complete pipe replacement. Replacement versus rehabilitation should be evaluated on a case-by-case basis, early in the design phase. Cost estimates are presented in Table 5.8.1.

TABLE 5.8.1
COST ESTIMATES FOR SEWER MAIN REPLACEMENT/REHABILITATION PROJECTS

Project No.	Phase	Length (ft)	Construction Cost	Total Project Cost
1	1	850	$333,700	$457,700
2	1	1100	$478,200	$654,200
3	1	1300	$540,200	$740,200
4	1	1300	$471,200	$645,200
5	1	1300	$489,200	$669,200
6	1	2300	$868,200	$1,187,200
7	1	600	$230,200	$316,200
		Subtotal Phase 1	**$3,410,900**	**$4,669,900**
8	2	1900	$810,200	$1,108,200
9	2	1350	$552,700	$755,700
10	2	1000	$401,200	$550,200
11	2	600	$255,200	$350,200
		Subtotal Phase 2	**$2,019,300**	**$2,764,300**
12	3	700	$311,200	$426,200
13	3	2200	$818,200	$1,118,200
14	3	750	$305,700	$418,700
15	3	500	$248,200	$340,200
16	3	800	$332,200	$454,200
17	3	750	$301,700	$413,700
18	3	1800	$584,200	$798,200
19	3	600	$273,200	$374,200
20	3	1150	$496,700	$679,700
21	3	2500	$997,200	$1,362,200
		Subtotal Phase 3	**$4,668,500**	**$6,385,500**
		Total	**$10,098,700**	**$13,819,700**

The City should implement a TV program for the entire collection system over a five-year period (20% per year) and continue to repeat the TVing at five-year intervals. Table 5.8.2 lists the annual cost to fund the proposed annual CCTV program.

TABLE 5.8.2
ANNUAL TV PROGRAM COST ESTIMATE

Item	Total Cost
Annual CCTV Program	$65,000
Total	**$65,000**

Cost estimates for the proposed pump station improvement projects are summarized in Table 5.8.3. Excluding the South Molalla Pump Station, all pump station improvement projects are all categorized as Phase 2 improvements, and will occur in years 5-10. The South Molalla Pump Station, given its age and condition, is classified as a Phase 1 improvement, and scheduled to occur within the next five years.

TABLE 5.8.3
PUMP STATION IMPROVEMENTS COST ESTIMATES

Project	Phase	Construction Cost	Total Project Cost
S. Molalla Pump Station	1	$491,500	$672,500
Taurus Pump Station	2	$269,000	$369,000
Stowers Pump Station	2	$150,000	$206,000
Steelhead & Coho Pump Station	2	$150,000	$206,000
East 5th & South Cole Pump Station	2	$150,000	$206,000
Total		**$1,210,500**	**$1,659,500**

WWTP Improvements

WWTP improvement capital costs are separated into four scenarios (PS #1, PS #2, PS #3, and PS #4). Table 5.8.4 lists WWTP improvement cost estimates for the four potential permit conditions.

TABLE 5.8.4
WWTP IMPROVEMENTS COST ESTIMATES

Item	Total Cost PS #1	Total Cost PS #2	Total Cost PS #3	Total Cost PS #4
Influent Screen	$485,355	$485,355	$485,355	$485,355
Grit Removal	$901,000	$901,000	$901,000	$901,000
Flow Equalization Basin	$1,190,000	$1,190,000	$1,190,000	$1,190,000
Transfer Pump Station	$844,000	$844,000	$844,000	$844,000
SBR	$6,707,000	$6,707,000	$6,707,000	$6,707,000
Tertiary Filtration	$2,387,000	$2,387,000	-	-
Lagoon Desludging & Disposal	$3,875,000	$3,875,000	$3,875,000	$3,875,000
Aerobic Digester	$3,332,000	$3,332,000	$3,332,000	$3,332,000
Biosolids Processing Facility	$1,867,000	$1,867,000	$1,867,000	$1,867,000
Disinfection (HS/UV)	$1,460,500	$1,460,500	$1,460,500	$1,460,500
Recycled Water Storage Improvements	$3,348,857	$3,348,857	$3,348,857	$3,348,857
Recycled Water Storage Expansion	$13,478,000	$4,356,000	$4,356,000	-
Recycled Water Irrigation Expansion	$2,010,000	$1,170,000	$1,110,000	$413,000
Discharge Monitoring Station	$415,000	$415,000	$415,000	$415,000
Misc. Equipment	$750,000	$750,000	$750,000	$750,000
Effluent Pump Station Upgrade and Expansion	$697,000	$697,000	$697,000	$697,000
Site Structures	$1,170,000	$1,170,000	$1,170,000	$1,170,000
Site Improvements and Yard Piping	$2,519,000	$2,519,000	$2,519,000	$2,519,000
WWTP Construction Estimate Total	**$47,437,000**	**$37,475,000**	**$35,028,000**	**$29,975,000**
Engineering - Design - Bidding Services	$4,744,000	$3,748,000	$3,503,000	$2,998,000
Engineering - Construction Services	$4,744,000	$3,748,000	$3,503,000	$2,998,000
Land Acquisition	$1,500,000	$1,500,000	$1,500,000	$-
Value Analysis and Value Engineering	$225,000	$225,000	$225,000	$225,000
Contingency (15%)	$7,116,000	$5,622,000	$5,255,000	$4,497,000
Environmental Report	$125,000	$125,000	$125,000	$100,000
Wetland Mitigation	$100,000	$100,000	$100,000	$100,000
Review Fees	$15,000	$15,000	$15,000	$15,000
Permitting	$150,000	$150,000	$150,000	$150,000
Administration & Legal	$300,000	$300,000	$300,000	$150,000
WWTP Total Project Estimate	**$66,456,000**	**$53,008,000**	**$49,704,000**	**$41,208,000**

The total present worth costs, in 2018 dollars, for WWTP improvements are summarized in Table 5.8.5.

TABLE 5.8.5
WWTP IMPROVEMENTS
TOTAL PRESENT WORTH ESTIMATE (2018 DOLLARS)

Item	Total Cost PS #1	Total Cost PS #2	Total Cost PS #3	Total Cost PS #4
WWTP Total Project Cost Estimate	$66,456,000	$53,008,000	$49,704,000	$41,208,000
WWTP O&M Total Present Worth	$17,264,000	$16,534,000	$16,286,000	$15,555,000
WWTP Total Present Worth	**$83,720,000**	**$69,542,000**	**$65,990,000**	**$56,763,000**

Total Project Costs

The total project cost for each potential permit scenario, in 2018 dollars, for Phase 1 collection system improvements, Phase 1 pump station improvements, and WWTP improvements is summarized in the following tables.

TABLE 5.8.6
TOTAL PROJECT COSTS (2018 DOLLARS)

Item	Total Cost PS #1	Total Cost PS #2	Total Cost PS #3	Total Cost PS #4
Collection System Improvements – Phase 1	$4,669,900	$4,669,900	$4,669,900	$4,669,900
Pump Station Improvements – Phase 1	$672,500	$672,500	$672,500	$672,500
WWTP Total Project Cost Estimate	$66,456,000	$53,008,000	$49,704,000	$41,208,000
Total Project Cost Estimate	**$71,798,400**	**$58,350,400**	**$55,046,400**	**$46,550,400**

Because funding acquisition and design of improvements will generally require approximately three years to complete, the total projected cost in three years (2021), assuming an annual inflation factor of 3%, is provided Table 5.8.7.

TABLE 5.8.7
TOTAL PROJECT COST (2021 DOLLARS)

Item	Total Cost PS #1	Total Cost PS #2	Total Cost PS #3	Total Cost PS #4
Collection System Improvements – Phase 1	$5,103,000	$5,103,000	$5,103,000	$5,103,000
Pump Station Improvements – Phase 1	$735,000	$735,000	$735,000	$735,000
WWTP Total Project Cost Estimate	$72,619,000	$57,924,000	$54,313,000	$45,030,000
Total Project Cost Estimate	**$78,457,000**	**$63,762,000**	**$60,151,000**	**$50,867,000**

5.9 Rates

The City completed a 5-year sanitary sewer CIP and rate study, and revised the user charges accordingly. The City adopted Resolution No. 2017 – 09, which establishes sanitary sewer rates and annual inflation adjustments, effective July 1, 2017. Billings for customers include two components: a fixed rate (base charge) and a volumetric rate (commodity charge). Residential and commercial users are billed the equivalent base rate. The base rate for commercial users is not calculated based on the number of Equivalent Dwelling Units (EDUs). It is recommended that the City adjust the base rate for commercial users based on the number of EDUs of each commercial user.

Changes to the City's rate structure will be required, and a sewer rate study will be prepared to establish rates to sufficiently fund future capital replacement and improvement needs, provide sufficient revenues for Operation and Maintenance (O&M), and maintain an adequate reserve fund.

5.10 Project Schedule

In order to meet the conditions of the pending Mutual Agreement Order (MAO) and NPDES Permit, WWTP improvements as outlined in this WWFCSMP should be constructed as soon as possible. Phasing is not a viable alternative for most of the WWTP improvements considering the extent and inter-relatedness of required treatment facility improvements.

The following is a tentative schedule identifying the key activities and approximate implementation dates for the improvements. The schedule is contingent upon timely DEQ review.

Schedule

Due to the pending permit modification applications; this WWFCSMP is developed for four future potential permit conditions. The time required for DEQ review of the pending permit modifications has not been defined by DEQ, but could significantly impact the project schedule. An optimistic project schedule is provided below, with the caveat that it is completely contingent on DEQ review time associated with permit modification applications.

The MAO requires that construction of the new WWTP identified in the final approved WWFCSMP must be completed no later than December 1, 2023. The proposed schedule was developed in accordance with the MAO; but again is contingent upon timely DEQ review of the WWFCSMP and pending permit modification applications.

• WWFCSMP Completed	December 2018
• DEQ Approval of WWFCSMP	January 2019
• WWFCSMP Approved by City of Molalla	February 2019
• Value Analysis	April 2019
• Secure Funding	January 2019– June 2019
• Start WWTP Improvements	
• Contract with Engineer	July 2019
• Environmental Assessment	August 2019
• Geotechnical Report	August 2019
• Site Surveys & Locates	August 2019
• Predesign Report	January 2020
• Value Engineering	March 2020
• DEQ Approval of Predesign Report & Environmental Assessment	June 2020
• Design of WWTP project	July 2020 - July 2021
• DEQ Approval of Plans	September 2021
• Advertise for Bids	January 2022
• WWTP Improvement Construction (18 Months)	March 2022 – October 2023
• Facility Commissioning	November 2023 – December 2023
• Performance Evaluation	January 2024 - January 2025
• Performance Evaluation Report	March 2025
• Design & Construction of Collection Expansion Improvements	As Necessary

SECTION 6:
FINANCING

SECTION 6: **FINANCING**

Most communities are unable to finance major infrastructure improvements without some form of governmental funding assistance such as low interest loans or grants. In this Section, a number of major Federal/State funding programs and local funding mechanisms that are appropriate for the recommended improvements are discussed.

6.1 Grant and Loan Programs

Some level of outside funding assistance in the form of grants or low interest loans may be necessary to make the proposed improvement projects affordable for the City of Molalla and its citizens. The amount and types of outside funding will dictate the amount of local funding that the City must secure. In evaluating grant and local programs, the major objective is to select a program, or a combination of programs, which are most applicable and available for the intended project.

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

Economic Development Administration (EDA) Public Works Grant Program

The EDA Public Works Grant Program, administered by the U.S. Department of Commerce, is aimed at projects which directly create permanent jobs or remove impediments to job creation in the project area. Thus, to be eligible for this grant, a community must be able to demonstrate the potential to create jobs from the project. Potential job creation is assessed with a survey of businesses to demonstrate the prospective number of jobs that might be created if the proposed project were completed.

Proposed projects must be located within an EDA-designated Economic Development District. Priority consideration is given to projects that improve opportunities for the establishment or expansion of industry and that creates or retain private sector jobs in both the near-term and the long-term. Communities that can demonstrate that the existing system is at capacity (i.e. moratorium on new connections) have a greater chance of being awarded this type of grant. EDA grants are usually in the range of 50 to 80 percent of the project cost; therefore some type of local funding is also required. Grants typically do not exceed one million dollars.

Water and Waste Disposal Loans and Grants (Rural Development)

The Rural Development Administration (Rural Development) manages the loans and grants for wastewater programs that used to be overseen by the Farmers Home Administration. While these programs are administered by a new agency, the program requirements are essentially the same. The Rural Utilities Service (RUS) is one of three entities that comprise the USDA's Rural Development mission area. The RUS supports various programs that provide financial and technical assistance for development and operation of safe and affordable water supply systems and sewer and other forms of waste disposal facilities.

Rural Development has the authority to make loans to public bodies and non-profit corporations to construct or improve essential community facilities. Grants are also available to applicants who meet the median household income (MHI) requirements. Eligible applicants must have a population of less than 10,000. Priority is given to public entities in areas smaller than 5,500 people to restore a deteriorating water supply, or to improve, enlarge, or modify a water facility and/or inadequate waste facility. Preference is given to requests that involve the merging of small facilities and those serving low-income communities.

In addition, borrowers must meet the following stipulations:

- Be unable to obtain needed funds from other sources at reasonable rates and terms,
- Legal capacity to borrow and repay loans, to pledge security for loans, and to operate and maintain the facilities or services,
- Financially sound and able to manage the facility effectively,
- Financially sound facility based on taxes, assessments, revenues, fees, or other satisfactory sources of income to pay all facility costs including operation and maintenance, and to retire the indebtedness and maintain a reserve,
- Water and waste disposal systems must be consistent with any development plans of state, multi-jurisdictional area, county, or municipality in which the proposed project is located. All facilities must comply with federal, state, and local laws including those concerned with zoning regulations, health and sanitation standards, and the control of water pollution.

Loan and grant funds may be used for the following types of improvements:

- Construct, repair, improve, expand, or otherwise modify waste collection, pumping, treatment, or other disposal facilities. Facilities to be financed may include such items as sewer lines, treatment plants (including stabilization ponds), storm sewer facilities, sanitary landfills, incinerators, and necessary equipment.
- Legal and engineering costs connected with the development of facilities,
- Other costs related to the development of the facility, including the acquisition of rights-of-way and easements, and the relocation of roads and utilities,
- Finance facilities in conjunction with funds from other agencies or those provided by the applicant.

Interim commercial financing will normally be used during construction and Rural Development funds will be available when the project is completed. If interim financing is not available or if the project cost is less than $50,000, multiple advances of Rural Development funds may be made as construction progresses.

The maximum term on all loans is 40 years. However, no repayment period will exceed any statutory limitation on the organization's borrowing authority, nor the useful life of the improvement of the facility to be financed. Interest rates are set quarterly and are based on current market yields for municipal obligations. Current interest rates may be obtained from any Rural Development office.

The following rates currently apply for the Rural Development program:

Market rate. Those applicants pay the market rate whose median household income (MHI) of the service area is more than the $52,855 (Oregon non-metropolitan MHI). The market rate is currently 3.25%.

Intermediate rate. The intermediate rate is paid by those applicants whose MHI of the service area is less than $52,855 but greater than $42,284. The intermediate rate is currently 2.625%.

Poverty line rate. Those applicants whose MHI of the service area is below $42,284 (80% of the non-metropolitan MHI) pay the lowest rate. Improvements must also be to correct a regulatory violation or health risk issue to qualify for this lowest rate. The current poverty line rate is 2.0%.

Maximum grant amounts, based on MHI, are provided in Table 6.1.1. The grants are calculated on the basis of eligible costs that do not include the costs attributable to reserve capacity or interim financing. In addition, grant funds cannot be used to reduce total user costs below that of comparable communities funded by RUS.

TABLE 6.1.1
MAXIMUM RURAL DEVELOPMENT GRANT FUNDS
BASED ON MEDIAN HOUSEHOLD INCOME

Median Household Income (MHI)	Maximum Grant [(a)]	Interest Rate [(b)]
<$42,284	75%	2.0%
$42,284 - $52,855	45%	2.625%
>$52,855	0%	3.25%

[(a)] MHI<$42,284 may be considered for a grant up to 75% of eligible project cost if the project is needed to alleviate a health or sanitary problem.
[(b)] Rates are current as of this quarter.

The 2011-2015 American Community Survey 5-Year Median Household Income (MHI) estimate is $55,534 (± $3,655). The 5-Year mean household income estimate is $64,447 (± $4,896). The MHI for the State of Oregon is $51,243 (± $271). At Molalla's MHI, the City may not be eligible for a grant.

There are other restrictions and requirements associated with these loans and grants. If the City becomes eligible for grant assistance, the grant will apply only to eligible project costs. Additionally, grant funds are only available after the City has incurred long-term debt resulting in an annual debt service obligation equal to 0.5% of the MHI. In addition, an annual funding allocation limits the Rural Development funds. To receive a Rural Development loan, the City must secure bonding authority, usually in the form of general obligation or revenue bonds.

Applications for financial assistance are made at area offices of Rural Development. For additional information on Rural Development loans and grant programs call 1-541-673-0136 or visit the RUS website at http://www.usda.gov/rus/water/. The Oregon Rural Development website is http://www.rurdev.usda.gov/or/.

Technical Assistance and Training Grants (TAT)

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

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

TAT funds may be used for the following activities:

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

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

(Oregon) Community Development Block Grant (CDBG) Program

The Community Development Block Grant Program (CDBG) section of the Infrastructure Finance Authority (IFA) administers the CDBG Program. Grants and technical assistance are available to develop livable urban communities for persons of low and moderate incomes by expanding economic opportunities and providing housing and suitable living environments.

Non-metropolitan cities and counties can apply for and receive grants. Oregon tribes, urban cities (Ashland, Bend, Corvallis, Eugene, Gresham, Hillsboro, Medford, Portland, Salem and Springfield) and counties (Clackamas, Multnomah, Washington) receive funds directly from Housing and Urban Development (HUD).

All projects must meet one of three national objectives:

1. The proposed activities must benefit low and moderate income individuals.

2. The activities must aid in the prevention or elimination of slums or blight.

3. There must be an urgent need that poses a serious and immediate threat to the health or welfare of the community.

Funding amounts are based on:

- The applicant’s need.
- The availability of funds.
- Other restrictions defined in the program’s guidelines.

The following are the maximum grants possible for any individual project, by category:

- Economic Development: $750,000
- Microenterprise: $100,000
- Public Works
  - o Water and Wastewater Improvements: $3,000,000 except preliminary/engineering planning grants: $150,000
  - o Downtown Revitalization: $400,000
  - o Offsite Infrastructure: $225,000
- Community/Public Facilities: $1,500,000
- Community Capacity/Technical Assistance: no specific per-award-limit but limited overall funds
- Emergency Grants: $500,000
- Regional Housing Rehabilitation: $400,000
- Emergency Projects: $500,000

For additional information on the CDBG programs, call 866-467-3466 or visit the IFA website at http://www.orinfrastructure.org/Learn-About-Infrastructure-Programs/Interested-in-a-Community-Development-Project/Community-Development-Block-Grant/.

Oregon Special Public Works Fund

The Special Public Works Fund (SPWF) provides funds for publically owned facilities that support economic and community development in Oregon**.** Special Public Works Funds provide funding for construction and/or improvement of infrastructure needed to support industrial, manufacturing and certain types of commercial development. Funds are available to public entities for:

- Planning
- Designing
- Purchasing
- Improving and constructing publically owned facilities
- Replacing publically owned essential community facilities
- Emergency projects as a result of a disaster

Public agencies that are eligible to apply for funding are:

- Cities
- Counties
- County service districts (organized under ORS Chapter 451)
- Tribal councils
- Ports
- Districts as defined in ORS 198.010
- Airport districts (ORS 838)

Facilities and infrastructure projects that are eligible for funding are:

- Airport facilities
- Buildings and associated equipment
- Restoration of environmental conditions on publically owned industrial lands
- Port facilities, wharves and docks
- The purchase of land, rights-of-way and easements necessary for a public facility
- Telecommunications facilities

- Railroads
- Roadways and bridges
- Solid waste disposal sites
- Storm drainage systems
- Wastewater systems
- Water systems

Loans

Loans for development (construction) projects range from less than $100,000 to $10 million. The Infrastructure Finance Authority offers very attractive interest rates that reflect tax-exempt market rates for highly qualified borrowers. Initial loan terms can be up to 25 years or the useful life of the project, whichever is less.

Grants

Grants are available for construction projects that create or retain trade-sector jobs. They are limited to $500,000 or 85% of the project cost, whichever is less, and are based on up to $5,000 per eligible job created or retained.

Limited grants are available to plan industrial site development for publically owned sites and for feasibility studies.

For additional information on IFA programs, call 503-986-0123 or visit the IFA website at http://www.orinfrastructure.org/Learn-About-Infrastructure-Programs/Interested-in-a-Community-Development-Project/Special-Public-Works-Fund/.

Water/Wastewater Financing Program

Water/wastewater financing is available for construction and/or improvement of water and wastewater systems to meet state and federal standards. This loan program funds the design and construction of public infrastructure needed to ensure compliance with the Clean Water Act (CWA).

The public entities that are eligible to apply for the program are:

- Cities
- Counties
- County service districts (organized under ORS Chapter 451)
- Tribal councils
- Ports
- Special districts as defined in ORS 198.010

The proposed project must be owned and operated by a public entity as listed above. Allowable funded project activities may include:

- Reasonable costs for construction improvement or expansion of drinking water system, wastewater system or storm water system.
- Water source, treatment, storage and distribution.
- Wastewater collection, treatment and disposal facilities, storm water system.
- Purchase of rights-of-way and easements necessary for construction.
- Design and construction engineering.

- Planning/technical assistance for small communities.

To be eligible for funding:

- A system must have received, or is likely to soon receive, a Notice of Non-Compliance by the appropriate regulatory agency or is for a facility plan or study required by a regulatory agency.
- A registered Professional Engineer will be responsible for the design and construction of the project.

Funding and Uses

Loan and grant amounts are determined by a financial analysis of the applicant's ability to afford a loan (debt capacity, repayment sources and other factors).

Loans

Program guidelines, project administration, loan terms and interest rates are similar to the Special Public Works Fund program. The maximum loan term is 25 years or the useful life of the infrastructure financed, whichever is less. The maximum loan amount is $10 million per project through a combination of direct and/or bond funded loans. Recently IFA is offering lower, reduced interest rates for municipalities whose household income is less than the statewide median income. The current terms of this loan are for 25 years at 3.74 % interest.

Loans are generally repaid with utility revenues or voter approved bond issues. A limited tax general obligation pledge also may be required. "Creditworthy" borrowers may be funded through the sale of state revenue bonds.

Grants

Grant awards up to $750,000 may be awarded based on a financial review.

An applicant is not eligible for grant funds if the applicant's annual median household income is equal or greater than 100 percent of the state average median household income for the same year.

Funding for Technical Assistance

The Infrastructure Finance Authority offers technical assistance with financing for municipalities with populations of less than 15,000. The funds may be used to finance preliminary planning, engineering studies and economic investigations.

Technical assistance projects must be in preparation for a construction project that is eligible and meets the established criteria.

- Grants up to $20,000 may be awarded per project.

- Loans up to $50,000 may be awarded per project.

Interested applicants should contact the Oregon Business Development Department (OBDD) prior to submitting an application. Applications are accepted year-round. For additional information on this IFA program, call 503-986-0123 or visit the IFA website at http://www.orinfrastructure.org/Learn-About-Infrastructure-Programs/Interested-in-a-Water-or-Wastewater-Improvement-Project/water-wastewater-financing/.

Department of Environmental Quality, Clean Water State Revolving Fund

The Clean Water State Revolving Fund (CWSRF) loan program is administered by the Oregon Department of Environmental Quality (DEQ) and provides low-cost loans for the planning, design or construction of various projects that prevent or mitigate water pollution. Eligible agencies include Indian tribal governments, cities, counties, sanitary districts, soil and water conservation districts, irrigation districts, various special districts and certain intergovernmental entities.

Six different types of loans are available within the program, including loans for planning, design, construction, emergencies, urgent repairs and local community projects. A portion of the fund is reserved for small communities, planning or green projects.

Interest rates for the loan program change quarterly based on a percentage of the national municipal bond rate. Those percentages vary from 25 to 65% of the bond rate. For example, with a quarterly bond rate of 4.1 percent, CWSRF interest rates range from 1.0 to 2.7% depending on the length of the loan repayment period.

Current CWSRF interest rates range from around 1 to 3%, depending on the type and terms of the loans. Different interest rates and other financial requirements apply to different loans. Rates are adjusted quarterly, based on the average Bond Buyer Rates of the previous quarter as published by the Federal Reserve. When a loan is signed, the interest rate is fixed for the life of the loan. Below are 2018 interest rates for loans executed from April 1 through June 30, 2018.

TABLE 6.1.2
CWSRF INTEREST RATES

Loan Type	Repayment Term	Annual Interest Rate
Planning	5 years	0.94%
Design/Construction	5 years	0.94%
Design/Construction	10 years	1.12%
Design/Construction	15 years	1.31%
Design/Construction	30 years	1.50%

All eligible proposed projects are ranked based on their application information. Points are assigned based on specific ranking criteria, which include: 1) the anticipated benefit for water quality or public health; 2) potential water quality or public health consequences of not funding the project; and 3) other considerations such as education and outreach. The DEQ website lists detailed ranking criteria.

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

Obtaining CWSRF funding requires the submission of an application, preparation of an environmental report on the project, a land use compatibility statement from a county planning official, and a copy of the user

charge system. There are additional requirements depending on the nature of the project. An applicant needs to contact a DEQ Project Officer to discuss the project and find out what is required.
For additional information on this and other DEQ programs, call 800-452-4011 or visit the DEQ website at http://www.deq.state.or.us/wq/loans/loans.htm.

Oregon Department of Energy, Small Scale Energy Loan Program

The Small Scale Energy Loan Program (SELP) program offers loans to projects whose purpose is to promote energy conservation and renewable energy resource development. Eligible applicants include cities, counties, special districts, individuals, and non-profit groups. Loans will cover up to 100% of construction costs, including engineering, fees, and studies. The finished project must at least break even in power costs.

The program offers low-interest loans for projects that:

- Conserve natural gas, electricity, oil, or other source of energy.
- Produce energy from renewable resources such as water, wind, geothermal, solar, biomass, waste materials or waste heat.
- Use recycled materials to create products.

Interested parties should contact the Oregon Office of Energy for details. For additional information on the Office of Energy programs, call 503-378-4040 or visit the Office of Energy website at http://oregon.gov/ENERGY/.

6.2 Local Funding Sources

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

General Obligation Bonds

A general obligation (G.O.) bond is backed by the full faith and credit of the issuer. For payment of the principal and interest on the bond, the issuer may levy *ad valorem* general property taxes. Such taxes are not needed if revenue from assessments, user charges or other sources are sufficient to cover debt service.

Oregon Revised Statutes limit the maximum term to 40 years for cities. Except in the event that Rural Development Administration will purchase the bonds, the realistic term for which general obligation bonds should be issued is 15 to 20 years. Under the present economic climate, the lower interest rates will be associated with the shorter terms.

Financing of wastewater system improvements by general obligation bonds is usually accomplished by the following procedure:

- Determination of the capital costs required for the improvement,
- An election authorizing the sale of general obligation bonds,
- Following voter approval, the bonds are offered for sale,

- The revenue from the bond sale is used to pay the capital costs associated with the projects.

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

These bonds can be revenue-supported, wherein a portion of the user fee is pledged toward payment of the debt service. Using this method, the need to collect additional property taxes to retire the obligated bonds is eliminated. Such revenue-supported general obligation bonds have most of the advantages of revenue bonds, but also maintain the lower interest rate and ready marketability of general obligation bonds. Because the users of the water system pay their share of the debt load based on their water usage rates, the share of that debt is distributed in a fare and equitable manner.

Advantages of general obligation bonds over other types of bonds include:

- The laws authorizing general obligation bonds are less restrictive than those governing other types of bonds.
- By the levying of taxes, the debt is repaid by all property benefited and not just the system users.
- Taxes paid in the retirement of these bonds are IRS-deductible.
- General obligation bonds offer flexibility to retire the bonds by tax levy and/or user charge revenue.

The disadvantage of general obligation bond debt is that it is often added to the debt ratios of the underlying municipality, thereby restricting the flexibility of the municipality to issue debt for other purposes. Furthermore, general obligation bonds are normally associated with the financing of facilities that benefit an entire community and must be approved by a majority vote and often necessitate extensive public information programs. A majority vote often requires waiting for a general election in order to obtain an adequate voter turnout. Waiting for a general election may take years, and too often a project needs to be undertaken in a much shorter amount of time.

Revenue Bonds

Revenue bonds offer some advantages over general obligation bonds and are becoming a more frequently used option. Revenue bonds are payable solely from charges made for the services provided. These bonds cannot be paid from tax levies or special assessments; their only security is the borrower's promise to operate the system in a way that will provide sufficient net revenue to meet the debt service and other obligations of the bond issue.

Many communities prefer revenue bonding, as opposed to general obligation bonding, because it insures that no tax will be levied. In addition, debt obligation will be limited to system users since repayment is derived from user fees. Another advantage of revenue bonds is that they do not count against a municipality's direct debt, but instead are considered "overlapping debt.” This feature can be a crucial advantage for a municipality near its debt limit or for the rating agencies, which consider very closely the amount of direct debt when assigning credit ratings. Revenue bonds also may be used in financing projects extending beyond normal municipal boundaries. These bonds may be supported by a pledge of revenues received in any legitimate and ongoing area of operation, within or outside the geographical boundaries of the issuer.

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

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

Municipalities may elect to issue revenue bonds for revenue-producing facilities without a vote of the electorate (ORS 288.805-288.945). In this case, certain notice and posting requirements must be met and a 60-day waiting period is mandatory. A petition signed by 5% of the municipality's registered voters may cause the issue to be referred to an election.

Improvement Bonds

Improvement (Bancroft) bonds can be issued under an Oregon law called the Bancroft Act. These bonds are an intermediate form of financing that is less than full-fledged general obligation or revenue bonds. This type of bond is quite useful, especially for smaller issuers or for limited purposes.

An improvement bond is payable only from the receipts of special benefit assessments, not from general tax revenues. Such bonds are issued only where certain properties are recipients of special benefits not accruing to other properties. For a specific improvement, all property within the improvement area is assessed on an equal basis, regardless of whether it is developed or undeveloped. The assessment is designed to apportion the cost of improvements, approximately in proportion to the afforded direct or indirect benefits, among the benefited property owners. This assessment becomes a direct lien against the property, and owners have the option of either paying the assessment in cash or applying for improvement bonds. If the improvement bond option is taken, the City sells Bancroft improvement bonds to finance the construction, and the assessment is paid over 20 years in 40 semi-annual installments with interest. Cities and special districts are limited to improvement bonds not exceeding 3% of true cash value.

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

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

Capital Construction (Sinking) Fund

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

The disadvantage of a sinking fund is that it is usually too small to undertake any significant projects. Also, setting aside money generated from user fees without a designated and specified need is not generally accepted in a municipal budgeting process.

Connection Fees

Most cities charge connection fees to cover the cost of connecting new development to water and wastewater systems. Based on recent legislation, connection fees can no longer be programmed to cover a portion of capital improvement costs.

System Development Charges

A system development charge (SDC) is essentially a fee collected as each piece of property is developed, and which is used to finance the necessary capital improvements and municipal services required by the development. Such a fee can only be used to recover the capital costs of infrastructure. Operating, maintenance, and replacement costs cannot be financed through system development charges.
Two types of charges are permitted under the Oregon Systems Development Charges Act, improvement fees and reimbursement fees. SDCs charged before construction are considered improvement fees and are used to finance capital improvements to be constructed. After construction, SDCs are considered reimbursement fees and are collected to recapture the costs associated with capital improvements already constructed or under construction. A reimbursement fee represents a charge for utilizing excess capacity in an existing facility paid for by others. The revenue generated by this fee is typically used to pay back existing loans for improvements.

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

Local Improvement District (LID)

Improvement bonds issued for local improvement districts (LIDs) are used to administer special assessments for financing local improvements in cities, counties, and some special districts. Common improvements financed through an LID include storm and sanitary sewers, street paving, curbs, sidewalls, water mains, recreational facilities, street lighting, and off-street parking. The basic principle of special assessment is that it is a charge imposed upon property owners who receive special benefits from an improvement beyond the general benefits received by all citizens in the community. A public agency should consider three "principles of benefit" when deciding to use special assessment: 1) direct service, 2) obligation to others, and 3) equal sharing/basis. Cities are limited to improvement bonds not exceeding three percent of true cash value.

The Oregon Legislature has provided cities with a procedure for special assessment financing (ORS 223.387-399), which applies when city charter or ordinance provisions do not specify otherwise. To establish an LID, an improvement district is formed, the boundaries are established, and the benefited properties and property owners are determined. An approximate assessment to each property is determined based on the above three principles of benefit, and is documented in a written report. Property owners are then given an opportunity to object to the project assessments. The assessments against the properties are usually not levied until the actual cost of the project is determined. Since this determination is normally not possible until the project is completed, funds are not available from assessments for the purpose of making monthly payments to the contractor. Therefore, some method of interim financing must be arranged based on the estimated total costs.

The primary disadvantage to this source of revenue is that the property to be assessed must have a true cash value at least equal to 50 percent of the total assessments to be levied. As a result, owners of undeveloped property usually require a substantial cash payment. In addition, the development of an assessment district is very cumbersome and expensive.

Ad Valorem Taxes

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

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

Ad valorem taxation, however, is less likely to result in individual users paying their proportionate share of the costs as compared to their benefits. Public hearings an election with voter approval would be required to implement *ad valorem* taxation.

User Fee

User fees can be used to retire general obligation bonds, and are commonly the sole source of revenue to retire revenue bonds and to finance operation and maintenance. User fees represent monthly charges of all residences, businesses, and other users that are connected to the wastewater system. These fees are established by resolution and may be modified, as needed, to account for increased or decreased operating and maintenance costs. User fees may be based on a metered volume of water consumption and/or on the type of user (e.g. residential, commercial, schools etc.).

Assessments

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

6.3 Financing Strategy

A financing strategy or plan must provide a mechanism to generate capital funds in sufficient amounts to pay for the proposed improvements over the relatively short duration in design and construction, generally two years. The financing strategy must also identify the manner in which annual revenue will be generated to cover the expense for long-term debt repayment and the on-going operation and maintenance of the system.

The objectives of a financial strategy include the following:

- Identify the capital improvement cost for the project and the estimated expense for operation and maintenance.
- Evaluate the potential funding sources and select the most viable program.
- Determine the availability of outside funding sources and identify the local cost share.
- Determine the cost to system users to finance the local share and the annual cost for operation and maintenance.

Project Expenses

Table 6.3.1 summarizes the total phase 1 project costs in 2021 dollars for each permit scenario. The identified projects expand, replace, or repair existing equipment and facilities and are expected to increase the annual operations and maintenance costs to the City.

TABLE 6.3.1
TOTAL PROJECT COST (2021 DOLLARS)

Item	Total Cost PS #1	Total Cost PS #2	Total Cost PS #3	Total Cost PS #4
Collection System Improvements – Phase 1	$5,103,000	$5,103,000	$5,103,000	$5,103,000
Pump Station Improvements – Phase 1	$735,000	$735,000	$735,000	$735,000
WWTP Total Project Cost Estimate	$72,619,000	$57,924,000	$54,313,000	$45,030,000
Total Project Cost Estimate	**$78,457,000**	**$63,762,000**	**$60,151,000**	**$50,867,000**

Funding Sources

With any of the proposed funding sources within the financial strategy, the City is advised to confirm specific funding amounts with the appropriate funding agencies prior to making local financing arrangements. Most of the grant programs require that the project address a DEQ-issued violation, potential violation or order before the project is eligible for funding. It is recommended that the City undertake efforts to secure funding in the form of grants and loans. Rural Development looks closely at sewer user rates and expects local rates to be at or above that of similar communities before the project becomes eligible for grants.

Based on a winter water consumption of 150 gpd/EDU, or approximately 600 cubic feet of monthly water use, the average residential sewer bill is approximately $57.31/month. Table 6.3.2 summarizes the City's current and future wastewater rate structures.

TABLE 6.3.2
CURRENT AND PROJECTED WASTEWATER RATES

Wastewater Rate Component	2017	2018	2019	2020	2021	2022
Monthly Base Rate ($/EDU)	$35.95	$38.31	$41.06	$44.07	$46.88	$48.30
Volume Charge ($/cubic feet)	$3.56	$3.79	$4.06	$4.36	$4.64	$4.78

The City recently entered into a Mutual Agreement and Order (MAO) with DEQ to provide temporary operating limits and to settle current violations. While the MAO will make the City eligible for grant funding from the standpoint of addressing current violations, actual eligibility is dependent on several factors.

It is recommended that the City schedule and attend another One-Stop meeting after regulatory approval of the final WWFCSMP in order to assess the funding environment at that time. Changes to the City's rate structure will be necessary. A sewer rate study will be prepared to establish rates to sufficiently fund future capital replacement and improvement needs, provide sufficient revenues for Operation and Maintenance, and maintain an adequate reserve fund.

SECTION 7:

REFERENCES

SECTION 7: **REFERENCES**

Park, Hee-Deung, In-Soung Chang, and Kwang-Jin Lee. 2015. Principles of Membrane Bioreactors for Wastewater Treatment. Boca Raton: CRC Press.

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Natural Treatment Systems - A Water Quality Match for Oregon's Cities and Towns, July, 2014. Oregon Department of Environmental Quality and Oregon Association of Clean Water Agencies.

City of Molalla
Clackamas County, Oregon

WASTEWATER FACILITY AND COLLECTION SYSTEM MASTER PLAN VOLUME 2

DRAFT

OCTOBER 2018

The Dyer Partnership Engineers & Planners, Inc.

Project No. 100.26

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City of Molalla

Clackamas County, Oregon

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Table 340A Designated Beneficial Uses in the Willamette Basin

Molalla-Pudding Subbasin TMDL Executive Summary

Mutual Agreement and Order (MAO)

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTE DISCHARGE PERMIT

Oregon Department of Environmental Quality
Northwest Region – Portland Office
2020 SW 4th Avenue, Suite 400
Telephone: 503-229-5263

Issued pursuant to ORS 468B.050 and The Federal Water Pollution Control Act (The Clean Water Act)

ISSUED TO:

City of Molalla
PO Box 248
Molalla, OR 97038

SOURCES COVERED BY THIS PERMIT:

Type of Waste	Outfall Number	Location
Treated Wastewater	001	45.15°N -122.54085°W
Recycled Water	002	Specified in RWU Plan
Biosolids	N/A	Specified in BLA Plan

FACILITY TYPE AND LOCATION:

Pre-aerated lagoons with effluent filtration
Molalla STP, 12424 Toliver Road
Molalla, OR 97038

RECEIVING STREAM INFORMATION:

WRD Basin: Willamette
USGS Subbasin: Molalla-Pudding
Receiving Stream: Molalla River
LLID: 1227171452976-20.0-D
County: Clackamas

Treatment System Class Level: III
Collection System Class Level: II

EPA REFERENCE #: OR-002238-1
Issued in response to application #962753 received August 24, 2012, and based on the land use compatibility statement in the permit record.

Tiffany Yelton-Bram	5/12/2014	June 1, 2014
Tiffany Yelton-Bram, Manager WQ Source Control Northwest Region	Signature Date	Effective Date

PERMITTED ACTIVITIES

Until this permit expires or is modified or revoked, the permittee is authorized to: 1) operate a wastewater collection, treatment, control and disposal system; and 2) discharge treated wastewater to waters of the state only from the authorized discharge point or points in Schedule A in conformance with the requirements, limits, and conditions set forth in this permit.

Unless specifically authorized by this permit, by another NPDES or WPCF permit, or by Oregon statute or administrative rule, any other direct or indirect discharge of pollutants to waters of the state is prohibited.

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SCHEDULE A
Waste Discharge Limits

1. Treated Effluent Outfall 001

a. May 1 – October 31: During this time period the permittee may not discharge to waters of the state.

b. November 1 – April 30: During this time period the permittee must comply with the limits in Tables A1 and A2 while discharging to waters of the state:

i. Biochemical Oxygen Demand (BOD_5) and Total Suspended Solids (TSS).

Table A1: BOD_5 and TSS Limits

Parameter	Average Effluent Concentrations, mg/L		Monthly Average lbs/day	Weekly Average lbs/day	Daily Maximum Lbs
	Monthly	Weekly			
BOD_5	10 mg/L	15 mg/L	160	240	320
TSS	10 mg/L	15 mg/L	160	240	320

Mass load limits are based on the average wet weather design flow to the facility which equals 1.92 MGD.

ii. Additional Parameters

Table A2: Limits for Additional Parameters

November - April	Limits
BOD_5 and TSS Removal Efficiency	May not be less than 85% monthly average for BOD_5 and TSS
E. coli Bacteria (see Note 1.)	Monthly geometric mean may not exceed 126 organisms per 100 ml. No single sample may exceed 406 organisms per 100 ml.
pH	May not be outside the range of 6.0 to 9.0 S.U.
Total Residual Chlorine	Monthly average concentration may not exceed 0.07 mg/L. Daily maximum concentration may not exceed 0.18 mg/L
Ammonia (NH_3-N)	Monthly average concentration may not exceed 16.7 mg/L. Daily maximum concentration may not exceed 25.9 mg/L.
Dilution	Discharge may not commence until gauged stream flow exceeds 350 cfs and will cease when the average stream flow for the previous seven-day-period is less than 350 cfs.
Temperature	Effluent discharge will cease when the 7-day moving average effluent temperature exceeds 18.0 degrees C.

Notes

1. No single *E. coli* sample may exceed 406 organisms per 100 mL; however, no violation has occurred if the permittee takes at least 5 consecutive re-samples at 4 hour intervals beginning within 28 hours after the original sample was taken and the log mean of the 5 re-samples is less than or equal to 126 *E. coli* organisms/100 mL.

2. Regulatory Mixing Zone

No wastes may be discharged or activities conducted that cause or contribute to a violation of water quality standards in OAR Chapter 340, Division 41 applicable to the Willamette Basin except within the following regulatory mixing zone:

> The allowable mixing zone includes that portion of the Molalla River with boundary dimensions equal to the length of the effluent diffuser plus 10-feet on each end with the mixing zone extending 5-feet upstream and 50-feet downstream of the diffuser. The Zone of Immediate Dilution (ZID) is defined as that portion of the allowable mixing zone within 5-feet of the diffuser.

3. Groundwater Protection

The permittee may not conduct any activities that could cause an adverse impact on existing or potential beneficial uses of groundwater. All wastewater and process related residuals must be managed and disposed of in a manner that will prevent a violation of the Groundwater Quality Protection Rules (OAR Chapter 340, Division 40).

4. Use of Recycled Water (Outfall 002)

The permittee is authorized to distribute recycled water if it is:

a. Treated and used according to the criteria listed in Table A3.
b. Managed as described in its DEQ-approved Recycled Water Use Plan unless exempt as provided in Schedule D, condition 3.
c. Used in a manner and applied at a rate that does not adversely impact groundwater quality.
d. Applied at a rate and in accordance with site management practices that ensure continued agricultural, horticultural, or silvicultural production and does not reduce the productivity of the site.
e. Irrigated using sound irrigation practices to prevent:
   i. Offsite surface runoff or subsurface drainage through drainage tile;
   ii. Creation of odors, fly and mosquito breeding, or other nuisance conditions; and
   iii. Overloading of land with nutrients, organics, or other pollutants.

Table A3: Recycled Water Limits

Class	Level of Treatment (after disinfection unless otherwise specified)	Beneficial Uses
A	Oxidized, filtered and disinfected. Before disinfection, turbidity may not exceed: • 2 NTUs within a 24-hour period. • 5 NTUs more than five percent of the time within a 24-hour period • 10 NTUs at any time. After disinfection, total coliform may not exceed: • A median of 2.2 organisms per 100 mL based on daily sampling over the last 7 days that analyses have been completed. • 23 organisms per 100 mL in any single sample.	• Class B, Class C, Class D, and nondisinfected uses. • Irrigation for any agricultural or horticultural use. • Landscape irrigation of parks, playgrounds, school yards, residential landscapes, or other landscapes accessible to the public. • Commercial car washing or fountains when the water is not intended for human consumption. • Water supply source for non restricted recreational impoundments.
B	Oxidized and disinfected. Total coliform may not exceed: • A median of 2.2 organisms per 100 mL, based on the last 7 days that analyses have been completed. • 23 total coliform organisms per 100 mL in any single sample.	• Class C, Class D, and nondisinfected uses. • Stand-alone fire suppression systems in commercial and residential building, non-residential toilet or urinal flushing, or floor drain trap priming. • Water supply source for restricted recreational impoundments.
C	Oxidized and disinfected. Total coliform may not exceed: • A median of 23 total coliform organisms per 100 mL, based on results of the last 7 days that analyses have been completed. • 240 total coliform organisms per 100 mL in any two consecutive samples.	• Class D and nondisinfected uses. • Irrigation of processed food crops; irrigation of orchards or vineyards if an irrigation method is used to apply recycled water directly to the soil. • Landscape irrigation of golf courses, cemeteries, highway medians, or industrial or business campuses. • Industrial, commercial, or construction uses limited to: industrial cooling, rock crushing, aggregate washing, mixing concrete, dust control, nonstructural fire fighting using aircraft, street sweeping, or sanitary sewer flushing.

5. Biosolids

The permittee may land apply biosolids or provide biosolids for sale or distribution, subject to the following conditions:

a. The permittee must manage biosolids in accordance with its DEQ-approved Biosolids Management Plan and Land Application Plan.

b. Except when used for land reclamation and approved by DEQ, biosolids must be applied at or below the agronomic rate required for maximum crop yield.

c. The permittee must obtain written site authorization from DEQ for each beneficial use site before land application (see Schedule D, Condition 6.b.), and follow the minimum site-specific management conditions in the site authorization letter.
d. Biosolids must meet one of the pathogen reduction standards under 40 CFR §503.32 and one of the vector attraction reduction standards under 40 CFR §503.33.
e. Pollutants in biosolids may not exceed the ceiling concentrations shown in Table A4 below. Biosolids exceeding the pollutant concentrations in Table A4 must be applied at a rate that does not exceed the corresponding cumulative pollutant loading rates.

Table A4: Biosolids Limits

Pollutant	Ceiling concentrations[1] (mg/kg)	Pollutant concentrations[1] (mg/kg)	Cumulative pollutant loading rates[1] (kg/ha)
Arsenic	75	41	41
Cadmium	85	39	39
Copper	4300	1500	1500
Lead	840	300	300
Mercury	57	17	17
Molybdenum	75	N/A	N/A
Nickel	420	420	420
Selenium	100	100	100
Zinc	7500	2800	2800

Note:
1. Biosolids pollutant limits are described in 40 CFR§503.13, which uses the terms *ceiling concentrations*, *pollutant concentrations*, and *cumulative pollutant loading rates*. Biosolids containing pollutants in excess of the ceiling concentrations may not be beneficially reused by application to the land. Biosolids containing pollutants in excess of the pollutant concentrations, but less than the ceiling concentrations, may be beneficially reused by application to the land; however, the total quantity of biosolids applied to the land may not exceed the cumulative pollutant loading rates.

6. **Septage Requirements**
Septage may not be accepted at this facility for treatment or processing without written approval from DEQ.

7. **Re-opener**
Upon EPA approval of a Total Maximum Daily Load (TMDL) addressing any pollutants during the discharge period, this permit may be re-opened to include any waste load allocations (WLA), best management practice or any other condition the TMDL requires.

SCHEDULE B
Minimum Monitoring and Reporting Requirements

1. Monitoring and Reporting Protocols

a. Test Methods, Quantitation Limits, and Laboratory Quality Assurance and Quality Control
   i. Test Methods – monitoring must be conducted according to test procedures in 40 CFR Part 136.
   ii. Quantitation Limits (QLs)[1] – all compliance analyses must meet the QLs specified in the permit. Effluent characterization monitoring must use the QLs unless one of the conditions below is met.
      a) The monitoring result indicates nondetect at an MDL which is less than or equal to the QL, or
      b) Monitoring is being conducted solely for the purpose of effluent characterization, and matrix effects prevent the attainment of QLs[2]. In such cases, DEQ may authorize re-sampling. If requested by the permit holder, Tier 1 re-sampling may be combined with Tier 2 monitoring.

   Laboratories may need to modify methods as allowed in 40 CFR Part 136.6 or in EPA's Solutions for Analytical Chemistry Problems with Clean Water Methods, EPA 821-R-07-002, March 2007 in order to achieve some QLs.
   iii. Laboratory Quality Assurance and Quality Control (QA/QC) – the permittee must develop and implement a written QA/QC program that conforms to the requirements of 40 CFR Part 136.7.

b. Re-analysis and Re-sampling if QA/QC Requirements Not Met

If QA/QC requirements are not met any analysis, the results must be included in reports, but not used in calculations required by this permit. The permittee must re-analyze the sample if QA/QC requirements are not met. If the sample cannot be re-analyzed, the permittee must re-sample and analyze at the earliest seasonally appropriate opportunity.

c. Significant Figures and Rounding Conventions

Mass load limits all have two significant figures unless otherwise noted. The permittee must report the same number of significant digits as the permit limit for a given parameter. Regardless of the rounding conventions used by the permittee (such as, rounding 5 up for the calculated results or, in the case of laboratory results, rounding 5 to the nearest even number), the permittee must use the convention consistently, and must ensure that laboratories employed by the permittee use the same convention[3].

d. Reporting of Detection Levels and Quantitation Limits

When reporting sampling results, the permittee must record the laboratory detection level and quantitation limit as defined below for each analyte except biochemical oxygen demand (BOD), suspended solids (TSS), fats, oil and grease (FOG), bacteria and pH).
   i. Detection Level (DL): The Method Detection Limit (MDL) or Limit of Detection (LOD) and derived using 40 CFR Part 136 Appendix B; and
   ii. Quantitation Limit (QL): The Method Reporting Limit (MRL) or Limit of Quantitation (LOQ). It is the lowest level at which the entire analytical system gives a recognizable signal and acceptable calibration for the analyte. It is equivalent to the concentration of the lowest calibration standard assuming that all method-specified sample weights, volumes, and cleanup procedures have been employed.

e. Reporting Sample Results

The permittee must follow the procedures listed below when reporting sampling results.

i. If a sample result is below the DL, the permittee must report the result as less than the specified DL. For example, if the DL is 1.0 µg/L and the result is non-detect, report "<1.0 µg/L" on the discharge monitoring report (DMR).

ii. If a sample result is above the DL but below the QL, the permittee must report the result as the DL preceded by DEQ's data code "e". For example, if the DL is 1.0 µg/l, the QL is 3.0 µg/L, and the result is estimated to be between the DL and QL, the permittee must report "e1.0 µg/L" on the DMR.

iii. If a sample result does not meet QA/QC requirements, the result must be included in the DMR along with a notation but must not be used in any calculation required by this permit.

iv. Requirements i. and ii. above do not apply to the following parameters: biochemical oxygen demand (BOD), suspended solids (TSS), fats, oil and grease (FOG), bacteria and pH.

f. Calculating and Reporting Mass Loads

The permittee must follow the procedures listed below when calculating and reporting mass loads.

Flow (MGD) X Concentration (mg/L) X 8.34 = Pounds per day

i. When concentration data are below the DL: To calculate the mass load from this result, use the DL. Report the mass load as less than the calculated mass load. For example, if flow is 2 MGD and the reported sample result is <1.0 µg/L, report "<0.02 lb/day" for mass load on the DMR (1.0 µg/L x 2 MGD x conversion factor = 0.017 lb/day, round off to 0.02 lb/day).

ii. When concentration data are above the DL, but below the QL: To calculate the mass load from this result, use the detection level. Report the mass load as the calculated mass load preceded by "e". For example, if flow is 2 MGD and the reported sample result is e1.0 µg/L, report "e0.02 lb/day" for mass load on the DMR (1.0 µg/L x 2 MGD x conversion factor = 0.017 lb/day, round off to 0.02 lb/day).

2. Influent Monitoring Requirements

The permittee must monitor influent just downstream of the Parshall flume and ahead of the pre-aeration basin in accordance with the table below.

Table B1: Influent Monitoring

Item or Parameter	Time Period	Minimum Frequency	Sample Type/Action	Report
flow (MGD)	year-round	daily	measurement by totalizing meter	1. daily values 2. monthly total 3. monthly average
flow meter calibration		annually	verification	report date that calibration was completed
BOD_5 and TSS (mg/L)	year-round	2/Week	24-hour composite	1. daily values 2. monthly average
pH (S.U.)	year-round	3/week	continuous	1. daily values 2. maximum daily value 3. minimum daily value

3. Compliance Effluent Monitoring

When discharging to the Molalla River, the permittee must monitor effluent for Outfall 001 at the discharge monitoring structure (DMS) located near the Molalla River and in accordance with the table below:

Table B2: Effluent Monitoring (November - April)

Item or Parameter	Minimum Frequency	Sample Type/Action	Report
flow (MGD)	daily	measurement by totalizing meter	1. daily values 2. monthly total 3. monthly average
BOD_5 and TSS (mg/L)	2/week	24-hour composite	1. daily values 2. monthly average 3. weekly averages 4. maximum weekly average 5. maximum daily value
BOD_5 and TSS mass load (lb/day)	2/week	calculation	1. daily values 2. monthly average 3. weekly averages 4. maximum weekly average 5. maximum daily value
BOD_5 and TSS percent removal (%)	monthly	calculation	monthly average percentage
pH (S.U.)	3/week	continuous	1. daily values 2. maximum daily value 3. minimum daily value
temperature (° C)	daily	continuous	1. daily maximum 2. weekly average of daily maximum
E. coli (colonies/100 mL or MPN/100mL depending on method)	1/week	grab	1. daily values 2. maximum daily value 3. monthly geometric mean
quantity chlorine used (lbs)	daily	measurement	1. daily values 2. monthly average
total residual chlorine (mg/L)	daily	continuous	1. daily values 2. maximum daily value 3. monthly average
Lagoon Depth	weekly	staff gauge reading	monthly values

4. Ambient Stream Monitoring (Molalla River)

The permit holder must report stream data using online USGS recordings from gauge station 14200000 located at river mile 6.01 according to the table below:

Table B3: Molalla River

Item or Parameter	Time period	Frequency	Sample type/action	Report
flow (cfs)	November-May	daily	on-line reading from USGS gauge station 14200000	1. daily values 2. monthly average
temperature	November-May	5/week	continuous	1. monthly average 2. 7-day average of daily maximum
alkalinity	November-May	annually	grab	daily values

5. **Effluent Toxics Characterization Monitoring**
The permittee must analyze effluent samples for the parameters listed in tables B4-B7 below. Samples must be collected at the DMS during two sample events each year in 2015 and 2016. Samples must be 24-hour composites except as noted in Table B4, B5 and B6 for Total Cyanide, Free Cyanide, Total Phenolic Compounds and Volatile Organic Compounds.

Table B4: Metals, Cyanide, Total Phenols, Nutrients and Hardness
(µg/L unless otherwise specified)

Pollutant[a]	CAS[b]	QL	Pollutant	CAS	QL
Antimony	7440360	0.10	Mercury	7439976	0.005
Arsenic (total)[c]	7440382	0.50	Nickel	7440020	10
Arsenic (Inorganic)[c]	7440382	1.0	Selenium	7782492	2.0
Arsenic III[c]	22541544	50	Silver	7440224	1.0
Beryllium	7440417	0.10	Thallium	7440280	0.10
Cadmium	7440439	0.10	Zinc	7440666	5.0
Chromium (total)	7440473	0.40	Cyanide (Free)[e]	57125	10
Chromium III[d]	16065831	10	Cyanide (Total)[e]	57125	5.0
Chromium VI[d]	18540299	10	Total Phenolic Compounds[f]		5.0
Copper	7440508	10	Nitrates-Nitrite (NO_3+NO_2-N)	14797558	100
Iron	7439896	100	Ammonia (NH_3-N)	7664417	1000
Lead	7439921	5	Hardness (Total as $CaCO^3$)		
Alkalinity					

a. All metals must be analyzed for total recoverable concentration unless otherwise specified.
b. Chemical Abstract Service
c. If the result for Total Arsenic does not exceed 1.0 µg/L, it is not necessary to monitor for Inorganic Arsenic and Arsenic III. Otherwise, Method 1632A must be used to monitor for Inorganic Arsenic and Arsenic III.
d. If the result for Total Chromium does not exceed 10 µg/L, then it is not necessary to monitor for Chromium III and Chromium VI.
e. When sampling for Cyanide, at least six discrete grab samples must be collected over the operating day with samples collected no less than one hour apart. The aliquot must be at least 100 mL and collected and composited into a larger container that has been preserved with sodium hydroxide to insure sample integrity. If the result for Total Cyanide does not exceed 5.0 µg/L, it is not necessary to test for free cyanide.
f. When sampling for Total Phenolic Compounds, at least six discrete grab samples must be collected over the operating day with samples collected no less than one hour apart. "Total Phenolic Compounds" is identified as Phenols in 40 CFR Part 136.3, Table 1B.

Table B5: Volatile Organic Compounds
(µg/L unless otherwise specified)

Pollutant[a]	CAS	QL	Pollutant[a]	CAS	QL
Acrolein	107028	5.0	1,1-dichloroethylene[e]	75354	0.50
acrylonitrile	107131	5.0	1,2-dichloropropane	78875	0.50
Benzene	71432	0.50	1,3-dichloropropylene[f]	542756	0.50
bromoform	75252	0.50	Ethylbenzene	100414	0.50
carbon tetrachloride	56235	0.50	methyl bromide[g]	74839	0.50
chlorobenzene	108907	0.50	methyl chloride[h]	74873	0.50
Chlorodibromomethane[b]	124481	0.50	methylene chloride	75092	0.50
chloroethane	75003	0.50	1,1,2,2-tetrachloroethane	79345	0.50
2-chloroethylvinyl ether	110758	5.0	tetrachloroethylene[i]	127184	0.50
chloroform	67663	0.50	Toluene	108883	0.50
dichlorobromomethane[c]	75274	0.50	1,1,1-trichloroethane	71556	0.50
1,1-dichloroethane	75343	0.50	1,1,2-trichloroethane	79005	0.50
1,2-dichloroethane	107062	0.50	Trichloroethylene[j]	79016	0.50
1,2-trans-dichloroethylene[d]	156605	0.50	vinyl chloride	75014	0.50

a. Permit holders with lagoon facilities that have retention times in excess of 24 hours may collect a single sample over the operating day. Permit holders with other types of facilities must collect six discrete samples (not less than 40 mL) over the operating day at intervals of at least one hour. The samples may be analyzed separately or composited. If analyzed separately, the analytical results for all samples must be averaged for reporting purposes. If composited, they must be proportionally composited in the laboratory at the time of analysis and this must be done in a manner that maintains the integrity of the samples and prevents the loss of volatile analytes. The quantitation limits listed above remain in effect for composite samples.
b. Chlorodibromomethane is identified as dibromochloromethane in 40 CFR Part 136.3, Table 1C.
c. Dichlorobromomethane is identified as Bromodichloromethane in 40 CFR Part 136.3, Table 1C.
d. 1,2-trans-dichloroethylene is identified as trans-1,2-dichloroethene in 40 CFR Part 136.3, Table 1C.
e. 1,1-dichloroethylene is identified as 1,1-dichloroethene in 40 CFR Part 136.3, Table 1C.
f. 1,3-dichloropropylene consists of both cis-1,3-dichloropropene and trans-1,3-dichloropropene. Both should be reported individually.
g. Methyl bromide is identified as Bromomethane in 40 CFR Part 136.3, Table 1C.
h. Methyl chloride is identified as chloromethane in 40 CFR Part 136.3, Table 1C.
i. Tetrachloroethylene is identified as tetrachloroethene in 40 CFR Part 136.3, Table 1C.
j. Trichloroethylene is identified as trichloroethene in 40 CFR Part 136.3, Table 1C.

Table B6: Acid-Extractable Compounds

(µg/L unless otherwise specified)

Pollutant	CAS	QL[a]	Pollutant	CAS	QL[a]
p-chloro-m-cresol	59507	1.0	2-nitrophenol	88755	2.0
2-chlorophenol	95578	1.0	4-nitrophenol	100027	5.0
2,4-dichlorophenol	120832	1.0	pentachlorophenol	87865	2.0
2,4-dimethylphenol	105679	5.0	Phenol	108952	1.0
4,6-dinitro-o-cresol[c]	534521	2.0	2,4,5-trichlorophenol[d]	95954	2.0
2,4-dinitrophenol	51285	5.0	2,4,6-trichlorophenol	88062	1.0

a. Some QLs may need methods with modification allowed in 40 CFR Part 136.6 or EPA's *Solutions for Analytical Chemistry Problems w/Clean Water Methods, March 2007.* **(url: http://water.epa.gov/scitech/methods/cwa/atp/upload/2008_02_06_methods_pumpkin.pdf)**

b. p-chloro-m-cresol is identified as 4-Chloro-3-methylphenol in 40 CFR Part 136.3, Table 1C.

c. 4,6-dinitro-o-cresol is identified as 2-Methyl-4,6-dinitrophenol in 40 CFR Part 136.3, Table 1C.

d. To monitor for 2,4,5-trichlorophenol, use EPA Method 625.

Table B7: Base-Extractable Compounds

(µg/L unless otherwise specified)

Pollutant	CAS	QL[a]	Pollutant	CAS	QL
acenaphthene	83329	1.0	3,3-Dichlorobenzidine	91941	1.0
acenaphthylene	208968	1.0	diethyl phthalate	84662	1.0
anthracene	120127	1.0	dimethyl phthalate	131113	1.0
benzidine	92875	10	2,4-dinitrotoluene	121142	1.0
benzo(a)anthracene	56553	1.0	2,6-dinitrotoluene	606202	1.0
benzo(a)pyrene	50328	1.0	1,2-diphenylhydrazine[d]	122667	5.0
3,4-benzofluoranthene[b]	205992	1.0	fluoranthene	206440	2.0
benzo(ghi)perylene	191242	1.0	fluorene	86737	1.0
benzo(k)fluoranthene	207089	1.0	hexachlorobenzene	118741	1.0
bis(2-chloroethoxy)methane	111911	2.0	hexachlorobutadiene	87683	2.0
bis(2-chloroethyl)ether	111444	1.0	hexachlorocyclopentadiene	77474	2.0
bis(2-chloroisopropyl)ether[c]	108601	2.0	hexachloroethane	67721	2.0
bis (2-ethylhexyl)phthalate	117817	1.0	indeno(1,2,3-cd)pyrene	193395	1.0
4-bromophenyl phenyl ether	101553	1.0	isophorone	78591	10
butylbenzyl phthalate	85687	1.0	napthalene	91203	1.0
2-chloronaphthalene	91587	1.0	nitrobenzene	98953	1.0
4-chlorophenyl phenyl ether	7005723	1.0	N-nitrosodimethylamine	62759	1.0
chrysene	218019	1.0	N-nitrosodi-n-propylamine	621647	2.0
di-n-butyl phthalate	84742	1.0	N-nitrosodiphenylamine	86306	1.0
di-n-octyl phthalate	117817	1.0	Pentachlorobenzene[e]	608935	10
dibenzo(a,h)anthracene	53703	1.0	phenanthrene	85018	1.0
1,2-Dichlorobenzene (o)	95501	0.50	pyrene	129000	1.0
1,3-Dichlorobenzene (m)	541731	0.50	1,2,4-trichlorobenzene	128821	5.0
1,4-Dichlorobenzene (p)	106467	0.50	Tetrachlorobenzene,1,2,4,5[e]	95943	1.0

a. Some QLs may need methods with modification allowed in 40 CFR Part 136.6 or EPA's *Solutions for Analytical chemistry Problems w/Clean Water Methods, March 2007.*
b. 3,4-benzofluoranthene is listed as Benzo(b)fluoranthene in 40 CFR Part 136.
c. Bis(2-chloroisopropyl)ether is listed as 2,2'-oxybis(2-chloro-propane in 40 CFR Part 136.
d. 1,2-diphenylhydrazine is difficult to analyze given its rapid decomposition rate in water. Azobenzene (a decomposition product of 1,2-diphenylhydrazine), should be analyzed as an estimate of this chemical.
e. To analyze for Pentachlorobenzene and Tetrachlorobenzene 1,2,4,5, use EPA Method 625.

6. Ambient and Additional Effluent Characterization Monitoring

DEQ will evaluate the results of monitoring required under Schedule B, condition 5: Effluent Toxics Characterization Monitoring, to determine whether the permittee will be required to conduct additional ambient water quality and/or effluent monitoring. DEQ will notify the permittee of its determination through a written "Monitoring Action Letter."

a. Sampling Plan

If additional monitoring is needed, the permittee must submit a sample and analysis plan to DEQ for approval within 3 months of receipt of the DEQ Monitoring Action Letter. The sampling plan must include the following:

i. Characterization of ambient water quality for any pollutants identified as having the reasonable potential to exceed the water quality criterion at the point of discharge .
ii. Completion of Schedule B sampling requirements that could not be completed due to analytical interferences.
iii. Characterization of effluent and ambient water quality for new pollutant parameter(s) adopted by the EQC after permit issuance.

iv. Characterization of effluent and ambient water quality, if necessary, when the receiving stream is listed as impaired on the DEQ 303(d) list for new parameter(s).
v. Sampling locations for receiving water must be located as far upstream from outfall location as necessary to insure that samples contain no effluent.
vi. Timing of sampling must coincide with the critical period.

b. Implementation
The permittee must begin implementing the approved plan within 3 months of DEQ approval.

7. Whole Effluent Toxicity Testing Requirements
The permittee must monitor final effluent for whole effluent toxicity as described below using the testing protocols specified in Schedule D, Condition 9, Whole Effluent Toxicity Testing for Freshwater. Samples for Outfall 001 must be collected at the DMS.

Table B8: WET Test Monitoring

Parameter	Minimum Frequency	Sample Type/Location
Acute toxicity	The permit holder must monitor 4 times over the permit cycle with each sample collected during a different month of the discharge period. All four samples may be collected in the first year of the permit or they may be collected during a different month each year over 4 years (i.e., Year 1, November, Year 2, December). When possible, conduct WET testing concurrent with Effluent Toxics Characterization Monitoring as described in Schedule B, Condition 5. If the four consecutive tests show no toxicity at the acute (ZID) and the chronic (RMZ) dilutions, no further testing is required. Otherwise, the permittee must re-test and if necessary, evaluate the cause of toxicity as described in Schedule D, Condition 9.	For acute toxicity: 24-hr composite taken at the DMS after dechlorination and before the effluent flume.
Chronic toxicity		For chronic toxicity: 24-hr composite, taken at the DMS after dechlorination and before the effluent flume.

8. Recycled Water Monitoring Requirements: Outfall no. 002
The permittee must monitor recycled water as listed below. The samples must be representative of the recycled water delivered for beneficial reuse at a location identified in the Recycled Water Use Plan.

Table B9: Recycled Water Monitoring

Item or Parameter	Minimum Frequency	Sample Type
flow (MGD) or quantity irrigated (inches/acre)	daily	measurement
flow meter calibration	annually	verification
quantity chlorine used (lbs)	daily	measurement
chlorine, total residual (mg/L)	daily	grab
pH	2/week	grab

Item or Parameter	Minimum Frequency	Sample Type
total coliform	daily (Class A) 3/week (Class B) 1/week (Class C)	grab
turbidity	hourly (Class A only)	measurement
nutrients (TKN, NO_2+NO_3-N, NH_3-N, Total Phosphorus)	quarterly	grab

9. Biosolids Monitoring Requirements

The permittee must monitor biosolids land applied or produced for sale or distribution as listed below. The samples must be representative of the quality and quantity of biosolids generated and the treatment process used to prepare the biosolids.

Table B10: Biosolids Monitoring

Item or Parameter	Minimum Frequency	Sample Type
nutrient and conventional parameters (% dry weight unless otherwise specified): 1) Total Kjeldahl Nitrogen (TKN) 2) Nitrate-Nitrogen (NO_3-N) 3) Ammonium Nitrogen (NH_4-N) 4) Total Phosphorus (P) 5) Potassium (K) 6) pH (S.U.) 7) Total Solids 8) Volatile Solids	as described in the DEQ-approved Biosolids Management Plan, but not less than the frequency in Table B11.	
pollutants: As, Cd, Cu, Hg, Pb, Mo, Ni, Se, Zn, mg/kg dry weight	as described in the DEQ-approved Biosolids Management Plan, but not less than the frequency in Table B11	
pathogen reduction	as described in the DEQ-approved Biosolids Management Plan, but not less than the frequency in Table B11.	as described in the DEQ-approved Biosolids Management Plan
vector attraction reduction	as described in the DEQ-approved Biosolids Management Plan, but not less than the frequency in Table B11.	as described in the DEQ-approved Biosolids Management Plan
record of biosolids land application: date, quantity, location.	each event	record the date, quantity, and location of biosolids land applied on site location map or equivalent electronic system, such as GIS.

Table B11: Biosolids Minimum Monitoring Frequency

Quantity of biosolids land applied or produced for sale or distribution per calendar year		Minimum Sampling Frequency
(dry metric tons)	(dry U.S. tons)	
Less than 290	Less than 320	Once per year
290 to 1,500	320 to 1,653	Once per quarter
1,500 to 15,000	1,653 to 16,535	Once per 60 days
15,000 or more	16,535 or more	Once per month

10. Permit Application Monitoring Requirements

The following information is provided for the convenience of the permit holder and does not represent a requirement under the current permit. The renewal application for this permit requires 3 scans for the parameters listed in the table below. This data may be collected up to 4.5 years in advance of submittal of the renewal application. DEQ recognizes that some facilities may find it difficult to collect 3 scans that are representative of the seasonal variation in the discharge from each outfall within the permit renewal timeframe, and is therefore calling attention to it within this permit.

Table B12: Effluent Monitoring Required for NPDES Permit Application
(a minimum of 3 scans required)

Parameter
Ammonia (as N)
Chlorine (Total Residual, TRC)
Dissolved Oxygen
Total Kjeldahl Nitrogen (TKN)
Nitrate Plus Nitrite Nitrogen
Oil and Grease

11. Minimum Reporting Requirements

The permittee must report monitoring results as listed below.

Table B13: Reporting Requirements and Due Dates

Reporting Requirement	Frequency	Due Date	Report Form (unless otherwise specified in writing)	Submit To:
1. Table B1: Influent Monitoring 2. Table B2: Effluent Monitoring	monthly	15^{th} day of the following month	DEQ-approved discharge monitoring report (DMR).	DEQ Regional Office (See notes a & b)

Reporting Requirement	Frequency	Due Date	Report Form (unless otherwise specified in writing)	Submit To:
Table B3: Ambient monitoring	Monthly (November-May)	15th day of the following month	DEQ-approved discharge monitoring report (DMR).	DEQ Regional Office
Tables B4 – B7: Effluent Toxics Characterization	once (See Note c.)	end of the 25th month of this permit term	• DEQ - approved electronic summary template • 1 hard copy	DEQ Regional Office
Table B8: WET Test Monitoring	See Table B8	within the month after performing the test.	1 hard copy	DEQ Regional Office
1. Recycled water annual report (see Schedule D for more detail) 2. Table B9: Recycled Water Monitoring	annually	January 31	2 hard copies	One each to: • DEQ Regional Office • DEQ Water Reuse Program Coordinator
1. Biosolids land application annual report describing solids handling activities for the previous year and includes the information described in OAR 340-050-0035(6)(a)-(e). 2. Table B10: Biosolids Monitoring	annually	February 19	3 hard copies	One each to: • DEQ Regional Office • DEQ Biosolids Program Coordinator • EPA Region 10
Inflow and infiltration report	annually	March 1	1 hard copy	DEQ Regional Office

Notes:

a. Name, certificate classification, and grade level of each responsible principal operator as well as identification of each system classification must be included on DMRs.

b. Equipment breakdowns and bypass events must be noted on DMRs.

c. Though the overall characterization only needs to be performed once during the permit cycle, a particular characterization may include multiple sampling events.

SCHEDULE D
Special Conditions

1. Inflow Removal

a. Within 180 days of the effective date of the permit, the permittee must submit to DEQ for approval an updated Inflow Removal Program. The program must consist of the following:
   i. Identification of all overflow points.
   ii. Verification that sewer system overflows are not occurring up to a 24-hour, 5-year storm event or equivalent.
   iii. Monitoring of all pump station overflow points.
   iv. A process for identifying and removing all inflow sources into the permittee's sewer system over which the permittee has legal control, including a time .schedule for identifying and reducing inflow.
   v. If the permittee does not have the necessary legal authority for all portions of the sewer system or treatment facility, a strategy and schedule for gaining legal authority to require inflow reduction and a process and schedule for identifying and removing inflow sources once legal authority has been obtained.

b. Within 60 days of receiving written DEQ comments, the permittee must submit a final approvable program and time schedule.

c. A copy of the program must be kept at the wastewater treatment facility for review upon request by DEQ.

d. An annual inflow and infiltration report must be submitted to the DEQ as directed in Schedule B. The report must include the following:
   i. Details of activities performed in the previous year to identify and reduce inflow and infiltration.
   ii. Details of activities planned for the following year to identify and reduce inflow and infiltration.
   iii. A summary of sanitary sewer overflows that occurred during the previous year.
   iv. Information that demonstrates compliance with the DEQ-approved Inflow Removal Plan required by condition 1.a above.

2. Emergency Response and Public Notification Plan

The permittee must develop and maintain an Emergency Response and Public Notification Plan per Schedule F, Section B, Conditions 7 & 8. The permit holder must develop the plan within six months of permit issuance and update the plan annually to ensure that telephone and email contact information for applicable public agencies are current and accurate. An updated copy of the plan must be kept on file at the wastewater treatment facility for Department review. The latest plan revision date must be listed on the plan cover along with the reviewer's initials or signature.

3. Recycled Water Use Plan

In order to distribute recycled water for reuse, the permittee must have and maintain a DEQ-approved Recycled Water Use Plan meeting the requirements in OAR 340-055-0025. The permittee must submit substantial modifications to an existing plan to DEQ for approval at least 60 days before making the proposed changes. Conditions in the plan are enforceable requirements under this permit.

4. Exempt Wastewater Reuse at the Treatment System

The permittee is exempt from the recycled water use requirements in OAR 340-055 when recycled water is used at the wastewater treatment system for landscape irrigation or for in-plant processes at a wastewater treatment system, and all of the following conditions are met:
   i. The recycled water is an oxidized and disinfected wastewater.
   ii. The recycled water is used at the wastewater treatment system site where it is generated or at an auxiliary wastewater or sludge treatment facility that is subject to the same NPDES or WPCF permit as the wastewater treatment system. Contiguous property to the parcel of land upon which the treatment system is located is considered the wastewater treatment system site if under the same ownership.
   iii. Spray or drift or both from the use does not occur off the site.
   iv. Public access to the site is restricted.

5. Biosolids Management Plan

The permittee must maintain a Biosolids Management Plan meeting the requirements in OAR 340-050-0031(5). The permittee must keep the plan updated and submit substantial modifications to an existing plan to DEQ for approval at least 60 days before making the proposed changes. Conditions in the plan are enforceable requirements under this permit.

6. Land Application Plan

a. Plan Contents

The permittee must maintain a land application plan that contains the information listed below. The land application plan may be incorporated into the Biosolids Management Plan.

i. All known DEQ-approved sites that will receive biosolids while the permit is effective.
ii. The geographic location, identified by county or smaller unit, of new sites which are not specifically listed at the time of permit application.
iii. Criteria that will be used in the selection of new sites.
iv. Management practices that will be implemented at new sites authorized by the DEQ.
v. Procedures for notifying property owners adjacent to proposed sites of the proposed activity before starting the application.

b. Site Authorization

The permittee must obtain written authorization from DEQ for each land application site before its use. Conditions in site authorizations are enforceable requirements under this permit. The permittee may land apply biosolids to a DEQ-approved site only as described in the site authorization, while this permit is effective, and with the written approval of the property owner. DEQ may modify or revoke a site authorization, following the procedures for a permit modification described in OAR 340-045-0055.

c. Public Participation

iii. No DEQ-initiated public notice is required for continued use of sites identified in the DEQ-approved land application plan.
iv. For new sites that fail to meet the site selection criteria in the land application plan, or that DEQ deems to be sensitive with respect to residential housing, runoff potential, or threat to groundwater, DEQ will provide an opportunity for public comment as directed by OAR 340-050-0015(10).
v. For all other new sites, the permittee must provide for public participation, following procedures in its DEQ-approved land application plan.

7. Wastewater Solids Transfers

a. *Within state.* The permittee may transfer wastewater solids including Class A and Class B biosolids, to another facility permitted to process or dispose of wastewater solids, including but not limited to: another wastewater treatment facility, landfill, or incinerator. The permittee must monitor, report, and dispose of solids as required under the receiving facility's permit.

b. *Out of state.* If wastewater solids, including Class A and Class B biosolids, are transferred out of state for use or disposal, the permittee must obtain written authorization from DEQ, meet Oregon requirements for the use or disposal of wastewater solids, notify in writing the receiving state of the proposed use or disposal of wastewater solids, and satisfy the requirements of the receiving state.

8. Hauled Waste Control

The permittee may accept hauled wastes at discharge points designated by the POTW after receiving written DEQ approval of a hauled waste control plan. Hauled wastes may include wastewater solids from another wastewater treatment facility, septage, grease trap wastes, portable and chemical toilet wastes, landfill leachate, groundwater remediation wastewaters and commercial/industrial wastewaters. Wastewater solids from out-of-state facilities must not exceed the ceiling concentration limits in Schedule A, Table A5: Biosolids Limits.

9. Lagoon Solids

At least 60 days, and preferably six months before removing accumulated solids from the lagoon, the permittee must submit to DEQ a biosolids management plan and land application plan as required in conditions 4 and 5 respectively.

DEQ will provide an opportunity for comment on the biosolids management plan and land application plan, as directed by OAR 340-050-0015(8). The permittee must follow the conditions in the approved plan.

10. Whole Effluent Toxicity Testing for Freshwater

a. The permit holder must conduct whole effluent toxicity (WET) tests as specified here and in Schedule B of this permit.

b. Acute Toxicity Testing - Organisms and Protocols

  i. The permittee must conduct 48-hour static renewal tests with *Ceriodaphnia dubia* (water flea) and 96-hour static renewal tests with *Pimephales promelas* (fathead minnow).

  ii. All test methods and procedures must be in accordance with Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, Fifth Edition, EPA-821-R-02-012, October 2002. Any deviation of the bioassay procedures outlined in this method must be submitted in writing to DEQ for review and approval before use.

  iii. Treatments to the final effluent samples (for example, dechlorination), except those included as part of the methodology, may not be performed by the laboratory unless approved by DEQ before analysis.

  iv. Unless otherwise approved by DEQ in writing, acute tests must be conducted on a control (0%) and the following dilution series: 6.25%, 10%, 25%, 50%, and 100%. An acute WET test will be considered to show toxicity if there is a statistically significant difference in survival between the control and 10% effluent reported as the NOEC $\leq$ 10 percent effluent.

c. Chronic Toxicity Testing - Organisms and Protocols

  i. The permittee must conduct tests with *Ceriodaphnia dubia* (water flea) for reproduction and survival test endpoint, *Pimephales promelas* (fathead minnow) for growth and survival test endpoint, and *Raphidocelis subcapitata* (green alga formerly known as *Selanastrum capricornutum*) for growth test endpoint.

  ii. All test methods and procedures must be in accordance with Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Fourth Edition, EPA-821-R-02-013, October 2002. Any deviation of the bioassay procedures outlined in this method must be submitted in writing to DEQ for review and approval before use.

  iii. Treatments to the final effluent samples (for example, dechlorination), except those included as part of the methodology, may not be performed by the laboratory unless approved by DEQ before analysis.

  iv. Unless otherwise approved by DEQ in writing, chronic tests must be conducted on a control (0%) and the following dilution series: 2%, 4%, 10%, 40%, and 100% A chronic WET test will be considered to show toxicity if the IC_{25} (25% inhibition concentration) occurs at dilutions equal to or less than the dilution that is known to occur at the edge of the mixing zone, that is, $IC_{25} \leq 4\%$

d. Dual End-Point Tests

  i. WET tests may be dual end-point tests in which both acute and chronic end-points can be determined from the results of a single chronic test. The acute end-point will be based on 48-hours for the *Ceriodaphnia dubia* (water flea) and 96-hours for the *Pimephales promelas* (fathead minnow).

  ii. All test methods and procedures must be in accordance with Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Fourth Edition, EPA-821-R-02-013, October 2002. Any deviation of the bioassay procedures outlined in this method must be submitted in writing to DEQ for review and approval before use.

  iii. Unless otherwise approved by DEQ in writing, tests run as dual end-point tests must be conducted on a control (0%) and the following dilution series: 2%, 4%, 10%, 40%, and 100%. Toxicity determinations for dual end-point tests must correspond to the acute and chronic tests described in conditions 9.b.iv. and 9.c.iv. above.

e. Evaluation of Causes and Exceedances
   i. If any test exhibits toxicity as described in conditions 9.b.iv. and 9.c.iv. above, the permittee must conduct another toxicity test using the same species and DEQ-approved methodology within two weeks unless DEQ approves otherwise.
   ii. If two consecutive WET test results indicate acute or chronic toxicity as described in conditions 9.b.iv. and 9.c.iv. above, the permittee must immediately notify DEQ of the results. DEQ will work with the permittee to determine the appropriate course of action to evaluate and address the toxicity.

f. Quality Assurance and Reporting
   i. Quality assurance criteria, statistical analyses, and data reporting for the WET tests must be in accordance with the EPA documents stated in this condition.
   ii. A bioassay laboratory report for each test must be prepared according to the EPA method documents referenced in this Schedule. The report must include all QA/QC documentation, statistical analysis for each test performed, standard reference toxicant test (SRT) conducted on each species required for the toxicity tests, and completed Chain-of-Custody forms for the samples including time of sample collection and receipt. Reports must be submitted to DEQ within 45 days of test completion.
   iii. The report must include all endpoints measured in the test: NOEC, LOEC, and IC_{25}.
   iv. The permittee must make available to DEQ upon request the written standard operating procedures they, or the laboratory performing the WET tests, use for all toxicity tests DEQ requires.

g. Reopener
   DEQ may reopen and modify this permit to include new limits, monitoring requirements, and/or conditions as determined by DEQ to be appropriate, and in accordance with procedures outlined in OAR Chapter 340, Division 45 if:
   i. WET testing data indicate acute and/or chronic toxicity.
   ii. The facility undergoes any process changes.
   iii. Discharge monitoring data indicate a change in the reasonable potential to exhibit toxicity.

11. Operator Certification

a. Definitions
   i. "Supervise" means to have full and active responsibility for the daily on-site technical operation of a wastewater treatment system or wastewater collection system.
   ii. "Supervisor" or "designated operator" means the operator delegated authority by the permittee for establishing and executing the specific practice and procedures for operating the wastewater treatment system or wastewater collection system in accordance with the policies of the owner of the system and any permit requirements.
   iii. "Shift Supervisor" means the operator delegated authority by the permittee for executing the specific practice and procedures for operating the wastewater treatment system or wastewater collection system when the system is operated on more than one daily shift.
   iv. "System" includes both the collection system and the treatment systems.

b. The permittee must comply with OAR Chapter 340, Division 49, "Regulations Pertaining to Certification of Wastewater System Operator Personnel" and designate a supervisor whose certification corresponds with the classification of the collection and/or treatment system, as specified on page 1 of this permit.

c. The permittee must have its system supervised full-time by one or more operators who hold a valid certificate for the type of wastewater treatment or wastewater collection system, and at a grade equal to or greater than the wastewater system's classification, as specified on page 1 of this permit.

d. The permittee's wastewater system may not be without the designated supervisor for more than 30 days. During this period, there must be another person available to supervise who is certified at no more than one grade lower than the classification of the wastewater system. The permittee must delegate authority to this operator to supervise the operation of the system.

e. If the wastewater system has more than one daily shift, the permittee must have another properly certified operator available to supervise system operation. Each shift supervisor, if any, must be certified at no more than one grade lower than the system classification.

f. The permittee is not required to have a supervisor on-site at all times; however, the supervisor must be available to the permittee and operator at all times.

g. The permittee must notify DEQ in writing of the name of the system supervisor. The permittee may replace or re-designate the system supervisor with another properly certified operator at any time and must notify DEQ in writing within 30 days of replacement or re-designation of operator in charge. The notice of replacement or re-designation must be sent to DEQ-Water Quality Division, Operator Certification Program, 2020 SW 4th Avenue, Suite 150, Portland, OR 97201

h. Upon written request, DEQ may grant the permittee reasonable time, not to exceed 120 days, to obtain the services of a qualified person to supervise the wastewater system. The written request must include a justification for the time needed, schedule for recruiting and hiring, date the system supervisor availability ceased, and name of the alternate system supervisor as required above.

12. Industrial Waste Survey/Pretreatment Program

The permittee must conduct an industrial user survey to determine the presence of any industrial users discharging wastewaters subject to pretreatment and submit a report on the findings to DEQ within 24 months of permit issuance. The purpose of the survey is to identify whether there are any categorical industrial users discharging to the POTW, and ensure regulatory oversight of these discharges to state waters. If the POTW has already completed a baseline IU Survey the results of this survey are to be provided to DEQ within two months of permit re-issuance.

Guidance on conducting IU Surveys can be found at
http://www.deq.state.or.us/wq/pretreatment/docs/guidance/IUSurveyGuidance.pdf

Once an initial baseline IU Survey is conducted it is to be maintained by the POTW and made available for inspection by DEQ. Every 5 years from permit renewal, the permittee must submit an updated IU survey.

13. Cooperative Operating Agreement with City of Canby

The permittee must maintain a copy of the Cooperative Operating Agreement with the city of Canby, and meet all Agreement conditions, particularly regarding contacting Canby when the permittee plans to begin discharging to the Molalla River.

14. Leak Test.

Within one year following permit issuance, the permittee must perform a lagoon leak test. Within 30 days after completing the test, the permittee must report the test results to DEQ. Depending on the test results, the permittee may need to take a further action, such as perform groundwater monitoring to determine if the leakage has adversely impacted groundwater quality.

SCHEDULE F
NPDES GENERAL CONDITIONS – DOMESTIC FACILITIES

SECTION A. STANDARD CONDITIONS

A1. Duty to Comply with Permit

The permittee must comply with all conditions of this permit. Failure to comply with any permit condition is a violation of Oregon Revised Statutes (ORS) 468B.025 and the federal Clean Water Act and is grounds for an enforcement action. Failure to comply is also grounds for DEQ to terminate, modify and reissue, revoke, or deny renewal of a permit.

A2. Penalties for Water Pollution and Permit Condition Violations

The permit is enforceable by DEQ or EPA, and in some circumstances also by third-parties under the citizen suit provisions 33 USC § 1365. DEQ enforcement is generally based on provisions of state statutes and Environmental Quality Commission (EQC) rules, and EPA enforcement is generally based on provisions of federal statutes and EPA regulations.

ORS 468.140 allows DEQ to impose civil penalties up to $10,000 per day for violation of a term, condition, or requirement of a permit. The federal Clean Water Act provides for civil penalties not to exceed $32,500 and administrative penalties not to exceed $11,000 per day for each violation of any condition or limitation of this permit.

Under ORS 468.943, unlawful water pollution, if committed by a person with criminal negligence, is punishable by a fine of up to $25,000, imprisonment for not more than one year, or both. Each day on which a violation occurs or continues is a separately punishable offense. The federal Clean Water Act provides for criminal penalties of not more than $50,000 per day of violation, or imprisonment of not more than 2 years, or both for second or subsequent negligent violations of this permit.

Under ORS 468.946, a person who knowingly discharges, places, or causes to be placed any waste into the waters of the state or in a location where the waste is likely to escape into the waters of the state is subject to a Class B felony punishable by a fine not to exceed $250,000 and up to 10 years in prison per ORS chapter 161. The federal Clean Water Act provides for criminal penalties of $5,000 to $50,000 per day of violation, or imprisonment of not more than 3 years, or both for knowing violations of the permit. In the case of a second or subsequent conviction for knowing violation, a person is subject to criminal penalties of not more than $100,000 per day of violation, or imprisonment of not more than 6 years, or both.

A3. Duty to Mitigate

The permittee must take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment. In addition, upon request of DEQ, the permittee must correct any adverse impact on the environment or human health resulting from noncompliance with this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

A4. Duty to Reapply

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and have the permit renewed. The application must be submitted at least 180 days before the expiration date of this permit.

DEQ may grant permission to submit an application less than 180 days in advance but no later than the permit expiration date.

