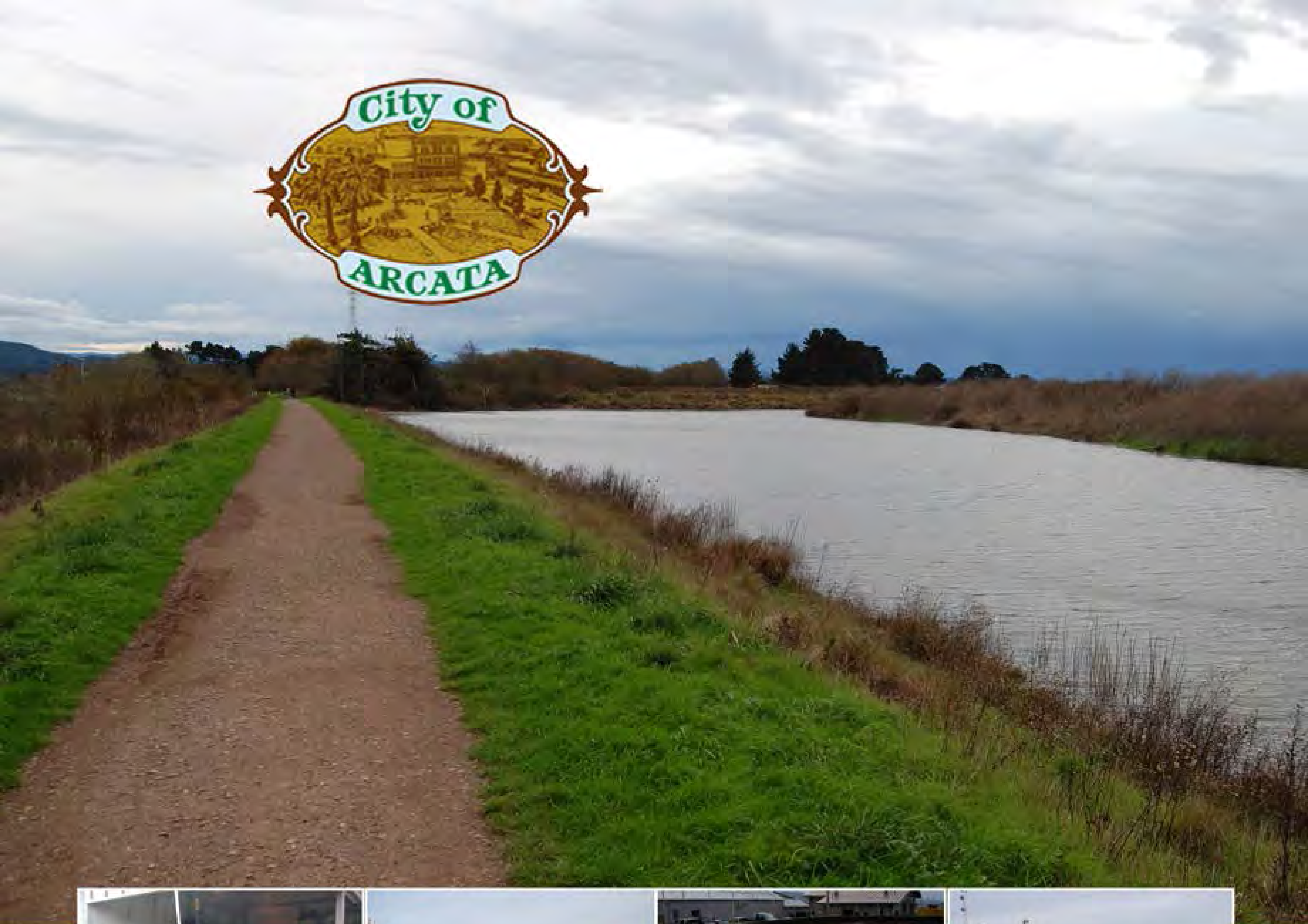

City of Arcata

Facility Plan

REVISED July 2017

LACO / carollo

CITY OF ARCATA

WASTEWATER TREATMENT FACILITY IMPROVEMENTS PROJECT

FACILITY PLAN

July 2017

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07/27/2017

CITY OF ARCATA

WASTEWATER TREATMENT FACILITY IMPROVEMENTS PROJECT

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EXECUTIVE SUMMARY

1.1 INTRODUCTION

The Arcata Wastewater Treatment Facility (AWTF) is owned and operated by the City of Arcata (City), serving residents within the City limits and the unincorporated community of Glendale. The AWTF, shown in Figure 1.1, has been discharging to Humboldt Bay since about 1949. The AWTF currently discharges treated wastewater to Humboldt Bay in conjunction with enhanced treatment occurring in the Arcata Marsh Wildlife Sanctuary (AMWS), constructed freshwater wetlands adjacent to the treatment facility. Discharges are regulated by the North Coast Regional Water Quality Control Board (RWQCB) through application of National Pollutant Discharge Elimination System (NPDES) permit.

In 2012 the AWTF began operating under a new NPDES permit that specifically addressed several long-term issues regarding disinfection, treatment units, and outfalls. Due to past compliance problems, the new permit required changes be made to improve wastewater treatment, protect beneficial uses, increase energy efficiency, and reduce chemical usage, thereby reducing the potential for permit violations.

In response to the new permit requirements, the City initiated this Facility Plan and plant improvement project to address several issues:

- Ongoing NPDES permit violations and regulatory compliance.
- Need to repair or rehabilitate (R&R) aging infrastructure and address deferred maintenance.
- Providing reliable hydraulic and treatment capacity for both wet and dry weather flows now and in the future.

This facility plan provides overall direction for the current permit compliance project as well as a future Capital Improvements Program (CIP) needed to maintain the treatment facility assets, repair, and rehabilitate existing assets, and modernize the facility to meet current levels of service. This executive summary provides a brief overview of key findings and recommendations of the Facility Plan. For more detailed information, the reader is directed to the individual chapters of the Plan.

This facility plan was prepared by the LACO/Carollo Engineers team as part of the Wastewater Treatment Facility Improvements Project professional services.

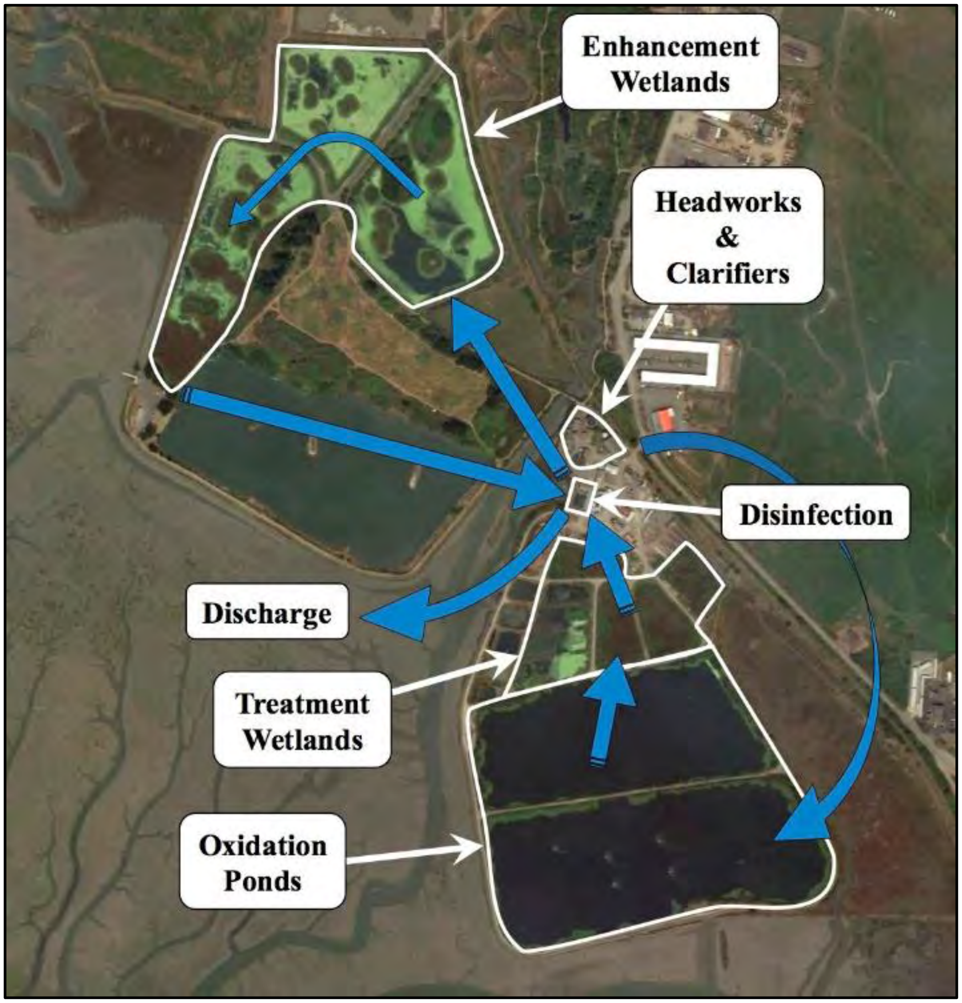


Figure 1.1 Existing AWTF Facilities

1.1.1 History of Facilities and Improvements

The original AWTF was constructed in the late 1950s. The AWTF has been upgraded throughout the years, with the last major upgrade project completed in the late 1980s. The project included a new headworks facility with screening and grit removal, a chlorine contact basin and chemical storage building, effluent pump stations and a new generator building. Since that project, smaller projects have included upgrades to the oxidation ponds, treatment and enhancement wetlands, digesters, pond aerators, chlorination/dechlorination system and the addition of a new standby generator. Generally the plant consists of these main elements:

- Influent pumps and preliminary treatment (screening and grit removal).
- Oxidation ponds, shown in Figure 1.2, and treatment wetlands that provide secondary treatment.

- Enhancement wetlands that provide polishing treatment in the AMWS.
- Chlorine contact basin that provides disinfection prior to discharge to Humboldt Bay.

Figure 1.2 AWTF Ponds Provide Secondary Treatment

The AWTF system relies heavily on land-based, natural treatment systems. This system has served the City well but has a number of drawbacks in that there is not sufficient room to further expand the natural treatment systems for additional capacity, and natural systems are inherently greatly affected by the weather (temperature and precipitation). As regulatory requirements have gotten more stringent over the years and with the initiation of mandatory minimum penalties in 2000, it has become more difficult to reliably meet permit compliance with the land-based natural system.