A5. Permit Actions

This permit may be modified, revoked and reissued, or terminated for cause including, but not limited to, the following:

a. Violation of any term, condition, or requirement of this permit, a rule, or a statute.
b. Obtaining this permit by misrepresentation or failure to disclose fully all material facts.
c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.
d. The permittee is identified as a Designated Management Agency or allocated a wasteload under a total maximum daily load (TMDL).
e. New information or regulations.
f. Modification of compliance schedules.
g. Requirements of permit reopener conditions
h. Correction of technical mistakes made in determining permit conditions.
i. Determination that the permitted activity endangers human health or the environment.
j. Other causes as specified in 40 CFR §§ 122.62, 122.64, and 124.5.
k. For communities with combined sewer overflows (CSOs):
   (1) To comply with any state or federal law regulation for CSOs that is adopted or promulgated subsequent to the effective date of this permit.
   (2) If new information that was not available at the time of permit issuance indicates that CSO controls imposed under this permit have failed to ensure attainment of water quality standards, including protection of designated uses.
   (3) Resulting from implementation of the permittee's long-term control plan and/or permit conditions related to CSOs.

The filing of a request by the permittee for a permit modification, revocation or reissuance, termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition.

A6. Toxic Pollutants
The permittee must comply with any applicable effluent standards or prohibitions established under Oregon Administrative Rule (OAR) 340-041-0033 and section 307(a) of the federal Clean Water Act for toxic pollutants, and with standards for sewage sludge use or disposal established under section 405(d) of the federal Clean Water Act, within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

A7. Property Rights and Other Legal Requirements
The issuance of this permit does not convey any property rights of any sort, or any exclusive privilege, or authorize any injury to persons or property or invasion of any other private rights, or any infringement of federal, tribal, state, or local laws or regulations.

A8. Permit References
Except for effluent standards or prohibitions established under section 307(a) of the federal Clean Water Act and OAR 340-041-0033 for toxic pollutants, and standards for sewage sludge use or disposal established under section 405(d) of the federal Clean Water Act, all rules and statutes referred to in this permit are those in effect on the date this permit is issued.

A9. Permit Fees
The permittee must pay the fees required by OAR.

SECTION B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

B1. Proper Operation and Maintenance
The permittee must at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) that are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems that are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

B2. Need to Halt or Reduce Activity Not a Defense

For industrial or commercial facilities, upon reduction, loss, or failure of the treatment facility, the permittee must, to the extent necessary to maintain compliance with its permit, control production or all discharges or both until the facility is restored or an alternative method of treatment is provided. This requirement applies, for example, when the primary source of power of the treatment facility fails or is reduced or lost. It is not a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

B3. Bypass of Treatment Facilities

a. Definitions
   (1) "Bypass" means intentional diversion of waste streams from any portion of the treatment facility. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, provided the diversion is to allow essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs b and c of this section.
   (2) "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources that can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.
b. Prohibition of bypass.
   (1) Bypass is prohibited and DEQ may take enforcement action against a permittee for bypass unless:
      i. Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;
      ii. There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass that occurred during normal periods of equipment downtime or preventative maintenance; and
      iii. The permittee submitted notices and requests as required under General Condition B3.c.
   (2) DEQ may approve an anticipated bypass, after considering its adverse effects and any alternatives to bypassing, if DEQ determines that it will meet the three conditions listed above in General Condition B3.b.(1).
c. Notice and request for bypass.
   (1) Anticipated bypass. If the permittee knows in advance of the need for a bypass, a written notice must be submitted to DEQ at least ten days before the date of the bypass.
   (2) Unanticipated bypass. The permittee must submit notice of an unanticipated bypass as required in General Condition D5.

B4. Upset

a. Definition. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operation error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventative maintenance, or careless or improper operation.
b. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of General Condition B4.c are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.
c. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset must demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:
   (1) An upset occurred and that the permittee can identify the causes(s) of the upset;
   (2) The permitted facility was at the time being properly operated;

(3) The permittee submitted notice of the upset as required in General Condition D5, hereof (24-hour notice); and
(4) The permittee complied with any remedial measures required under General Condition A3 hereof.

d. Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

B5. Treatment of Single Operational Upset

For purposes of this permit, a single operational upset that leads to simultaneous violations of more than one pollutant parameter will be treated as a single violation. A single operational upset is an exceptional incident that causes simultaneous, unintentional, unknowing (not the result of a knowing act or omission), temporary noncompliance with more than one federal Clean Water Act effluent discharge pollutant parameter. A single operational upset does not include federal Clean Water Act violations involving discharge without a NPDES permit or noncompliance to the extent caused by improperly designed or inadequate treatment facilities. Each day of a single operational upset is a violation.

B6. Overflows from Wastewater Conveyance Systems and Associated Pump Stations

a. Definition. "Overflow" means any spill, release or diversion of sewage including:
   (1) An overflow that results in a discharge to waters of the United States; and
   (2) An overflow of wastewater, including a wastewater backup into a building (other than a backup caused solely by a blockage or other malfunction in a privately owned sewer or building lateral), even if that overflow does not reach waters of the United States.
b. Reporting required. All overflows must be reported orally to DEQ within 24 hours from the time the permittee becomes aware of the overflow. Reporting procedures are described in more detail in General Condition D5.

B7. Public Notification of Effluent Violation or Overflow

If effluent limitations specified in this permit are exceeded or an overflow occurs that threatens public health, the permittee must take such steps as are necessary to alert the public, health agencies and other affected entities (for example, public water systems) about the extent and nature of the discharge in accordance with the notification procedures developed under General Condition B8. Such steps may include, but are not limited to, posting of the river at access points and other places, news releases, and paid announcements on radio and television.

B8. Emergency Response and Public Notification Plan

The permittee must develop and implement an emergency response and public notification plan that identifies measures to protect public health from overflows, bypasses, or upsets that may endanger public health. At a minimum the plan must include mechanisms to:

a. Ensure that the permittee is aware (to the greatest extent possible) of such events;
b. Ensure notification of appropriate personnel and ensure that they are immediately dispatched for investigation and response;
c. Ensure immediate notification to the public, health agencies, and other affected public entities (including public water systems). The overflow response plan must identify the public health and other officials who will receive immediate notification;
d. Ensure that appropriate personnel are aware of and follow the plan and are appropriately trained;
e. Provide emergency operations; and
f. Ensure that DEQ is notified of the public notification steps taken.

B9. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters must be disposed of in such a manner as to prevent any pollutant from such materials from entering waters of the state, causing nuisance conditions, or creating a public health hazard.

SECTION C. MONITORING AND RECORDS

C1. Representative Sampling

Sampling and measurements taken as required herein must be representative of the volume and nature of the monitored discharge. All samples must be taken at the monitoring points specified in this permit, and must be taken, unless otherwise specified, before the effluent joins or is diluted by any other waste stream, body of water, or substance. Monitoring points must not be changed without notification to and the approval of DEQ.

C2. Flow Measurements

Appropriate flow measurement devices and methods consistent with accepted scientific practices must be selected and used to ensure the accuracy and reliability of measurements of the volume of monitored discharges. The devices must be installed, calibrated and maintained to insure that the accuracy of the measurements is consistent with the accepted capability of that type of device. Devices selected must be capable of measuring flows with a maximum deviation of less than ± 10 percent from true discharge rates throughout the range of expected discharge volumes.

C3. Monitoring Procedures

Monitoring must be conducted according to test procedures approved under 40 CFR part 136 or, in the case of sludge use and disposal, approved under 40 CFR part 503 unless other test procedures have been specified in this permit.

C4. Penalties of Tampering

The federal Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit may, upon conviction, be punished by a fine of not more than $10,000 per violation, imprisonment for not more than two years, or both. If a conviction of a person is for a violation committed after a first conviction of such person, punishment is a fine not more than $20,000 per day of violation, or by imprisonment of not more than four years, or both.

C5. Reporting of Monitoring Results

Monitoring results must be summarized each month on a discharge monitoring report form approved by DEQ. The reports must be submitted monthly and are to be mailed, delivered or otherwise transmitted by the 15th day of the following month unless specifically approved otherwise in Schedule B of this permit.

C6. Additional Monitoring by the Permittee

If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR part 136 or, in the case of sludge use and disposal, approved under 40 CFR part 503, or as specified in this permit, the results of this monitoring must be included in the calculation and reporting of the data submitted in the discharge monitoring report. Such increased frequency must also be indicated. For a pollutant parameter that may be sampled more than once per day (for example, total residual chlorine), only the average daily value must be recorded unless otherwise specified in this permit.

C7. Averaging of Measurements

Calculations for all limitations that require averaging of measurements must utilize an arithmetic mean, except for bacteria which must be averaged as specified in this permit.

C8. Retention of Records

Records of monitoring information required by this permit related to the permittee's sewage sludge use and disposal activities must be retained for a period of at least 5 years (or longer as required by 40 CFR part 503). Records of all monitoring information including all calibration and maintenance records, all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit and records of all data used to complete the application for this permit must be retained for a period of at least 3 years from the date of the sample, measurement, report, or application. This period may be extended by request of DEQ at any time.

C9. Records Contents

Records of monitoring information must include:

a. The date, exact place, time, and methods of sampling or measurements;
b. The individual(s) who performed the sampling or measurements;
c. The date(s) analyses were performed;
d. The individual(s) who performed the analyses;
e. The analytical techniques or methods used; and
f. The results of such analyses.

C10. Inspection and Entry

The permittee must allow DEQ or EPA upon the presentation of credentials to:

a. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;
b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and
d. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by state law, any substances or parameters at any location.

C11. Confidentiality of Information

Any information relating to this permit that is submitted to or obtained by DEQ is available to the public unless classified as confidential by the Director of DEQ under ORS 468.095. The permittee may request that information be classified as confidential if it is a trade secret as defined by that statute. The name and address of the permittee, permit applications, permits, effluent data, and information required by NPDES application forms under 40 CFR § 122.21 are not classified as confidential [40 CFR § 122.7(b)].

SECTION D. REPORTING REQUIREMENTS

D1. Planned Changes

The permittee must comply with OAR 340-052, "Review of Plans and Specifications" and 40 CFR § 122.41(l)(1). Except where exempted under OAR 340-052, no construction, installation, or modification involving disposal systems, treatment works, sewerage systems, or common sewers may be commenced until the plans and specifications are submitted to and approved by DEQ. The permittee must give notice to DEQ as soon as possible of any planned physical alternations or additions to the permitted facility.

D2. Anticipated Noncompliance

The permittee must give advance notice to DEQ of any planned changes in the permitted facility or activity that may result in noncompliance with permit requirements.

D3. Transfers

This permit may be transferred to a new permittee provided the transferee acquires a property interest in the permitted activity and agrees in writing to fully comply with all the terms and conditions of the permit and EQC rules. No permit may be transferred to a third party without prior written approval from DEQ. DEQ may require modification, revocation, and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under 40 CFR § 122.61. The permittee must notify DEQ when a transfer of property interest takes place.

D4. Compliance Schedule

Reports of compliance or noncompliance with, or any progress reports on interim and final requirements contained in any compliance schedule of this permit must be submitted no later than 14 days following each schedule date. Any reports of noncompliance must include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirements.

D5. Twenty-Four Hour Reporting

The permittee must report any noncompliance that may endanger health or the environment. Any information must be provided orally (by telephone) to the DEQ regional office or Oregon Emergency Response System (1-800-452-0311) as specified below within 24 hours from the time the permittee becomes aware of the circumstances.

a. Overflows.
   (1) Oral Reporting within 24 hours.
      i. For overflows other than basement backups, the following information must be reported to the Oregon Emergency Response System (OERS) at 1-800-452-0311. For basement backups, this information should be reported directly to the DEQ regional office.
         (a) The location of the overflow;
         (b) The receiving water (if there is one);
         (c) An estimate of the volume of the overflow;
         (d) A description of the sewer system component from which the release occurred (for example, manhole, constructed overflow pipe, crack in pipe); and
         (e) The estimated date and time when the overflow began and stopped or will be stopped.
      ii. The following information must be reported to the DEQ regional office within 24 hours, or during normal business hours, whichever is earlier:
         (a) The OERS incident number (if applicable); and
         (b) A brief description of the event.
   (2) Written reporting within 5 days.
      i. The following information must be provided in writing to the DEQ regional office within 5 days of the time the permittee becomes aware of the overflow:
         (a) The OERS incident number (if applicable);
         (b) The cause or suspected cause of the overflow;
         (c) Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the overflow and a schedule of major milestones for those steps;
         (d) Steps taken or planned to mitigate the impact(s) of the overflow and a schedule of major milestones for those steps; and
         (e) For storm-related overflows, the rainfall intensity (inches/hour) and duration of the storm associated with the overflow.

      DEQ may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.
b. Other instances of noncompliance.
   (1) The following instances of noncompliance must be reported:
      i. Any unanticipated bypass that exceeds any effluent limitation in this permit;
      ii. Any upset that exceeds any effluent limitation in this permit;
      iii. Violation of maximum daily discharge limitation for any of the pollutants listed by DEQ in this permit; and
      iv. Any noncompliance that may endanger human health or the environment.
   (2) During normal business hours, the DEQ regional office must be called. Outside of normal business hours, DEQ must be contacted at 1-800-452-0311 (Oregon Emergency Response System).
   (3) A written submission must be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission must contain:
      i. A description of the noncompliance and its cause;
      ii. The period of noncompliance, including exact dates and times;
      iii. The estimated time noncompliance is expected to continue if it has not been corrected;
      iv. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance; and
      v. Public notification steps taken, pursuant to General Condition B7.
   (4) DEQ may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

D6. <u>Other Noncompliance</u>
The permittee must report all instances of noncompliance not reported under General Condition D4 or D5 at the time monitoring reports are submitted. The reports must contain:
a. A description of the noncompliance and its cause;
b. The period of noncompliance, including exact dates and times;
c. The estimated time noncompliance is expected to continue if it has not been corrected; and
d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

D7. <u>Duty to Provide Information</u>
The permittee must furnish to DEQ within a reasonable time any information that DEQ may request to determine compliance with the permit or to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit. The permittee must also furnish to DEQ, upon request, copies of records required to be kept by this permit.

Other Information: When the permittee becomes aware that it has failed to submit any relevant facts or has submitted incorrect information in a permit application or any report to DEQ, it must promptly submit such facts or information.

D8. <u>Signatory Requirements</u>
All applications, reports or information submitted to DEQ must be signed and certified in accordance with 40 CFR § 122.22.

D9. <u>Falsification of Information</u>
Under ORS 468.953, any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance, is subject to a Class C felony punishable by a fine not to exceed $125,000 per violation and up to 5 years in prison per ORS chapter 161. Additionally, according to 40 CFR § 122.41(k)(2), any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit including monitoring reports or reports of compliance or non-compliance will, upon conviction, be punished by a federal civil penalty not to exceed $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

D10. <u>Changes to Indirect Dischargers</u>
The permittee must provide adequate notice to DEQ of the following:
a. Any new introduction of pollutants into the POTW from an indirect discharger which would be subject to section 301 or 306 of the federal Clean Water Act if it were directly discharging those pollutants and;
b. Any substantial change in the volume or character of pollutants being introduced into the POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.
c. For the purposes of this paragraph, adequate notice must include information on (i) the quality and quantity of effluent introduced into the POTW, and (ii) any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

SECTION E. DEFINITIONS

E1. *BOD* or *BOD_5* means five-day biochemical oxygen demand.
E2. *CBOD* or *$CBOD_5$* means five-day carbonaceous biochemical oxygen demand.
E3. *TSS* means total suspended solids.
E4. *Bacteria* means but is not limited to fecal coliform bacteria, total coliform bacteria, *Escherichia coli* (*E. coli*) bacteria, and *Enterococcus* bacteria.
E5. *FC* means fecal coliform bacteria.
E6. *Total residual chlorine* means combined chlorine forms plus free residual chlorine
E7. *Technology based permit effluent limitations* means technology-based treatment requirements as defined in 40 CFR § 125.3, and concentration and mass load effluent limitations that are based on minimum design criteria specified in OAR 340-041.

E8. *mg/l* means milligrams per liter.
E9. *µg/l* means microgram per liter.
E10. *kg* means kilograms.
E11. *m^3/d* means cubic meters per day.
E12. *MGD* means million gallons per day.
E13. *Average monthly effluent limitation* as defined at 40 CFR § 122.2 means the highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month.
E14. *Average weekly effluent limitation* as defined at 40 CFR § 122.2 means the highest allowable average of daily discharges over a calendar week, calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges measured during that week.
E15. *Daily discharge* as defined at 40 CFR § 122.2 means the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the daily discharge must be calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurement, the daily discharge must be calculated as the average measurement of the pollutant over the day.
E16. *24-hour composite sample* means a sample formed by collecting and mixing discrete samples taken periodically and based on time or flow. The sample must be collected and stored in accordance with 40 CFR part 136.
E17. *Grab sample* means an individual discrete sample collected over a period of time not to exceed 15 minutes.
E18. *Quarter* means January through March, April through June, July through September, or October through December.
E19. *Month* means calendar month.
E20. *Week* means a calendar week of Sunday through Saturday.
E21. *POTW* means a publicly-owned treatment works.

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[1] DEQ recognizes that high TSS levels in influent can make achievement of QLs difficult, and at this time DEQ is not requiring that influent monitoring be performed using the QLs listed in the permit.

[2] Elevated TSS levels can result in matrix effects.
[3] For more information, refer to the Significant Figures IMD at http://www.deq.state.or.us/wq/pubs/imds/SigFigsIMD.pdf

State of Oregon
Department of Environmental Quality

National Pollutant Discharge Elimination System
PERMIT EVALUATION AND FACT SHEET

Oregon Department of Environmental Quality

Northwest Region
2020 SW 4th Avenue, Suite 400
Portland, OR 97201-4987
(503) 229-5263

Permittee:	City of Molalla PO Box 248 Molalla, OR 97038
Existing Permit Information:	File Number: 57613 Permit Number: 101514 Expiration Date: December 31, 2008 EPA Reference Number: OR-002238-1
Source Contact:	Otis Phillips, 503-829-5407 STP Operations Supervisor
Source Location:	12424 Toliver Road Molalla, Oregon
LLID	1227171452976-20.0-D
Receiving Stream	Molalla River
Proposed Action:	Renew Permit Application Number: 972786 Date Received: July 7, 2008
Source Category	NPDES Minor Domestic
Permit Writer:	Lyle Christensen Natural Resource Specialist

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1.0 INTRODUCTION

The existing National Pollutant Discharge Elimination System (NPDES) Permit expired on December 31, 2008. The Department received renewal application number 972786 from City of Molalla on July 7, 2008. As this renewal application was submitted to the Department in a timely manner prior to the expiration date of the permit, the permit shall not be deemed to expire until final action has been taken on the renewal application to issue the new permit as per OAR 340-045-0040.

This permit evaluation report describes the basis and methodology used in developing the permit. The permit is divided into several sections:

Schedule A – Waste discharge limitations
Schedule B – Minimum monitoring and report requirements
Schedule C – Compliance conditions and schedules
Schedule D – Special conditions
Schedule F – General conditions

The Federal Water Pollution Control Act of 1972 and subsequent amendments require a NPDES permit for the discharge of wastewater to surface waters. Furthermore, Oregon Revised Statutes (ORS 468B.050) also require a discharger be granted a permit for the discharge of wastewater to surface waters. This proposed permit action by the Department complies with both federal and state requirements.

2.0 FACILITY DESCRIPTION

2.1 General

City of Molalla operates a publicly owned treatment works (POTW) that serves much of the developed area within the Molalla urban growth boundary. The POTW is located just west of the City along Highway 213 between Highway 211 on the south and Toliver Road on the north. (See Map)

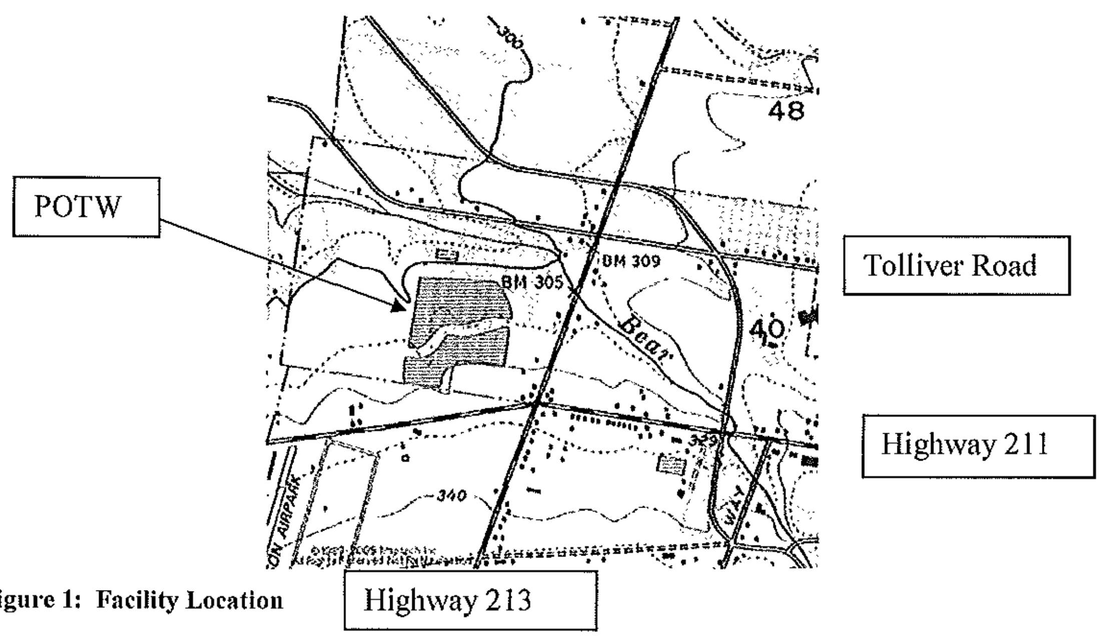


Figure 1: Facility Location

2.2 Wastewater Treatment

The POTW includes a headworks with screening and compaction, followed by an asphalt lined aeration basin. The screened and aerated influent is pumped up to a two-cell facultative lagoon treatment system totally about 25 surface acres. Lagoon effluent is further treated through a dissolved air flotation (DAF) unit and then filtered. The final treated water is disinfected using chlorine and is either irrigated (during the drier months) or discharged to the Molalla River in accordance with restrictions established in this permit. A schematic of the treatment process/wastewater flow is attached. The application indicates the population served in Molalla to be 7195 persons while the most recent discharge monitoring report (DMR) for March 2009 listed a population served as 7605 persons.

2.3 Changes in Operation

Up until January 2007, when facility upgrades were completed, the final effluent was discharged during the wetter winter months to Bear Creek at the plant site. In 2006 a pipeline was completed and an outfall structure was built that allowed the effluent to be discharged at a new location on the Molalla River nearly five miles from the plant site. The discharge point on Bear Creek was abandoned in January 2007.

2.4 Groundwater Issues

Facilities that recycle wastewater are required to apply water in such a way that groundwater will not be impacted. Controlling irrigation to agronomic loading rates is considered to be protective of the groundwater resource in those areas of application. The last permit renewal included a requirement for the facility to perform a lagoon leak test on this facility. A report on that testing was provided to the Department on November 19, 2004. The test was performed in September 2004 and indicated a leakage rate of approximately 0.21 inches/day. Historically it was DEQs policy that lagoon systems with leakage rates of less than 0.25 inches/day were not required to do a formal groundwater review at renewal. The Figure 1 vicinity map that was presented with the application identifies nearly 20 water wells within ¼ mile of the treatment plant. Previously the Department indicated that the City should review well log information related to the identified wells and also develop a sampling plan to confirm that off site groundwater is not being impacted by this facility. Because the lagoon leakage rate is considered low for existing structures no further groundwater analysis was required. Schedule D of this permit includes a condition that would require hydrogeologic characterization and groundwater monitoring if concerns regarding adverse offsite groundwater quality due to this facility are elevated through complaints or other indirect evidence.

2.5 Storm Water

Plant site storm water is not controlled and/or discharged from the plant site. The majority of storm water soaks into the ground.

2.6 Outfalls

Outfall 001 is located on the Molalla River at around river mile 20. Effluent is only discharged from this point during the wet weather months when stream flow is at least 300 cfs as gauged at the USGS gauging station. Outfall 002 is the recycled water outfall and represents monitoring for a number of different locations where land application of treated effluent occurs.

2.7 Industrial Pretreatment – majors only

This facility is a minor domestic permit and does not have a pretreatment program.

2.8 Biosolids

Biosolids accumulate in the treatment lagoons and periodically must be removed for land application. This was last done in 2000. The permit includes a condition that would require City of Molalla to comply with state biosolids regulations (Division 50) if solids are to be removed during this permt period.

2.9 Inflow and Infiltration (I/I)

Inflow and infiltration (I/I) is a measure of the extraneous water that enters a collection system. Permit holders are expected to have programs in place to reduce and control I/I for a number of different reasons including-

- I/I can overload and/or damage treatment facilities.
- I/I can increase energy usage due to additional pumping costs.
- I/I can contribute to basement backups and sewage overflows resulting in unexpected property damage and unneceessary public health issues.
- I/I adds to sewage treatment costs.

For these and other reasons it is preemptive for permit holders to assure that construction standards for new sewers are adhered to and that ongoing programs of maintenance and repair within the collection system are budgeted. The permit includes a condition that requires City of Molalla to have a program in place to identify and reduce I/I within their collection system. A report is required annually summarizing their activity in this area.

3.0 PERMIT HISTORY

3.1 Compliance history

Discharge monitoring reports (DMRs) and inspection reports were reviewed since the last renewal. Prior to the construction of the new outfall and plant upgrades effluent violations were frequently observed primarily due to lack of dilution during the discharge period. The plant upgrades addressed those concerns. During the 2006 irrigation season, a warning letter (WL-NWR-WQ-0132) was issued by the Department for a bacteria violation noted during September.

This violation was not repeated. In March 2009, a warning letter (WL-NWR-WQ-09-0028) was issued for ammonia limit violations noted during November and December 2008 and January 2009 for discharges to the Molalla River. The limits in the permit are water quality based and because stream flows were much higher than the worst case low flow used to establish effluent limits it was determined that the elevated effluent ammonia observed did not cause or contribute to in-stream water quality standards violations. A summary of effluent monitoring data is attached to this fact sheet.

Inspections of this facility were completed on July 20, 2005, February 14, 2007, and April 30, 2008. No violations were noted in these reports. During the 2008 site visit, DEQ laboratory personnel gathered field data and observations for analysis of the Molalla River mixing zone established for this discharge.

4.0 RECEIVING WATER

The City of Molalla discharges to the Molalla River which is a tributary stream in the Willamette Basin. The water quality standards for all waterbodies (Oregon Administrative Rules 340-41) and specifically the Willamette Basin (Oregon Administrative Rules 340-41-0345) were developed to protect the beneficial uses for the basin. The designated beneficial uses of the Molalla River are as follows:

- public and private domestic water supply,
- industrial water supply,
- irrigation,
- livestock watering,
- anadromous fish passage,
- salmonid spawning and rearing,
- resident fish and aquatic life,
- wildlife and hunting,
- fishing,
- boating,
- water contact recreation,
- aesthetic quality, and
- hydro power

4.1 Receiving Stream Water Quality

The treatment plant discharges to a reach of the Molalla River near river mile 20 (see picture below). The Molalla River drains from the Cascade Mountains to the Willamette River. As such, the observed stream flow is markedly influenced by winter rains and spring snowmelt. This facilities' discharge is limited to periods of higher stream flow.

Certain reaches of this river are listed, including where this discharge occurs, as water quality impaired under DEQ's 303(d) inventory of impaired water bodies. Table 1 shows a list of parameters the Molalla River is water quality limited for downstream of the City of Molalla STP discharge location. In 2008 the Department issued Total Maximum Daily Loads (TMDL) for temperature and bacteria. The TMDL analysis concluded that there would be no reasonable potential for this facility to contribute to the bacteria or temperature listings.

Table 1: Listed Water Quality Limited Parameters

River Mile	Parameter	Season	Criteria
0 to 25	Bacteria	Fall/Winter/Spring	
19.7 to 44.7	Temperature	August 15-June 15	Spawning 13.0°C
18.2 to 48.3	Temperature	Year Around	Core cold water habitat16.0°C
0 to 25	Temperature	Summer	

4.2 Mixing Zone Analysis

Federal regulations (40 CFR 131.13) allow for the use of mixing zones, also known as "allocated impact zones". These are small areas around a discharge where water quality standards may be suspended. Application of mixing zones must ensure acute toxicity to drifting organisms is prevented and the integrity of the waterbody as a whole is not impaired. EPA does not have specific regulations pertaining to mixing zones. Each state may adopt its own mixing zone regulations that are subject to review and approval by EPA. In States that lack approved mixing zone regulations, ambient water quality standards must be met at the end of the pipe. OAR 340-041-0053(1) provides that the Department may suspend all or part of the water quality standards in a designated portion of the receiving water to serve as a zone of dilution for wastes and receiving waters to mix thoroughly.

The Department has developed mixing zone regulations and policy based in part on the acute and chronic aquatic life criteria. Based on EPA guidance and the Department's mixing zone regulations, two mixing zones may be developed for each discharge that reflect acute and chronic effects: 1) The acute mixing zone, also known as the "zone of initial dilution" (ZID), and 2) the chronic mixing zone, usually referred to as "the mixing zone". Acute criteria are suspended within the ZID but it is designed to prevent lethality to organisms passing through the ZID. Chronic criteria are suspended within the mixing zone and it is designed to protect the integrity of the entire water body as a whole. The allowable size of the mixing zone should be based upon the relative size of the discharge to the receiving stream, the beneficial uses of the receiving stream, location of other discharges nearby, location of drinking water intakes, and other considerations. More specific guidance is available from EPA regarding criteria used in appropriately sizing a ZID. Primarily the ZID must be designed to prevent lethality to drifting organisms.

During the planning and design of the new outfall to the Molalla River, the City of Molalla was required to provide preliminary computer modeling of the impacts for the discharge. That modeling effort was used to evaluate the potential discharge and aid in defining the boundaries of the permit defined mixing zone. The outfall is a multiport diffuser located away from the west bank of the river. The mixing zone is listed as the length of the diffuser plus ten feet on either end, extending five-feet upstream and fifty-feet downstream. The ZID is specified as the area within five feet of the diffuser. On April 30, 2008, DEQ laboratory conducted a field evaluation of the mixing zone to confirm assumptions used during the design, construction and permitting process. In December 2007, the DEQ adopted its "Regulatory Mixing Zone Internal Management Directive". This guidance document provides the basic process for reviewing mixing zones during the permitting process. Based on that guidance it was determined a Level 1 (Simple) evaluation was most appropriate for this discharge. Because of relatively high river flows (gauged at 2200 cfs downstream near City of Canby) observed at the time of the study, it was difficult to make a safe validation of dilution and mixing. What was concluded was that under the observed condition the stream was very turbulent and rapid mixing and high dilution of the effluent was observed. No issues were identified at the site.

The DEQ's mixing zone rule includes temperature thermal plume limitations. DEQ field evaluation included gathering information to help evaluate if the four following adverse effects on salmonids inside the mixing zone are minimized.

1) *Impairment of spawning is prevented by limiting exposure to temperatures above 13 degrees Celsius.* Discharge monitoring data from the past three winters indicates that the Molalla STP discharge is often less than 13°C. The permit will require continued monitoring of effluent temperature and proposes that if the seven-day moving average for effluent temperature reaches 18°C that discharge be stopped. Even when effluent temperatures are above 13°C the rapid mixing provided by the diffuser will prevent thermal issues in the mixing zone. Temperature monitoring over the past few years indicates that the rise in effluent temperature corresponds with rising ambient stream temperatures. This permit provides protection to stream temperature impacts by limiting effluent temperature.

2) *Acute impairment or instantaneous lethality is prevented or minimized by limiting potential fish exposure to temperatures of less than 32 degrees Celsius for more than 2 seconds.* This facility will not be allowed to discharge if effluent temperature reaches 16°C.

3) *Thermal shock caused by a sudden increase in water temperature is prevented or minimized by limiting potential fish exposure to temperatures of 25.0 degrees Celsius or more to less than 5% of the cross section of 100% of the 7Q10 low flow of the water body.* Again this facility will never discharge effluent near this temperature.

4) *Unless the ambient temperature is 21.0 degrees or greater, migration blockage is prevented or minimized by limiting potential fish exposure to temperatures of 21 degrees Celsius or more to less than 25% of the cross section of 100% of the 7Q10 low flow of the water body.* Again with the temperature limits in this permit, this will never happen.

4.3 Environmental Mapping

The City of Molalla discharges to the Molalla River at RM 20.0 through Outfall 001. Figure 2 below locates the outfall on a USGS Quad Map of this area. Based on the Oregon Department of Fish and Wildlife fish habitat maps and Oregon Administrative Rules, Division 41, Water Quality Standards, Figure 340A (Fish Use Designations, Willamette Basin), this section of the Molalla River is utilized by salmonids for spawning (Sept 1- June15), rearing and migration. The Molalla River at this location is also considered to be water quality limited for temperature.

OUTFALL

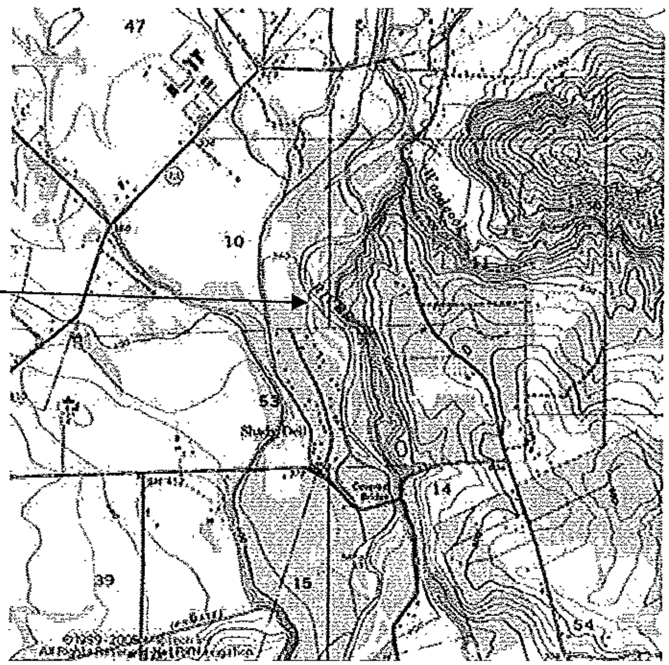


Figure 2: Outfall Location

The discharge is located approximately 1 mile downstream of Feyrer Park and nearly 15 miles upstream of the City of Canby. There are some public access sites to this portion of the river. Local citizens utilize the river for recreation and fishing. The discharge is located in a watershed utilized as source water for drinking water; however, no drinking water intakes are located within ½ mile of the Outfall. No other NPDES permitted discharges are located within ½ mile of this outfall.

5.0 PERMIT LIMITATIONS

Two categories of effluent limitations exist for NPDES permits: 1) Technology based effluent limits, and 2) Water quality based effluent limits. Technology based effluent limits apply the secondary treatment requirements established by EPA for municipal dischargers (POTWs). Technology based effluent limits were established to require a minimum level of treatment for municipal sources to meet the federal secondary standards (40CFR Part 133). Water quality based effluent limits are designed to be protective of the beneficial uses of the receiving water and are independent of the available treatment technology. In addition, when performing a permit renewal, there are existing permit limits. These may be technology-based limits, water quality-based limits, or limits based on best professional judgment. When renewing a permit, the most stringent of technology based or water quality based limits apply.

5.1 Existing Permit Limits

The current permit for this facility includes effluent limitations on Biochemical Oxygen Demand (BOD_5), Total Suspended Solids (TSS), bacteria, pH, chlorine, ammonia (NH_3-N) and dilution.

5.2 Technology-Based Effluent Limits

Secondary treatment requires at minimum the following standards be met for BOD_5, TSS and pH:

- BOD_5 shall not exceed a 30-day average of 30 mg/l and a 7-day average of 45 mg/l and the 30-day average percent removal shall not be less than 85 percent.

- TSS shall not exceed a 30-day average of 30 mg/l and a 7-day average of 45 mg/l and the 30-day average percent removal shall not be less than 85 percent.

- pH shall be maintained within the limits of 6.0 to 9.0.

The City of Molalla STP limitations for BOD_5, TSS and pH are at least as stringent as the federal requirements in that the following must be met:

- BOD_5 shall not exceed a monthly average of 10 mg/l and a weekly average of 15 mg/l and the monthly average percent removal shall not be less than 85 percent.

- TSS shall not exceed a monthly average of 10 mg/l and a weekly average of 15 mg/l and the monthly average percent removal shall not be less than 85 percent.

- pH shall be maintained within the limits of 6.0 to 9.0.

In addition DEQ requires that mass load limitations for BOD_5 and TSS must be met when discharging to surface waters. These loads are required to be reported in pounds per day and include a monthly average, weekly average and daily mass limitation. For this facility these limit were established based on a wet weather design flow of 1.92 mgd. Weekly limits are 1.5 times the monthly mass and the daily limit is twice the monthly mass. Limits are calculated as follows:

BOD_5 and TSS- Average Monthly Limit = (1.92 mgd)(10mg/l)(8.34 lbs/gal)=160 lbs/day
Average Weekly Limit = (1.5)160 lbs(Average Monthly Limit)= 240 lbs/day
Daily Limit= (2.0)160 lbs= 320 lbs

5.3 Water Quality-Based Effluent Limits

Reasonable Potential Analysis

The Department performs an analysis to determine if there is a reasonable potential to cause or contribute to violations of instream water quality criteria. The Department has adopted EPA's recommended methodology for performing a reasonable potential analysis (RPA). This methodology was developed primarily for acute and chronic criteria but can be adapted to other criteria based on different frequencies and durations. This RPA takes into account effluent variability, available dilution (if applicable), and receiving stream water quality. The RPA for specific parameters are discussed below.

In accordance with DEQ's "Internal Management Directive for Reasonable Potential Analysis for Toxic Pollutants" (September 2005), domestic sources like City of Molalla with a dry weather design flow greater than 0.1 mgd but less than 1 mgd must be characterized for chlorine and ammonia. The RPA spreadsheet using current data from over the past three years for this renewal indicates that no reasonable potential exists for ammonia.

Permit Limit Derivation

During the last permit renewal, effluent limits were included in the permit for both ammonia and chlorine. These limits were established assuming very conservative assumptions but without any real monitoring results available. Because chlorine is controlled using dechlorination, the effluent chlorine level is controlled by the operation of the dechlorination system. The limits for chlorine will remain the same. Ammonia is not specifically controlled through this treatment system. The use of new information (actual recent monitoring data and the mixing zone review) was considered in evaluating the water quality based ammonia limit. The limit for ammonia was revised slightly based on that analysis.

The RPA spreadsheet and permit effluent derivation worksheet are attached.

The pH is a measure of how acidic or basic a solution is. At a pH of 7.0 s.u. the solution is considered neutral. The purpose of an in-stream water quality pH standard is generally the protection of aquatic life since most aquatic organisms can only tolerate a fairly narrow range around 7.0 s.u.

The Willamette Basin Water Quality Standard for pH is found in OAR 340-041-0345(1)(a). The allowed range is 6.5 to 8.5 s.u. The proposed permit limits pH to the range 6.0 to 9.0 s.u. This limit is based on Federal secondary treatment standards for wastewater treatment facilities (40 CFR Part 133.102), and is applied to the majority of domestic NPDES permittees in the state. Within the permittee's mixing zone, the water quality standard for pH does not have to be met. The Department evaluated pH using a spreadsheet that derives the pH at the mixing zone boundary **(See attached).** Mixing with ambient water within the mixing zone will ensure that the pH at the edge of the mixing zone meets the ambient criteria. Therefore, the Department considers the proposed permit limits to be protective of the water quality standard.

The water quality based effluent limits for total residual chlorine proposed in this permit are lower than the Minimum Level (ML) for chlorine of 0.1 mg/L published by EPA. In accordance with EPA Region X Guidance for WQBELs below Analytical Detection Limits issued in 1996, the permit should include the ML as a "compliance evaluation level". The Department is proposing to include a note in Schedule A establishing 0.10 mg/L as a compliance evaluation level for total residual chlorine.

5.5 Whole Effluent Toxicity

Though this facility remains classed as a minor domestic NPDES facility, design data from the recent upgrade and flow information in the application indicates that this facility is routinely treating over 1 mgd which is the threshold for requiring whole effluent toxicity (WET) or bioassay tests at publicly owned treatment works. The permit includes the requirements for bioassay tests that will meet the application requirements for the next renewal. Because of the apparent steady growth in population within the Molalla community and flow at the POTW, this facility will need to be recommended to EPA for reclassification as a major facility in the immediate future.

5.6 Antidegradation

An Antidegradation Review was performed for this discharge. The permit is being renewed without any increase in discharge loadings. Permit renewals with the same discharge loadings as the previous permit are not considered to lower water quality from the existing condition. Based on the antidegradation review, the Department determined the proposed discharge complies with the Antidegradation Policy for Surface Waters found in OAR 340-041-0026. See attached anti-degradation review.

6.0 PERMIT DRAFT DISCUSSION

6.1 Face Page

The face page provides information about the permittee, description of the wastewater, outfall locations, receiving stream information, permit approval authority, and a description of permitted activities. The permittee is authorized to construct, install, modify, or operate a wastewater collection, treatment, control and disposal system. The permit allows discharge to the Molalla River and the use of recycled water within limits set by the permit. All other discharges are prohibited.

6.2 Schedule A - Waste Discharge Limitations

The periods of when discharge is allowed and the limitations that must be met for this facility are provided in this Schedule. These limits remain the same as the previous permit with some minor exceptions:

- The BOD_5 and TSS percent removal had been adjusted to a lower level than 85% for the last permit. This was done because of concern that the new headworks was lowering influent loading. A review of the monitoring reports over the past three years indicates that the facility has no difficulty meeting 85% removal.
- Ammonia limits were revised using current data and it changed the monthly average from 11.9 mg/l to 16.7 mg/l. The daily maximum remains the same.
- The previous permit relied on a staged flow to allow the operator the ability to determine the quantity to be discharged based on a dilution ratio. The intent was to maximize protection while allowing flexibility on the discharge side. Actual practice has seen that given adequate stream flow discharge volume does not need to be as closely monitored. What the draft permit proposes is that if the gauged flow is above 350 cfs, discharge can occur. Under all other stream flow circumstances, the plant will just hold effluent in the lagoons. This change should ease the operator's decision on discharging by just tracking the gauged stream flow.
- Another limit that will need to be tracked is the moving average effluent temperature. If the temperature is above 18 degrees Celsius, discharge will be prohibited. This limit was necessary to achieve the thermal plume limitations defined in DEQ's mixing zone rule (OAR-340-041-0053).

Bacteria:

The proposed permit limits are based on the *E. coli* standard contained in OAR 340-041-0009(5). The proposed limits are a monthly geometric mean of 126 *E. coli* per 100 mL, with no single sample exceeding 406 *E. coli* per 100 mL. If a single sample exceeds 406 *E. coli* per 100 mL, then the permittee may take five consecutive re-samples. If the log mean of the five re-samples is less than or equal to 126, a violation is not triggered. The re-sampling must be taken at four hour intervals beginning within 28 hours after the original sample was taken.

The proposed limits are taken directly from the Oregon bacteria rule which is found in OAR 340-041-0009. This rule establishes numeric in-stream water quality standards (OAR 340-041-0009(1)) and establishes effluent limitations and the methodology for establishing a violation (OAR 340-041-0009(5)).

Regarding the general condition 6 found in Section B of Schedule F in this permit which prohibits overflows from wastewater conveyance systems, the Environmental Quality Commission (EQC) recognizes that it is impossible to design and construct a conveyance system that will prevent overflows under all storm conditions. The applicant is not seeking permit coverage for overflows and the permit does not authorize such discharges. The State of Oregon has determined that all wastewater conveyance systems should be designed to transport storm events up to a specific size to the treatment facility. Therefore, in exercising its enforcement discretion regarding Sanitary Sewer Overflows, the Department will consider the following:

(1) Whether the permittee has conveyance and treatment facilities adequate to prevent overflows except during a storm event greater than the one-in-five-year, 24-hour duration storm from November 1 through May 21 and except during a storm event greater than the one-in-ten-year, 24-hour duration storm from May 22 through October 31. In addition, DEQ will also consider using enforcement discretion for overflows that occur during a storm event less than the one-in-five-year, 24-hour duration storm from November 1 through May 21 if the permittee had separate sanitary and storm sewers on January 10, 1996, had experienced sanitary sewer overflows due to inflow and infiltration problems, and has submitted an acceptable plan to the Department to address these sanitary sewer overflows by January 1, 2010;
(2) Whether the permittee has provided the highest and best practicable treatment and/or control of wastes, activities, and flows and has properly operated the conveyance and treatment facilities;
(3) Whether the permittee has minimized the potential environmental and public health impacts from the overflow; and
(4) Whether the permittee has properly maintained the capacity of the conveyance system.

DEQ will review the permittee's determination of the one-in-five-year, 24-hour duration winter storm and the one-in-ten year, 24-hour duration summer storm as described above in the permit holder's facilities plan. In the event that a permit holder reports an overflow event associated with a storm event and DEQ does not have information from the permit holder sufficient to determine whether or not the storm event exceeds storm events as specified in OAR 340-041-0009(6) & (7), DEQ will perform the determination using the information contained in Figure 26 of the 1973 NOAA Atlas 2 entitled "Precipitation-Frequency Atlas of the Western United States, Volume X – Oregon". This figure is entitled "Isopluvials of 5-yr 24-hr precipitation in tenths of an inch". The Atlas can be obtained on line at http://hdsc.nws.noaa.gov/hdsc/pfds/other/or_pfds.html, however the file is very large. A scanned version of Figure 26 is available at: http://www.wrcc.dri.edu/pcpnfreq/or5y24.gif. DEQ will compare the information in this figure with rainfall data available from the National Weather Service, or other source as necessary.

6.3 Schedule B – Minimum Monitoring and Reporting Requirements

This schedule includes the monitoring and reporting requirements established in this permit. In addition to the monthly monitoring and reporting requirements being listed, the reporting procedures are also established. Annual report requirements for I/I, recycled water and biosolids are found within this schedule.

6.4 Schedule C - Compliance Schedules and Conditions

No compliance schedules are incorporated in this permit.

6.5 Schedule D - Special Conditions

The following special conditions are included:

1. This facility requires a certified operator. Specific requirements related to that certified operator are provided in this condition.
2. If biosolids are to be removed from the treatment lagoons, the permittee is required to update their management plan at least six months prior to removal.
3. Specific requirements in relation to the reuse of recycled wastewater are provided.
4. Instructions regarding WET tests are included in this condition.
5. Hydrogeologic characterization is not required provided the facility operates in accord with the permit and evidence develops that groundwater is no longer being protected.
6. Treatment plant site use of recycled water is considered an exempt reuse.
7. The permittee is required to make notification to the DEQ in accord with the permit.

6.6 Schedule F - NPDES General Conditions

All NPDES permits issued in the State of Oregon contain certain conditions that remain the same regardless of the type of discharge and the activity causing the discharge. These conditions are called General Conditions. These conditions can be changed or modified only on a statewide basis. The latest edition of the NPDES General Conditions is from 2009 and this edition is included as Schedule F of the draft permit.

Section A contains standard conditions which include compliance with the permit, assessment of penalties, mitigation of noncompliance, permit renewal application, enforcement actions, toxic discharges, property rights and referenced rules and statutes. Section B contains requirements for operation and maintenance of the pollution control facilities. This section includes conditions for proper operation and maintenance, duty to halt or reduce activity in order to maintain compliance, bypass of treatment facilities, upset conditions, treatment of single operational events, overflows from wastewater conveyance systems and associated pump stations, public notification of effluent violation or overflow, and disposal of removed substances. Section C contains requirements for monitoring and reporting. This section includes conditions for representative sampling, flow measurement, monitoring procedures, penalties of tampering, reporting of monitoring results, additional monitoring by the permittee, averaging of measurements, retention of records, contents of records, and inspection and entry. Section D contains reporting requirements and includes conditions for reporting planned changes, anticipated noncompliance, permit transfers, progress on compliance schedules, noncompliance which may endanger public health or the environment, other noncompliances, and other information. Section D also contains signatory requirements and the consequences of falsifying reports. Section E contains the definitions used throughout the permit.

6.7 Permit Processing/Public Comment/Appeal Process

The beginning and end date of the public comment period to receive written comments regarding this permit, and the contact name and telephone number are included in the public notice. The permittee is the only party having standing to file a permit appeal. If the Permittee is dissatisfied with the conditions of the permit when issued, they may request a hearing before the EQC or it's designated hearing officer, within 20 days of the final permit being mailed. The request for hearing must be sent to the Director of the Department. Any hearing held shall be conducted pursuant to regulations of the Department.

Antidegradation Review Sheet

ANTIDEGRADATION REVIEW SHEET
FOR A PROPOSED INDIVIDUAL NPDES DISCHARGE

1. What is the name of Surface Water that receives the discharge? Molalla River

   Briefly describe the proposed activity: Discharge of treated pulp and paper effluent

   Is this review for a renewal OR new (circle one) permit application?
   Go to Step 2.

2. Is this surface water an **Outstanding Resource Water** or **upstream** from an **Outstanding Resource Water**?

   ~~Yes.~~ Go to Step 5.
   No. Go to Step 3.

3. Is this surface water a **High Quality Water**?

   Yes. Go to Step 8.
   No. Go to Step 4.

8. Will the proposed activity result in a Lowering of Water Quality in the **High Quality Water**?
   Yes. Go to Step 9.
   No. Proceed with Permit Application. Applicant should provide basis for conclusion. Go to Step 24.

   This conclusion is explained and supported by data and evaluations included with the permit evaluation report and attachments accompanying the proposed NPDES permit renewal. This is an existing discharge and there is no change in their operation. There is no request for a mass load increase.

24. On the basis of the Antidegradation Review, the following is recommended:
    _X_ Proceed with Application to Interagency Coordination and Public Comment Phase.

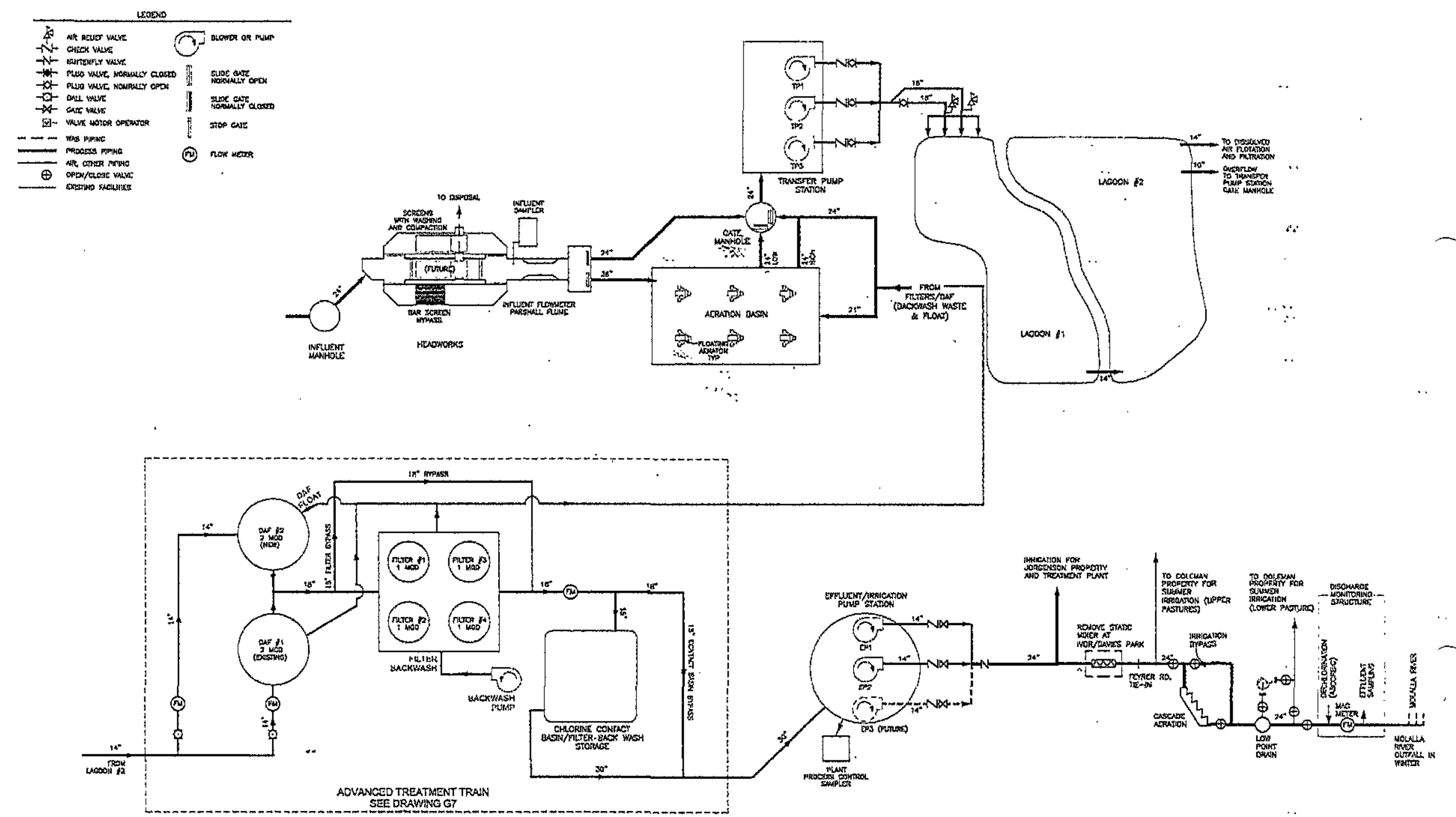
    ____ Deny Application; return to applicant and provide public notice.

Action Approved

Section: Northwest Region – WQ Source Control Section

Review Prepared By: Lyle Christensen
Phone: 503-229-5295
Date Prepared: May 6, 2009

Exhibit #1



TETRA TECH
7080 SW Fir Loop
Portland, Oregon 97223
503-684-9097 Fax 503-598-0583

CITY OF MOLALLA
2008 NPDES PERMIT RENEWAL
Figure 5
PLANT SCHEMATIC

Exhibit # 2

Molalla DMR Data

date	Influent flow (MGD) max	Influent flow (MGD) mth av	Influent BOD5 mth av	Influent TSS (mg/l)	Effluent flow(MGD) max	Effluent flow(MGD) mth av	Effluent BOD5 mg/l	Effluent BOD5 %rem	Effluent TSS mg/l	Effluent TSS %rem	Effluent NH3-N (mg/l) mth av	Effluent NH3-N (mg/l) max	Effluent E.coli mth av	Effluent DO mth av	Effluent Temp max wk	Molalla River Flow (cfs) min	Molalla River Flow (cfs) av	Molalla River DO (mg/l) av	Molalla River Temp wk max
Sep-09	0.9	0.7	241	243	No river discharge													10.1	20.7
Aug-09	0.7	0.7	237	235	No river discharge													9.5	23.5
Jul-09	0.8	0.7	235	238	No river discharge													8.8	27.5
Jun-09	0.9	0.8	203	201	No river discharge													9.8	20.5
May-09	2.4	1.3	135	112	No river discharge													11.9	16
Apr-09	1.8	1.3	134	125	3.1	2.3	6.5	95	1.6	99	8.3	9.6	<1	9.6	16.9	742	1581	12.1	9.8
Mar-09	2.3	1.6	104	104	1.7	1	5.9	95	3.3	97	9.8	12	<1	10.6	10.4	806	1682	11.9	7.3
Feb-09	2.1	1.2	130	126	1.7	1.3	5.7	95	1.5	99	10.3	11.3	<1	11.1	8.2	501	984	13.4	6.9
Jan-09	6.8	2	92	97	3.6	3.2	4.3	95	1.1	98	11.7	13.9	<1	11.6	7.9	821	3102	13.2	7.1
Dec-08	3	1.5	148	141	1.6	1.4	4.6	97	0.7	99	15.5	16.4	<1	11.2	10	405	819	13.4	8
Nov-08	2.3	1.2	146	134	1.4	1.3	1.8	99	0.8	99	11.7	14.8	<1	10.8	11.4	459	669	11.9	10.5
Oct-08	1.1	0.8	253	270	No river discharge													11.4	15.4
Sep-08	0.9	0.7	274	339	No river discharge													9.8	20.4
Aug-08	1	0.8	290	402	No river discharge													9.2	23.8
Jul-08	1.3	0.8	265	380	No river discharge													9.1	22
Jun-08	1.7	0.7	169	157	No river discharge													11.7	15.1
May-08	2.1	1.2	142	120	No river discharge													12.3	9.8
Apr-08	2	1.4	119	130	3	2	8.1	93	1.3	99	9	10.5	<1	11	13.1	997	1409	12.6	8.5
Mar-08	3	1.8	119	131	3	2.3	5.5	95	2.7	98	8.4	9.2	<1	12.8	10.9	1110	1768	12.8	8
Feb-08	3.4	1.7	133	174	3.8	2.2	6.1	95	3.7	98	7.1	9.2	<1	12.3	9.4	1170	1603	12.9	7.6
Jan-08	3.7	2.3	81	83	3.3	2.3	4.8	94	2.5	97	7.3	8.1	<1	11.7	7.3	881	2184	13.6	7
Dec-07	4.3	2.4	82	88	3.4	3	6	92	2.2	97	6.9	8.4	<1	10.7	8.9	799	2653	13.1	8.8
Nov-07	3.1	1.3	135	165	1.6	1.1	5.4	95	2.7	95	3.6	5.5	<1	12.1	13.6	157	902	12.8	8.7
Oct-07	2.1	1.1	165	175	No river discharge													11.8	12.8
Sep-07	1.4	0.7	225	215	No river discharge													10	20.8
Aug-07	0.8	0.7	207	218	No river discharge													9.2	22.5
Jul-07	1	0.8	194	225	No river discharge													8.9	25.2
Jun-07	1	0.8	171	177	No river discharge													9.8	20.1
May-07	1.3	0.9	155	161	No river discharge													10.9	18.9
Apr-07	1.7	1.3	118	120	1.7	1.5	9.1	92	5.6	95	9.1	10.3	<1	12.8	16.3	648	1023	12.2	11.2
Mar-07	3.1	1.8	85	97	1.9	1.6	6	92	4.9	94	8.2	9.4	<1	10.4	14.3	1140	1959	13	8.1
Feb-07	3.3	1.7	95	110	1.7	1.4	6.3	92	5.3	95	7.1	9.2	<1	12	10.8	360	1496	13.4	7.8
Jan-07	5.3	1.8	100	118	3.9	1.7	6.4	93	3.8	96	6.7	9.2	<1	11.8	9.3	446	1968	13	7.5

Exhibit #3

Reasonable Potential Analysis - Chlorine and Ammonia

Facility Name: **Molalla STP**

Date: 3/9/2009

Dilution values? (Y/N)	n	calculated
Low Flow Dilution @ ZID (1Q10)	*	*
Low Flow Dilution @ MZ (7Q10)	*	*
Low Flow Dilution @ MZ (30Q5)	*	*
High Flow Dilution @ ZID (1Q10)	*	5.0
High Flow Dilution @ MZ (7Q10)	*	13.1
High Flow Dilution @ MZ (30Q5)	*	15.1
Enter data below if no dilution data is available		
Data to estimate dilution	**Summer**	**Winter**
Effluent Flow (mgd) =	*	2
1Q10 (CFS) =	*	125
7Q10 (CFS) =	*	150
30Q5 (CFS) =	*	175
% dilution at MZ =	*	25
% dilution at ZID =	*	10

Confidence Level =	99%
Probability Basis =	95%

Summer data	**Effluent**	**Stream**	**Mixed**		
			ZID	**MZ**	
pH * =	*	*	*	*	(6.5-9)
Temp * =	*	*	*	*	° C
Alkalinity =	*	*			
Salmonids Present? (Y/N)	n/a	*			
Salmonid Spawning? (Y/N)	n/a	*			
Fresh Water ? (Y/N)	n/a	*			
Salinity (ppt)	*	*	*	*	
Winter data					
pH * =	7.7	7.9	7.8	7.9	(6.5-9)
Temp * =	13.2	7.3	8.5	7.7	° C
Alkalinity =	70	15			
Salmonids Present? (Y/N)	n/a	y			
Salmonid Spawning? (Y/N)	n/a	y			
Fresh Water ? (Y/N)	n/a	y			
Salinity (ppt)	0	0	*	*	

PARAMETER	# of Samples	Highest Conc. mg/l	Coef. of Variance	Calculated Maximum Conc. mg/l	Background Conc. mg/l	Maximum Conc. at ZID mg/l	Maximum Conc. at MZ mg/l	WQ CRITERIA Acute (CMC) mg/l	WQ CRITERIA Chronic (CCC) mg/l	REASONABLE POTENTIAL ? ACUTE	REASONABLE POTENTIAL ? CHRONIC
Low Flow Season											
CHLORINE	*	*	*	*	*	*	*	0.019	0.011	*	*
AMMONIA - Freshwater	*	*	*	*	*	*	*	*	*	*	*
AMMONIA - Saltwater	*	*	*	*	*	*	*	n/a	n/a	*	*
AMMONIA - Proposed 1hr/4day	*	*	*	*	*	*	*	*	*	*	*
*AMMONIA - Proposed 30day**	*	*	*	*	*	n/a	*	n/a	n/a	n/a	*
High Flow Season											
CHLORINE	*	*	*	*	*	*	*	0.019	0.011	*	*
AMMONIA - Freshwater	106	16.400	0.33	16.40	0.02	3.27	1.27	8.3	1.5	NO	NO
AMMONIA - Saltwater	*	*	*	*	*	*	*	n/a	n/a	*	*
AMMONIA - Proposed 1hr/4day	105	16.400	0.33	16.40	0.02	3.27	1.27	8.0	7.47	NO	NO
*AMMONIA - Proposed 30day**	106	16.400	0.33	16.40	0.02	n/a	1.10	n/a	3.0	n/a	NO

* -NOTES :

Temperature must be between 0 and 30 ° C
pH must be between 6.5 and 9
Ammonia is total ammonia as N

Permit Limits - Chlorine and Ammonia

Facility Name: **Molalla STP** **Date:** 3/10/2009

Dilution Values? (Y/N)	Y	calculated
Low Flow Dilution @ ZID (1Q10)	*	*
Low Flow Dilution @ MZ (7Q10)	*	*
Low Flow Dilution @ MZ (30Q5)	*	*
High Flow Dilution @ ZID (1Q10)	10	*
High Flow Dilution @ MZ (7Q10)	13	*
High Flow Dilution @ MZ (30Q5)	*	*
If no dilution values Enter flow rates here	**Summer**	**Winter**
Effluent Flow (MGD)	*	*
1Q10 (CFS)	*	*
7Q10 (CFS)	*	*
30Q5 (CFS)	*	*
% dilution at MZ	*	*
% dilution at ZID	*	*
probability basis (WLA multipliers)	99%	

Summer data	Effluent	Stream	Mixed ZID 1Q10	Mixed MZ 7Q10	Mixed MZ 30Q5	
pH * =	*	*	*	*	*	(6.5-9)
Temp * =	*	*	*	*	*	° C
Alkalinity =	*	*				
Salmonids Present? (Y/N)	n/a	*				
Salmonid Spawning? (Y/N)	n/a	*				
Fresh Water ? (Y/N)	n/a	*				
Salinity	*	*	*	*		
Winter data						
pH * =	7.7	7.9	7.8	7.8	*	(6.5-9)
Temp * =	13.2	7.3	7.9	7.8	*	° C
Alkalinity =	70	15				
Salmonids Present? (Y/N)	n/a	y				
Salmonid Sapwning (Y/N)	n/a	y				
Fresh Water ? (Y/N)	n/a	y				
Salinity	0	0	0.0	0.0		

PARAMETER	WATER QUALITY CRITERIA 1 Hour (CMC) mg/l	4 Day (CCC) mg/l	30 Day (CCC) mg/l	Back-ground mg/l	Allocations Acute mg/l	Allocations 4 Day mg/l	Allocations 30 Day mg/L	CV	# Samples /Mo	Acute LTA mg/l	4 day LTA mg/l	30 day LTA mg/L	Min LTA mg/l	Concentration Limits 95% Monthly mg/l	Concentration Limits 99% Daily mg/l
Low Flow Season															
CHLORINE	0.019	0.011	n/a	*	*	*	n/a	*	*	*	*	n/a	*	*	*
AMMONIA - Freshwater	n/a	n/a	n/a	*	*	*	n/a	*	*	*	*	n/a	*	*	*
AMMONIA - Saltwater	n/a	n/a	n/a	*	*	*	n/a	*	*	*	*	n/a	*	*	*
AMMONIA - Proposed	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
High Flow Season															
CHLORINE	0.019	0.011	n/a	0.00	0.18	0.14	n/a	0.5	30	0.07	0.08	n/a	0.07	**0.1**	**0.2**
AMMONIA - Freshwater	7.9	1.5	n/a	0.02	75.97	18.65	n/a	0.33	4	37.87	12.91	n/a	12.91	**16.7**	**25.9**
AMMONIA - Saltwater	n/a	n/a	n/a	*	*	*	n/a	*	*	*	*	n/a	*	*	*
AMMONIA - Proposed	7.6	*	*	*	*	*	*	*	*	*	*	*	*	*	*

NOTES :

Temperature must be between 0 and 30 ° C
pH must be between 6.5 and 9
Ammonia is mg/l ammonia as N.

Exhibit #4

Calculation of pH of a mixture of two flows.
Based on the procedure in EPA's DESCON program (EPA, 1988. Technical Guidance on Supplementary Stream Design Conditions for Steady State Modeling. USEPA Office of Water, Washington D.C.)

	RPA for pH	
INPUT	Lower pH	Upper pH
Molalla STP pH evaluation	Criteria	Criteria
1. DILUTION FACTOR AT MZ BOUNDARY - (Qe+Qr)/Qe	13	13
2. UPSTREAM/BACKGROUND CHARACTERISTICS		
Temperature (deg C):	7.3	7.3
pH:	6.9	7.7
Alkalinity (mg CaCO3/L):	15.0	15.0
3. EFFLUENT CHARACTERISTICS		
Temperature (deg C):	15.0	15.0
pH:	6.0	9.0
Alkalinity (mg CaCO3/L):	70.0	70.0
4. APPLICABLE PH CRITERIA	6.5	8.5
OUTPUT		
1. IONIZATION CONSTANTS		
Upstream/Background pKa:	6.49	6.49
Effluent pKa:	6.42	6.42
2. IONIZATION FRACTIONS		
Upstream/Background Ionization Fraction:	0.72	0.94
Effluent Ionization Fraction:	0.28	1.00
3. TOTAL INORGANIC CARBON		
Upstream/Background Total Inorganic Carbon (mg CaCO3/	20.84	15.93
Effluent Total Inorganic Carbon (mg CaCO3/L):	254.12	70.18
4. CONDITIONS AT MIXING ZONE BOUNDARY		
Temperature (deg C):	7.89	7.89
Alkalinity (mg CaCO3/L):	19.23	19.23
Total Inorganic Carbon (mg CaCO3/L):	38.78	20.10
pKa:	6.48	6.48
pH at Mixing Zone Boundary:	**6.5**	**7.8**
Is there Reasonable Potential?	**No**	**No**

Table 340A

Designated Beneficial Uses
Willamette Basin
(340-041-0340)

Beneficial Uses	Willamette River Tributaries						Main Stem Willamette River			
	Clackamas River	Molalla River	Santiam River	McKenzie River	Tualatin River	All Other Streams & Tributaries	Mouth to Willamette Falls, Including Multnomah Channel	Willamette Falls to Newberg	Newberg to Salem	Salem to Coast Fork
Public Domestic Water Supply[1]	X	X	X	X	X	X	X	X	X	X
Private Domestic Water Supply[1]	X	X	X	X	X	X	X	X	X	X
Industrial Water Supply	X	X	X	X	X	X	X	X	X	X
Irrigation	X	X	X	X	X	X	X	X	X	X
Livestock Watering	X	X	X	X	X	X	X	X	X	X
Fish & Aquatic Life[2]	X	X	X	X	X	X	X	X	X	X
Wildlife & Hunting	X	X	X	X	X	X	X	X	X	X
Fishing	X	X	X	X	X	X	X	X	X	X
Boating	X	X	X	X	X	X	X	X	X	X
Water Contact Recreation	X	X	X	X	X	X	X[3]	X	X	X
Aesthetic Quality	X	X	X	X	X	X	X	X	X	X
Hydro Power	X	X	X	X	X	X	X	X		
Commercial Navigation & Transportation							X	X	X	

[1] With adequate pretreatment and natural quality that meets drinking water standards.

[2] See also Figures 340A and 340B for fish use designations for this basin.

[3] Not to conflict with commercial activities in Portland Harbor.

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State of Oregon
Department of
Environmental
Quality

<u>OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY</u>
December 2008

Molalla-Pudding Subbasin TMDL & WQMP

December 2008

Molalla-Pudding Subbasin Total Maximum Daily Load (TMDL) and Water Quality Management Plan (WQMP)

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Molalla-Pudding Subbasin Total Maximum Daily Load (TMDL) Outline of Contents

Executive Summary

Introduction

This document contains Total Maximum Daily Loads (TMDLs) for several types of water pollution causing impairment of waterbodies in the Molalla Pudding Subbasin. TMDLs are limits on pollution intended to bring rivers, lakes and streams into compliance with water quality standards designed to protect human health, aquatic life, and other beneficial uses of water. Development of TMDLs is required by the federal Clean Water Act of 1972, and the Oregon Department of Environmental Quality is the state agency authorized by federal and state law and regulation to develop these pollution limits.

Section 303(d) of the federal Clean Water Act requires states to periodically list waterbodies that do not meet water quality standards ("303(d) list"). The 2004-06 303(d) list identified 28 stream segments in the Molalla-Pudding Subbasin as water quality limited and needing TMDLs (including segments with multiple listings for the same parameter in different seasons). The 2002 303(d) list also included a reach of the Molalla River (listed for bacteria and temperature impairment) and a reach of the Pudding River (listed for summer bacteria impairment) that were not included on the 2004-06 list. The 2004 – 06 303(d) list as well as earlier lists are available online at http://www.deq.state.or.us/wq/assessment/assessment.htm. In addition to the impaired stream reaches from the 2004 – 06 and 2002 303(d) lists, DEQ addressed three stream reaches, not previously listed, impaired by pesticides: Zollner Creek and Little Pudding River for DDT and the Pudding River for dieldrin. A summary of the water quality impaired stream reaches addressed by the Molalla Pudding Subbasin TMDLs is included in Chapter 1, Overview (Table 1-1) and Chapter 7, Water Quality Management Plan (Table 7 -1). DEQ completed 30 TMDLs and proposed delisting three impaired stream reaches. In 1993, DEQ completed a TMDL to address dissolved oxygen impairment in the Pudding River. The 1993 TMDL was not reviewed or changed as part of this TMDL and the allocations established in that TMDL and incorporated into facility permits remain in effect.

The Molalla-Pudding Subbasin (approximately 878 square miles in area) is located in the north-eastern portion of the middle Willamette Basin. The Molalla River flows into the Willamette River between river miles 35 and 36 and the Pudding River is a tributary to the Molalla River less than a mile upstream of the Molalla River mouth. The subbasin is located within Clackamas and Marion Counties and includes the communities of Woodburn, Mt. Angel, Silverton, Canby, Molalla, Hubbard, Gervais, Aurora, Brooks, Barlow, Colton and Scotts Mills and portions of Salem, Keizer, Donald, and Wilsonville. Most land in the Molalla-Pudding Subbasin is privately owned, with the U.S. Bureau of Land Management (BLM) administering the largest portion of public land (67 square miles in the upper Molalla watershed), and the state managing Silver Falls State Park (approximately 13 square miles). Land use in the Molalla-Pudding Subbasin is 53% forestry and 40% agriculture, with the remaining percentage urban, residential, and industrial. Ecoregions range from high elevation Cascade Highlands to low elevation Prairie Terraces. Fish use includes a number of salmonid species, including winter and summer steelhead, spring and fall Chinook, and Coho, as well as resident cutthroat trout.

Fourteen stream reaches are listed as impaired by high stream temperature, which affects rearing and spawning habitat for salmonids. Two of those reaches are listed individually for spawning and non-spawning seasons. The temperature TMDL addresses all of these listings and applies basinwide.

There are seven stream reaches listed as impaired by bacteria contamination in the subbasin (including two reaches impaired both in summer and fall/winter/spring). Bacteria listings are based on standards for water-contact recreation. The TMDLs for bacteria address all bacteria listings on the 2004-06 and 2002 303(d) lists and apply basinwide year-round.

There is one listing in Zollner Creek for nitrate. The nitrate TMDL addresses that listing and applies to Zollner Creek and all its tributaries year-round. There are three stream reaches impaired by pesticides no longer in use: the Pudding River (DDT and dieldrin) and Zollner Creek (DDT, chlordane and dieldrin) and Little Pudding River (DDT). The TMDL addresses six impairments on these stream reaches and applies to the Pudding River, Little Pudding River and Zollner Creek and their tributaries.

Five stream reaches are listed for metals, specifically iron, manganese and arsenic. The TMDL addresses the two iron listings and applies to the Pudding River and Zollner Creek and their tributaries. DEQ proposes delisting manganese and arsenic and that a TMDL is not necessary because the in-stream concentrations appear to be natural.

One stream reach was listed on the 2004 – 06 list for dissolved oxygen violation. This parameter is not addressed with a TMDL at this time because the listing occurred after the data collection for this TMDL was complete.

TMDLs

Total Maximum Daily Loads have been developed for most of the types of pollution causing impairment of beneficial uses in the Molalla-Pudding Subbasin. These TMDLs determine the amount of a given pollutant (e.g., heat, fecal bacteria, nitrate) that a waterbody may receive without violating a water quality standard.

This amount of pollutant is called the Loading Capacity, which is allocated to various uses. The amount that current pollution exceeds the loading capacity is termed the Excess Load. The allocations for point source discharges are termed “waste load allocations,” and allocations for non-point sources of pollutants (e.g., urban, agricultural or forest runoff) are called “load allocations.” The sum of all allocations, plus a margin of safety for uncertainty, and a reserve capacity for future needs, is the TMDL.

The TMDLs in this document address 30 stream reaches impaired for a particular parameter. DEQ recommends delisting three stream reaches (one Zollner Creek arsenic and 2 Zollner Creek and Pudding River manganese listings). One listing (dissolved oxygen) will remain on 303(d) list until more data are collected to confirm whether or not dissolved oxygen criteria in the West Fork Little Pudding River are being met.

Temperature TMDL Summary

DEQ’s water quality standards are applied to protect the most sensitive beneficial uses in a waterbody. Numeric criteria in the temperature standard were developed to protect different aspects of the life histories of salmon and trout: spawning, rearing and migration. During non-spawning periods, the criterion that applies to the Pudding River and the lower Molalla River is 18 °C for rearing and migration. The upper Molalla River, upper Molalla tributaries, and upper reaches of some tributaries to the Pudding River are considered core cold water habitat and the non-spawning temperature criterion that applies is 16 °C. During spawning season, variably from late summer or early fall through late spring, the temperature criterion that applies is 13 °C. The upper Molalla River and Table Rock Fork are listed for being warmer than the spawning criterion. All 14 of the temperature-impaired stream reaches, including the reaches listed for spawning season temperature violations, are addressed by this TMDL. The load allocations for the temperature TMDL apply year-round and basinwide. Explicit wasteload allocations to point sources on the Pudding River and its tributaries apply June 1 – September 30. Wasteload allocations to point sources on the Molalla River and its tributaries apply May 1 through October 31.

Continuous temperature data was collected between May and October 2004, at several locations in the subbasin, on the mainstem Pudding and Molalla Rivers and their tributaries. Thermal Infrared Radiometry (TIR) data, which measures surface water temperatures, was collected in the afternoon of July 26, 2004, along the length of the Molalla River and the afternoons of August 11 and 12, 2004, along the length of the Pudding River. The continuous temperature data and the TIR data were used to calibrate the temperature model, Heat Source. Once the model is calibrated for a stream system, the model can be used to simulate future conditions with changes in riparian vegetation, flows, channel width and other conditions.

The Molalla and Pudding Rivers were modeled to determine the “natural thermal potential” (NTP) of the systems. The NTP is the thermal profile of a water body determined with best available methods of analysis and the best available information on the system potential riparian vegetation, stream geomorphology, stream flows and other measures that reflect natural conditions with human-caused influence minimized. The results of the modeling indicate that the NTP for both the Molalla and Pudding Rivers for several weeks between July and September is higher than the relevant numeric stream temperature criterion. When the NTP exceeds the numeric temperature criterion, the NTP replaces the numeric criterion for the modeled stream reaches.

For point sources of heat such as wastewater treatment plants, waste load allocations have been developed that limit the increase in temperature of the receiving stream (due to the point source effluent) to a portion of an allowance for “human use.” The heat loads allocated to point sources in the Molalla-Pudding Subbasin are those loads that would cause no more than a 0.2°C increase when fully mixed in the stream above the applicable criterion (which may be the NTP). Available data indicated that existing discharges from point sources to the Molalla River caused less than a 0.2°C in-stream temperature increase, and they were allocated heat loads equivalent to the heat load from their current discharge. For non-point sources, the load allocation is the heat load that would result if system potential vegetation were allowed to develop in the riparian zone. Representation of system potential vegetation followed the methodology used in the Willamette Basin temperature TMDL, which takes into account factors such as soils, slope, elevation, historical vegetation, and geomorphology. Non-point sources are allocated a heat load equivalent to a 0.05°C increase in-steam above the applicable criterion. A heat load equivalent to the remaining 0.05°C increase allowed for human use is allocated to reserve capacity to accommodate for future growth.

Bacteria TMDL Summary

Oregon’s bacteria water quality criteria protect human health and the beneficial use of water contact recreation. This TMDL addresses seven bacteria-impaired stream reaches from both the 2004-06 and 2002 303(d) lists. The 2002 bacteria listings for the Molalla River from river mile 0 to 25 and the summer (June 1 – September 30) listing for the Pudding River from river mile 0 to 35.4 had been removed from the 2004-06 303(d) list, but a review of data indicated that the bacteria criteria could be exceeded at the highest stream flows on the Molalla River and during the summer on the Pudding River. For those reasons, a bacteria TMDL was completed for the Molalla River and the summer season for the Pudding River. Wastewater treatment plants were given waste load allocations based on the numeric criteria of a logarithmic average of 126 *E.coli* organisms per 100 milliliters and no one sample exceeding 406 *E.coli* organisms per 100 milliliters. Analysis of bacteria data, stream flows, and precipitation indicates that the main sources of bacteria contamination in the Molalla and Pudding Rivers and their tributaries are non-point sources. Non-point sources include agricultural runoff and urban stormwater, though runoff from forestry land use does not appear to cause the bacteria criteria to be exceeded. Load allocations are expressed in terms of a surrogate measure – percent reduction in bacteria concentrations. Load allocations apply generally by land use, basin-wide, and year-round. Stream and season-specific load allocations were calculated for streams where sufficient stream flow data were available to calculate a loading capacity and excess load. Load allocations, as percent reductions, were reduced until no one sample (based on available data) exceeded the single sample criterion of 406 *E.coli* organisms per 100 milliliters.

Nitrate TMDL Summary

Zollner Creek is listed for nitrate impairment. The water quality criterion for nitrate is based on a drinking water standard for protection of human health. This TMDL addresses the nitrate listing and applies year round to Zollner Creek and its tributaries. Eventual attainment of the human health criterion (10 milligrams/liter) may not be sufficient to prevent future water quality problems from excessive algae growth, high pH or low dissolved oxygen. All likely sources of nitrate are non-point, as no permitted point sources are located on Zollner Creek and land use is 99% agricultural. The load allocation to non point sources in all sectors is the loading capacity minus 10% for a margin of safety.

Pesticides TMDL Summary

Three listings from the 2004-06 303(d) list for legacy pesticides (pesticides no longer in use) apply to the Pudding River and Zollner Creek. The Pudding River is listed for DDT and Zollner Creek for dieldrin and chlordane. DEQ’s data review indicated that Zollner Creek and Little Pudding River were also impaired by DDT contamination and the Pudding River for dieldrin. The source for DDT in the Pudding River appears to be eroded sediments from Zollner Creek and the Little Pudding River watersheds. Load allocations for DDT and dieldrin are expressed as percent reductions necessary to achieve the human health criteria based on water and fish ingestion. The load allocation for chlordane is expressed as a percent reduction necessary to meet the Oregon Department of Human Services -- Health Division (DHS) action level for fish tissue since DEQ's data review found that chlordane has not been detected in surface water in Zollner Creek. The TMDL also uses a surrogate measure of total suspended solids (TSS), which correlates strongly with DDT, to set targets that will achieve partial load allocations for non-point sources in all sectors. A 96 -hour average TSS target of 15 mg/L for the Pudding River and Zollner Creek and 7 mg/L for the Little Pudding River will partially achieve the load allocations. Additional monitoring is needed in the Little Pudding River and Zollner Creek watersheds to identify "hot spots" or those areas where DDT concentrations are higher than surroundings. Land use and riparian management can then be tailored to reduce erosion and runoff from those areas. While dieldrin was not found to correlate as strongly with total suspended solids in-stream, DEQ's data review indicates that dieldrin concentrations and frequency of detection are decreasing in the subbasin. DEQ expects that significant TSS reductions in Zollner Creek, the Pudding River, and the Little Pudding River and ongoing decay of dieldrin over time should result in the achievement of both aquatic health chronic toxicity and human health based criteria for dieldrin.

Metals TMDL Summary

Two listings for metals are addressed by this TMDL, and DEQ recommends that the remaining three listings do not require a TMDL and should be delisted. Iron, manganese and arsenic are naturally occurring substances and particularly prevalent in soils deriving from eroded volcanic rocks. DEQ's data review and analysis of metals correlation with stream flow and precipitation supports the conclusion that manganese and arsenic are present in the Pudding River and Zollner Creek at natural concentrations and are not concentrated by human activities. Iron concentrations correlate with stream flow and precipitation and DEQ's conclusion is that human caused activities that lead to eroding stream banks and runoff may concentrate iron in surface water at higher than natural concentrations. A surrogate measure of percent reduction is used to set load allocations for non-point sources. The load allocation applies year round to the Pudding River, Zollner Creek, and their tributaries. Point sources are allocated their current conditions and will be required to monitor so DEQ can evaluate if point sources cause or contribute to iron water quality criterion exceedances.

Water Quality Management Plan

The TMDLs include a Water Quality Management Plan designed to identify strategies and approaches for implementing the TMDLs. The WQMP identifies the Designated Management Agencies (local, state and federal government agencies and other entities with responsibility for addressing pollution problems in their control). Example management strategies that could be implemented by DMAs to meet the allocations in each of the TMDLs are also included in the WQMP. The WQMP identifies currently available TMDL implementation plans, guidance for DMAs required to submit implementation plans, and the schedule for submitting those plans.

Public Process

The Molalla-Pudding TMDLs have been developed over a course of several years and have involved review by stakeholders throughout the process. A review committee representing basin stakeholders provided feedback and suggestions to DEQ over the last two years. These TMDLs were available for public review for 60 days, between August 29 and October 31, 2008. A public hearing was held in Silverton, Oregon on October 16, 2008. All comments received were considered before issuing this final TMDL. Responses to the public comments are available in a separate document located on DEQ's website.

Conclusion

The TMDLs address 30 impaired stream reaches in the Molalla-Pudding Subbasin. Implementation of the waste load allocations and load allocations is expected to bring those waterbodies into compliance with water quality standards so the beneficial uses will be protected.

BEFORE THE ENVIRONMENTAL QUALITY COMMISSION

OF THE STATE OF OREGON

IN THE MATTER OF:	)	MUTUAL AGREEMENT
	)	AND ORDER
The City of Molalla	)	NO. WQ/M-NWR-2016-246
Permittee.	)	CLACKAMAS COUNTY
	)	

WHEREAS:

1. On May 12, 2014, the Department of Environmental Quality (Department or DEQ) issued National Pollutant Discharge Elimination System (NPDES) Waste Discharge Permit Number 101514 (Permit) to the City of Molalla (Permittee). The Permit authorizes the Permittee to construct, install, modify or operate wastewater treatment, control and disposal facilities (facilities) and discharge adequately treated wastewaters into the Molalla River, waters of the state, in conformance with the requirements, limitations and conditions set forth in the Permit. The Permit expires on June 1, 2019.

2. Permittee has violated the Permit as follows:

A. On November 9, 2016, DEQ issued Permittee Notice of Civil Penalty Assessment and Order No. WQ/M-NWR-2016-163. The Notice assessed $5,150 in civil penalties for failing to comply with turbidity and bacteria limits in recycled water. This Mutual Agreement and Order (MAO) amends the penalty amount in Notice of Civil Penalty Assessment and Order No. WQ/M-NWR-2016-163 to recognize the withdrawal of the violation related to the lagoon leak test.

B. From October 12-31, 2016, Permittee discharged fully treated effluent to the Molalla River in violation of Schedule A, Condition 1 and ORS 468B.025(1)(a).

C. Failed to comply with TMDL planning and implementation requirements as described in Warning Letter with Opportunity to Correct No. 2016-WLOTC-1563, issued May 13, 2016.

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D. From May 22 through June 1, 2017, Permittee discharged fully treated effluent to the Molalla River in violation of Schedule A, Condition 1 of the permit and ORS 468B.025(1)(a).

E. From June 14-26, 2017 Permittee discharged fully treated effluent to the Molalla River in violation of Schedule A, Condition 1 of the permit and ORS 468B.025(1)(a).

F. From October 12-31, 2017, the Permittee discharged fully treated wastewater to the Molalla River in violation of Schedule A, Condition 1 of the permit and ORS 468B.025(1)(a).

G. On September 6, 2017 violated ORS 468B.025(1)(b) when it discharged chlorinated effluent to Bear Creek that caused an exceedance of the acute toxicity water quality standard for chlorine.

H. In July, August, September and October of 2017, Permittee violated permit effluent limits for turbidity and total coliform bacteria in recycled water.

I Permittee exceeded the monthly total suspended solids (TSS) average concentration effluent limit of 10 milligrams per liter by discharging effluent with the following monthly average TSS concentrations: November 2015 - 11 mg/L, December 2015 - 11 mg/L January 2017 - 12 mg/L.

J. For an unknown amount of time following the implementation of the Class A standard in the August 29, 2014 Recycled Water Use Plan and prior to April 2016, it is possible that Permittee's turbidimeter was not providing accurate information. Any potential violations of the Recycled Water Use Plan or the Permit due to those errors in measurement are expressly resolved by this MAO.

3. DEQ and the Permittee recognize that until new or modified facilities are constructed and put into full operation, Permittee might continue to violate the seasonal discharge limit and its effluent limits for total suspended solids (TSS).

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4. DEQ and Permittee recognize that the Environmental Quality Commission has the authority to impose a civil penalty and to issue an abatement order for violations of conditions of the Permit. Therefore, pursuant to ORS 183.415(5), DEQ and Permittee wish to settle those past violations referred to in Paragraph 2 and address future violations referred to in Paragraph 3 (unless caused negligently, willfully or intentionally) in advance by this Mutual Agreement and Order (MAO).

5. The U.S. Environmental Protection Agency appropriately delegated the federal NPDES permitting program to DEQ, making DEQ the primary administrator and enforcer of the NPDES permits. DEQ believes that this MAO furthers the goals of the NPDES permitting program by ensuring progress towards compliance and is consistent with DEQ's goal of protecting human health and the environment. However, DEQ and Permittee recognize that this MAO does not eliminate the possibility of additional enforcement of Permit requirements by the U.S. Environmental Protection Agency or citizens under the federal citizen suit provisions.

6. This MAO is not intended to limit, in any way, DEQ's right to proceed against Permittee in any forum for any unknown past or future violations not expressly settled herein.

7. This MAO is not intended to limit, in any way, Permittee's right to apply for an amended permit during the course of this MAO.

NOW THEREFORE, it is stipulated and agreed that:

8. The Environmental Quality Commission shall issue a final order:

A. Requiring Permittee to comply with the following compliance order:

(1) Development of a Wastewater Facility and Collection System Master Plan document that will comply with the applicable DEQ requirements for a facilities plan (herein called the "Master Plan"), as described in http://www.oregon.gov/deq/FilterDocs/FacilitiesPlansGuidelines.pdf according to the following schedule:

1) Notice to proceed 9/1/17.

2) By 7/2/18, submit draft Master Plan for DEQ review and approval.

3) Within 60 days of receiving all of DEQ comments on the draft Master Plan, revise the plan consistent with DEQ's comments and submit for DEQ review and approval.

4) Within 40 days of DEQ approval of Master Plan, Planning Commission to hold public hearings to recommend approval by City Council. Within 30 days following Planning Commission approval, City Council to hold its first public meeting for adoption of Master Plan and ordinance within.

5) The plan above must evaluate the removal of infiltration and inflow, removal of biosolids and expanded use of recycled water as both interim steps prior to any other plant upgrade or expansion and as ongoing activities to best manage the collection and treatment system and beneficially use of biosolids and recycled water.

6) Because Permittee will be submitting a permit modification application the results of which may change the recommendations of the facilities planning process, DEQ shall prioritize reviewing Permittee's application to the extent possible to ensure minimal delay.

7) If the results of DEQ's final decision on Permittee's permit modification application require revisions to the Master Plan, Permittee shall provide DEQ with an amended draft Master Plan within 180 days of DEQ's decision becoming final.

8) Within 60 days of receiving all of DEQ comments on the revised draft Master Plan, Permittee shall revise the plan consistent with DEQ's comments and submit for DEQ review and approval.

9) Within 45 days of DEQ approval of the revised final Master Plan, Planning Commission to hold public hearings to recommend approval by the City Council. Within 30 days following Planning Commission approval, City Council to hold its first public meeting for adoption of Master Plan and ordinance within.

10) Construction of the new WWTP identified in the final approved Master Plan must be completed no later than 12/1/2023.

11) DEQ shall have 6 weeks from the date of receipt to review any submittal from Permittee related to construction of the WWTP. Should the DEQ review period exceed this time limitation, the deadline contained in 8.A.(1)(10) shall be extended by an equivalent amount of time.

B. Requiring the Permittee to meet the following interim effluent limitations, measured as specified in the Permit, until completions of the upgrades identified in the final Master Plan:

	Units	Average Monthly	Average Weekly	Daily Maximum
TSS (November 1 – April 30)	mg/L	15	20	-
	lbs/day	240	300	480
	% removal	85	-	-

C. The Permittee will submit any plans and specifications for collection system and treatment plant upgrades or expansions to DEQ for review and approval. A Certification of Capacity stating that the Permittee agrees to provide sewer service and has sewerage system and treatment capacity to do so must be included with all plan and specification reviews submitted by the Permittee to DEQ, per OAR 340-052-0015(3)(c).

D. If the existing lagoons are used as part of the upgraded facility, the lagoons will be drained and the clay liners checked for leaks and repaired or replaced as necessary.

E. Any out of season discharges not authorized by the Permit that occur during the months of May, June and October will be addressed per DEQ's Enforcement Guidance Internal Management Directive in effect at the time of the violation provided the following conditions are met:

1. The Molalla WWTP lagoons have less than one month storage capacity available;

2. The fields designated to accept recycled water do not have the capacity to assimilate recycled water;

3. The Molalla River:

i. has had a 7-day moving average of 350 cubic feet per second or greater as measured at the USGS monitoring station number14200000 MOLALLA RIVER NEAR CANBY, OR; (if there is an active monitoring station which better characterizes Molalla River Flow near the outfall, this station may be substituted subject to DEQ approval), and/or

ii. the 7-day moving average effluent temperature does not exceed 18.0 C.

iii. These moving averages determination shall begin on the seventh day of discharging.

4. Permittee notifies:

i. DEQ as soon as possible that an out of season discharge may be necessary to prevent an overtopping of the WWTP lagoons, and

ii. DEQ when a discharge commences.

iii. the City of Canby water treatment facility when a discharge commences.

5. i. Permittee complies with the monitoring requirements in

Schedule B, Conditions 3 and 4 of the permit.

ii. Permittee's discharge does not exceed the effluent limits in Schedule A of the permit.

6. The above conditions, 1 through 5, shall be recorded in the Daily Monitoring Reports each day discharge occurs.

F. Requiring Permittee, upon receipt of a written Penalty Demand Notice from DEQ, to pay the following civil penalties:

1. $600 for each day of violation of the compliance order set forth in Paragraph 8A.

2. $1,500 for each day of out of season discharge occurring during the months of May, June and October where the conditions of Paragraph 8.E are not met.

3. For exceedance of the limits in 8.B, $300 for any exceedance of 50% or more of the limit, $150 for any exceedance of 20% or more, but less than 50% of the limit, and $75 for an exceedance of less than 20% of the limit.

G. Imposing upon permittee a civil penalty of $23,325 for the violations listed in Paragraph 10 below. The penalty may be mitigated to $4,665 through performance of a Supplemental Environmental Project in accordance with the provisions of Paragraph 12.

9. If any event occurs that is beyond Permittee's reasonable control and that causes or may cause a delay or deviation in performance of the requirements of this MAO, Permittee shall immediately notify DEQ verbally of the cause of delay or deviation and its anticipated duration, the measures that have been or will be taken to prevent or minimize the delay or deviation, and the timetable by which Permittee proposes to carry out such measures. Permittee shall confirm in writing this information within five (5) working days of the onset of the event. It is Permittee's responsibility in the written notification to demonstrate to DEQ's satisfaction that the delay or deviation has been or will be caused by circumstances beyond the control and despite due diligence of Permittee. If Permittee so demonstrates, DEQ shall extend times of

performance of related activities under this MAO as appropriate. Circumstances or events beyond Permittee's control include, but are not limited to, acts of nature, unforeseen strikes, work stoppages, fires, explosion, riot, sabotage, or war. Increased cost of performance or a consultant's failure to provide timely reports are not considered circumstances beyond Permittee's control.

10. The violations set forth in Paragraph 2 above are expressly settled herein for the following penalties, Paragraph 2.A, $5,100; 2.B, $3,000; 2.C, $1,725; 2.D, $3,000; 2.E, $3,000; 2.F, $3,000, and 2.G, $4,500 for a total civil penalty of $23,325. The violations cited in Paragraphs 2.H, 2.I and 2.J are resolved without penalty.

11. Based on evidence submitted by Permittee that no violation occurred, DEQ dismisses Violation 3 of Notice of Civil Penalty Assessment and Order No. WQ/M-NWR-2016-163.

12. The $23,325 civil penalty may be mitigated to $4,665 on the condition that Respondent completes a Supplemental Environmental Project approved by DEQ. A SEP proposal must be submitted to DEQ within 90 days of full execution of the MAO. An approved SEP will be incorporated into this MAO by amendment. If DEQ does not approve an SEP by March 1, 2019, the balance of the civil penalty, $18,660, becomes immediately due and owing. Payment of the $4,665 penalty not subject to mitigation through a SEP is due 30 days from full execution of this MAO.

13. Permittee and DEQ hereby waive any and all of their rights to any and all notices, hearing, judicial review, and to service of a copy of the final order herein. DEQ reserves the right to enforce this order through appropriate administrative and judicial proceedings.

14. Regarding the order set forth in Paragraph 8A above, Permittee acknowledges that Permittee is responsible for complying with that order regardless of the availability of any federal or state grant monies.

15. The terms of this MAO may be amended by mutual agreement of DEQ and

Permittee.

16. DEQ may amend the compliance order and conditions in, or terminate, this MAO upon finding that such modification is necessary because of changed circumstances or to protect public health and the environment. DEQ shall provide Permittee a minimum of thirty (30) days written notice prior to issuing an Order amending or terminating this MAO. If Permittee contests the Order, the applicable procedures for conduct of contested cases in such matters shall apply.

17. This MAO shall be binding on the parties and their respective successors, agents, and assigns. The undersigned representative of each party certifies that he or she is fully authorized to execute and bind such party to this MAO. No change in ownership or corporate or partnership status relating to the facility shall in any way alter Permittee's obligations under this MAO, unless otherwise approved in writing by DEQ.

18. All reports, notices and other communications required under or relating to this MAO should be directed to Tiffany Yelton Bram, DEQ Water Quality Northwest Regional Office, 700 NE Multnomah St., Suite 600, Portland, Oregon 97232, phone number 503 229 5219, with copies sent to Jeff Bachman, Office of Compliance and Enforcement, same address. The contact person for Permittee shall be Gerald Fisher, City of Molalla - Director of Public Works, 117 N. Molalla Avenue, P.O. Box 248, Molalla, OR 97038, 503.829.6855.

19. Permittee acknowledges that it has actual notice of the contents and requirements of this MAO and that failure to fulfill any of the requirements hereof will constitute a violation of this MAO and subject Permittee to payment of civil penalties pursuant to Paragraph 8.F above.

20. Any stipulated civil penalty imposed pursuant to Paragraph 8.F shall be due upon written demand. Stipulated civil penalties shall be paid by check or money order made payable to "**State Treasurer, State of Oregon**" and sent to the **DEQ, Business Office, 700 NE Multnomah Street, Suite 600, Portland, Oregon 97232**. Within 20 days of receipt of a "Demand for Payment of Stipulated Civil Penalty" Notice from DEQ, Permittee may request a hearing to contest the Demand Notice. At any such hearing, the issue shall be limited to

Permittee's compliance or non-compliance with this MAO. The amount of each stipulated civil penalty for each violation and/or day of violation is established in advance by this MAO and shall not be a contestable issue.

21. This MAO shall terminate at the end of the day on the date the final compliance task in Paragraph 8A above is to be completed. However, Permittee remains liable for stipulated penalties for any violations of the MAO occurring during the period the MAO was in effect and demanded pursuant to Paragraph 20.

CITY OF MOLALLA

9-17-18
Date

Dan Huff
City Manager

DEPARTMENT OF ENVIRONMENTAL QUALITY and
ENVIRONMENTAL QUALITY COMMISSION

10/4/18
Date

Kieran O'Donnell, Manager
Office of Compliance and Enforcement
on behalf of DEQ pursuant to OAR 340-012-0170
on behalf of the EQC pursuant to OAR 340-011-0505

APPENDIX B: FIGURES AND MAPPING

Climate Data

FIRM Map

Wetland Inventory Map

Topo Map

Zoning Map

NRCS Soil Map

Lagoon #1 Sludge Depths (2018) and Percentage Dry Solids Data

Lagoon #2 Sludge Depths (2018) and Percentage Dry Solids Data

Effluent Irrigation Force Main and Profile Drawing

Aerated Lagoon Sludge Depths (2017)

Molalla Drawings and Design Data

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Summary of Monthly Normals 1981-2010

Generated on 09/07/2017

National Centers for Environmental Information
151 Patton Avenue
Asheville, North Carolina 28801

Current Location: Elev: 647 ft. Lat: 45.1783° N Lon: -122.5063° W
Station: **MOLALLA 7 NE, OR US USC00355681**

Temperature (°F)																						
Mean							Cooling Degree Days						Heating Degree Days				Mean Number of Days					
							Base (above)						Base (above)									
Month	Daily Max	Daily Min	Mean	Long Term Max Std Dev	Long Term Min Std Dev	Long Term Avg Std Dev	55	57	60	65	70	72	55	57	60	65	Max >= 100	Max >= 90	Max >= 50	Max <= 32	Min <= 32	Min <= 0
01	47.6	35.2	41.4				-7777	0	0	0	0	0	422	484	577	732	0.0	0.0	11.8	0.0	10.0	0.0
02	52.0	35.9	44.0				-7777	-7777	-7777	0	0	0	309	365	449	589	0.0	0.0	17.8	0.0	6.3	0.0
03	56.3	38.4	47.4				4	2	1	0	0	0	241	301	393	547	0.0	0.0	26.5	0.0	1.5	0.0
04	61.2	41.2	51.2				24	13	5	1	0	0	137	186	269	415	0.0	0.0	27.5	0.0	0.0	0.0
05	67.6	46.6	57.1				98	65	34	8	1	-7777	33	62	124	253	0.0	0.0	31.0	0.0	0.0	0.0
06	73.0	50.8	61.9				215	162	93	28	7	4	8	15	36	120	0.0	0.8	30.0	0.0	0.0	0.0
07	80.5	54.8	67.7				392	330	241	115	48	32	-7777	1	4	33	0.6	4.0	31.0	0.0	0.0	0.0
08	82.2	55.3	68.8				426	364	272	137	52	32	0	-7777	1	21	0.0	6.2	31.0	0.0	0.0	0.0
09	76.3	52.0	64.2				279	224	150	61	18	10	5	10	26	87	0.0	2.4	30.0	0.0	0.0	0.0
10	63.4	45.2	54.3				54	34	15	2	-7777	-7777	76	118	191	334	0.0	0.0	30.6	0.0	0.2	0.0
11	52.5	39.3	45.9				5	2	-7777	0	0	0	278	335	423	573	0.0	0.0	19.9	0.0	1.8	0.0
12	46.5	34.5	40.5				-7777	0	0	0	0	0	449	511	604	759	0.0	0.0	10.8	0.0	10.8	0.0
Summary	63.3	44.1	53.7	0.0	0.0	0.0	1497	1196	811	352	126	78	1958	2388	3097	4463	0.6	13.4	297.9	0.0	30.6	0.0

-7777: a non-zero value that would round to zero

Empty or blank cells indicate data is missing or insufficient occurrences to compute value

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Summary of Monthly Normals 1981-2010

Generated on 09/07/2017

National Centers for Environmental Information
151 Patton Avenue
Asheville, North Carolina 28801

Current Location: Elev: 647 ft. Lat: 45.1783° N Lon: -122.5063° W
Station: **MOLALLA 7 NE, OR US USC00355681**

Precipitation (in.)								
	Totals	Mean Number of Days				Precipitation Probabilities Probability that precipitation will be equal to or less than the indicated amount		
	Means	Daily Precipitation				Monthly Precipitation vs. Probability Levels		
Month	**Mean**	**>= 0.01**	**>= 0.10**	**>= 0.50**	**>= 1.00**	**0.25**	**0.50**	**0.75**
01	6.18							
02	4.60							
03	4.82							
04	4.30							
05	3.17							
06	2.29							
07	1.01							
08	0.76							
09	2.02							
10	4.32							
11	7.04							
12	6.90							
Summary	47.41	0.0	0.0	0.0	0.0	0.00	0.00	0.00

-7777: a non-zero value that would round to zero

Empty or blank cells indicate data is missing or insufficient occurrences to compute value

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Summary of Monthly Normals
1981-2010

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National Centers for Environmental Information
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Current Location: Elev: 647 ft. Lat: 45.1783° N Lon: -122.5063° W
Station: **MOLALLA 7 NE, OR US USC00355681**

Growing Degree Units (Monthly)

Base	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
40	95	124	230	336	530	657	857	891	724	444	190	97
45	33	39	99	195	375	507	702	736	574	290	80	31
50	6	4	26	82	222	358	547	581	425	149	22	5
55	-7777	-7777	4	24	98	215	392	426	279	54	5	-7777
60	0	-7777	1	5	34	93	241	272	150	15	-7777	0
Growing Degree Units for Corn (Monthly)												
50/86	24	49	104	171	281	373	528	554	431	215	60	21

Growing Degree Units (Accumulated Monthly)

Base	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
40	95	219	449	785	1315	1972	2829	3720	4444	4888	5078	5175
45	33	72	171	366	741	1248	1950	2686	3260	3550	3630	3661
50	6	10	36	118	340	698	1245	1826	2251	2400	2422	2427
55	0	0	4	28	126	341	733	1159	1438	1492	1497	1497
60	0	0	1	6	40	133	374	646	796	811	811	811
Growing Degree Units for Corn (Monthly Accumulated)												
50/86	24	73	177	348	629	1002	1530	2084	2515	2730	2790	2811

Note: For corn, temperatures below 50 are set to 50, and temperatures above 86 are set to 86.

-7777: a non-zero value that would round to zero.

Empty or blank cells indicate data is missing or insufficient occurrences to compute value.

CLIMATOGRAPHY OF THE UNITED STATES NO. 20
OREGON CITY, OR

CLIMATOLOGICAL SUMMARY

PERIOD: 1951-80
ELEVATION: 167 FT

	TEMPERATURE (F)														
	MEANS			EXTREMES						MEAN NUMBER OF DAYS				DEGREE DAYS	
										MAX		MIN			
	* DAILY MAXIMUM	* DAILY MINIMUM	* MONTHLY	RECORD HIGHEST	YEAR	DAY	RECORD LOWEST	YEAR	DAY	90 AND ABOVE	32 AND BELOW	32 AND BELOW	0 AND BELOW	* # HEATING BASE 65	* COOLING BASE 65
JAN	45.9	34.4	40.2	64+	58	15	9+	57	27	0	2	12	0	769	0
FEB	51.7	36.9	44.3	73+	68	29	13+	79	2	0	0	7	0	580	0
MAR	55.5	38.0	46.8	77+	64	29	22	71	1	0	0	5	0	564	0
APR	62.0	41.1	51.5	91+	57	29	28+	72	2	0	0	1	0	405	0
MAY	69.4	46.1	57.8	96	63	20	31+	54	1	1	0	0	0	232	9
JUN	75.1	51.3	63.3	99+	61	17	37+	76	3	2	0	0	0	107	56
JUL	82.4	54.4	68.4	107	56	19	41+	76	2	6	0	0	0	23	129
AUG	81.2	54.3	67.8	106+	77	17	41+	51	29	5	0	0	0	44	131
SEP	76.1	51.1	63.6	101+	58	7	33+	65	17	2	0	0	0	98	56
OCT	64.8	45.0	54.9	94	70	3	24+	71	28	0	0	1	0	313	0
NOV	53.4	39.2	46.3	73	70	2	9+	55	15	0	0	5	0	561	0
DEC	47.5	36.1	41.8	66+	80	30	6+	64	17	0	1	8	0	719	0
YEAR	63.8	44.0	53.9	107	JUL 56	19	6	DEC 64	17	16	3	39	0	4415	301

	PRECIPITATION TOTALS (INCHES)											
							SNOW			MEAN NUMBER OF DAYS		
	* MEAN	* GREATEST MONTHLY	YEAR	GREATEST DAILY	YEAR	DAY	MEAN	MAXIMUM MONTHLY	YEAR	.10 OR MORE	.50 OR MORE	1.00 OR MORE
JAN	8.11	16.77	53	2.86	74	15	2.7	18.9	69	14	5	2
FEB	5.14	11.74	61	3.13	68	19	.4	5.2	62	11	3	1
MAR	4.99	9.43	57	2.09	63	29	.7	11.2	51	12	3	1
APR	3.37	9.44	69	2.20	69	18	.0	.0		8	2	0
MAY	2.64	5.80	60	1.58	63	06	.0	.0		7	1	0
JUN	1.87	4.40	69	1.93	69	23	.0	.0		4	1	0
JUL	.56	2.82	74	.99	74	08	.0	.0		2	0	0
AUG	1.24	4.95	68	2.43	56	25	.0	.0		3	1	0
SEP	2.08	4.50	69	1.86	51	30	.0	.0		4	1	0
OCT	3.79	7.69	56	2.40	55	09	.0	.0		9	2	1
NOV	6.59	14.21	73	3.35	60	24	.2	2.0	78	12	4	2
DEC	8.02	14.78	64	3.22	64	22	1.2	13.6	68	14	6	2
YEAR	48.40	16.77	JAN 53	3.35	NOV 60	24	5.2	18.9	JAN 69	100	29	9

*FROM 1951-80 NORMALS

ESTIMATED VALUE BASED ON DATA FROM SURROUNDING STATIONS

\+ ALSO ON EARLIER DATES.

DEGREE DAYS TO SELECTED BASE TEMPERATURES (F)

BASE BELOW	HEATING DEGREE DAYS												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
65	769	580	564	405	232	107	23	44	98	313	561	719	4415
60	614	440	409	259	113	37	0	10	30	166	411	564	3053
57	521	356	316	177	64	15	0	0	12	93	321	471	2346
55	466	305	260	129	38	8	0	0	6	58	267	409	1946
50	324	181	130	46	7	0	0	0	0	8	140	262	1098

BASE ABOVE	COOLING DEGREE DAYS												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
55	7	5	6	24	125	257	415	397	264	55	6	0	1561
57	0	0	0	12	89	204	353	339	210	28	0	0	1235
60	0	0	0	0	45	136	264	252	138	7	0	0	842
65	0	0	0	0	9	56	129	131	56	0	0	0	381
70	0	0	0	0	0	13	43	52	12	0	0	0	120

DERIVED FROM THE 1951-80 MONTHLY NORMALS

PROBABILITY THAT THE MONTHLY PRECIPITATION WILL BE EQUAL TO OR LESS THAN THE INDICATED PRECIPITATION AMOUNT

MONTHLY PRECIPITATION (INCHES)

PROBABILITY LEVELS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
.05	2.22	1.95	2.16	.80	.90	.34	.00	.00	.14	.93	1.86	2.96
.10	2.99	2.43	2.61	1.19	1.15	.51	.00	.00	.35	1.29	2.49	3.71
.20	4.16	3.11	3.24	1.68	1.51	.78	.04	.12	.68	1.84	3.44	4.79
.30	5.18	3.68	3.75	2.11	1.82	1.04	.12	.29	.99	2.33	4.26	5.70
.40	6.18	4.23	4.23	2.54	2.12	1.30	.22	.49	1.31	2.82	5.06	6.56
.50	7.23	4.78	4.72	2.98	2.42	1.58	.34	.74	1.66	3.33	5.91	7.43
.60	8.40	5.38	5.24	3.48	2.75	1.90	.48	1.06	2.07	3.91	6.84	8.39
.70	9.77	6.08	5.83	4.07	3.14	2.28	.67	1.48	2.57	4.59	7.93	9.50
.80	11.56	6.97	6.50	4.83	3.64	2.80	.95	2.07	3.24	5.48	9.36	10.91
.90	14.37	8.33	7.73	6.04	4.42	3.62	1.41	3.11	4.34	6.89	11.59	13.09
.95	16.99	9.58	8.77	7.17	5.13	4.41	1.88	4.17	5.41	8.22	13.68	15.09

THESE VALUES WERE DETERMINED FROM THE INCOMPLETE GAMMA DISTRIBUTION.

5-YR JAN

10-YR MAY

Monthly Precipitation Probabilities and Quintiles, 1971-2000

CLIMATOGRAPHY OF THE UNITED STATES NO. 81, Supplement No. 1

Monthly Precipitation (inches)

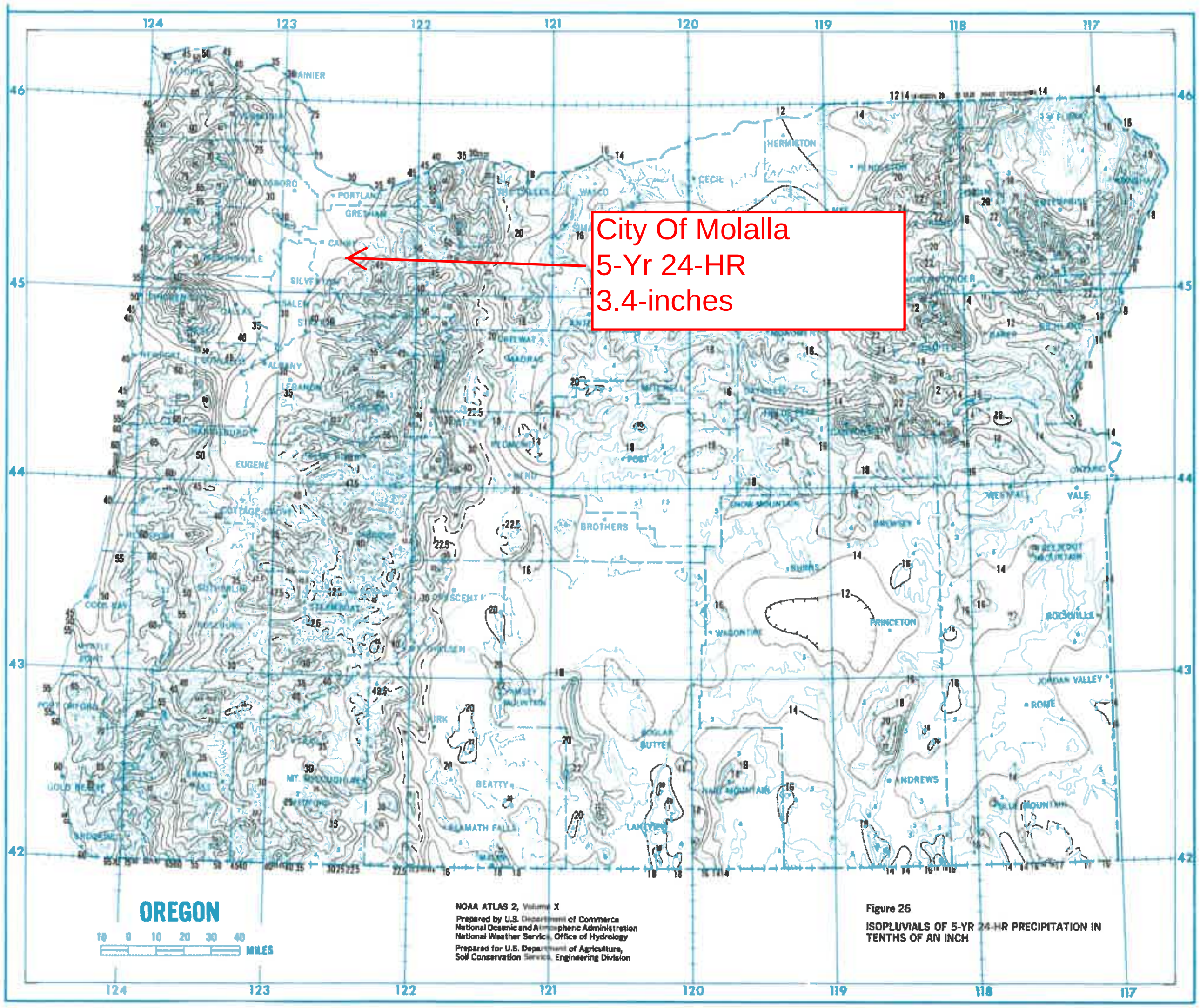
Station Description	Quin	Prob	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ANN
351175 BNO	Q0	MIN	0.09	0.12	0.23	0.10	0.10	0.11	0.00	0.00	0.00	0.00	0.10	0.07	
BURNS MUNICIPAL AP		0.1	0.33	0.30	0.46	0.26	0.33	0.15	0.00	0.02	0.01	0.07	0.27	0.25	7.21
OR	Q1	0.2	0.51	0.46	0.64	0.39	0.49	0.24	0.08	0.08	0.06	0.20	0.43	0.43	8.19
	Q2	0.4	0.83	0.77	0.95	0.62	0.76	0.43	0.22	0.22	0.21	0.44	0.74	0.81	9.65
		0.5	1.00	0.93	1.11	0.74	0.91	0.53	0.29	0.31	0.31	0.57	0.92	1.02	10.32
	Q3	0.6	1.20	1.12	1.28	0.87	1.08	0.65	0.39	0.41	0.43	0.72	1.11	1.27	11.03
	Q4	0.8	1.75	1.65	1.76	1.25	1.54	1.00	0.66	0.74	0.83	1.15	1.68	2.00	12.79
		0.9	2.25	2.14	2.19	1.60	1.95	1.33	0.92	1.06	1.24	1.56	2.21	2.70	14.23
	Q5	MAX	2.46	3.50	3.66	2.27	2.84	3.05	1.22	1.56	2.13	1.72	2.73	3.88	
352709 EUG	Q0	MIN	0.31	1.59	1.68	0.49	0.14	0.07	0.00	0.00	0.00	0.11	1.33	1.24	
EUGENE MAHLON SWEET AP		0.1	2.22	2.43	2.57	1.22	0.75	0.32	0.00	0.00	0.00	0.68	3.05	2.64	38.14
OR	Q1	0.2	3.35	3.34	3.37	1.76	1.15	0.53	0.08	0.04	0.28	1.16	4.27	3.86	42.03
	Q2	0.4	5.41	4.90	4.68	2.71	1.87	0.97	0.28	0.29	0.80	2.12	6.39	6.04	47.63
		0.5	6.53	5.70	5.34	3.21	2.26	1.22	0.41	0.49	1.11	2.67	7.50	7.20	50.19
	Q3	0.6	7.79	6.59	6.06	3.77	2.71	1.51	0.57	0.76	1.47	3.31	8.72	8.50	52.85
	Q4	0.8	11.31	8.99	7.97	5.31	3.96	2.35	1.07	1.69	2.53	5.16	12.07	12.10	59.36
		0.9	14.53	11.11	9.63	6.70	5.10	3.14	1.57	2.67	3.57	6.92	15.04	15.36	64.56
	Q5	MAX	15.36	16.89	12.46	7.85	6.92	3.88	3.00	3.46	4.65	8.12	20.48	17.63	
354506 LMT	Q0	MIN	0.14	0.13	0.26	0.09	0.13	0.01	0.00	0.00	0.00	0.00	0.22	0.22	
KLAMATH FALLS 2 SSW		0.1	0.50	0.35	0.49	0.20	0.14	0.11	0.00	0.00	0.00	0.00	0.45	0.42	9.63
OR	Q1	0.2	0.79	0.55	0.71	0.33	0.28	0.20	0.01	0.00	0.07	0.15	0.74	0.71	10.90
	Q2	0.4	1.36	0.95	1.12	0.60	0.60	0.40	0.10	0.09	0.31	0.44	1.29	1.28	12.78
		0.5	1.67	1.17	1.33	0.75	0.79	0.52	0.18	0.20	0.44	0.61	1.59	1.61	13.65
	Q3	0.6	2.03	1.42	1.57	0.92	1.03	0.66	0.28	0.35	0.58	0.81	1.95	1.99	14.55
	Q4	0.8	3.06	2.14	2.24	1.43	1.75	1.08	0.61	0.87	0.97	1.40	2.97	3.10	16.82
		0.9	4.02	2.80	2.85	1.90	2.46	1.49	0.98	1.44	1.33	1.98	3.92	4.14	18.65
	Q5	MAX	4.91	4.66	3.05	2.62	4.83	1.86	2.41	2.73	2.45	2.94	5.79	5.87	
355429 MFR	Q0	MIN	0.19	0.20	0.42	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.36	
MEDFORD AP		0.1	0.67	0.57	0.72	0.46	0.24	0.05	0.00	0.00	0.00	0.16	0.79	0.55	12.46
OR	Q1	0.2	1.03	0.88	0.98	0.65	0.44	0.16	0.00	0.00	0.04	0.35	1.22	0.96	14.19
	Q2	0.4	1.71	1.45	1.43	0.98	0.80	0.38	0.08	0.05	0.31	0.75	2.03	1.80	16.75
		0.5	2.08	1.77	1.67	1.16	0.99	0.50	0.15	0.15	0.48	0.98	2.47	2.28	17.94
	Q3	0.6	2.50	2.12	1.92	1.36	1.22	0.65	0.24	0.30	0.68	1.26	2.97	2.84	19.19
	Q4	0.8	3.69	3.13	2.62	1.89	1.86	1.10	0.54	0.89	1.33	2.08	4.38	4.50	22.31
		0.9	4.78	4.05	3.23	2.37	2.45	1.53	0.86	1.55	1.97	2.88	5.68	6.07	24.84
	Q5	MAX	5.44	5.67	3.97	3.59	4.26	2.62	1.34	2.83	4.22	3.98	7.67	9.94	
356546 PDT	Q0	MIN	0.41	0.12	0.26	0.18	0.07	0.03	0.00	0.00	0.00	0.00	0.19	0.21	
PENDLETON MUNICIPAL AP		0.1	0.54	0.44	0.59	0.36	0.31	0.17	0.03	0.00	0.00	0.21	0.61	0.44	9.49
OR	Q1	0.2	0.74	0.62	0.76	0.52	0.48	0.29	0.08	0.01	0.04	0.42	0.84	0.66	10.48
	Q2	0.4	1.11	0.93	1.03	0.82	0.82	0.51	0.20	0.14	0.26	0.72	1.25	1.06	11.92
		0.5	1.29	1.09	1.17	0.98	1.01	0.63	0.28	0.26	0.40	0.87	1.46	1.27	12.57
	Q3	0.6	1.50	1.26	1.32	1.16	1.23	0.77	0.37	0.41	0.57	1.04	1.69	1.51	13.25
	Q4	0.8	2.07	1.74	1.71	1.65	1.84	1.19	0.67	0.95	1.08	1.49	2.32	2.19	14.93
		0.9	2.57	2.17	2.05	2.10	2.40	1.57	0.97	1.53	1.58	1.90	2.88	2.80	16.27
	Q5	MAX	3.53	2.98	2.82	2.78	3.18	2.31	1.45	2.58	2.10	2.67	3.76	4.68	
356634 MEH	Q0	MIN	0.41	0.39	0.55	0.18	0.23	0.17	0.00	0.00	0.00	0.02	0.23	0.28	
PILOT ROCK 1 SE		0.1	0.57	0.54	0.84	0.47	0.59	0.44	0.00	0.00	0.00	0.17	0.63	0.46	10.80
OR	Q1	0.2	0.76	0.70	1.03	0.68	0.83	0.62	0.06	0.05	0.06	0.30	0.88	0.66	11.88
	Q2	0.4	1.07	0.96	1.33	1.06	1.26	0.93	0.20	0.23	0.30	0.59	1.31	1.02	13.42
		0.5	1.23	1.09	1.47	1.27	1.48	1.10	0.28	0.37	0.45	0.75	1.53	1.21	14.12
	Q3	0.6	1.40	1.24	1.62	1.49	1.73	1.28	0.37	0.54	0.64	0.95	1.78	1.42	14.85
	Q4	0.8	1.86	1.61	2.02	2.12	2.41	1.78	0.67	1.13	1.22	1.53	2.46	2.00	16.64
		0.9	2.26	1.94	2.35	2.69	3.01	2.22	0.95	1.74	1.80	2.08	3.06	2.53	18.06
	Q5	MAX	3.03	2.53	3.12	3.27	4.29	2.38	1.23	2.68	1.85	2.45	3.91	3.27	
356751 PDX	Q0	MIN	0.06	0.72	1.49	1.04	0.10	0.14	0.00	0.00	0.00	0.19	0.77	1.38	
PORTLAND INTL AP		0.1	1.45	1.67	1.97	1.25	0.72	0.46	0.08	0.07	0.10	0.68	2.11	2.29	27.51
OR	Q1	0.2	2.19	2.26	2.43	1.60	1.07	0.69	0.19	0.18	0.34	1.10	2.92	3.10	30.41
	Q2	0.4	3.57	3.27	3.16	2.17	1.71	1.12	0.41	0.45	0.87	1.91	4.30	4.47	34.61
		0.5	4.31	3.78	3.51	2.46	2.05	1.36	0.54	0.63	1.19	2.37	5.02	5.17	36.53
	Q3	0.6	5.15	4.34	3.89	2.76	2.43	1.62	0.69	0.84	1.57	2.89	5.81	5.94	38.52
	Q4	0.8	7.52	5.86	4.88	3.57	3.50	2.36	1.16	1.51	2.70	4.38	7.97	8.01	43.41
		0.9	9.68	7.20	5.71	4.26	4.47	3.03	1.60	2.18	3.80	5.77	9.87	9.84	47.33
	Q5	MAX	8.51	10.03	7.14	5.26	5.55	4.06	2.68	3.29	4.30	8.41	11.55	13.35	
357062 RDM	Q0	MIN	0.13	0.00	0.16	0.02	0.04	0.00	0.00	0.00	0.00	0.00	0.12	0.00	
REDMOND ROBERTS AP		0.1	0.26	0.17	0.20	0.10	0.12	0.04	0.02	0.00	0.00	0.10	0.19	0.11	5.96
OR	Q1	0.2	0.40	0.28	0.31	0.19	0.24	0.10	0.07	0.00	0.03	0.21	0.33	0.25	6.72
	Q2	0.4	0.67	0.47	0.52	0.38	0.51	0.29	0.22	0.17	0.16	0.38	0.61	0.53	7.85
		0.5	0.81	0.58	0.64	0.49	0.68	0.40	0.33	0.30	0.24	0.48	0.77	0.69	8.37
	Q3	0.6	0.98	0.69	0.77	0.63	0.89	0.55	0.47	0.45	0.34	0.58	0.96	0.89	8.92
	Q4	0.8	1.44	1.02	1.14	1.03	1.51	1.02	0.91	0.94	0.62	0.86	1.51	1.47	10.27
		0.9	1.87	1.32	1.49	1.42	2.13	1.50	1.37	1.45	0.90	1.12	2.04	2.03	11.37
	Q5	MAX	1.98	2.37	1.65	1.75	4.62	2.47	3.73	2.54	1.25	1.17	3.15	3.57	

Monthly Precipitation Probabilities and Quintiles, 1971-2000

CLIMATOGRAPHY OF THE UNITED STATES NO. 81, Supplement No. 1

Monthly Precipitation (inches)

Station Description	Quin	Prob	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ANN
357310 REO	Q0	MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	
ROME 2 NW		0.1	0.00	0.09	0.24	0.25	0.10	0.10	0.00	0.00	0.00	0.00	0.23	0.10	5.19
OR	Q1	0.2	0.18	0.17	0.37	0.39	0.29	0.26	0.00	0.00	0.00	0.13	0.35	0.19	6.07
	Q2	0.4	0.46	0.35	0.59	0.62	0.67	0.54	0.09	0.00	0.22	0.31	0.55	0.41	7.39
		0.5	0.61	0.45	0.70	0.74	0.89	0.69	0.20	0.08	0.34	0.41	0.64	0.54	8.01
	Q3	0.6	0.78	0.57	0.82	0.87	1.14	0.86	0.34	0.19	0.48	0.53	0.75	0.70	8.67
	Q4	0.8	1.28	0.93	1.16	1.22	1.89	1.34	0.79	0.53	0.91	0.87	1.04	1.19	10.33
		0.9	1.75	1.26	1.46	1.54	2.61	1.79	1.25	0.87	1.34	1.19	1.29	1.66	11.70
	Q5	MAX	3.30	1.68	1.86	2.74	4.99	2.11	2.56	1.88	2.37	2.33	1.53	2.32	
357331 RBG	Q0	MIN	0.58	1.02	1.25	0.88	0.27	0.13	0.00	0.00	0.00	0.06	1.09	0.84	
ROSEBURG KQEN		0.1	1.74	1.62	1.91	1.23	0.49	0.18	0.00	0.00	0.00	0.41	1.89	1.65	23.68
OR	Q1	0.2	2.47	2.21	2.40	1.60	0.75	0.31	0.00	0.00	0.12	0.73	2.68	2.45	26.64
	Q2	0.4	3.73	3.20	3.18	2.22	1.25	0.57	0.12	0.12	0.44	1.38	4.07	3.89	30.98
		0.5	4.39	3.70	3.57	2.53	1.53	0.72	0.22	0.25	0.66	1.76	4.79	4.67	32.99
	Q3	0.6	5.13	4.26	3.99	2.87	1.84	0.90	0.34	0.44	0.93	2.21	5.60	5.54	35.08
	Q4	0.8	7.14	5.77	5.08	3.77	2.72	1.42	0.76	1.13	1.78	3.54	7.81	7.96	40.27
		0.9	8.94	7.09	6.01	4.55	3.52	1.91	1.21	1.91	2.66	4.80	9.78	10.17	44.47
	Q5	MAX	9.92	9.75	6.99	5.61	6.33	2.67	2.98	3.30	3.70	4.66	15.91	15.77	
357500 SLE	Q0	MIN	0.41	0.75	0.89	0.62	0.05	0.26	0.00	0.00	0.00	0.12	1.13	1.26	
SALEM MCNARY AP		0.1	2.04	1.88	1.92	1.11	0.63	0.44	0.01	0.00	0.10	0.68	2.44	2.59	28.68
OR	Q1	0.2	2.88	2.62	2.49	1.50	0.94	0.66	0.06	0.04	0.27	1.12	3.36	3.51	32.07
	Q2	0.4	4.37	3.89	3.40	2.16	1.52	1.04	0.22	0.24	0.69	1.98	4.92	5.06	37.01
		0.5	5.15	4.54	3.86	2.50	1.82	1.25	0.34	0.38	0.96	2.46	5.73	5.85	39.28
	Q3	0.6	6.02	5.27	4.36	2.87	2.17	1.48	0.48	0.57	1.30	3.02	6.63	6.72	41.65
	Q4	0.8	8.40	7.26	5.68	3.87	3.14	2.13	0.95	1.16	2.34	4.62	9.04	9.07	47.51
		0.9	10.52	9.02	6.82	4.75	4.03	2.72	1.43	1.77	3.39	6.12	11.18	11.13	52.23
	Q5	MAX	10.89	13.01	8.56	5.72	5.56	4.19	2.63	2.56	3.98	7.96	15.23	15.01	
357698 SXT	Q0	MIN	0.18	0.28	1.43	0.73	0.11	0.10	0.00	0.00	0.00	0.01	0.74	0.49	
SEXTON SUMMIT		0.1	0.98	1.52	1.86	1.02	0.36	0.28	0.00	0.00	0.00	0.31	1.31	1.27	20.99
OR	Q1	0.2	1.65	2.14	2.38	1.35	0.56	0.42	0.04	0.00	0.13	0.66	2.08	2.02	24.45
	Q2	0.4	3.00	3.23	3.23	1.90	0.93	0.67	0.15	0.13	0.50	1.50	3.57	3.47	29.68
		0.5	3.77	3.80	3.65	2.18	1.14	0.81	0.22	0.25	0.74	2.04	4.40	4.28	32.14
	Q3	0.6	4.66	4.43	4.10	2.48	1.37	0.96	0.31	0.42	1.04	2.69	5.34	5.20	34.74
	Q4	0.8	7.24	6.16	5.29	3.30	2.02	1.38	0.59	1.04	2.00	4.71	8.03	7.82	41.30
		0.9	9.68	7.71	6.32	4.01	2.62	1.76	0.86	1.73	2.98	6.74	10.53	10.26	46.70
	Q5	MAX	17.33	8.49	7.36	4.30	4.06	2.80	1.81	4.23	4.26	6.59	24.09	11.79	
360106 ABE	Q0	MIN	0.67	1.01	0.97	0.61	1.43	0.97	0.33	0.76	1.10	1.10	0.68	0.62	
ALLENTOWN LEHIGH VLY AP		0.1	1.20	1.35	1.77	1.32	2.03	1.68	1.44	1.42	1.51	1.45	1.37	1.08	36.37
PA	Q1	0.2	1.71	1.71	2.23	1.82	2.64	2.24	2.06	2.06	2.15	1.91	1.90	1.58	39.13
	Q2	0.4	2.61	2.28	2.97	2.68	3.63	3.17	3.17	3.20	3.27	2.67	2.83	2.47	43.04
		0.5	3.08	2.57	3.34	3.13	4.13	3.64	3.74	3.80	3.85	3.06	3.30	2.95	44.80
	Q3	0.6	3.60	2.88	3.73	3.62	4.68	4.16	4.39	4.47	4.51	3.48	3.83	3.48	46.60
	Q4	0.8	5.04	3.69	4.76	4.95	6.11	5.54	6.17	6.33	6.30	4.59	5.27	4.95	50.98
		0.9	6.33	4.38	5.64	6.13	7.36	6.75	7.77	8.01	7.91	5.56	6.55	6.28	54.43
	Q5	MAX	8.42	5.44	6.59	7.87	10.62	8.58	9.26	9.42	11.57	7.49	9.69	7.89	
360130 AOO	Q0	MIN	0.27	0.64	0.90	0.79	1.14	0.82	1.20	0.02	0.31	0.73	0.64	0.59	
ALTOONA BLAIR CO AP		0.1	0.75	1.00	1.60	1.15	2.19	1.51	1.66	0.86	1.15	0.95	0.99	1.00	29.52
PA	Q1	0.2	1.09	1.31	2.02	1.62	2.65	2.05	2.16	1.28	1.60	1.35	1.45	1.34	31.77
	Q2	0.4	1.71	1.84	2.67	2.44	3.35	2.97	2.99	2.05	2.36	2.07	2.27	1.89	34.97
		0.5	2.04	2.11	3.00	2.87	3.69	3.44	3.41	2.47	2.76	2.44	2.71	2.17	36.40
	Q3	0.6	2.41	2.40	3.35	3.34	4.06	3.96	3.86	2.93	3.20	2.86	3.20	2.48	37.88
	Q4	0.8	3.43	3.18	4.26	4.64	4.98	5.36	5.07	4.24	4.40	4.02	4.57	3.30	41.46
		0.9	4.35	3.85	5.04	5.80	5.76	6.60	6.11	5.43	5.46	5.05	5.81	4.02	44.29
	Q5	MAX	6.91	4.40	5.60	7.48	6.34	11.46	8.74	7.07	8.51	7.02	10.90	4.29	
360865 BFD	Q0	MIN	1.29	0.75	0.50	1.30	0.94	1.55	1.50	1.75	1.77	0.98	0.40	1.21	
BRADFORD RGNL AP		0.1	1.63	1.45	1.50	1.90	1.82	2.31	2.22	1.91	2.33	1.63	1.56	2.25	35.99
PA	Q1	0.2	2.12	1.83	2.04	2.33	2.35	3.09	2.73	2.44	2.83	2.04	2.09	2.71	39.25
	Q2	0.4	2.92	2.42	2.96	3.00	3.21	4.39	3.53	3.29	3.62	2.70	2.99	3.42	43.91
		0.5	3.33	2.72	3.42	3.32	3.65	5.04	3.93	3.71	4.01	3.03	3.44	3.77	46.03
	Q3	0.6	3.77	3.04	3.94	3.67	4.12	5.76	4.35	4.17	4.42	3.38	3.94	4.14	48.21
	Q4	0.8	4.93	3.87	5.33	4.57	5.36	7.70	5.43	5.37	5.47	4.29	5.29	5.08	53.54
		0.9	5.94	4.58	6.55	5.33	6.43	9.39	6.35	6.40	6.36	5.07	6.47	5.87	57.78
	Q5	MAX	8.13	5.29	6.72	6.23	8.84	11.21	10.09	8.55	7.57	6.81	8.93	7.28	
362260 DUJ	Q0	MIN	1.05	0.98	1.69	1.18	1.42	0.86	2.15	0.67	0.73	0.73	0.71	2.02	
DUBOIS JEFFERSON CO AP		0.1	1.36	1.40	2.01	1.82	1.72	1.91	1.70	1.61	1.97	1.35	1.35	1.99	35.61
PA	Q1	0.2	1.77	1.75	2.44	2.23	2.25	2.66	2.25	2.16	2.49	1.75	1.80	2.36	38.00
	Q2	0.4	2.43	2.31	3.11	2.89	3.13	3.95	3.16	3.10	3.31	2.39	2.55	2.93	41.35
		0.5	2.76	2.59	3.44	3.21	3.57	4.63	3.62	3.58	3.71	2.72	2.93	3.21	42.85
	Q3	0.6	3.11	2.89	3.79	3.56	4.04	5.37	4.12	4.10	4.15	3.07	3.35	3.50	44.38
	Q4	0.8	4.06	3.66	4.68	4.44	5.31	7.40	5.47	5.51	5.29	4.00	4.46	4.24	48.09
		0.9	4.88	4.32	5.43	5.19	6.41	9.21	6.64	6.74	6.27	4.81	5.44	4.85	51.00
	Q5	MAX	6.49	5.47	6.70	5.18	9.10	14.68	10.32	10.08	8.31	6.61	8.72	7.01	



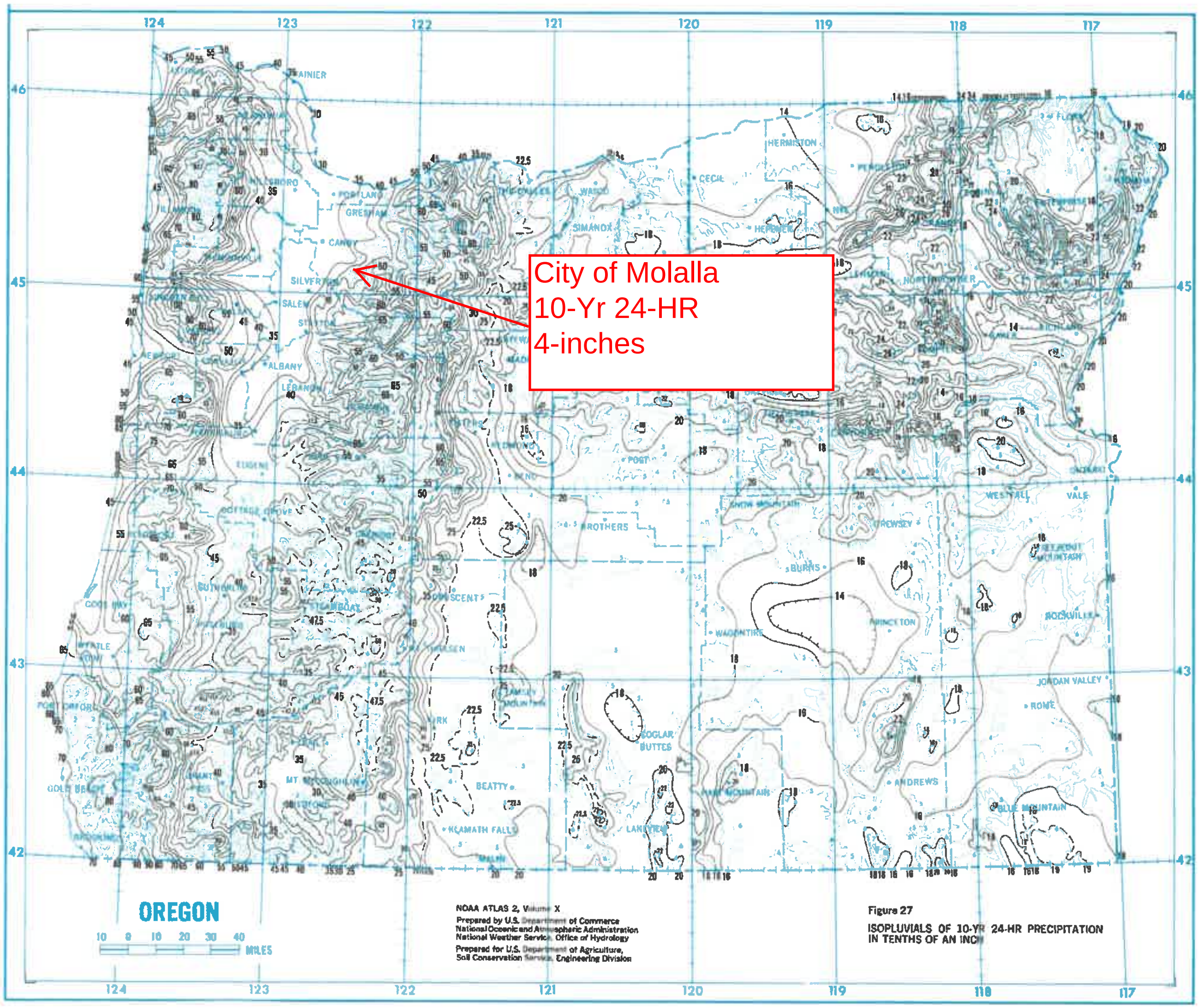
NOAA ATLAS 2, Volume X

Prepared by U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, Office of Hydrology

Prepared for U.S. Department of Agriculture,
Soil Conservation Service, Engineering Division

Figure 26

ISOPLUVIALS OF 5-YR 24-HR PRECIPITATION IN TENTHS OF AN INCH


City of Molalla
10-Yr 24-HR
4-inches
OREGON
MILES
NOAA ATLAS 2, Volume X
Prepared by U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, Office of Hydrology
Prepared for U.S. Department of Agriculture,
Soil Conservation Service, Engineering Division
Figure 27
ISOPLUVIALS OF 10-YR 24-HR PRECIPITATION
IN TENTHS OF AN INCH

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole–foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures.** Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 10. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum.** For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC–3, #9202
1315 East–West Highway
Silver Spring, MD 20910–3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713–3242,** or visit its website at http://www.ngs.noaa.gov/.

Base map information shown on this FIRM was derived from multiple sources. High resolution color orthophotos produced by Merrick & Co., Pixxures, Inc., and Clean Water Services covered portions of the county. USGS Digital Quadrangles at a scale of 1:12000 or less dated 6/20/94 covered the remainder of the county.

This map reflects more detailed and up–to–date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables *in the Flood Insurance Study report (which contains authoritative hydraulic data*) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de–annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1–800–358–9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, *a Flood Insurance Study report*, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1–800–358–9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1–877–FEMA MAP** (1–877–336–2627) or visit the FEMA website at http://www.fema.gov/.

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	1% annual chance floodplain boundary
	0.2% annual chance floodplain boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
~~ 513 ~~~~	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A ——— A	Cross section line
23 - - - - 23	Transect line
97°07'30", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
$^{42}75^{000m}$N	1000-meter Universal Transverse Mercator grid ticks, zone 10
6000000 M	5000-foot grid ticks: Oregon State Plane coordinate system, north zone (FIPSZONE 3601), Lambert Conformal Conic
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
June 17, 2008
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1–800–638–6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0540D

FIRM
FLOOD INSURANCE RATE MAP

CLACKAMAS COUNTY, OREGON
AND INCORPORATED AREAS

PANEL 540 OF 1175
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

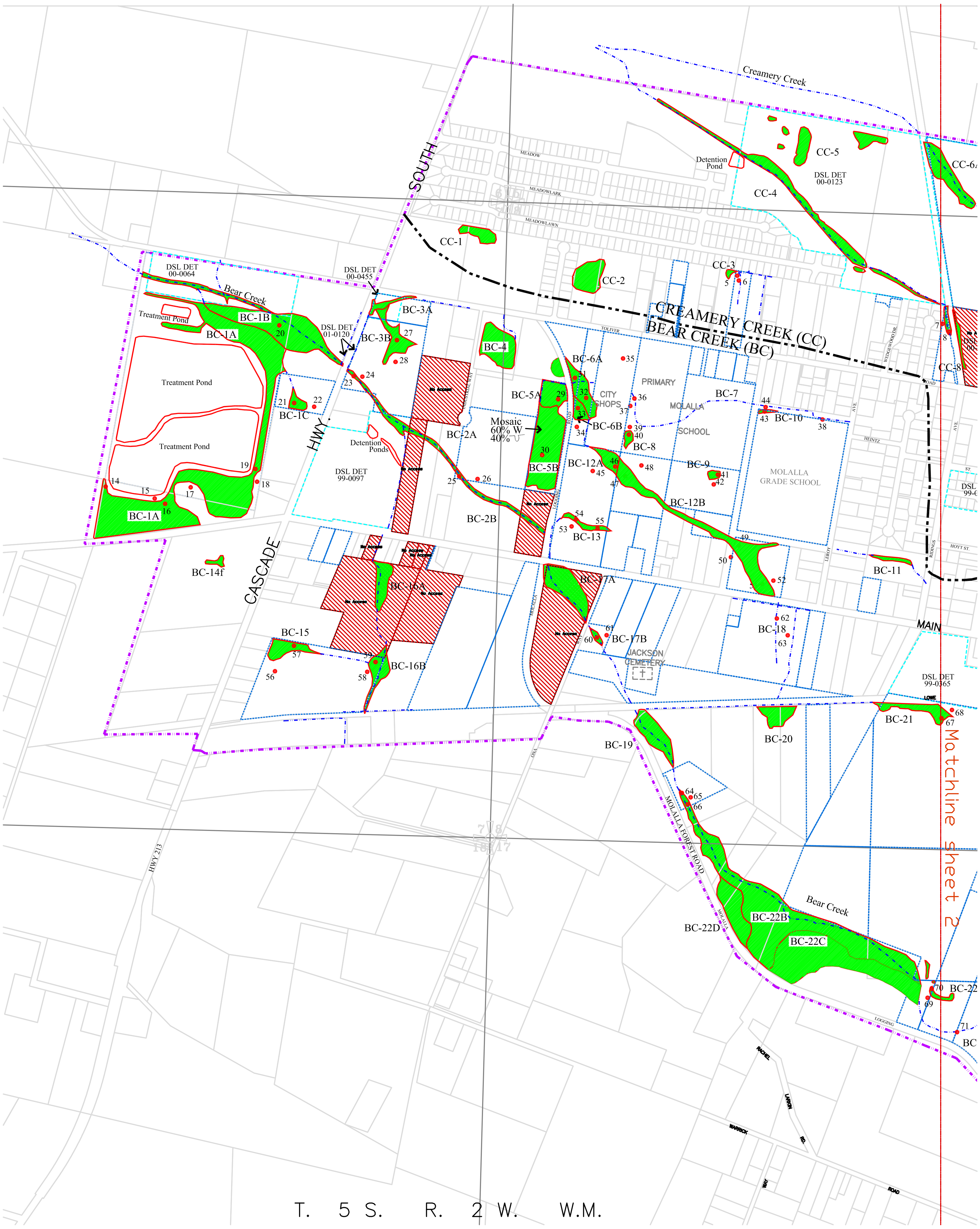
COMMUNITY	NUMBER	PANEL	SUFFIX
CLACKAMAS COUNTY	415588	0540	D
MOLALLA, CITY OF	410020	0540	D

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
41005C0540D

EFFECTIVE DATE
JUNE 17, 2008

Federal Emergency Management Agency



LEGEND

Project Boundary		Division of State Lands Determination	
Watershed Boundary		Potentially Jurisdictional Wetland	
Creeks/drainages		Access Denied	
		On-site permission	
		Wetland Code	BC-7

GRAPHIC SCALE

400 0 200 400 800 1600

Scale in Feet

Funding for this project was provided by a grant from the Oregon Department of Land Conservation and Development

THIS MAP IS FOR PLANNING PURPOSES ONLY
WETLAND BOUNDARIES ARE APPROXIMATE
AND SUBJECT TO CHANGE

Information shown on this map is for planning purposes only and wetland information is subject to change. There may be unmapped wetlands subject to regulation and all wetland boundary mapping is approximate. In all cases, actual field conditions determine wetland boundaries. You are advised to contact the Division of State Lands and the U.S. Army Corps of Engineers with any regulatory questions.

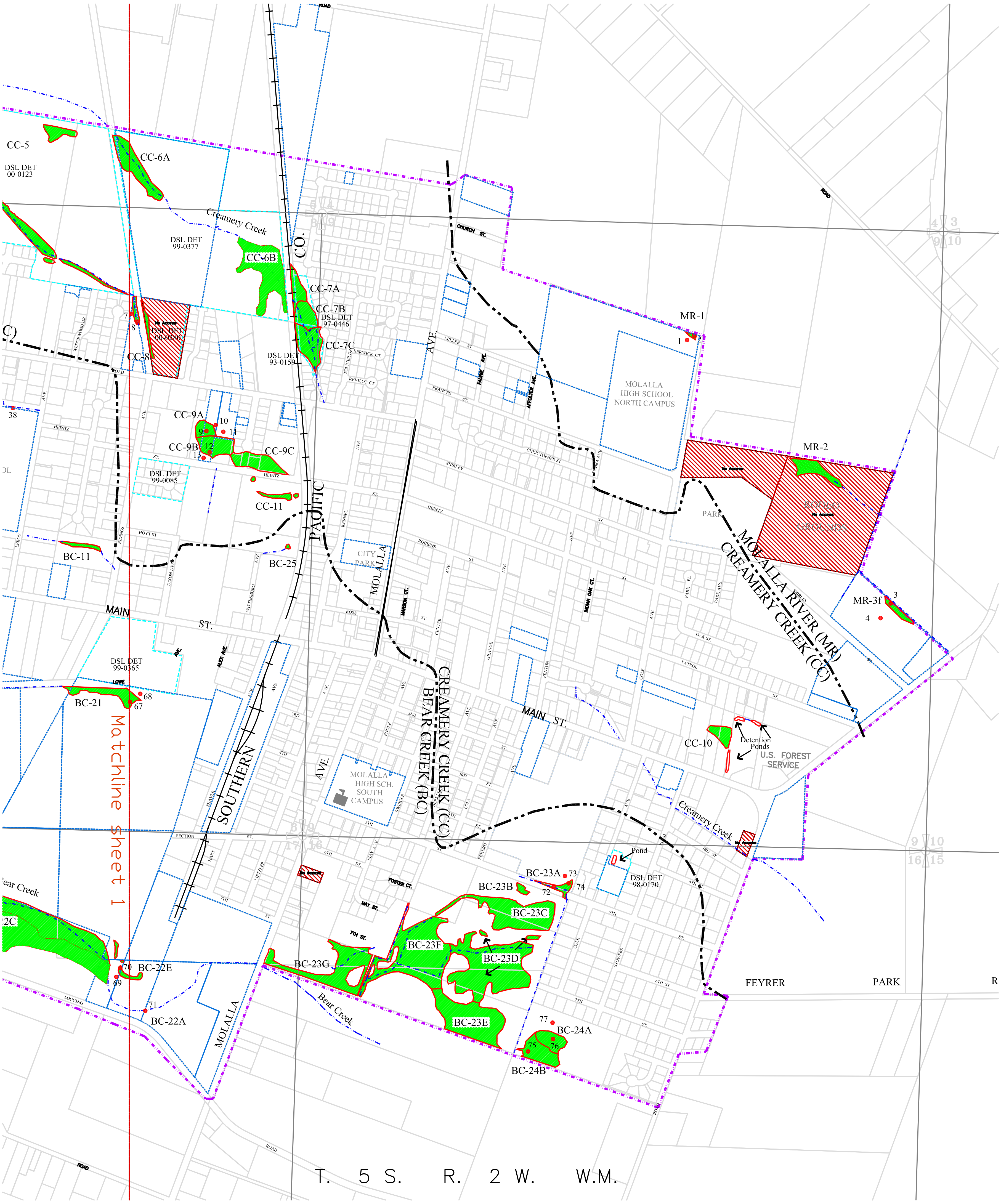
DATE: June, 2001
BASE MAP INFO: Supplied by City of Molalla, Clackmas County ISGIS
JOB NO.: 2250

MAP 5a: MOLALLA
Local Wetlands Inventory

Pacific Habitat Services,Inc.
9450 SW Commerce Circle, Suite 180
Wilsonville, Oregon 97070
Phone: (503) 570-0800

PHS

Sheet: 1 of: 2



LEGEND

Project Boundary		Division of State Lands Determination	
Watershed Boundary		Potentially Jurisdictional Wetland	
Creeks/drainages		Access Denied	
		On-site permission	
		Wetland Code	BC-7

GRAPHIC SCALE

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DATE: June, 2001

BASE MAP INFO: Supplied by City of Molalla, Clackmas County ISGIS

JOB NO.: 2250

MAP 5b: MOLALLA
Local Wetlands Inventory

Pacific Habitat Services, Inc.
9450 SW Commerce Circle, Suite 180
Wilsonville, Oregon 97070
Phone: (503) 570-0800
PHS

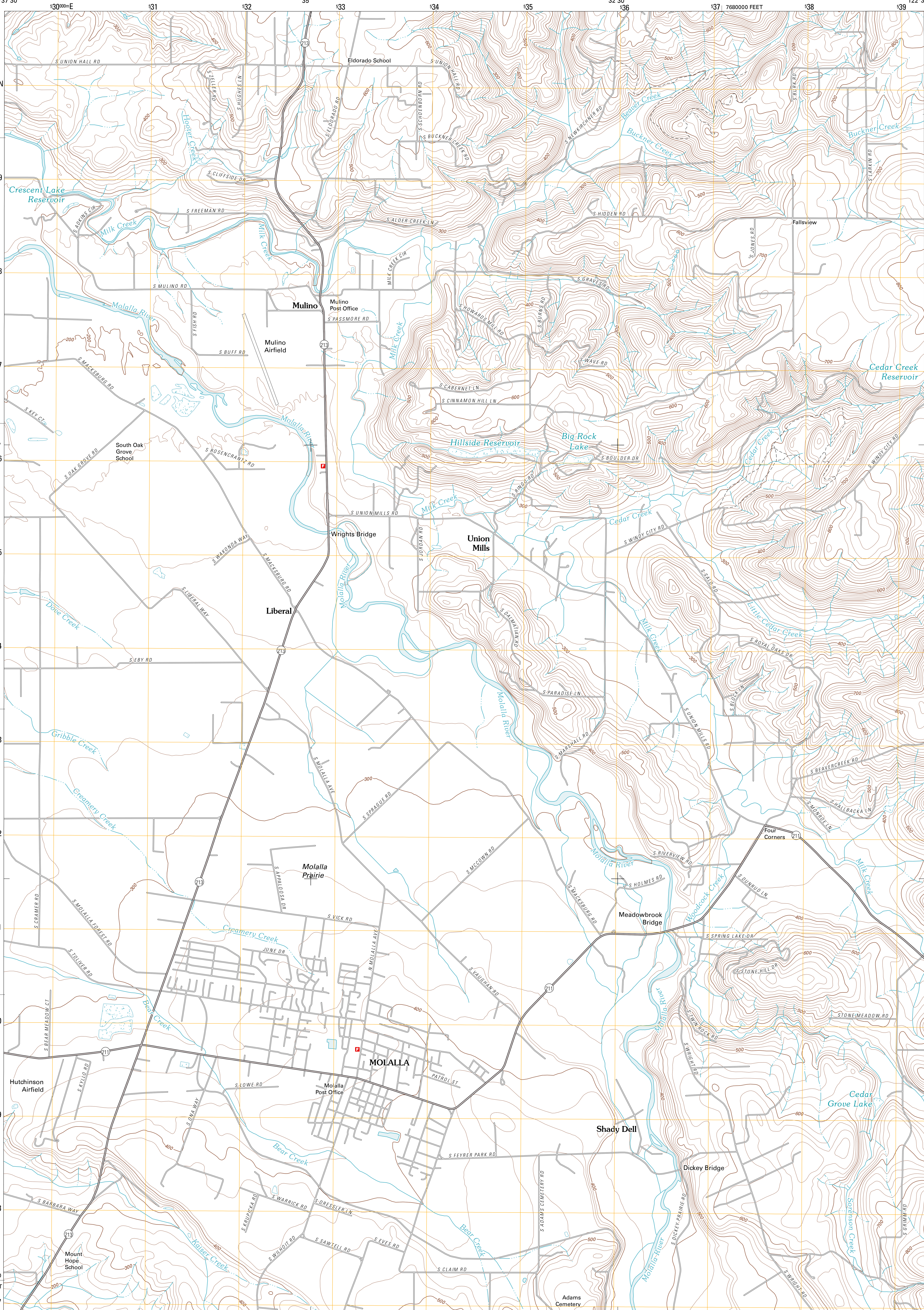
Sheet: 2 of: 2

USGS
science for a changing world

U.S. DEPARTMENT OF THE INTERIOR
U. S. GEOLOGICAL SURVEY

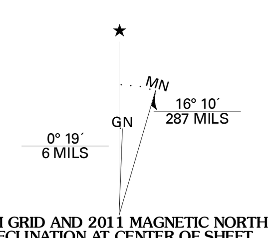
The National Map
US Topo

MOLALLA QUADRANGLE
OREGON-CLACKAMAS CO.
7.5-MINUTE SERIES



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid: Universal Transverse Mercator, Zone 10T
10 000-foot ticks: Oregon Coordinate System of 1983 (north zone)

Imagery....................................NAIP, June 2009
Roads....................................©2006-2010 Tele Atlas
Names..GNIS, 2010
Hydrography................National Hydrography Dataset, 2009
Contours............................National Elevation Dataset, 1999
Boundaries.............Census, IBWC, IBC, USGS, 1972 - 2010



UTM GRID AND 2011 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000-m Square ID ER / EQ $^{50}00$
Grid Zone Designation 10T

SCALE 1:24 000

KILOMETERS 1 0.5 0 1 2
METERS 1000 500 0 1000 2000
MILES 1 0.5 0 1
FEET 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

CONTOUR INTERVAL 20 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with version 0.5.10
of the USGS US Topo Product Standard.
A metadata file associated with this product is draft version 0.5.16

QUADRANGLE LOCATION

Canby	Oregon City	Redland
Yoder	Molalla	Colton
Scotts Mills	Wilhoit	Fernwood

ADJOINING 7.5' QUADRANGLES

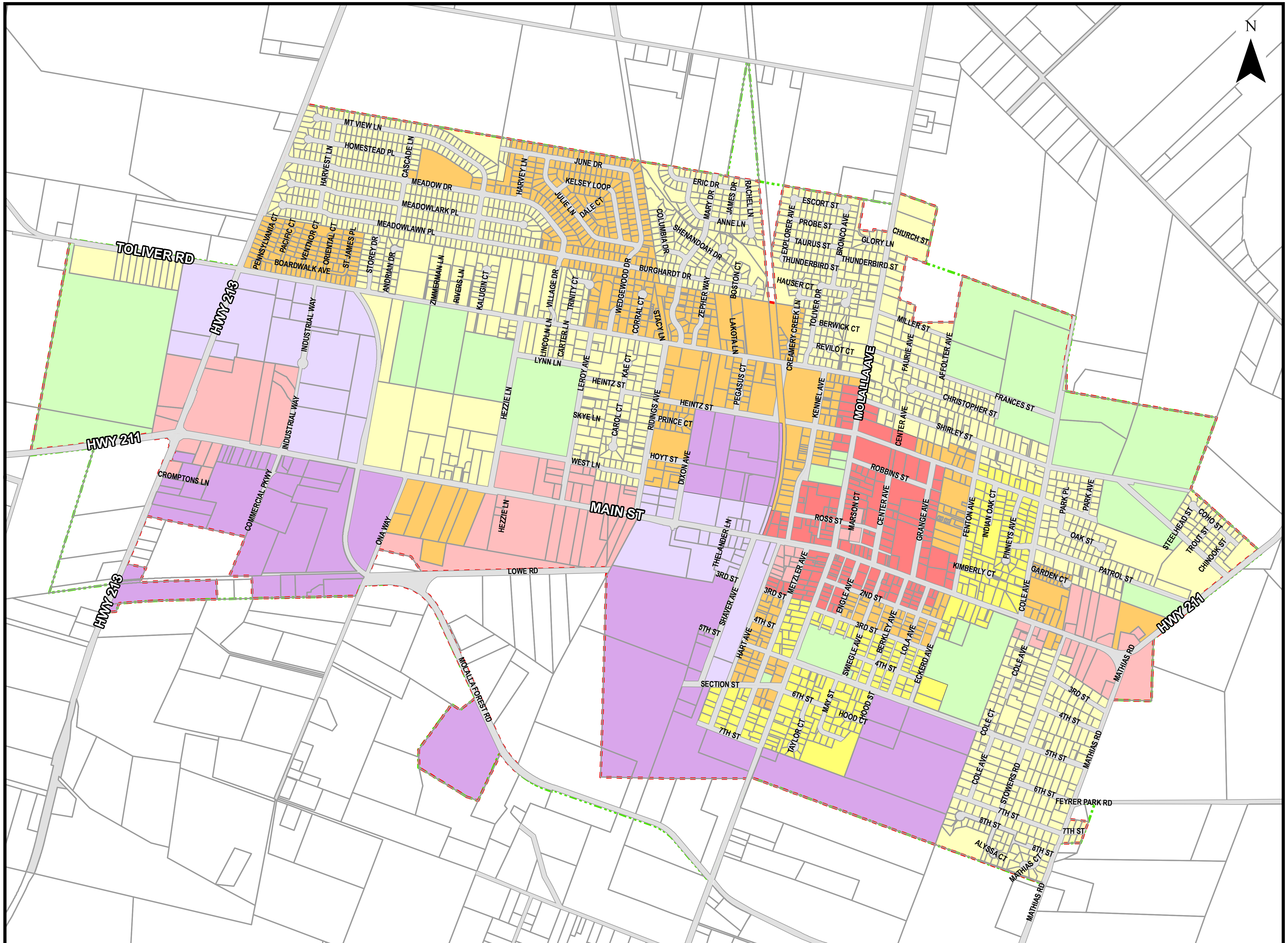
ROAD CLASSIFICATION

Interstate Route	State Route
US Route	Local Road
Ramp	4WD

Interstate Route   US Route   State Route

MOLALLA, OR
2011

City Of Molalla Zoning Map



Zoning Districts

- Central Commercial (C-1)
- General Commercial (C-2)
- Light Industrial (M-1)
- Heavy Industrial (M-2)
- Single Family Residential (R-1)
- Two Family Residential (R-2)
- Multi-Family Residential (R-3)
- Public and Semi Public (PSP)

Boundaries

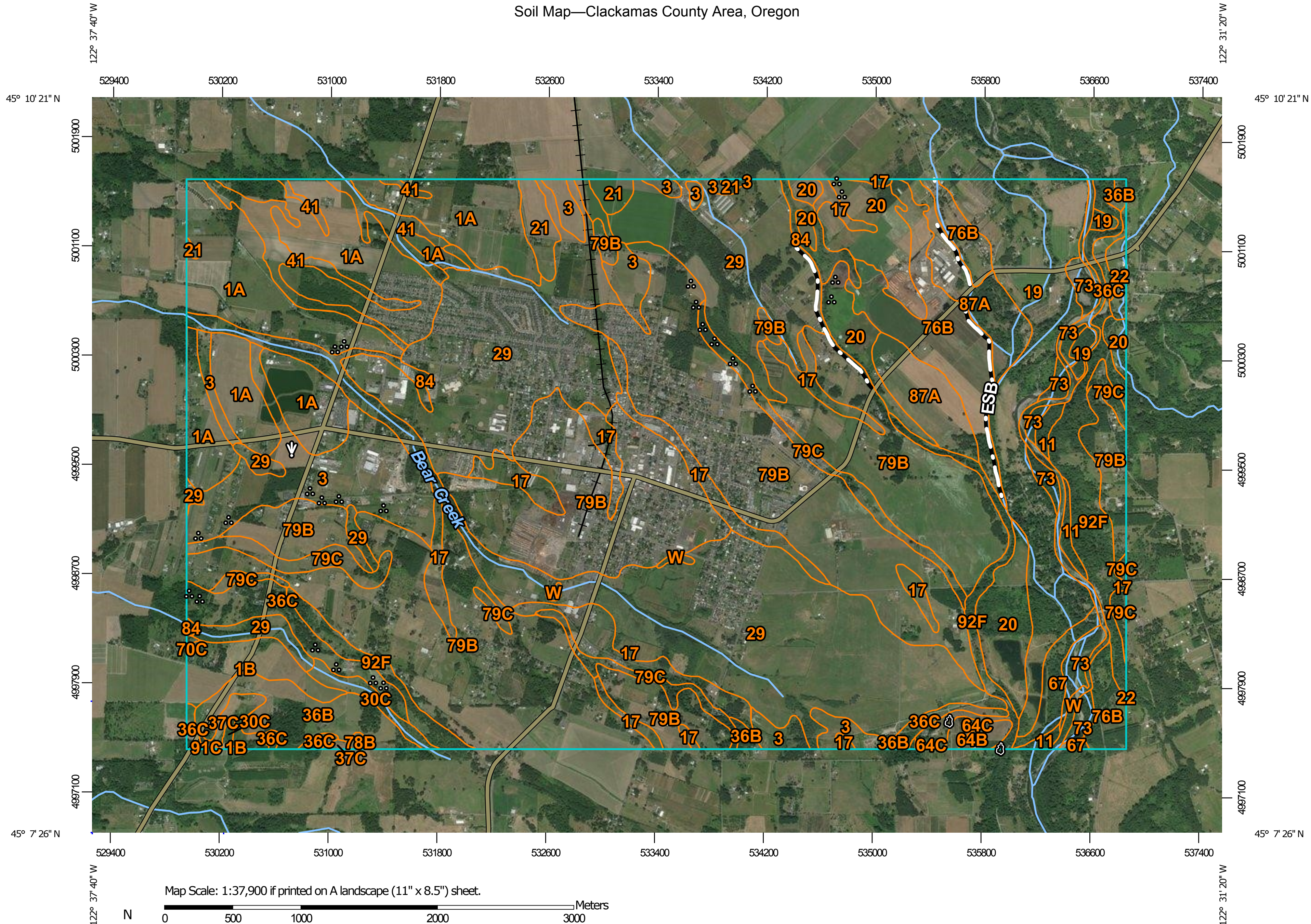
- CityBoundary
- Urban Growth Boundary

Scale = 1:12,000

0 1,000 2,000 Feet

MOLALLA OREGON

The data shown represents administrative boundary data prepared by Clackamas County Information Services and the City of Molalla. It is presented "as is," as of January, 2017. This data may be subject to change. The City of Molalla and Clackamas County Information Services shall assume no liability for any errors, positional accuracy, omissions, or inaccuracies in the information provided and therefore, there are no warranties which accompany this product. The City of Molalla and Clackamas County Information Services assume no liability for decisions made or action taken (or not taken) based upon any of the furnished information or data.



Map Scale: 1:37,900 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 500, 1000, 2000, 3000

Feet: 0, 1500, 3000, 6000, 9000

Map projection: Web Mercator   Corner coordinates: WGS84   Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Clackamas County Area, Oregon
Survey Area Data: Version 11, Sep 16, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 19, 2015—Sep 13, 2016

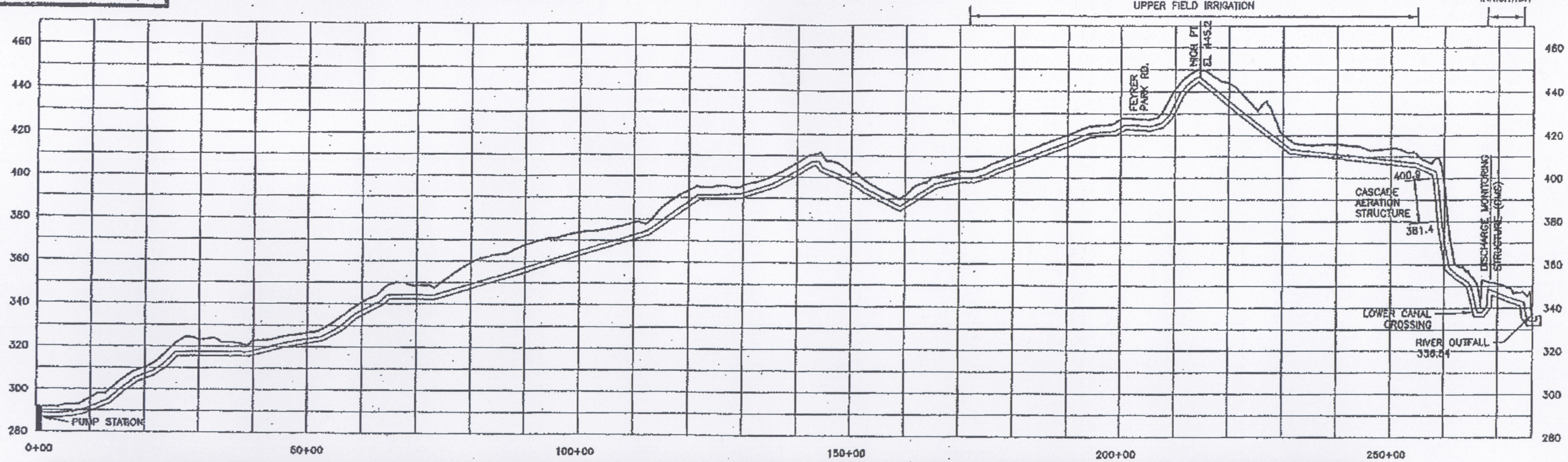
The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

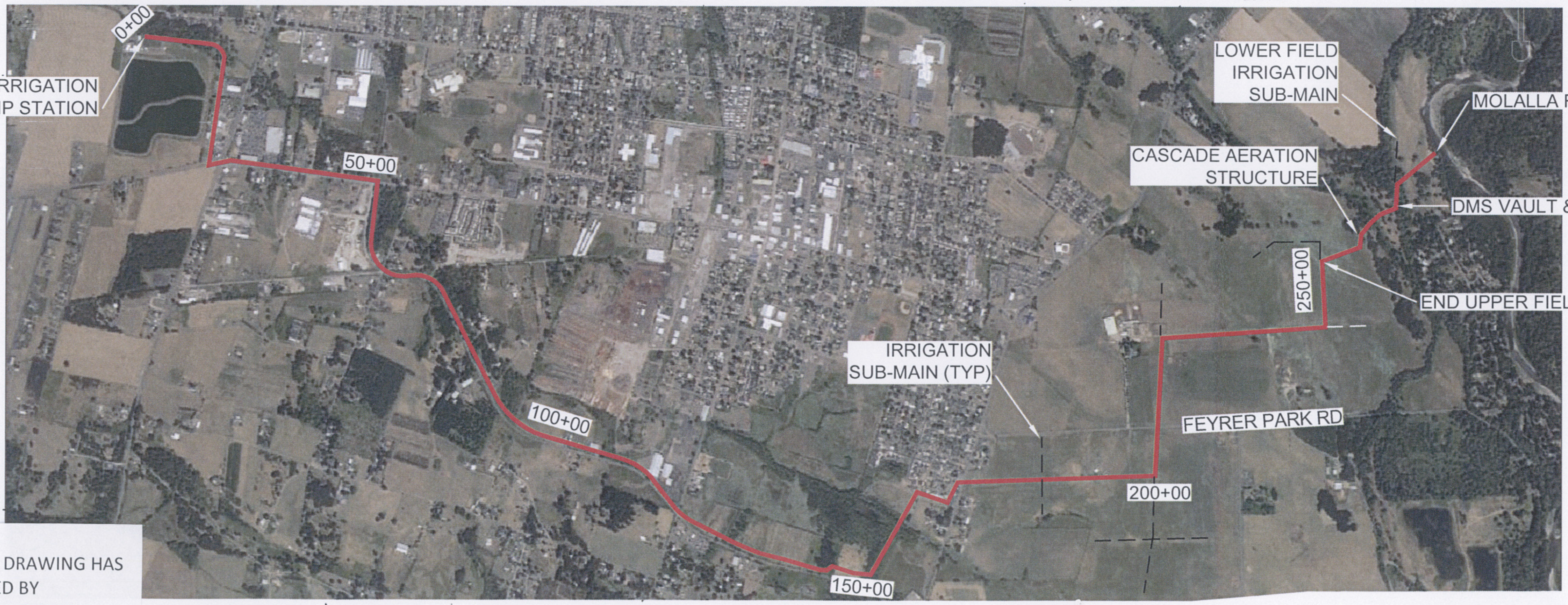
Map Unit Legend

Clackamas County Area, Oregon (OR610)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
1A	Aloha silt loam, 0 to 3 percent slopes	727.1	10.2%
1B	Aloha silt loam, 3 to 6 percent slopes	73.8	1.0%
3	Amity silt loam	350.2	4.9%
11	Camas gravelly sandy loam	26.5	0.4%
17	Clackamas silt loam	261.3	3.7%
19	Cloquato silt loam	389.6	5.4%
20	Coburg silty clay loam	263.6	3.7%
21	Concord silt loam	51.1	0.7%
22	Conser silty clay loam	16.4	0.2%
29	Dayton silt loam	1,462.5	20.5%
30C	Delena silt loam, 3 to 12 percent slopes	28.6	0.4%
36B	Hardscrabble silt loam, 2 to 7 percent slopes	126.4	1.8%
36C	Hardscrabble silt loam, 7 to 20 percent slopes	127.6	1.8%
37C	Helvetia silt loam, 8 to 15 percent slopes	26.0	0.4%
41	Huberly silt loam	112.6	1.6%
64B	Nekia silty clay loam, 2 to 8 percent slopes	3.3	0.0%
64C	Nekia silty clay loam, 8 to 15 percent slopes	19.6	0.3%
67	Newberg fine sandy loam	40.6	0.6%
70C	Powell silt loam, 8 to 15 percent slopes	1.0	0.0%
73	Riverwash	79.6	1.1%
76B	Salem silt loam, 0 to 7 percent slopes	245.8	3.4%
78B	Saum silt loam, 3 to 8 percent slopes	3.3	0.0%
79B	Sawtell silt loam, 0 to 8 percent slopes	1,963.1	27.5%
79C	Sawtell silt loam, 8 to 15 percent slopes	164.4	2.3%
84	Wapato silty clay loam	107.6	1.5%
87A	Willamette silt loam, gravelly substratum, 0 to 3 percent slopes	167.4	2.3%

Clackamas County Area, Oregon (OR610)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
91C	Woodburn silt loam, 8 to 15 percent slopes	0.8	0.0%
92F	Xerochrepts and Haploxerolls, very steep	253.0	3.5%
W	Water	58.9	0.8%
Totals for Area of Interest		**7,151.6**	**100.0%**

NOTE: THIS DRAWING IS PROVIDED FOR REGULATORY REVIEW AND APPROVAL PURPOSES ONLY.