However, there is recognition that the facility as a whole, and the AMWS specifically, provides a tremendous community benefit. Not only do the residents of the area visit the marsh and its five miles of trails, but visitors come from far to see the wildlife that frequents the marsh. The Arcata Marsh Interpretative Center affords wetland and natural treatment educational opportunities for these visitors. Over 300 bird species have been observed using the marsh and it provides an important stop on the Pacific Flyway for migrating birds. A typical scene on a recreational trail is shown in Figure 1.3.

Figure 1.3 AMWS Provides a Significant Community Benefit

1.2 PLAN DEVELOPMENT AND REVIEW PROCESS

The City of Arcata, with its natural treatment system and the AMWS, are recognized as being leaders in sustainability and dedicated to being leaders in environmental progress. Established City Council goals that relate to this plan include (see 2015-16 Goals at http://www.cityofarcata.org/435/City-Council-Goals):

- Improving ***facilities and infrastructure*** to provide citizen safety and comfort.
- Providing ***environmental leadership*** to improve water resource management, increase local energy independence, strive towards zero waste and supporting ecosystem functions.
- Provide ***sustainable development*** by improving community services.
- Improve the quality of ***public services*** by improving communication with the public.
- Encourage ***citizen and community health*** by providing recreational opportunities, support essential human services, and encourage community participation.
- ***Prepare for future needs*** by providing leadership in developing adaption strategies for climate change and using best available science for future planning.

This Facility Plan strives to use these goals to help the City continue to provide wastewater services (an essential human service) in a safe manner that meets regulatory requirements and still provides the community benefits that is expected and loved.

To meet these goals for the facility plan as well as meeting Council goals, a triple bottom line approach of considering environmental, economic, and social impacts and benefits was established to use in considering alternatives and the overall direction of the plan. This is shown in Figure 1.4.