NOTE:
THE ORIGINAL DRAWING HAS BEEN MODIFIED BY THE DYER PARTNERSHIP

FIG. 3-1

DATE: JAN 2007	CIVIL REVIEW:
DESIGNED: KCW	ARCH REVIEW:
DRAWN: KCW	STRUC REVIEW:
CHECKED: JBM	MECH REVIEW:
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REV | DATE | DES | CHECK | APPROVALS | REVISION DESCRIPTION

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REGISTERED PROFESSIONAL ENGINEER 9504 OREGON JERRY D. MINOR EXPIRES 12/31/08

REGISTERED PROFESSIONAL ENGINEER OREGON ERIK G. NORDHOLM EXPIRES 12/31/08

CITY OF MOLALLA
WASTEWATER TREATMENT PLANT IMPROVEMENTS

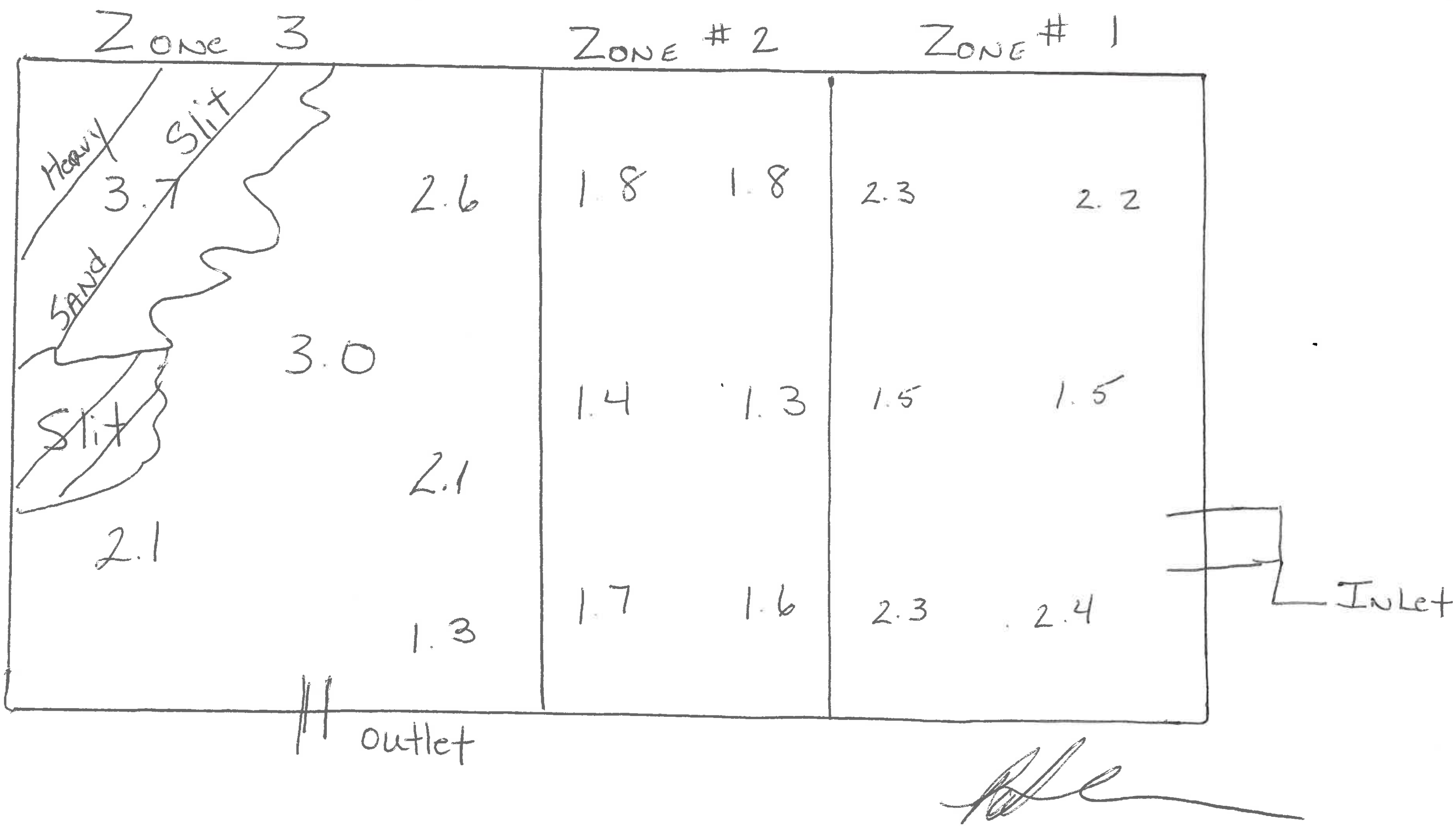
EFFLUENT / IRRIGATION FORCEMAIN
PLAN AND PROFILE

FILE NO:	G8.dwg
PROJECT NO:	3430026
DWG NO:	G8
SHEET:	8 OF 83

RIVER CITY
ENVIRONMENTAL INC.
WORKING TOGETHER FOR A CLEAN ENVIRONMENT

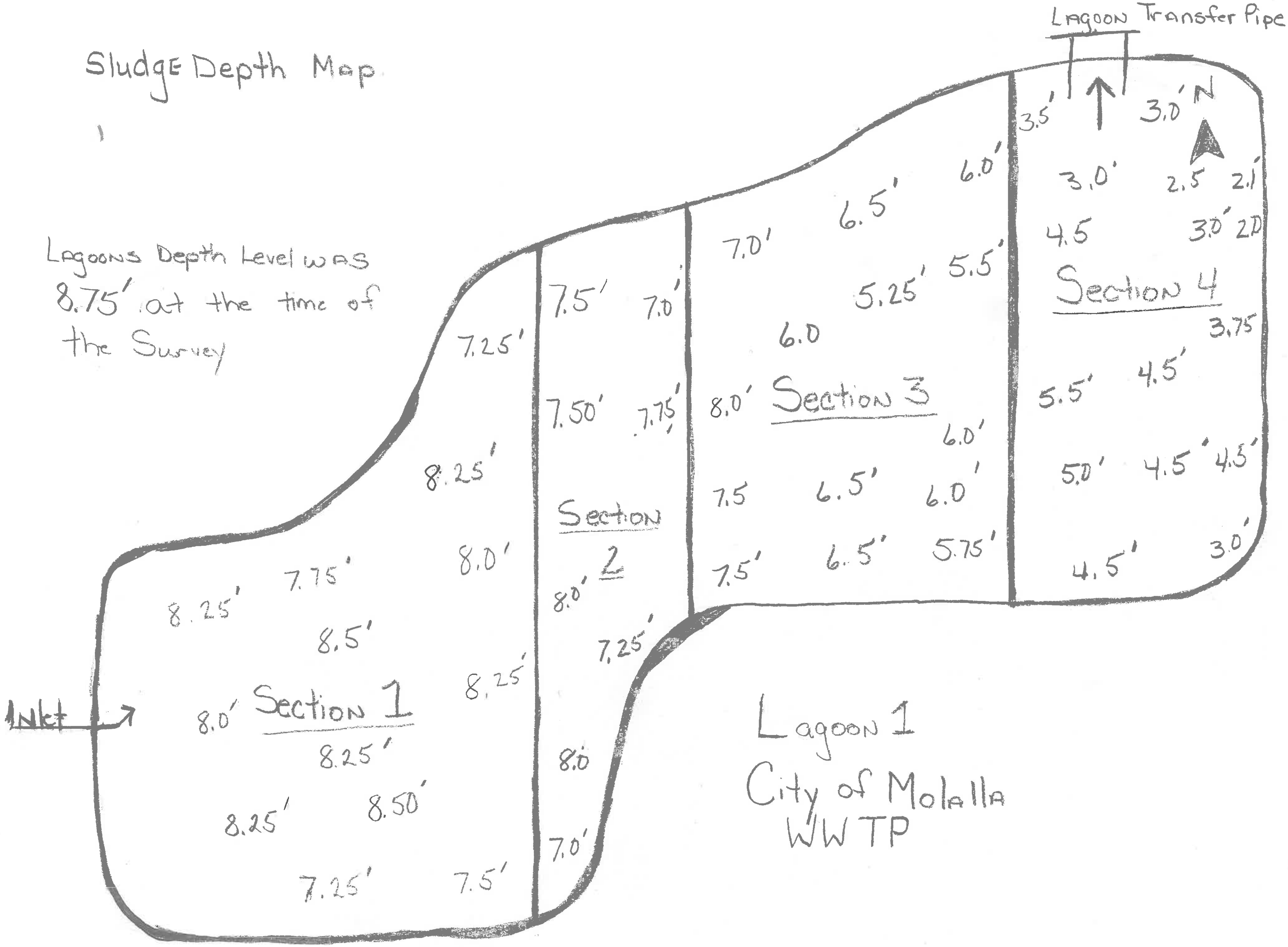
Aerated Basin

Molalla WWTP



Sludge Depth Map

Lagoons Depth Level was 8.75' at the time of the Survey



Lagoon 1
City of Molalla
WWTP

City of Molalla

Project: **Lagoon #1**
Location: **Mollala,OR**
Feed Sample Calculations
Feb.2018 Pond Sample

Section # 1

Sample	Sample Weight grams	Cooked Dry Weight	% Feed solids
1	5.5	0.0	13.43
2	5.4	0.0	10.60
3	5.9	0.0	11.60
4	5.5	0.0	10.56
5	5.6	0.0	9.15
6	5.0	0.0	9.32
7	5.3	0.0	11.45
8	5.1	0.0	9.88
9	5.3	0.0	8.13
0	5.0	0.0	10.55
11	5.1	0.0	8.34
12	5.4	0.0	9.44
		(incl tin)	
			Average Feed % Solids
			10.75%

Section #2

Sample	Sample Weight grams	CookedDry Weight	% Feed solids
1	5.3	0.0	7.95
2	5.6	0.0	7.11
3	5.1	0.0	8.43
4	5.7	0.0	7.78
5	4.8	0.0	6.05
6	5.1	0.0	7.13
			Average Feed % Solids
			7.41%

Section #3

Section #4

Sample	Sample Weight grams	Cooked Dry Weight	% Feed solids
1	4.7	0.0	6.94
2	5.0	0.0	6.11
3	5.8	0.0	5.23
4	5.2	0.0	5.68
5	5.1	0.0	5.25
6	5.3	0.0	5.98

Average Feed % Solids
5.87%

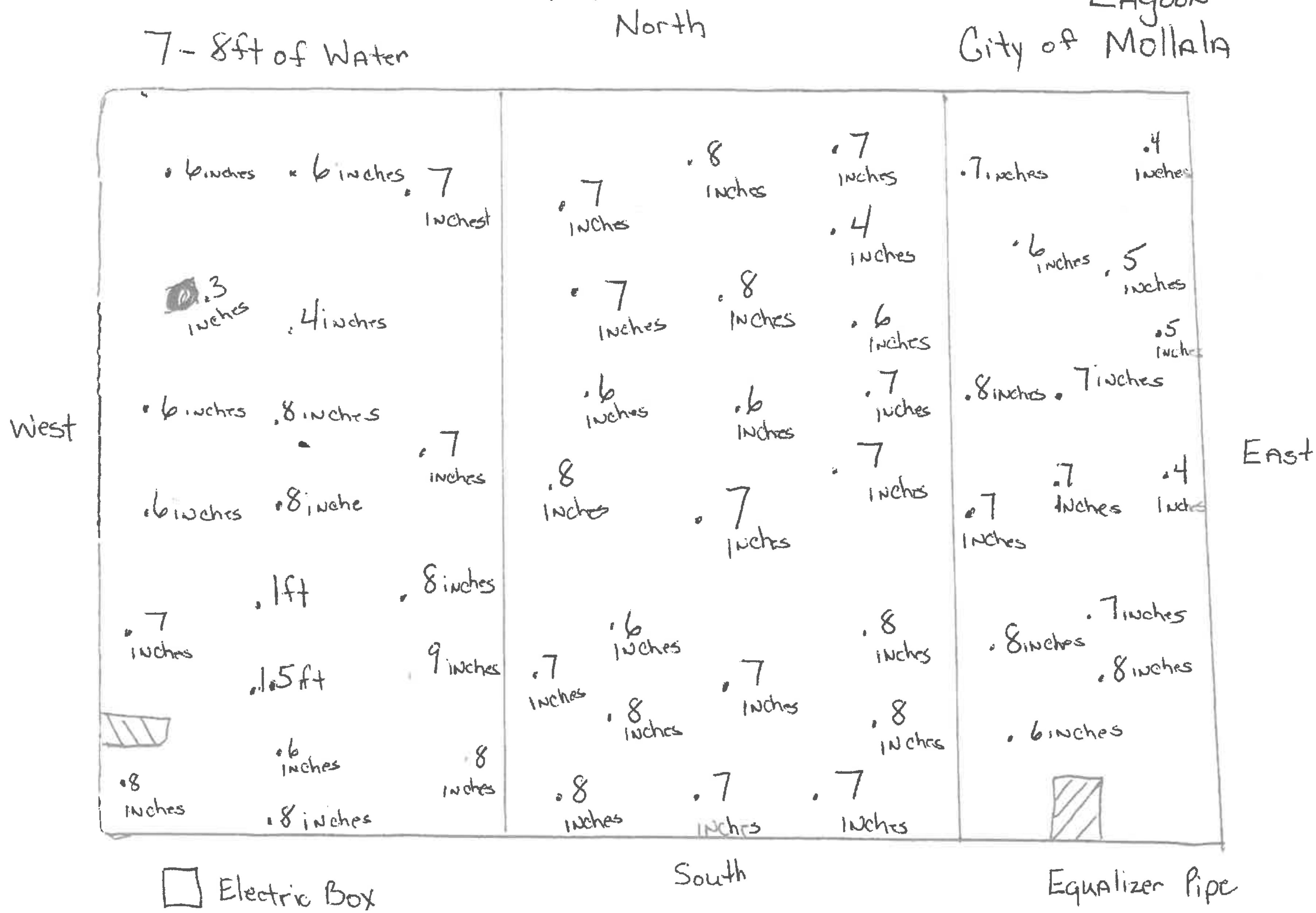
Sample	Sample Weight grams	Cooked Dry Weight	% Feed solids
1	4.6	0.0	4.33
2	5.7	0.0	4.97
3	5.4	0.0	3.11
4	5.1	0.0	4.08
5	5.5	0.0	4.89

Average Feed % Solids
4.14%

LAGOON #2
4/1/2013

Lagoon #2
City of Mollala

7-8ft of Water



City of Molalla

Project: **Lagoon #2**
Location: **Mollala,OR**
Feed Sample Calculations
March.2018 Pond Sample #2

Section # 1

Sample	Sample Weight grams	Cooked Dry Weight	% Feed solids
1	5.3	0.0	2.96
2	5.2	0.0	2.87
3	5.9	0.0	1.57
4	4.9	0.0	1.89
5	6.1	0.0	2.19

(incl tin)

Average Feed % Solids
2.30%

Section #2

Sample	Sample Weight grams	CookedDry Weight	% Feed solids
1	6	0.0	2.11
2	6.1	0.0	2.76
3	5.4	0.0	2.06
4	5.9	0.0	2.89
5	5	0.0	3.1

Average Feed % Solids
2.58%

Section #3

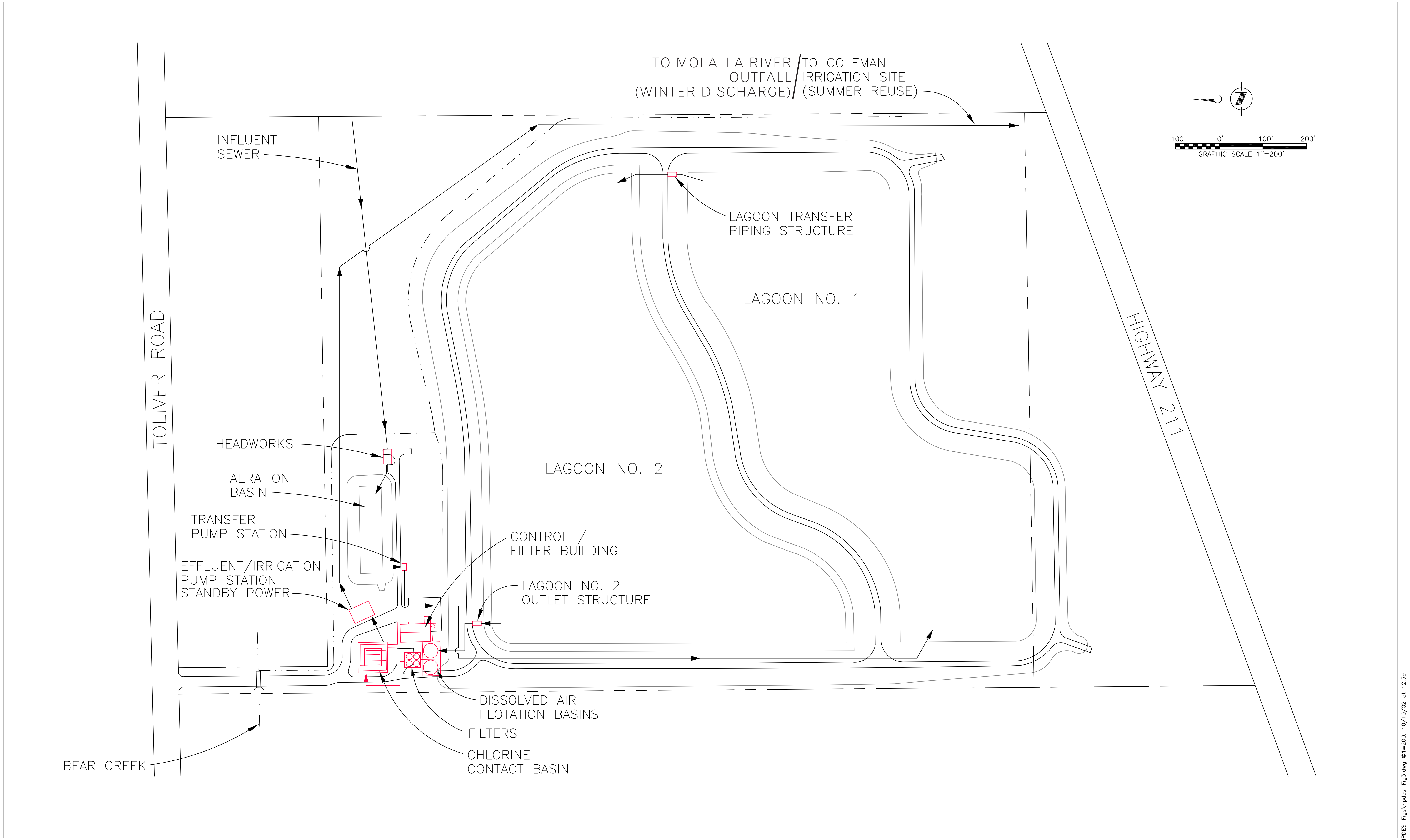
Sample	Sample Weight grams	Cooked Dry Weight	% Feed solids
1	5	0.0	3.26
2	5.6	0.0	2.72
3	5.2	0.0	1.76
4	5.4	0.0	2.03
5	5	0.0	2.31

Average Feed % Solids
2.42%

Section #4

Sample	Sample Weight grams	Cooked Dry Weight	% Feed solids
1	0	0.0	0
2	0	0.0	0
3	0	0.0	0
4	0	0.0	0
5	0	0.0	0

Average Feed % Solids
0.00%



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City of Molalla, Oregon
2008 NPDES PERMIT RENEWAL

FIGURE 2
WWTP SITE PLAN

FLOW DATA

Existing and Projected Flows

	2005	2015	2025
ADWF – Average dry weather flow	0.80 mgd	1.1 mgd	1.4 mgd
MMDWF – Max month dry weather flow	1.28 mgd	1.7 mgd	2.3 mgd
AWWF – Average wet weather flow	1.30 mgd	2.3 mgd	3.0 mgd
MMWWF – Max month wet weather flow	2.04 mgd	3.1 mgd	4.1 mgd
PDF – Peak day flow	7.06 mgd	8.5 mgd	10.3 mgd

DESIGN DATA

Effluent Quality

Required Effluent Quality	BOD5 < 10 mg/l	TSS < 10 mg/l
Anticipated Filter Effluent Quality	BOD5 < 5 mg/l	TSS < 5 mg/l

Headworks (2002 Construction)

Type of screens	In-channel fine screens, perforated plate
Number of screens	1
Peak flow capacity, each	9.25 mgd
Bypass screen	Manually cleaned screen
Screenings washing	Yes
Screenings compaction	Yes
Septage	Excluded
Headworks, influent flow measurement	
Number of flumes	1
Throat width	24 inches
Peak flow capacity	21.4 mgd
Minimum flow capability	0.27 mgd

Aeration Basin (1980 Construction)

Dimensions	
Size (bottom of basin)	200 feet by 54 feet
Side slopes (horiz:vert)	2:1
Maximum side water depth	10 feet with 2 feet freeboard
Basin volume, maximum	1,300,000 gallons
Basin liner	Asphalt-concrete
Aerators	
Type	Aspirating
Number	6
Horsepower, each	10 horsepower
Basin outlet	Overflow weir to pump station

Transfer Pump Station (2002 Construction)

Estimated PIF from basin	9.25 mgd
Main pump type	Centrifugal submersible w/vfd
Main pumps	
Operating	1
Standby	1
Main pump capacity each	5800 gpm at 51 ft tdh
Jockey pump type	Centrifugal submersible w/vfd
Jockey pump number	1
Jockey pump capacity (one forcemain)	2500 gpm at 49 ft tdh and 2100 gpm at 56 ft tdh
Station peak capacity	7800 gpm (11.23 mgd)
Required operating volume	4060 gal
Wet well levels	
Maximum W.S. El	286.0 ft
Minimum W.S. El	272.0 ft
Operating volume	55,820 gal (includes aeration basin)

Transfer Forcemain (2002 Construction)

Number	2
Material	HDPE
Size	18-inch (nominal, ID)
Length	1630 feet
Velocity at 2500 gpm	3.2 feet/sec
Velocity at 2100 gpm	2.6 feet/sec
Velocity at 7800 gpm	4.9 feet/sec
Outlet to lagoon 1	
Number/size	4-ports/12-inch

Lagoon No. 1 (1980 Construction)

Lagoon dimensions	
Surface area	11.4 acres (at 6-foot (average) depth)
Maximum depth	12 feet with 3 feet of freeboard
Working depth (max. To min.)	9 feet
Lagoon volume, maximum	137 acre-feet (45 mg)
Lagoon liner	Native clay
Aeration	None
Outlet	
Size	10-inch
Type	Surface weir and fixed pipe on bottom of lagoon

Lagoon No. 2 (1980 Construction)

Lagoon dimensions	
Surface area	13.6 acres (at 6-foot average depth)
Maximum depth	12 feet with 3 feet of freeboard
Working depth	9 feet
Lagoon volume, maximum	163 acre-feet (53 mg)
Lagoon liner	Native clay
Outlet	
Size	14-inch
Type	Fixed pipes at two depths

Dissolved Air Flotation (DAF) (1980 Construction)

Capacity	2.0 mgd
Tank Diameter	31 feet
Surface area	750 square feet (sf)
Hydraulic loading rate	2.59 gpm/sf, including recycle
Hydraulic capacity	2.80 mgd, including recycle
Chemical feed rates	
Alum	75 – 150 mg/l (not used)
Soda	37 – 75 mg/l (not used)
Polyaluminum Chloride	35 – 70 mg/l
Acid	0 – 10 mg/l (not used)
Operating parameters	
Pressurized recycle flow	350 to 700 gpm
Operating pressure	45 to 80 pounds per square inch (psi)
Maximum horizontal velocity	3.1 feet per second
Maximum daily sludge	2290 pounds dry solids, 15,300 gallons
Recycle Pumps	
Number	2
Size	20 HP
Flow	350 gpm
Recycle Flow Meter (Existing)	
Type	Propeller
Size	6 Inch
Range	0–2 MGD
Influent Flow Meter (FM-2) **(2007 Construction)**	
Type	Electromagnetic Insertion Type
Size	12 Inch
Range	0–10 MGD

Dissolved Air Flotation (DAF) **(2007 Construction)**

Capacity	2.0 mgd
Tank Diameter	38 feet
Surface area	1,075 square feet (sf)
Maximum surface loading rate	2.0 gpm/sf, including recycle
Hydraulic capacity	3.1 mgd, including recycle
Chemical feed rates	
Polyaluminum Chloride	35 – 70 mg/l
Operating parameters	
Pressurized recycle flow	350–700 gpm
Operating pressure	125 PSI
Maximum horizontal velocity	<3.1 FPS
Maximum daily sludge	1,670 pounds dry solids, 10,000 gallons
Recycle Pumps	
Number	2
Size	25 HP
Flow	350 gpm
Recycle Flow Meter (FM-3)	
Type	**Propeller**
Size	6 Inch
Range	0–2.5 MGD
Influent Flow Meter (FM-1)	
Type	**Doppler**
Size	14 Inch
Range	0–14 MGD

Plant Air (Proposed)

Air Compressor	
Type	Rotary Screw
Size	15 HP
Output	51 ACFM
Operating Pressure	125 psig

Gravity Filters (1980 Construction) – To Be Abandoned

Capacity	2.1 mgd
Number of filters	2
Surface area, total	310 square feet
Maximum loading rate	5 gpm/sf
Hydraulic capacity	2.2 mgd
Media	
Type	Gravel, sand, and anthracite coal
Depth	22" gravel, 9" sand, 21" coal
Backwash / surface wash	Automatic on timer or pressure differential
Backwash rate	20 gpm/sf
Surface wash	103 gpm

Gravity Filters **(2007 Construction)**

Capacity	4.0 mgd
Number of filters	4
Surface area, total	573 square feet
Maximum loading rate	4.85 gpm/sf
Hydraulic capacity	4.0 mgd
Media	
Type	Gravel, sand, and anthracite coal
Depth	12" silica sand, 24" anthracite coal
Backwash control	Manual, timed or pressure differential
Backwash rate	15 gpm/sf
Backwash flow (1 filter)	2,147 gpm
Backwash duration	4 – 8 minutes
Backwash volume	8,600 – 17,200 gallons
Air Scour Blower	
Type	Rotary Positive Displacement
Size	15 HP
Air scour rate	3.0 scfm/sf
Air Scour flow (1 filter)	429 scfm @ 4 psig
Backwash Flow Meter (FM-5)	
Type	**Transit Time**
Size	16 Inch
Range	0–17 MGD
Filter Effluent Flow Meter (FM-4)	
Type	**Transit Time**
Size	18 Inch
Range	0–23 MGD

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CIVIL REVIEW
ARCH REVIEW
STRUC REVIEW
MECH REVIEW

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CITY OF MOLALLA
2008 NPDES PERMIT RENEWAL
Figure 3
DESIGN DATA 1

Disinfection (1980 Construction)

Type	150-pound gas cylinders
Chlorinator capacity	100 ppd
Feed rate, minimum	30 to 50 pounds / million gallons
Residual, minimum	2 mg/l
Chlorine Contact Chamber	
Sidewater depth	4 feet with 1 foot of freeboard
Volume	67,500 gallons
Length to width ratio	24

Outfall to Bear Creek (1980 Construction) – To Be Abandoned

Size and material	18-inch concrete
Length	270 feet
Single port	
Type	Perpendicular to streamflow
Stream gauge	
Type	Box culvert with 10' weir
Measurement	Manual staff guage

Effluent/Irrigation Pump Station (2000 Construction)

Pumps	
Type	Vertical turbine
No. Of pumps	2 + 1 future
Capacity	500-7,000 gpm
Motor horsepower	300 bhp
Motor control	VFD
Wet well	
Type	12-ft id manhole
Operating volume, pump 1 on to pump off	3,800 gal
Level control	Pressure transducer
Lift station (In Plant)	
Pump type	Submersible
No. Of pumps	2
Capacity, each pump	175 gpm at 15 ft tdh
Motor horsepower	3 bhp
Speed	1750 rpm
Wet well	6-ft ID manhole
Level control	Pressure transducer

Plant Standby Power Generator (2000 Construction)

Reliability Class	I
Location	Eff/Irr Pump Station
Type	Diesel Engine
Size	750 KW
Transfer Switch	Automatic

Plant Alarm System

Type	After Hours via Auto Telephone Dialer

Effluent/Irrigation Forcemain (2000 & 2006 Construction)

Material	PVC and HDPE
Size (Nominal Inside diameter)	24 inches
Length	27,000 feet (approx. entire length)
Capacity	
Design Capacity	10.1 mgd
Design Velocity	5.0 fps
Approx. Operating Range of Flows	1.0 to 4.0 mgd
Operating Velocities	0.5 to 2.0 fps

Discharge Monitoring Structure (2006 Construction)

Dechlorination (for surface water discharge conditions only)	
Feed Solution	Ascorbic Acid
Chemical Feed Pumps	2 – 13 gph (with 1000:1 Turndown)
Feed Control	Flow and Cl2 residual paced
Effluent Sampler:	
Type: Flow Paced or Time Composite	For Bacteria BOD, TSS, NH3, pH,
Continuous Monitoring/Recording:	
Temperature	Probe.
DO	Probe
Chlorine	Residual Analyzer (2)
Flow Measurement:	
Type	Electromagnetic Multi-port Insertion Type
Size	12-inch

Molalla River Outfall (2006 Construction)

Material (for outfall extension and diffuser)	HDPE
Size (Nominal ID)	24 inches
Length	23 feet
Diffuser Design	
Number of Ports	Three (Duckbill)
Diameter of Port	Eight inches
Minimum Summer Submergence	One Inch
Minimum Winter Submergence	12 Inches

DATE: JAN 2007
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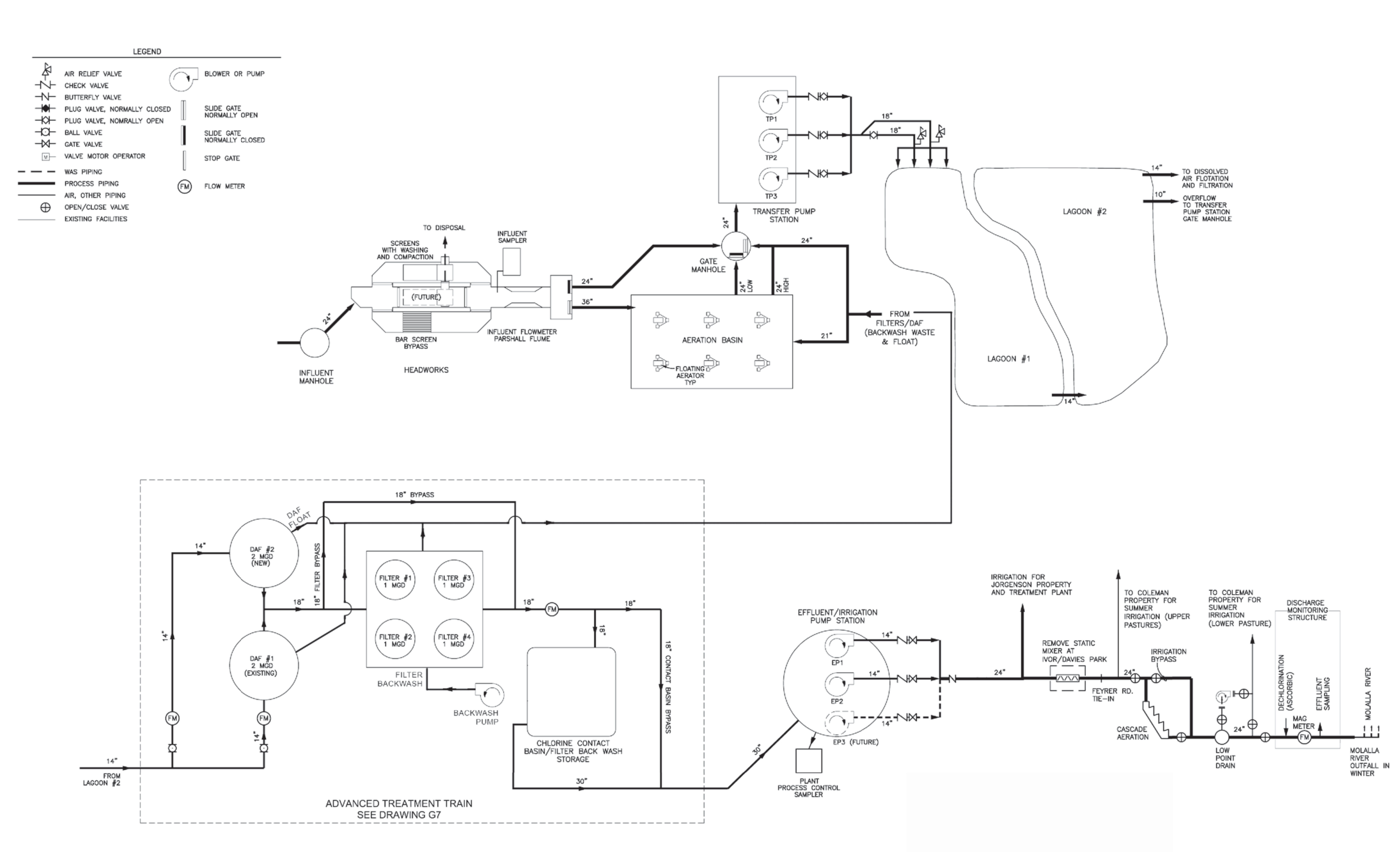
CITY OF MOLALLA
2008 NPDES PERMIT RENEWAL
Figure 4
DESIGN DATA 2



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CITY OF MOLALLA
2008 NPDES PERMIT RENEWAL
Figure 5
PLANT SCHEMATIC

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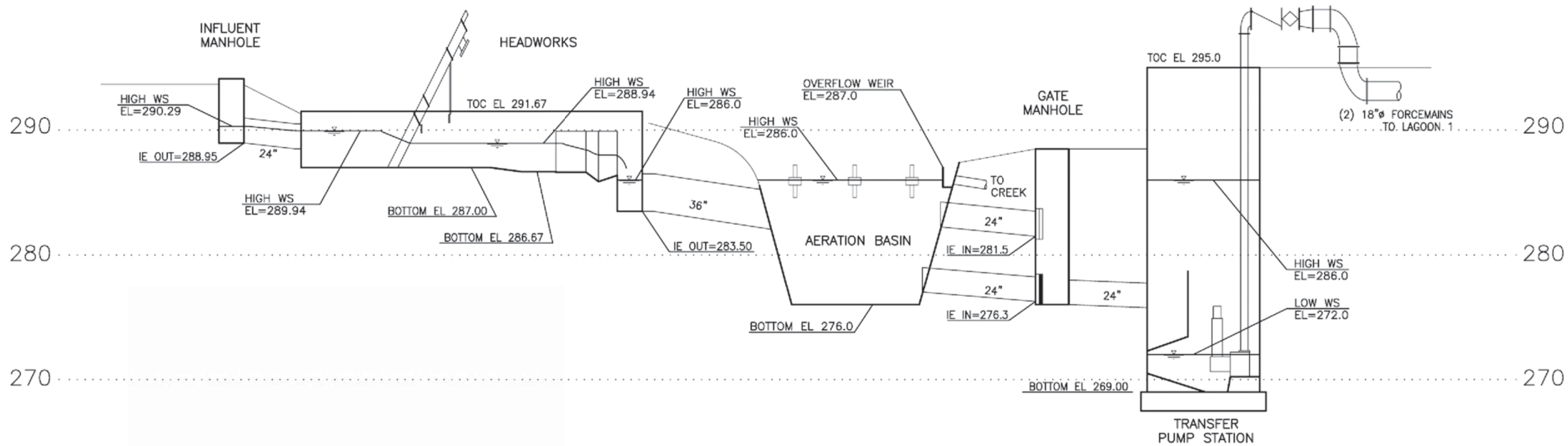

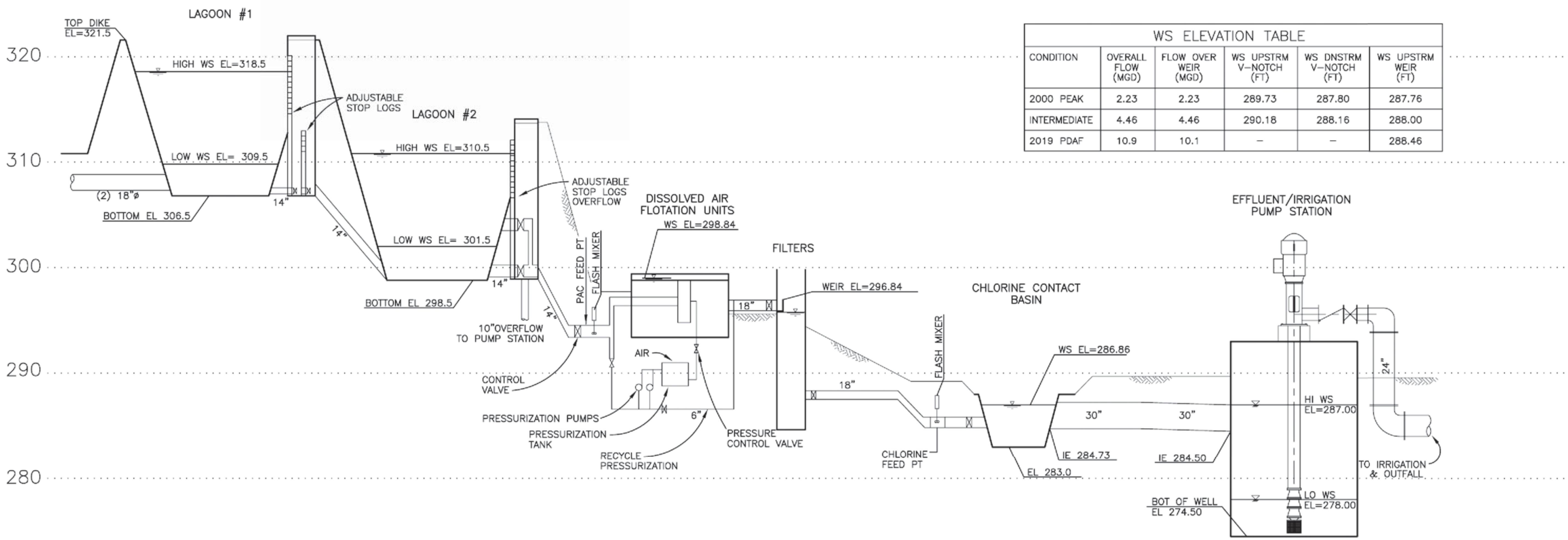

WS ELEVATION TABLE

CONDITION	OVERALL FLOW (MGD)	FLOW OVER WEIR (MGD)	WS UPSTRM V-NOTCH (FT)	WS DNSTRM V-NOTCH (FT)	WS UPSTRM WEIR (FT)
2000 PEAK	2.23	2.23	289.73	287.80	287.76
INTERMEDIATE	4.46	4.46	290.18	288.16	288.00
2019 PDAF	10.9	10.1	–	–	288.46

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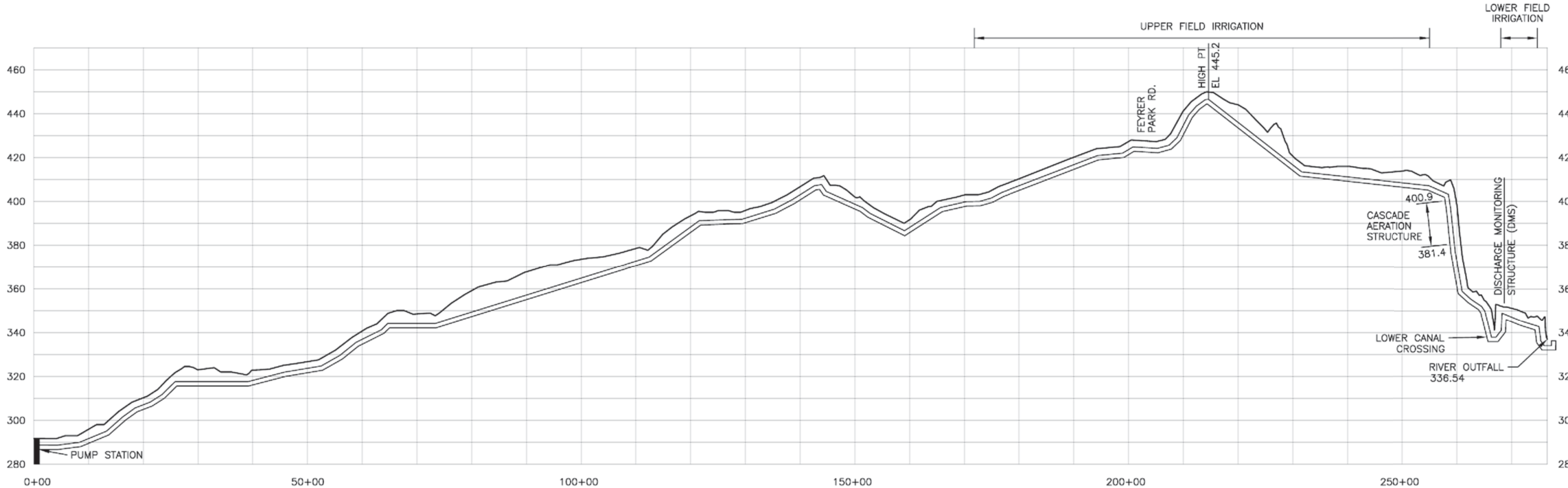
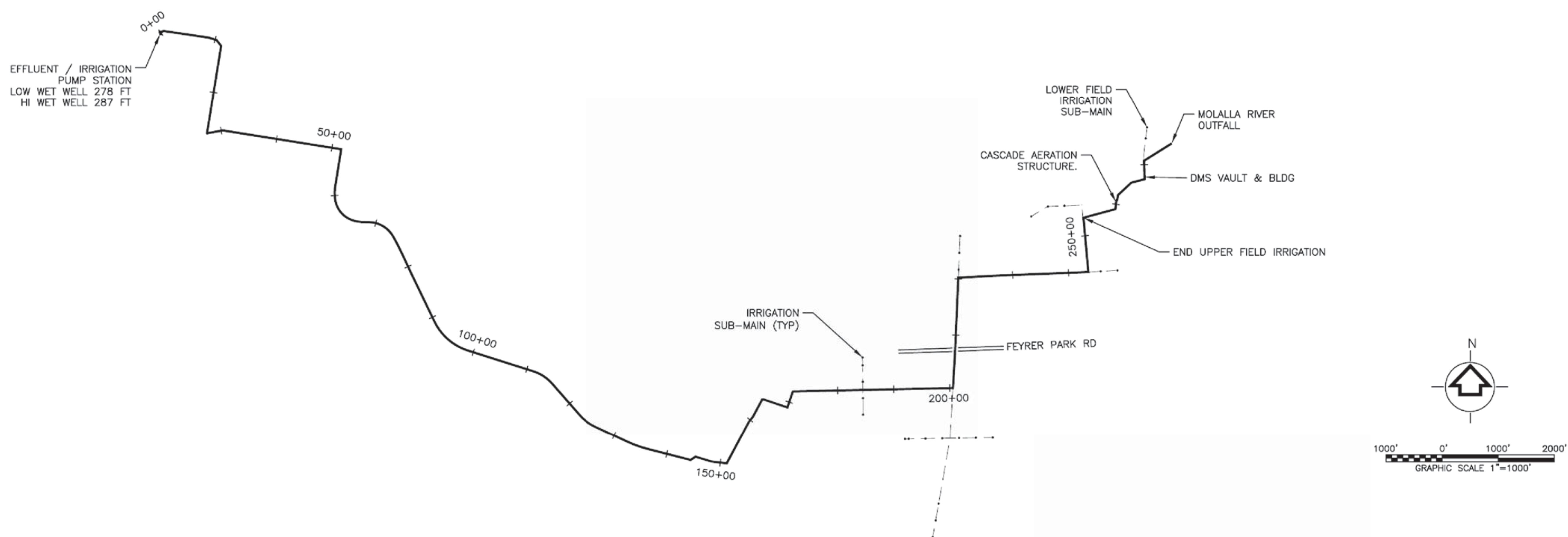
CITY OF MOLALLA
2008 NPDES PERMIT RENEWAL
Figure 6
HYDRAULIC PROFILE





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7080 SW Fir Loop
Portland, Oregon 97223
503-684-9097 Fax: 503-598-0583

CITY OF MOLALLA
2008 NPDES PERMIT RENEWAL
Figure 7
EFFLUENT/IRRIGATION FORCE MAIN PLAN AND PROFILE

This drawing is full size when 22"x 34" or is reduced to half size when 11"x17"

APPENDIX C: COST ESTIMATES AND FUNDING

Cost Estimates

City of Molalla Project 100.26			Collection System Improvements Summary 2/27/2018	
Collection System Improvements				
Project No.	**Phase**	**Length (ft)**	**Construction Cost**	**Total Project Cost**
1	1	850	$ 333,700	$ 457,700
2	1	1100	$ 478,200	$ 654,200
3	1	1300	$ 540,200	$ 740,200
4	1	1300	$ 471,200	$ 645,200
5	1	1300	$ 489,200	$ 669,200
6	1	2300	$ 868,200	$ 1,187,200
7	1	600	$ 230,200	$ 316,200
		Subtotal Phase I	$ 3,410,900	$ 4,669,900
8	2	1900	$ 810,200	$ 1,108,200
9	2	1350	$ 552,700	$ 755,700
10	2	1000	$ 401,200	$ 550,200
11	2	600	$ 255,200	$ 350,200
		Subtotal Phase II	$ 2,019,300	$ 2,764,300
12	3	700	$ 311,200	$ 426,200
13	3	2200	$ 818,200	$ 1,118,200
14	3	750	$ 305,700	$ 418,700
15	3	500	$ 248,200	$ 340,200
16	3	800	$ 332,200	$ 454,200
17	3	750	$ 301,700	$ 413,700
18	3	1800	$ 584,200	$ 798,200
19	3	600	$ 273,200	$ 374,200
20	3	1150	$ 496,700	$ 679,700
21	3	2500	$ 997,200	$ 1,362,200
		Subtotal Phase III	$ 4,668,500	$ 6,385,500
		Total	$ 10,098,700	$ 13,819,700

City of Molalla Project 100.26		Pump Station Improvements Summary 2/27/2018
Pump Station Improvements		
Project	**Construction Cost**	**Total Project Cost**
Taurus Pump Station Improvements	$ 269,000	$ 369,000
S. Molalla Pump Station Improvements	$ 491,500	$ 672,500
Stowers Pump Station Improvements	$ 150,000	$ 206,000
Steelhead & Coho Pump Station Improvements	$ 150,000	$ 206,000
East 5th & South Cole Pump Station Improvements	$ 150,000	$ 206,000
Total	$ 1,210,500	$ 1,659,500

City of Molalla Project 100.26				Taurus Pump Station 12/12/2017
Cost Estimate				
Description	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
Mobilization, Bond & Insurance	LS	1	$ 20,000.00	$ 20,000.00
Demolition & Wastewater Bypass	LS	1	$ 38,000.00	$ 38,000.00
Civil Site Work	LS	1	$ 16,000.00	$ 16,000.00
Submersible Pump System and Controls	LS	1	$ 85,000.00	$ 85,000.00
Effluent Piping & Vault	LS	1	$ 35,000.00	$ 35,000.00
WWTP SCADA Communication and Integration	LS	1	$ 50,000.00	$ 50,000.00
Electrical	LS	1	$ 25,000.00	$ 25,000.00
			Construction	**$ 269,000.00**
			Contingency	**$ 41,000.00**
			Engineering, Bidding, CM	**$ 54,000.00**
			Admin. / Legal	**$ 5,000.00**
			Total Project Cost	**$ 369,000.00**

City of Molalla				S. Molalla Pump Station
Project 100.26				12/12/2017
Cost Estimate				
Description	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
Const. Facilities & Temporary Controls	LS	1	$ 35,000	$ 35,000
Demolition & Site Preparation	LS	1	$ 70,000	$ 70,000
By-Pass Pumping	LS	1	$ 7,000	$ 7,000
7.5hp Submersible Pumps (Rail Guides, Piping, Valves)	LS	2	$ 50,000	$ 100,000
New 5-Feet Diameter Wetwell, Lid and Traffic Rated Hatch	LS	1	$ 25,000	$ 25,000
New Pump Station Concrete Pad	LS	1	$ 10,000	$ 10,000
Control Panel with Controls (NEMA 4X) & SCADA	LS	1	$ 35,000	$ 35,000
Level Control (Pressure Transducer, Float Backup)	LS	1	$ 5,000	$ 5,000
Natural Gas Generator & Concrete Pad	LS	1	$ 35,000	$ 35,000
Check Valve Vault (Traffic Rated)	LS	1	$ 8,000	$ 8,000
Transfer Switch	LS	1	$ 15,000	$ 15,000
Electrical Rack & Utility Station	LS	1	$ 6,000	$ 6,000
Portable Boom Crane & Socket	EA	1	$ 6,500	$ 6,500
Bollards	EA	3	$ 500	$ 1,500
New Access Roadway	LS	1	$ 5,000	$ 5,000
Controls Building	LS	1	$ 15,000	$ 15,000
New Water Service & Backflow Preventer	LS	1	$ 2,000	$ 2,000
New Fencing w/ Privacy Slats & 16-Feet Wide Gate	LS	1	$ 10,000	$ 10,000
Mechanical	LS	1	$ 11,000	$ 11,000
Electrical, New Phone & Power Service	LS	1	$ 8,000	$ 8,000
4" Dia Force Main	LF	700	$ 60	$ 42,000
Surface Removal and Replacement	LF	700	$ 35	$ 24,500
Temporary Protection and Direction of Traffic	LS	1	$ 10,000	$ 10,000
Landscaping	LS	1	$ 5,000	$ 5,000
			Construction	**$ 491,500.00**
			Contingency	**$ 74,000.00**
			Engineering, Bidding, CM	**$ 99,000.00**
			Admin. / Legal	**$ 8,000.00**
			Total Project Cost	**$ 672,500.00**

City of Molalla				Misc. Pump Station Improvements
Project 100.26				12/12/2017

Stowers Pump Station Improvements Cost Estimate

Description	Unit	Quantity	Unit Cost	Total Cost
Mobilization, Bond & Insurance	LS	1	$ 11,000.00	$ 11,000.00
Submersible Pumps & Controls	LS	1	$ 85,000.00	$ 85,000.00
Level Control (Pressure Transducer, Float Backup)	LS	1	$ 5,000.00	$ 5,000.00
WWTP SCADA Communication and Integration	LS	1	$ 12,000.00	$ 12,000.00
By-Pass Pumping	LS	1	$ 7,000.00	$ 7,000.00
Wet Well Rehabilitation & Top Slab	LS	1	$ 20,000.00	$ 20,000.00
Hatch, Fiberglass Insert	LS	1	$ 10,000.00	$ 10,000.00
			Construction	**$ 150,000.00**
			Contingency	**$ 23,000.00**
			Engineering, Bidding, CM	**$ 30,000.00**
			Admin. / Legal	**$ 3,000.00**
			Total Project Cost	**$ 206,000.00**

Steelhead & Coho Pump Station Improvements Cost Estimate

Description	Unit	Quantity	Unit Cost	Total Cost
Mobilization, Bond & Insurance	LS	1	$ 11,000.00	$ 11,000.00
Submersible Pump System and Controls	LS	1	$ 85,000.00	$ 85,000.00
Level Control (Pressure Transducer, Float Backup)	LS	1	$ 5,000.00	$ 5,000.00
WWTP SCADA Communication and Integration	LS	1	$ 12,000.00	$ 12,000.00
By-Pass Pumping	LS	1	$ 7,000.00	$ 7,000.00
Wet Well Rehabilitation & Top Slab	LS	1	$ 20,000.00	$ 20,000.00
Hatch, Fiberglass Insert	LS	1	$ 10,000.00	$ 10,000.00
			Construction	**$ 150,000.00**
			Contingency	**$ 23,000.00**
			Engineering, Bidding, CM	**$ 30,000.00**
			Admin. / Legal	**$ 3,000.00**
			Total Project Cost	**$ 206,000.00**

East 5th & South Cole Pump Station Improvements Cost Estimate

Description	Unit	Quantity	Unit Cost	Total Cost
Mobilization, Bond & Insurance	LS	1	$ 11,000.00	$ 11,000.00
Submersible Pump System and Controls	LS	1	$ 85,000.00	$ 85,000.00
Level Control (Pressure Transducer, Float Backup)	LS	1	$ 5,000.00	$ 5,000.00
WWTP SCADA Communication and Integration	LS	1	$ 12,000.00	$ 12,000.00
By-Pass Pumping	LS	1	$ 7,000.00	$ 7,000.00
Wet Well Rehabilitation & Top Slab	LS	1	$ 20,000.00	$ 20,000.00
Hatch, Fiberglass Insert	LS	1	$ 10,000.00	$ 10,000.00
			Construction	**$ 150,000.00**
			Contingency	**$ 23,000.00**
			Engineering, Bidding, CM	**$ 30,000.00**
			Admin. / Legal	**$ 3,000.00**
			Total Project Cost	**$ 206,000.00**

City of Molalla			Collection System Improvement Projects	
Project 100.26				**10/12/2018**
Cost Estimate: Project 1			**Phase**	**1**
Item	**Quantity**	**Unit**	**Unit Cost ($)**	**Total Cost ($)**
Temp. Facilities and Control	1	LS	$ 29,000	$ 29,000
Demolition & Site Prep	1	LS	$ 18,000	$ 18,000
8" Dia. Gravity Sewer	850	LF	$ 175	$ 148,750
Manholes 8'-12'	3	EA	$ 12,000	$ 36,000
Surface Removal & Replacement (Sewer Main)	850	LF	$ 35	$ 29,750
Foundation Rock	20	CY	$ 55	$ 1,100
Rock Excavation	20	CY	$ 55	$ 1,100
Temporary Protection and Direction of Traffic	1	LS	$ 10,000	$ 10,000
Service Lateral Replacement	20	EA	$ 3,000	$ 60,000
			Construction	**$ 333,700**
			Contingency	**$ 51,000**
			Engineering, Bidding, CM	**$ 67,000**
			Admin. / Legal	**$ 6,000**
			Total Project Cost	**$ 457,700**

City of Molalla		Collection System Improvement Projects		
Project 100.26				**10/12/2018**
Cost Estimate: Project 2			**Phase**	**1**
Item	**Quantity**	**Unit**	**Unit Cost ($)**	**Total Cost ($)**
Temp. Facilities and Control	1	LS	$ 42,000	$ 42,000
Demolition & Site Prep	1	LS	$ 25,000	$ 25,000
8" Dia. Gravity Sewer	1100	LF	$ 175	$ 192,500
Manholes 8'-12'	4	EA	$ 12,000	$ 48,000
Surface Removal & Replacement (Sewer Main)	1100	LF	$ 35	$ 38,500
Foundation Rock	20	CY	$ 55	$ 1,100
Rock Excavation	20	CY	$ 55	$ 1,100
Temporary Protection and Direction of Traffic	1	LS	$ 10,000	$ 10,000
Service Lateral Replacement	40	EA	$ 3,000	$ 120,000
			Construction	**$ 478,200**
			Contingency	**$ 72,000**
			Engineering, Bidding, CM	**$ 96,000**
			Admin. / Legal	**$ 8,000**
			Total Project Cost	**$ 654,200**

City of Molalla		Collection System Improvement Projects		
Project 100.26				**10/12/2018**
Cost Estimate: Project 3			**Phase**	**1**
Item	**Quantity**	**Unit**	**Unit Cost ($)**	**Total Cost ($)**
Temp. Facilities and Control	1	LS	$ 47,000	$ 47,000
Demolition & Site Prep	1	LS	$ 28,000	$ 28,000
8" Dia. Gravity Sewer	1300	LF	$ 175	$ 227,500
Manholes 8'-12'	5	EA	$ 12,000	$ 60,000
Surface Removal & Replacement (Sewer Main)	1300	LF	$ 35	$ 45,500
Foundation Rock	20	CY	$ 55	$ 1,100
Rock Excavation	20	CY	$ 55	$ 1,100
Temporary Protection and Direction of Traffic	1	LS	$ 10,000	$ 10,000
Service Lateral Replacement	40	EA	$ 3,000	$ 120,000
			Construction	**$ 540,200**
			Contingency	**$ 82,000**
			Engineering, Bidding, CM	**$ 109,000**
			Admin. / Legal	**$ 9,000**
			Total Project Cost	**$ 740,200**

City of Molalla		Collection System Improvement Projects		
Project 100.26				**10/12/2018**
Cost Estimate: Project 4			**Phase**	**1**
Item	**Quantity**	**Unit**	**Unit Cost ($)**	**Total Cost ($)**
Temp. Facilities and Control	1	LS	$ 41,000	$ 41,000
Demolition & Site Prep	1	LS	$ 25,000	$ 25,000
8" Dia. Gravity Sewer	1300	LF	$ 175	$ 227,500
Manholes 8'-12'	5	EA	$ 12,000	$ 60,000
Surface Removal & Replacement (Sewer Main)	1300	LF	$ 35	$ 45,500
Foundation Rock	20	CY	$ 55	$ 1,100
Rock Excavation	20	CY	$ 55	$ 1,100
Temporary Protection and Direction of Traffic	1	LS	$ 10,000	$ 10,000
Service Lateral Replacement	20	EA	$ 3,000	$ 60,000
			Construction	**$ 471,200**
			Contingency	**$ 71,000**
			Engineering, Bidding, CM	**$ 95,000**
			Admin. / Legal	**$ 8,000**
			Total Project Cost	**$ 645,200**

City of Molalla			Collection System Improvement Projects	
Project 100.26				**10/12/2018**
Cost Estimate: Project 5			**Phase**	**1**
Item	**Quantity**	**Unit**	**Unit Cost ($)**	**Total Cost ($)**
Temp. Facilities and Control	1	LS	$ 43,000	$ 43,000
Demolition & Site Prep	1	LS	$ 26,000	$ 26,000
8" Dia. Gravity Sewer	1300	LF	$ 175	$ 227,500
Manholes 8'-12'	5	EA	$ 12,000	$ 60,000
Surface Removal & Replacement (Sewer Main)	1300	LF	$ 35	$ 45,500
Foundation Rock	20	CY	$ 55	$ 1,100
Rock Excavation	20	CY	$ 55	$ 1,100
Temporary Protection and Direction of Traffic	1	LS	$ 10,000	$ 10,000
Service Lateral Replacement	25	EA	$ 3,000	$ 75,000
			Construction	**$ 489,200**
			Contingency	**$ 74,000**
			Engineering, Bidding, CM	**$ 98,000**
			Admin. / Legal	**$ 8,000**
			Total Project Cost	**$ 669,200**

City of Molalla		Collection System Improvement Projects		
Project 100.26				**10/12/2018**
Cost Estimate: Project 6			**Phase**	**1**
Item	**Quantity**	**Unit**	**Unit Cost ($)**	**Total Cost ($)**
Temp. Facilities and Control	1	LS	$ 75,000	$ 75,000
Demolition & Site Prep	1	LS	$ 45,000	$ 45,000
8" Dia. Gravity Sewer	2300	LF	$ 175	$ 402,500
Manholes 8'-12'	14	EA	$ 12,000	$ 168,000
Surface Removal & Replacement (Sewer Main)	2300	LF	$ 35	$ 80,500
Foundation Rock	20	CY	$ 55	$ 1,100
Rock Excavation	20	CY	$ 55	$ 1,100
Temporary Protection and Direction of Traffic	1	LS	$ 20,000	$ 20,000
Service Lateral Replacement	25	EA	$ 3,000	$ 75,000
			Construction	**$ 868,200**
			Contingency	**$ 131,000**
			Engineering, Bidding, CM	**$ 174,000**
			Admin. / Legal	**$ 14,000**
			Total Project Cost	**$ 1,187,200**

City of Molalla			Collection System Improvement Projects	
Project 100.26				**10/12/2018**
Cost Estimate: Project 7			**Phase**	**1**
Item	**Quantity**	**Unit**	**Unit Cost ($)**	**Total Cost ($)**
Temp. Facilities and Control	1	LS	$ 20,000	$ 20,000
Demolition & Site Prep	1	LS	$ 12,000	$ 12,000
8" Dia. Gravity Sewer	600	LF	$ 175	$ 105,000
Manholes 8'-12'	2	EA	$ 12,000	$ 24,000
Surface Removal & Replacement (Sewer Main)	600	LF	$ 35	$ 21,000
Foundation Rock	20	CY	$ 55	$ 1,100
Rock Excavation	20	CY	$ 55	$ 1,100
Temporary Protection and Direction of Traffic	1	LS	$ 10,000	$ 10,000
Service Lateral Replacement	12	EA	$ 3,000	$ 36,000
			Construction	**$ 230,200**
			Contingency	**$ 35,000**
			Engineering, Bidding, CM	**$ 47,000**
			Admin. / Legal	**$ 4,000**
			Total Project Cost	**$ 316,200**

City of Molalla	Collection System Improvement Projects			
Project 100.26				**10/12/2018**
Cost Estimate: Project 8			**Phase**	**2**
Item	**Quantity**	**Unit**	**Unit Cost ($)**	**Total Cost ($)**
Temp. Facilities and Control	1	LS	$ 70,000	$ 70,000
Demolition & Site Prep	1	LS	$ 42,000	$ 42,000
10" Dia. Gravity Sewer	1900	LF	$ 185	$ 351,500
Manholes 8'-12'	9	EA	$ 12,000	$ 108,000
Surface Removal & Replacement (Sewer Main)	1900	LF	$ 35	$ 66,500
Foundation Rock	20	CY	$ 55	$ 1,100
Rock Excavation	20	CY	$ 55	$ 1,100
Temporary Protection and Direction of Traffic	1	LS	$ 20,000	$ 20,000
Service Lateral Replacement	50	EA	$ 3,000	$ 150,000
			Construction	**$ 810,200**
			Contingency	**$ 122,000**
			Engineering, Bidding, CM	**$ 163,000**
			Admin. / Legal	**$ 13,000**
			Total Project Cost	**$ 1,108,200**

City of Molalla		Collection System Improvement Projects		
Project 100.26				**10/12/2018**
Cost Estimate: Project 9			**Phase**	**2**
Item	**Quantity**	**Unit**	**Unit Cost ($)**	**Total Cost ($)**
Temp. Facilities and Control	1	LS	$ 48,000	$ 48,000
Demolition & Site Prep	1	LS	$ 29,000	$ 29,000
8" Dia. Gravity Sewer	1350	LF	$ 175	$ 236,250
Manholes 8'-12'	5	EA	$ 12,000	$ 60,000
Surface Removal & Replacement (Sewer Main)	1350	LF	$ 35	$ 47,250
Foundation Rock	20	CY	$ 55	$ 1,100
Rock Excavation	20	CY	$ 55	$ 1,100
Temporary Protection and Direction of Traffic	1	LS	$ 10,000	$ 10,000
Service Lateral Replacement	40	EA	$ 3,000	$ 120,000
			Construction	**$ 552,700**
			Contingency	**$ 83,000**
			Engineering, Bidding, CM	**$ 111,000**
			Admin. / Legal	**$ 9,000**
			Total Project Cost	**$ 755,700**

City of Molalla		Collection System Improvement Projects		
Project 100.26				**10/12/2018**
Cost Estimate: Project 10			**Phase**	**2**
Item	**Quantity**	**Unit**	**Unit Cost ($)**	**Total Cost ($)**
Temp. Facilities and Control	1	LS	$ 35,000	$ 35,000
Demolition & Site Prep	1	LS	$ 21,000	$ 21,000
8" Dia. Gravity Sewer	1000	LF	$ 175	$ 175,000
Manholes 8'-12'	4	EA	$ 12,000	$ 48,000
Surface Removal & Replacement (Sewer Main)	1000	LF	$ 35	$ 35,000
Foundation Rock	20	CY	$ 55	$ 1,100
Rock Excavation	20	CY	$ 55	$ 1,100
Temporary Protection and Direction of Traffic	1	LS	$ 10,000	$ 10,000
Service Lateral Replacement	25	EA	$ 3,000	$ 75,000
			Construction	**$ 401,200**
			Contingency	**$ 61,000**
			Engineering, Bidding, CM	**$ 81,000**
			Admin. / Legal	**$ 7,000**
			Total Project Cost	**$ 550,200**

City of Molalla			Collection System Improvement Projects	
Project 100.26				**10/12/2018**
Cost Estimate: Project 11			**Phase**	**2**
Item	**Quantity**	**Unit**	**Unit Cost ($)**	**Total Cost ($)**
Temp. Facilities and Control	1	LS	$ 22,000	$ 22,000
Demolition & Site Prep	1	LS	$ 14,000	$ 14,000
8" Dia. Gravity Sewer	600	LF	$ 175	$ 105,000
Manholes 8'-12'	3	EA	$ 12,000	$ 36,000
Surface Removal & Replacement (Sewer Main)	600	LF	$ 35	$ 21,000
Foundation Rock	20	CY	$ 55	$ 1,100
Rock Excavation	20	CY	$ 55	$ 1,100
Temporary Protection and Direction of Traffic	1	LS	$ 10,000	$ 10,000
Service Lateral Replacement	15	EA	$ 3,000	$ 45,000
			Construction	**$ 255,200**
			Contingency	**$ 39,000**
			Engineering, Bidding, CM	**$ 52,000**
			Admin. / Legal	**$ 4,000**
			Total Project Cost	**$ 350,200**

City of Molalla		Collection System Improvement Projects		
Project 100.26				**10/12/2018**
Cost Estimate: Project 12			**Phase**	**3**
Item	**Quantity**	**Unit**	**Unit Cost ($)**	**Total Cost ($)**
Temp. Facilities and Control	1	LS	$ 27,000	$ 27,000
Demolition & Site Prep	1	LS	$ 17,000	$ 17,000
8" Dia. Gravity Sewer	700	LF	$ 175	$ 122,500
Manholes 8'-12'	4	EA	$ 12,000	$ 48,000
Surface Removal & Replacement (Sewer Main)	700	LF	$ 35	$ 24,500
Foundation Rock	20	CY	$ 55	$ 1,100
Rock Excavation	20	CY	$ 55	$ 1,100
Temporary Protection and Direction of Traffic	1	LS	$ 10,000	$ 10,000
Service Lateral Replacement	20	EA	$ 3,000	$ 60,000
			Construction	**$ 311,200**
			Contingency	**$ 47,000**
			Engineering, Bidding, CM	**$ 63,000**
			Admin. / Legal	**$ 5,000**
			Total Project Cost	**$ 426,200**

City of Molalla		Collection System Improvement Projects		
Project 100.26				**10/12/2018**
Cost Estimate: Project 13			**Phase**	**3**
Item	**Quantity**	**Unit**	**Unit Cost ($)**	**Total Cost ($)**
Temp. Facilities and Control	1	LS	$ 71,000	$ 71,000
Demolition & Site Prep	1	LS	$ 43,000	$ 43,000
8" Dia. Gravity Sewer	2200	LF	$ 175	$ 385,000
Manholes 4'-8'	7	EA	$ 10,000	$ 70,000
Surface Removal & Replacement (Sewer Main)	2200	LF	$ 35	$ 77,000
Foundation Rock	20	CY	$ 55	$ 1,100
Rock Excavation	20	CY	$ 55	$ 1,100
Temporary Protection and Direction of Traffic	1	LS	$ 20,000	$ 20,000
Service Lateral Replacement	50	EA	$ 3,000	$ 150,000
			Construction	**$ 818,200**
			Contingency	**$ 123,000**
			Engineering, Bidding, CM	**$ 164,000**
			Admin. / Legal	**$ 13,000**
			Total Project Cost	**$ 1,118,200**

City of Molalla		Collection System Improvement Projects		
Project 100.26				**10/12/2018**
Cost Estimate: Project 14			**Phase**	**3**
Item	**Quantity**	**Unit**	**Unit Cost ($)**	**Total Cost ($)**
Temp. Facilities and Control	1	LS	$ 27,000	$ 27,000
Demolition & Site Prep	1	LS	$ 16,000	$ 16,000
8" Dia. Gravity Sewer	750	LF	$ 175	$ 131,250
Manholes 8'-12'	4	EA	$ 12,000	$ 48,000
Surface Removal & Replacement (Sewer Main)	750	LF	$ 35	$ 26,250
Foundation Rock	20	CY	$ 55	$ 1,100
Rock Excavation	20	CY	$ 55	$ 1,100
Temporary Protection and Direction of Traffic	1	LS	$ 10,000	$ 10,000
Service Lateral Replacement	15	EA	$ 3,000	$ 45,000
			Construction	**$ 305,700**
			Contingency	**$ 46,000**
			Engineering, Bidding, CM	**$ 62,000**
			Admin. / Legal	**$ 5,000**
			Total Project Cost	**$ 418,700**

City of Molalla	Collection System Improvement Projects			
Project 100.26				**10/12/2018**
Cost Estimate: Project 15			**Phase**	**3**
Item	**Quantity**	**Unit**	**Unit Cost ($)**	**Total Cost ($)**
Temp. Facilities and Control	1	LS	$ 22,000	$ 22,000
Demolition & Site Prep	1	LS	$ 13,000	$ 13,000
8" Dia. Gravity Sewer	500	LF	$ 175	$ 87,500
Manholes 8'-12'	3	EA	$ 12,000	$ 36,000
Surface Removal & Replacement (Sewer Main)	500	LF	$ 35	$ 17,500
Foundation Rock	20	CY	$ 55	$ 1,100
Rock Excavation	20	CY	$ 55	$ 1,100
Temporary Protection and Direction of Traffic	1	LS	$ 10,000	$ 10,000
Service Lateral Replacement	20	EA	$ 3,000	$ 60,000
			Construction	**$ 248,200**
			Contingency	**$ 38,000**
			Engineering, Bidding, CM	**$ 50,000**
			Admin. / Legal	**$ 4,000**
			Total Project Cost	**$ 340,200**

City of Molalla		Collection System Improvement Projects		
Project 100.26				**10/12/2018**
Cost Estimate: Project 16			**Phase**	**3**
Item	**Quantity**	**Unit**	**Unit Cost ($)**	**Total Cost ($)**
Temp. Facilities and Control	1	LS	$ 29,000	$ 29,000
Demolition & Site Prep	1	LS	$ 18,000	$ 18,000
8" Dia. Gravity Sewer	800	LF	$ 175	$ 140,000
Manholes 4'-8'	3	EA	$ 10,000	$ 30,000
Surface Removal & Replacement (Sewer Main)	800	LF	$ 35	$ 28,000
Foundation Rock	20	CY	$ 55	$ 1,100
Rock Excavation	20	CY	$ 55	$ 1,100
Temporary Protection and Direction of Traffic	1	LS	$ 10,000	$ 10,000
Service Lateral Replacement	25	EA	$ 3,000	$ 75,000
			Construction	**$ 332,200**
			Contingency	**$ 50,000**
			Engineering, Bidding, CM	**$ 67,000**
			Admin. / Legal	**$ 5,000**
			Total Project Cost	**$ 454,200**

City of Molalla		Collection System Improvement Projects		
Project 100.26				**10/12/2018**
Cost Estimate: Project 17			**Phase**	**3**
Item	**Quantity**	**Unit**	**Unit Cost ($)**	**Total Cost ($)**
Temp. Facilities and Control	1	LS	$ 26,000	$ 26,000
Demolition & Site Prep	1	LS	$ 16,000	$ 16,000
8" Dia. Gravity Sewer	750	LF	$ 175	$ 131,250
Manholes 4'-8'	3	EA	$ 10,000	$ 30,000
Surface Removal & Replacement (Sewer Main)	750	LF	$ 35	$ 26,250
Foundation Rock	20	CY	$ 55	$ 1,100
Rock Excavation	20	CY	$ 55	$ 1,100
Temporary Protection and Direction of Traffic	1	LS	$ 10,000	$ 10,000
Service Lateral Replacement	20	EA	$ 3,000	$ 60,000
			Construction	**$ 301,700**
			Contingency	**$ 46,000**
			Engineering, Bidding, CM	**$ 61,000**
			Admin. / Legal	**$ 5,000**
			Total Project Cost	**$ 413,700**

City of Molalla		Collection System Improvement Projects		
Project 100.26				**10/12/2018**
Cost Estimate: Project 18			**Phase**	**3**
Item	**Quantity**	**Unit**	**Unit Cost ($)**	**Total Cost ($)**
Temp. Facilities and Control	1	LS	$ 51,000	$ 51,000
Demolition & Site Prep	1	LS	$ 31,000	$ 31,000
8" Dia. Gravity Sewer	1800	LF	$ 175	$ 315,000
Manholes 8'-12'	6	EA	$ 12,000	$ 72,000
Surface Removal & Replacement (Sewer Main)	1800	LF	$ 35	$ 63,000
Foundation Rock	20	CY	$ 55	$ 1,100
Rock Excavation	20	CY	$ 55	$ 1,100
Temporary Protection and Direction of Traffic	1	LS	$ 20,000	$ 20,000
Service Lateral Replacement	10	EA	$ 3,000	$ 30,000
			Construction	**$ 584,200**
			Contingency	**$ 88,000**
			Engineering, Bidding, CM	**$ 117,000**
			Admin. / Legal	**$ 9,000**
			Total Project Cost	**$ 798,200**

City of Molalla		Collection System Improvement Projects		
Project 100.26				**10/12/2018**
Cost Estimate: Project 19			**Phase**	**3**
Item	**Quantity**	**Unit**	**Unit Cost ($)**	**Total Cost ($)**
Temp. Facilities and Control	1	LS	$ 24,000	$ 24,000
Demolition & Site Prep	1	LS	$ 15,000	$ 15,000
10" Dia. Gravity Sewer	600	LF	$ 185	$ 111,000
Manholes 12'-16'	3	EA	$ 14,000	$ 42,000
Surface Removal & Replacement (Sewer Main)	600	LF	$ 35	$ 21,000
Foundation Rock	20	CY	$ 55	$ 1,100
Rock Excavation	20	CY	$ 55	$ 1,100
Temporary Protection and Direction of Traffic	1	LS	$ 10,000	$ 10,000
Service Lateral Replacement	16	EA	$ 3,000	$ 48,000
			Construction	**$ 273,200**
			Contingency	**$ 41,000**
			Engineering, Bidding, CM	**$ 55,000**
			Admin. / Legal	**$ 5,000**
			Total Project Cost	**$ 374,200**

City of Molalla			Collection System Improvement Projects	
Project 100.26				**10/12/2018**
Cost Estimate: Project 20			**Phase**	**3**
Item	**Quantity**	**Unit**	**Unit Cost ($)**	**Total Cost ($)**
Temp. Facilities and Control	1	LS	$ 43,000	$ 43,000
Demolition & Site Prep	1	LS	$ 26,000	$ 26,000
8" Dia. Gravity Sewer	1150	LF	$ 175	$ 201,250
Manholes 8'-12'	7	EA	$ 12,000	$ 84,000
Surface Removal & Replacement (Sewer Main)	1150	LF	$ 35	$ 40,250
Foundation Rock	20	CY	$ 55	$ 1,100
Rock Excavation	20	CY	$ 55	$ 1,100
Temporary Protection and Direction of Traffic	1	LS	$ 10,000	$ 10,000
Service Lateral Replacement	30	EA	$ 3,000	$ 90,000
			Construction	**$ 496,700**
			Contingency	**$ 75,000**
			Engineering, Bidding, CM	**$ 100,000**
			Admin. / Legal	**$ 8,000**
			Total Project Cost	**$ 679,700**

City of Molalla		Collection System Improvement Projects		
Project 100.26				**10/12/2018**
Cost Estimate: Project 21			**Phase**	**3**
Item	**Quantity**	**Unit**	**Unit Cost ($)**	**Total Cost ($)**
Temp. Facilities and Control	1	LS	$ 86,000	$ 86,000
Demolition & Site Prep	1	LS	$ 52,000	$ 52,000
8" Dia. Gravity Sewer	2500	LF	$ 175	$ 437,500
Manholes 8'-12'	11	EA	$ 12,000	$ 132,000
Surface Removal & Replacement (Sewer Main)	2500	LF	$ 35	$ 87,500
Foundation Rock	20	CY	$ 55	$ 1,100
Rock Excavation	20	CY	$ 55	$ 1,100
Temporary Protection and Direction of Traffic	1	LS	$ 20,000	$ 20,000
Service Lateral Replacement	60	EA	$ 3,000	$ 180,000
			Construction	**$ 997,200**
			Contingency	**$ 150,000**
			Engineering, Bidding, CM	**$ 200,000**
			Admin. / Legal	**$ 15,000**
			Total Project Cost	**$ 1,362,200**

City of Molalla				WWTP Improvements Summary
Project 100.26				10/18/2018

WWTP Improvements Summary - Total Cost Estimates

Item	PS #1	PS #2	PS #3	PS #4
Influent Screen	$ 485,355	$ 485,355	$ 485,355	$ 485,355
Grit Removal	$ 901,000	$ 901,000	$ 901,000	$ 901,000
Flow Equalization Basin	$ 1,190,000	$ 1,190,000	$ 1,190,000	$ 1,190,000
Transfer Pump Station	$ 844,000	$ 844,000	$ 844,000	$ 844,000
SBR	$ 6,707,000	$ 6,707,000	$ 6,707,000	$ 6,707,000
Tertiary Filtration	$ 2,387,000	$ 2,387,000	-	-
Lagoon Desludging & Disposal	$ 3,875,000	$ 3,875,000	$ 3,875,000	$ 3,875,000
Aerobic Digester	$ 3,332,000	$ 3,332,000	$ 3,332,000	$ 3,332,000
Biosolids Processing Facility	$ 1,867,000	$ 1,867,000	$ 1,867,000	$ 1,867,000
Disinfection (HS/UV)	$ 1,460,500	$ 1,460,500	$ 1,460,500	$ 1,460,500
Recycled Water Storage Bank Stabilization & Improvements	$ 3,348,857	$ 3,348,857	$ 3,348,857	$ 3,348,857
Recycled Water Storage Expansion Systems	$ 13,478,000	$ 4,356,000	$ 4,356,000	-
Recycled Water Irrigation Expansion Systems	$ 2,010,000	$ 1,170,000	$ 1,110,000	$ 413,000
Discharge Monitoring Station Improvements	$ 415,000	$ 415,000	$ 415,000	$ 415,000
Misc. Equipment	$ 750,000	$ 750,000	$ 750,000	$ 750,000
Effluent Pump Station Upgrade and Expansion	$ 697,000	$ 697,000	$ 697,000	$ 697,000
Site Structures	$ 1,170,000	$ 1,170,000	$ 1,170,000	$ 1,170,000
Site Improvements and Yard Piping	$ 2,519,000	$ 2,519,000	$ 2,519,000	$ 2,519,000
WWTP Construction Estimate Total	**$ 47,437,000**	**$ 37,475,000**	**$ 35,028,000**	**$ 29,975,000**
Engineering - Design - Bidding Services	$ 4,744,000	$ 3,748,000	$ 3,503,000	$ 2,998,000
Engineering - Construction Services	$ 4,744,000	$ 3,748,000	$ 3,503,000	$ 2,998,000
Land Acquisition	$ 1,500,000	$ 1,500,000	$ 1,500,000	$ -
Value Analysis and Value Engineering	$ 225,000	$ 225,000	$ 225,000	$ 225,000
Contingency (15%)	$ 7,116,000	$ 5,622,000	$ 5,255,000	$ 4,497,000
Environmental Report	$ 125,000	$ 125,000	$ 125,000	$ 100,000
Wetland Mitigation	$ 100,000	$ 100,000	$ 100,000	$ 100,000
Review Fees	$ 15,000	$ 15,000	$ 15,000	$ 15,000
Permitting	$ 150,000	$ 150,000	$ 150,000	$ 150,000
Administration & Legal	$ 300,000	$ 300,000	$ 300,000	$ 150,000
WWTP Total Project Estimate	**$ 66,456,000**	**$ 53,008,000**	**$ 49,704,000**	**$ 41,208,000**

WWTP Total Present Worth (2018 Dollars)

Item	PS #1	PS #2	PS #3	PS #4
WWTP Total Project Cost Estimate	$ 66,456,000	$ 53,008,000	$ 49,704,000	$ 41,208,000
O&M Total Present Worth	$ 17,264,000	$ 16,534,000	$ 16,286,000	$ 15,555,000
Total	**$ 83,720,000**	**$ 69,542,000**	**$ 65,990,000**	**$ 56,763,000**

Total Project Costs: Phase I (2018 Dollars)

Item	PS #1	PS #2	PS #3	PS #4
Collection System Improvements – Phase I	$ 4,669,900	$ 4,669,900	$ 4,669,900	$ 4,669,900
Pump Station Improvements – Phase I	$ 672,500	$ 672,500	$ 672,500	$ 672,500
WWTP Total Project Cost Estimate	$ 66,456,000	$ 53,008,000	$ 49,704,000	$ 41,208,000
Total	**$ 71,798,400**	**$ 58,350,400**	**$ 55,046,400**	**$ 46,550,400**

Total Project Costs: Phase I (2021 Dollars)

Item	PS #1	PS #2	PS #3	PS #4
Collection System Improvements – Phase I	$ 5,103,000	$ 5,103,000	$ 5,103,000	$ 5,103,000
Pump Station Improvements – Phase I	$ 735,000	$ 735,000	$ 735,000	$ 735,000
WWTP Total Project Cost Estimate	$ 72,619,000	$ 57,924,000	$ 54,313,000	$ 45,030,000
Total Project Estimate (3 yr Inflation @ 3% Annually)	**$ 78,457,000**	**$ 63,762,000**	**$ 60,151,000**	**$ 50,867,000**

City of Molalla Project 100.26			Complete WWTP Cost Summary 10/18/2018	
Construction Cost Estimate - Complete WWTP				
Item	**PS #1**	**PS #2**	**PS #3**	**PS #4**
Influent Screen	$ 485,355	$ 485,355	$ 485,355	$ 485,355
Grit Removal	$ 901,000	$ 901,000	$ 901,000	$ 901,000
Flow Equalization Basin	$ 1,190,000	$ 1,190,000	$ 1,190,000	$ 1,190,000
Transfer Pump Station	$ 844,000	$ 844,000	$ 844,000	$ 844,000
Biological System	$ 6,707,000	$ 6,707,000	$ 6,707,000	$ 6,707,000
Lagoon Desludging & Disposal	$ 3,875,000	$ 3,875,000	$ 3,875,000	$ 3,875,000
Aerobic Digester	$ 3,332,000	$ 3,332,000	$ 3,332,000	$ 3,332,000
Tertiary Filtration	$ 2,387,000	$ 2,387,000	-	-
Biosolids Processing Facility	$ 1,867,000	$ 1,867,000	$ 1,867,000	$ 1,867,000
Disinfection (UV/HS)	$ 1,460,500	$ 1,460,500	$ 1,460,500	$ 1,460,500
Recycled Water Storage Bank Stabilization & Improvements	$ 3,348,857	$ 3,348,857	$ 3,348,857	$ 3,348,857
Recycled Water Storage Expansion Systems	$ 13,478,000	$ 4,356,000	$ 4,356,000	-
Recycled Water Irrigation Expansion Systems	$ 2,010,000	$ 1,170,000	$ 1,110,000	$ 413,000
Discharge Monitoring Station Improvements	$ 415,000	$ 415,000	$ 415,000	$ 415,000
Misc. Equipment	$ 750,000	$ 750,000	$ 750,000	$ 750,000
Effluent Pump Station Expansion	$ 697,000	$ 697,000	$ 697,000	$ 697,000
Site Structures	$ 1,170,000	$ 1,170,000	$ 1,170,000	$ 1,170,000
Site Improvements and Yard Piping	$ 2,519,000	$ 2,519,000	$ 2,519,000	$ 2,519,000
WWTP Construction Estimate Total	**$ 47,437,000**	**$ 37,475,000**	**$ 35,028,000**	**$ 29,975,000**

City of Molalla				WWTP Improvements O&M Summary
Project 100.26				10/18/2018
WWTP Improvements O&M Summary (2043)				
Item	**Annual Cost PS #1**	**Annual Cost PS #2**	**Annual Cost PS #3**	**Annual Cost PS #4**
Influent Screen	$20,000	$20,000	$20,000	$20,000
Grit Removal	$14,000	$14,000	$14,000	$14,000
Transfer Pump Station	$44,012	$44,012	$44,012	$44,012
SBR	$159,000	$159,000	$159,000	$159,000
Tertiary Filtration	$17,000	$17,000	-	-
Effluent Pump Station	$136,756	$136,756	$136,756	$136,756
Aerobic Digester	$105,000	$105,000	$105,000	$105,000
Biosolids Processing Facility	$28,000	$28,000	$28,000	$28,000
Disinfection (HS/UV)	$41,000	$41,000	$41,000	$41,000
Biosolids Disposal	$267,038	$267,038	$267,038	$267,038
Effluent Disposal / Land Application	$350,000	$300,000	$300,000	$250,000
WWTP Annual O&M Estimate Total	**$1,182,000**	**$1,132,000**	**$1,115,000**	**$1,065,000**
WWTP 20 Yr Present Worth (3.2%)	**$17,264,000**	**$16,534,000**	**$16,286,000**	**$15,555,000**

1. Short lived assets included.

2. Biosolids disposal costs are based on landfill disposal. Costs will decrease with land application of biosolids.

City of Molalla Project 100.26				WWTP Improvements Short Lived Assets 10/22/2018
WWTP Improvements Short Lived Assets (Existing & Proposed)				
Item	**Qty**	**Repair or Repacement Value**	**Frequency**	**Annual Cost**
Influent Screen				
Drive Motors, Brushes, Solenoid	2	$ 30,000	15	$ 4,000
Washer/Compactors	2	$ 10,000	15	$ 1,333
Instrumentation and Controls	1	$ 10,000	15	$ 667
Grit System				
Seals, Solenoids, Belts	2	$ 500	5	$ 200
Chamber Drive Motor & Grit Washer Motor	3	$ 7,000	15	$ 1,400
Concentrator and Grit Pump Impeller	4	$ 15,000	15	$ 4,000
Grit Washer Screw	1	$ 10,000	15	$ 667
Pump Motor	2	$ 10,000	15	$ 1,333
Grit Pump Volute	2	$ 7,000	15	$ 933
Grit Washer Busing	1	$ 500	15	$ 33
Transfer Pump Station				
Submersible Pumps Repair	3	$ 12,000	10	$ 3,600
Instrumentation and Controls	1	$ 15,000	15	$ 1,000
SBR				
Decanter	4	$ 2,500	5	$ 2,000
Blower Oil & Grease	4	$ 250	1	$ 1,000
Blower Bearings & Equipment	4	$ 15,000	10	$ 6,000
Blower Inlet Filter	4	$ 500	3	$ 667
Diffusers Membrane Replacement	4	$ 3,500	10	$ 1,400
WAS Pumps	4	$ 2,500	3	$ 3,333
Mixers	4	$ 1,500	3	$ 2,000
Instrumentation and Controls	1	$ 35,000	15	$ 2,333
Tertiary Filtration (PS #1 and PS #2)				
Drum Lip Seals	1	$ 200	5	$ 40
Filter Media Panels	504	$ 150	15	$ 5,040
Drum Bearings	2	$ 1,000	10	$ 200
WWTP Total Present Worth (2018 Dollars)	1	$ 2,500	10	$ 250
Sprocket Wheel Motor and Drum	1	$ 1,000	5	$ 200
Strainer Cartridge	1	$ 500	5	$ 100
Pump	1	$ 4,000	10	$ 400
Effluent Sampler	1	$ 6,000	15	$ 400
Instrumentation and Controls	1	$ 15,000	15	$ 1,000
UV/HS Disinfection				
Lamps	1	$ 50,000	15	$ 3,333
Instrumentation & Controls	1	$ 17,000	15	$ 1,133
Chemical Feed Pumps	2	$ 15,000	15	$ 2,000
Effluent Pump Station				
Submersible Pumps Repair	3	$ 45,000	15	$ 9,000
Instrumentation & Controls	1	$ 20,000	15	$ 1,333
Aerobic Digesters				
Blower Bearings	3	$ 1,500	10	$ 450
Blower Filters	3	$ 1,500	10	$ 450
Diffusers	1	$ 8,000	10	$ 800
Instrumentation & Controls	1	$ 20,000	15	$ 1,333
Biosolids Screw Press Systems				
Polymer System	1	$ 20,000	15	$ 1,333
Sludge Pumps Repair	1	$ 25,000	15	$ 1,667
Instrumentation & Controls	1	$ 15,000	15	$ 1,000
Conveyor	1	$ 15,000	15	$ 1,000
Misc. Instrumentation and Controls				
Level Sensors	8	$ 3,000	15	$ 1,600
Flow Meters	6	$ 12,000	15	$ 4,800
Lab Instruments	1	$ 40,000	15	$ 2,667
Standby Generators	2	$ 50,000	15	$ 6,667
Computer, Printer, UPS	1	$ 4,000	10	$ 400
PLC Parts	1	$ 40,000	10	$ 4,000
			WWTP Annual Short Lived Asset Total	**$ 90,000**

City of Molalla Project 100.26	WWTP Improvements Short Lived Assets 10/22/2018
WWTP Improvements Short Lived Assets	
Item	**Annual Cost**
Influent Screen	$ 6,000
Grit System	$ 8,567
Transfer Pump Station	$ 4,600
SBR	$ 18,733
Tertiary Filtration (PS #1 and PS #2)	$ 7,630
UV/HS Disinfection	$ 6,467
Effluent Pump Station	$ 10,333
Aerobic Digesters	$ 3,033
Biosolids Screw Press Systems	$ 5,000
Misc. Instrumentation and Controls	$ 20,133
WWTP Annual Short Lived Asset Total	**$ 90,000**

City of Molalla				Buildings & Site Work
Project 100.26				10/18/2018

Construction Cost Estimate - Misc. Site Work

Description	Unit	Quantity	Unit Cost	Total Cost
Construction Facilities & Temporary Facilities	LS	1	$ 190,000	$ 190,000
Roadway Excavation	LS	1	$ 50,000	$ 50,000
Drive and parking Aggregate Base	LS	1	$ 100,000	$ 100,000
Drive and Parking Paving	LS	1	$ 500,000	$ 500,000
Effluent Line from WWTP to Effluent Pump Station (EPS)	LF	2,500	$ 150	$ 375,000
Manholes (Effluent Line)	EA	6	$ 12,000	$ 72,000
Recycled Water Effluent Line from Lagoon #2 to EPS	LF	250	$ 180	$ 45,000
Blower to SBR Line	LF	500	$ 65	$ 48,750
Blower to Digester Line	LF	750	$ 77	$ 38,500
WAS Line	LF	500	$ 40	$ 20,000
Digester Supernatant Drain Lines	LF	500	$ 50	$ 25,000
Non-potable Water Lines	LF	750	$ 40	$ 30,000
Potable Water System	LS	1	$ 35,000	$ 35,000
Force Main (Parallel 18" diameter Lines)	LF	1,200	$ 250	$ 300,000.00
Plant Drain Pump Station	LS	1	$ 100,000	$ 100,000
Non Potable Water System	LS	1	$ 120,000	$ 120,000
New Compound Lighting	LS	1	$ 50,000	$ 50,000
Erosion Control	LS	1	$ 25,000	$ 25,000
Final Landscaping	LS	1	$ 45,000	$ 45,000
Site Drainage	LS	1	$ 75,000	$ 75,000
Fencing	LS	1	$ 75,000	$ 75,000
Electrical	LS	1	$ 100,000	$ 100,000
Demo Tertiary Systems & Chlorine Contact Chamber	LS	1	$ 100,000	$ 100,000
			Total	**$ 2,519,000**

Construction Cost Estimate - Public Works Buildings

Description	Unit	Quantity	Unit Cost	Total Cost
Control Building	SF	4,000	$ 225	$ 900,000
Concrete	LS	1	$ 50,000	$ 50,000
Mechanical	LS	1	$ 25,000	$ 25,000
WWTP Total Present Worth (2018 Dollars)	LS	1	$ 35,000	$ 35,000
Furnishings	LS	1	$ 20,000	$ 20,000
Laboratory Equipment	LS	1	$ 40,000	$ 40,000
Remodel Lab	LS	1	$ 100,000	$ 100,000
			Total	**$ 1,170,000**

City of Molalla Projcet 100.26				Influent Screen 12/12/2017
Construction Cost Estimate - Influent Screen				
Description	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
Const. Facilities & Temporary Controls	LS	1	$ 42,575	$ 42,575
Demolition & Site Preparation	LS	1	$ 17,030	$ 17,030
New Mechanical Screen	LS	1	$ 240,900	$ 240,900
New Washer/Compactor	LS	1	$ 113,850	$ 113,850
Grating Modifications	LS	1	$ 1,000	$ 1,000
Mechanical	LS	1	$ 20,000	$ 20,000
Electrical	LS	1	$ 40,000	$ 40,000
Control & SCADA Modifications	LS	1	$ 10,000	$ 10,000
			Total	**$ 485,355**

O&M Cost Estimate - Influent Screen				
Description	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
Equipment Power (per screen)	kW-hr	43,362	$ 0.10	$ 4,336
Parts & Repair	LS	1	$ 6,000	$ 6,000
Operation Labor	Hr	78	$ 28	$ 2,184
Solids Disposal	Loads	104	$ 40	$ 4,160
Maintenance Labor	Hr	104	$ 28	$ 2,912
			Operations & Maintenance	**$ 19,592**
			Interest Rate	3.2%
			Project life	20
			Present Value O&M Cost	**$ 287,000.00**

City of Molalla Project 100.26				Grit Removal 12/12/2017
Construction Cost Estimate - Grit Removal				
Description	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
Const. Facilities & Temporary Controls	LS	1	$ 84,700	$ 84,700
Demolition	LS	1	$ 15,000	$ 15,000
Vortex Grit Removal Equipment	LS	1	$ 260,000	$ 260,000
Grit Classifier Equipment	LS	1	$ 80,000	$ 80,000
Excavation	CY	150	$ 15	$ 2,250
Structural Fill	CY	60	$ 45	$ 2,700
Pist Grit Structure Concrete	CY	40	$ 1,000	$ 40,000
Concrete Structure/Flow Channels	CY	130	$ 1,200	$ 156,000
24" Effluent Piping	LS	1	$ 20,000	$ 20,000
4" Grit Piping and Valves	LS	1	$ 7,500	$ 7,500
Non-Potable Process Water	LS	1	$ 3,000	$ 3,000
New AC Paving and Base Rock	SY	35	$ 55	$ 1,925
Aluminum Grating	SF	100	$ 50	$ 5,000
Parshall Flume	LS	1	$ 10,000	$ 10,000
Flow Meter	LS	1	$ 7,500	$ 7,500
Slide Gates	EA	3	$ 10,000	$ 30,000
Mechanical	LS	1	$ 45,000	$ 45,000
Electrical	LS	1	$ 75,000	$ 75,000
Lighting	LS	1	$ 12,000	$ 12,000
Instrumentation, Controls, & SCADA	LS	1	$ 30,000	$ 30,000
Coatings	SF	900	$ 15	$ 13,500
			Total	**$ 901,000**

O&M Cost Estimate - Grit Removal				
Description	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
Equipment Power	kW-hr	17,500	$ 0.10	$ 1,750
Parts & Repair	LS	1	$ 8,567	$ 8,567
Operation Labor	Hr	78	$ 28	$ 2,184
Solids Disposal	Hr	52	$ 28	$ 1,456
Maintenance Labor	Hr	10	$ 28	$ 280
			Operations & Maintenance	**$ 14,237**
WWTP Total Present Worth (2018 Dollars)				
			Interest Rate	3.2%
			Project life	20
			Present Value O&M Cost	**$ 208,000**

City of Molalla				**Influent Flow Equalization**
Project 100.26				**12/12/2017**
Construction Cost Estimate - Flow Equalizaton				
Description	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
Construction Facilities & Temporary Controls	LS	1	$ 130,000	$ 130,000
Gravel Under Structure	CY	1300	$ 50	$ 65,000
Concrete Slab	CY	700	$ 1,200	$ 840,000
Piping, Valves	LS	1	$ 35,000	$ 35,000
Backfill	CY	4000	$ 30	$ 120,000
			Total	**$ 1,190,000**

City of Molalla				Transfer Pump Station
Project 100.26				10/10/2018

Construction Cost Estimate - Transfer Pump Station

Description	Unit	Quantity	Unit Cost	Total Cost
Mobilization, Bond & Insurance	LS	1	$ 55,000.00	$ 55,000.00
Demolition & Wastewater Bypass	LS	1	$ 120,000.00	$ 120,000.00
Civil Site Work	LS	1	$ 16,000.00	$ 16,000.00
Submersible Pumps	LS	3	$ 112,750.00	$ 338,250.00
Controls	LS	1	$ 199,375.00	$ 199,375.00
Valves, Piping	LS	1	$ 50,000.00	$ 50,000.00
WWTP SCADA Communication and Integration	LS	1	$ 25,000.00	$ 25,000.00
Instrumentation	LS	1	$ 15,000.00	$ 15,000.00
Electrical	LS	1	$ 25,000.00	$ 25,000.00
			Total	**$ 844,000.00**

O&M Cost Estimate - Transfer Pump Station

Description	Unit	Quantity	Unit Cost	Total Cost
Electrical Power Demands	Kwh	365,000	$ 0.10	$ 36,500
Parts & Repair	LS	1	$ 4,600	$ 4,600
Monitoring & Operation	Hr	52	$ 28	$ 1,456
Maintenance Labor	Hr	52	$ 28	$ 1,456
			Annual Operations & Maintenance	**$ 44,012**
			Interest Rate	3.2%
			Term	20
			Present Value O&M Cost	**$ 643,000**

City of Molalla				SBR
Project 100.26				12/12/2017

Construction Cost Estimate - SBR

Description	Unit	Quantity	Unit Cost	Total Cost
Site Preparation	SF	21,760	$ 15	$ 326,400
Excavation	CY	2,420	$ 30	$ 72,600
Backfill (struc.)	CY	200	$ 35	$ 7,000
Gravel under Struc	CY	1,610	$ 50	$ 80,500
Outer Concrete Walls	CY	410	$ 1,200	$ 492,000
Outer Concrete Footings	CY	180	$ 1,200	$ 216,000
Interior Concrete Walls	CY	380	$ 900	$ 342,000
Interior Concrete Wall Ftgings	CY	60	$ 1,200	$ 72,000
Btm. Concrete Slab in Tank	CY	830	$ 900	$ 747,000
Walkway Concrete Slab	CY	200	$ 1,500	$ 300,000
Outlet Concrete weir	CY	100	$ 900	$ 90,000
Sidewalk	CY	50	$ 500	$ 25,000
Equipment	LS	1.0	$ 3,438,000	$ 3,438,000
Controls	LS	1.0	$ 130,000	$ 130,000
Electrical	LS	1.0	$ 85,000	$ 85,000
Hand rails	LF	1,170	$ 75	$ 87,750
Grates	LS	1.0	$ 135,000	$ 135,000
Stairs	LF	30.0	$ 350	$ 10,500
Wetland Mitigation	LS	1.0	$ 50,000	$ 50,000
			Total	**$ 6,707,000**

O&M Cost Estimate - SBR

Description	Unit	Quantity	Unit Cost	Total Cost
Electrical Power Demands	Kwh	1,179,715	$ 0.10	$ 117,972
Parts & Repair	LS	1	$ 18,733	$ 18,733
Monitoring & Operation	Hr	500	$ 28	$ 14,000
Maintenance Labor	Hr	312	$ 28	$ 8,736
Annual Operations & Maintenance				**$ 159,441**
			Interest Rate	3.2%
			Term	20
			Present Value O&M Cost	**$ 2,329,000**

City of Molalla				Conventional Activated Sludge
Project 100.26				**12/12/2017**

Construction Cost Estimate - CAS

Description	Unit	Quantity	Unit Cost	Total Cost
Site Clring & Prep	SF	20000.0	$ 15	$ 300,000
Excavation	CY	3560.0	$ 30	$ 106,800
Backfill (struc.)	CY	280.0	$ 35	$ 9,800
Gravel under struc	CY	2370.0	$ 50	$ 118,500
Concrete Slab	CY	1600.0	$ 900	$ 1,440,000
Concrete Walls	CY	1900.0	$ 1,200	$ 2,280,000
Concrete Outer Footings	CY	80.0	$ 1,200	$ 96,000
Grout, Clarifier Bottom	CY	382.0	$ 600	$ 229,200
Equipment	LS	1.0	$ 3,209,000	$ 3,209,000
Electrical	LS	1.0	$ 65,000	$ 65,000
Mechanical	LS	1.0	$ 120,000	$ 120,000
Controls	LS	1.0	$ 75,000	$ 75,000
Wetland Mitigation	LS	1.0	$ 50,000	$ 50,000
			Total	**$ 8,099,000**

O&M Cost Estimate - CAS

Description	Unit	Quantity	Unit Cost	Total Cost
Electrical Power Demands	Kwh	1,598,110	$ 0.10	$ 159,811
Parts & Repair	LS	1	$ 7,087	$ 7,087
Monitoring & Operation	Hr	500	$ 28	$ 14,000
Maintenance Labor	Hr	312	$ 28	$ 8,736
			Annual Operations & Maintenance	**$ 189,634**
			Interest Rate	3.2%
			Term	20
			Present Value O&M Cost	**$ 2,770,000**

City of Molalla				MBR
Project 100.26				12/12/2017

Construction Cost Estimate - MBR

Description	Unit	Quantity	Unit Cost	Total Cost
Site Preparation	SF	11,000	15	$ 165,000
Influent Fine Screens	LS	1	1,250,000	$ 1,250,000
Excavation	CY	1,180	30	$ 35,400
Backfill (struc.)	CY	150	$ 50	$ 7,500
Gravel under struc	CY	790	$ 50	$ 39,500
Btm. slab in tank	CY	390	$ 900	$ 351,000
Outer Walls	CY	320	$ 1,200	$ 384,000
Outer Footings	CY	100	$ 1,200	$ 120,000
Interior Walls	CY	220	$ 900	$ 198,000
Interior Wall Footings	CY	40	$ 1,200	$ 48,000
Walkway Slab	CY	40	$ 1,500	$ 60,000
Sidewalk	CY	50	$ 500	$ 25,000
MBR Equipment & Installation	LS	1	$8,831,200	$ 8,831,200
Controls & SCADA	LS	1	$ 250,000	$ 250,000
Electrical	LS	1	$ 250,000	$ 250,000
Mechanical	LS	1	$ 250,000	$ 250,000
Hand rails	LF	750	$ 75	$ 56,250
Crane	LS	1	$ 50,000	$ 50,000
Instrumentation	LS	1	$ 30,000	$ 30,000
Distribution Channel	LS	1	$ 100,000	$ 100,000
WAS/RAS Chamber	LS	1	$ 100,000	$ 100,000
Stairs	LF	30	$ 300	$ 9,000
Total				**$ 12,610,000**

O&M Cost Estimate - MBR

Description	Unit	Quantity	Unit Cost	Total Cost
Electrical Power Demands	Kwh	1,992,000	$ 0.10	$ 199,200
Parts & Repair	LS	1	$ 103,107	$ 103,107
Chemicals	LS	1	$ 3,287	$ 3,287
Monitoring & Operation	Hr	500	$ 28	$ 14,000
Maintenance Labor	Hr	312	$ 28	$ 8,736
			WWTP Total Present Worth (2018 Dollars)	**$ 328,330**
			Interest Rate	3.2%
			Term	20
			Present Value O&M Cost	**$ 4,796,000**

City of Molalla				Oxidation Ditch
Project 100.26				12/12/2017

Construction Cost Estimate - Oxidation Ditch

Description	Unit	Quantity	Unit Cost	Total Cost
Site Clearing & Prep	SF	25000	$ 3	$ 75,000
Excavation	CY	2220	$ 30	$ 66,600
Backfill (struc.)	CY	360	$ 35	$ 12,600
Gravel under struc	CY	1000	$ 50	$ 50,000
Concrete	CY	1600	$ 1,200	$ 1,920,000
Equipment	LS	1	$ 1,650,000	$ 1,650,000
Electrical	LS	1	$ 75,000	$ 75,000
Mechanical	LS	1	$ 120,000	$ 120,000
Controls	LS	1	$ 75,000	$ 75,000
Hand rails	LF	600	$ 75	$ 45,000
Stairs	LF	100	$ 350	$ 35,000
			Total	**$ 4,124,000**

Construction Cost Estimate - Secondary Clarifiers 80 ft Diameter

Description	Unit	Quantity	Unit Cost	Total Cost
Site Preparation	LS	1	$ 20,000	$ 20,000
Excavation	CY	820	$ 30	$ 24,600
Backfill (struc.)	CY	410	$ 35	$ 14,350
Gravel under struc	CY	200	$ 50	$ 10,000
Concrete Slab	CY	280	$ 1,200	$ 336,000
Outer Walls	CY	150	$ 1,200	$ 180,000
Outer Footings	CY	80	$ 1,200	$ 96,000
Center Sludge Ring Foundation	CY	10	$ 1,200	$ 12,000
Launder Concrete	CY	50	$ 1,500	$ 75,000
Equipment	LS	1	$ 206,300	$ 206,300
Electrical	LS	1	$ 120,000	$ 120,000
Instrumentation	LS	1	$ 50,000	$ 50,000
Misc. Equipment	LS	1	$ 50,000	$ 50,000
Wall fittings pipe	LS	1	$ 5,000	$ 5,000
Stairs	LF	20	$ 300	$ 6,000
			Subtotal (EA)	$ 1,446,300
			WWTP Total Present Worth (2018 Dollars)	**$ 2,892,600**

Construction Cost Estimate - Primary Sludge Pump Station

Description	Unit	Quantity	Unit Cost	Total Cost
Site Preparation	SF	1,600	$ 15	$ 24,000
Pumps	EA	2	$ 50,000	$ 100,000
Mag meters	EA	2	$ 18,000	$ 36,000
Misc. Hardware	LS	1	$ 10,000	$ 10,000
Pump monorail	LS	2	$ 12,000	$ 24,000
Pump Hoists	EA	2	$ 10,000	$ 20,000
Control panel	LS	1	$ 35,000	$ 35,000
Instrumentation	LS	1	$ 15,000	$ 15,000
Wet Well Excavation & backfill	CY	210	$ 125	$ 26,250
Wet Well Concrete Structure	CY	50	$ 1,200	$ 60,000
Wet Well Lid with Hatch (Traffic Rated, New Concrete Pad)	LS	4	$ 12,500	$ 50,000
Piping, Valves	LS	1	$ 35,000	$ 35,000
Electrical	LS	1	$ 50,000	$ 50,000
Building (25' x 25')	SF	625	$ 200	$ 125,000
			Total	**$ 610,000**

City of Molalla				Oxidation Ditch
Project 100.26				12/12/2017

Construction Cost Estimate - RAS/WAS Pump Station

Description	Unit	Quantity	Unit Cost	Total Cost
Site Preparation	SF	1,600	$ 15	$ 24,000
RAS Pumps	EA	2	$ 55,000	$ 110,000
WAS Pumps	EA	2	$ 32,000	$ 64,000
RAS mag meters	EA	2	$ 18,000	$ 36,000
WAS mag meters	EA	2	$ 18,000	$ 36,000
6" DI sta. pipe	LF	180	$ 180	$ 32,400
DI fittings	LF	2,500	$ 4	$ 10,000
Misc. Hardware	LS	1	$ 15,000	$ 15,000
Pump monorail	LS	2	$ 16,000	$ 32,000
Pump Hoists	EA	2	$ 10,000	$ 20,000
Control panel	LS	1	$ 45,000	$ 45,000
Wet Well Excavation & backfill	CY	210	$ 125	$ 26,250
Wet Well Concrete Structure	CY	50	$ 1,200	$ 60,000
Wet Well Lid with Hatch (Traffic Rated, New Concrete Pad)	LS	4	$ 12,500	$ 50,000
Instrumentation	LS	1	$ 25,000	$ 25,000
Electrical	LS	1	$ 55,000	$ 55,000
Building (25' x 25')	SF	625	$ 200	$ 125,000
			Total	**$ 766,000**

Construction Cost Estimate - Primary Clarifiers 95 ft Diameter

Description	Unit	Quantity	Unit Cost	Total Cost
Site Preparation	LS	1	$ 90,000	$ 90,000
Excavation	CY	1,140	$ 30	$ 34,200
Backfill (struc.)	CY	570	$ 35	$ 19,950
Gravel under struc	CY	270	$ 50	$ 13,500
Concrete Slab	CY	350	$ 1,200	$ 420,000
Outer Walls	CY	170	$ 1,200	$ 204,000
Outer Footings	CY	90	$ 1,200	$ 108,000
Center Sludge Ring Foundation	CY	10	$ 1,200	$ 12,000
Launder Concrete	CY	50	$ 1,500	$ 75,000
Equipment	LS	1	$ 295,600	$ 295,600
Electrical	LS	1	$ 120,000	$ 120,000
Instrumentation	LS	1	$ 30,000	$ 30,000
Misc. Equipment	LS	1	$ 50,000	$ 50,000
Wall fittings pipe	LS	1	$ 5,000	$ 5,000
Stairs	LF	20	$ 300	$ 6,000
			Subtotal (EA)	$ 1,779,900
			Total for Two Clarifiers	**$ 3,263,000**

O&M Cost Estimate (w/ Primary Clarification)

Description	Unit	Quantity	Unit Cost	Total Cost
Electrical Power Demands (Oxidation Ditch)	Kwh	793,971	$ 0.10	$ 79,397
Electrical Power Demands (RAS/WAS/Primary Pumps)	Kwh	415,786	$ 0.10	$ 41,579
RAS/WAS/Primary O&M	LS	1	$ 13,750	$ 13,750
Parts & Repair	LS	1	$ 7,500	$ 7,500
Monitoring & Operation	Hr	500	$ 28	$ 14,000
Maintenance Labor	Hr	312	$ 28	$ 8,736
			Annual Operations & Maintenance	**$ 164,962**
			Interest Rate	3.2%
			Term	20
			Present Value O&M Cost	**$ 2,409,000**

City of Molalla				Tertiary Systems
Project 100.26				10/18/2018

Construction Cost Estimate - Up-flow Sand Filters

Description	Unit	Qnt.	Unit Cst.	Tot. Cost
Site Preparation	SF	3,150	$ 15	$ 47,250
Excavation	CY	380	$ 20	$ 7,600
Gravel under structure	CY	190	$ 50	$ 9,500
Concrete Slab	CY	140	$ 900	$ 126,000
Backfill - structural	CY	100	$ 35	$ 3,500
Electrical	LS	1	$ 48,000	$ 48,000
Piping and gates	LS	1	$ 65,000	$ 65,000
Valves	LS	1	$ 15,000	$ 15,000
Mag Meter	EA	3	$ 11,000	$ 33,000
Instrumentation	LS	1	$ 25,000	$ 25,000
Canopy	LS	1	$ 250,000	$ 250,000
Galvanized Stairs and access platform	LS	1	$ 75,000	$ 75,000
Equipment	LS	1	$ 2,156,000	$ 2,156,000
			Total	**$ 2,861,000**

Construction Cost Estimate - Disk Filter

Description	Unit	Qnt.	Unit Cst.	Tot. Cost
Site Preparation	SF	1,040	$ 15	$ 15,600
Excavation	CY	150	$ 20	$ 3,000
Gravel under structure	CY	80	$ 50	$ 4,000
Backfill - structural	CY	60	$ 35	$ 2,100
Btm Concrete Slab	CY	40	$ 900	$ 36,000
Concrete Wall	CY	60	$ 1,200	$ 72,000
Electrical	LS	1	$ 45,000	$ 45,000
Piping and gates	LS	1	$ 50,000	$ 50,000
Valves	LS	1	$ 15,000	$ 15,000
Mag Meter	EA	3	$ 11,000	$ 33,000
Instrumentation	LS	1	$ 25,000	$ 25,000
Canopy	LS	1	$ 150,000	$ 150,000
Galvanized Stairs, access platform and handrail	LS	1	$ 50,000	$ 50,000
Equipment	LS	1	$ 1,886,600	$ 1,886,600
			Total	**$ 2,387,000**

O&M Cost Estimate - Disk Filter

Description	Unit	Quantity	Unit Cost	Total Cost
Electrical Power Demands	Kwh	24,820	$ 0.10	$ 2,482
Parts & Repair	LS	1	$ 7,630	$ 7,630
Monitoring & Operation	Hr	208	$ 28	$ 5,824
Maintenance Labor	Hr	40	$ 28	$ 1,120
		Operations & Maintenance		**$ 17,056**
			Interest Rate	3.2%
			Term	20
			Present Value O&M Cost	**$ 249,000**

O&M Cost Estimate - Up-flow Sand Filter

Description	Unit	Quantity	Unit Cost	Total Cost
Electrical Power Demands	Kwh	209,870	$ 0.10	$ 20,987
Parts & Repair	LS	1	$ 7,000	$ 7,000
Monitoring & Operation	Hr	208	$ 28	$ 5,824
Maintenance Labor	Hr	40	$ 28	$ 1,120
		Operations & Maintenance		**$ 34,931**
			Interest Rate	3.2%
			Term	20
			Present Value O&M Cost	**$ 510,000**

City of Molalla			Effluent Pump Station Upgrades & Expansion	
Project 100.26				10/2/2018

Construction Cost Estimate - Effluent Pump Station

Description	Unit	Quantity	Unit Cost	Total Cost
Mobilization & Demobilization	LS	1	$ 75,000	$ 75,000
Piping, Valves	LS	1	$ 20,000	$ 20,000
300 hp Effluent Pumps	EA	3	$ 130,625	$ 391,875
Control Panel Upgrades	LS	1	$ 190,000	$ 190,000
Level Controls	LS	1	$ 10,000	$ 10,000
Mechanical	LS	1	$ 10,000	$ 10,000
			Total	**$ 697,000**

O&M Cost Estimate - Effluent Pump Station

Description	Unit	Quantity	Unit Cost	Total Cost
Electrical Power Demands	Kwh	1,235,107	$ 0.10	$ 123,511
Parts & Repair	LS	1	$ 10,333	$ 10,333
Monitoring & Operation	Hr	52	$ 28	$ 1,456
Maintenance Labor	Hr	52	$ 28	$ 1,456
			Annual Operations & Maintenance	**$ 136,756**
			Interest Rate	3.2%
			Term	20
			Present Value O&M Cost	**$ 1,997,000**

City of Molalla				Misc. Equipment
Project 100.26				12/12/2017
Construction Cost Estimate - Misc. Equipment				
Description	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
Standby Generator (500kw) and Trans Switch	LS	1	$ 250,000	$ 250,000
Standby Generator (750kw) and Trans Switch	LS	1	$ 350,000	$ 350,000
Truck w/ Spreader	LS	1	$ 150,000	$ 150,000
			Total	**$ 750,000**

City of Molalla				Lagoon Dredging, Dewatering, & Disposal
Project 100.26				12/12/2017
Construction Cost Estimate - Lagoon Dredging, Dewatering, & Disposal				
Description	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
Aerated Lagoon Dredging & Disposal	LS	1.0	$ 125,000	$ 125,000
Solids Dredging & Disposal (Lagoon #1 and #2)	LS	1.0	$ 3,750,000	$ 3,750,000
			Total	**$ 3,875,000**

City of Molalla				**Biosolids Management Systems**
Project 100.26				**10/20/2018**

Construction Cost Estimate - Aerobic Digester (Glass Fused Tanks - Two)

Description	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
Const. Facilities & Temporary Controls	LS	1	$220,000	$220,000
Site Preparation	LS	1	$150,000	$150,000
Excavation	CY	650	$ 30	$ 19,500
Backfill (struc.)	CY	330	$ 35	$ 11,550
Gravel under struc	CY	160	$ 50	$ 8,000
Concrete Slab	CY	250	$ 1,200	$ 300,000
Outer Footings	CY	80	$ 1,200	$ 96,000
Glass Fused Bolted Steel Tank	LS	1	$ 563,800	$ 563,800
Subtotal	EA	2		$ 2,738,000
Sidewalk	CY	50	$ 500	$ 25,000
Blowers, diffusers, and controls	LS	1	$ 618,800	$ 618,800
Decanter	LS	2	$ 15,000	$ 30,000
Access Fly Bridge	LS	2	$ 80,000	$ 160,000
WAS Flow Meter	LS	2	$ 7,500	$ 15,000
Sludge Pump	LS	2	$ 25,000	$ 50,000
Instrumentation	LS	1	$ 25,000	$ 25,000
Electrical	LS	1	$ 65,000	$ 65,000
Misc. Equipment	LS	1	$ 20,000	$ 20,000
Wall fittings pipe	LS	1	$ 5,000	$ 5,000
Handrail	LF	100	$ 75	$ 7,500
Stairs	LF	30	$ 350	$ 10,500
			Total	$ 3,770,000

Construction Cost Estimate - Aerobic Digester (Concrete Rectangular Tanks - Two)

Description	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
Site Preparation	SF	5,310	$ 3	$ 15,930
Excavation	CY	590	$ 30	$ 17,700
Backfill (struc.)	CY	100	$ 35	$ 3,500
Gravel under struc	CY	390	$ 50	$ 19,500
Outer Concrete Walls	CY	220	$ 1,200	$ 264,000
Outer Concrete Footings	CY	100	$ 1,200	$ 120,000
Btm. Concrete slab in tank	CY	610	$ 900	$ 549,000
WWTP Total Present Worth (2018 Dollars)	CY	120	$ 1,500	$ 180,000
Subtotal	EA	2		$ 2,340,000
Sidewalk	CY	50	$ 500	$ 25,000
Blowers, diffusers, and controls	LS	1	$ 618,800	$ 618,800
Decanter	LS	2	$ 15,000	$ 30,000
Access Fly Bridge	LS	2	$ 60,000	$ 120,000
WAS Flow Meter	LS	2	$ 7,500	$ 15,000
Sludge Pumps	LS	2	$ 25,000	$ 50,000
Instrumentation	LS	1	$ 25,000	$ 25,000
Electrical	LS	1	$ 65,000	$ 65,000
Misc. Equipment	LS	1	$ 20,000	$ 20,000
Wall fittings pipe	LS	1	$ 5,000	$ 5,000
Handrail	LF	100	$ 75	$ 7,500
Stairs	LF	30	$ 350	$ 10,500
			Total	$ 3,332,000

City of Molalla				Biosolids Management Systems
Project 100.26				10/20/2018

Construction Cost Estimate - Anaerobic Digester

Description	Unit	Quantity	Unit Cost	Total Cost
Site Preparation	SF	5,000	$ 3	$ 15,000
Excavation	CY	490	$ 30	$ 14,700
Backfill (struc.)	CY	250	$ 35	$ 8,750
Gravel under struc	CY	120	$ 50	$ 6,000
60 ft Diameter Concrete Tank	LS	1	$ 2,362,500	$ 2,362,500
Outer Footings	CY	70	$ 1,200	$ 84,000
Subtotal	EA	1		$ 2,491,000
Sidewalk	CY	40	$ 500	$ 20,000
0.75 MBTU/hr Heat Exchanger with Boiler	LS	1	$ 577,500	$ 577,500
Radial Beam Gasholder Cover	LS	1	$ 594,000	$ 594,000
Sludge Mixers	LS	1	$ 453,800	$ 453,800
Gas Safety Equipment	LS	1	$ 354,800	$ 354,800
WAS Flow Meter	LS	2	$ 7,500	$ 15,000
Sludge Pumps	LS	2	$ 25,000	$ 50,000
Instrumentation	LS	1	$ 25,000	$ 25,000
Electrical	LS	1	$ 100,000	$ 100,000
Misc. Equipment	LS	1	$ 40,000	$ 40,000
Wall fittings pipe	LS	1	$ 5,000	$ 5,000
Stairs	LF	30	$ 350	$ 10,500
Structure	SF	1,500	$ 130	$ 195,000
			Total	$ 4,932,000

Construction Cost Estimate - Biosolids Screw Press & Structure

Description	Unit	Quantity	Unit Cost	Total Cost
Const. Facilities & Temporary Controls	LS	1	$90,000.00	$ 90,000
Site Preparation	LS	1	$60,000.00	$ 60,000
Excavation	CY	310	$ 20	$ 6,200
Backfill (struc.)	CY	80	$ 40	$ 3,200
Gravel under struc	CY	160	$ 50	$ 8,000
New Filter Press & Conveyor System	EA	1	$ 610,500	$ 610,500
Electrical	LS	1	$ 90,000	$ 90,000
Instrumentation	LS	1	$ 70,000	$ 70,000
Piping	LS	1	$ 25,000	$ 25,000
Sludge Pumps	EA	1	$ 32,000	$ 32,000
Storage Tank	LS	1	$ 160,000	$ 160,000
Spreader Truck	LS	1	$ 150,000	$ 150,000
Structure	SF	2,500	$ 225	$ 562,500
			Total	$ 1,867,000

Construction Cost Estimate - Sludge Drying Beds

Description	Unit	Qnt.	Unit Cst.	Tot. Cost
Site Preparation	LS	1	$ 142,000	$ 142,000
Walls	CY	100	$ 800	$ 80,000
Footing	CY	233	$ 800	$ 186,667
Excavation	CY	4202	$ 15	$ 63,033
Liner	SF	54000	$ 2	$ 81,000
Gravel Sand	CY	3000	$ 50	$ 150,000
Perferated Collection Pipe	LF	3600	$ 20	$ 72,000
Distribution Pipe	LF	120	$ 25	$ 3,000
Stop Logs	EA	30	$ 600	$ 18,000
Structural Cover	SF	50000	$ 45	$ 2,250,000
Misc. items	LS	1	$ 10,000	$ 10,000
Lights	LS	1	$ 10,000	$ 10,000
			Total	$ 3,065,700

City of Molalla			Biosolids Management Systems - MBT	
Project 100.26				12/12/2017
Construction Cost Estimate - Aerobic Digester & MBT (Glass Fused Tanks - Two)				
Description	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
Const. Facilities & Temporary Controls	LS	1	$ 250,000.00	$ 250,000.00
Site Preparation	LS	1	$ 160,000.00	$ 160,000.00
Excavation	CY	290	$ 30	$ 8,700
Backfill (struc.)	CY	150	$ 35	$ 5,250
Gravel under struc	CY	70	$ 50	$ 3,500
Concrete Slab	CY	110	$ 1,200	$ 132,000
Outer Footings	CY	50	$ 1,200	$ 60,000
Glass Fused Bolted Steel Tank	LS	1	$ 412,500	$ 412,500
Subtotal	EA	2		$ 2,064,000
Sidewalk	CY	50	$ 500	$ 25,000
MBT, blowers, diffusers, and controls	LS	1	$ 1,366,800	$ 1,366,800
MBT Tank	LS	1	$ 250,000	$ 250,000
Access Fly Bridge	LS	2	$ 80,000	$ 160,000
WAS Flow Meter	LS	2	$ 7,500	$ 15,000
Sludge Pump	LS	2	$ 25,000	$ 50,000
Instrumentation	LS	1	$ 25,000	$ 25,000
Electrical	LS	1	$ 80,000	$ 80,000
Misc. Equipment	LS	1	$ 50,000	$ 50,000
Wall fittings pipe	LS	1	$ 5,000	$ 5,000
Handrail	LF	100	$ 75	$ 7,500
Stairs	LF	30	$ 350	$ 10,500
			Total	$ 4,109,000

City of Molalla				Biosolids Management Systems
Project 100.26				**12/12/2017**

O&M Cost Estimate - Drying Beds

Description	Unit	Quantity	Unit Cost	Total Cost
Front end loader & truck O&M	Hr	260	$ 130	$ 33,800
Sludge Removal Labor	Hr	150	$ 28	$ 4,200
Weekly Cleaning Labor	Hr	15	$ 28	$ 420
Monitoring & Operation	Hr	125	$ 28	$ 3,500
Maintenance Labor	Hr	15	$ 55	$ 825
		Operations & Maintenance		**$ 42,745**
			Interest Rate	3.2%
			Term	20
			Present Value O&M Cost	**$ 624,000**

O&M Cost Estimate - Dewatering Screw Press

Description	Unit	Quantity	Unit Cost	Total Cost
Energy to Press	kWh	7,564	$ 0.10	$ 756
Energy to Misc. Elec. Load	kWh	2,500	$ 0.10	$ 250
Polymers	LS	1	$ 8,000	$ 8,000
Weekly Cleaning Labor	Hr	104	$ 28	$ 2,912
Monitoring & Operation	Hr	300	$ 28	$ 8,400
Maintenance Labor	Hr	40	$ 55	$ 2,200
Press Parts	LS	1	$ 5,000	$ 5,000
			Operations & Maintenance	**$ 27,518**
			Interest Rate	3.2%
			Term	20
			Present Value O&M Cost	**$ 402,000**

O&M Cost Estimate - Aerobic Digester

Description	Unit	Quantity	Unit Cost	Total Cost
Energy to Aeration	kWh	980,025	$ 0.10	$ 98,003
Equipment Repair & Replacement	LS	1	$ 3,033	$ 3,033
O&M Labor	Hr	150	$ 28	$ 4,200
			Operations & Maintenance	**$ 105,236**
WWTP Total Present Worth (2018 Dollars)				
			Interest Rate	3.2%
			Term	20
			Present Value O&M Cost	**$ 1,537,081**

O&M Cost Estimate - Anaerobic Digester

Description	Unit	Quantity	Unit Cost	Total Cost
Electrical Consumption	kWh	392,098	$ 0.10	$ 39,210
Misc. Equipment Repair & Replacement	LS	1	$ 15,000	$ 15,000
Mixers Repair (Annual Reserve Fund)	LS	1	$ 2,500	$ 2,500
Digester Cover Recoating (Annual Reserve Fund)	LS	1	$ 2,500	$ 2,500
O&M Labor	Hr	550	$ 28	$ 15,400
			Operations & Maintenance	**$ 74,610**
			Interest Rate	3.2%
			Term	20
			Present Value O&M Cost	**$ 1,089,755**

City of Molalla				Biosolids Management Systems - MBT
Project 100.26				12/12/2017
O&M Cost Estimate - Aerobic Digester & MBT				
Description	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
Energy for Aeration, Scouring	kWh	1,208,968	$ 0.10	$ 120,897
Equipment Repair & Replacement	LS	1	$ 17,500	$ 17,500
O&M Labor	Hr	365	$ 28	$ 10,220
			Operations & Maintenance	**$ 148,617**
			Interest Rate	3.2%
			Term	20
			Present Value O&M Cost	**$ 2,170,706**

City of Molalla				Biosolids Disposal Alternatives
Project 100.26				**12/12/2017**

Liquid Sludge Land Application (Based on 4,511,400 Gallons/Year)

Description	Unit	Quantity	Unit Cost	Total Cost
Energy to Pump to Tanker	kWh	1,103	$ 0.10	$ 110
Tanker Expense per Trip	Trip	1,500	$ 65	$ 97,500
Labor for spreading	Hr	3,000	$ 28	$ 84,000
Monitoring & Operation	Hr	72	$ 28	$ 2,016
Maintenance Labor	Hr	52	$ 28	$ 1,456
			Operations & Maintenance	**$ 185,082**
			Interest Rate	3.2%
			Project life	20
			Present Value O&M Cost	**$ 2,703,000**

Liquid Sludge Haul to Biosolids Disposal Facility (Based on Year-Round Disposal)

Description	Unit	Quantity	Unit Cost	Total Cost
Disposal Tipping Fee	Gallons	4,511,400	$ 0.08	$ 360,912
Monitoring & Operation	Hr	496	$ 28	$ 13,881
Maintenance Labor	Hr	20	$ 28	$ 560
			Operations & Maintenance	**$ 375,353**
			Interest Rate	3.2%
			Project life	20
			Present Value O&M Cost	**$ 5,482,000**

Dry Sludge Land Fill Annual & Present Worth O&M (Aerobically Digested Biosolids)

Description	Unit	Quantity	Unit Cost	Total Cost
Tipping Fee	Ton	2,686	65	$ 174,590
Front end loader op. expense	Load	320	50	$ 16,000
Truck expense	Hr	960	50	$ 48,000
Labor for driving	Hr	960	28	$ 26,880
Monitoring & Operation	Hr	32	28	$ 896
Maintenance Labor	Hr	24	28	$ 672
			Operations & Maintenance	**$ 267,038**
			WWTP Total Present Worth (2018 Dollars)	3.2%
			Project life	20
			Present Value O&M Cost	**$ 3,900,000**

Dry Sludge Land Fill Annual & Present Worth O&M (Anaerobically Digested Biosolids)

Description	Unit	Quantity	Unit Cost	Total Cost
Tipping Fee	Ton	1,650	65	$ 107,250
Front end loader op. expense	Load	200	50	$ 10,000
Truck expense	Hr	600	50	$ 30,000
Labor for driving	Hr	600	28	$ 16,800
Monitoring & Operation	Hr	32	28	$ 896
Maintenance Labor	Hr	24	28	$ 672
			Operations & Maintenance	**$ 165,618**
			Interest Rate	3.2%
			Project life	20
			Present Value O&M Cost	**$ 2,419,000**

City of Molalla				Disinfection Systems
Project 100.26				12/12/2017

Construction Cost Estimate - UV (Year Round)

Description	Unit	Qnt.	Unit Cost	Total Cost
Site Preparation	SF	1320	$ 25	$ 33,000
Excavation	CY	150	$ 20	$ 3,000
Gravel under structure	CY	100	$ 50	$ 5,000
Concrete - foundation	CY	50	$ 1,200	$ 60,000
Btm. Slab	CY	50	$ 900	$ 45,000
Walls	CY	50	$ 1,200	$ 60,000
Concrete - Walkway	CY	10	$ 1,200	$ 12,000
Backfill - structural	CY	60	$ 30	$ 1,800
Electrical	LS	1	$ 65,000	$ 65,000
Piping and gates	LS	1	$ 40,000	$ 40,000
Instrumentation	LS	1	$ 25,000	$ 25,000
Shelter over outdoor UV channel	SF	750	$ 200	$ 150,000
			Subtotal	$ 500,000
Equipment	LS	1	$ 1,122,000	$ 1,122,000
			Total	**$ 1,622,000**

Construction Cost Estimate - UV (Winter Only)

Description	Unit	Qnt.	Unit Cost	Total Cost
Site Preparation	SF	1320	$ 25	$ 33,000
Excavation	CY	150	$ 20	$ 3,000
Gravel under structure	CY	100	$ 50	$ 5,000
Concrete - foundation	CY	50	$ 1,200	$ 60,000
Btm. Slab	CY	50	$ 900	$ 45,000
Walls	CY	50	$ 1,200	$ 60,000
Concrete - Walkway	CY	10	$ 1,200	$ 12,000
Backfill - structural	CY	60	$ 30	$ 1,800
Electrical	LS	1	$ 65,000	$ 65,000
Piping and gates	LS	1	$ 40,000	$ 40,000
Instrumentation	LS	1	$ 25,000	$ 25,000
Shelter over outdoor UV channel	SF	750	$ 200	$ 150,000
			Subtotal	$ 500,000
Equipment	LS	1	$ 577,500	$ 577,500
			WWTP Total Present Worth (2018 Dollars)	**$ 1,077,500**

Construction Cost Estimate - HS Chlorination of Recycled Water

Description	Unit	Quantity	Unit Cost	Total Cost
Site Preparation	LS	1	$ 20,000	$ 20,000
Electrical	LS	1	$ 25,000	$ 25,000
Piping & Fittings	LS	1	$ 25,000	$ 25,000
Instrumentation	LS	1	$ 25,000	$ 25,000
Structure	SF	200	$ 200	$ 40,000
			Subtotal	**$ 135,000**
Chlorination Equipment (pumps, tanks, etc.)	LS	1	$ 248,000	$ 248,000
			Total	**$ 383,000**

Construction Cost Estimate - OSG Chlorination of Recycled Water

Description	Unit	Quantity	Unit Cost	Total Cost
Site Preparation	LS	1	$ 20,000	$ 20,000
Electrical	LS	1	$ 25,000	$ 25,000
Piping & Fittings	LS	1	$ 25,000	$ 25,000
Instrumentation	LS	1	$ 25,000	$ 25,000
Structure	SF	200	$ 200	$ 40,000
			Subtotal	**$ 135,000**
Chlorination Equipment (pumps, tanks, etc.)	LS	1	$ 688,000	$ 688,000
			Total	**$ 823,000**

City of Molalla				Disinfection Systems
Project 100.26				12/12/2017

Construction Cost Estimate - HS Chlorination / Dechlorination Year Round

Description	Unit	Quantity	Unit Cost	Total Cost
Site Preparation	LS	1	$100,000	$ 100,000
Excavation	CY	660	$20	$ 13,200
Backfill Sturcture	CY	277	$50	$ 13,867
Concrete Slab	CY	200	$900	$ 180,000
Concrete Exterior Walls	CY	50	$1,200	$ 60,000
Concrete Interior Walls	CY	90	$1,200	$ 108,000
New Inlet Structure	LS	1	$3,500	$ 3,500
Drainage and cleaning sumps	EA	6	$3,500	$ 21,000
Misc Grating	SF	750	$50	$ 37,500
Misc Piping	LF	200	$80	$ 16,000
New Handrail	LF	500	$30	$ 15,000
New injection piping and equipment	LS	1	$30,000	$ 30,000
New flow pace meter	LS	1	$7,000	$ 7,000
Instrumentation	LS	1	$25,000	$ 25,000
Electrical	LS	1	$20,000	$ 20,000
Dechlorination Equipment (bldg., pumps, tanks, etc.)	LS	1	$90,240	$ 90,240
Subtotal	**EA**	**2**		**$ 1,481,000**
Chlorination Equipment (pumps, tanks, etc.)	LS	1	$ 248,000	$ 248,000
			Total	**$ 1,729,000**

Construction Cost Estimate - OSG Chlorination / Dechlorination Year Round

Description	Unit	Quantity	Unit Cost	Total Cost
Site Preparation	LS	1	$100,000	$ 100,000
Excavation	CY	660	$20	$ 13,200
Backfill Sturcture	CY	277	$50	$ 13,867
Concrete Slab	CY	200	$900	$ 180,000
Concrete Exterior Walls	CY	50	$1,200	$ 60,000
Concrete Interior Walls	CY	90	$1,200	$ 108,000
New Inlet Structure	LS	1	$3,500	$ 3,500
Drainage and cleaning sumps	EA	6	$3,500	$ 21,000
Misc Grating	SF	750	$50	$ 37,500
Misc Piping	LF	200	$80	$ 16,000
New Handrail	LF	500	$30	$ 15,000
New injection piping and equipment	LS	1	$30,000	$ 30,000
New flow pace meter	LS	1	$7,000	$ 7,000
Instrumentation	LS	1	$25,000	$ 25,000
Electrical	LS	1	$20,000	$ 20,000
Dechlorination Equipment (bldg., pumps, tanks, etc.)	LS	1	$90,240	$ 90,240
Subtotal	**EA**	**2**		**$ 1,481,000**
Chlorination Equipment (pumps, tanks, etc.)	LS	1	$ 688,000	$ 688,000
			Total	**$ 2,169,000**

Full Year H/S (Chlorine) / Dechlorination Disinfection Annual & Present Worth O&M

Operations & Maintenance Costs	Unit	Quantity	Unit Cost	Total Cost
Electricity	kWh	9,000	$ 0.10	$ 900
Labor @ 5 hrs per week	Hr	260	$ 28.00	$ 7,280
Hypochlorite Solution	lb	17,315	$ 1.25	$ 21,644
Sulphur Dioxide 150 lb cylinders	lb	14,429	$ 0.75	$ 10,822
Eductors Power @ 1.5 Hp	kWh	9,290	$ 0.10	$ 929
Repair Parts	LS	1	$ 2,500.00	$ 2,500
Reagents	LS	1	$ 1,200.00	$ 1,200
			Annual Project Total	**$ 45,274**
			Interest Rate	3.2%
			Project life	20
			Present Value O&M Cost	**$ 661,000**

City of Molalla				Disinfection Systems
Project 100.26				12/12/2017

Full Year OSG (Chlorine) / Dechlorination Disinfection Annual & Present Worth O&M

Operations & Maintenance Costs	Unit	Quantity	Unit Cost	Total Cost
Electricity	kWh	66,000	$ 0.10	$ 6,600
Labor @ 5 hrs per week	Hr	260	$ 28.00	$ 7,280
Salts	ton	22	$ 150.00	$ 3,247
Sulphur Dioxide 150 lb cylinders	lb	14,429	$ 0.75	$ 10,822
Eductors Power @ 1.5 Hp	kWh	9,290	$ 0.10	$ 929
Repair Parts	LS	1	$ 3,500.00	$ 3,500
Reagents	LS	1	$ 1,200.00	$ 1,200
			Annual Project Total	**$ 33,577**
			Interest Rate	3.2%
			Project life	20
			Present Value O&M Cost	**$ 490,000**

6 Months H/S (Chlorine) / Dechlorination Disinfection Annual & Present Worth O&M

Operations & Maintenance Costs	Unit	Quantity	Unit Cost	Total Cost
Electricity	kWh	4,500	$ 0.10	$ 450
Labor @ 5 hrs per week	Hr	150	$ 28.00	$ 4,200
Hypochlorite Solution	lb	8,657	$ 1.00	$ 8,657
Sulphur Dioxide 150 lb cylinders	lb	14,429	$ 0.75	$ 10,822
Eductors Power @ 1.5 Hp	kWh	9,290	$ 0.10	$ 929
Repair Parts	LS	1	$ 1,500.00	$ 1,500
Reagents	LS	1	$ 1,200.00	$ 1,200
			Annual Project Total	**$ 27,758**
			Interest Rate	3.2%
			Project life	20
			Present Value O&M Cost	**$ 405,000**

6 Months Year OSG (Chlorine) / Dechlorination Disinfection Annual & Present Worth O&M

Operations & Maintenance Costs	Unit	Quantity	Unit Cost	Total Cost
Electricity	kWh	33,000	$ 0.10	$ 3,300
Labor @ 5 hrs per week	Hr	150	$ 28.00	$ 4,200
Salts	ton	5	$ 125.00	$ 676
Sulphur Dioxide 150 lb cylinders	lb	4,329	$ 0.50	$ 2,164
Eductors Power @ 1.5 Hp	kWh	4,645	$ 0.20	$ 929
Repair Parts	LS	1	$ 3,500.00	$ 3,500
Reagents	LS	1	$ 1,200.00	$ 1,200
			Annual Project Total	**$ 15,970**
			Interest Rate	3.2%
			Project life	20
			Present Value O&M Cost	**$ 233,000**

Full Year UV Disinfection Annual & Present Worth O&M

Description	Unit	Quantity	Unit Cost	Total Cost
Energy to Lamps	kWh	262,800	$ 0.10	$ 26,280
Weekly Lamp Cleaning	Hr	104	$ 28	$ 2,912
Lamp Replacement	EA	25	$ 600	$ 15,000
Ballast Replacement	EA	6	$ 180	$ 1,080
Quartz Replacement	EA	10	$ 45	$ 450
Monitoring & Operation and Semi Annual Basin Cleaning	Hr	120	$ 22	$ 2,640
			Operations & Maintenance	**$ 48,362**
			Interest Rate	3.2%
			Project life	20
			Present Value O&M Cost	**$ 706,000**

City of Molalla Project 100.26				Disinfection Systems 12/12/2017
6 months UV Disinfection Annual & Present Worth O&M				
Description	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
Energy to Lamps	kWh	43,800	$ 0.10	$ 4,380
Weekly Lamp Cleaning	Hr	52	$ 28	$ 1,456
Lamp Replacement	EA	10	$ 600	$ 6,000
Ballast Replacement	EA	2	$ 180	$ 360
Quartz Replacement	EA	2	$ 45	$ 90
Monitoring & Operation	Hr	52	$ 22	$ 1,144
Semi Annual Basin Cleaning	Hr	8	$ 22	$ 176
			Operations & Maintenance	**$ 13,606**
			Interest Rate	3.2%
			Project life	20
			Present Value O&M Cost	**$ 199,000**

City of Molalla				Lagoon (Recyled Water Storage) Improvements	
Construction Cost Estimate					10/12/2018

Lagoon No. 1 - Outlet Structure (50 Linear Feet Each Direction)

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Mobilization, Bond & Insurance	LS	1	$ 1,500	$ 1,500
2	Demolition & Site Preparation	LS	1	$ 2,100	$ 2,100
3	Existing Concrete Debris Removal	LS	1	$ 2,500	$ 2,500
4	Embankment Reshaping	CY	300	$ 20	$ 6,000
5	Class 100 Rip-Rap Installation	Ton	350	$ 15	$ 5,250
				Construction Total	$ 17,350
				Contingency	$ 2,600
				Engineering	$ 4,300
				Total	$ 24,250

Lagoon No. 1 - North Side Bank (300 Linear Feet to the west of the outlet structure)

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Mobilization, Bond & Insurance	LS	1	$ 3,000	$ 3,000
2	Demolition & Site Preparation	LS	1	$ 5,500	$ 5,500
3	Existing Concrete Debris Removal	LS	1	$ 5,000	$ 5,000
4	Embankment Reshaping	CY	850	$ 20	$ 17,000
5	Class 100 Rip-Rap Installation	Ton	950	$ 15	$ 14,250
				Construction Total	$ 44,750
				Contingency	$ 6,700
				Engineering	$ 11,200
				Total	$ 62,650

Lagoon No. 1 - East Side Bank (500 Linear Feet)

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Mobilization, Bond & Insurance	LS	1	$ 4,100	$ 4,100
2	Demolition & Site Preparation	LS	1	$ 8,000	$ 8,000
3	Embankment Reshaping	CY	1,400	$ 20	$ 28,000
4	Class 100 Rip-Rap Installation	Ton	1,600	$ 15	$ 24,000
				Construction Total	$ 64,100
				Contingency	$ 9,600
				Engineering	$ 16,000
				Total	$ 89,700

Lagoon No. 1 - North Side Bank (900 Linear Feet)

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Mobilization, Bond & Insurance	LS	1	$ 3,000	$ 3,000
2	Demolition & Site Preparation	LS	1	$ 5,500	$ 5,500
3	Existing Concrete Debris Removal	LS	1	$ 5,000	$ 5,000
4	Embankment Reshaping	CY	2,500	$ 20	$ 50,000
5	Class 100 Rip-Rap Installation	Ton	2,800	$ 15	$ 42,000
				Construction Total	$ 105,500
				Contingency	$ 15,800
				Engineering	$ 26,400
				Total	$ 147,700

City of Molalla					Lagoon (Recyled Water Storage) Impr. Cont.
Construction Cost Estimate					**10/12/2018**

Lagoon No. 1 - South Side Bank (1,000 Linear Feet)

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Mobilization, Bond & Insurance	LS	1	$ 4,100	$ 4,100
2	Demolition & Site Preparation	LS	1	$ 8,000	$ 8,000
4	Embankment Reshaping	CY	2,800	$ 20	$ 56,000
5	Class 100 Rip-Rap Installation	Ton	3,100	$ 15	$ 46,500
				Construction Total	$ 114,600
				Contingency	$ 17,200
				Engineering	$ 28,700
				Total	$ 160,500

Lagoon No. 2 - West Side Bank (700 Linear Feet)

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Mobilization, Bond & Insurance	LS	1	$ 5,000	$ 5,000
2	Demolition & Site Preparation	LS	1	$ 9,000	$ 9,000
3	Embankment Reshaping	CY	1,950	$ 20	$ 39,000
4	Class 100 Rip-Rap Installation	Ton	2,100	$ 15	$ 31,500
				Construction Total	$ 84,500
				Contingency	$ 12,700
				Engineering	$ 21,100
				Total	$ 118,300

Lagoon Storm Drainage

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 28,000	$ 28,000
2	Demolition & Site Preparation	LS	All	$ 19,000	$ 19,000
3	15" PVC Storm Drain Line	LF	1,200	$ 75	$ 90,000
4	Area Drain	EA	6	$ 2,000	$ 12,000
5	Drainage Swale	LF	100	$ 30	$ 3,000
6	Transfer Pipe - Additional Valving	LS	All	$ 50,000	$ 50,000
7	Transfer Pipe Stabilization	LS	All	$ 75,000	$ 75,000
				Construction Total	$ 277,000
				Contingency	$ 41,600
				Engineering	$ 69,300
				Total	$ 387,900

Lagoon Transfer Pipe System Improvements

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Control	LS	1	$ 57,000	$ 57,000
2	Demolition & Site Preparation	LS	1	$ 38,000	$ 38,000
3	Intake Structure	LS	1	$ 300,000	$ 300,000
4	Flow Channel	LS	1	$ 75,000	$ 75,000
5	Concrete Spillway	LS	1	$ 100,000	$ 100,000
				Construction Total	$ 570,000
				Contingency	$ 85,500
				Engineering	$ 142,500
				Project Total	$ 798,000

City of Molalla Construction Cost Estimate				Lagoon (Recyled Water Storage) Impr. Cont. 10/12/2018	
Lagoon No. 1 & 2 - Lining					
Item	**Description**	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
1	Const. Facilities & Temporary Control	LS	1	$ 205,000	$ 205,000
2	Demolition & Site Preparation	LS	1	$ 140,000	$ 140,000
3	60-mil HDPE Liner w/ Penetrations, Underlayment	LS	1	$ 1,142,857	$ 1,142,857
4	Liner Anchor Trench & Backfill	LF	7,320	$ 10	$ 73,200
5	Dewatering	LS	1	$ 50,000	$ 50,000
6	Drainage	LS	1	$ 450,000	$ 450,000
7	Inlet Structure	LS	1	$ 10,000	$ 10,000
				Construction Total	$ 2,071,057
				Contingency	$ 310,700
				Engineering	$ 517,800
				Project Total	$ 2,899,557

Item	Cost Estimate
Construction Total	$ 3,348,857

City of Molalla			Discharge Monitoring Station Improvements	
Project 100.26				**12/12/2017**
Construction Cost Estimate - DMS Improvements				
Description	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
Const. Facilities & Temporary Control	LS	1	$ 42,000.00	$ 42,000.00
Demolition & Site Preparation	LS	1	$ 28,000.00	$ 28,000.00
Piping & Valves	LS	1	$ 250,000	$ 250,000
Flow Meter & Vault	LS	1	$ 50,000	$ 50,000
Electrical & Controls	LS	1	$ 45,000	$ 45,000
			Total	$ 415,000

City of Molalla				Recycled Water Storage Expansion Systems
Project 100.26				10/5/2018

Construction Cost Estimate - PS #1: Recycled Water Storage Expansion

Description	Unit	Quantity	Unit Cost	Total Cost
Const. Facilities & Temporary Control	LS	1	$ 1,348,000	$ 1,348,000
Demolition & Site Preparation	LS	1	$ 899,000	$ 899,000
Excavation	CY	36,000	$ 15	$ 540,000
Berm Construction	CY	410,000	$ 15	$ 6,150,000
Pond Lining				
Pond Underdrain	LF	45,000	$ 15	$ 675,000
Pond Anchor Trench	LF	10,000	$ 5	$ 50,000
HDPE Lining Placement	SF	2,400,000	$ 1.20	$ 2,880,000
Transfer Piping	LF	1,400	$ 150.00	$ 210,000
Valves	EA	5	$ 5,000.00	$ 25,000
Manholes	EA	5	$ 12,000.00	$ 60,000
Outlet Structures	LS	2	$ 50,000	$ 100,000
Outlet Structure Handrail	LF	225	$ 75	$ 16,875
Outlet Slide Gate	LS	2	$ 10,000	$ 20,000
Inlet Structures	LS	2	$ 10,000	$ 20,000
Access Road	LF	4,500	$ 20	$ 90,000
Fencing	LF	5,250	$ 75	$ 393,750
			Total	**$ 13,478,000**

Construction Cost Estimate - PS #2 and PS #3: Recycled Water Storage Expansion

Description	Unit	Quantity	Unit Cost	Total Cost
Const. Facilities & Temporary Control	LS	1	$ 436,000	$ 436,000
Demolition & Site Preparation	LS	1	$ 291,000	$ 291,000
Excavation	CY	8,000	$ 15	$ 120,000
Berm Construction	CY	110,000	$ 15	$ 1,650,000
Pond Lining				
Pond Underdrain	LF	13,000	$ 15	$ 195,000
Pond Anchor Trench	LF	5,200	$ 5	$ 26,000
HDPE Lining Placement	SF	660,000	$ 1.20	$ 792,000
Transfer Piping	LF	1,000	$ 150.00	$ 150,000
Valves	EA	5	$ 5,000.00	$ 25,000
Manholes	EA	5	$ 12,000.00	$ 60,000
Outlet Structures	esent Wor	2	$ 50,000	$ 100,000
Outlet Structure Handrail	LF	225	$ 75	$ 16,875
Outlet Slide Gate	LS	2	$ 10,000	$ 20,000
Inlet Structures	LS	2	$ 10,000	$ 20,000
Access Road	LF	3,010	$ 20	$ 60,200
Fencing	LF	5,250	$ 75	$ 393,750
			Total	**$ 4,356,000**

City of Molalla				Irrigation Expansion Systems
Project 100.26				10/5/2018

Construction Cost Estimate - PS #1. Land Application Expansion

Description	Unit	Quantity	Unit Cost	Total Cost
Force Main Expansions	LF	8,150	$ 150	$ 1,222,500
Irrigation Equipment	AC	525	$ 1,500	$ 787,500
			Total	**$ 2,010,000**

Construction Cost Estimate - PS #2. Land Application Expansion

Description	Unit	Quantity	Unit Cost	Total Cost
Force Main Expansions	LF	5,650	$ 150	$ 847,500
Irrigation Equipment	AC	215	$ 1,500	$ 322,500
			Total	**$ 1,170,000**

Construction Cost Estimate - PS #3. Land Application Expansion

Description	Unit	Quantity	Unit Cost	Total Cost
Force Main Expansions	LF	5,650	$ 150	$ 847,500
Irrigation Equipment	AC	175	$ 1,500	$ 262,500
			Total	**$ 1,110,000**

Construction Cost Estimate - PS #4. Land Application Expansion

Description	Unit	Quantity	Unit Cost	Total Cost
Force Main Expansions	LF	1,750	$ 150	$ 262,500
Irrigation Equipment	AC	100	$ 1,500	$ 150,000
			Total	**$ 413,000**

APPENDIX D: MISCELLANEOUS REPORTS AND STUDIES

Population Forecast (PSU)

Resolution No. 2017 – 09 (Sewer Rates)

FY 2016 - 2017 Budget

FY 2017 – 2018 Budget

Utilities Rate Study (2017)

Pump Station Run Time Data (2017)

Recycled Water Balance Calculations

Biosolids Management Plan (2013)

Clackamas County

Population Forecasts by Age Group / Year	2017	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2067
00-04	22,617	24,125	25,624	26,442	27,110	28,104	29,530	31,168	32,562	33,513	34,219	34,541
05-09	24,666	25,525	28,473	30,140	31,015	31,772	32,880	34,462	36,264	37,804	38,842	39,157
10-14	26,799	27,325	28,980	32,213	34,001	34,957	35,747	36,896	38,550	40,476	42,120	42,567
15-19	25,779	25,797	26,696	28,343	31,563	33,453	34,501	35,177	36,181	37,710	39,517	40,139
20-24	21,321	21,736	22,061	22,723	24,035	26,737	28,275	29,061	29,511	30,267	31,474	32,058
25-29	23,085	23,429	24,135	24,414	25,068	26,497	29,428	31,040	31,806	32,229	32,999	33,512
30-34	24,775	26,721	27,674	28,416	28,670	29,413	31,041	34,391	36,171	36,990	37,422	37,769
35-39	26,423	27,978	31,529	32,549	33,336	33,612	34,425	36,244	40,043	42,032	42,915	43,107
40-44	27,747	29,013	31,697	35,605	36,659	37,522	37,775	38,595	40,519	44,677	46,824	47,207
45-49	28,678	29,212	31,535	34,343	38,476	39,596	40,471	40,649	41,414	43,395	47,779	48,679
50-54	28,838	28,177	29,411	31,643	34,369	38,489	39,552	40,329	40,388	41,068	42,971	44,653
55-59	29,462	28,966	27,666	28,788	30,896	33,555	37,532	38,485	39,135	39,127	39,737	40,464
60-64	28,165	29,188	28,425	27,044	28,050	30,076	32,601	36,358	37,153	37,687	37,605	37,827
65-69	23,826	26,591	28,574	27,741	26,333	27,310	29,251	31,649	35,205	35,917	36,395	36,365
70-74	18,030	20,804	25,071	26,886	26,063	24,762	25,678	27,470	29,680	32,992	33,654	33,847
75-79	12,348	15,374	18,722	22,524	24,139	23,422	22,266	23,077	24,657	26,662	29,645	29,900
80-84	7,949	9,171	12,717	15,236	18,349	19,734	19,000	18,093	18,770	20,086	21,798	22,773
85+	9,177	9,727	11,666	14,959	18,611	22,931	26,619	28,588	29,369	30,432	32,101	33,029
Total	**409,688**	**428,860**	**460,657**	**490,011**	**516,744**	**541,943**	**566,573**	**591,732**	**617,377**	**643,064**	**668,018**	**677,596**

Population Forecasts prepared by: Population Research Center, Portland State University, June 30, 2017.

Proposed forecasts represent populations as of July 1 of each year

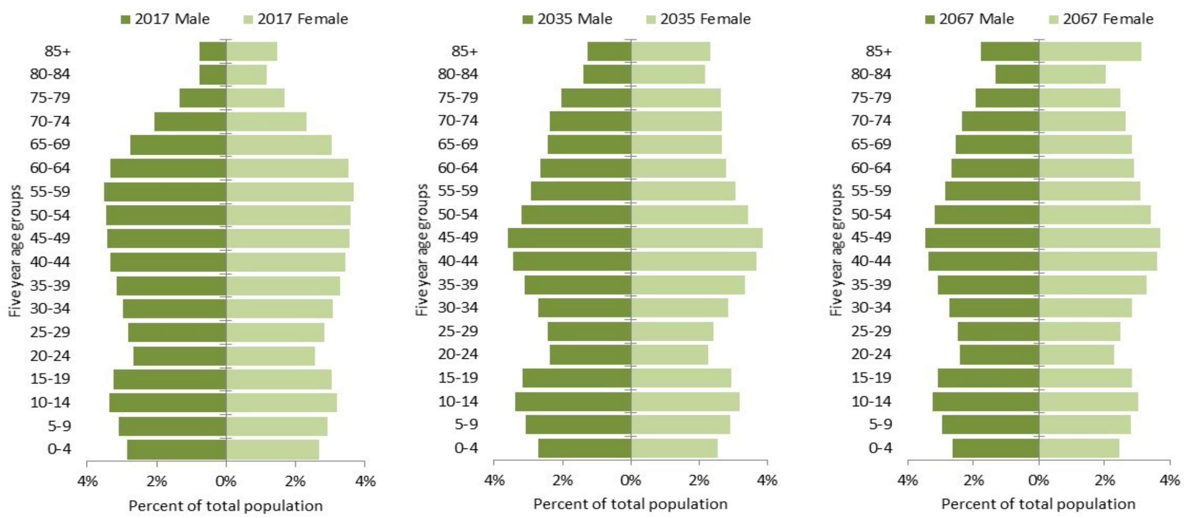
Forecasts for Total Population

Area / Year	2017	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2067
Clackamas County	409,688	428,860	460,657	490,011	516,744	541,943	566,573	591,732	617,377	643,064	668,018	677,596
Barlow UGB	140	142	144	146	148	151	153	155	156	158	160	161
Canby UGB	17,976	18,933	20,607	22,318	24,045	25,748	27,431	29,121	30,846	32,617	34,413	35,118
Estacada UGB	4,102	4,482	5,105	5,502	5,731	5,930	6,129	6,328	6,497	6,635	6,738	6,766
Molalla UGB	9,939	10,652	11,948	13,314	14,705	16,118	17,549	18,963	20,369	21,764	23,139	23,678
Sandy UGB	11,346	12,485	14,521	16,588	18,700	20,911	23,238	25,697	28,237	30,873	33,585	34,695
Outside UGB Area	83,444	84,753	86,429	87,681	88,484	88,960	89,296	89,765	90,415	91,126	91,754	91,906

Population Forecasts prepared by: Population Research Center, Portland State University, June 30, 2017.

Proposed forecasts represent populations as of July 1 of each year

Clackamas County Age Structure by Gender



Source: Forecast by Population Research Center (PRC)

RESOLUTION No. 2017 - 09

A RESOLUTION OF THE CITY OF MOLALLA, OREGON ESTABLISHING SANITARY SEWER RATES AND ANNUAL INFLATION ADJUSTMENTS THEREAFTER AS PROVIDED BY MOLALLA MUNICIPAL CODE CHAPTER 13.08

WHEREAS, The Molalla Municipal Code Section 13.08.370 provides that fees for sanitary sewer service be established by resolution of the City Council; and

WHEREAS, the City desires to regularly review the costs of operating, maintaining and improving the sanitary system; and

WHEREAS, the City has previously established via Resolution No. 2006-10, a schedule of future sewer rate increases that began on October 1, 2006; and

WHEREAS, the City has caused to be prepared a fee rate study which has identified sanitary sewer system costs, rate structure alternatives and equitable cost recovery methods; and

WHEREAS, the City intends to complete a 5 year sanitary sewer capital improvement plan and rate study and revise the fees based on the updated plan by August 1, 2017; and

WHEREAS, the City has previously establish within its sanitary sewer rate structure an annual increase to address inflation, service provision and maintenance.

NOW THEREFORE, BE IT RESOLVED by the City Council of the City of Molalla as follows:

Section 1. Resolution No. 2015-13 is repealed upon the effective date of this Resolution.

Section 2. The fixed fee shall be based on a rate per equivalent dwelling unit (EDU) per month. The variable fee shall be based on the per hundred cubic feet (Ccf) of winter average water consumption. Sanitary Sewer Rates and Fees are established:

Rate Schedule thru June 30, 2017 – Sanitary Sewer
(All Residential, Commercial, and Industrial inside the City)

All Classes	Rate	Use Charge (per 100 cubic feet)
Equivalent Dwelling Unit	**$33.76**	**$3.34**

Rate Schedule Effective July 01, 2017 – Sanitary Sewer
(All Residential, Commercial, and Industrial inside the City)

All Classes	Rate	Use Charge (per 100 cubic feet)
Equivalent Dwelling Unit	**$35.95**	**$3.56**

Rates for all services outside of the City limits shall be 150% of the rate schedule shown above.

Section 3. Annual inflationary adjustments for all sanitary sewer users shall be effective automatically each year on July 1 based on the published values by the Bureau of Labor Statistics Portland-Salem for All Urban Consumers (CPI-U).

Section 4. This Resolution shall be effective upon adoption and all rates and charges established herein for sanitary sewer customers shall go into effect as of dates provided in rate schedule.

Duly adopted by Molalla City Council the _______ day of ____________________, 2017.

____
Mayor, Jimmy Thompson

ATTEST the ___________day of __________________, 2017

____
City Recorder, Sadie Cramer

FY 2017

Adopted Budget

City of Molalla and Molalla Urban Renewal Agency

June 30, 2016 to July 31, 2017

Actuals FY 2013/2014	Actuals FY 2014/2015	Budgeted FY 2015/2016	PUBLIC WORKS - STREET FUND Account Name	Proposed FY 2016/2017	Approved FY 2016/2017	Adopted FY 2016/2017
$ 75,502.66	$ 73,199.00	$ 75,000.00	POWER	$ 91,250.00	$ 91,250.00	$ 91,250.00
$ 6,349.82	$ 7,558.22	$ 8,500.00	PHONE	$ 8,500.00	$ 8,500.00	$ 8,500.00
$ 1,657.33	$ 2,045.73	$ 2,000.00	NATURAL GAS	$ 2,500.00	$ 2,500.00	$ 2,500.00
$ 15,976.52	$ 21,745.91	$ 30,000.00	O&M	$ 25,000.00	$ 25,000.00	$ 25,000.00
$ 12,711.17	$ 23,121.28	$ 30,000.00	O&M (PARKS)	$ 30,900.00	$ 30,900.00	$ 30,900.00
$ 3,558.16	$ 3,669.19	$ 5,000.00	BUILDING MAINTENANCE	$ 5,000.00	$ 5,000.00	$ 5,000.00
$ -	$ -	$ 2,500.00	TRANING & CONF. TRAVEL	$ 2,500.00	$ 2,500.00	$ 2,500.00
$ 75.00	$ 120.00	$ 100.00	DUES & MEMBERSHIP	$ 120.00	$ 120.00	$ 120.00
$ -	$ -	$ -	POSTAGE	$ 100.00	$ 100.00	$ 100.00
$ 8,060.49	$ 9,882.68	$ 12,000.00	COMPUTER NETWORK	$ 12,650.00	$ 12,650.00	$ 12,650.00
$ 14,464.54	$ 12,841.00	$ 50,000.00	PROFESSIONAL SERVICES	$ 20,000.00	$ 20,000.00	$ 20,000.00
$ 13,546.15	$ 17,717.81	$ 20,500.00	INSURANCE/LIABILITY/GEN	$ 25,760.00	$ 25,760.00	$ 25,760.00
$ 13,694.62	$ 11,209.35	$ 14,000.00	VEHICLE FUEL	$ 15,000.00	$ 15,000.00	$ 15,000.00
$ 6,540.47	$ 1,219.11	$ 2,500.00	VEHICLE FUEL (PARKS)	$ 2,500.00	$ 2,500.00	$ 2,500.00
$ 12,268.30	$ 6,310.33	$ 7,500.00	VEHICLE REPAIR	$ 7,500.00	$ 7,500.00	$ 7,500.00
$ 1,130.75	$ 1,073.44	$ 2,000.00	VEHICLE REPAIR (PARKS)	$ 2,500.00	$ 2,500.00	$ 2,500.00
$ 6,184.23	$ 7,142.39	$ 5,000.00	UNIFORMS & SAFETY GEAR	$ 5,000.00	$ 5,000.00	$ 5,000.00
$ -	$ -	$ -	UNIFORMS & SAFETY GEAR (PARKS)	$ 1,000.00	$ 1,000.00	$ 1,000.00
$ 66,062.19	$ 60,535.88	$ 78,000.00	COST ALLOCATION AGREEMENT	$ 70,221.54	$ 70,221.54	$ 70,221.54
$ 315,000.00	$ 192,889.97	$ -	PW PERSONNEL SERVICE AGREEMENT	$ -	$ -	$ -
$ 3,876.35	$ 69,623.84	$ 100,000.00	SIDEWALK / STREET REPAIRS	$ 75,000.00	$ 75,000.00	$ 75,000.00
$ -	$ 14,064.95	$ 20,000.00	SMALL EQUIPMENT / TOOLS	$ 10,000.00	$ 10,000.00	$ 10,000.00
$ 7,208.45	$ 5,878.67	$ 15,000.00	SIGNS	$ 5,000.00	$ 5,000.00	$ 5,000.00
$ -	$ -	$ -	FOOTPATH / BICYCLE TRAILS	$ -	$ -	$ -
$ 583,867.20	**$ 541,848.75**	**$ 479,600.00**	**Total Street/Parks Material & Services**	**$ 418,001.54**	**$ 418,001.54**	**$ 418,001.54**

Actuals FY 2013/2014	Actuals FY 2014/2015	Budgeted FY 2015/2016	PUBLIC WORKS - STREET FUND Account Name	Proposed FY 2016/2017	Approved FY 2016/2017	Adopted FY 2016/2017
$ 134,023.46	$ 716,052.36	$ 557,000.00	CAPITAL IMPROVEMENTS	$ 155,927.00	$ 155,927.00	$ 887,927.00
$ 134,023.46	**$ 716,052.36**	**$ 557,000.00**	**Total Street/Parks Capital**	**$ 155,927.00**	**$ 155,927.00**	**$ 887,927.00**

**Phase 1 Lola Street: $100,927.00
**EQ/Vehicle Purchased (Shared): $15,000.00
**Vactor Payment 4 of 5: $22,000.00
**Shop Building: $750,000.00

Actuals FY 2013/2014	Actuals FY 2014/2015	Budgeted FY 2015/2016	PUBLIC WORKS - STREET FUND Account Name	Proposed FY 2016/2017	Approved FY 2016/2017	Adopted FY 2016/2017
$ -	$ -	$ 100,000.00	OPERATING CONTINGENCY	$ 111,899.00	$ 111,899.00	$ 150,738.46
$ -	**$ -**	**$ 100,000.00**	**Total Street/Parks Contingency Reserve**	**$ 111,899.00**	**$ 111,899.00**	**$ 150,738.46**

Sewer Fund

The Sewer Fund anticipates seeing increases to the Miscellaneous, Monthly User Fee, and Service Connection line items due to community growth, increased sewer rates, and public works fees.

Continuing to move forward into year three of the NPDES Permit, public works proactively looks for opportunities to reduce expenditure requirements while maintaining an aging infrastructure system with increasing inflation and operation costs. Materials and Service expenditures have been included to meet annual permit responsibilities to removal of bio-solids, remove and reduce storm water inflow and infiltration, and manage additional fuel and maintenances for the recycled water program. Additionally, estimated increases for Power, Insurance/Liability/Gen, Cost Allocation, and Professional Services line items have been included to better represent the projected operating expenditures. The FY 2016/17 cost to treat a gallon of raw sewage is $0.31.

Capital Improvement funds have been included for planned collection repairs on coinciding street projects, filter media for improved treatment, and sand and grit removal of the aeration basin. In addition, the funds have been included to update the Wastewater Treatment Facility Plant. The following tables provide a full summary of activity in the sewer fund for both resources and requirements.

Actuals FY 2013/2014	Actuals FY 2014/2015	Budgeted FY 2015/2016	PUBLIC WORKS - SEWER SUMMARY *RESOURCES*	Proposed FY 2016/2017	Approved FY 2016/2017	Adopted FY 2016/2017
$ 610,102.77	$ 624,851.82	$ 403,415.04	*BFB*	$ 343,039.00	$ 343,039.00	$ 475,000.00
$ 1,563,923.60	$ 1,624,714.28	$ 1,602,000.00	*Fees, Licenses, Permits*	$ 2,171,920.00	$ 2,171,920.00	$ 2,171,920.00
$ -	$ 400,000.00	$ 200,000.00	*Transfers In*	$ -	$ -	$ -
$ 2,075.00	$ 4,881.72	$ 2,500.00	*All Other Resources*	$ 5,000.00	$ 5,000.00	$ 5,000.00
$ 2,176,101.37	**$ 2,654,447.82**	**$ 2,207,915.04**	***TOTAL RESOURCES***	**$ 2,519,959.00**	**$ 2,519,959.00**	**$ 2,651,920.00**

Actuals FY 2013/2014	Actuals FY 2014/2015	Budgeted FY 2015/2016	*REQUIREMENTS*	Proposed FY 2016/2017	Approved FY 2016/2017	Adopted FY 2016/2017
$ -	$ -	$ 482,330.00	*Personnel Service*	$ 510,000.00	$ 510,000.00	$ 558,675.00
$ 1,050,950.63	$ 1,986,780.10	$ 1,175,590.04	*Material & Services*	$ 884,832.18	$ 884,832.18	$ 984,832.18
$ 74,798.92	$ 59,514.68	$ 160,500.00	*Capital Improvement*	$ 326,090.00	$ 326,090.00	$ 333,427.00
$ 425,500.00	$ 204,738.00	$ 315,928.56	*Debt Service Transfer*	$ 315,550.00	$ 315,550.00	$ 315,550.00
$ -	$ -	$ -	*Transfer Out*	$ -	$ -	$ 150,000.00
$ -	$ -	$ -	*Contingency*	$ 216,192.00	$ 216,192.00	$ 193,341.00
$ 1,551,249.55	**$ 2,251,032.78**	**$ 2,134,348.60**	***TOTAL REQUIREMENTS***	**$ 2,252,664.18**	**$ 2,252,664.18**	**$ 2,535,825.18**
$ -	$ -	$ 73,566.44	*UEFB*	$ 267,294.82	$ 267,294.82	$ 116,094.82
$ 624,851.82	**$ 403,415.04**	**$ -**	***NET RESOURCES OVER REQUIREMENTS***	**$ -**	**$ -**	**$ 0.00**

Actuals FY 2013/2014	Actuals FY 2014/2015	Budgeted FY 2015/2016	PUBLIC WORKS - SEWER FUND Account Name	Proposed FY 2016/2017	Approved FY 2016/2017	Adopted FY 2016/2017
$ 610,102.77	$ 624,851.82	$ 403,415.04	BEGINNING FUND BALANCE	$ 343,039.00	$ 343,039.00	$ 475,000.00
$ 2,075.00	$ 4,881.72	$ 2,500.00	MISCELLANEOUS	$ 5,000.00	$ 5,000.00	$ 5,000.00
$ -	$ 400,000.00	$ 200,000.00	TRANSFER FROM GENERAL FUND	$ -	$ -	$ -
$ 1,548,923.60	$ 1,600,714.28	$ 1,575,000.00	MONTHLY USER FEE	$ 2,161,920.00	$ 2,161,920.00	$ 2,161,920.00
$ 15,000.00	$ 24,000.00	$ 27,000.00	SERVICE CONNECTIONS	$ 10,000.00	$ 10,000.00	$ 10,000.00
$ 2,176,101.37	**$ 2,654,447.82**	**$ 2,207,915.04**	**Total Sewer Resources**	**$ 2,519,959.00**	**$ 2,519,959.00**	**$ 2,651,920.00**

Actuals FY 2013/2014	Actuals FY 2014/2015	Budgeted FY 2015/2016	PUBLIC WORKS - SEWER FUND Account Name	Proposed FY 2016/2017	Approved FY 2016/2017	Adopted FY 2016/2017
$ -	$ -	$ 32,250.00	PERS	$ 42,000.00	$ 42,000.00	$ 42,000.00
$ -	$ -	$ 7,800.00	SAIF	$ 8,500.00	$ 8,500.00	$ 8,500.00
$ -	$ -	$ 20,500.00	FICA	$ 26,000.00	$ 26,000.00	$ 26,000.00
$ -	$ -	$ 88,500.00	INSURANCE	$ 80,000.00	$ 80,000.00	$ 80,000.00
$ -	$ -	$ 10,000.00	UNEMPLOYMENT LIABILITY	$ 10,000.00	$ 10,000.00	$ 10,000.00
$ -	$ -	$ 25,000.00	PW DIRECTOR	$ 25,500.00	$ 25,500.00	$ 25,500.00
$ -	$ -	$ -	CITY ENGINEER	$ -	$ -	$ 21,675.00
$ -	$ -	$ 69,000.00	PLANT OPERATOR	$ 71,000.00	$ 71,000.00	$ 71,000.00
$ -	$ -	$ 60,480.00	ASST. PLANT OPERATOR	$ 65,000.00	$ 65,000.00	$ 65,000.00
$ -	$ -	$ 15,500.00	CREW - FOREMAN	$ 23,500.00	$ 23,500.00	$ 23,500.00
$ -	$ -	$ 17,000.00	GIS MAPPING TECHNICIAN	$ -	$ -	$ -
$ -	$ -	$ 67,000.00	CREW - SEWER	$ 79,000.00	$ 79,000.00	$ 79,000.00
$ -	$ -	$ 20,000.00	CREW - SEASONAL	$ 20,000.00	$ 20,000.00	$ 20,000.00
$ -	$ -	$ 14,300.00	UTILITY BILLING CLERK	$ 29,500.00	$ 29,500.00	$ 29,500.00
$ -	$ -	$ -	CODE ENFORCEMENT	$ -	$ -	$ 12,000.00
$ -	$ -	$ 25,000.00	OVERTIME	$ 20,000.00	$ 20,000.00	$ 20,000.00
$ -	$ -	$ 10,000.00	ACCRUED PAYROLL LIABILITY	$ 10,000.00	$ 10,000.00	$ 25,000.00
$ -	**$ -**	**$ 482,330.00**	**Total Sewer Personnel Service**	**$ 510,000.00**	**$ 510,000.00**	**$ 558,675.00**

Actuals FY 2013/2014	Actuals FY 2014/2015	Budgeted FY 2015/2016	PUBLIC WORKS - SEWER FUND Account Name	Proposed FY 2016/2017	Approved FY 2016/2017	Adopted FY 2016/2017
$ 148,575.28	$ 140,307.38	$ 160,000.00	POWER	$ 164,800.00	$ 164,800.00	$ 164,800.00
$ 3,963.97	$ 7,491.00	$ 7,500.00	PHONE	$ 9,500.00	$ 9,500.00	$ 9,500.00
$ 1,688.56	$ 1,668.05	$ 2,000.00	NATURAL GAS	$ 2,000.00	$ 2,000.00	$ 2,000.00
$ 63,746.04	$ 94,692.62	$ 100,000.00	OPERATIONS & MAINTENANCE	$ 80,000.00	$ 80,000.00	$ 80,000.00
$ 9,191.47	$ 16,542.66	$ 10,000.00	BUILDING MAINTENANCE	$ 15,000.00	$ 15,000.00	$ 15,000.00
$ -	$ -	$ 4,000.00	TRANING & CONF. TRAVEL	$ 2,000.00	$ 2,000.00	$ 2,000.00
$ 3,500.00	$ 2,775.50	$ 2,750.00	DUES & MEMBERSHIP	$ 2,000.00	$ 2,000.00	$ 2,000.00

$ 5,630.42	$ 6,419.08	$ 6,000.00	POSTAGE	$ 6,000.00	$ 6,000.00	$ 6,000.00
$ -	$ -	$ 5,000.00	COMPUTER HARDWARE & SOFTWARE	$ 5,000.00	$ 5,000.00	$ 5,000.00
$ 3,856.21	$ 6,656.42	$ 9,000.00	COMPUTER NETWORK	$ 8,200.00	$ 8,200.00	$ 8,200.00
$ 7,436.88	$ 699,742.90	$ 286,740.04	PROFESSIONAL SERVICES	$ 100,000.00	$ 100,000.00	$ 200,000.00
$ 15,417.30	$ 18,717.81	$ 22,000.00	INSURANCE/LIABILITY/GEN	$ 28,000.00	$ 28,000.00	$ 28,000.00
$ 10,121.19	$ 9,135.88	$ 14,000.00	VEHICLE FUEL	$ 11,000.00	$ 11,000.00	$ 11,000.00
$ 1,837.49	$ 8,551.41	$ 7,500.00	VEHICLE REPAIR	$ 4,000.00	$ 4,000.00	$ 4,000.00
$ -	$ 9,788.98	$ 19,600.00	IRRIGATION FUEL	$ 11,000.00	$ 11,000.00	$ 11,000.00
$ 12,093.46	$ 7,198.64	$ 4,500.00	UNIFORMS & SAFETY GEAR	$ 4,500.00	$ 4,500.00	$ 4,500.00
$ -	$ 84,000.00	$ -	LITIGATION PAYOUT	$ -	$ -	$ -
$ 95,270.41	$ 109,005.49	$ 150,000.00	COST ALLOCATION AGREEMENT	$ 116,832.18	$ 116,832.18	$ 116,832.18
$ 420,000.00	$ 499,049.13	$ -	PW PERSONNEL SERVICE AGREEMENT	$ -	$ -	$ -
$ -	$ 44,270.26	$ 50,000.00	BIOSOLIDS REMOVAL	$ 50,000.00	$ 50,000.00	$ 50,000.00
$ -	$ 1,257.00	$ 5,000.00	EFFLUENT MONITORING	$ 10,000.00	$ 10,000.00	$ 10,000.00
$ -	$ 43,991.80	$ 130,000.00	INFLOW & INFILTRATION	$ 75,000.00	$ 75,000.00	$ 75,000.00
$ 171,175.76	$ 175,518.09	$ 180,000.00	CHLORINE & CHEMICALS	$ 180,000.00	$ 180,000.00	$ 180,000.00
$ 77,446.19	$ -	$ -	LICENSE FEE	$ -	$ -	$ -
$ 1,050,950.63	**$ 1,986,780.10**	**$ 1,175,590.04**	**Total Sewer Material & Services**	**$ 884,832.18**	**$ 884,832.18**	**$ 984,832.18**

Actuals FY 2013/2014	Actuals FY 2014/2015	Budgeted FY 2015/2016	PUBLIC WORKS - SEWER FUND Account Name	Proposed FY 2016/2017	Approved FY 2016/2017	Adopted FY 2016/2017
$ 35,541.97	$ 59,514.68	$ 160,500.00	CAPITAL IMPROVEMENTS	$ 326,090.00	$ 326,090.00	$ 333,427.00
$ 39,256.95	$ -	$ -	SEWER EQUIPMENT	$ -	$ -	$ -
$ 74,798.92	**$ 59,514.68**	**$ 160,500.00**		**$ 326,090.00**	**$ 326,090.00**	**$ 333,427.00**

**Effluent Pump House HVAC: $15,000.00 **Phase 1 Lola Street: $100927.00
**Master Plan Update: $115,000.00 **Vactor 4 of 5: $22500.00
**Gravity Filter Media: $30,000.00 **EQ/Vehicle Purchased (Shared): $15,000.00
**Molalla Avenue Sewer Line Repair: $25,000.00 **Aeration Basin: $10,000.00

Actuals FY 2013/2014	Actuals FY 2014/2015	Budgeted FY 2015/2016	PUBLIC WORKS - SEWER FUND Account Name	Proposed FY 2016/2017	Approved FY 2016/2017	Adopted FY 2016/2017
$ -	$ -	$ -	TRANSFER TO STREET FUND	$ -	$ -	$ 150,000.00
$ 250,500.00	$ 174,000.00	$ 315,928.56	TRANSFER TO SEWER DEBT	$ 315,550.00	$ 315,550.00	$ 315,550.00
$ 175,000.00	$ 30,738.00	$ -	TRANSFER TO CWSRF	$ -	$ -	$ -
$ 425,500.00	**$ 204,738.00**	**$ 315,928.56**	**Total Sewer Transfers Out**	**$ 315,550.00**	**$ 315,550.00**	**$ 465,550.00**

Actuals FY 2013/2014	Actuals FY 2014/2015	Budgeted FY 2015/2016	PUBLIC WORKS - SEWER FUND Account Name	Proposed FY 2016/2017	Approved FY 2016/2017	Adopted FY 2016/2017
$ -	$ -	$ -	CONTINGENCY	$ 216,192.00	$ 216,192.00	$ 193,341.00
$ -	**$ -**	**$ -**	**Total Sewer Contingency/Reserve**	**$ 216,192.00**	**$ 216,192.00**	**$ 193,341.00**

Water Fund

The Water Fund anticipates notable increases to Monthly User Fee and Service Connection line items due to increased utility rates and community growth. Utility rates were last increased in 2009. The FY 2016/2017 fiscal year cost to treat a gallon of drinking water delivered to your faucet cost is $0.33. The average liter bottle of water purchased by consumers on a daily basis is $1.49. The City is providing clean, quality water and delivering it to the consumer at a lower cost than any other local source of this resource. This is all done while maintaining the water plant and the distribution system. The urban legend that the City of Molalla water is the most expensive in the State is completely false. In a study done in 2015, the City of Molalla was a mid-range rate charger with many of the cities below us currently undergoing a rate increase.

During this budget process, management and City Council are in the process of reviewing and adjusting the water usage and base rates. Any adjustment made after the budget process will result in revenue needing to be recognized through a supplemental budget process and then allocated as needed. If management is preparing for a larger scale project in future fiscal years, the unrecognized revenue will

FY 2018

ADOPTED BUDGET

CITY OF MOLALLA AND
MOLALLA URBAN RENEWAL AGENCY

SEWER FUND SUMMARY

Actuals FY 2014/2015	Actuals FY 2015/2016	Budgeted FY 2016/2017	PUBLIC WORKS - SEWER SUMMARY *RESOURCES*	Proposed FY 2017/2018	Approved FY 2017/2018	Adopted FY 2017/2018
$ 624,851.82	$ 403,415.04	$ 475,000.00	*BFB*	$ 380,021.00	$ 380,021.00	$ 380,021.00
$ 1,624,714.28	$ 1,891,277.17	$ 2,171,920.00	*Fees, Licenses, Permits*	$ 2,106,000.00	$ 2,106,000.00	$ 2,106,000.00
$ 400,000.00	$ 200,000.00	$ -	*Transfers In*	$ -	$ -	$ -
$ 4,881.72	$ 27,971.68	$ 5,000.00	*All Other Resources*	$ 27,000.00	$ 27,000.00	$ 27,000.00
$ 2,654,447.82	$ 2,522,663.89	$ 2,651,920.00	*TOTAL RESOURCES*	$ 2,513,021.00	$ 2,513,021.00	$ 2,513,021.00
			REQUIREMENTS			
$ 1.00	$ 457,591.74	$ 558,675.00	*Personnel Service*	$ 588,575.00	$ 588,575.00	$ 588,575.00
$ 1,986,780.10	$ 1,128,892.50	$ 984,832.18	*Material & Services - Maintenance*	$ 679,919.00	$ 679,919.00	$ 679,919.00
$ -	$ -	$ -	*Material & Services - Operations*	$ 336,200.00	$ 336,200.00	$ 336,200.00
$ 59,514.68	$ 164,125.96	$ 333,427.00	*Capital Improvements*	$ 66,652.00	$ 66,652.00	$ 66,652.00
$ 204,738.00	$ 315,928.56	$ 465,550.00	*Transfers Out*	$ 626,435.00	$ 626,435.00	$ 626,435.00
$ -	$ -	$ 193,341.00	*Contingency*	$ 215,240.00	$ 215,240.00	$ 215,240.00
$ 2,251,033.78	$ 2,066,538.76	$ 2,535,825.18	*TOTAL REQUIREMENTS*	$ 2,513,021.00	$ 2,513,021.00	$ 2,513,021.00
$ -	$ -	$ 116,094.82	*UEFB*	$ -	$ -	$ -
$ 403,414.04	$ 456,125.13	$ 0.00	*NET RESOURCES OVER REQUIREMENTS*	$ -	$ -	$ -

SEWER FUND LINE ITEM DETAIL

Actuals FY 2014/2015	Actuals FY 2015/2016	Budgeted FY 2016/2017	PUBLIC WORKS - SEWER FUND Account Name	Proposed FY 2017/2018	Approved FY 2017/2018	Adopted FY 2017/2018
$ 624,851.82	$ 403,415.04	$ 475,000.00	BEGINNING FUND BALANCE	$ 380,021.00	$ 380,021.00	$ 380,021.00
$ 4,881.72	$ 27,971.68	$ 5,000.00	MISCELLANEOUS	$ 2,000.00	$ 2,000.00	$ 2,000.00
$ -	$ -	$ -	WASTEWATER DECREE ALLOCATION	$ 25,000.00	$ 25,000.00	$ 25,000.00
$ 400,000.00	$ 200,000.00	$ -	TRANSFER FROM GENERAL FUND	$ -	$ -	$ -
$ 1,600,714.28	$ 1,855,877.17	$ 2,161,920.00	MONTHLY USER FEE	$ 2,100,000.00	$ 2,100,000.00	$ 2,100,000.00
$ 24,000.00	$ 35,400.00	$ 10,000.00	SERVICE CONNECTIONS	$ 6,000.00	$ 6,000.00	$ 6,000.00
$ 2,654,447.82	**$ 2,522,663.89**	**$ 2,651,920.00**	**Total Sewer Resources**	**$ 2,513,021.00**	**$ 2,513,021.00**	**$ 2,513,021.00**

Actuals FY 2014/2015	Actuals FY 2015/2016	Budgeted FY 2016/2017	PUBLIC WORKS - SEWER FUND Account Name	Proposed FY 2017/2018	Approved FY 2017/2018	Adopted FY 2017/2018
$ -	$ 40,841.94	$ 42,000.00	PERS	$ 56,525.00	$ 56,525.00	$ 56,525.00
$ -	$ 7,013.76	$ 8,500.00	SAIF	$ 12,350.00	$ 12,350.00	$ 12,350.00
$ -	$ 23,391.45	$ 26,000.00	FICA	$ 27,650.00	$ 27,650.00	$ 27,650.00
$ -	$ 68,138.51	$ 80,000.00	INSURANCE	$ 92,250.00	$ 92,250.00	$ 92,250.00
$ -	$ 12,740.25	$ 10,000.00	UNEMPLOYMENT LIABILITY	$ -	$ -	$ -
$ -	$ 27,180.37	$ 25,500.00	PW DIRECTOR	$ 28,000.00	$ 28,000.00	$ 28,000.00
$ -	$ -	$ 21,675.00	CITY ENGINEER	$ -	$ -	$ -
$ -	$ -	$ -	SENIOR ENGINEERING TECH	$ 20,700.00	$ 20,700.00	$ 20,700.00
$ 1.00	$ -	$ -	PW OPERATIONS SUPERVISOR	$ 15,500.00	$ 15,500.00	$ 15,500.00
$ -	$ 62,679.50	$ 71,000.00	PLANT OPERATOR	$ 72,000.00	$ 72,000.00	$ 72,000.00
$ -	$ 70,842.60	$ 65,000.00	ASST. PLANT OPERATOR	$ 67,000.00	$ 67,000.00	$ 67,000.00
$ -	$ -	$ 12,000.00	CODE ENFORCEMENT	$ -	$ -	$ -
$ -	$ 20,811.28	$ 23,500.00	CREW - FOREMAN	$ 20,850.00	$ 20,850.00	$ 20,850.00
$ -	$ 4,207.50	$ -	GIS MAPPING TECHNICIAN	$ 17,200.00	$ 17,200.00	$ 17,200.00
$ -	$ 70,028.17	$ 79,000.00	CREW - SEWER	$ 95,200.00	$ 95,200.00	$ 95,200.00
$ -	$ 21,500.38	$ 20,000.00	CREW - SEASONAL	$ 20,000.00	$ 20,000.00	$ 20,000.00
$ -	$ 16,330.61	$ 29,500.00	UTILITY BILLING CLERK	$ 21,600.00	$ 21,600.00	$ 21,600.00
$ -	$ -	$ -	EXEC ADMINISTRATIVE ASSISTANT	$ 6,750.00	$ 6,750.00	$ 6,750.00
$ -	$ 11,885.42	$ 20,000.00	OVERTIME	$ 15,000.00	$ 15,000.00	$ 15,000.00
$ -	$ -	$ 25,000.00	ACCRUED PAYROLL LIABILITY	$ -	$ -	$ -
$ 1.00	**$ 457,591.74**	**$ 558,675.00**	**Total Sewer Personnel Service**	**$ 588,575.00**	**$ 588,575.00**	**$ 588,575.00**

Actuals FY 2014/2015	Actuals FY 2015/2016	Budgeted FY 2016/2017	PUBLIC WORKS - SEWER FUND Account Name	Proposed FY 2017/2018	Approved FY 2017/2018	Adopted FY 2017/2018
$ -	$ -	$ 193,341.00	CONTINGENCY	$ 215,240.00	$ 215,240.00	$ 215,240.00
$ -	**$ -**	**$ 193,341.00**	**Total Sewer Contingency/Reserve**	**$ 215,240.00**	**$ 215,240.00**	**$ 215,240.00**

Actuals FY 2014/2015	Actuals FY 2015/2016	Budgeted FY 2016/2017	PUBLIC WORKS - SEWER FUND Account Name	Proposed FY 2017/2018	Approved FY 2017/2018	Adopted FY 2017/2018
$ 140,307.38	$ 149,224.51	$ 164,800.00	POWER	$ 160,000.00	$ 160,000.00	$ 160,000.00
$ 7,491.00	$ 8,330.52	$ 9,500.00	PHONE	$ 9,500.00	$ 9,500.00	$ 9,500.00
$ 1,668.05	$ 1,764.09	$ 2,000.00	NATURAL GAS	$ 2,000.00	$ 2,000.00	$ 2,000.00
$ 94,692.62	$ 116,917.47	$ 80,000.00	OPERATIONS & MAINTENANCE	$ 23,485.00	$ 23,485.00	$ 23,485.00
$ 16,542.66	$ 27,881.12	$ 15,000.00	BUILDING MAINTENANCE	$ 7,500.00	$ 7,500.00	$ 7,500.00
$ -	$ 1,039.72	$ 2,000.00	TRANING & CONF. TRAVEL	$ 2,725.00	$ 2,725.00	$ 2,725.00
$ 2,775.50	$ 3,365.67	$ 2,000.00	DUES & MEMBERSHIP	$ 1,660.00	$ 1,660.00	$ 1,660.00
$ 6,419.08	$ 5,785.92	$ 6,000.00	POSTAGE	$ 7,000.00	$ 7,000.00	$ 7,000.00
$ -	$ -	$ 5,000.00	COMPUTER HARDWARE & SOFTWARE	$ -	$ -	$ -
$ 6,656.42	$ 6,352.53	$ 8,200.00	COMPUTER NETWORK	$ 13,920.00	$ 13,920.00	$ 13,920.00
$ 699,742.90	$ 346,339.68	$ 200,000.00	PROFESSIONAL SERVICES	$ 52,650.00	$ 52,650.00	$ 52,650.00
$ -	$ -	$ -	LEGAL & RECORDING	$ 100,000.00	$ 100,000.00	$ 100,000.00
$ 18,717.81	$ 23,448.95	$ 28,000.00	INSURANCE/LIABILITY/GEN	$ 39,600.00	$ 39,600.00	$ 39,600.00
$ 9,135.88	$ 1,378.88	$ 11,000.00	VEHICLE FUEL	$ 2,500.00	$ 2,500.00	$ 2,500.00
$ 8,551.41	$ 4,110.65	$ 4,000.00	VEHICLE REPAIR	$ 21,000.00	$ 21,000.00	$ 21,000.00
$ 9,788.98	$ 11,295.57	$ 11,000.00	IRRIGATION FUEL	$ -	$ -	$ -
$ 7,198.64	$ 4,544.90	$ 4,500.00	UNIFORMS & SAFETY GEAR	$ 3,795.00	$ 3,795.00	$ 3,795.00
$ 84,000.00	$ -	$ -	LITIGATION PAYOUT	$ -	$ -	$ -
$ 109,005.49	$ 130,413.78	$ 116,832.18	COST ALLOCATION AGREEMENT	$ 113,884.00	$ 113,884.00	$ 113,884.00
$ 499,049.13	$ -	$ -	PW PERSONNEL SERVICE AGREEMENT	$ -	$ -	$ -
$ 44,270.26	$ 45,487.50	$ 50,000.00	BIOSOLIDS REMOVAL	$ -	$ -	$ -
$ 1,257.00	$ 10,340.00	$ 10,000.00	EFFLUENT MONITORING	$ -	$ -	$ -
$ 43,991.80	$ 56,064.53	$ 75,000.00	INFLOW & INFILTRATION	$ 75,000.00	$ 75,000.00	$ 75,000.00
$ 175,518.09	$ 174,806.51	$ 180,000.00	CHLORINE & CHEMICALS	$ -	$ -	$ -
$ -	$ -	$ -	SEWER LINE REPAIR	$ 15,000.00	$ 15,000.00	$ 15,000.00
$ -	$ -	$ -	NEW WATER CONNECTIONS	$ 5,000.00	$ 5,000.00	$ 5,000.00
$ -	$ -	$ -	PERMITS	$ 1,000.00	$ 1,000.00	$ 1,000.00
$ -	$ -	$ -	SMALL EQUIP/TOOLS	$ 2,700.00	$ 2,700.00	$ 2,700.00
$ -	$ -	$ -	LIFT STATION MAINT	$ 20,000.00	$ 20,000.00	$ 20,000.00
$ 1,986,780.10	**$ 1,128,892.50**	**$ 984,832.18**	**Total Sewer Maint. Material & Services**	**$ 679,919.00**	**$ 679,919.00**	**$ 679,919.00**

Actuals FY 2014/2015	Actuals FY 2015/2016	Budgeted FY 2016/2017	PUBLIC WORKS - SEWER FUND Account Name	Proposed FY 2017/2018	Approved FY 2017/2018	Adopted FY 2017/2018
$ -	$ -	$ -	OPERATIONS & MAINTENANCE	$ 70,000.00	$ 70,000.00	$ 70,000.00
$ -	$ -	$ -	BUILDING MAINTENANCE	$ 10,000.00	$ 10,000.00	$ 10,000.00
$ -	$ -	$ -	TRANING & CONF. TRAVEL	$ 700.00	$ 700.00	$ 700.00
$ -	$ -	$ -	DUES & MEMBERSHIP	$ 1,000.00	$ 1,000.00	$ 1,000.00
$ -	$ -	$ -	VEHICLE FUEL	$ 2,500.00	$ 2,500.00	$ 2,500.00
$ -	$ -	$ -	VEHICLE REPAIR	$ 2,000.00	$ 2,000.00	$ 2,000.00
$ -	$ -	$ -	IRRIGATION FUEL	$ 11,000.00	$ 11,000.00	$ 11,000.00
$ -	$ -	$ -	UNIFORMS & SAFETY GEAR	$ 2,000.00	$ 2,000.00	$ 2,000.00
$ -	$ -	$ -	BIOSOLIDS REMOVAL	$ 40,000.00	$ 40,000.00	$ 40,000.00
$ -	$ -	$ -	EFFLUENT MONITORING	$ 8,000.00	$ 8,000.00	$ 8,000.00
$ -	$ -	$ -	CHLORINE & CHEMICALS	$ 180,000.00	$ 180,000.00	$ 180,000.00
$ -	$ -	$ -	PERMITS	$ 9,000.00	$ 9,000.00	$ 9,000.00
$ -	**$ -**	**$ -**	**Total Sewer Operation Material & Service**	**$ 336,200.00**	**$ 336,200.00**	**$ 336,200.00**

Actuals FY 2014/2015	Actuals FY 2015/2016	Budgeted FY 2016/2017	PUBLIC WORKS - SEWER FUND Account Name	Proposed FY 2017/2018	Approved FY 2017/2018	Adopted FY 2017/2018
$ 59,514.68	$ 164,125.96	$ 333,427.00	CAPITAL IMPROVEMENTS	$ 66,652.00	$ 66,652.00	$ 66,652.00
$ 59,514.68	**$ 164,125.96**	**$ 333,427.00**	**Total Sewer Capital Improvement**	**$ 66,652.00**	**$ 66,652.00**	**$ 66,652.00**

Actuals FY 2014/2015	Actuals FY 2015/2016	Budgeted FY 2016/2017	PUBLIC WORKS - SEWER FUND Account Name	Proposed FY 2017/2018	Approved FY 2017/2018	Adopted FY 2017/2018
$ 174,000.00	$ 315,928.56	$ 315,550.00	TRANSFER TO SEWER DEBT	$ 316,350.00	$ 316,350.00	$ 316,350.00
$ -	$ -	$ 150,000.00	TRANSFER TO SHOP CAP. PROJECT	$ -	$ -	$ -
$ -	$ -	$ -	TRANSFER TO CAPITAL PROJECT F	$ 228,000.00	$ 228,000.00	$ 228,000.00
$ -	$ -	$ -	TRANSFER TO FLEET REPLACE FUND	$ 25,000.00	$ 25,000.00	$ 25,000.00
$ 30,738.00	$ -	$ -	TRANSFER TO CWSRF	$ 57,085.00	$ 57,085.00	$ 57,085.00
$ 204,738.00	**$ 315,928.56**	**$ 465,550.00**	**Total Sewer Transfers Out**	**$ 626,435.00**	**$ 626,435.00**	**$ 626,435.00**

Presented by:

DONOVAN
enterprises, inc.

July

2017

Utilities Rate Study

Final Report

Prepared for:

Molalla
Oregon

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Analysis of Water Demand

An analysis of actual water sales in fiscal 2015-16 was undertaken to understand overall system demands, and to specifically identify who is buying water and when they buy that water. In fiscal 2015-16, 77% of all water was sold to the single family residential customer class. The balance, 23% was sold to commercial, master metered multi-family, industrial, and institutional customers. From a peak day demand perspective, the residential class had a peak day factor (i.e., peak day demand divided by average day demand) 1.87 compared to a peak day factor for the commercial/industrial class of 1.69. Intuitively, this makes sense since peaking demand for water occurs in the hot summer months when irrigation demand is at its highest. The largest users of irrigation water in the City are single family residential customers. The water sales data for fiscal 2015-16 is contained in Table 5.

Table 5 - Molalla Water Sales Volumes in Fiscal 2015-16

Classification	Commercial/Industrial			Residential			Bulk CF	Total CF
	Total CF	Inside CF	Outside CF	Total CF	Inside CF	Outside CF		
July-15	1,019,929	990,159	29,770	4,109,614	4,045,478	64,136	4,509	5,134,052
August-15	1,379,871	1,360,013	19,858	5,121,849	5,044,476	77,373	4,859	6,506,579
September-15	993,256	975,294	17,962	2,597,701	2,556,685	41,016	3,217	3,594,174
October-15	685,984	664,769	21,215	2,416,380	2,378,684	37,696	2,498	3,104,862
November-15	551,017	523,799	27,218	1,891,108	1,857,279	33,829	2,365	2,444,490
December-15	(5,842)	2,782	(8,624)	22,196	20,512	1,684	-	16,354
January-16	1,037,295	992,166	45,129	3,876,402	3,805,060	71,342	6,900	4,920,597
February-16	498,178	486,377	11,801	1,890,491	1,848,960	41,531	6,011	2,394,680
March-16	551,501	524,521	26,980	2,063,314	2,023,537	39,777	5,114	2,619,929
April-16	493,379	480,050	13,329	1,925,695	1,893,350	32,345	3,035	2,422,109
May-16	1,369,689	1,341,431	28,258	3,267,772	3,040,594	227,178	2,417	4,639,878
June-16	1,050,804	999,019	51,785	3,329,364	3,271,659	57,705	2,741	4,382,909
Total	9,625,061	9,340,380	284,681	32,511,886	31,786,274	725,612	43,666	42,180,613
Average Month	802,088	778,365	23,723	2,709,324	2,648,856	60,468	3,639	3,515,051
Peak Month - Volume	1,379,871	1,360,013	51,785	5,121,849	5,044,476	227,178	6,900	6,506,579
Peak Month	Aug-15	Aug-15	Jun-16	Aug-15	Aug-15	May-16	Jan-16	Aug-15
Peak Month Factor	1.7203	1.7473	2.1829	1.8905	1.9044	3.7570	1.8962	1.8511
Average Day	26,370	25,590	780	89,074	87,086	1,988	120	115,563
Peak Day	44,512	43,871	1,726.17	165,221	162,725	7,328	223	209,890
Peak Day Factor	1.6880	1.7144	2.2132	1.8549	1.8686	3.6863	1.8605	1.8162

Existing and Projected Water Rates

The City's current water rate structure was last reviewed in 2010. A number of rate increases have been implemented by the Council since that time, but the basic water rate methodology has remained intact. Billings for customers include two components: a fixed rate (demand charge) and a volume rate (commodity charge). The two components are added together to compute an invoice for each customer. The fixed rates are based on costs associated with maintaining/reading meters and the costs associated with billing and are charged per connection to the water system. Volume rates are based on the customer class for each 100 cubic feet (ccf) of water. The last rate adjustments were made by the City Council via Resolution no. 2016-08 (dated May 25, 2016) with an implementation date of July 1, 2017. The current and projected schedule of water rates and charges is shown below in Table 4.

Table 6 - Schedule of Current and Projected Molalla Water Rates

Water Rate Component	Effective on July 1					
	2017	2018	2019	2020	2021	2022
Monthly base rate - $/Account	$ 13.07	$ 13.44	$ 13.80	$ 14.18	$ 14.57	$ 15.05
Volume charge - $/Ccf	$ 2.87	$ 2.95	$ 3.03	$ 3.11	$ 3.20	$ 3.31

Rate Design Alternatives

The City's current water rate methodology is sound, conforms to industry practice, and promotes conservation. We see no reason to move off of this methodology.

Analysis of Wastewater System Revenue Requirements

For the budget year (fiscal 2018), it is forecast that the wastewater utility will generate sufficient revenues from rates, charges and fees to meet its obligations and produce an unappropriated ending balance in the Wastewater Operating Fund of $215,240. The beginning balance for this same fiscal year is estimated to be $380,021. This level of operating reserve represents 35 days of wastewater system operating expenses and is below our recommended level of sixty (60) days of operating expenses. The strategy for the wastewater utility is to gradually raise the fund balance (via annual rate increases) up to the recommended reserve level by the end of the five year forecast horizon.

For the forecast of revenue requirements, the following assumptions were made based on discussions with City staff:

Inflation in costs and growth in the customer base – Per guidance from City staff, the following factors were applied for estimating future cost escalation:

- All direct labor line items – 3.0% per year
- Pension plan contributions (City cost) – 8.0% per year
- Health insurance premiums (City cost) – 6.0% per year
- Professional services (including contract services) – 3.0% per year
- All other operating expense line items – 3.0% per year
- The growth forecast expressed in the annual increase in Equivalent Dwelling Units (EDUs) is estimated to be 1.0% per year over the five (5) year forecast horizon.

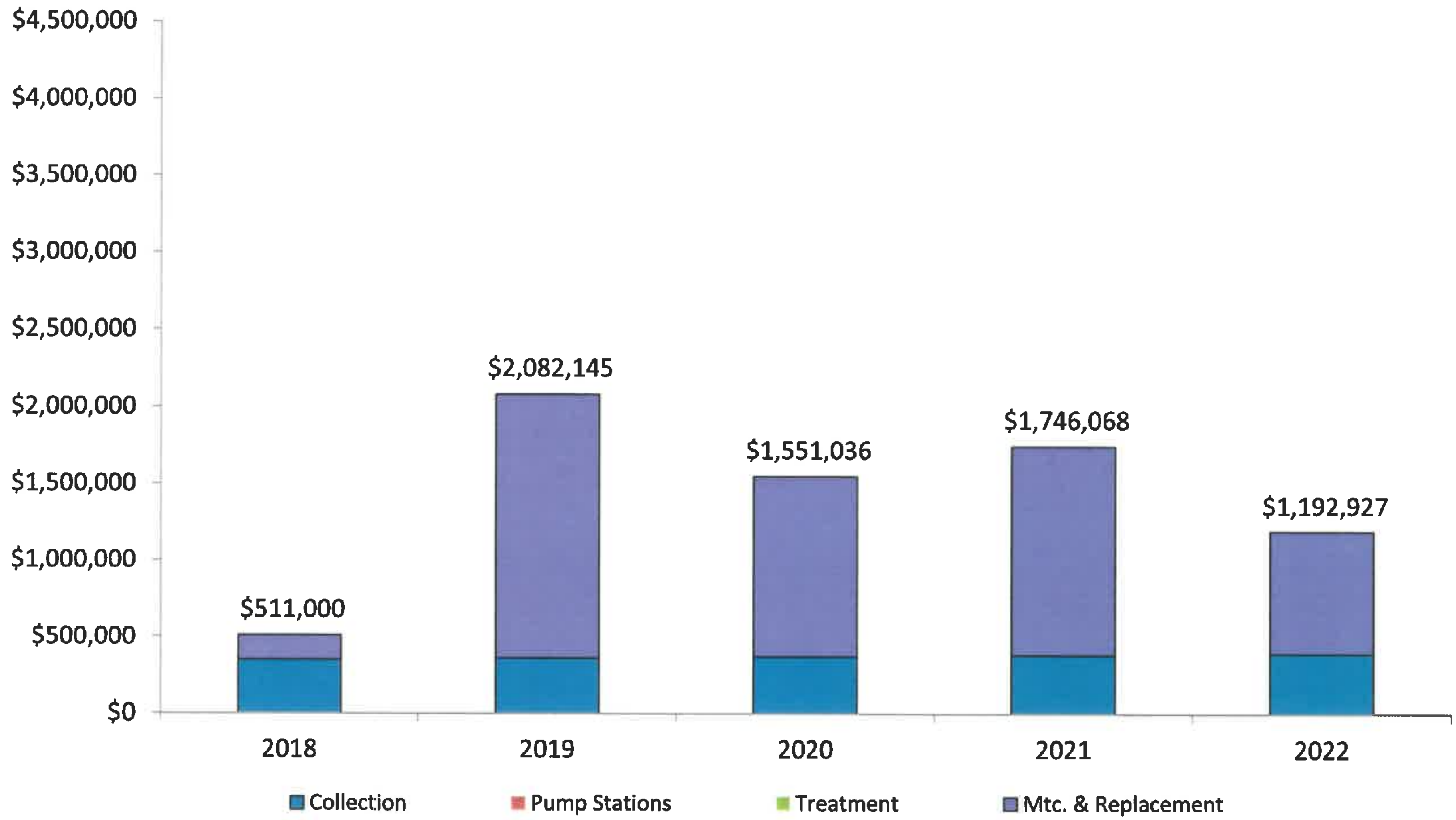
Capital Improvement Plan Funding In the upcoming budget year 2018, total wastewater system capital improvement costs are estimated to be $511,000. All of the projects are related to the wastewater treatment and collection system, and consist of the following projects:

Project Description	Cost
Wastewater master plan	$200,000
City Shops improvements	137,000
WWTP – Rebuild & add new headworks screen	121,000
WWTP – Headworks gantry crane	3,000
WWTP – Spare parts inventory	50,000
Total	$511,000

It is assumed all project costs will be funded with cash on hand or cash that is generated from wastewater rates, and is accounted for in the revenue requirements calculations. We have not budgeted for any costs in the other minor capital line items.

Over the next twenty years, the City plans on investing $29,561,772 (2016 dollars) in the wastewater system, the preponderance of which will be spent on collection system repair, replacement, and expansion. The first five years of investments amounts to $7,083,176, and is also shown graphically in Figure 3.

Figure 3 - Forecast of Wastewater Capital Expenditures



Under this initial wastewater system financial plan, it is assumed that all of the capital improvement costs are to be funded from a mix of new debt, wastewater SDCs, and free cash flow generated in the wastewater operating fund. The water CIP funding plan is shown below in Table 7.

Table 7 - Forecast of Future Wastewater System Capital Financing Plan

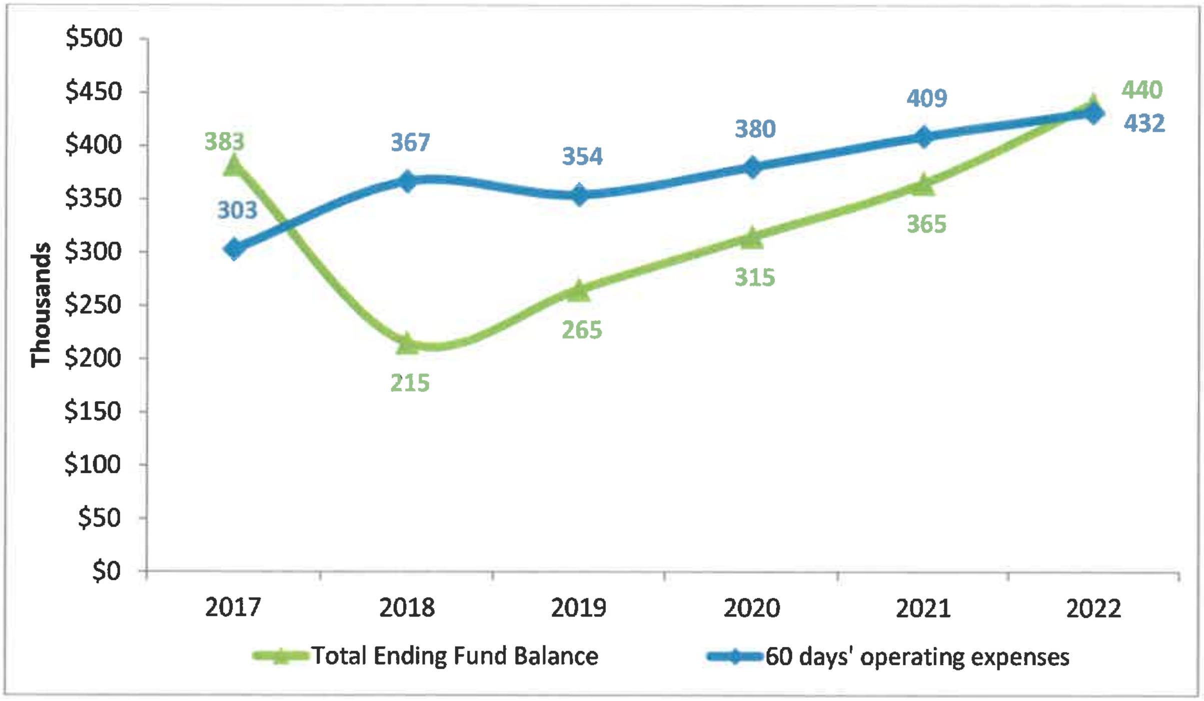
Capital Improvements Financing	2018	2019	2020	2021	2022
Capital Costs to be Funded	511,000	2,082,145	1,551,036	1,746,068	1,192,927
less: Contributions from SDCs	283,000	563,350	-	-	-
less: Contributions From Construction Fund bal	-	-	-	-	-
less: Contributions From Utility Rates	228,000	-	-	-	-
less: Developer Contributions	-	-	-	-	-
Amount to be Financed	-	1,518,795	1,551,036	1,746,068	1,192,927
Long-term Borrowing:					
Revenue Bonds:					
Amount Borrowed	-	1,640,428	1,675,251	1,885,903	1,288,463
less: Financing Cost	-	16,404	16,753	18,859	12,885
less: Reserve Funding	-	105,229	107,463	120,975	82,651
less: Refunding of BANs	-	-	-	-	-
Net Funds from Revenue Bonds	-	1,518,795	1,551,036	1,746,068	1,192,927
New Annual Debt Service:					
Debt Service	-	105,229	212,691	333,667	416,318

As in the case of the water financial forecast, it should be noted, the City is budgeting for total wastewater rate revenues of $2,100,000 for fiscal 2017-18. This level of ongoing cash flow in combination with future debt proceeds, fund balances in the water SDC and operating funds is sufficient to make the water capital funding plan work.

Operating Costs in Excess of Inflation – As in the case of water, we have not identified any categories in this analysis. Also, we have not planned or budgeted for any additional labor. If the wastewater utility does add staff, these costs will impact the current revenue requirements forecast.

Modeling for Contingencies, Reserves, and Ending Fund Balances – As discussed above, the Wastewater Operating Fund is expected to end fiscal 2017-18 with an unappropriated ending fund balance of $215,240; not enough to meet our minimum operating reserve requirements. Our forecast assumes the City will be raising rates to fund all future wastewater system obligations and generate additional cash to increase the ending fund balance in the wastewater fund to meet the minimum operating reserve requirement by the end of fiscal 2021-22. The forecast of targeted wastewater operating fund balances and operating reserve requirements is shown below in Figure 4.

Figure 4 - Forecast of Wastewater Operating Fund Balances and Operating Reserve Requirements



Revenue Requirements Forecast & Results

All of the above cost elements are contained in the revenue requirements model and from this, the "base case" forecast was developed. The base case assumes the utility would fund the operating costs as adjusted for inflation. This base case resulted in the following forecast of wastewater system revenue requirements (Table 8).

Table 8 – Base Case Forecast of Wastewater System Revenue Requirements

	Budget	Forecast				
	2018	2019	2020	2021	2022	2023
Projection of Cash Flow:						
Revenues:						
Total licenses and permits	-	-	-	-	-	-
Total Service Charges	2,100,000	2,100,000	2,237,762	2,398,246	2,573,861	2,737,861
Total interest earned	-	1,722	2,122	2,522	2,922	3,522
Total other financing sources	-	-	-	-	-	-
Total miscellaneous income	33,000	33,990	35,010	36,060	37,142	38,256
Subtotal gross operating revenues	2,133,000	2,135,712	2,274,894	2,436,828	2,613,925	2,779,639
Operations & Maintenance Expense:						
Total personal services	588,575	611,826	636,167	661,658	688,364	716,354
Total materials and services	1,016,119	1,046,603	1,078,001	1,110,341	1,143,651	1,177,960
Total capital outlay	66,652	68,652	70,711	72,833	75,018	77,268
Transfers to other funds	398,435	496,394	600,499	717,612	795,892	791,011
Total operations and maintenance expense	2,069,781	2,223,474	2,385,378	2,562,443	2,702,925	2,762,593
(Use)/replacement of fund balance	63,219	50,000	50,000	50,000	75,000	100,000
Net Cash	(0)	(137,762)	(160,484)	(175,615)	(164,000)	(82,954)
Net Deficiency/(Surplus)	0	137,762	160,484	175,615	164,000	82,954
Test of Coverage Requirement:						
Gross Revenues:						
Operating revenues	2,133,000	2,135,712	2,274,894	2,436,828	2,613,925	2,779,639
System Development Charges	94,000	95,880	97,798	99,754	101,749	103,784
Total Gross Revenues	2,227,000	2,231,592	2,372,691	2,536,581	2,715,673	2,883,423
Operating Expenses:						
Total personal services	588,575	611,826	636,167	661,658	688,364	716,354
Total materials and services	1,016,119	1,046,603	1,078,001	1,110,341	1,143,651	1,177,960
Transfers to other funds	25,000	25,750	26,523	27,318	28,138	28,982
Transfers to/(from) the rate stabilization account	-	-	-	-	-	-
Total Operating Expenses	1,629,694	1,684,179	1,740,690	1,799,317	1,860,153	1,923,296
Net Revenues	597,306	547,414	632,002	737,265	855,521	960,127
Debt Service	369,050	470,644	573,976	690,294	767,755	762,029
Coverage Recognized	1.62	1.16	1.10	1.07	1.11	1.26
Coverage Required	1.20	1.20	1.20	1.20	1.20	1.20
Net Deficiency/(Surplus)	(154,446)	17,359	56,770	91,088	65,785	(45,692)
Projection of Revenue Sufficiency and Forecasted Rates:						
Maximum Deficiency	0	137,762	160,484	175,615	164,000	82,954
Percent Increase Required Over Current Rate Revenues	0.00%	6.56%	7.17%	7.32%	6.37%	3.03%
Five Year Average Increase in Revenue Requirements		6.09%	6.09%	6.09%	6.09%	6.09%
Revenues Recovered From Existing Rates and Charges:	2,100,000	2,100,000	2,237,762	2,398,246	2,573,861	2,737,861
add: Revenues Recovered From Rate Increase	0	137,762	160,484	175,615	164,000	82,954
Total Revenues Recovered From Rates & Charges after Increase	2,100,000	2,237,762	2,398,246	2,573,861	2,737,861	2,820,815

Table 8 shows, forecasted annual changes in wastewater system revenue requirements average 6.09% per year from fiscal 2018-19 through fiscal 2022-23. On July 1, 2017, the City enacted a 6.48% general rate increase that is accounted for in the budget year 2017-18 budgeted rate revenues.

Allocation of Revenue Requirements to Customer Classes (Cost of Service)

The cost of service analysis is intended to provide the analytical basis for equitably recovering the forecasted revenue requirement from customer classes according to the demand they place on the wastewater system. Consistent with industry practice, the analysis involves a two-step process; first, capital and O&M costs are allocated to the functional categories (service functions) of the wastewater system using operational and system design criteria. Then, based on customer class characteristics derived from historical billing system data (i.e., number of customers and monthly water usage), these functionally allocated costs are distributed to the customer classes.

Cost of service allocations are made for a test year considered representative of the period in which proposed rates are expected to be in effect. Fiscal 2018 has been used as the test year for the cost of service analysis.

Functional Cost Allocations

Capital and operating costs are allocated to the following functional components of the wastewater system. The wastewater functional components and their descriptions are shown in Table 9.

Table 9 - Wastewater System Functional Components

Wastewater Functional Component	Description
Customer Accounts	Costs associated with providing service to customers regardless of the level of wastewater contribution, such as billing and customer service. These costs are typically associated with the number of accounts or customers.
Wastewater Flow (Q)	Costs are associated with conveying and treating customer contributed wastewater flow (volume).
Infiltration & Inflow (I&I)	Costs are associated with conveying and treating I&I of groundwater and stormwater runoff into sanitary sewers.
Strength of Discharge	Costs are associated with treating effluent loadings of biochemical oxygen demand (BOD) and total suspended solids (TSS).

Capital related costs include debt service payments, system reinvestment funding, and a portion of additions/uses of cash reserves. The most common method of assigning the capital portion of the revenue requirement to functional components is to allocate such costs on the basis of existing plant-in-service. The allocation of historical plant assets utilizes documented engineering and planning criteria from both the City and industry standards.

Operating costs include O&M expenses and a portion of additions/uses of cash reserves. These costs are allocated to the functions based on a detailed review of line item categories, generally following the cost causation process used in the allocation of plant. For example, customer billing related costs are assigned to the customer component; system operating costs for collection and treatment are allocated in the same manner as collection and treatment plant costs; other operational costs are assigned in proportion to total plant; and general and administrative costs are allocated in proportion to all other costs.

The functional cost allocation process results in a pool of costs for each functional category. From these cost pools, unit costs are created that form the building blocks for designing rate structures that recognize the demands of each customer class. As a result, costs will be recovered from customer classes based on their demand by functional category. Through this process if one customer class places a higher or lower proportional average demand in one functional category, that customer class pays a higher or lower portion of that functional category's cost.

Allocations to Customer Classes

The next step in the cost of service analysis involves distribution of the functionally allocated system costs to the customer classes. A key component in the allocation of system costs to customer classes is testing the reliability and accuracy of customer statistics. This is accomplished through a review of historical billing system data and application of the rate schedule in effect for that year. City staff provided historical billing system records for fiscal 2015-16, including number of accounts, equivalent residential units (ERUs), and monthly water usage. The test of reliability is conducted by applying the detailed billing statistics to the rates in effect for that year. The total revenue generated from these customer statistics should approximate the actual revenue receipts shown in the financial statements (with minor differences due to accounts receivables, delinquencies, timing of connections and disconnections throughout the year, etc.). If the revenue estimates are within reasonable limits, statistics are determined "valid" and an adjustment factor is applied to the statistics if necessary to account for any minor discrepancies. The results of this analysis indicated that the customer statistics are valid and will serve as a reasonable basis for projecting revenues and allocating system costs to the customer classes.

Customer usage statistics are also evaluated to determine if current customer class designations represent an appropriate grouping of customers, or if revisions are warranted to better reflect groupings that exhibit similar usage patterns. The City currently categorizes customers into two major groups for rate design purposes: Residential includes single family residential (SFR), multi-family residential (MFR), and manufactured home parks. The same schedule of rates applies to all customers within this class.

Commercial includes all non-residential customers, such as commercial businesses, schools, churches, etc. The same base charge applies to all customers within this class. The volume charge varies by subclass depending on an assumed strength concentration.

The functionally allocated system-wide costs are allocated to the recommended customer classes to determine "cost shares" based on the relative demands placed on the system by each class. Test year fiscal 2016 customer statistics form the basis for this allocation.

Functional costs are allocated to the customer classes as follows: Customer costs are allocated based on proportional shares of total system number of accounts. Wastewater flow costs are allocated to the customer classes based on their proportional share of total billed volume (winter water usage for SFR and actual monthly water usage for MFR and commercial customers). I&I costs are allocated based on customer flow patterns. Finally, strength costs are allocated to the customer classed based on their proportional share of total billed volume.

Determine Rate Structure and Develop Rates

The principal consideration in establishing utility rates is to obtain rates for customers that generate sufficient revenues for the utility and that are reasonably commensurate with the cost of providing service. Other considerations in designing rates should include customer equity, incentives for conservation, ease of implementation, and impact on customer bills. These considerations are consistent with the City's identified rate structure goals noted in the previous section.

Existing and Projected Wastewater Rates

The City's current wastewater rate structure was last reviewed in 2010. Although the structure has not changed since that time, the rates have been increased on a regular basis. As in the case of water rates, billings for customers include two components: a fixed rate (demand charge) and a volume rate (commodity charge). The two components are added together to compute an invoice for each customer. The fixed rates are based on costs associated with maintaining/reading meters and the costs associated with billing and are charged per connection to the sewer system. Volume rates are based on the customer class for each 100 cubic feet (ccf) of water or a fixed amount if no measurable consumption is available. The last rate adjustments were made by the City Council via Resolution no. 2017-09 (dated June 14, 2017) with an implementation date of July 1, 2017. The current and projected schedule of wastewater rates and charges is shown below in Table 10.

Table 10 - Schedule of Molalla Wastewater Rates Effective December 15, 2015

	Effective on July 1					
Wastewater Rate Component	2017	2018	2019	2020	2021	2022
Monthly base rate - $/EDU	$ 35.95	$ 38.31	$ 41.06	$ 44.07	$ 46.88	$ 48.30
Volume charge - $/Ccf	$ 3.56	$ 3.79	$ 4.06	$ 4.36	$ 4.64	$ 4.78

The City's current wastewater rate structure is consistent with industry standard, and promotes conservation and equity. Some of the key elements of this rate structure are:

Treatment of Customers without Measurable Water Consumption

Under the City's wastewater rate structure, accounts are considered to be "without measurable water consumption" when potable water is obtained from a well or where the customer has no personal water consumption history established during the winter averaging period within the service area. For single family and multifamily residential customers, new customer accounts without history are set based on 5.50 ccf (monthly) per dwelling unit until measurable consumption is recorded and used to establish a new rate. Customers receiving only sewer service who obtain potable water from a well or another water provider are set based on 5.50 ccf (monthly). Adjustments may be made based on actual usage during the winter averaging months of November through April if the customer can provide sufficient documentation.

For commercial customers without measurable water consumption history, a two-step policy is used as follows:

1. Strengths will be defined by Standard Industrial Classification (SIC) code (i.e. restaurants defined as high) or the customer may elect to have a qualified laboratory regularly monitor and provide measurements of Biological Oxygen Demand (BOD), Total Suspended Solids (TSS) and other particulates (i.e. fats, oils, and grease) to the City.
2. Volumes will be from certification of meter readings provided at the source (well or 3rd party provider). It will be the customer's responsibility to obtain and forward meter readings to the City on a regular bases. In absence of actual meter readings, the City will utilize average usage patterns from similar commercial customers with measurable usage. This method is to be an interim step until such time as a system to measure water usage can be implemented and/or received.

Residential Customers Charged Based on Winter Average Water Consumption

At one time, the City charged all residential wastewater customers on a flat rate basis. Some time ago, the City moved off of this approach and implemented a consumption based rate (CBR) strategy for its residential class. Commercial/industrial and wholesale customers have always been billed based on metered water consumption. Under a CBR methodology, a portion of the wastewater bill is based on how much water a customer uses during the non-irrigation or winter average period, as winter water use is a reasonable estimate of a customer's wastewater discharge. A CBR structure enhances the equity of the wastewater rates by relating a portion of an individual's wastewater bill to the actual discharge into the collection and treatment system. When coupled with a service charge per account that continues to assess the majority of wastewater system costs on a fixed monthly basis, a CBR structure generally balances revenue stability and equity objectives. The policy workings of the City's winter average billing methodology for residential accounts is:

1. Volume will be based on 6-month winter averaging of water consumption. The winter average period will be defined as the 6-month period starting with the first full billing cycle starting on or after November 1st of each year.
2. Accounts with an average usage of less than 1 ccf of water consumption are automatically assessed at the 5.50 ccf average.
3. Customers may request in writing to have the sewer based on actual usage if the property is vacant (transition between tenants, foreclosure, etc.) or consistently averages below 1 ccf per billing cycle over a 12-month period.
4. The assigned average for water consumption may be appealed to the City Manager, or his/her designee, and could be modified pending a review of the account and findings thereof.

Commercial Customers Charged Based on Assumed Strength of Discharge

The City's current wastewater volume charge is monolithic and assumes all customers' strength of discharge is the same. Based on analysis of historical billing records, we have found that 94.0% of all accounts are single family residential, and 5.5% are large multifamily residential, light commercial. The strength of discharge characteristics of this 99.5% of the Molalla population is indeed the same. Industry surveys by the U.S. EPA, and the Water Environment Federation indicate these groups produce low strength of discharge in the range of 200 mg/liter BOD, and 200 mg/liter TSS.

However, the remaining 0.5% of the Molalla population is classified as industrial (i.e., 15 accounts in fiscal 2015-16). We suggest the City consider billing these customers on their assumed strength of discharge. Under this approach, heavy commercial and industrial customers are grouped into low, medium, high, and industrial extra strength categories based upon their standard industrial classification. The City's strength of discharge class limits could be as follows (per industry guidelines):

Strength Classification	BOD (mg/l)	TSS (mg/l)
Low	0-250	0-300
Medium	251-500	301-600
High	501-1,000	601-1,200
Special	1,001+	1,201+

Under this approach, the responsible person for paying the sewer charge may appeal the strength classification made by the City. Such appeal would be made in writing to the City Manager. The person appealing must provide sufficient information as to the strength of the sewer discharge created by their use so that the City Manager or designee may evaluate the evidence and determine the proper strength of the waste generated.

Rate Design Alternatives

There are a variety of wastewater rate structures in use across the state and the nation. This study seeks to establish the guiding principles to be considered during the wastewater rate setting. It is important to establish the principles in advance of undertaking the technical work of rate setting. Once the principles are established and fixed, then the rate setting process evolves from them. It must also be recognized that there needs to be a balance in how the principles are applied; e.g., a flat rate is simple, but it may not necessarily be fair and equitable if customers are not equally responsible for the cost of the system. The Review will seek to determine and evaluate alternatives by comparing the various types of rate structures against each principle to determine which structure most satisfies the principles. One must recognize that one or more principles may compete or be in direct contrast with another. Ultimately, the objective is to identify the structure that best meets as many of the principles as possible.

Any rate structure that is considered must respect current legislation and contractual commitments. The main objective is to ensure the wastewater system is sustainable over the long term, thereby ensuring the protection of the health of citizens and the environment. The concepts of user pay and full cost pricing are key elements of which the City should address in the future. The question of what each customer pays is, however, a complex issue with varying viewpoints and interests.

The following principles should be used to develop alternative rate structures for Council's consideration:

1. be fair and equitable
2. promote conservation
3. be affordable and financially sustainable
4. stabilize revenue
5. be justifiable
6. be simple to understand
7. support economic development;

The City's CBR rate structure has been in place for many years, and works well for the City and its customers. Based on the equity the rate structure provides to customers, there is no reason to think the current rate structure for wastewater services is unfair or unreasonable. We recommend the City stay with this rate structure at this time.

PUMP STATION RUN TIME DATA

The following pages summarize pump station run time data from January 1, 2017 to December 31, 2017.

Stowers Lift Station

Pump 1 -	170 gpm[1]

	Minimum		Maximum		Average	
	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)
Wet Weather	0.40	4,080	4.05	41,310	2.48	25,251
Dry Weather	0.45	4,590	6.73	68,680	1.12	11,412

Pump 2 -	188 gpm[1]

	Minimum		Maximum		Average	
	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)
Wet Weather	1.05	10,710	4.05	41,310	2.49	25,405
Dry Weather	0.30	3,060	2.43	24,820	1.04	10,653

(1) Pump flow based on January 18, 2018 draw down testing

Stowers Lift Station

Pump 1 -	170 gpm[1]

	Minimum		Maximum		Average	
	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)
Jan-March	1.80	18,360	4.05	41,310	2.83	28,914
July-Sept	0.45	4,590	1.25	12,750	0.70	7,100

Pump 2 -	188 gpm[1]

	Minimum		Maximum		Average	
	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)
Jan-March	1.05	10,710	4.05	41,310	2.79	28,468
July-Sept	0.30	3,060	1.30	13,260	0.69	7,007

(1) Pump flow based on January 18, 2018 draw down testing

South Molalla Lift Station

	Pump 1 - 79 gpm[1]					
	Minimum		Maximum		Average	
	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)
Wet Weather	1.97	9,322	7.90	37,446	4.95	23,476
Dry Weather	0.47	2,212	5.85	27,729	1.67	7,924

	Pump 2 - 82 gpm[1]					
	Minimum		Maximum		Average	
	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)
Wet Weather	1.87	8,848	9.35	44,319	5.10	24,193
Dry Weather	0.57	2,686	6.00	28,440	1.69	8,031

(1) Pump flow based on January 18, 2018 draw down testing

South Molalla Lift Station

Pump 1 - 79 gpm[1]

	Minimum		Maximum		Average	
	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)
Jan-March	2.50	11,850	7.90	37,446	5.42	25,685
July-Sept	0.47	2,212	2.85	13,509	1.03	4,865

Pump 2 - 82 gpm[1]

	Minimum		Maximum		Average	
	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)
Jan-March	2.50	11,850	9.10	43,134	5.40	25,610
July-Sept	0.57	2,686	2.85	13,509	1.02	4,825

(1) Pump flow based on January 18, 2018 draw down testing

Shelmar Lift Station

Pump 1 - 167 gpm[1]						
	Minimum		Maximum		Average	
	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)
Wet Weather	0.30	3,006	3.15	31,563	1.70	17,004
Dry Weather	0.47	4,676	3.17	31,730	1.20	12,023

Pump 2 - 187 gpm[1]						
	Minimum		Maximum		Average	
	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)
Wet Weather	0.00	0	5.90	59,118	2.01	20,169
Dry Weather	0.00	0	2.60	26,052	1.08	10,868

(1) Pump flow based on January 18, 2018 draw down testing

Shelmar Lift Station

Pump 1 - 167 gpm[1]						
	Minimum		Maximum		Average	
	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)
Jan-March	0.45	4,509	3.15	31,563	1.98	19,871
July-Sept	0.60	6,012	1.35	13,527	0.88	8,855

Pump 2 - 187 gpm[1]						
	Minimum		Maximum		Average	
	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)
Jan-March	0.00	0	5.90	59,118	2.14	21,418
July-Sept	0.75	7,515	1.35	13,527	0.98	9,796

(1) Pump flow based on January 18, 2018 draw down testing

5th & Cole Lift Station

Pump 1 - 238 gpm[1]						
	Minimum		Maximum		Average	
	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)
Wet Weather	0.37	5,236	2.40	34,272	1.56	22,323
Dry Weather	0.35	4,998	1.70	24,276	0.75	10,651

Pump 2 - 253 gpm[1]						
	Minimum		Maximum		Average	
	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)
Wet Weather	0.75	10,710	2.55	36,414	1.65	23,491
Dry Weather	0.35	4,998	1.80	25,704	0.74	10,500

(1) Pump flow based on January 18, 2018 draw down testing

5th & Cole Lift Station

Pump 1 - 238 gpm[1]						
	Minimum		Maximum		Average	
	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)
Jan-March	0.37	5,236	2.40	34,272	1.68	24,007
July-Sept	0.35	4,998	1.10	15,708	0.50	7,136

Pump 2 - 253 gpm[1]						
	Minimum		Maximum		Average	
	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)
Jan-March	1.30	18,564	2.55	36,414	1.88	26,844
July-Sept	0.35	4,998	1.00	14,280	0.56	8,051

(1) Pump flow based on January 18, 2018 draw down testing

Molalla River Run Lift Station

Pump 1 - 160 gpm(1)						
	Minimum		Maximum		Average	
	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)
Wet Weather	0.00	0	2.60	24,960	0.63	6,083
Dry Weather	0.25	2,400	1.25	12,000	0.43	4,176

Pump 2 - 160 gpm(1)						
	Minimum		Maximum		Average	
	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)
Wet Weather	0.43	4,080	2.60	24,960	0.63	6,083
Dry Weather	0.25	2,400	1.20	11,520	0.43	4,094

(1) Pump flow based on January 18, 2018 draw down testing

Molalla River Run Lift Station

Pump 1 - 160 gpm[1]

	Minimum		Maximum		Average	
	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)
Jan-March	0.00	0	0.85	8,160	0.62	5,959
July-Sept	0.25	2,400	1.15	11,040	0.38	3,623

Pump 2 - 160 gpm[1]

	Minimum		Maximum		Average	
	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)	Run Time (Hrs./Day)	Flow (Gal./Day)
Jan-March	0.45	4,320	1.23	11,840	0.67	6,426
July-Sept	0.27	2,560	0.50	4,800	0.35	3,404

(1) Pump flow based on January 18, 2018 draw down testing

City of Molalla
Monthly Water Balance
Future (2043) - PS #1
Project Number 100.26

Influent Flow Information:	AWWF	4.24	mgd		
	ADWF	1.9	mgd		
Lagoon Information (7):	Average Lagoon Area	25	acres		
	Future Additional Lagoon Area	35	acres		
	Assumed Level at beginning of summer	3	ft		
	Maximum water level	12	ft		
	Maximum total storage capacity	720	ac-ft	235	MG
	Maximum surge volume	540	ac-ft	176	MG
	Irrigation area	440	acres		
	Additional Irrigation Area	400	acres		
	Irrigation efficiency	100%			
	Irrigation May and Oct	Yes			
	Discharge May	No			
	Discharge June	No			
	Discharge October	No			

Month	Influent (1)		Precipitation (2)		Evap. (3)			Irrigation (4)			Lagoon Leakage (5)			Molalla River Discharge (6)		Net Storage	Storage Accum.	Surge Volume
	(MG)	(ac-ft)	(in)	(ac-ft)	(in)	(ac-ft)	(MG)	(in)	(ac-ft)	(MG)	(in)	(ac-ft)	(MG)	(MG)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)
																	180	
May	105	322	2.59	13.0	4.1	-20.50	-6.68	1.31	-91.7	-29.9	0	0	0	0	0	222	402	222
June	60	183	2.07	10.4	5.1	-25.50	-8.31	3.01	-210.7	-68.7	0	0	0	0	0	-43	360	180
July	48	148	0.52	2.6	6.9	-34.50	-11.24	5.88	-411.6	-134.1	0	0	0	0	0	-295	180	0
August	45	139	1.07	5.4	6.2	-31.00	-10.10	4.68	-327.6	-106.7	0	0	0	0	0	-214	180	0
September	45	139	2.02	10.1	4.2	-21.00	-6.84	1.53	-107.1	-34.9	0	0	0	0	0	21	201	21
October	46	142	4.29	21.5	1.9	-9.50	-3.10	0.19	-13.3	-4.3	0	0	0	0	0	141	342	162
November	97	296	6.38	31.9	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-97	-296	32	374	194
December	191	585	7.13	35.7	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-191	-585	36	409	229
January	140	431	7.31	36.6	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-140	-431	37	446	266
February	115	352	4.99	25.0	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-115	-352	25	471	291
March	144	441	5.13	25.7	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-144	-441	26	496	316
April	81	250	3.2	16.0	3.1	-15.50	-5.05	0	0.0	0.0	0	0	0	-81	-250	1	497	317
May	105	322	2.59	13.0	4.1	-20.50	-6.68	1.31	-91.7	-29.9	0	0	0	0	0	222	719	539
June	60	183	2.07	10.4	5.1	-25.50	-8.31	3.01	-210.7	-68.7	0	0	0	0	0	-43	676	496
July	48	148	0.52	2.6	6.9	-34.50	-11.24	5.88	-411.6	-134.1	0	0	0	0	0	-295	381	201
August	45	139	1.07	5.4	6.2	-31.00	-10.10	4.68	-327.6	-106.7	0	0	0	0	0	-214	180	0
September	45	139	2.02	10.1	4.2	-21.00	-6.84	1.53	-107.1	-34.9	0	0	0	0	0	21	201	21
October	46	142	4.29	21.5	1.9	-9.50	-3.10	0.19	-13.3	-4.3	0	0	0	0	0	141	342	162
November	97	296	6.38	31.9	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-97	-296	32	374	194
December	191	585	7.13	35.7	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-191	-585	36	409	229
January	140	431	7.31	36.6	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-140	-431	37	446	266
February	115	352	4.99	25.0	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-115	-352	25	471	291
March	144	441	5.13	25.7	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-144	-441	26	496	316
April	81	250	3.2	16.0	3.1	-15.50	-5.05	0	0.0	0.0	0	0	0	-81	-250	1	497	317
Total	1117	3428	47	234	31.5	-157.5	-51.3	16.6	-1162.0	-378.6	0	0	0	-767	-2355	Required	719	539

Average Flow	-4.2
AWWF	-4.2

(1) Influent based on AWWF and ADWF and historical distribution of flows.
(2) Precipitation data derived from NOAA Molalla station.
(3) Evaporation based on historical means for Corvallis in the Climatology Handbook, September 1969.
(4) Irrigation based on 2015 RWUP.
(5) Lined lagoon.
(6) Molalla River discharge is equal to influent flow.
(7) Assumes sludge is removed from lagoons to allow flow equalization.

City of Molalla
Monthly Water Balance
Future (2043) - PS #2
Project Number 100.26

Influent Flow Information:	AWWF	4.24	mgd
	ADWF	1.9	mgd
Lagoon Information (7):	Average Lagoon Area	25	acres
	Future Additional Lagoon Area	10	acres
	Assumed Level at beginning of summer	3	ft
	Maximum water level	12	ft
	Maximum total storage capacity	420	ac-ft 137 MG
	Maximum surge volume	315	ac-ft 103 MG
	Irrigation area	440	acres
	Additional Irrigation Area	150	acres
	Irrigation efficiency	100%	
	Irrigation May and Oct	Yes	
	Discharge May	Yes	
	Discharge June	No	
	Discharge October	No	

Month	Influent (1)		Precipitation (2)		Evap. (3)			Irrigation (4)			Lagoon Leakage (5)			Molalla River Discharge (6)		Net Storage	Storage Accum.	Surge Volume
	(MG)	(ac-ft)	(in)	(ac-ft)	(in)	(ac-ft)	(MG)	(in)	(ac-ft)	(MG)	(in)	(ac-ft)	(MG)	(MG)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)
																	105	
May	105	322	2.59	7.6	4.1	-11.96	-3.90	1.31	-64.4	-21.0	0	0	0	-105	-322	-69	105	0
June	60	183	2.07	6.0	5.1	-14.88	-4.85	3.01	-148.0	-48.2	0	0	0	0	0	26	131	26
July	48	148	0.52	1.5	6.9	-20.13	-6.56	5.88	-289.1	-94.2	0	0	0	0	0	-159	105	0
August	45	139	1.07	3.1	6.2	-18.08	-5.89	4.68	-230.1	-75.0	0	0	0	0	0	-106	105	0
September	45	139	2.02	5.9	4.2	-12.25	-3.99	1.53	-75.2	-24.5	0	0	0	0	0	57	162	57
October	46	142	4.29	12.5	1.9	-5.54	-1.81	0.19	-9.3	-3.0	0	0	0	0	0	140	302	197
November	97	296	6.38	18.6	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-97	-296	19	321	216
December	191	585	7.13	20.8	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-191	-585	21	341	236
January	140	431	7.31	21.3	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-140	-431	21	363	258
February	115	352	4.99	14.6	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-115	-352	15	377	272
March	144	441	5.13	15.0	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-144	-441	15	392	287
April	81	250	3.2	9.3	3.1	-9.04	-2.95	0	0.0	0.0	0	0	0	-81	-250	0	393	288
May	105	322	2.59	7.6	4.1	-11.96	-3.90	1.31	-64.4	-21.0	0	0	0	-105	-322	-69	324	219
June	60	183	2.07	6.0	5.1	-14.88	-4.85	3.01	-148.0	-48.2	0	0	0	0	0	26	350	245
July	48	148	0.52	1.5	6.9	-20.13	-6.56	5.88	-289.1	-94.2	0	0	0	0	0	-159	191	86
August	45	139	1.07	3.1	6.2	-18.08	-5.89	4.68	-230.1	-75.0	0	0	0	0	0	-106	105	0
September	45	139	2.02	5.9	4.2	-12.25	-3.99	1.53	-75.2	-24.5	0	0	0	0	0	57	162	57
October	46	142	4.29	12.5	1.9	-5.54	-1.81	0.19	-9.3	-3.0	0	0	0	0	0	140	302	197
November	97	296	6.38	18.6	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-97	-296	19	321	216
December	191	585	7.13	20.8	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-191	-585	21	341	236
January	140	431	7.31	21.3	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-140	-431	21	363	258
February	115	352	4.99	14.6	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-115	-352	15	377	272
March	144	441	5.13	15.0	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-144	-441	15	392	287
April	81	250	3.2	9.3	3.1	-9.04	-2.95	0	0.0	0.0	0	0	0	-81	-250	0	393	288
Total	1117	3428	47	136	31.5	-91.9	-29.9	16.6	-816.2	-265.9	0	0	0	-872	-2677	Required	393	288

Average Flow	-4.8
AWWF	-4.2

(1) Influent based on AWWF and ADWF and historical distribution of flows.
(2) Precipitation data derived from NOAA Molalla station.
(3) Evaporation based on historical means for Corvallis in the Climatology Handbook, September 1969.
(4) Irrigation based on 2015 RWUP.
(5) Lined lagoon.
(6) Molalla River discharge is equal to influent flow.
(7) Assumes sludge is removed from lagoons to allow flow equalization.

City of Molalla
Monthly Water Balance
Future (2043) - PS #3
Project Number 100.26

Influent Flow Information:	AWWF	4.24	mgd		
	ADWF	1.9	mgd		
Lagoon Information (7):	Average Lagoon Area	25	acres		
	Future Additional Lagoon Area	10	acres		
	Assumed Level at beginning of summer	3	ft		
	Maximum water level	12	ft		
	Maximum total storage capacity	420	ac-ft	137	MG
	Maximum surge volume	315	ac-ft	103	MG
	Irrigation area	440	acres		
	Additional Irrigation Area	100	acres		
	Irrigation efficiency	100%			
	Irrigation May and Oct	Yes			
	October Discharge	No			
	May Discharge	No			
	June Discharge	No			

Month	Influent (1)		Precipitation (2)		Evap. (3)			Irrigation (4)			Lagoon Leakage (5)			Molalla River Discharge (6)		Net Storage	Storage Accum.	Surge Volume
	(MG)	(ac-ft)	(in)	(ac-ft)	(in)	(ac-ft)	(MG)	(in)	(ac-ft)	(MG)	(in)	(ac-ft)	(MG)	(MG)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)
																	105	
May	105	322	2.59	7.6	4.1	-11.96	-3.90	1.31	-59.0	-19.2	0	0	0	0	0	258	363	258
June	60	183	2.07	6.0	5.1	-14.88	-4.85	3.01	-135.5	-44.1	0	0	0	0	0	39	402	297
July	48	148	0.52	1.5	6.9	-20.13	-6.56	5.88	-264.6	-86.2	0	0	0	0	0	-135	267	162
August	45	139	1.07	3.1	6.2	-18.08	-5.89	4.68	-210.6	-68.6	0	0	0	0	0	-87	181	76
September	45	139	2.02	5.9	4.2	-12.25	-3.99	1.53	-68.9	-22.4	0	0	0	0	0	64	244	139
October	46	142	4.29	12.5	1.9	-5.54	-1.81	0.19	-8.6	-2.8	0	0	0	0	0	140	385	280
November	97	296	6.38	18.6	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-117	-359	-45	340	235
December	191	585	7.13	20.8	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-210	-645	-39	301	196
January	140	431	7.31	21.3	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-166	-510	-58	243	138
February	115	352	4.99	14.6	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-140	-428	-61	182	77
March	144	441	5.13	15.0	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-168	-514	-58	123	18
April	81	250	3.2	9.3	3.1	-9.04	-2.95	0	0.0	0.0	0	0	0	-105	-321	-71	105	0
Total	1117	3428	47	136	31.5	-91.9	-29.9	16.6	-747.0	-243.4	0	0	0	-905	-2778	Required	402	297

Average Flow	-5.0
AWWF	-5.0

(1) Influent based on AWWF and ADWF and historical distribution of flows.
(2) Precipitation data derived from NOAA Molalla station.
(3) Evaporation based on historical means for Corvallis in the Climatology Handbook, September 1969.
(4) Irrigation based on 2015 RWUP.
(5) Lined lagoon.
(6) Molalla River discharge is equal to influent flow plus surge volume at end of October plus precipitation in winter.
(7) Assumes sludge is removed from lagoons to allow flow equalization.

City of Molalla
Monthly Water Balance
Future (2043) - PS #4
Project Number 100.26

Influent Flow Information:	AWWF	4.24	mgd		
	ADWF	1.9	mgd		
Lagoon Information (7):	Average Lagoon Area	25	acres		
	Future Additional Lagoon Area	0	acres		
	Assumed Level at beginning of summer	3	ft		
	Maximum water level	12	ft		
	Maximum total storage capacity	300	ac-ft	98	MG
	Maximum surge volume	225	ac-ft	73	MG
	Irrigation area	440	acres		
	Additional Irrigation Area	100	acres		
	Irrigation efficiency	100%			
	Irrigation May and Oct	Yes			
	October Discharge	No			
	May Discharge	Yes			
	June Discharge	No			

Month	Influent (1)		Precipitation (2)		Evap. (3)			Irrigation (4)			Lagoon Leakage (5)			Molalla River Discharge (6)		Net Storage	Storage Accum.	Surge Volume
	(MG)	(ac-ft)	(in)	(ac-ft)	(in)	(ac-ft)	(MG)	(in)	(ac-ft)	(MG)	(in)	(ac-ft)	(MG)	(MG)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)
																	75	
May	105	322	2.59	5.4	4.1	-8.54	-2.78	1.31	-59.0	-19.2	0	0	0	-105	-322	-62	75	0
June	60	183	2.07	4.3	5.1	-10.63	-3.46	3.01	-135.5	-44.1	0	0	0	0	0	41	116	41
July	48	148	0.52	1.1	6.9	-14.38	-4.68	5.88	-264.6	-86.2	0	0	0	0	0	-130	75	0
August	45	139	1.07	2.2	6.2	-12.92	-4.21	4.68	-210.6	-68.6	0	0	0	0	0	-82	75	0
September	45	139	2.02	4.2	4.2	-8.75	-2.85	1.53	-68.9	-22.4	0	0	0	0	0	66	141	66
October	46	142	4.29	8.9	1.9	-3.96	-1.29	0.19	-8.6	-2.8	0	0	0	0	0	138	279	204
November	97	296	6.38	13.3	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-111	-342	-33	246	171
December	191	585	7.13	14.9	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-205	-629	-29	218	143
January	140	431	7.31	15.2	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-159	-488	-42	176	101
February	115	352	4.99	10.4	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-133	-407	-44	131	56
March	144	441	5.13	10.7	0.0	0.00	0.00	0	0.0	0.0	0	0	0	-161	-494	-42	89	14
April	81	250	3.2	6.7	3.1	-6.46	-2.10	0	0.0	0.0	0	0	0	-98	-301	-51	75	0
Total	1117	3428	47	97	31.5	-65.6	-21.4	16.6	-747.0	-243.4	0	0	0	-972	-2983	Required	279	204

Average Flow	-5.4
AWWF	-4.8

(1) Influent based on AWWF and ADWF and historical distribution of flows.
(2) Precipitation data derived from NOAA Molalla station.
(3) Evaporation based on historical means for Corvallis in the Climatology Handbook, September 1969.
(4) Irrigation based on 2015 RWUP.
(5) Lined lagoon.
(6) Molalla River discharge is equal to influent flow plus surge volume at end of October plus precipitation in winter.
(7) Assumes sludge is removed from lagoons to allow flow equalization.

Biosolids Management Plan
For
The City of Molalla

NPDES Permit No. 101514
File No. 57613

September 10, 2013

City of Molalla Wastewater Treatment Facility
12424 S. Toliver Rd.
Molalla OR 97038

Contact: Jon Patrick
(503) 829-5407

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LIST OF APPENDICES

INTRODUCTION

This document updates and amends the 1999 Biosolids Management Plan (BSMP) for the City of Molalla's Wastewater Treatment Facility (Molalla WWTF). Molalla WWTF's biosolids program is governed by Oregon Administrative Rule (OAR) 340-050 and by the Code of Federal Regulations (CFR) Section 40, Part 503. The program is also guided by the Department of Environmental Quality's (DEQ's) Internal Management Directive (IMD): Implementing Oregon's Biosolids Program. The BSMP is being updated to address the requirements of OAR 340-050 and the IMD, but also to serve as a tool for Molalla WWTF's administration and operations staff involved with the biosolids program. The BSMP is scheduled for future updates at each renewal of the City's NPDES permit. The updated BSMP is part of the City's NPDES permit and is enforceable.

The City of Molalla owns and operates a wastewater collection and treatment system located at 12424 S. Toliver Road in Molalla, Oregon.. The treatment plant serves a population of about 8000 people. The wastewater that the city treats is primarily residential with a few restaurants and no major industrial dischargers. The designed average dry weather flow is 0.800 million gallons per day (MGD). Actual flows during the dry season averaged 0.899 MGD and during the wet season averaged 1.887 MGD. The peak flow design capacity is 4.000 MGD. Details of the treatment plant are provided in Appendix A.

Treated effluent is discharged November 1st to May 31st to the Molalla River at river mile 20. In summer effluent is beneficially reused for irrigation.

SOLIDS MANAGEMENT HISTORY

The lagoon system of treatment allows the plant to go for long periods of time between solids removals from the lagoons. This longer storage and digestion time makes it hard to determine the quantity of solids that accumulate in the lagoon. However, due to the long term storage, the solids are in well-digested and fairly inert.

Between the time when the plant was put into service in 1978 and 1999 there was one poor attempt made at biosolids removal in 1989. It did not go well due to poor quality dredging equipment. To date the 1999 biosolids removal has been the only successful removal. They were able to remove approximately 712 dry tons and direct inject it into the neighboring field. In 2010 there was another poor attempt at removal by a contracted company that was only successful in removing approximately 55 dry tons of solids. They wet hauled the solids to another facility for processing which was very expensive.

Over time the solids have built up and have caused problems for the plant. Solids get disturbed by the agitation of the water by wind and rain, which increases the amount of solids entering number two lagoon. The buildup of solids also decreases the aerobic zone available in the pond, which decreases treatment efficiency and can lead to odor problems. Since we need to leave a nice cap of water over the sludge to avoid nuisance odors we cannot lower the level of water in number one lagoon below the sludge level.

Biosolids contain nutrients and organic matter that can be safe and beneficial to farmers. The recycling of biosolids by farmers is also economical for the farmer and the treatment plant. The farmer receives nutrients that he doesn't have to pay for and the treatment plant doesn't have to pay to haul it to a landfill.

WASTEWATER TREATMENT FACILITY

Liquids Processing

The City of Molalla wastewater treatment plant is an aerated lagoon system. It has one aeration basin and two lagoons operated in series. The first holding pond is approximately 11.4 acres. The second holding pond is 13.6 acres. Both ponds have an operating depth of 3 to 12 feet. The majority of the sludge builds up on the west end of number one lagoon.

The first stage of treatment is the headworks. The headworks is made up of a mechanical fine screen system with a manual bar rack for high flows. Its design capacity is 9.25mgd. The water then flows through a 12-inch Parshall flume to measure the flow before entering the aeration basin. The aeration basin adds dissolved oxygen and mixing with six ten hp mechanical aerators. The influent flow is mixed with the return waste skimmed off the DAFs and the backwash water from the filters. The aeration basin has a capacity of 1.33MGD. From there wastewater is pumped to number one lagoon by the transfer pump station. The transfer pump station is made up of two 112hp pumps and one 50hp pump. It has a peak capacity of 11.23MGD. Number one lagoon has a capacity of 45million gallons and gravity flows into lagoon number two with a capacity of 53Million gallons. From there two Dissolved Air Floatation units use a process of adding dissolved oxygen and polymer to float and settle solids. They have a design capacity of 2.0 mgd each. It then gravity flows through sand and anthracite coal filters where any floating impurities are trapped on the surface and the majority of other solids are caught in the sand and anthracite. Each filter has a design capacity of one million gallons a day. The filter effluent gravity flows into the chlorine contact basin. Calcium hypochlorite is used for disinfection. A chlorine solution is added to the line prior to entering the contact basin and is followed by an inline mixer. It is then pumped five miles to the discharge monitoring station by the effluent pump station, which consists of two 300hp vertical pumps rated for 5 MGD each. The discharge monitoring station is where ascorbic acid is added to dechlorinate the effluent before it discharges into the Molalla River.

There have been several upgrades made to the process since the facility's previously approved biosolids management plan in 1999. In 2000 an effluent pump station was built. It included two 300hp vfd controlled pumps and a 750kw backup generator. Construction of the effluent/irrigation line was also started. In 2002 the new transfer pump station was built. Along with the transfer force main. The new automated fine screen was also added in 2002 replacing the old comminuter at the headworks. In 2007 a new Dissolved Air Floatation (DAF) unit was installed along with the four sand and anthracite coal filters replacing the two old ones. In 2011 we upgraded the old chlorine gas system to a safer calcium hypochlorite system for disinfection. See attached facility drawings for more information (Appendix A).

Solids Processing

Solids flow into number one lagoon after the aeration basin where everything settles out. Most of the solids settle out in the first section of number one lagoon. This fast settling is attributed to the combination of aeration and the mixing of polymer left in solids removed from the DAF units. The majority of solids have been in the lagoons for several years. Solids break down anaerobically over a long period of time.

The solids are covered with a layer of water that keeps them from causing odor problems. The City of Molalla plans to apply 289 dry tons per year in the years that solids are applied. When field application is not available the solids will be anaerobically digested in the bottom of number one lagoon.

Septage Processing

The City of Molalla does not receive septage at this time.

Pretreatment Program

The City of Molalla is not required at this time to implement an industrial wastewater pretreatment program, as the city does not currently have a significant source of industrial wastewater.

BIOSOLIDS TREATMENT PROCESSES

Under 40 CFR Part 503 and Oregon Administrative Rules Chapter 340 Division 50, pathogen reduction and vector attraction reduction for biosolids must be met prior to land application. Vector attraction reduction requirements can also be met at the time of land application if biosolids are direct injected below the surface of the land or incorporated into the soil within 6 hours after application to the land. Biosolids are categorized as Class A or Class B depending on the method used to determine pathogen reduction. Biosolids may also be classified as exceptional quality (EQ) if the product meets: pollutant concentration limits in 40 CFR Part 503, one of the class A pathogen reduction alternatives in 40 CFR 503.32(a), and one of the vector attraction reduction options in 40 CFR 503.33(b) (1) through (8). To meet regulatory requirements, pathogen reduction method other than what is specified in this biosolids management plan.

The City of Molalla will certify in writing that Class B pathogen requirements and vector attraction reduction requirements are met. The City of Molalla will also notify the Department in writing and obtain written approval prior to any process change that would use a pathogen reduction or vector attraction reduction method other than what is specified in this biosolids management plan.

Pathogen Reduction

Pathogen reduction requirements of 40 CFR Part 503 and OAR 340-050 are met through Alternative #1 for Class B biosolids in 40 CFR 503.32(b)(2): The geometric mean of the density of fecal coliform of seven representative samples shall be less than either 2 million Most Probable Number (MPN) or 2 million Colony Forming Units (CFU) per gram of total solids (dry weight basis).

Vector Attraction Reduction

Vector attraction reduction requirements of 40 CFR Part 503 are met through Option #2 in 503.33(b)(2): Less than 17% additional volatile solids loss during bench-scale anaerobic batch digestion of the sewage sludge for 40 additional days at 30ºC to 37ºC (86ºF to 99ºF). Biosolids meet this requirement through years of anaerobic digestion in the bottom of number one lagoon.

BIOSOLIDS STORAGE

Treatment Facility

From the number one lagoon the liquid biosolids are pumped to a truck for land application. The lagoon can hold several years' accumulation of solids when land application is not available.

Staging

There will be no staging of biosolids since the City of Molalla will load the truck and wet apply biosolids the same day.

Field Storage

Field storage is not needed at this time because the City of Molalla plans to wet apply the biosolids.

TRANSPORTATION

The City of Molalla owns the tanker truck used to transport biosolids from the wastewater treatment facility to authorized land application sites. The city of Molalla employees operate the tanker truck. The City of Molalla is able to handle the volume of biosolids produced through these transportation practices.

Liquid biosolids are loaded from the west end of number one lagoon at the treatment facility into a tanker truck for land application. For a map of the location of section one of lagoon one see the included map in appendix C on page 24. The biosolids will be pumped to the tanker truck by a dredge. The truck will be parked on the dike between lagoon #1 and lagoon #2 for filling. If any material is spilled it will go back into one of the lagoons. Any remaining material will be cleaned up immediately.

REMEDIAL PROCEDURES

All spills into waters of the state or spills on the ground surface that are likely to enter waters of the state will be reported immediately to Oregon Emergency Response System (OERS) at 1-800-452-0311 and the Department's regional biosolids specialist at (503) 229-5347. All spills of 50 gallons or more on the ground surface will be reported to OERS and the Department's regional biosolids specialist within 24 hour(s) of the spill incident.

Spill During Transportation of Biosolids

The City of Molalla is responsible for cleanup of any biosolids spills that occur while transporting to land application sites. If a spill occurs during the transport of biosolids between the wastewater treatment facility and the land application site, the City of Molalla will:

- Contain the spill.
- Post the area and set up temporary fencing if there is a potential for public exposure.
- Remove spilled biosolids with a vactor trailer.
- Cover the area with dry lime if needed
- Apply absorbent (e.g., sand) if needed
- Transport spilled product to a Department authorized biosolids land application or disposal site.

See spill contingency plan for more information (Appendix G).

MONITORING AND REPORTING

Monitoring and Sampling Program

All monitoring and reporting will be conducted in accordance with the City of Molalla's NPDES permit. Monitoring of biosolids generated by the Molalla WWTF is required only when the biosolids are dredged from the lagoons and land applied as a fertilizer and/or soil amendment for agricultural crops. The City conducted sampling, analysis, and measurement of solids in the 2 lagoons in July 2012 to determine if the solids accumulated meet the requirements for land application to agricultural land as allowed under federal and state biosolids rules. The solids sampling and analyses was conducted in accordance with Molalla's Biosolids Sampling Plan, approved by the Department on June 18, 2012, and presented in Appendix B. Results of the solids monitoring are provided in Appendix C and in the Biosolids Characteristics section of this BSMP.

Record keeping and Reporting Procedures

The City of Molalla as the preparer and land applier of biosolids is required to maintain records to demonstrate that federal and state biosolids requirements are met. Records will be kept on file by the City of Molalla, and will be available upon request by the Department. Monitoring and sampling records will be retained for a period no less than 5 years, unless otherwise required by the NPDES permit or a site authorization letter. The minimum required records include the following information:

- Pollutant concentrations of each parameter stated in the permit,
- Pathogen requirements for Class B biosolids as stated in the permit,
- Vector attraction reduction requirements as stated in the permit,
- Description of how the management practices in 40 CFR §503.14 and site restrictions in 40 CFR §503.32(b)(5) are met for each biosolids land application site (, and
- Certification that the information submitted is accurate to determine compliance with pathogen and vector attraction reduction requirements, and site restriction/management requirements.

Annual Reporting

A biosolids annual report is required to be submitted to the Department each year by February 19th or as required by the permit if bulk biosolids have been land applied, or biosolids derived products were sold or given away the previous year. The report will include information on biosolids handling activities and data (i.e., monitoring results, nutrient loading rates) from the previous calendar year. Some of the information required with the annual report includes:

- Daily site logs or records, including date, time, and quantity (gallon, pounds) of nitrogen/acre land applied.
- Map, including scale, showing the site and the land application location that coincides with the daily site application method
- Signed copy of the certification statement (see next section on Certification Statement).

Certification Statement

The City of Molalla is capable of meeting Class B pathogen reduction and vector attraction reduction requirements. As required under 40 CFR §503.17, the City of Molalla must retain a certification statement indicating whether compliance with pathogen reduction, vector attraction reduction, and certain site restrictions have been met. The certification statement must be retained for a period of five years, and must be submitted with the annual report that is due February 19th or as required by the permit. The City of Molalla will retain the following certification statement and it will be signed by a principal executive officer or ranking elected official or their duly authorized representative (e.g., individual or position having responsibility for the overall operation of the system, such as the position of plant manager, supervisor, superintendent or equivalent responsibility).

"I certify, under penalty of law, that the information that will be used to determine compliance with the Class B pathogen requirements in 40 CFR §503.32(b) alternative #1, the vector attraction reduction requirement in 40 CFR §503.33(b) option 2, and the site restrictions in 40 CFR §503.32(b)(5) for each site on which Class B sewage sludge was applied, was prepared under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate this information. I am aware that there are significant penalties for false certification, including the possibility of fine and imprisonment."

Signature______________________________________Date________________________

The City of Molalla is also required as the land applier to certify that the management practices in 40 CFR §503.14 are being met. This certification includes that biosolids are being land applied at approved agronomic loading rates as specified in Department issued site authorization letters.

"I certify, under penalty of law that the management practices in 40 CFR §503.14 have been met for each site on which bulk biosolids is applied. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the management practices have been met. I am aware that there are significant penalties for false certification, including the possibility of fine and imprisonment."

Signature______________________________________Date________________________

BIOSOLIDS CHARACTERISTICS

Pollutant Characteristics

The following table is a representative biosolids analysis for pollutant characteristics. This data and all previous data indicate that pollutant concentrations for all regulated pollutants have been met.

Parameter	Biosolids Analytical Result (mg/kg)	Sample Date	40 CFR §503.13(b)(3) Pollutant Concentration Limits (mg/kg)
Arsenic (As)	7.88	6/18/2012	41
Cadmium (Cd)	2.39	6/18/2012	39
Chromium (Cr)	35	6/18/2012	-
Copper (Cu)	277	6/18/2012	1500

Lead (Pb)	60.9	6/18/2012	300
Mercury (Hg)	1.76	6/18/2012	17
Molybdenum (Mo)	21.7	6/18/2012	-
Nickel (Ni)	20.9	6/18/2012	420
Selenium (Se)	4.06	6/18/2012	100
Zinc (Zn)	882	6/18/2012	2800

Nutrient Characteristics and Other Parameters

The following table is a representative biosolids analysis for nutrient characteristics and other parameters.

Parameter/measurement unit	Biosolids Analytical Result	Sample Date
Total solids, percent	9.2%	6/18/2012
Volatile solids, percent	32.8%	6/18/2012
TKN, percent	2.283%	6/18/2012
NO_3-N, percent	<0.027%	6/18/2012
NH_4-N, percent	0.576%	6/18/2012
Phosphorus (P), percent	2.130%	6/18/2012
Potassium (K), percent	0.050%	6/18/2012
pH, standard unit	7.0	6/18/2012

LAND APPLICATION PLAN

One hundred percent of biosolids generated by City of Molalla will be beneficially used through land application. The following biosolids land application plan outlines agronomic application rate and site crops, where biosolids are land applied, site selection criteria for a new site, and site and crop management practices.

Agronomic Application Rate and Site Crops

Class B biosolids are required to be land applied to a site at a rate that is equal to or less than the agronomic rate for the site. An agronomic rate is the whole biosolids application rate (dry weight basis) designed to provide the annual total amount of nitrogen needed by a crop and to minimize the amount of nitrogen passing below the root zone of the crop or vegetation to groundwater.

The annual application rate for pasture is 100 pounds available nitrogen (N) per acre, unless the application site demonstrates additional nitrogen is required to match crop uptake rates. The land application sites authorized for use can assimilate the total plant available nitrogen the biosolids provide on an annual basis. Specific site agronomic loading rates are stated in the Department issued site authorization letters.

Site Inventory of Existing and Potential Sites

The City of Molalla currently has one site authorized by the Department for land application of Class B biosolids and one site that is pending Department approval. Details of these sites are listed in the table below. See Appendix F for maps and more site information.

Biosolids Land Application Site Inventory

Field ID	Township Range and section	Tax lot numbers	Total acres	Spreadable Acres	Department Authorized Date
Jorgenson	T5S R2E S7	1000, 1100, & 1400	76.1	62.3	1999
Johnson	T4S R2E S32	300	42.5	28	Pending

Selection Criteria for a New Site

If necessary, the City of Molalla will locate additional sites for land applying biosolids. Prior to using any site for land application, the City of Molalla is required to receive a written site authorization letter from the Department. The following site conditions will be considered when determining the suitability of a site for land application:

- All sites will be located on agricultural or forestland in Clackamas County.
- A site should be on a stable geologic formation not subject to flooding or excessive run-off from adjacent land.
- Minimum depth to permanent groundwater should be four feet and the minimum depth to temporary groundwater should be one foot at the time when application of liquid biosolids occurs.
- Topography should be suitable for normal agricultural operations. Liquid biosolids should not be land applied on bare soils when the slope exceeds 12 percent. Dewatered or dried biosolids may be land applied on well-vegetated slopes up to 30 percent.
- Soil should have a minimum rooting depth of 24 inches.

Public Notification

The City of Molalla is required to notify the public of the proposed land application activity. Each year prior to land application of biosolids, the City of Molalla should verify for those sites to be used for the year that the property owners who received prior notification have not changed. If a property owner has changed, notification of the land application activity should be made to the new property owner and documented. See Appendix E for copies of public notification documents used by the City of Molalla.

Site Management Practices

Site access restrictions and setbacks will be followed as outlined in the Department's site authorization letters. The City of Molalla will ensure that access is restricted by appropriate means as necessary, such as fencing or posting of signs at the land application site. Biosolids land application will not occur in those areas designated as buffer strips and will be achieved through accurate measurement of the buffer area prior to commencing land application.

Crop Management Practices

The City will apply biosolids to pastured sites only during summer months and at rates that do not exceed 100 pounds of plant available nitrogen (PAN) per acre per year, or 100 lbs PAN/ac/yr. Soil conditions must be favorable for application such that runoff, leaching, or soil compaction does not occur. The timing of land application will take into consideration tilling and irrigation practices that may occur on an authorized site.

The overall management of nutrients at the land application sites takes into account the amount of biosolids land applied, the amount of commercial fertilizers used and the amount of residual nutrients in the soil. When additional sources of nitrogen (e.g., commercial fertilizer) are applied to a site, then the application of biosolids should be reduced to compensate for the additional nitrogen loading. For more information, see Appendix F and Appendix D.

APPENDIX A BSMP Approval Letter From DEQ (Reserved)

APPENDIX B Wastewater Facility Design Specifications and Illustrations

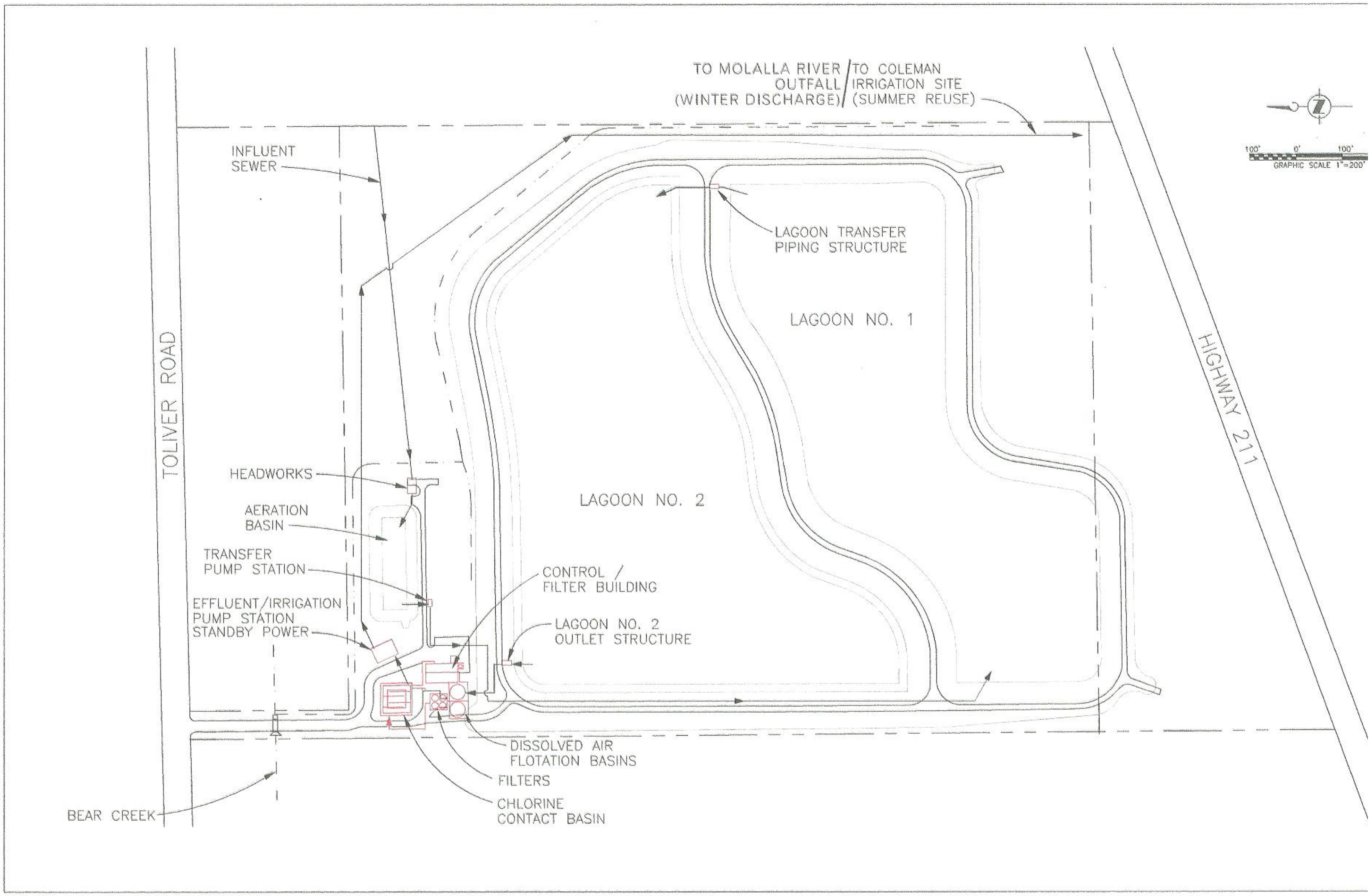

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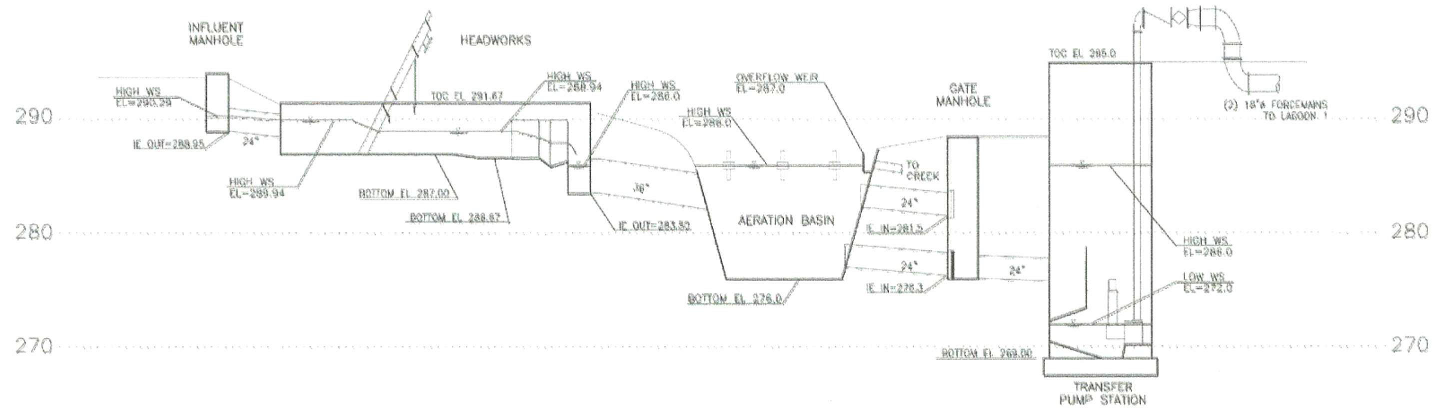
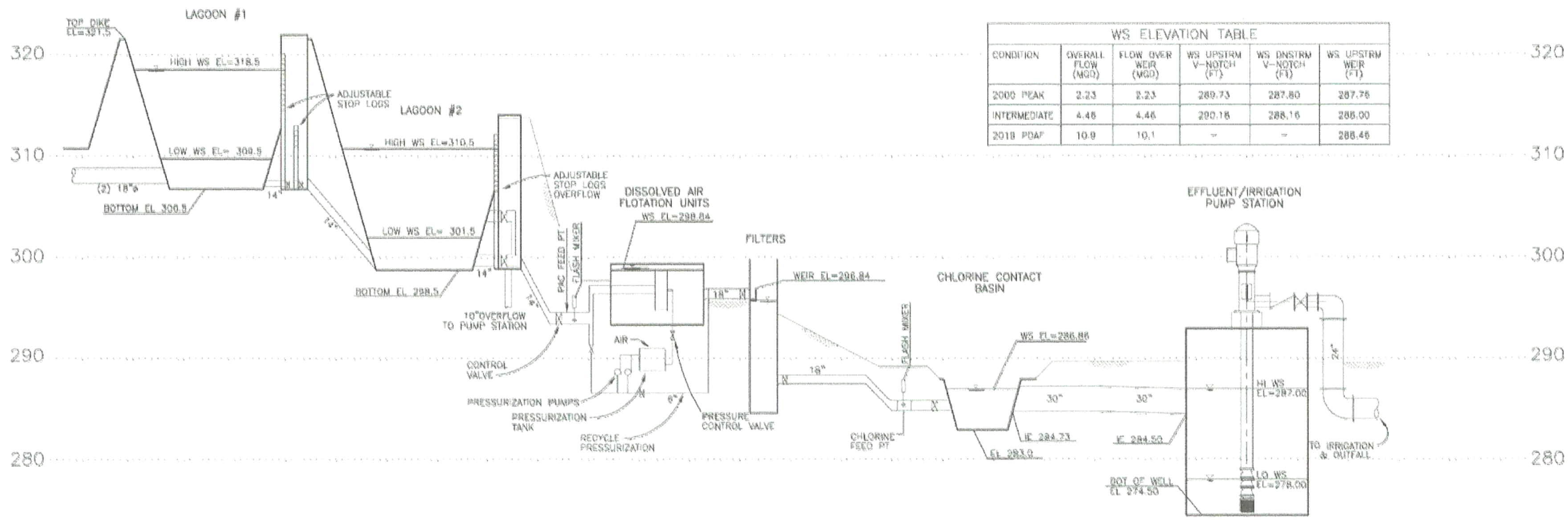
FIGURE 2
WWTP SITE PLA





WS ELEVATION TABLE

CONDITION	OVERALL FLOW (MGD)	FLOW OVER WEIR (MGD)	WS UPSTRM V-NOTCH (FT)	WS DNSTRM V-NOTCH (FT)	WS UPSTRM WEIR (FT)
2000 PEAK	2.23	2.23	289.73	287.80	287.76
INTERMEDIATE	4.46	4.46	290.16	288.16	288.00
2018 PDAF	10.9	10.1	-	-	288.46

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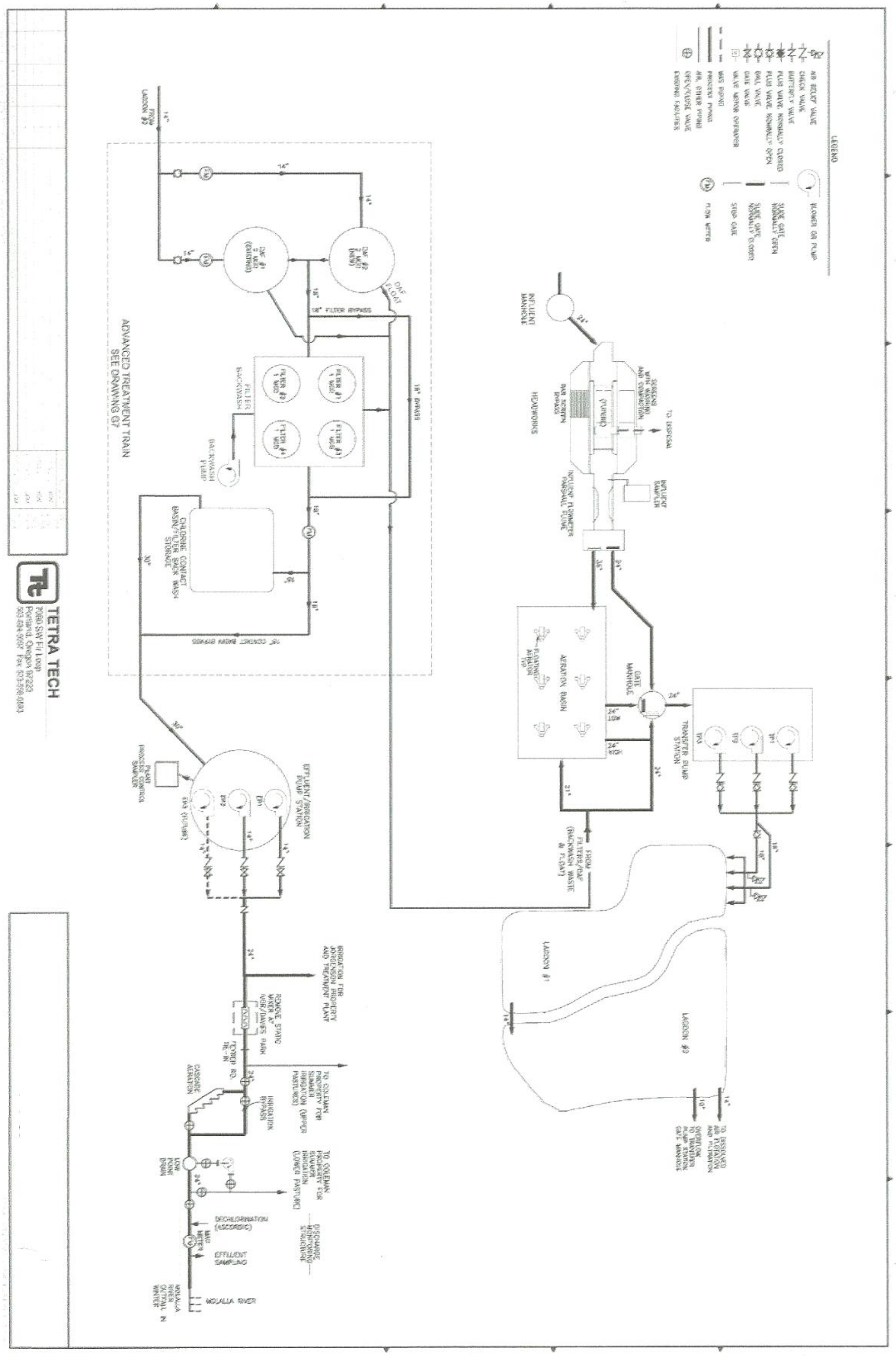
LEGEND
HEADWORKS
INFLUENT MANHOLE
AERATION BASIN
TRANSFER PUMP STATION
LAGOON #1
LAGOON #3
ADVANCED TREATMENT TRAIN
SEE DRAWING G7
EFFLUENT/IRRIGATION PUMP STATION
DECHLORINATION (ASCORBIC)
EFFLUENT SAMPLING
MOLALLA RIVER
TETRA TECH

FLOW DATA

Existing and Projected Flows

	2005	2015	2025
ADWF – Average dry weather flow	0.90 mgd	1.1 mgd	1.4 mgd
MMDWF – Max month dry weather flow	1.28 mgd	1.7 mgd	2.3 mgd
AWWF – Average wet weather flow	1.50 mgd	2.1 mgd	3.0 mgd
MMWWF – Max month wet weather flow	2.04 mgd	3.1 mgd	4.1 mgd
PDF – Peak day flow	7.08 mgd	8.5 mgd	10.3 mgd

DESIGN DATA

Effluent Quality

Required Effluent Quality	BOD5 < 10 mg/l	TSS < 10 mg/l
Anticipated Filter Effluent Quality	BOD5 < 5 mg/l	TSS < 5 mg/l

Headworks (2002 Construction)

Type of screens	In-channel fine screens, perforated plate
Number of screens	1
Peak flow capacity, each	9.25 mgd
Bypass screen	Manually cleaned screen
Screenings washing	Yes
Screenings compaction	Yes
Septage	Excluded
Headworks, influent flow measurement	
Number of flumes	1
Throat width	24 inches
Peak flow capacity	21.4 mgd
Minimum flow capability	0.27 mgd

Aeration Basin (1980 Construction)

Dimensions	
Size (bottom of basin)	200 feet by 54 feet
Side slopes (horiz:vert)	2:1
Maximum side water depth	10 feet with 2 feet freeboard
Basin volume, maximum	1,300,000 gallons
Basin liner	Asphalt concrete
Aerators	
Type	Aspirating
Number	6
Horsepower, each	10 horsepower
Basin outlet	Overflow weir to pump station

Transfer Pump Station (2002 Construction)

Estimated PF from basin	9.25 mgd
Main pump type	Centrifugal submersible w/vfd
Main pumps	
Operating	1
Standby	1
Main pump capacity each	5800 gpm at 51 ft tdh
Jockey pump type	Centrifugal submersible w/vfd
Jockey pump number	1
Jockey pump capacity (one forcemain)	2500 gpm at 49 ft tdh and 2100 gpm at 56 ft tdh
Station peak capacity	7800 gpm (11.23 mgd)
Required operating volume	4060 gal
Wet well levels	
Maximum W.S. el	286.0 ft
Minimum W.S. el	272.0 ft
Operating volume	55,820 gal (includes aeration basin)

Transfer Forcemain (2002 Construction)

Number	2
Material	HDPE
Size	16 inch (nominal, ID)
Length	1530 feet
Velocity at 2500 gpm	3.2 feet/sec
Velocity at 2100 gpm	2.6 feet/sec
Velocity at 7800 gpm	4.9 feet/sec
Outlet to lagoon 1	
Number/size	4-ports/12-inch

Lagoon No. 1 (1980 Construction)

Lagoon dimensions	
Surface area	11.4 acres (at 6-foot (average) depth)
Maximum depth	12 feet with 3 feet of freeboard
Working depth (max. to min.)	9 feet
Lagoon volume, maximum	137 acre-feet (45 mg)
Lagoon liner	Native clay
Aeration	None
Outlet	
Size	10-inch
Type	Surface weir and fixed pipe on bottom of lagoon

Lagoon No. 2 (1980 Construction)

Lagoon dimensions	
Surface area	13.6 acres (at 6-foot average depth)
Maximum depth	12 feet with 3 feet of freeboard
Working depth	9 feet
Lagoon volume, maximum	163 acre-feet (53 mg)
Lagoon liner	Native clay
Outlet	
Size	14-inch
Type	Fixed pipes at two depths

Dissolved Air Flotation (DAF) (1980 Construction)

Capacity	2.0 mgd
Tank Diameter	31 feet
Surface area	755 square feet (sf)
Hydraulic loading rate	2.50 gpm/sf, including recycle
Hydraulic capacity	2.90 mgd, including recycle
Chemical feed rates	
Alum	75 – 150 mg/l (not used)
Soda	37 – 75 mg/l (not used)
Polyaluminum Chloride	35 – 70 mg/l
Acid	0 – 10 mg/l (not used)
Operating parameters	
Pressurized recycle flow	350 to 700 gpm
Operating pressure	45 to 80 pounds per square inch (psi)
Maximum horizontal velocity	3.1 feet per second
Maximum daily sludge	2280 pounds dry solids, 15,300 gallons
Recycle Pumps	
Number	2
Size	20 HP
Flow	350 gpm
Recycle Flow Meter (Existing)	
Type	Propeller
Size	5 inch
Range	0–2 MGD
Influent Flow Meter (FM-2) **(2007 Construction)**	
Type	Electromagnetic insertion type
Size	12 inch
Range	0–10 MGD

Dissolved Air Flotation (DAF) **(2007 Construction)**

Capacity	2.0 mgd
Tank Diameter	38 feet
Surface area	1,075 square feet (sf)
Maximum surface loading rate	2.0 gpm/sf, including recycle
Hydraulic capacity	3.1 mgd, including recycle
Chemical feed rates	
Polyaluminum Chloride	35 – 70 mg/l
Operating parameters	
Pressurized recycle flow	350-700 gpm
Operating pressure	125 PSI
Maximum horizontal velocity	<3.1 FPS
Maximum daily sludge	1,670 pounds dry solids, 10,000 gallons
Recycle Pumps	
Number	2
Size	25 HP
Flow	350 gpm
Recycle Flow Meter (FM-3)	
Type	**Propeller**
Size	6 inch
Range	0–2.5 MGD
Influent Flow Meter (FM-1)	
Type	**Doppler**
Size	14 inch
Range	0–14 MGD

Plant Air (Proposed)

Air Compressor	
Type	Rotary Screw
Size	15 HP
Output	51 ACFM
Operating Pressure	125 psig

Gravity Filters (1980 Construction) – To Be Abandoned

Capacity	2.1 mgd
Number of filters	2
Surface area, total	310 square feet
Maximum loading rate	5 gpm/sf
Hydraulic capacity	2.2 mgd
Media	
Type	Gravel, sand, and anthracite coal
Depth	22" gravel, 9" sand, 21" coal
Backwash / surface wash	Automatic on timer or pressure differential
Backwash rate	20 gpm/sf
Surface wash	10.5 gpm

Gravity Filters **(2007 Construction)**

Capacity	4.0 mgd
Number of filters	4
Surface area, total	573 square feet
Maximum loading rate	4.85 gpm/sf
Hydraulic capacity	4.0 mgd
Media	
Type	Gravel, sand, and anthracite coal
Depth	12" silica sand, 24" anthracite coal
Backwash control	Manual, timed or pressure differential
Backwash rate	15 gpm/sf
Backwash flow (1 filter)	2,147 gpm
Backwash duration	4 – 8 minutes
Backwash volume	8,600 – 17,200 gallons
Air Scour Blower	
Type	Rotary Positive Displacement
Size	15 HP
Air scour rate	3.0 scfm/sf
Air Scour flow (1 filter)	429 scfm @ 4 psig
Backwash Flow Meter (FM-5)	
Type	**Transit Time**
Size	16 inch
Range	0–17 MGD
Filter Effluent Flow Meter (FM-4)	
Type	**Transit Time**
Size	18 inch
Range	0–23 MGD

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Disinfection (1980 Construction)

Type	150-pound gas cylinders
Chlorinator capacity	100 ppd
Feed rate, minimum	30 to 50 pounds / million gallons
Residual, minimum	2 mg/l
Chlorine Contact Chamber	
Sidewater depth	4 feet with 1 feet of freeboard
Volume	87,500 gallons
Length to width ratio	24

Outfall to Bear Creek (1980 Construction) – To Be Abandoned

Size and material	18 inch concrete
Length	270 feet
Single port	
Type	Perpendicular to streamflow
Stream gauge	
Type	Box culvert with 10' weir
Measurement	Manual staff guage

Effluent/Irrigation Pump Station (2000 Construction)

Pumps	
Type	Vertical turbine
No. Of pumps	2 + 1 future
Capacity	500–7,000 gpm
Motor horsepower	300 bhp
Motor control	VFD
Wet well	
Type	12-ft id manhole
Operating volume, pump 1 on to pump off	3,800 gal
Level control	Pressure transducer
Lift station (in Plant)	
Pump type	Submersible
No. Of pumps	2
Capacity, each pump	175 gpm at 15 ft tdh
Motor horsepower	3 bhp
Speed	1750 rpm
Wet well	8-ft ID manhole
Level control	Pressure transducer

Plant Standby Power Generator (2000 Construction)

Reliability Class	I
Location	Eff/Irr Pump Station
Type	Diesel Engine
Size	750 KW
Transfer Switch	Automatic

Plant Alarm System

Type	After Hours via Auto Telephone Dialer

Effluent/Irrigation Forcemain (2000 & 2006 Construction)

Material	PVC and HDPE
Size (Nominal inside diameter)	24 inches
Length	27,000 feet (approx. entire length)
Capacity	
Design Capacity	10.1 mgd
Design Velocity	5.0 fps
Approx. Operating Range of Flows	1.0 to 4.0 mgd
Operating Velocities	0.5 to 2.0 fps

Discharge Monitoring Structure (2006 Construction)

Dechlorination (for surface water discharge conditions only)	
Feed Solution	Ascorbic Acid
Chemical Feed Pumps	2 – 13 gph (with 1000:1 Turndown)
Feed Control	Flow and Cl2 residual paced
Effluent Sampler:	
Type: Flow Paced or Time Composite	For Bacteria BOD, TSS, NH3, pH,
Continuous Monitoring/Recording:	
Temperature	Probe.
DO	Probe
Chlorine	Residual Analyzer (2)
Flow Measurement:	
Type	Electromagnetic Multi-port Insertion Type
Size	12-inch

Molalla River Outfall (2006 Construction)

Material (for outfall extension and diffuser)	HDPE
Size (Nominal ID)	24 inches
Length	23 feet
Diffuser Design	
Number of Ports	Three (Duckbill)
Diameter of Port	Eight inches
Minimum Summer Submergence	One inch
Minimum Winter Submergence	12 inches

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APPENDIX C Solids Sampling Plan

Oregon
John A. Kitzhaber, MD, Governor

Department of Environmental Quality
Northwest Region Portland Office/Water Quality
2020 SW 4th Avenue, Suite 400
Portland, OR 97201-4987
(503) 229-5263
FAX (503) 229-6957
TTY 711

June 18, 2012

Jon Patrick, Lead Operator
City of Molalla Wastewater Treatment Plant
12424 S. Toliver Road,
Molalla, OR 97038

Re: WQ-Clackamas County
City of Molalla Wastewater Treatment Plant
NPDES Permit No. 101514; File No. 57613
Approval of Lagoon Solids Sampling Plan

Dear Mr. Patrick:

The Department of Environmental Quality (DEQ) has completed the review of the Lagoon Solids Sampling Plan for the City of Molalla Wastewater Treatment Plant, revised and submitted to the DEQ on June 14, 2012. The City plans to dredge solids from one section of a lagoon in summer 2013 and must first sample the solids to determine if requirements for land application of biosolids can be met without further treatment. The revised sampling plan is hereby approved.

DEQ understands that the sampling plan will be made part of the proposed Biosolids Management Plan that must be submitted for DEQ review, public notice and approval *prior to* the land application of biosolids next year. Please submit the results of all solids analyses from the lagoon samples as soon as available.

If you have any questions about this approval or the required Biosolids Management Plan, please feel free to contact me by phone at 503.229.5347 or by email at schrandt.connie@deq.state.or.us.

Sincerely,

Connie M. Schrandt

Connie M. Schrandt
Soils/Land Application Specialist

Ec: Ron Doughten, DEQ-HQ

Lagoon Solids Sampling Plan
City of Molalla Water Pollution Control Facility
2012

The City of Molalla plans to dredge solids from Pond #1 at the wastewater plant and land-apply the solids at agronomic rates to two proposed pasture sites. No more than 290 dry tons of solids will be applied per year and the sampling will be conducted once per year. Should the city plan on hauling more than 290 dry tons for land application in the same year, the biosolids management plan and the sampling frequency may be revised.

For sampling purposes, the lagoon (Pond #1) was sectioned into four quadrants (see site map attached). Since the majority of solids are built up in quadrant #1 and the City intends to dredge biosolids from quadrant #1 only, quadrant #1 was further divided into 10 subsections. Three individual samples will be collected from each subsection: one for the composite bench scale anaerobic digestion test, one for Fecal Coliforms, and one for metals, pH, and nutrients. Samples for the bench scale test and the metals, pH and nutrients tests will be composited into one sample at the treatment plant prior to transporting to Alexin Analytical for analysis.

The samples will be collected from a boat with a sludge judge. The depth of the sludge blanket and the approximate depth of the sample below the surface of the sludge blanket will be recorded prior to collecting the samples. All the samples will be pulled from near the bottom of the sludge blanket because that is where we will be drawing solids. The samples will be received at Alexin Analytical within six hours after they are collected and a chain of custody report will be filled out showing the time, date, location, number of samples, name of person collecting the sample and what the sample will be tested for. If the sample is taken to the lab by someone other than the person sampling that will be noted on the chain of custody report as well as the time and date it is received by Alexin Analytical. Samples will be transported in a cooler with ice.

Fecal Coliforms

Samples for fecal coliform testing will be collected from each of the 10 subsections in Quadrant #1 and placed in 100ml sterile bottles provided by Alexin Analytical. Each bottle will be labeled with the subsection it was sampled from.

Class B Biosolids must meet the fecal coliforms requirement of less than 2,000,000 MPN or CFU per gram of dry solids before it can be land applied (40 CFR Part 503.32(b)(2)). Results will be reported as MPN/100 g on a dry weight basis. See attached copy of EPA/625/R-92/013 Appendix F.

Bench scale Anaerobic Digestion

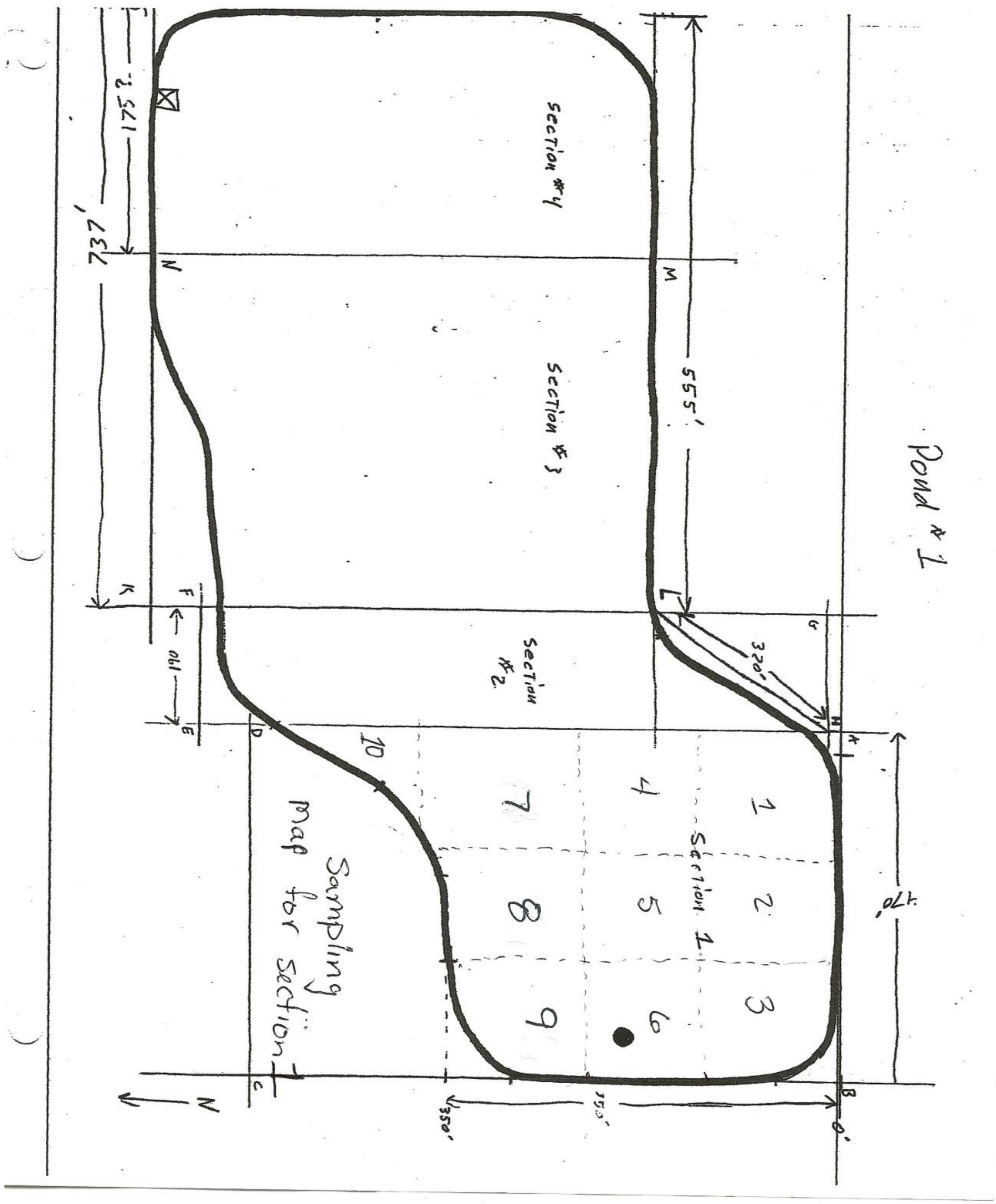
Samples for the bench scale anaerobic digestion test will be composited from each subsection of quadrant #1. One 500ml sample will be collected from each subsection and the sample containers will be completely filled and sealed tightly to void oxygen and maintain anaerobic conditions. These samples will be taken to the lab at the wastewater plant and composited into a one-liter container that will also be completely filled and sealed tightly to void oxygen and maintain anaerobic conditions.

Alexin Analytical will start the bench scale anaerobic digestion test the same day the samples are collected. The test consists of an initial total solids and total volatile solids determination, then subsamples of the composite are incubated under anaerobic conditions between 30 and 37 degrees Celsius for 40 days. The subsamples are tested again for total solids and total volatile solids with some samples being tested after the first 20 days. After the 40-day digestion period, volatile solids must be reduced by less than 17% to meet Vector Attraction Reduction requirements (40 CFR 503.33b opt. #2) described in the biosolids management plan. See attached copy of EPA /625/R-92/013 Appendix D.

Metals, pH and Nutrients

One 1-liter composite sample will be made from the 100 ml sample containers from each subsection for nutrients, pH and metals. The specific metals to be analyzed are Arsenic, Cadmium, Copper, Lead, Mercury, Molybdenum, Nickel, Selenium and Zinc as required by 40 CFR Part 503.13. The composite sample will also be analyzed for the following nutrients: Total Kjeldahl Nitrogen (TKN), Nitrate-nitrogen (NO_3-N), Ammonia-nitrogen (NH_4-N), Phosphorous, Potassium and pH.

Nutrients, total solids and total volatile solids results will be reported as % dry weight and pH test results will be reported in standard units.


Pond # 1
Sampling Map for Section 1
Section #4
Section #3
Section #2
Section 1
737'
175?
555'
320'
190
470'
350'
0'
1
2
3
4
5
6
7
8
9
10
N

EPA/625/R - 92 /013/Appendix D

Appendix D
Guidance on Three Vector Attraction Reduction Tests

This appendix provides guidance for the vector attraction reduction Options 2,3, and 4 to demonstrate reduced vector attraction (see Chapter 8 for a description of these requirements).

1. Additional Digestion Test for Anaerobically Digested Sewage Sludge

Background

The additional digestion test for anaerobically digested sewage sludge is based on research by Jeris et al. (1985). Farrell and Bhide (1993) explain in more detail the origin of the time and volatile solids reduction requirements of the test.

Jeris et al. (1985) measured changes in many parameters including volatile solids content while carrying out additional digestion of anaerobically digested sludge from several treatment works for long periods. Samples were removed from the digesters weekly for analysis. Because substantial amount of sample was needed for all of these tests, they used continuously mixed digesters of 18 liters capacity. The equipment and procedures of Jeris et al., although not complex, appear to be more elaborate than needed for a control test. EPA staff (Farrell and Bhide, 1993) have experimented with simplified tests and the procedure recommended is based on their work.

Recommended Procedure

The essentials of the test are as follows:

- Remove, from the plant-scale digester, a representative sample of the sewage sludge to be evaluated to determine additional volatile solids destruction. Keep the sample protected from oxygen and maintain it at the temperature of the digester. Commence the test within 6 hours after taking the sample.
- Flush fifteen 100-mL volumetric flasks with nitrogen, and add approximately 50 mL of the sludge to be tested into each flask. Frequently mix the test sludge during this operation to assure that its composition remains uniform. Select five flasks at random, and determine total solids content and volatile solids content, using the entire 50 mL for the determination. Seal each of the remaining flasks with a stopper with a single glass tube through it to allow generated gases to escape.
- Connect the glass tubing from each flask through a flexible connection to a manifold. To allow generated gases to escape and prevent entry of air, connect the manifold to a watersealed bubbler by means of a vertical glass tube. The tube should be at least 30-cm long with enough water in the bubbler so that an increase in atmospheric pressure will not cause backflow of air or water into the manifold. Maintain the flasks containing the sludge at constant temperature either by inserting them in a water bath (the sludge level in the flasks must be below the water level in the bath) or by placing the entire apparatus in a constant temperature room or box. The temperature of the additional digestion test should be the average temperature of the plant digester, which should be in the range of 30°C to 40°C (86°F to 104°F). Temperature should be controlled within + 0.15°C (0.27°F).
- Each flask should be swirled every day to assure adequate mixing, using care not to displace sludge up into the neck of the flask. Observe the water seal for the first few days of operation. There should be evidence that gas is being produced and passing through the bubbler.
- After 20 days, withdraw five flasks at random. Determine total and volatile solids content using the entire sample for the determination. Swirl the flask vigorously before pouring out its contents to minimize the hold up of thickened sludge on the walls and to assure that any material left adhering to the flask walls will have the same average composition as the material withdrawn. Use a consistent procedure. If holdup on walls appears excessive, a minimal amount of distilled water may be used to wash solids off the walls. Total removal is not necessary, but any solids left on the walls should be approximately of the same composition as the material removed.
- After 40 days, remove the remaining five flasks. Determine total and volatile solids content using the entire sample from each flask for the determination. Use the same precautions as in the preceding step to remove virtually all of the sludge, leaving only material with the same approximate composition as the material removed.

Total and volatile solids contents are determined using the procedures of Method 2540 G of Standard Methods (APHA, 1992).

Mean values and standard deviations of the total solids content, the volatile solids content, and the percent volatile solids are calculated. Volatile solids reductions that result from the additional digestion periods of 20 and 40 days are calculated from the mean values by the Van Kleeck equation and by a material balance (refer to Appendix C for a general description of these calculations). The results obtained at 20 days give an early indication that the test is proceeding satisfactorily and will help substantiate the 40-day result.

Alternative approaches are possible. The treatment works may already have versatile bench-scale digesters available. This equipment could be used for the test, provided accuracy and reproducibility can be demonstrated. The approach described above was developed because Farrell and Bhide (1993) in their preliminary work experienced much difficulty in withdrawing representative samples from large digesters even when care was taken to stir the digesters thoroughly before sampling. If an alternative experimental setup is used, it is still advisable to carry out multiple tests for the volatile solids content in order to reduce the standard error of this measurement, because error in the volatile solids content measurement is inflated by the nature of the equation used to calculate the volatile solids reduction.

Variability in flow rates and nature of the sludge will result in variability in performance of the plant-scale digesters. It is advisable to run the additional digestion test routinely so that sufficient data are available to indicate average performance. The arithmetic mean of successive tests (a minimum of three is suggested) should show an additional volatile solids reduction of $\leq$ 17%.

Calculation Details

Appendix C, Determination of Volatile Solids Reduction by Digestion, describes calculation methods to use for digesters that are continuously fed or are fed at least once a day. Although the additional anaerobic digestion test is a batch digestion, the material balance calculations approach is the same. Masses of starting streams (input streams) are set equal to masses of ending streams (output streams).

The test requires that the fixed volatile solids reduction (FVSR) be calculated both by the Van Kleeck equation and the material balance method. The Van Kleeck equation calculations can be made in the manner described in Appendix C.

The calculation of the volatile solids reduction (and the fixed fractional solids reduction [FFSR]) by the mass balance method shown below has been refined by subtracting out the mass of gas lost from the mass of sludge at the end of the digestion step. For continuous digestion, this loss of mass usually is ignored, because the amount is small in relation to the total digesting mass, and mass before and after digestion are assumed to be the same. Considering the inherent difficulty in matching mass and composition entering to mass and composition leaving for a continuous process, this is a reasonable procedure. For batch digestion, the excellent correspondence between starting material and final digested sludge provides much greater accuracy in the mass balance calculation, so inclusion of this lost mass is worthwhile.

In the equations presented below, concentrations of fixed and volatile solids are mass fractions--mass of solids per unit mass of sludge (mass of sludge includes both the solids and the water in the sludge)– and are indicated by, the symbols lowercase y and x. This is different from the usage in Appendix C where concentrations are given in mass per unit volume, and are indicated by the symbols uppercase y and x. This change has been made because masses can be determined more accurately than volumes in small-scale tests.

In the material balance calculation, it is assumed that as the sludge digests, volatile solids and fixed solids are converted to gases that escape or to volatile compounds that distill off when the sludge is dried. Any production or consumption of water by the biochemical reactions in digestion is assumed to be negligible. The data collected (volatile solids and fixed solids concentrations of feed and digested sludge) allow mass balances to be drawn on volatile solids, fixed solids, and water. As noted, it is assumed that there is no change in water mass – all water in the feed is present in the digested sludge. Fractional reductions in volatile solids and fixed solids can be calculated from these mass balances for the period of digestion. Details of the calculation of these relationships are given by Farrell and Bhide (1993). The final form of the equations for fractional volatile solids reduction (mass balance [m.b.] method) and fractional fixed solids reduction (m.b. method) are given below:

$$FVSR(m.b.) = \frac{y_f(1-x_b)-y_b(1-x_f)}{y_f(1-x_b-y_b)} \qquad (1a)$$

$$FFSR(m.b.) = \frac{x_f(1-y_b)-x_b(1-y_f)}{x_f(1-x_b-y_b)} \qquad (1b)$$

where:

y = mass fraction of volatile solids in the liquid sludge
x = mass fraction of fixed solids in the liquid sludge
f = indicates feed sludge at start of the test
b = indicates "bottoms" sludge at end of the test

If the fixed solids loss is zero, these two equations are reduced to Equation 2 below:

$$FVSR(m.b.) = (y_f - y_b)/y_f(1-y_b) \qquad (2)$$

If the fixed solids loss is not zero but is substantially smaller than the volatile solids reduction, Equation 2 gives surprisingly accurate results. For five sludges batch-digested by Farrell and Bhide (1993), the fixed solids reductions were about one-third of the volatile solids reductions. When the FVSR(m.b.) calculated by Equation 1a averaged 15%, the FVSR(m.b.) calculated by Equation 2 averaged 14.93%, which is a trivial difference.

The disappearance of fixed solids unfortunately has a relatively large effect on the calculation of FVSR by the Van Kleeck equation. The result is lower than it should be. For five sludges that were batch-digested by Farrell and Bhide (1993), the FVSR calculated by the Van Kleeck method averaged 15%, whereas the FVSR (m.b.) calculated by Equation 1a or 2 averaged about 20%. When the desired endpoint is an FVSR below 17%, this is a substantial discrepancy.

The additional digestion test was developed for use with the Van Kleeck equation, and the 17% requirement is based on results calculated with this equation. In the future, use of the more accurate mass balance equation may be required, with the requirement adjusted upward by an appropriate amount. This cannot be done until more data with different sludge become available.

2. Specific Oxygen Uptake Rate

Background

The specific oxygen uptake rate of a sewage sludge is an accepted method for indicating the biological activity of an activated sewage sludge mixed liquor or an aerobically digesting sludge. The procedure required by the Part 503 regulation for this test is presented in Standard Methods (APHA, 1992) as Method 2710 B, Oxygen-Consumption Rate.

The use of the specific oxygen uptake rate (SOUR) has been recommended by Eikum and Paulsrud (1977) as a reliable method for indicating sludge stability provided temperature effects are taken into consideration. For primary sewage sludges aerobically digested at 18°C (64°F), sludge was adequately stabilized (i.e., it did not putrefy and cause offensive odors) when the SOUR was less than 1.2 mg O_2/hr/g VSS (volatile suspended solids). The authors investigated several alternative methods for indicating stability of aerobically digested sludges and recommended the SOUR test as the one with the most advantages and the least disadvantages.

Ahlberg and Boyko (1972) also recommend the SOUR as an index of stability. They found that, for aerobic digesters operated at temperatures above 10°C (50°F), SOUR fell to about 2.0 mg O_2/hr/gVSS after a total sludge age of 60 days and to 1.0 mg O_2/hr/g VSS after about 120 days sludge age. These authors state that a SOUR of less than 1.0 mg O2/hr/g VSS at temperatures above 10°C (50°F) indicates a stable sludge.

The results obtained by these authors indicate that long digestion times–more than double the residence time for most aerobic digesters in use today–are needed to eliminate odor generation from aerobically digested sludges. Since the industry is not being deluged with complaints about odor from aerobic digesters, it appears that a higher SOUR standard can be chosen than they suggest without causing problems from odor (and vector attraction).

The results of long-term batch aerobic digestion tests by Jeris et al. (1985) provide information that is helpful in setting a SOUR requirement that is reasonably attainable and still protective. Farrell and Bhide (1993) reviewed the data these authors obtained with four sewage sludges from aerobic treatment processes and concluded that a standard of 1.5 mg O_2/hr/g TS at 20°C (68°F) would discriminate between adequately stabilized and poorly stabilized sludges. The "adequately digested" sludges were not totally trouble-free, i.e., it was possible under adverse conditions to develop odorous conditions. In all cases where the sludge was deemed to be adequate, minor adjustment in plant operating conditions created an acceptable sludge.

The SOUR requirement is based on total solids rather than volatile suspended solids. This usage is preferred for consistency with the rest of the Part 503 regulation where all loadings are expressed on a total solids basis. The use of total solids concentration in the SOUR calculation is rational since the entire sludge solids and not just the volatile solids degrade and may exert some oxygen demand. Making an adjustment for the difference caused by basing the requirement on TS instead of VSS, the standard is about 1.8 times higher than Eikum and Paulsrud's recommended value and 2.1 times higher than Ahlberg and Boykos' recommendation.

Unlike anaerobic digestion, which is typically conducted at 35°C (95°F), aerobic digestion is carried out without any deliberate temperature control. The temperature of the digesting sludge will be close to ambient temperature, which can range from 5°C to 30°C (41°F to 86°F). In this temperature range, SOUR increases with increasing temperature. Consequently, if a requirement for SOUR is selected, there must be some way to convert SOUR test results to a standard temperature. Conceivably, the problem could be avoided if the sludge were simply heated or cooled to the standard temperature before running the SOUR test. Unfortunately, this is not possible, because temperature changes in digested sludge cause short-term instabilities in oxygen uptake rate (Benedict and Carlson [1973], Farrell and Bhide [1993]).

Eikum and Paulsrud (1977) recommend that the following equation be used to adjust the SOUR determined at one temperature to the SOUR for another temperature:

$$(SOUR)_{T1} / (SOUR)_{T2} = \theta^{(T1-T2)} \qquad (3)$$

where:

$(SOUR)_{T1}$ = specific oxygen uptake rate at T_1
$(SOUR)_{T2}$ = specific oxygen uptake rate at T_2
θ = the Streeter-Phelps temperature sensitivity coefficient

These authors calculated the temperature sensitivity coefficient using their data on the effect of temperature on the rate of reduction in volatile suspended solids with time during aerobic digestion. This is an approximate approach, because there is no certainty that there is a one-to-one relationship between oxygen uptake rate and rate of volatile solids disappearance. Another problem is that the coeffficient depends on the makeup of each individual sludge. For example, Koers and Mavinic (1977) found the value of θ to be less than 1.072 at temperatures above 15°C (59°F) for aerobic digestion of waste activated sludges, whereas Eikum and Paulsrud (1977) determined θ to equal 1.112 for primary sludges. Grady and Lim (1980) reviewed the data of several investigators and recommended that θ = 1.05 be used for digestion of waste-activated sludges when more specific information is not available. Based on a review of the available information and their own work, Farrell and Bhide (1993) recommend that Eikum and Paulsruds' temperature correction procedure be utilized, using a temperature sensitivity coefficient in the range of 1.05 to 1.07.

Recommended Procedure for Temperature Correction

A SOUR of 1.5 mg O_2/hr/g total solids at 20°C (68°F) was selected to indicate that an aerobically digested sludge has been adequately reduced in vector attraction.

The SOUR of the sludge is to be measured at the temperature at which the aerobic digestion is occurring in the treatment works and corrected to 20°C (68°F) by the following equation:

$$SOUR_{20} = SOUR_T \times \theta^{(20-T)} \qquad (4)$$

where
θ = 1.05 above 20°C (68°F)
1.07 below 20°C (68°F)

This correction may be applied only if the temperature of the sludge is between 10°C and 30°C (50°F and 86°F). The restriction to the indicated temperature range is required to limit the possible error in the SOUR caused by selecting an improper temperature coefficient. Farrell and Bhide's (1993) results indicate that the suggested values for θ will give a conservative value for SOUR when translated from the actual temperature to 20°C (68°F).

The experimental equipment and procedures for the SOUR test are those described in Part 2710 B, Oxygen Consumption Rate, of Standard Methods (APHA, 1992). The method allows the use of a probe with an oxygen-sensitive electrode or a respirometer. The method advises that manufacturer's directions be followed if a respirometer is used. No further reference to respirometric methods will be made here. A timing device is needed as well as a 300-mL biological oxygen demand (BOD) bottle. A magnetic mixer with stirring bar is also required.

The procedure of Standard Method 2710 B should be followed with one exception. The total solids concentration instead of the volatile suspended solids concentration is used in the calculation of the SOUR. Total solids concentration is determined by Standard Method 2540 G. Method 2710 B cautions that if the suspended solids content of the sludge is greater than 0.5%, additional stirring besides that provided by the stirring bar be considered. Experiments by Farrell and Bhide (1993) were carried out with sludges up to 2% in solids content without difficulty if the SOUR was lower than about 3.0 mg O_2/g/h. It is possible to verify that mixing is adequate by running repeat measurements at several stirrer bar speeds. If stirring is adequate, oxygen uptake will be independent of stirrer speed.

The inert mineral solids in the wastewater in which the sludge particles are suspended do not exert an oxygen demand and probably should not be part of the total solids in the SOUR determination. Ordinarily, they are such a small part of the total solids that they can be ignored. If the ratio of inert dissolved mineral solids in the treated wastewater to the total solids in the sludge being tested is greater than 0.15, a correction should be made to the total solids concentration. Inert dissolved mineral solids in the treated wastewater effluent is determined by the method of Part 2540 B of Standard Methods (APHA, 1992). This quantity is subtracted from the total solids of the sludge to determine the total solids to be used in the SOUR calculation.

The collection of the sample and the time between sample collection and measurement of the SOUR are important. The sample should be a composite of grab samples taken within a period of a few minutes duration. The sample should be transported to the laboratory expeditiously and kept under aeration if the SOUR test cannot be run immediately. The sludge should be kept at the temperature of the digester from which it was drawn and aerated thoroughly before it is poured into the BOD bottle for the test. If the temperature differs from 20°C (68°F) by more than ±10°C (±18°F), the temperature correction may be inappropriate and the result should not be used to prove that the sewage sludge meets the SOUR requirement.

Variability in flow rates and nature of the sludge will result in variability in performance of the plant-scale digesters. It is advisable to run the SOUR test routinely so that sufficient data are available to indicate average performance. The arithmetic mean of successive tests-a minimum of seven over 2 or 3 weeks is suggested-should give a SOUR of ≤ 1.5 mg O_2/hr/g total solids.

3. *Additional Digestion Test for Aerobically Digested Sewage Sludge*

Background

Part 503 lists several options that can be used to demonstrate reduction of vector attraction in sewage sludge. These options include reduction of volatile solids by 38% and demonstration of the SOUR value discussed above (see also Chapter 8). These options are feasible for many, but not all, digested sludges. For example, sludges from extended aeration treatment works that are aerobically digested usually cannot meet this requirement because they already are partially reduced in volatile solids content by their exposure to long aeration times in the wastewater treatment process.

The specific oxygen uptake test can be utilized to evaluate aerobic sludges that do not meet the 38% volatile solids reduction requirement. Unfortunately, this test has a number of limitations. It cannot be applied if the sludges have been digested at temperatures lower than 10°C (50°F) or higher than 30°C (86°F). It has not been evaluated under all possible conditions of use, such as for sludges of more than 2% solids.

A straightforward approach for aerobically treated sludges that cannot meet either of the above criteria is to determine to what extent they can be digested further. If they show very little capacity for further digestion, they will have a low potential for additional biodegradation and odor generation that attracts vectors. Such a test necessarily takes many days to complete, because time must be provided to get measurable biodegradation. Under most circumstances, this is not a serious drawback. If a digester must be evaluated every 4 months to see if the sewage sludge meets vector attraction reduction requirements, it will be necessary to start a regular assessment program. A record can be produced showing compliance. The sludge currently being produced cannot be evaluated quickly but it will be possible to show compliance over a period of time.

The additional digestion test for aerobically digested sludges in Part 503 is based on research by Jeris et al. (1985), and has been discussed by Farrell et al. (EPA, 1992). Farrell and Bhide (1993) explain in more detail the origin of the time and volatile solids reduction requirements of the test.

Jeris et al. (1985) demonstrated that several parameters–volatile solids reduction, COD, BOD, and SOUR–declined smoothly and approached asymptotic values with time as sludge was aerobically digested. Any one of these parameters potentially could be used as an index of vector attraction reduction for aerobic sludges. SOUR has been adopted (see above) for this purpose. Farrell and Bhide (1993) have shown that the additional volatile solids reduction that occurs when sludge is batch digested aerobically for 30 days correlates equally as well as SOUR with the degree of vector attraction reduction of the sludge. They recommend that a sewage sludge be accepted as suitably reduced in vector attraction when it shows less than 15% additional volatile solids reduction after 30 days additional batch digestion at 20°C (68°F). For three out of four sludges investigated by Jeris et al. (1985), the relationship between SOUR and additional volatile solids reduction showed that the SOUR was approximately equal to 1.5 mg O_2/hr/g (the Part 503 requirement for SOUR) when additional volatile solids reduction was 15%. The two requirements thus agree well with one another.

Recommended Procedure

There is considerable flexibility in selecting the size of the digesters used for the additional aerobic digestion test. Farrell and Bhide (1993) used a 20-liter fish tank. A tank of rectangular cross-section is suggested because sidewalls are easily accessible and are easily scraped clean of adhering solids. The tank should have a loose-fitting cover that allows air to escape. It is preferable to vent exhaust gas to a hood to avoid exposure to aerosols. Oil and particle-free air is supplied to the bottom of the digester through porous stones at a rate sufficient to thoroughly mix the sewage sludge. This will supply adequate oxygen to the sludge, but the oxygen level in the digesting sludge should be checked with a dissolved oxygen meter to be sure that the supply of oxygen is adequate. Oxygen level should be at least 2 mg/L. Mechanical mixers also were used to keep down foam and improve mixing.

If the total solids content of the sewage sludge is greater than 2%, the sludge must be diluted to 2% solids with secondary effluent at the start of the test. The requirement stems from the results of Reynolds (1973) and Malina (1966) which demonstrate that rate of volatile solids reduction decreases as the feed solitis concentration increases. Thus, for example, a sludge with a 2% solids content that showed more than 15% volatile solids reduction when digested for 30 days might show a lower volatile solids reduction and would pass the test if it were at 4%. This dilution may cause a temporary change in rate of volatile solids reduction. However, the long duration of the test should provide adequate time for recovery and demonstration of the appropriate reduction in volatile solids content.

When sampling the sludge, care should be taken to keep the sludge aerobic and avoid unnecessary temperature shocks. The sludge is digested at 20°C (68°F) even if the digester was at some other temperature. It is expected that the bacterial population will suffer a temporary shock if there is a substantial temperature change, but the test is of sufficient duration to overcome this effect and show a normal volatile solids reduction. Even if the bacteria are shocked and do not recover completely, the test simulates what would happen to the sludge in the environment. If it passes the test, it is highly unlikely that the sludge will attract vectors when used or disposed to the environment. For example, if a sludge digested at 35°C (95°F) has not been adequately reduced in volatile solids and is shocked into biological inactivity for 30 days when its temperature is lowered to 20°C (68°F), it will be shocked in the same way if it is applied to the soil at ambient temperature. Consequently, it is unlikely to attract vectors.

The digester is charged with about 12 liters of the sewage sludge to be additionally digested, and aeration is commenced. The constant flow of air to the aerobic digestion test unit will cause a substantial loss of water from the digester. Water loss should be made up every day with distilled water.

Solids that adhere to the walls above and below the water line should be scraped off and dispersed back into the sludge daily. The temperature of the digesting sludge should be approximately 20°C (68°F). If the temperature of the laboratory is maintained at about 22°C (72°F), evaporation of water from the digester will cool the sludge to about 20°C (68°F).

Sewage sludge is sampled every week for five successive weeks. Before sampling, makeup water is added (this will generally require that air is temporarily shut off to allow the water level to be established), and sludge is scraped off the walls and redistributed into the digester. The sludge in the digester is thoroughly mixed with a paddle before sampling, making sure to mix the bottom sludge with the top. The sample is comprised of several grab samples collected with a ladle while the digester is being mixed. The entire sampling procedure is duplicated to collect a second sample.

Total and volatile solids contents of both samples are determined preferably by Standard Method 2540 G (APHA, 1992). Percent volatile solids is calculated from total and volatile solids content. Standard Methods (APHA, 1992) states that duplicates should agree within 5% of their average. If agreement is substantially poorer than this, the sampling and analysis should be repeated.

Calculation Details

Fraction volatile solids reduction is calculated by the Van Kleeck formula (see Appendix C) and by a mass balance method. The mass balance (m.b.) equations become very simple, because final mass of sludge is made very nearly equal to initial mass of sludge by adjusting the volume by adding water. These equations for fractional volatile solids reduction (FVSR) and fractional fixed solids reduction (FFSR) are:

$$FVSR(m.b.) = (y_f - y_b) / y_f \qquad (5a)$$

$$FFSR(m.b.) = (x_f - x_b) / x_f \qquad (5b)$$

where:

y and x = mass fraction of volatile and fixed solids, respectively (see previous section on "Calculation details" for explanation of "mass fraction")

f and b = subscripts indicating initial and final sludges

This calculation assumes that initial and final sludge densities are the same. Very little error is introduced by this assumption.

The calculation of the fractional fixed solids reduction is not a requirement of the test, but it will provide useful information.

The test was developed from information based on the reduction in volatile solids content calculated by the Van Kleeck equation. As noted in the section on the additional anaerobic digestion test, for batch processes the material balance procedure for calculating volatile solids reduction is superior to the Van Kleeck approach. It is expected that the volatile solids reduction by the mass balance method will show a higher volatile solids reduction than the calculation made by using the Van Kleeck equation.

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Appendix F
Sample Preparation for Fecal Coliform Tests and *Salmonella* sp. Analysis

1. Sample Preparation for Fecal Coliform Tests

1.1 Class B Alternative 1

To demonstrate that a given domestic sludge sample meets Class B Pathogen requirements under alternative 1, the density of fecal coliform from at least seven samples of treated sewage sludge must be determined and the geometric mean of the fecal coliform density must not exceed 2 million Colony Forming Units (CFU) or Most Probable Number (MPN) per gram of total solids (dry weight basis). The solids content of treated domestic sludge can be highly variable. Therefore, an aliquot of each sample must be dried and the solids content determined in accordance with procedure 2540 G. of the 18th edition of Standard Methods for the Examination of Water and Wastewater (SM).

Sludge samples to be analyzed in accordance with SM 9221 E. Fecal Coliform MPN Procedure and 9222 D. Fecal Coliform Membrane Filter Procedure may require dilution prior to analysis. An ideal sample volume will yield results which accurately estimate the fecal coliform density of the sludge. Detection of fecal coliform in undiluted samples could easily exceed the detection limits of these procedures. Therefore, it is recommended that the following procedures be used (experienced analysts may substitute other dilution schemes as appropriate).

For Liquid Samples:

1. Use a sterile graduated cylinder to transfer 30.0 mL of well mixed sample to a sterile blender jar. Use 270 mL of sterile buffered dilution water (see Section 9050C) to rinse any remaining sample from the cylinder into the blender. Cover and blend for two minutes on high speed. 1.0 mL of this mixture is 0.1 mL of the original sample or $1.0X10^{-1}$.

2. Use a sterile pipette to transfer 11.0 mL of the blended sample mixture to 99 mL of sterile buffered dilution in a sterile screw cap bottle and mix by vigorously shaking the bottle a minimum of 25 times. This is dilution "A." 1.0 mL of this mixture is 0.010 mL of the original sample or $1.0X10^{-2}$.

3. Use a sterile pipette to transfer 1.0 mL of dilution "A" to a second screw cap bottle containing 99 mL of sterile buffered dilution water, and mix as before. This is dilution "B." 1.0 mL of this mixture is 0.00010 mL of the original sample or $1.0X10^{-4}$.

4. Use a sterile pipette to transfer 1.0 mL of dilution "B" to a sterile screw cap bottle containing 99 mL of sterile buffered dilution water, and mix as before. This is dilution "C." Go to step 5 for MPN analysis (preferred) or 7 for MF analysis.

5. For MPN analysis, follow procedure 9221 E. in SM. Four series of 5 tubes will be used for the analysis. Inoculate the first series of 5 tubes each with 10.0 mL of dilution "B." This is a 0.0010 mL of the original sample. The second series of tubes should be inoculated with 1.0 mL of dilution "B" (0.00010). The third series of tubes should receive 10.0 mL of "C" (0.000010). Inoculate a fourth series of 5 tubes each with 1.0 mL of dilution "C" (0.0000010). Continue the procedure as described in SM.

6. Refer to Table 9221.IV. in SM to estimate the MPN index/100 mL. Only three of the four series of five tubes will be used for estimating the MPN. Choose the highest dilution that gives positive results in all five tubes, and the next two higher dilutions for your estimate. Compute the MPN/g according to the following equation:

$$\text{MPN Fecal Coliform/g} = \frac{10 \times \text{MPN Index/100 mL}}{\text{largest volume} \times \text{\% dry solids}}$$

Examples:

In the examples given below, the dilutions used to determine the MPN are underlined. The number in the numerator represents positive tubes; that in the denominator, the total number of tubes planted; the combination of positives simply represents the total number of positive tubes per dilution.

Example	0.0010 mL	0.00010 mL	0.000010 mL	0.0000010 mL	Combination of positives
a	5/5	5/5	3/5	0/5	5-3-0
b	5/5	3/5	1/5	0/5	5-3-1
c	0/5	1/5	0/5	0/5	0-1-0

For each example we will assume that the total solids content is 4.0%.

For example a:

The MPN index/100 mL from Table 9221.4 is 80. Therefore:

$$MPN/g = \frac{10 x 80}{0.00010 \times 4.0} = 2.0 \times 10^6$$

For example b:

The MPN index/100 mL from Table 9221.4 is 110. Therefore:

$$MPN/g = \frac{10 x 110}{0.0010 \times 4.0} = 2.8 \times 10^5$$

For example c:

The MPN index/100 mL from Table 9221.4 is 2. Therefore:

$$MPN/g = \frac{10 x 2}{0.0010 \times 4.0} = 5.0 \times 10^3$$

5. Alternately the membrane filter procedure may be used to determine fecal coliform density. This method should only be used if comparability with the MPN procedure has been established for the specific sample medium. Three individual filtrations should be conducted in accordance with SM 9222 D. using 10.0 mL of dilution "C," and 1.0 mL and 10.0 mL of dilution "B." These represent 0.000010, 0.00010, and 0.0010 mL of the original sample. Incubate samples, and count colonies as directed. Experienced analysts are encouraged to modify this dilution scheme (e.g. half log dilutions) in order to obtain filters which yield between 20 and 60 CFU.

6. Compute the density of CFU from membrane filters which yield counts within the desired range of 20 to 60 fecal coliform colonies:

$$\text{coliform colonies/g} = \frac{\text{coliform colonies counted} \times 100}{\text{mL sample} \times \text{\% dry solids}}$$

For Solid Samples:

1. In a sterile dish weigh out 30.0 grams of well mixed sample. Whenever possible, the sample tested should contain all materials which will be included in the sludge. For example, if wood chips are part of a sludge compost, some mixing or grinding means may be needed to achieve homogeneity before testing. One exception would be large pieces of wood which are not easily ground and may be discarded before blending. Transfer the sample to a sterile blender. Use 270 mL of sterile buffered dilution water to rinse any remaining sample into the blender. Cover and blend on high speed for two minutes. One milliliter of this sample contains 0.10 g of the original sample.

2. Use a sterile pipette to transfer 11.0 mL of the blender contents to a screw cap bottle containing 99 mL of sterile buffered dilution water and shake vigorously a minimum of 25 times. One milliliter of this sample contains 0.010 g of the original sample. This is dilution "A."

3. Follow the procedures for "Liquid Samples" starting at Step 3.

Examples:

Seven samples of a treated sludge were obtained prior to land spreading. The solids concentration of each sample was determined according to SM. These were found to be:

Sample No.	Solids Concentration (%)
1	3.8
2	4.3
3	4.0
4	4.2
5	4.1
6	3.7
7	3.9

The samples were liquid with some solids. Therefore the procedure for liquid sample preparation was used. Furthermore, the membrane filter technique was used to determine if the fecal coliform concentration of the sludge would meet the criteria for Class B alternative 1. Samples were prepared in accordance with the procedure outlined above. This yielded 21 individual membrane filters (MF) plus controls. The results from these tests are shown in Table 1

Table 1. Number of Fecal Coliform Colonies on MF Plates

Sample No.	0.000010 mL Filtration	0.00010 mL Filtration	0.0010 mL Filtration
1	0	1	23
2	2	18	TNTC
3	0	8	65
4	0	5	58
5	0	1	17
6	0	1	39
7	0	1	20

The coliform density is calculated using only those MF plates which have between 20 and 60 blue colonies whenever possible. However, there may be occasions when the total number of colonies on a plate will be above or below the ideal range. If the colonies are not discrete and appear to be growing together results should be reported as "too numerous to count" (TNTC). If no filter has a coliform count falling in the ideal range (20 - 60), total the coliform counts on all countable filters and report as coliform colonies/g. For sample number 2 the fecal coliform density is:

$$\text{coliform colonies/g} = \frac{(2+18)\times 100}{(0.000010 + 0.00010) \times 4.3} = 4.2 \times 10^6$$

Sample number 3 has two filters which have colony counts outside the ideal range also. In this case both countable plates should be used to calculate the coliform density/g. For sample number 3, the fecal coliform density is:

$$\text{coliform colonies/g} = \frac{(8 + 65) \times 100}{(0.00010 + 0.0010) \times 4.0} = 1.6 \times 10^6$$

Except for sample number 5, all of the remaining samples have at least one membrane filter within the ideal range. For these samples, use the number of colonies formed on that filter to calculate the coliform density. For sample number 1, the fecal coliform density is:

$$\text{coliform colonies/g} = \frac{23\times 100}{0.0010 \times 3.8} = 6.0 \times 10^5$$

Coliform densities of all the samples were calculated and converted to $\log_{10}$ values to compute a geometric mean. These calculated values are presented in Table 2.

Table 2. Coliform Density of Sludge Samples

Sample No.	Coliform Density	$\log_{10}$
1	6.0×10^5	5.78
2	4.2×10^6	6.63
3	1.6×10^6	6.22
4	1.4×10^6	6.14
5	4.0×10^5	5.60
6	1.0×10^6	6.02
7	5.1×10^5	5.71

The geometric mean for the seven samples is determined by averaging the $\log_{10}$ values of the coliform density and taking the antilog of that value.

$$(5.78 + 6.63 + 6.22 + 6.14 + 5.60 + 6.02 + 5.71)/7 = 6.01$$

The antilog of $6.01 = 1.03 \times 10^6$

Therefore, the geometric mean fecal coliform density is below 2 million and the sludge meets Class B Pathogen requirements under alternative 1.

1.2 Class A Alternative 1

Part 503 requires that, to qualify as a Class A sludge, treated sewage sludge must be monitored for fecal coliform (or *Salmonella* sp. and have a density of less than 1,000 MPN fecal coliform per gram of total solids (dry weight basis). The regulation does not specify total number of samples. However, it is suggested that a sampling event extend over two weeks and that at least seven samples be collected and analyzed. The membrane filter procedure may not be used for this determination. This is because the high concentration of solids in such sludges may plug the filter or, render the filter uncountable. The total solids content for each sample must be determined in accordance with procedure 2540 G. of SM.

For Liquid Samples:

1. Follow procedure 9221 E. in SM. Inoculate at least four series of five tubes using ten fold serial dilutions. Prepare the sample as described for "Class B Alternative 1, Liquid Samples," except inoculate each of the first series of tubes with 10.0 mL of the blender contents (the concentration of the enrichment broth must be adjusted to compensate for the volume of added sample). This is equivalent to adding 1.0 mL of sludge to the first series of tubes. Inoculate the remaining tubes and complete the analysis in accordance with SM.

2. Calculate the MPN as directed in Step 4 above.

For Solid Samples:

1. Follow procedure 9221 E. in SM. Inoculate at least four series of five tubes using ten fold serial dilutions. Prepare the sample as described for "Class B Alternative 1, Solid Samples," except inoculate each of the first series of tubes with 10.0 mL of the blender contents (the concentration of the enrichment broth must be adjusted to compensate for the volume of added sample). This is equivalent to adding 1.0 g of sludge (wet wieght) to the first series of tubes. Inoculate the remaining tubes and complete the analysis in accordance with SM.

2. Calculate the MPN as directed in step 4 above.

2. Sample Preparation for *Salmonella* sp. Analysis

Salmonella sp. quantification may be used to demonstrate that a sludge meets Class A criteria, instead of analyzing for fecal coliforms. Sludges with *Salmonella* sp. densities below 3 MPN/4 g total solids (dry weight basis) meet Class A criteria. The analytical method described in Appendix F of this document describes the procedure used to identify *Salmonella* sp. in a water sample. Similarly, the procedures for analysis of *Salmonella* sp. in SM (Section 9260 D) do not address procedures for sludges, the sample preparation step described here should be used, and the total solids content of each sample must be determined according to method 2540 G in SM.

For Liquid Samples:

1. Follow the same procedure used for liquid sample preparation for fecal coliform analysis described under "Class A Alternative 1." However, the enrichment medium used for this analysis should be dulcitol selenite broth (DSE) as described in Appendix G of this document or dulcitol selenite or tetrathionate broth as described in SM. Only three series of five tubes should be used for this MPN procedure. Use a sterile open tip pipette to transfer 10.0 mL of well mixed sample to each tube in the first series. These tubes should contain 10.0 mL of double strength enrichment broth. Each tube in the second series should contain 10.0 mL of double strength enrichment broth. These tubes should each receive 10.0

mL of the blended mixture. The final series of tubes should contain 10.0 mL of single strength enrichment broth. These tubes should each receive 1.0 mL of the blended mixture. Complete the MPN procedure as described in Appendix G or SM as appropriate.

2. Refer to Table 9221.IV. in SM to estimate the MPN index/100 mL. Calculate the MPN/4 g according to the following equation:

$$\textit{Salmonella}\text{ sp. MPN/4 g} = \frac{\text{MPN Index/100 mL x 4}}{\text{\% dry solids}}$$

For example:

If one tube in the first series was identified as being positive for *Salmonella* sp. and no other tubes were found to be positive, from Table 9221.IV one finds that a 1-0-0 combination of positives has an MPN index/100 mL of 2. If the percent of dry solids for the sample was 4.0, then:

$$\textit{Salmonella}\text{ sp. MPN/4g} \quad \frac{2 \times 4}{4.0 = 2} = 2$$

For Solid Samples:

1. Follow the procedure for solid sample preparation for fecal coliform analysis described under Class A Alternative 1 above. However, the enrichment medium used for this analysis should be dulcitol selenite broth (DSE) as described in Appendix G or dulcitol selenite or tetrathionate broth as described in SM, and only three series of five tubes should be used for this MPN procedure. Use aseptic technique to weigh out and transfer 10.0 g of well mixed sample to each screw cap tube in the first series, shake vigorously to mix. These tubes should contain 10.0 mL of double strength enrichment broth. Likewise, each tube in the second series should contain 10.0 mL of double strength enrichment broth. These tubes should receive 10.0 mL of the blended mixture. The final series of tubes should contain 10.0 mL of single strength enrichment broth. These tubes should receive 1.0 mL of the blended mixture. Alternately, because the calculated detection limit is dependent upon the total solids content of the sample, samples with total solids contents >28% can be blended as described above and the blender contents can be used for inoculating the initial series of tubes. When this option is chosen, the final series of tubes will contain 0.1 mL of the blender contents. Complete the MPN procedure as described in Appendix G or SM as appropriate.

2. Refer to Table 9221.IV. in SM to estimate the MPN index/100 mL. Calculate the MPN/4 g according to the following equation:

$$\textit{Salmonella}\text{ sp. MPN/4g} = \frac{\text{MPN Index/100mL x 4}}{\text{\% dry solids}}$$

Appendix D: Sample Results and Agronomic Rate Calculation

NOTE: This is adapted from Pacific Northwest Extension publication number, PNW0511e.

Enter information in these cells as applicable

You must enter information in these cells to determine an application rate

Cells of this color are calulations for your use

Version 20-Dec-07

GENERAL INFORMATION

Biosolids Source		
Field Number/ID		
Dry tons biosolids available (= wet tons x % solids)	290	dry tons
Acres available		acres

BIOSOLIDS DATA

Ammonia/ammonium-N	5,760	mg/kg	12	#/dry ton
Nitrate-N		mg/kg	0	#/dry ton
Total Kjeldahl N	22,830	mg/kg	46	#/dry ton
Percent solids	10%			
Organic nitrogen		mg/kg	0	#/dry ton

NITROGEN (N) CREDITS

PREVIOUS BIOSOLIDS APPLICATIONS	Last Year	2 Years Ago	3 Years Ago	4 Years Ago
Dry tons applied/acre to site				
Organic N concentration (mg/kg)				
N credit (#/dry ton)	0	0	0	0
N credit (#/acre)	0	0	0	0

OTHER CREDITS NOT ACCOUNTED FOR			
Nitrate-N applied in irrigation water	0	#/acre	
N applied at seeding (starter fertilizer)	0	#/acre	
Preplant nitrate-N in root zone (east of Cascades)		#/acre	NOTE: not required if accounted for in the nitrogen recommendation in Cell B30
Plowdown of cover or green manure crop		#/acre	NOTE: not required if accounted for in the nitrogen recommendation in Cell B30
Previous manure applications		#/acre	NOTE: not required if accounted for in the nitrogen recommendation in Cell B30
Total N credit	0	#/acre	

NITROGEN FERTILIZER RECOMMENDATION

Nitrogen recommendation **(via guidelines, agronomist, etc.)**	100	# N/acre/yr

ESTIMATED BIOSOLIDS PLANT-AVAILABLE NITROGEN

Percent of ammonium-N retained after application **(see Table 1)**	55%	
Percent of organic N mineralized in Year 1 **(see Table 2)**	15%	
Estimated plant-available N in biosolids	6	# N/dry ton
Amount of plant-available N needed from biosolids	100	# N/acre

AGRONOMIC BIOSOLIDS APPLICATION RATE

Dry tons per acre =	15.8	dt/acre
Wet tons per acre =	157.8	wt/acre
Cubic yards per acre =	187.8	yd^3/acre
Cubic feet per acre =	5,071.0	ft^3/acre
Gallons per acre =	37,933.1	gallons/acre
Acre-inches per acre	1.40	acre-inches/acre

ACREAGE NEEDED

Acres needed	18.4	acres

Alexin Analytical Laboratories, Inc.
Professional Laboratory Services
13035 SW Pacific Hwy
Tigard, OR 97223
Tel.: (503) 639-9311 Fax: (503) 684-1588

ANALYSIS REPORT

ORELAP Accredited Lab#: OR-100013

Reported: 07/13/2012
Received: 06/27/12 to 07/02/12
Sampled By: Jon Patrick
Work Order: Multiple Work Orders

Project: Biosolids Plan
Project # : NPDES #101514
Permit # : -
PO # : -

Sampling Location: Lagoon 1
Sample Matrix: Sludge

CLIENT
Molalla
Attn: Jon Patrick
PO Box 248
Molalla OR, 97038
Phone: (503) 829-5407

Lab Number	Sample Name	Sampled: 6/27/12 9:00	Sample Type
2179004-01	**Fecal Section #1**		**Grab**

Microbiological Analysis	Method	Result	Units	MRL	Analysis Date/ Time
Fecal Coliform	SM 9221E	3.0	MPN/g	0.0	06/28/2012 10:47

Wet Chemistry	Method	Result	Units	MRL	Analysis Date/ Time
Total Solids	SM 2540-B	5.5	Weight %	0.1	07/03/2012 9:00

Lab Number	Sample Name	Sampled: 6/27/12 9:00	Sample Type
2179004-02	**Fecal Section #2**		**Grab**

Microbiological Analysis	Method	Result	Units	MRL	Analysis Date/ Time
Fecal Coliform	SM 9221E	2.2	MPN/g	0.0	06/28/2012 10:46

Wet Chemistry	Method	Result	Units	MRL	Analysis Date/ Time
Total Solids	SM 2540-B	9.0	Weight %	0.1	07/03/2012 9:00

Lab Number	Sample Name	Sampled: 6/27/12 9:00	Sample Type
2179004-03	**Fecal Section #3**		**Grab**

Microbiological Analysis	Method	Result	Units	MRL	Analysis Date/ Time
Fecal Coliform	SM 9221E	5.6	MPN/g	0.0	06/28/2012 10:45

Wet Chemistry	Method	Result	Units	MRL	Analysis Date/ Time
Total Solids	SM 2540-B	14.0	Weight %	0.1	07/03/2012 9:00

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ANALYSIS REPORT

ORELAP Accredited Lab#: OR-100013

Reported: 07/13/2012
Received: 06/27/12 to 07/02/12
Sampled By: Jon Patrick
Work Order: Multiple Work Orders

CLIENT
Molalla
Attn: Jon Patrick
PO Box 248
Molalla OR, 97038
Phone: (503) 829-5407

Project: Biosolids Plan
Project # : NPDES #101514
Permit # : -
PO # : -

Sampling Location: Lagoon 1
Sample Matrix: Sludge

Lab Number	Sample Name	Sampled: 6/27/12 9:00	Sample Type
2179004-04	**Fecal Section #4**		**Grab**

Microbiological Analysis	Method	Result	Units	MRL	Analysis Date/ Time
Fecal Coliform	SM 9221E	7.8	MPN/g	0.0	06/28/2012 10:30

Wet Chemistry	Method	Result	Units	MRL	Analysis Date/ Time
Total Solids	SM 2540-B	12.0	Weight %	0.1	07/03/2012 9:00

Lab Number	Sample Name	Sampled: 6/27/12 9:00	Sample Type
2179004-05	**Fecal Section #5**		**Grab**

Microbiological Analysis	Method	Result	Units	MRL	Analysis Date/ Time
Fecal Coliform	SM 9221E	<2.2	MPN/g	0.0	06/28/2012 10:28

Wet Chemistry	Method	Result	Units	MRL	Analysis Date/ Time
Total Solids	SM 2540-B	7.7	Weight %	0.1	07/03/2012 9:00

Lab Number	Sample Name	Sampled: 7/2/12 9:00	Sample Type
2184004-01	**Section 6**		**Grab**

Microbiological Analysis	Method	Result	Units	MRL	Analysis Date/ Time
Fecal Coliform	SM 9221E	< 2.2	MPN/g	0.0	07/03/2012 11:25

Wet Chemistry	Method	Result	Units	MRL	Analysis Date/ Time
Total Solids	SM 2540-B	7.6	Weight %	0.1	07/03/2012 9:00

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ANALYSIS REPORT

ORELAP Accredited Lab#: OR-100013

Reported: 07/13/2012
Received: 06/27/12 to 07/02/12
Sampled By: Jon Patrick
Work Order: Multiple Work Orders

CLIENT
Molalla
Attn: Jon Patrick
PO Box 248
Molalla OR, 97038
Phone: (503) 829-5407

Project: Biosolids Plan
Project # : NPDES #101514
Permit # : -
PO # : -

Sampling Location: Lagoon 1
Sample Matrix: Sludge

Lab Number	Sample Name	Sampled: 7/2/12 9:00	Sample Type
2184004-02	Section 7		Grab

Microbiological Analysis	Method	Result	Units	MRL	Analysis Date/ Time
Fecal Coliform	SM 9221E	< 2.0	MPN/g	0.0	07/03/2012 11:23

Wet Chemistry	Method	Result	Units	MRL	Analysis Date/ Time
Total Solids	SM 2540-B	8.6	Weight %	0.1	07/03/2012 9:00

Lab Number	Sample Name	Sampled: 7/2/12 9:00	Sample Type
2184004-03	Section 8		Grab

Microbiological Analysis	Method	Result	Units	MRL	Analysis Date/ Time
Fecal Coliform	SM 9221E	1.6	MPN/g	0.0	07/03/2012 11:22

Wet Chemistry	Method	Result	Units	MRL	Analysis Date/ Time
Total Solids	SM 2540-B	11.1	Weight %	0.1	07/03/2012 9:00

Lab Number	Sample Name	Sampled: 7/2/12 9:00	Sample Type
2184004-04	Section 9		Grab

Microbiological Analysis	Method	Result	Units	MRL	Analysis Date/ Time
Fecal Coliform	SM 9221E	< 1.5	MPN/g	0.0	07/03/2012 11:20

Wet Chemistry	Method	Result	Units	MRL	Analysis Date/ Time
Total Solids	SM 2540-B	12.0	Weight %	0.1	07/03/2012 9:00

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ANALYSIS REPORT

ORELAP Accredited Lab#: OR-100013

Reported: 07/13/2012
Received: 06/27/12 to 07/02/12
Sampled By: Jon Patrick
Work Order: Multiple Work Orders

CLIENT

Molalla
Attn: Jon Patrick
PO Box 248
Molalla OR, 97038
Phone: (503) 829-5407

Project: Biosolids Plan
Project # : NPDES #101514
Permit # : -
PO # : -

Sampling Location: Lagoon 1
Sample Matrix: Sludge

Lab Number	Sample Name	Sampled: 7/2/12 9:00	Sample Type
2184004-05	**Section 10**		**Grab**

Microbiological Analysis	Method	Result	Units	MRL	Analysis Date/ Time
Fecal Coliform	SM 9221E	<1.8	MPN/g	0.0	07/03/2012 11:15

Wet Chemistry	Method	Result	Units	MRL	Analysis Date/ Time
Total Solids	SM 2540-B	10.4	Weight %	0.1	07/03/2012 9:00

ND = None detected MRL = Minimum Reporting Limit

Approved by: Scott Dickman
Scott Dickman
Lab Director

Approved by: Ruth Carpenter
Ruth Carpenter
Microbiology Technical Director

ANALYSIS REPORT

ANALYSIS REPORT

Alexin Analytical Laboratories, Inc.

Professional Laboratory Services

C
L Molalla
I PO Box 248
E Molalla OR 97038
N
T phone: 503-829-5407
fax: 503-829-4298

Date Reported: 8/17/12
Date Sampled: 6/8/12
Date Received: 6/18/12
Lab Number: **2170011**
Page: 1 of 1

Sampling Location: Lagoon #1 Section #1
Sampled by: Jon Patrick

Sample ID: **40 Day bench scale**
Laboratory Sample #: 2170011-01

Contaminant	Method	Results
Vector Attraction Reduction	CFR-40 Part 266 p. 497	**12.1%**

Sample ID: **Metals, pH, Nutrients**
Laboratory Sample #: 2170011-02

Contaminant	Method	Results ppm	dry mg/kg
Arsenic	EPA 200.9	**0.725**	7.88
Cadmium	EPA 200.7	**0.220**	2.39
Chromium	EPA 200.7	**3.22**	35.0
Copper	EPA 200.7	**25.5**	277
Lead	EPA 200.7	**5.60**	60.9
Mercury	EPA 245.1	**0.162**	1.76
Molybdenum	EPA 200.9	**<2.00**	<21.7
Nickel	EPA 200.7	**1.92**	20.9
Selenium	EPA 200.9	**0.374**	4.06
Zinc	EPA200.7	**81.1**	882
pH	EPA 150.1	**7.0**	pH units
Total Kjeldahl Nitrogen	EPA351.3	**2100**	2.283%
Ammonia Nitrogen	SM4500-NH3 F	**530**	0.576%
Nitrate	SM4500-NO3 D	**<25.0**	<0.027%
Phosphorus	EPA365.3	**1960**	2.130%
Potassium	SM3111B	**46**	0.050%
Total Solids	SM2540-B	**9.2%**	
Volatile Solids	SM2540-E	**32.8%**	

Approved By

Scott Dickman
Lab Director

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Appendix E: Public Notification Documents

Letter to Neighbors

Dear Neighbor,

The city of Molalla Wastewater Treatment Plant is going to be delivering biosolids to a property in your area.

Biosolids are a natural and organic byproduct of wastewater treatment. Through various treatment processes solids are stabilized, bacteria are killed and odors are reduced. Biosolids are a beneficial source of nutrients to the soil. Biosolids application can improve soil characteristics and greatly improve plant growth. Applications of biosolids reduce the need for chemical fertilizers. There is a flyer attached with more information.

The use of biosolids is regulated by the Oregon Department of environmental Quality and the U.S. Environmental protection Agency to protect public health and the environment. The biosolids will be tested and meet all the requirements for class b biosolids before they are applied.

I will personally be out to survey the site and mark setbacks from wells, property lines, water sources and roadways. DEQ staff will also visit the site to ensure that all requirements are met prior to any application.

I would be happy to meet with you personally or discuss over the phone any questions or concerns you may have about the application of biosolids. Please call me at
(503) 829-5407

You can also contact Paul Kenedy from Oregon Department of Environmental Quality with your questions or concerns. His number is 1(541) 687-7439.

City of Molalla
Wastewater Treatment Plant
Lead Operator
Jon Patrick

Fact Sheet

Biosolids: A Beneficial Resource

Background
Biosolids are the nutrient-rich organic solids that are derived from the treatment of domestic wastewater at municipal wastewater facilities. Once biosolids have been treated to meet state and federal regulations, they can be beneficially used for land application or, in some cases, sold or given away like compost.

Recognizing the value of biosolids
Since 1978, DEQ has addressed the need to effectively manage the beneficial use of biosolids. Oregon's policy supports the land application of treated domestic wastewater biosolids, biosolids-derived products and domestic septage when managed in a manner that protects public health and maintains or improves environmental quality.

What is regulated?
The land application of biosolids, biosolids-derived products and domestic septage is a highly regulated practice. Regulatory requirements are established under Oregon Administrative Rules chapter 340, division 50. The state rules incorporate most of the federal technical biosolids regulations, including requirements for pathogen reduction, vector attraction reduction, and limits for trace pollutants. Monitoring is also required for several nutrients.

How biosolids are used
Land applying biosolids can have several benefits. The organic matter in biosolids can improve the quality and overall characteristics of cultivated soil. The additional nutrients provided by biosolids can improve plant growth. Approximately 95% of biosolids generated in Oregon are land applied on DEQ-approved sites for agricultural purposes such as hay and pasture. In 2001, biosolids from 108 domestic wastewater treatment facilities were land applied on 18,618 acres, which is about 0.11% of all Oregon land in farms. Biosolids are also used for silvicultural and horticultural activities. DEQ works with wastewater treatment facilities to ensure that management of biosolids and land application activities are adequately addressed through a National Pollutant Discharge Elimination System (NPDES) or Water Pollution Control Facility (WPCF) permit, a biosolids management plan, and site authorization letters. Good agronomic practices and site management activities ensure the protection of public health and the environment.

Land application of biosolids at an Oregon farm.

Biosolids Management Plans
Facilities are required to manage and operate their biosolids operations under a biosolids management plan. These plans are specific to each facility and are considered an extension of the facility's NPDES or WPCF permit. Together with a facility's permit and land application site authorizations, the plan provides assurance that biosolids processing and management activities are addressed in a comprehensive manner and problems with compliance are minimized. Plans must be current and on file with the permit. Each site used for land application of biosolids must be authorized by DEQ before use. Prior to authorizing a land application site, a facility must submit specific site information to DEQ for evaluation, and then DEQ will conduct a field visit. Notification to neighbors about the land application activity is also required. Any site that may be sensitive to residential housing or have runoff potential will be subject to a public comment process.

State rules also outline best management practices regarding use limitations, criteria for site selection and approval, and application.

For more information
For program information, please contact the program coordinator. For specific wastewater treatment facility and land application site information, please contact the appropriate regional specialist (list at right).

Alternative formats
Alternative formats of this document can be made available. Contact DEQ's Office of Communications & Outreach, Portland, for more information at (503) 229-5696, or call toll-free in Oregon at 1-800-452-4011, ext. 5696.

State of Oregon
Department of Environmental Quality

Water Quality Division
Biosolids Program
811 SW 6th Avenue
Portland, OR 97204
Phone: 503-229-5472
800-452-4011
Fax: 503-229-6037
Contact: Ron Doughten
www.oregon.gov/DEQ/

Program staff

Headquarters, Portland
Ron Doughten
Program Coordinator
503-229-5472

Northwest Region, Portland
Connie Schrandt
503-229-5347

Western Region, Eugene
Paul Kennedy
541-687-7439

Eastern Region, Bend
Paul Devito
541-633-2029

Jayne West
541-633-2028

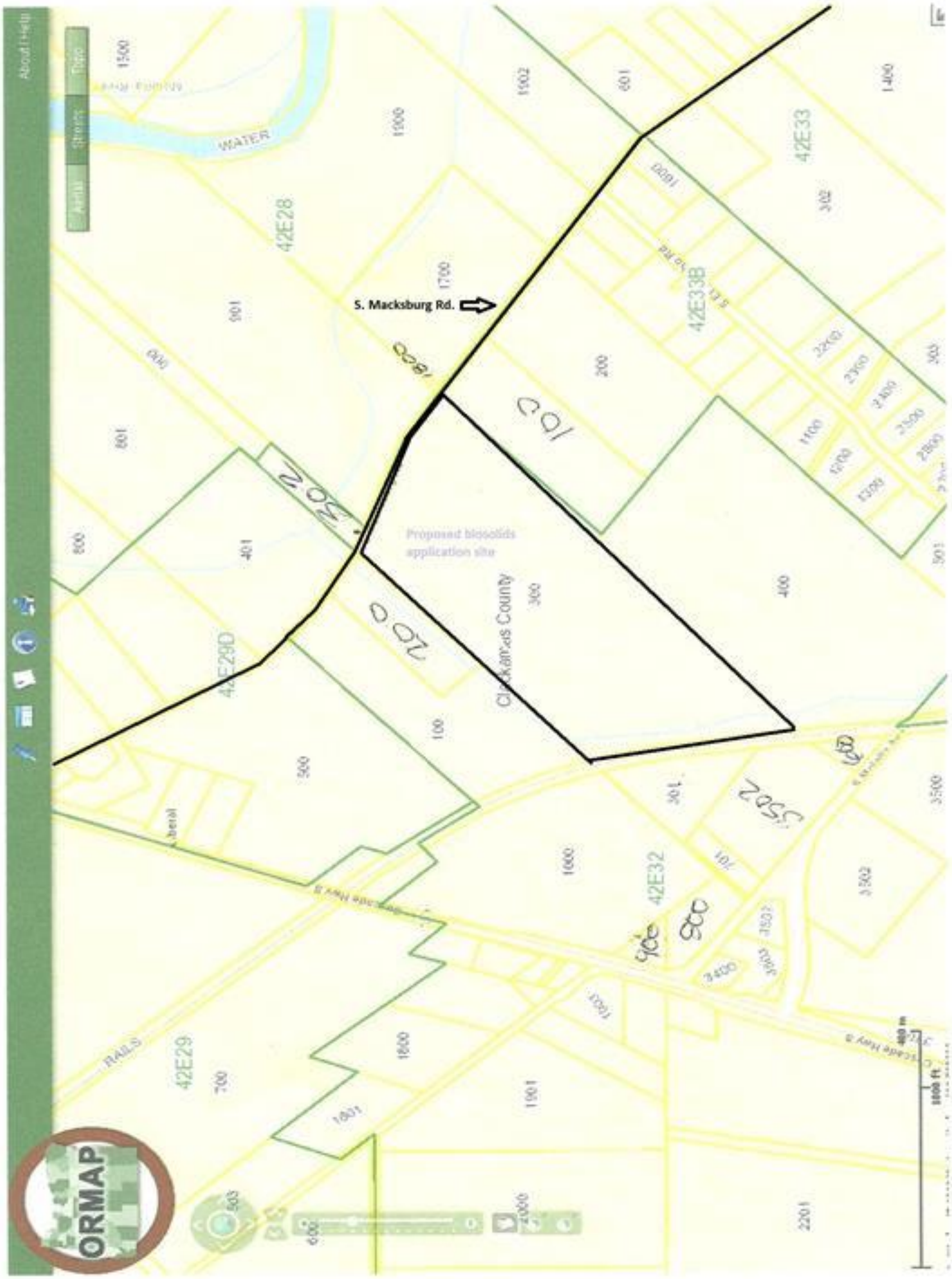
Eastern Region, Pendleton
Steve McMillan
541-278-4617

Duane Smith
541-278-4607

Heidi Williams
541-278-4608

Eastern Region, The Dalles
Carl Nadler
541-298-7255 x227

05-WQ-002
Last updated: 8/9/2011
By: Ron Doughten



http://www.ormap.net/flexviewer/index.html

5/1/2013

Appendix F Proposed Site Authorization Information

Biosolids Land Application Site Approval for City Of Molalla Wastewater Treatment Plant

The City of Molalla would like to have the following site approved for biosolids application. The site is owned by Brad Johnson and zoned EFU. The field is used for hay. We intend to apply biosolids after the last cutting, or between cuttings.

Site Information:

Site Owner: Brad Johnson
Address: 32113 S. Palmer Rd. Molalla, OR 97038
Phone: 503-819-4173

Site Location:

Site: 14220 S. Macksburg Rd. Molalla, OR 97038
Site Zoning: EFU
Property Size: 42.53 Acres
Net Property after Buffers: 28.8

Nearest Residences: There is a residence on the property. The nearest residence that is not on the property is approximately 200 feet from the application area. There are also residences on the adjacent parcels. There are three residences across Macksburg road to the north of the property. There are four properties to the south across the railroad tracks. There are two to the West. We will leave at least 200-foot buffer from every well and a minimum of 10 feet from the fence line.

Surrounding Property use: The surrounding properties are rural residences on larger parcels. The adjacent property to the South East is an open field. There are railroad tracks on the south side and Macksburg road on the north side.

Buffer Areas: There will be a ten-foot buffer from the property line and a 20-foot buffer from the road on the Macksburg Road side. There will also be a buffer of a minimum of 75 feet to the creek. There will be a 200-foot buffer to any wells including the one on the site. The only well that was within 200 feet of the proposed application area was the well on the property. The next two closest wells are across the street and across the creek. They are both approximately 240feet from the proposed application area. We adjusted the application area to meet the buffer requirement for the well on site. See attached map with well locations marked on it.

Agricultural and Crop Management Information:

Intended Crop: The intended crop is hay.
Nitrogen assimilative capacity of hay: 100 pounds of nitrogen per acre (based on Oregon State University Extension Service publications PNW 508-E and FG 63)
Harvest method: baled hay and then pasture for cows
Irrigation Practices: It will be irrigated intermittently to keep the grass green. It will not be irrigated after the biosolids application for a length of time to be determined later.
Fertilizer use: It will be fertilized as needed in conjunction with biosolids application and not to exceed the nitrogen required.
Application Timing: The City of Molalla will apply Biosolids from June until the end of September of each year. (Immediately after the hay is cut)

Soil Information:

Soil Types: 22 Conser Silty Clay Loam
20 Coburg Silty Clay Loam
See attached soil descriptions for more information

Biosolids Land Application Information:

Biosolids Characteristics: See attached lab results for information on nutrients, solids pH and metals. The tables below summarize the data.

Parameter	**Biosolids Analytical Result (mg/kg)**
Arsenic (As)	7.88
Cadmium (Cd)	2.39
Chromium (Cr)	35
Copper (Cu)	277
Lead (Pb)	60.9
Mercury (Hg)	1.76
Molybdenum (Mo)	21.7
Nickel (Ni)	20.9
Selenium (Se)	4.06
Zinc (Zn)	882

Parameter/measurement unit	Biosolids Analytical Result	Sample Date
Total solids, percent	9.2%	6/18/2012
Volatile solids, percent	32.8%	6/18/2012
TKN, percent	2.283%	6/18/2012
NO_3-N, percent	<0.027%	6/18/2012
NH_4-N, percent	0.576%	6/18/2012
Phosphorus (P), percent	2.130%	6/18/2012
Potassium (K), percent	0.050%	6/18/2012
pH, standard unit	7.0	6/18/2012

Public Participation Information:

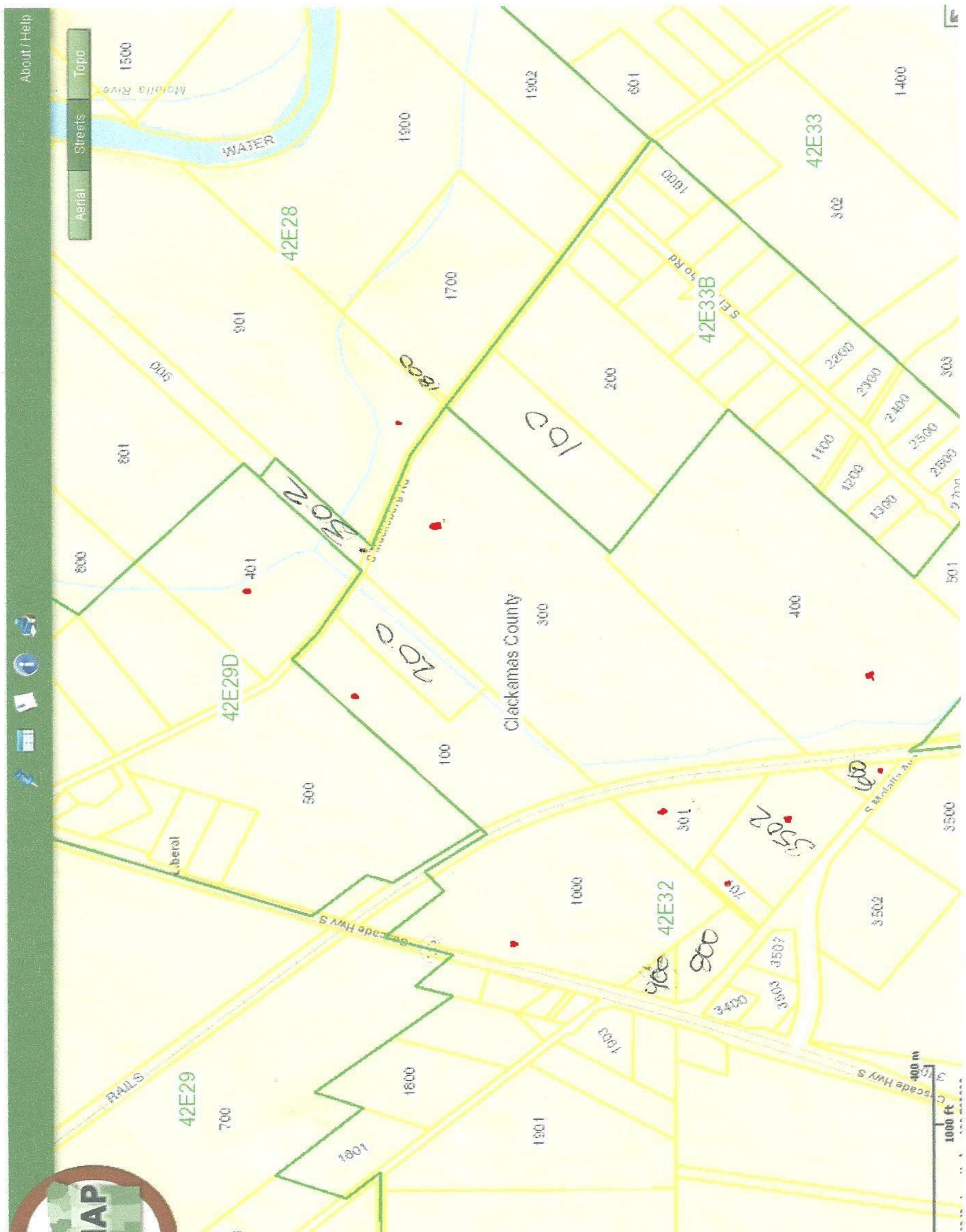
People with adjacent properties were contacted by mail. The letters were mailed on July 6th. A letter with my phone number was mailed explaining what biosolids are and showing the proposed application location. I will also attach a copy of the biosolids information flyer from the Oregon DEQ website. I talked with the neighbors in adjacent properties on May 2nd and 3rd, 2013 to verify well distances from the application site. See the attached mailing list and contacts as well as a copy of the letter.

Comments and Complaints:
One person Called me about the biosolids but did not leave any contact information in their message, so I am waiting for a follow up call from them. Another Person called on 6/12/13 and talked for about an hour about biosolids and the process of applications. She wanted to know how we keep it from contaminating ground water. Her name is Ann Gross. I explained that we did not apply biosolids until the water table was more than 48 inches from the surface. Another lady called but wouldn’t give a name and she just called to ask where it was going to be applied because she was having a hard time reading the map. She then asked if it would stink. I told her it might have some odor but not as bad as pig or chicken manure.

Names and addresses of neighbors and owner information from Clackamas County Tax Records

	Neighboring tax lot and property owner information			
map & tax lot	**owner**	**co-owner**	**co-owner**	**mailing address**
42E32 00100	PRICE JEFFREY H			13976 S MACKSBURG RD, MOLALLA, OR 9703
42E32 00200	BODUNOV STEPAN F	BODUNOV FENIA		13990 S MACKSBURG RD, MOLALLA, OR 97038
42E32 00400	GOTTSACKER PATRICIA J	JOHNSON LINDA L	LANTZ DEBORA M	PO BOX 1388, MANZANITA, OR 97130
42E32 01000	DUNTON MICHAEL LYNN & DENISE MARI			29086 S HWY 213, MOLALLA, OR 97038
42E32 00301	WILLAMETTE EGG FARMS LLC			31348 S HWY 170, CANBY, OR 97013
42E32 03502	GINGERICH FAMILY LTD PRTNRS			PO BOX 910, CANBY, OR 97013
42E32 00701	KIRK LOIS E			2326 SW MCGINNIS AVE, TROUTDALE, OR 97060
42E32 00600	STEVENS TERRY & CINDY			29410 S MOLALLA AVE, MOLALLA, OR 97038
42E32 00302	HUNT KENNETH N & WREATHA-JEAN			PO BOX 870, MOLALLA, OR 97038
42E29D 00401	HUNT KENNETH N & WREATHA-JEAN			PO BOX 870, MOLALLA, OR 97038
42E28 00901	NUNN CALVIN L & BETH A FOX-NUNN			14231 S MACKSBURG RD, MOLALLA, OR 97038
42E28 01700	MORRISON LIANNE & ROBERT			14251 S MACKSBURG RD, MOLALLA, OR 97038
42E28 01800	GROHS ANNA			PO BOX 1036, MOLALLA, OR 97038
42E33B 00100	GROHS ANNA			PO BOX 1036, MOLALLA, OR 97038
42E33B 00200	GROHS ANNA			PO BOX 1036, MOLALLA, OR 97038
42E32 00300	JOHNSON BRADLEY R	JOHNSON CONNIE LEA		32113 Palmer Rd. Molalla, OR 97038

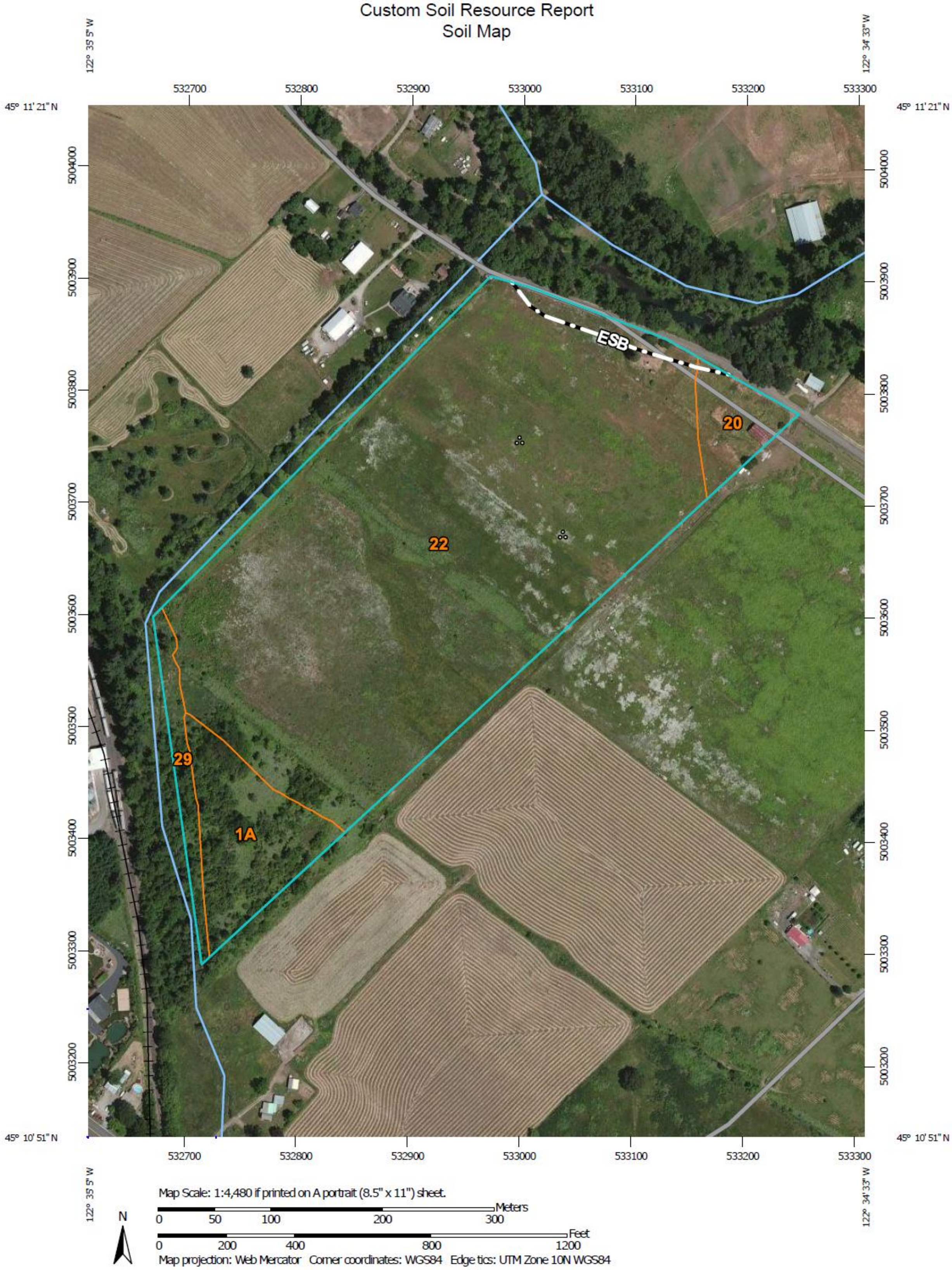
Vicinity Map with well locations for Tax lot 42E32 00300



5/1/2013

http://www.ormap.net/flexviewer/index.html

Custom Soil Resource Report
Soil Map



8

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Clackamas County Area, Oregon
Survey Area Data: Version 7, Aug 20, 2012

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 8, 2010—Sep 4, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Clackamas County Area, Oregon (OR610)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
1A	Aloha silt loam, 0 to 3 percent slopes	3.4	8.9%
20	Coburg silty clay loam	1.5	3.8%
22	Conser silty clay loam	32.8	84.6%
29	Dayton silt loam	1.1	2.8%
Totals for Area of Interest		**38.8**	**100.0%**

Clackamas County Area, Oregon

1A—Aloha silt loam, 0 to 3 percent slopes

Map Unit Setting

Elevation: 150 to 400 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days

Map Unit Composition

Aloha and similar soils: 85 percent
Minor components: 5 percent

Description of Aloha

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified glaciolacustrine deposits

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 11.9 inches)

Interpretive groups

Farmland classification: Prime farmland if drained
Land capability classification (irrigated): 2w
Land capability (nonirrigated): 2w
Hydrologic Soil Group: C/D

Typical profile

0 to 8 inches: Silt loam
8 to 51 inches: Silt loam
51 to 80 inches: Silt loam

Minor Components

Huberly

Percent of map unit: 3 percent
Landform: Swales on terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Dayton

Percent of map unit: 2 percent

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

20—Coburg silty clay loam

Map Unit Setting

Elevation: 100 to 1,500 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days

Map Unit Composition

Coburg and similar soils: 85 percent
Minor components: 6 percent

Description of Coburg

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed silty and clayey alluvium

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 11.4 inches)

Interpretive groups

Farmland classification: All areas are prime farmland
Land capability classification (irrigated): 2w
Land capability (nonirrigated): 2w
Hydrologic Soil Group: C

Typical profile

0 to 20 inches: Silty clay loam
20 to 60 inches: Silty clay loam

Minor Components

Conser

Percent of map unit: 5 percent

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Cove

Percent of map unit: 1 percent
Landform: Flood plains
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear

22—Conser silty clay loam

Map Unit Setting

Elevation: 100 to 1,500 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days

Map Unit Composition

Conser and similar soils: 85 percent
Minor components: 2 percent

Description of Conser

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed silty and clayey alluvium

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 18 inches
Frequency of flooding: RareNone
Frequency of ponding: None
Available water capacity: High (about 9.6 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability classification (irrigated): 3w
Land capability (nonirrigated): 3w
Hydrologic Soil Group: C/D

Typical profile

0 to 7 inches: Silty clay loam
7 to 48 inches: Silty clay loam
48 to 60 inches: Loam

Minor Components

Cove

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Linear

29—Dayton silt loam

Map Unit Setting

Elevation: 150 to 400 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days

Map Unit Composition

Dayton, thick surface, and similar soils: 90 percent
Minor components: 5 percent

Description of Dayton, Thick Surface

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Stratified glaciolacustrine deposits

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 12 to 24 inches to abrupt textural change
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.5 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability classification (irrigated): 4w
Land capability (nonirrigated): 4w

Hydrologic Soil Group: D

Typical profile

0 to 7 inches: Silt loam
7 to 21 inches: Silty clay loam
21 to 60 inches: Clay

Minor Components

Concord

Percent of map unit: 3 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Huberly

Percent of map unit: 2 percent
Landform: Swales on terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Custom Soil Resource Report
Map—Land Application of Municipal Biosolids, summer (OR)

Map Scale: 1:4,480 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 50, 100, 200, 300

Feet: 0, 200, 400, 800, 1200

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

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Tables—Land Application of Municipal Biosolids, summer (OR)

Land Application of Municipal Biosolids, summer (OR)— Summary by Map Unit — Clackamas County Area, Oregon (OR610)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
1A	Aloha silt loam, 0 to 3 percent slopes	Not limited	Aloha (85%)		3.4	8.9%
			Huberly (3%)			
			Dayton (2%)			
20	Coburg silty clay loam	Not limited	Coburg (85%)		1.5	3.8%
			Conser (5%)			
			Cove (1%)			
22	Conser silty clay loam	Not limited	Conser (85%)		32.8	84.6%
			Cove (2%)			
29	Dayton silt loam	Not limited	Dayton, thick surface (90%)		1.1	2.8%
			Concord (3%)			
			Huberly (2%)			
Totals for Area of Interest					**38.8**	**100.0%**

Land Application of Municipal Biosolids, summer (OR)— Summary by Rating Value		
Rating	**Acres in AOI**	**Percent of AOI**
Not limited	38.8	100.0%
Totals for Area of Interest	**38.8**	**100.0%**

Rating Options—Land Application of Municipal Biosolids, summer (OR)

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Biosolids Facts and Agreement

I, the undersigned, do hereby certify that I have read and understand the following information and requirements regarding the disposal of biosolids on my property:

Origin

Digested municipal biosolids is the result of treating human wastes under controlled conditions. This reduces chances of odor and disease. This material is well suited as a soil amendment and for supplementing crop nitrogen requirements.

Precautions

Because of the origin of the biosolids, it is necessary to take certain precautions with its application and disposal to prevent contamination of surface or groundwater's and reduce the possibility of nuisance odor conditions. Care must be taken to maintain a minimum 50 foot setback from a ditch, channel, pond or waterway. A minimum setback of 200 feet must be maintained from downgradient springs, infiltration galleries, water withdrawal points from surface waters and wells.

Other precautions include maintaining buffer zones adjacent to property lines and residential areas. The amount of distance necessary to make up a buffer zone will very with local conditions and the method of biosolids application.

Responsibility

It is the city's responsibility to insure the proper handling and disposal of all biosolids generated at the sewage treatment plant. Precautions must be taken in transporting the biosolids from treatment plant to the application site to prevent leaking or spilling the biosolids onto highways, streets, roads, or waterways.

Access

The land owner/controller must limit access to the biosolids site for 12 months following application if the biosolids is not worked into the soil. Access is assumed to be controlled if the site is located on rural private land.

Cropping

As a general guideline, crops grown for direct human consumption (fresh market fruits and vegetables) should not be planted sooner that 18 months after biosolids application. If the crop is to be treated or processed prior to marketing so that disease causing organisms are not a concern, the DEQ may allow biosolids application within 18 months.

Other crops, such as grains, may receive biosolids applications up to 60 days prior to harvest. There are no time restrictions for non-edible crops such as grass and nursery stock.

Grazing

Application of digested biosolids is allowed on pasture and forage crops. However, Federal regulations prohibit "animals whose products are consumed by humans" from grazing for at least 30 days after biosolids application. This is especially true for dairies, where animal contact or direct intake of biosolids, through grazing, could result in milk contamination.

Application of Municipal Biosolids

The application of digested biosolids on agricultural land should be managed to utilize its fertilizer value to the maximum extent possible. The recommended amount of biosolids to be applied to you land is based on nitrogen requirements of the crop(s) you plan to grow and will very depending on the amount of nitrogen in the biosolids.

It is important to use only the amount of nitrogen, either from biosolids or from commercial fertilizer, which your crop requires. The amount of commercial fertilizer you would normally use must be reduced by the amount available in the biosolids to be applied on your land. If too much nitrogen is applied, whether from biosolids or commercial fertilizer, it can leach into groundwater and cause pollution.

Determining the proper amount of sludge to be applied is the responsibility of the treatment plant staff. However, it is important that the landowner provide accurate information on the crop to be grown, so that proper correct application rates might be chosen.

Brad Johnson

Print name of site owner 14588 S. Macksburg Rd.

14220 S. Macksburg Rd. Molalla, OR 97038

Site Description (address) 12310 S. Oak grove Rd,

[signature] 5/29/13

Signature of site owner Date

Jonathon Patrick

Molalla Plant Superintendent

[signature] 5/29/13

Signature of Superintendent Date

Appendix G Existing Site Authorization Information

Oregon

John A. Kitzhaber, M.D., Governor

Department of Environmental Quality
Northwest Region Portland Office
2020 SW 4th Avenue, Suite 400
Portland, OR 97201-1987
(503) 229-5263
FAX (503) 229-6957
TTY (503) 229-5471

August 25, 1999

KERN BUCKNER BIOSOLIDS MANAGER
CITY OF MOLALLA WASTEWATER TREATMENT FACILITY
PO BOX 248
MOLALLA OR 97038

Re: WQ-SDS-Clackamas County
Molalla Wastewater Treatment Facility (WWTF)
Biosolids Land Application Authorization Modification
T.R. Jorgenson Site
TL1000, 1100 & 1400; S07; T5S; R2E WM Clackamas County
NPDES Permit No. 101541
Site ID # 57613

Dear Mr. Buckner:

This letter is in response to your request of August 12, 1999, for a modification of the May 7, 1999, Department of Environmental Quality (Department) authorization letter for the above-described site. The modification is necessary due to the change in the planned method of application of biosolids to the silage corn field and due to the resulting change in the volatilization rate of ammonia.

The application method is proposed to change from a combination of truck spreading and spray irrigation to soil injection. This change will result in a change in ammonia volatilization from 50% to 15%.

The Department approves this change in biosolids application method. Accordingly, items 13. and 3. of the Department's May 7, 1999, site authorization letter are modified as follow.

13. Biosolids land application shall be by soil injection.

3. Based on the City's latest biosolids analysis of 1998 (assuming a 22.5% mineralization rate, a total solids content of 4% and an ammonia volatilization rate of 15%), existing crop, topographic and soil conditions of the field, up to 196.2 kilogram (kg) of available nitrogen (467,985 liter (l) (18.91 dry megagram (Mg))) of biosolids per ha (175 pounds (50,031 gallons (8.43 dry tons)) per acre) per year can be applied to areas of the T.R. Jorgenson silage corn site acceptable for receiving biosolids. Changes in biosolids characteristics or cropping practices will necessitate appropriate adjustments in the application rate to maintain nitrogen application consistent with crop demands.

It is noted that the date of the last biosolids sample analysis for the Molalla WWTF was August 18, 1998. Since the federal biosolids regulations require a minimum of one complete sample analysis per year, including pathogens, vector attraction, pollutants and nutrients, Molalla should resample the lagoon biosolids and obtain sample results prior to land application. The results of the nutrient analysis should be used to recalculate the biosolids application rate for the Jorgenson silage cornfield. The results of the new analysis should be reported to the Department at the time of the submittal of the annual report for 1999.

All other applicable conditions of the Department's May 7, 1999, site authorization letter remain in effect. If you have any questions regarding this modification, please contact me at 229-5616.

Sincerely,

Bruce W. Henderson

Bruce W. Henderson
Biosolids Specialist
Northwest Region

cc: Doug Peters, Water Quality Division, Headquarters, DEQ
T.R. Jorgenson
12305 South Highway 211
Molalla, OR 97038

Oregon

FAX COVER SHEET

DEPARTMENT OF ENVIRONMENTAL QUALITY

NORTHWEST REGION

DATE: 8/24/99 TIME: 1755

TO: Kern Buckner

FROM: Bruce Henderson

TELEPHONE:(503) 229.5616 EXTENSION: —

FAX NUMBER (503)229-~~6945~~ 6957

COVER PAGE PLUS 2 PAGES

MESSAGE: Please replace the earlier version of this letter (8/24/99) with the current letter (8/25/99) for both fax and mail delivery. The new letter contains correct data for item 3. Please note that since the biosolids sample results are over 1 year old, a new sample should be taken and analyzed. Results of nutrient analysis should be used to recalculate application rate.

2020 SW Fourth Avenue
Suite 400
Portland, OR 97201-4987
(503) 229-5263 Voice/TDD

Oregon
John A. Kitzhaber, M.D., Governor

Department of Environmental Quality
Northwest Region Portland Office
2020 SW 4th Avenue, Suite 400
Portland, OR 97201-4987
(503) 229-5263
FAX (503) 229-6957
TTY (503) 229-5471

August 24, 1999

KERN BUCKNER BIOSOLIDS MANAGER
CITY OF MOLALLA WASTEWATER TREATMENT FACILITY
PO BOX 248
MOLALLA OR 97038

Re: WQ-SDS-Clackamas County
Molalla Wastewater Treatment Facility (WWTF)
Biosolids Land Application Authorization Modification
T.R. Jorgenson Site
TL1000, 1100 & 1400; S07; T5S; R2E WM Clackamas County
NPDES Permit No. 101541
Site ID # 57613

Dear Mr. Buckner:

This letter is in response to your request of August 12, 1999, for a modification of the May 7, 1999, Department of Environmental Quality (Department) authorization letter for the above-described site. The modification is necessary due to the change in the planned method of application of biosolids to the silage corn field and due to the resulting change in the volatilization rate of ammonia.

The application method is proposed to change from a combination of truck spreading and spray irrigation to soil injection. This change will result in a change in ammonia volatilization from 50% to 15%.

The Department approves this change in biosolids application method. Accordingly, items 13. and 3. of the Department's May 7, 1999, site authorization letter are modified as follow.

13. Biosolids land application shall be by soil injection.

3. Based on the City's latest biosolids analysis of 1998 (assuming a 22.5% mineralization rate, a total solids content of 4% and an ammonia volatilization rate of 15%), existing crop, topographic and soil conditions of the field, up to 196.2 kilogram (kg) of available nitrogen (311,990 liter (l) (12.6 dry megagram (Mg))) of biosolids per ha (175 pounds (33,354 gallons (5.6 dry tons)) per acre) per year can be applied to areas of the T.R. Jorgenson silage corn site acceptable for receiving biosolids. Changes in biosolids characteristics or cropping practices will necessitate appropriate adjustments in the application rate to maintain nitrogen application consistent with crop demands.

All other applicable conditions of the Department's May 7, 1999, site authorization letter remain in effect. If you have any questions regarding this modification, please contact me at 229-5616.

Sincerely,

Bruce W. Henderson

Bruce W. Henderson
Biosolids Specialist
Northwest Region

cc: Doug Peters, Water Quality Division, Headquarters, DEQ
T.R. Jorgenson
12305 South Highway 211
Molalla, OR 97038

Oregon
John A. Kitzhaber, M.D., Governor

Department of Environmental Quality
Northwest Region
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TTY (503) 229-5471

May 7, 1999

KERN BUCKNER BIOSOLIDS MANAGER
CITY OF MOLALLA WASTEWATER TREATMENT FACILITY
PO BOX 248
MOLALLA OR 97038

Re: WQ-SDS-Clackamas County
Molalla Wastewater Treatment Facility
(WWTF)
Biosolids Land Application
Authorization Modification
T.R. Jorgenson Site
TL1000, 1100 & 1400; S07; T5S; R2E WM
Clackamas County
NPDES Permit No. 101541
Site ID # 57613

Dear Mr. Buckner:

This letter is a modification of the May 3, 1999, Department of Environmental Quality (Department) authorization letter for the above-described site. The modification is necessary due to the change of crop from hay to silage corn and due to a change in the volatilization rate of ammonia from 15% to 50%.

As you are aware, I evaluated the T.R. Jorgenson site with you on October 29, 1998, to determine if the site would be suitable for the land application of pre-aerated lagoon stabilized liquid biosolids from the Molalla WWTF. At a later time you provided the Department of Environmental Quality with a request for authorization to land apply biosolids to a 25.2 hectare (ha) (62.3-acre) silage corn site on the 30.8 ha (76.1-acre) property referenced above.

The property consists of three tax lots. Tax Lot 1000 has 19.6 ha (48.5 acre) of usable area of the total area of 22.6 ha (55.88 acre). Tax Lot 1100 has 0.6 ha (1.4 acre) of usable area of the total area of 1.0 ha (2.35 acre). Tax Lot 1400 has 5.0 ha (12.4 acre) of usable area of the total area of 7.2 ha (17.87 acre).

The request included information characterizing soils, topography, biosolids, crop type, crop management, annual available nitrogen loading (agronomic loading rate), documentation of public notification, and a signed agreement between the City and the owner, Mr. Jorgenson.

DEQ-1

Based upon evaluation of the site and the information submitted, I am pleased to advise you that the T.R. Jorgenson property described above is authorized for the seasonal application of pre-aerated lagoon stabilized liquid biosolids from the Molalla WWTF provided:

1. Biosolids processing and handling will comply with Oregon biosolids rules and guidelines (OAR 340-50-005 to OAR 340-50-080) and all other applicable statutes, rules, and federal regulations, including the federal biosolids regulations (40 CFR Part 503).

2. Biosolids volatile solids content shall be monitored to assure that the vector attraction reduction requirements of the federal biosolids regulations are met. Also, solid waste debris contained in the lagoon biosolids shall either be removed through screening or mechanically reduced in size through grinding so as not to create nuisance conditions at the land application site.

3. Based on the City's latest biosolids analysis of 1998 (assuming a 22.5% mineralization rate and a total solids content of 4%), existing crop, topographic and soil conditions of the field, up to 196.2 kilogram (kg) of available nitrogen (357,179 liter (l) (14.44 dry megagram (Mg))) of biosolids per ha (175 pounds (38,185 gallons (6.44 dry tons)) per acre) per year can be applied to areas of the T.R. Jorgenson silage corn site acceptable for receiving biosolids. Changes in biosolids characteristics or cropping practices will necessitate appropriate adjustments in the application rate to maintain nitrogen loadings consistent with crop demands.

4. If other sources of nitrogen are applied to the field, the biosolids application rate must be reduced so that commercial, animal manure or green chop nitrogen plus biosolids nitrogen does not exceed the agronomic loading rate of any field within the site.

5. The above Condition 3. notwithstanding, the application rate shall not exceed 46,770 l per ha (5000 gallons per acre) per hour or 215,757 l per ha (23,066 gallons per acre) per day. The resting period between applications should be at least 48 hours. Weather conditions should be considered and the resting period adjusted upward for inclement weather.

6. Biosolids land application shall cease when precipitation exceeds 0.6 centimeter (cm) (1/4 inch) per hour or when 2.5 cm (one inch) or more of precipitation occurs in a 24-hour period. Land application shall be withheld from the site for at least one day for every consecutive day of precipitation where a 0.6 cm (1/4 inch) per hour or 2.5 cm (one-inch) per 24-hour precipitation event occurs.

7. Biosolids shall be applied evenly and thinly in a manner that will prevent ponding and runoff.

8. Biosolids land application shall cease when the ground surface is frozen or snow covered. Application can resume as soon as the ground surface has thawed and the soil has sufficiently dried.

9. Areas where biosolids have been applied shall be clearly marked by flag pins or stakes which note the date when biosolids were last applied.

10. A 30-day interval shall follow the application of biosolids prior to grazing livestock on any field or prior to the harvesting of crops from biosolids areas that are to be fed to animals.

11. Public access to the site shall be restricted for at least 12 months after biosolids land application have ceased.

12. Biosolids land application is authorized on a seasonal basis (May 15th through November 15th, yearly). Care should be taken to avoid wet soil conditions, particularly in concave areas and during the early and late parts of the approved biosolids land application period, at the time of application.

13. Biosolids land application shall be via spray irrigation or truck application. Biosolids land application via spray irrigation shall not occur when wind speeds exceed 15 mph. Regardless of wind speed, spray irrigation of biosolids shall cease when wind drift causes biosolids to settle onto non-authorized areas.

14. For truck application, a 15 meter (m) (50 foot) minimum setback shall be maintained from the following features and points of biosolids land application: the top of the ditch bank along State Highway 211, located along the south site perimeter; the culvert outlet, located near the northeast site corner; and from the top of the bank of Bear Creek, located along the north site perimeter.

    For spray irrigation of liquid biosolids, a minimum 23 m (75 foot) setback shall be observed from water features, including the bank of Bear Creek and the culvert outlet referenced above, and points of biosolids land application.

15. A minimum setback of 61 m (200 feet) shall be maintained from all wells and other water sources and points of biosolids application. This includes the four domestic wells located near the northwest, northeast and southwest site corners and adjacent to the property residence located along State Highway 211 near the south site boundary.

Also, when using spray irrigation for the land application of biosolids, a minimum setback of 91-m (300 feet) shall be maintained from all occupied structures and major roadways. This includes the two residences located within the south part of the property and adjacent to the southwest corner of the property. Additionally, this includes State Highway 211 along the south boundary of the property.

16. Immediately following land application, the biosolids tanker operator shall wash down (at the application site) areas of equipment coated with biosolids to prevent biosolids from leaking onto public highways.

17. The City's truck operator shall clean up any spillage of biosolids. Spillages that cannot be completely cleaned up must be covered with dry lime and posted where appropriate.

18. The Department shall be notified within one hour, through the Oregon Emergency Response System (OERS), of any spills of more than 189 l (50 gallons) or other threats to the environment that may occur. Failure to provide prompt notification may be considered cause for taking enforcement action against the City. The telephone number of OERS is 1-800-452-0311 (24 hour per day service).

19. In the event an odor problem is reported to the Department after biosolids have been land applied at the Jorgenson site, immediate steps, such as, but not limited to, the addition of liming materials, must be taken to counteract that condition.

20. The City shall maintain daily records for the biosolids land application site which indicate (on a field map grid system) where, when, and what volume of biosolids were land applied to a particular site.

21. Site records shall indicate the date, location and amount of biosolids applied, segments of each field that received biosolids, amount of nutrients applied to each area receiving biosolids and the type of crop grown. These data shall be maintained at the Molalla WWTF and be made available to the Department for review upon request.

22. The Department shall have the right to (at reasonable times): enter the City's place of biosolids land application and record keeping to review biosolids management operations and records, obtain copies of any records required under the terms of this authorization and the City's biosolids management plan, inspect any monitoring equipment required under this authorization, inspect any collection, transport, or land application vehicles, and obtain any photographic documentation or evidence deemed appropriate.

23. The City shall provide the Department with an annual report that comprehensively describes biosolids handling activities, including at the Jorgenson site, during the yearly reporting period. The report shall be submitted annually by February 19th following the calendar year of the report.

24. The Department may impose any additional restrictions or conditions deemed necessary to assure adequate biosolids management. Any variations from the City's Department approved biosolids management plan and this authorization letter must receive prior written approval from the Northwest Region Office.

25. This authorization is subject to revocation should health hazards, environmental degradation, or nuisance conditions develop as a result of inadequate biosolids treatment or site management. This authorization is considered to be part of your approved biosolids management plan. Therefore, if operations are not conducted in accordance with terms specified under this authorization, the Department will initiate an enforcement action that may lead to the assessment of a civil penalty.

If you have any questions regarding this authorization, please contact me at 229-5616.

Sincerely,

Bruce W. Henderson

Bruce W. Henderson
Biosolids Specialist
Northwest Region

cc: Doug Peters, Water Quality Division, Headquarters, DEQ
T.R. Jorgenson
12305 South Highway 211
Molalla, OR 97038

Oregon
John A. Kitzhaber, M.D., Governor

Department of Environmental Quality
Northwest Region
2020 SW Fourth Avenue
Suite 400
Portland, OR 97201-4987
(503) 229-5263 Voice
TTY (503) 229-5471

May 3, 1999

KERN BUCKNER BIOSOLIDS MANAGER
CITY OF MOLALLA WASTEWATER TREATMENT FACILITY
PO BOX 248
MOLALLA OR 97038

Re: WQ-SDS-Clackamas County
Molalla Wastewater Treatment Facility
(WWTF)
Biosolids Land Application
Authorization
T.R. Jorgenson Site
TL1000, 1100 & 1400; S07; T5S; R2E WM
Clackamas County
NPDES Permit No. 101541
Site ID # 57613

Dear Mr. Buckner:

As you are aware, I evaluated the T.R. Jorgenson site with you on October 29, 1998, to determine if the site would be suitable for the land application of pre-aerated lagoon stabilized liquid biosolids from the Molalla WWTF. At a later time you provided the Department of Environmental Quality (Department) with a request for authorization to land apply biosolids to a 25.2 hectare (ha) (62.3-acre) hay field site on the 30.8 ha (76.1-acre) property referenced above.

The property consists of three tax lots. Tax Lot 1000 has 19.6 ha (48.5 acre) of usable area of the total area of 22.6 ha (55.88 acre). Tax Lot 1100 has 0.6 ha (1.4 acre) of usable area of the total area of 1.0 ha (2.35 acre). Tax Lot 1400 has 5.0 ha (12.4 acre) of usable area of the total area of 7.2 ha (17.87 acre).

The request included information characterizing soils, topography, biosolids, crop type, crop management, annual available nitrogen loading (agronomic loading rate), documentation of public notification, and a signed agreement between the City and the owner, Mr. Jorgenson.

Based upon evaluation of the site and the information submitted, I am pleased to advise you that the T.R. Jorgenson property described above is authorized for the seasonal application of pre-aerated lagoon stabilized liquid biosolids from the Molalla WWTF provided:

DEQ-1

1. Biosolids processing and handling will comply with Oregon biosolids rules and guidelines (OAR 340-50-005 to OAR 340-50-080) and all other applicable statutes, rules, and federal regulations, including the federal biosolids regulations (40 CFR Part 503).

2. Biosolids volatile solids content shall be monitored to assure that the vector attraction reduction requirements of the federal biosolids regulations are met. Also, solid waste debris contained in the lagoon biosolids shall either be removed through screening or mechanically reduced in size through grinding so as not to create nuisance conditions at the land application site.

3. Based on the City's latest biosolids analysis of 1998 (assuming immediate biosolids soil incorporation, a 22.5% mineralization rate and a total solids content of 4%), existing crop, topographic and soil conditions of the field, up to 134.5 kilogram (kg) of available nitrogen (215,757 liter (l) (8.72 dry megagram (Mg))) of biosolids per ha (120 pounds (23,066 gallons (3.89 dry tons)) per acre) per year can be applied to areas of the T.R. Jorgenson hay field site acceptable for receiving biosolids. Changes in biosolids characteristics or cropping practices will necessitate appropriate adjustments in the application rate to maintain nitrogen loadings consistent with crop demands.

4. If other sources of nitrogen are applied to the field, the biosolids application rate must be reduced so that commercial, animal manure or green chop nitrogen plus biosolids nitrogen does not exceed the agronomic loading rate of any field within the site.

5. The above Condition 3. notwithstanding, the application rate shall not exceed 46,770 l per ha (5000 gallons per acre) per hour or 215,757 l per ha (23,066 gallons per acre) per day. The resting period between applications should be at least 48 hours. Weather conditions should be considered and the resting period adjusted upward for inclement weather.

6. Biosolids land application shall cease when precipitation exceeds 0.6 centimeter (cm) (1/4 inch) per hour or when 2.5 cm (one inch) or more of precipitation occurs in a 24-hour period. Land application shall be withheld from the site for at least one day for every consecutive day of precipitation where a 0.6 cm (1/4 inch) per hour or 2.5 cm (one-inch) per 24-hour precipitation event occurs.

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14. For truck application, a 15 meter (m) (50 foot) minimum setback shall be maintained from the following features and points of biosolids land application: the top of the ditch bank along State Highway 211, located along the south site perimeter; the culvert outlet, located near the northeast site corner; and from the top of the bank of Bear Creek, located along the north site perimeter.

    For spray irrigation of liquid biosolids, a minimum 23 m (75 foot) setback shall be observed from water features, including the bank of Bear Creek and the culvert outlet referenced above, and points of biosolids land application.

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Also, when using spray irrigation for the land application of biosolids, a minimum setback of 91-m (300 feet) shall be maintained from all occupied structures and major roadways. This includes the two residences located within the south part of the property and adjacent to the southwest corner of the property. Additionally, this includes State Highway 211 along the south boundary of the property.

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19. In the event an odor problem is reported to the Department after biosolids have been land applied at the Jorgenson site, immediate steps, such as, but not limited to, the addition of liming materials, must be taken to counteract that condition.

20. The City shall maintain daily records for the biosolids land application site which indicate (on a field map grid system) where, when, and what volume of biosolids were land applied to a particular site.

21. Site records shall indicate the date, location and amount of biosolids applied, segments of each field that received biosolids, amount of nutrients applied to each area receiving biosolids and the type of crop grown. These data shall be maintained at the Molalla WWTF and be made available to the Department for review upon request.

22. The Department shall have the right to (at reasonable times): enter the City's place of biosolids land application and record keeping to review biosolids management operations and records, obtain copies of any records required under the terms of this authorization and the City's biosolids management plan, inspect any monitoring equipment required under this authorization, inspect any collection, transport, or land application vehicles, and obtain any photographic documentation or evidence deemed appropriate.

23. The City shall provide the Department with an annual report that comprehensively describes biosolids handling activities, including at the Jorgenson site, during the yearly reporting period. The report shall be submitted annually by February 19th following the calendar year of the report.

24. The Department may impose any additional restrictions or conditions deemed necessary to assure adequate biosolids management. Any variations from the City's Department approved biosolids management plan and this authorization letter must receive prior written approval from the Northwest Region Office.

25. This authorization is subject to revocation should health hazards, environmental degradation, or nuisance conditions develop as a result of inadequate biosolids treatment or site management. This authorization is considered to be part of your approved biosolids management plan. Therefore, if operations are not conducted in accordance with terms specified under this authorization, the Department will initiate an enforcement action that may lead to the assessment of a civil penalty.

If you have any questions regarding this authorization, please contact me at 229-5616.

Sincerely,

Bruce W. Henderson

Bruce W. Henderson
Biosolids Specialist
Northwest Region

cc: Doug Peters, Water Quality Division, Headquarters, DEQ
T.R. Jorgenson
12305 South Highway 211
Molalla, OR 97038

Priority

BIOSOLIDS APPLICATION SITE WORKSHEET

1. **Site:** B, Slim's farm land next to treatment plant

2. **Site Owner:** T.R. Jorgenson

3. **Vicinity:** **A)** 12305 S. Hwy 211, Molalla, OR. 97038 (503) 829-7707
   B) T5S, R2E, Section 7
   C) Tax lot#: 1000 (55.88 acres), 1100 (2.35 acres) & 1400 (17.87 acres)
   D) County: Clackamas

4. **Area of Land:** **A) Major set backs to consider:**
   1. Bear Creek on North side of property
   2. Ditch along Hwy 211
   3. Culverts
   4. Wells: I talked to the neighbors closest to the application site and found that there are four wells that will require additional setbacks. The four wells have been noted on the sketch map of the site. A 200 foot set back will be observer from all wells.

   B) Gross: 76.1 acres
   C) Useable: 68 acres
   D) Buffers and set backs: 5.7 acres
   E) Net land: 62.3 acres

5. **Soil Type:** **A)** 1A- Aloha Silt Loam
   B) 3-Amity Silt Loam
   C)

6. **Crop:** **A) Type:** Corn, irrigated
   B) Method of Harvest (silage/Pasture): Silage

7. **Nitrogen Requirement:** 175 lb./acre (as per OSU Extension Services web page)

8. **Anticipated Nitrogen To Be Applied By Owner:** None

9. **Method of Application:** Truck or sprinkler

10. **Time of Year For Application:** Spring (May - June)

Molalla Wastewater Plant

Organic Load Rates

Site: B, T.R. Jorgenson ("Slim")
Crop type: Silage corn
Type of Digestion: Facultative
Nitrogen needed for this crop: 175 lb./acre
Date of Application: Spring (May-June)
Total solids (TS): 6 %
Method of Application: truck/sprinkler
TS applied: 4 %
Class of Sludge: B
Volatile solids: 46 %
Available Acres on this site (after buffers considered): 62.3 acres

Parameters	mg/kg wet	mg/kg dry	% (w/w)	lb./Ton	*APLR, Kg/ha/yr.	APLR lb./acre/yr.	**PAR, lb./acre/yr.	Ceiling conc. mg/kg, dry
Mercury (Hg)	0.33	5.5	0.00055	0.011	0.85	2.0995	0.145	57
Arsenic (As)	1	16.7	0.001667	0.03333	2.0	4.94	0.440	75
Lead (Pb)	8.9	148.3	0.014833	0.29667	15	37.05	3.918	840
Zinc (Zn)	129	2150.0	0.215	4.3	140	345.8	56.792	7500
Copper (Cu)	39.2	653.3	0.065333	1.30667	75	185.25	17.258	4300
Nickel (Ni)	2.2	36.7	0.003667	0.07333	21	51.87	0.969	420
Cadmium (Cd)	0.4	6.7	0.000667	0.01333	1.9	4.693	0.176	85
Chromium (Cr)	3	50.0	0.005	0.1	150	370.5	1.321	3000
Selenium (Se)	0.34	5.7	0.000567	0.01133	5.0	12.35	0.150	100
Molybdenum (Mo)	0.3	5.0	0.0005	0.01	0.9	2.223	0.132	75
TKN	2160	36000.0	3.6	72				
Organic N	1950	32500.0	3.25	65				
NH4-N	210	3500.0	0.35	7				
NO3-N	0	0.0	0	0				
NO2-N	0	0.0	0	0				
P	1100	18333.3	1.833333	36.6667				
K	33.2	553.3	0.055333	1.10667				

Available-N
NH4-N: (0.5250)(20)(0.5) = 5.25 lb/DT
NO3-N: 0
Org-N (5.4-0.525)(20)(0.225) = 21.9375 lb/DT
Total-N: 27.19
AAR: 175/27.19 = 6.44 DT/A/Y
(6.44)(2000)(100/4)(1/8.345)(1/1.01) = 38,185 g/A/Y

* **APLR**: Annual Pollution Load Rate is a limit the EPA sets on the amount of pollutant applied to the land (503.13 Table 4).
****PAR**: Pollutant Application Rate is the amount of each pollutant applied to the land as determined by the agronomic load rate.
Ceiling Concentration is the application limit set by the EPA which let biosolids be applied with out calculating site life.
If any pollutant is above this level a cumulative polutaion load rate must be calculated.

2. Nitrogen Requirements:
A. Crop Nitrogen Requirements (lb./acre): 175 lb./acre
B. Supplemental Fertilizer N (lb./acre): 0 lb./acre

3. Total Available Nitrogen (TAN) in sludge, lb./ton (dry): 13.25 lb./dry ton
Organic N: 9.75 lb./ton
NH4-N: 3.5 lb./ton
NO3-N: 0 lb./ton
TAN calculation biased on a mineralization rate of 0.15 and a volatilization factor of 0.5

4. Agronomic Loading Rate (N required for crop / TAN):
With respect to Nitrogen the sludge can be applied at a rate of 78398 gal./acre/yr.

13.208	ton/acre	(N req., lb/A) / (total N, lb/DT)
26415	lb./acre	(DT/A)(2000lb./T)
78398	gal./acre	(lb/A)(1/8.34)(1/1.01)(100/%TS appl.)

4%

5. Fertilizer P and K values for the sludge:
P= 484.3 lb. P /acre
K= 14.6 lb. K /acre

sludge load rates

6. Cumulative Pollutant Loading Rates (CPLR)(Does not need to be calculated if pollutant levels are below table 1 of 40 CFR 503.13):

The treatment plant does not apply sludge every year, so instead of determining the CPLR in terms of years we will calculate the total amount of pollutants applied to date. If the total amount applied to date reaches 90% of the CPLR we will know to watch the next applications and possibly choose a new site for the next application of sludge.

Pollutant	CPLR (lb./acre) * 100%	90%	conc. mg/kg (dry)	application rate (lb./acre)	total amount of pollutant applied on last application date (lb./acre)	Total amount of pollutant applied to date (lb./acre)
Mercury (Hg)	15	13.4	8.25	26,415	0	0.217924528
Arsenic (As)	37	33	25.00	26,415	0	0.660377358
Lead (Pb)	268	240.8	222.50	26,415	0	5.877358491
Zinc (Zn)	2,500	2,229	3225.00	26,415	0	85.18867925
Copper (Cu)	1,339	1,204	980.00	26,415	0	25.88679245
Nickel (Ni)	375	337.1	55.00	26,415	0	1.452830189
Cadmium (Cd)	35	31.2	10.00	26,415	0	0.264150943
Chromium (Cr)	2,677	22,408	75.00	26,415	0	1.981132075
Selenium (Se)	89	80.3	8.50	26,415	0	0.224528302
Molybdenum (Mo)			7.50	26,415	0	0.198113208

* CPLR is the Cumulative Pollutant Loading Rate. This is a value from Table 2 of 40 CFR 503.13.

---

7. Fecal Coliform Count, MPN method (geometric mean of seven samples):

55.0 per g TS (dry)

Seven Samples: (MPN/100 mL)

220	220	220
220	220	
220	220	

Class B biosolids must have less than 2,000,000 MPN, so these are class B biosolids.

12Φ: hay
2ΦΦΦ
15%: volu

8. Site Characteristics:

A) Gross tax lot: 76.1 acres
B) Useable amount of land: 68 acres
C) Area of all buffers and set backs: 5.7 acres
D) Net land area: 62.3 acres
D) Total galons per 62.3 acres that can be applied at this site: 4884192.78 gallons

1ΦΦΦ: 48.5 + 14ΦΦ: 12.9
11ΦΦ: 1.4

9. Vector Attraction Reduction: Option II (Method described in the EPA document "Environmental Regulations and Technology, Control of Pathogens and Vector Attraction in Sewage Sludge". EPA/625/R-92/013, Dec. 1992)

Five samples from different locations and depth in pond: Percent volatile solids reduction from day 0 to day 40 at 35 degrees C.

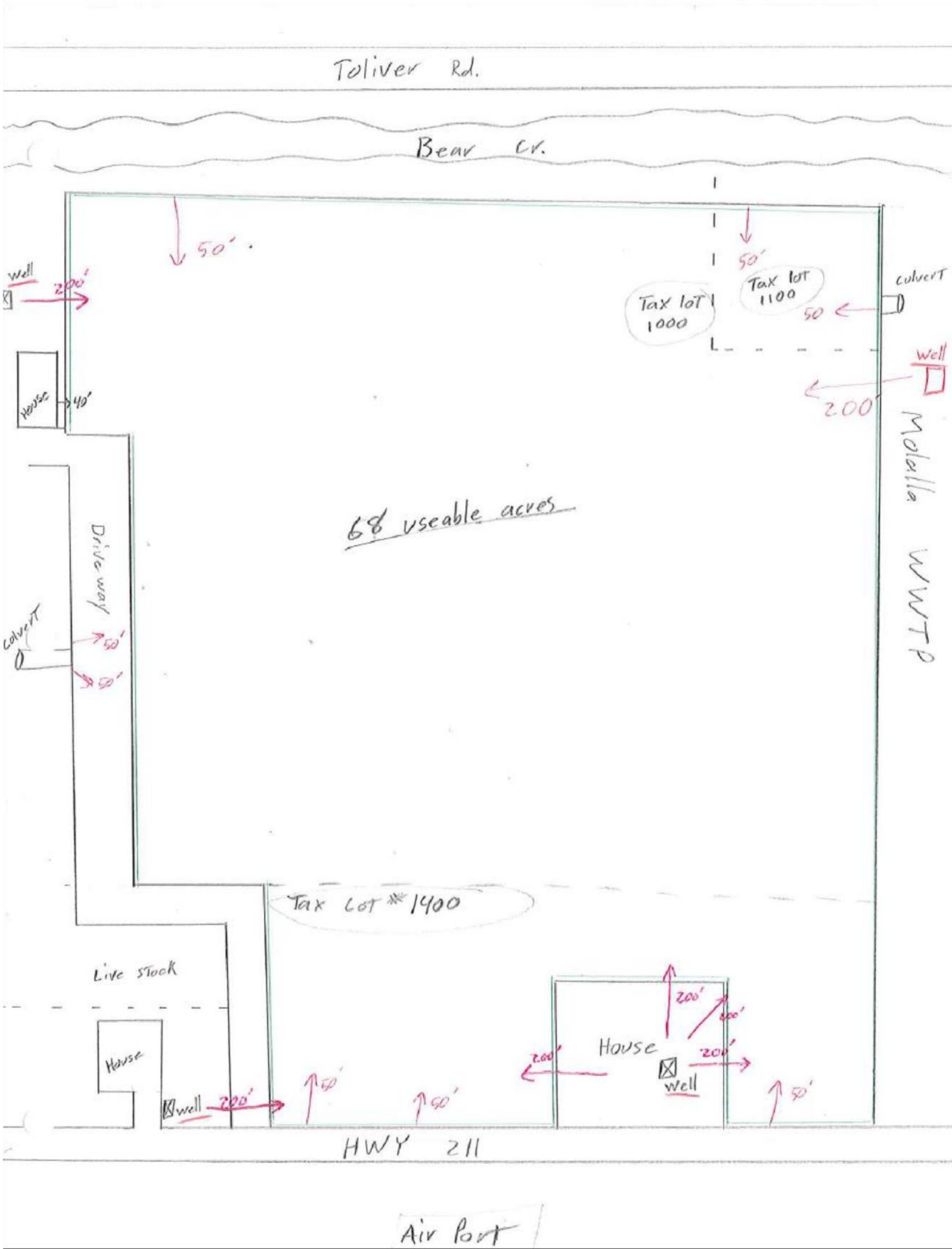
1	2	3	4	5
0.93%	-0.46%	3.35%	16.20%	2.51%

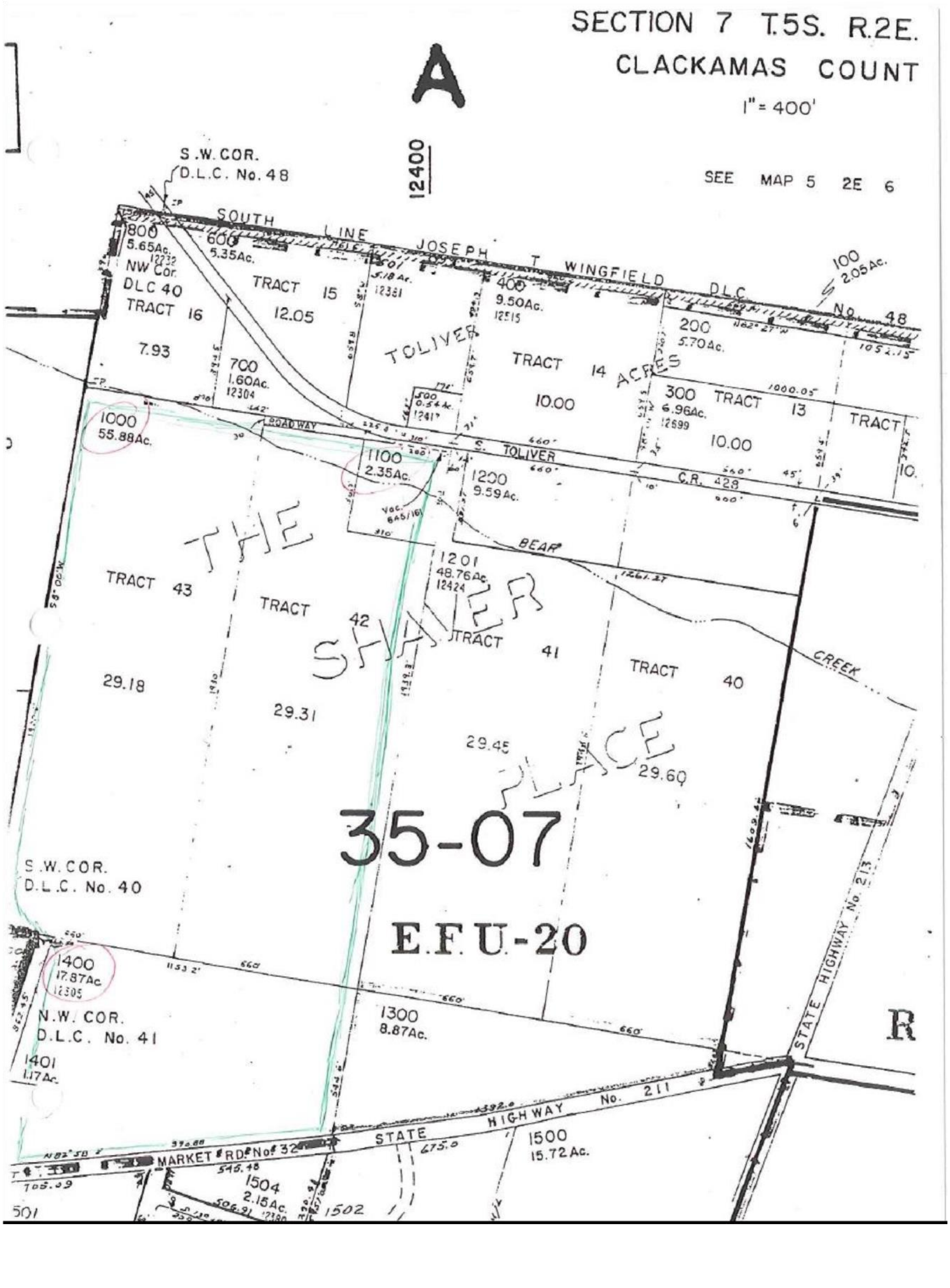
Average: 4.55% Volatile solids reduction in 40 days at 35 degrees C.

Option II is achieved when there is less than 17% reduction in VS, so in this case option II has been met and no further vector attraction Reduction steps need to be taken.

I certify under, penalty of law, that the Class B pathogen requirement in 503.32(b)(2)(ii) and the vector attraction reduction requirement in 503.33(b)(2) have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the pathogen requirements and the vector attraction reduction requirements have been met. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment.

Kevn Buckner	[signature]	12/25/98
Name of biosolids manager	Signature of biosolids manager	Date


Toliver Rd.
Bear Cr.
50'
Well
200'
Tax lot 1000
Tax lot 1100
50'
50
culvert
Well
200'
House
40'
Molalla WWTP
68 useable acres
Drive way
culvert
50'
50'
Tax Lot # 1400
Live stock
200'
200'
House
200'
200'
Well
House
Well
200'
50'
50'
50'
HWY 211
Air Port

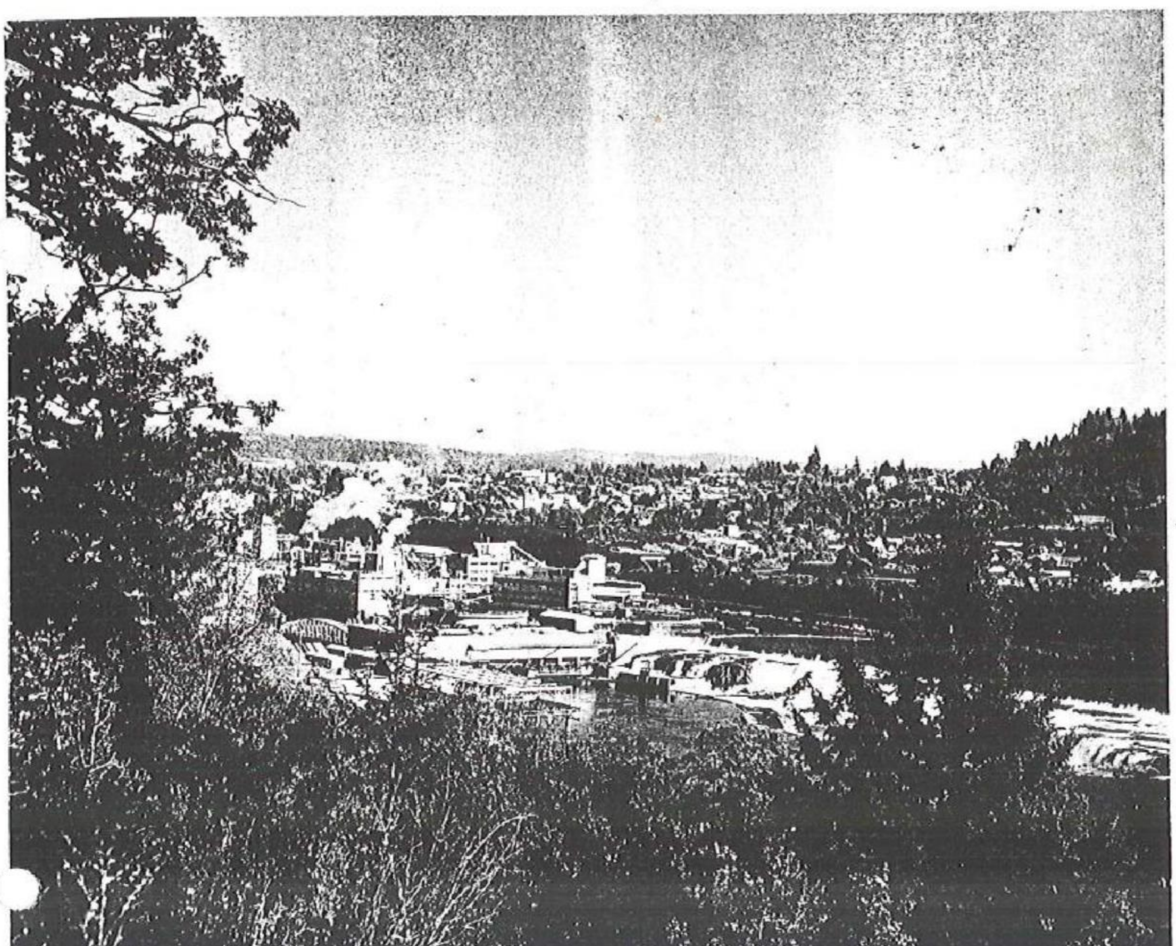

SECTION 7 T.5S. R.2E.
CLACKAMAS COUNT
1" = 400'
A
12400
S.W. COR.
D.L.C. No. 48
SEE MAP 5 2E 6
SOUTH LINE JOSEPH T WINGFIELD D.L.C. No. 48
800
5.65Ac.
600
5.35Ac.
NW Cor.
DLC 40
TRACT 16
7.93
TRACT 15
12.05
100
2.05Ac.
400
9.50Ac.
TOLIVER TRACT 14 ACRES
10.00
200
5.70Ac.
700
1.60Ac.
300 TRACT 13
6.96Ac.
10.00
TRACT
1000
55.88Ac.
ROADWAY
1100
2.35Ac.
S. TOLIVER
C.R. 428
1200
9.59Ac.
BEAR
CREEK
THE SHAVER PLACE
1201
48.76Ac.
TRACT 43
29.18
TRACT 42
29.31
TRACT 41
29.45
TRACT 40
29.60
35-07
E.F.U.-20
S.W. COR.
D.L.C. No. 40
1400
17.87Ac.
N.W. COR.
D.L.C. No. 41
1401
1.17Ac.
1300
8.87Ac.
STATE HIGHWAY No. 211
STATE HIGHWAY No. 213
MARKET RD. No. 32
1500
15.72 Ac.
1504
2.15Ac.
1502
501
R

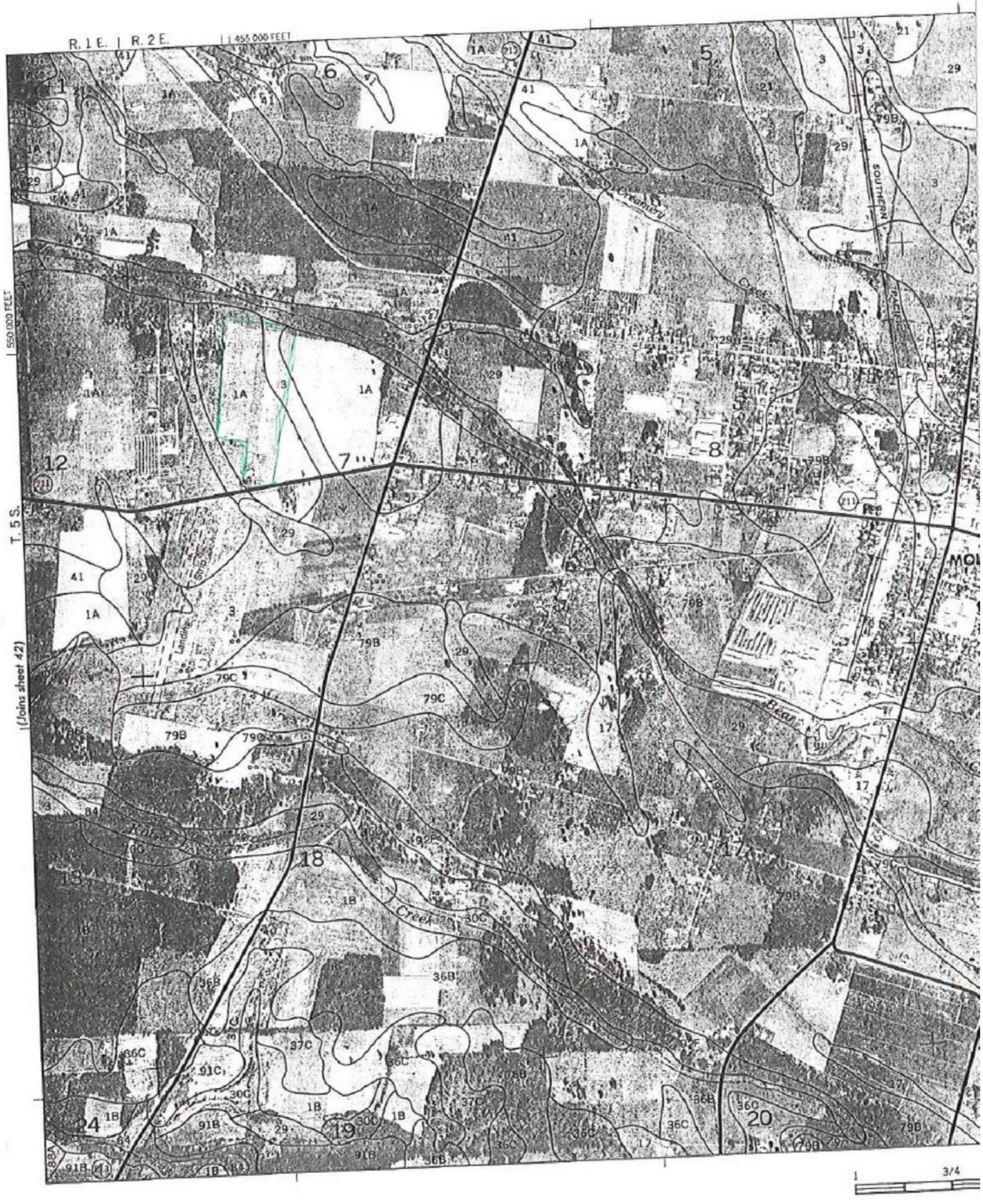
United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
United States
Department of
the Interior,
Bureau of Land
Management, and
Oregon Agricultural
Experiment Station

Soil Survey of Clackamas County Area, Oregon




R. 1 E.
R. 2 E.
455 000 FEET
550 000 FEET
T. 5 S.
(Joins sheet 42)
SOUTHERN
PACIFIC
Creek
Creek
MOL
1A
3
29
41
79B
79C
17
36B
36C
37C
30C
91B
91C
1B
21
5
6
7
8
12
13
18
19
20
24
3/4

give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils or miscellaneous areas.

Map Unit Descriptions

1A—Aloha silt loam, 0 to 3 percent slopes. This deep, somewhat poorly drained soil is on broad valley terraces. It formed in stratified glaciolacustrine deposits. The vegetation in areas not cultivated is mainly Douglas-fir, Oregon white oak, snowberry, rose, tall Oregon-grape, grasses, and forbs. Elevation is 150 to 350 feet. The average annual precipitation is about 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The upper 27 inches of the subsoil is dark brown, dark grayish brown, and yellowish brown silt loam, and the lower 16 inches is dark grayish brown and dark brown loam. The upper 9 inches of the substratum is dark brown loam. Below this are dark grayish brown, stratified very fine sandy loam and silt loam. The lower part of the subsoil and the upper part of the substratum in places are slightly brittle and weakly cemented.

Included in this unit are small areas of Woodburn, Quatama, Huberly, and Dayton soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Aloha soil is moderately slow. Available water capacity is 11 to 13 inches. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The water table is at a depth of 12 to 24 inches in winter and early in spring. This soil is droughty in summer.

Most areas of this unit are used for crops, mainly sweet corn, bush beans, winter wheat, and pasture. Among the other crops grown are filberts, strawberries, and grass seed. Some areas of the unit are used for homesite development and wildlife habitat. This unit is subject to increased use as homesites. Where the unit has been used as homesites, as much as 80 percent of the area not covered by buildings or other impervious material has been disturbed. The disturbed areas have been covered by as much as 20 inches of fill material or have had as much as 30 inches of the original profile removed by cutting and grading. The fill material is most commonly from adjacent areas of Aloha soils that have been cut or graded.

This unit is suited to crops. It is limited mainly by wetness and droughtiness. Most climatically adapted crops can be grown if drainage is provided. Tile drainage can be used to reduce wetness if a suitable outlet is available. In summer, irrigation is required for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water.

Excessive cultivation of the soil in this unit can result in the formation of a tillage pan, which can be broken by subsoiling when the soil is dry. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. When the soil is wet, grazing and other activities that cause trampling result in compaction of the surface layer, poor tilth, and excessive runoff.

If this unit is used for homesite development, the main limitations are wetness and the moderately slow permeability. Drainage is needed if roads and buildings are constructed. Wetness is reduced by installing drain tile around footings. Septic tank absorption fields do not function properly during rainy periods.

Preserving the existing plant cover during construction helps to control erosion. Topsoil can be stockpiled and used to reclaim areas disturbed by cutting and filling. Drainage is needed for best results with most lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. Plants that tolerate wetness and droughtiness should be selected if drainage and irrigation are not provided.

This map unit is in capability subclass IIw.

1B—Aloha silt loam, 3 to 6 percent slopes. This deep, somewhat poorly drained soil is on broad valley terraces. It formed in stratified glaciolacustrine deposits. The vegetation in areas not cultivated is mainly Douglas-fir, Oregon white oak, snowberry, rose, tall Oregon-grape, grasses, and forbs. Elevation is 150 to 350 feet. The average annual precipitation is about 40 to 60 inches, the average annual air temperature is 52 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The upper 27 inches of the subsoil is dark brown, dark grayish brown, and yellowish brown silt loam, and the lower 16 inches is dark grayish brown and dark brown loam. The upper 9 inches of the substratum is dark brown loam. Below this are stratified very fine sandy loam and silt loam. The lower part of the subsoil and upper part of the substratum in places are slightly brittle and weakly cemented.

Included in this unit are small areas of Woodburn, Quatama, Huberly, and Dayton soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Aloha soil is moderately slow. Available water capacity is about 11 to 13 inches. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The water table is at a depth of 12 to 24 inches in winter and early in spring. This soil is droughty in summer.

nd ...s. Brushy plants such as alder and salal limit
l regeneration of Douglas-fir.
is unit is used for homesite development, the main
tions are slope, moderately slow permeability,
-swell potential, and the hazard of erosion.
vation for roads and buildings increases the risk of
on. Preserving the existing plant cover during
truction helps to control erosion. Roads and
ings should be designed to offset the limited ability
e soil in this unit to support a load.
this unit is used for septic tank absorption fields, the
limitation is the moderately slow permeability. The
pness of slope is a concern in installing septic tank
rption fields.
is map unit is in capability subclass VIe.

E—Alspaugh clay loam, 30 to 50 percent slopes. deep, well drained soil is on high terraces and ng uplands. It formed in alluvium and colluvium ived dominantly from andesite and tuff. The native etation is mainly Douglas-fir, red alder, salal, ckenfern, and swordfern. Elevation is 800 to 1,800 t. The average annual precipitation is about 60 to 85 hes, the average annual air temperature is 48 to 52 grees F, and the average frost-free period is 140 to 0 days.

Typically, the surface layer is dark brown clay loam out nches thick. The subsoil is dark brown and ddish brown clay about 29 inches thick. The bstratum to a depth of 60 inches or more is reddish own very gravelly clay.

Included in this unit are small areas of McCully, inney, and Aschoff soils. Included areas make up about 0 percent of the total acreage.

Permeability of this Alspaugh soil is moderately slow. vailable water capacity is about 5.5 to 9.5 inches. ffective rooting depth is 60 inches or more. Runoff is apid, and the hazard of water erosion is severe.

This unit is used for timber production, wildlife habitat, nd recreation.

This unit is suited to the production of Douglas-fir. The ite index for Douglas-fir ranges from 143 to 159. On the basis of a site index of 150, the potential production per acre of merchantable timber is 9,480 cubic feet from an even-aged, fully stocked stand of trees 60 years old or 86,800 board feet (International rule, one-eighth-inch kerf) from an even-aged, fully stocked stand of trees 80 years old.

The main concerns in producing and harvesting timber are slope and the hazard of erosion. Conventional methods of harvesting trees are difficult to use on this unit because of the steepness of slope. Highlead or other cable logging methods can be used. Use of these methods is limited during November through March. Roads need heavy base rock for year-round use. Roads ar idings can be protected from erosion by constructing water bars and by seeding cuts and fills. Brushy plants such as alder and salal limit natural regeneration of Douglas-fir.

This map unit is in capability subclass VIe.

3—Amity silt loam. This deep, somewhat poorly drained soil is on broad valley terraces. It formed in stratified glaciolacustrine deposits. Slope is 0 to 3 percent. The vegetation in areas not cultivated is mainly Douglas-fir, Oregon white oak, wild rose, willow, and grasses. Elevation is 150 to 350 feet. The average annual precipitation is about 40 to 50 inches, the average annual air temperature is 50 to 54 degrees F, and the average frost-free period is 165 to 210 days.

Typically, the surface layer is very dark grayish brown silt loam about 15 inches thick. The subsurface layer is dark gray silt loam about 7 inches thick. The subsoil is grayish brown and light olive brown silty clay loam about 13 inches thick. The substratum to a depth of 60 inches or more is olive brown silty clay loam.

Included in this unit are small areas of Woodburn, Aloha, Dayton, and Huberly soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Amity soil is moderately slow. Available water capacity is about 11 to 13 inches. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The water table is at a depth of 6 to 18 inches in winter and early in spring. This soil is droughty in summer.

Most areas of this unit are used for cultivated crops and pasture. The main cultivated crops are sweet corn and bush beans. Among the other crops grown are winter wheat, blackberries, filberts, and grass seed. This unit is also used for homesite development, wildlife habitat, and recreation.

This unit is suited to crops. It is limited mainly by wetness. Most climatically adapted crops can be grown if drainage is provided. Tile drainage can be used to reduce wetness if a suitable outlet is available. In summer, irrigation is required for maximum production of most crops. Sprinkler irrigation is a suitable method of applying water.

Excessive cultivation of the soil can result in the formation of a tillage pan, which can be broken by subsoiling when the soil is dry. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium. When the soil is wet, grazing and other activities that cause trampling result in compaction of the surface layer, poor tilth, and excessive runoff.

If this unit is used for homesite development, the main limitations are wetness and the moderately slow permeability. Drainage is needed if roads and buildings are constructed. Wetness is reduced by installing drain tile around footings. Septic tank absorption fields do not function properly during rainy periods.

Preserving the existing plant cover during construction helps to control erosion. Topsoil can be stockpiled and used to reclaim areas disturbed by cutting and filling. Drainage is needed for best results with most lawn grasses, shade trees, ornamental trees, shrubs, vines, and vegetable gardens. Plants that tolerate wetness and droughtiness should be selected if drainage and irrigation are not provided.

This map unit is in capability subclass IIw.

4E—Andic Cryaquepts, moderately steep. These moderately deep to deep, very poorly drained soils are along drainageways of high mountainous uplands. They formed in colluvium derived dominantly from andesite and basalt mixed with volcanic ash. Slope is 5 to 30 percent. The native vegetation is mainly red alder, mountain alder, and devilsclub with scattered western hemlock and western redcedar (fig. 5). Elevation is 2,700 to 4,000 feet. The average annual precipitation is 80 to 100 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 30 to 90 days.

No single profile of Andic Cryaquepts is typical, but one commonly observed in the survey area has a surface layer of cobbly sandy loam about 7 inches thick. The subsoil is very gravelly sandy loam about 19 inches thick. The substratum to a depth of 60 inches or more is compacted, slightly brittle very cobbly sandy loam. In some areas of similar included soils, the surface layer is silt loam or loam. Depth to bedrock is 30 to 60 inches or more.

Included in this unit are small areas of Highcamp, Soosap, and Kinzel soils and Rock outcrop. Also included are small areas of organic soils in the more

Figure 5.—Andic Cryaquepts, moderately steep, in foreground. Highcamp and Soosap soils in background.

Biosolids Facts and Agreement

I, the undersigned, do hereby certify that I have read and understand the following information and requirements regarding the disposal of biosolids on my property:

Origin

Digested municipal biosolids is the result of treating human wastes under controlled conditions. This reduces chances of odor and disease. This material is well suited as a soil amendment and for supplementing crop nitrogen requirements.

Precautions

Because of the origin of the biosolids, it is necessary to take certain precautions with its application and disposal to prevent contamination of surface or groundwater's and reduce the possibility of nuisance odor conditions. Care must be taken to maintain a minimum 50 foot setback from a ditch, channel, pond or waterway. A minimum setback of 200 feet must be maintained from downgradient springs, infiltration galleries, water withdrawal points from surface waters and wells.

Other precautions include maintaining buffer zones adjacent to property lines and residential areas. The amount of distance necessary to make up a buffer zone will very with local conditions and the method of biosolids application.

Responsibility

It is the city's responsibility to insure the proper handling and disposal of all biosolids generated at the sewage treatment plant. Precautions must be taken in transporting the biosolids from treatment plant to the application site to prevent leaking or spilling the biosolids onto highways, streets, roads, or waterways.

Access

The land owner/controller must limit access to the biosolids site for 12 months following application if the biosolids is not worked into the soil. Access is assumed to be controlled if the site is located on rural private land.

Cropping

As a general guideline, crops grown for direct human consumption (fresh market fruits and vegetables) should not be planted sooner that 18 months after biosolids application. If the crop is to be treated or processed prior to marketing so that disease causing organisms are not a concern, the DEQ may allow biosolids application within 18 months.

Other crops, such as grains, may receive biosolids applications up to 60 days prior to harvest. There are no time restrictions for non-edible crops such as grass and nursery stock.

Grazing
Application of digested biosolids is allowed on pasture and forage crops. However, Federal regulations prohibit "animals whose products are consumed by humans" from grazing for at least 30 days after biosolids application. This is especially true for dairies, where animal contact or direct intake of biosolids, through grazing, could result in milk contamination.

Application of Municipal Biosolids
The application of digested biosolids on agricultural land should be managed to utilize its fertilizer value to the maximum extent possible. The recommended amount of biosolids to be applied to you land is based on nitrogen requirements of the crop(s) you plan to grow and will very depending on the amount of nitrogen in the biosolids.

It is important to use only the amount of nitrogen, either from biosolids or from commercial fertilizer, which your crop requires. The amount of commercial fertilizer you would normally use must be reduced by the amount available in the biosolids to be applied on your land. If too much nitrogen is applied, whether from biosolids or commercial fertilizer, it can leach into groundwater and cause pollution.

Determining the proper amount of sludge to be applied is the responsibility of the treatment plant staff. However, it is important that the landowner provide accurate information on the crop to be grown, so that proper correct application rates might be chosen.

T. R. JORGENSEN
Print name of site owner

12305
~~12129~~ S. Hwy 211, Molalla, OR. 97038
Site Description (address)

T R Jorgensen
Signature of site owner

12-29-98
Date

Dennis St. Clair
Molalla Plant Superintendent

Dennis St. Clair
Signature of Superintendent

1/4/99
Date

SLUDGE SITE EVALUATION WORKSHEET (SEE ATTACHED MAP FOR PROFILE LOCATIONS)

Kern Buckner

Site No: 2 Examiner: BW Henderson w/ Date: 10/29/98

1100: 150, 2.35 Silage
1000: 50, 155.85

Owner: Shim Jorgensen Acres: ______ Crop: Corn Irrigated?: yes *

T.L.: 1100 1000 Sec: 7 TWP: 5S R: 2E Co: Clackamas

Sludge Generator: Molalla WWTF Application Method: truck

*effluent reuse water from Molalla WWTF

140 → 170 N

Factor	Pit 1	Pit 2	Pit 3	Pit 4
Landscape Position				
% Slope				
Direction of Slope				
Topsoil Texture				
Topsoil Color				
Probable CEC				
%/Type Coarse Frag.				
Rooting Depth (In)				
Effective Soil Depth (In)				
Depth to Evid. of Sat (In)				
Type Groundwater				
Depth to Rap. Drain. Mat. (In)				
Other				

low Valley terrace - Valley soils w/gvls & cbbls, - M ≥ 12" & ESD GRDS: ≥ 2' - Ø - 3% slope - plowed land - 2 possible wells on prop (residences) & one adj well - 50' buffers: ditches along road & adj to Bear Cr. & Bear Cr. - Seasonal auth: 5/15 to 10/15 w/ caution in May & early June: Wet soils → trafficability & ponding/runoff

SITE CRITERIA

- Stable Landform
- No Flooding
- No Run Off to Nearby Land
- Perm. G.W. to be 48" at Sludge Appl.
- Temp. G.W. to be 12" at Sludge Appl.
- Slope = 12% for Wet Sludge
- 24" + Rooting Depth
- 24" + To Rapidly Draining Materials

BUFFERS

Residential:

Injection = None
Truck Spread = 0' - 50'
Spray = 300' - 500'

Major Highways:

Surface Water = 50'

Water Source = 200'

MPR:h
WH583
1/28/86

Appendix H: Spill Contingency Plan

2012 Biosolids Spill Contingency Plan
For the City of Molalla

Spills During Hauling:

Amounts over 50 gallons:

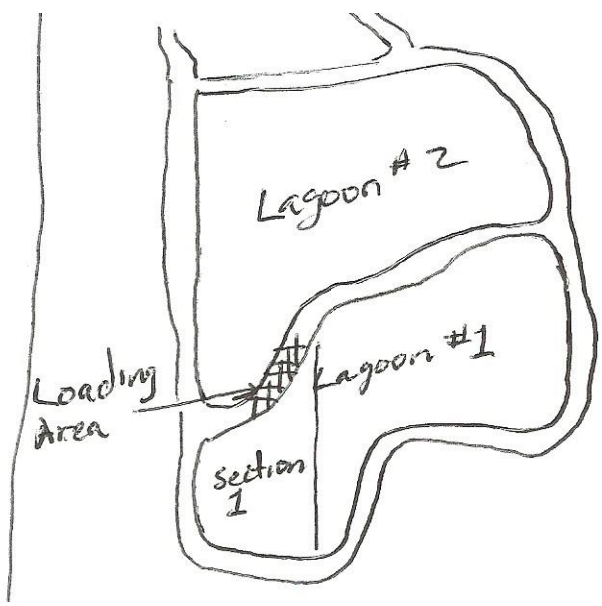
- Call Oregon Emergency Response System at 1 (800) 452-0311.
- Call the Head of Public Works for the City of Molalla at (503) 793-7026.
- Have him send the vactor trailer to suck up as much as possible.
- Try to contain the Spill with berms.
- Try to stop the leak.
- If possible contain area with caution tape.

Amounts under 50 gallons:

- Put out berms or containment materials
- Notify Head of Public Works for the City of Molalla at (503) 793 7026 Use vactor trailer to suck up the spill.
- Apply absorbent material to remaining amount.
- Apply lime to the surface after it is sucked up to kill pathogenic material.

Spills During Loading:

The truck will be parked on the dike between number one and number two lagoons. There will be a layer of liner material laid down on the dike prior to the truck driving in to load. Any spilled material will naturally flow back into one of the two lagoons. The remaining residue will be washed back into the lagoons with a hose to avoid nuisance conditions. See map of loading area.



Notes:

Biosolids contain Pathogenic organisms. Avoid contact with skin. Always wash hands thoroughly after any contact.

Spill containment Equipment:

Check the spill containment equipment before start of hauling each day to make sure that everything is in the truck and in usable condition. It is also necessary to do a pre trip inspection on the vehicle every day before use.

Checklist:

4 spill containment booms
1 50lb sack of lime
2 50lb sacks of absorbent material
1 copy of spill containment plan with contact info 1 exposure
kit gloves suit face shield mask.

APPENDIX E: PHOTOS

Photos

INFLUENT HEADWORKS

INFLUENT HEADWORKS, CONT.

AERATION BASIN

TRANSFER PUMP STATION

TRANSFER PUMP STATION, CONT.

FACULTATIVE / STORAGE LAGOONS

FACULTATIVE / STORAGE LAGOONS, CONT.

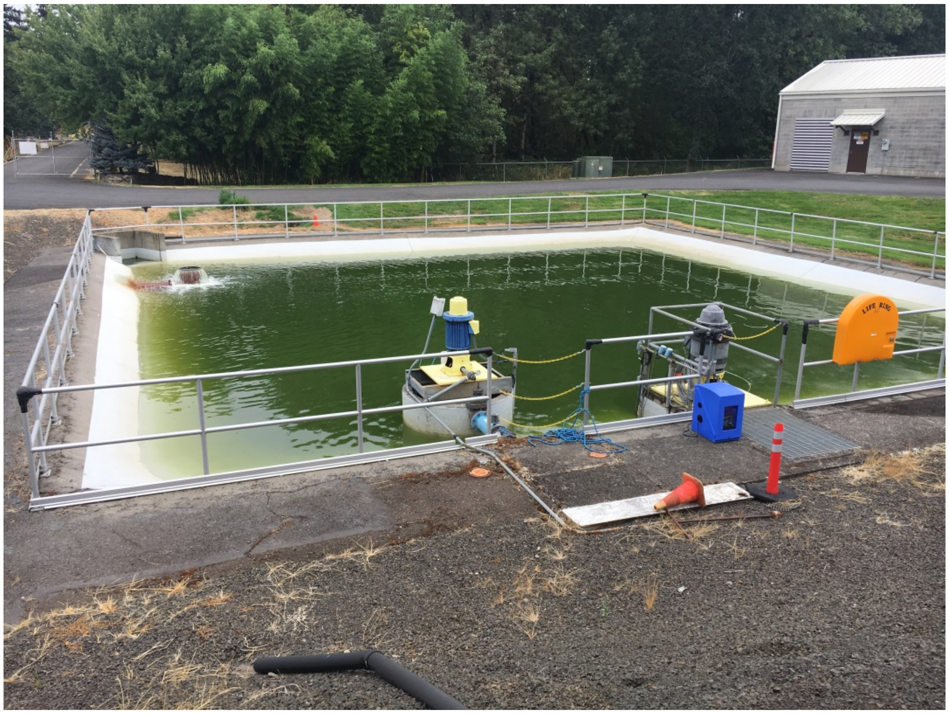
DAF UNITS

DAF UNITS, CONT.

GRAVITY FILTERS

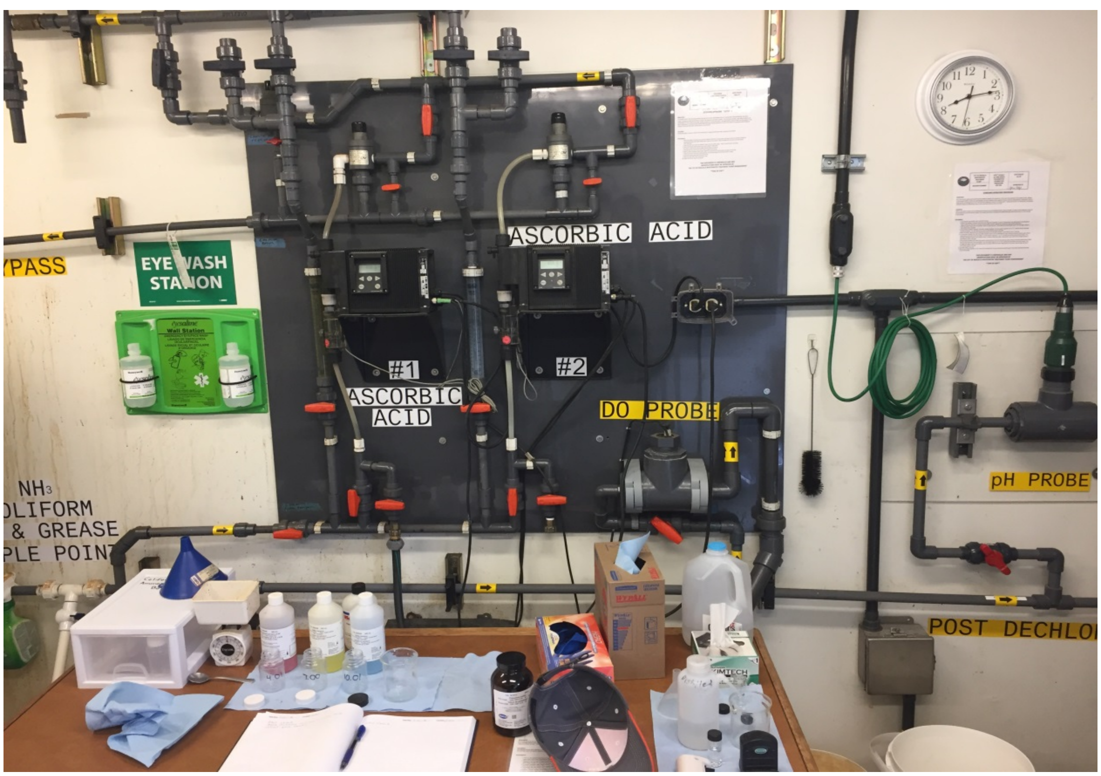
DISINFECTION SYSTEM

CONTACT BASIN



EFFLUENT PUMP STATION

DISCHARGE MONITORING STATION



DISCHARGE MONITORING STATION, CONT.

EAST 5TH AND COLE PUMP STATION

S. MOLALLA AVE PUMP STATION

STEELHEAD AND COHO STREET PUMP STATION

STOWERS PUMP STATION

TAURUS PUMP STATION