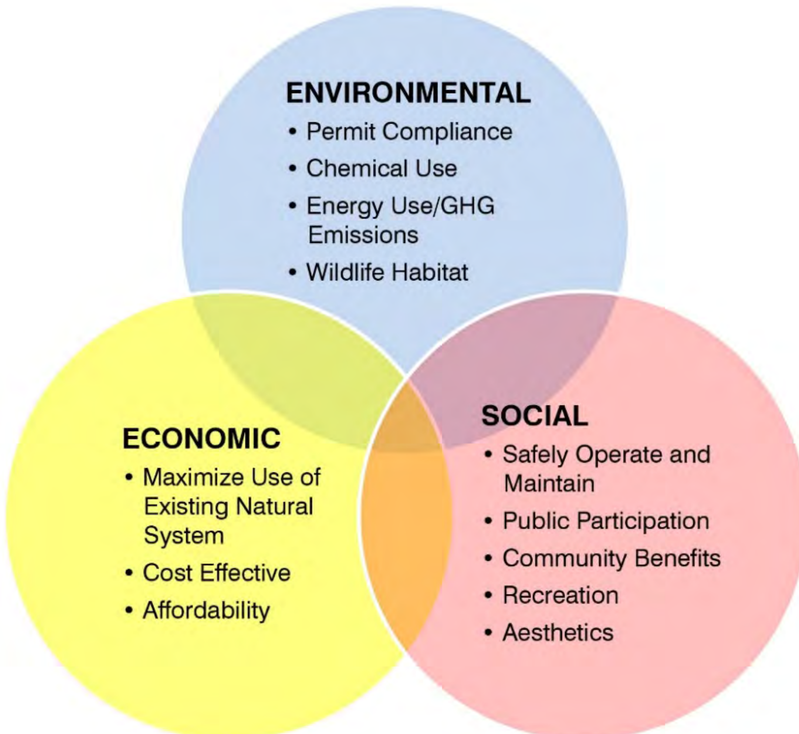


Figure 1.4 Triple Bottom Line Framework

1.2.1 Public Process and Review

Given the strong affiliation of the community and the college (Humboldt State University) with the AWTF and AMWS, it is critical that public input be provided into any proposed changes to the system. In order to get input, an Administrative Draft Facility Plan was presented to the City Staff and the Arcata Marsh Research Institute (AMRI) in September 2015. This original plan focused on needed repair and replacement, as well as permit compliance to replace the chlorination system with UV for the new outfall location in the brackish marsh. At this meeting, comments were received about concern over the process capacity being inadequate once chlorination was eliminated. At the time, process capacity was not in the scope of work. Following this input, the project team, along with the City and AMRI, did additional work and met in November 2015 to identify the capacity shortfall and alternatives to address this shortfall. Revised technical memorandums were distributed for City and AMRI review, and numerous conference calls were held to review technical work. In April 2016, a public workshop was held to present the findings and recommendations of the Draft Facility Plan, followed by a public Council Meeting on April 20th. At these meetings, significant discussion took place regarding the use of the existing natural system and investing in improving it. This Facility Plan incorporates additional alternative evaluation and development to address many of these comments. The Facility Plan was presented on June 6 and June 13, 2016 at City Council Workshops.

Following the public meetings, City staff was able to meet with RWQCB staff June 27, 2016 to discuss the facility plan and the future NPDES permit. Based on feedback from the RWQCB, it was determined that the three alternatives identified in the draft facility plan would not completely meet the requirements of the RWQCB. Subsequently, City staff, AMRI and project team members met and developed a new alternative that would meet these requirements. The team proposed a new phased Alternative 4A/B in early 2017. The following steps were taken to arrive at a consensus alternative:

- The oxidation pond treatment improvements were reviewed and revised based on the review completed by an outside expert. The improvements were developed to improve the ponds systems ability to meet the anticipated discharge limits including the ability to remove ammonia.
- The City indicated a preference to phase in the parallel secondary treatment which will allow the benefits of the pond improvements to be incorporated into the sizing of the parallel secondary treatment improvements. A second oxidation ditch could be sized and constructed in a second phase, once the benefits of the oxidation pond upgrade were established.
- The flow schematic was updated to address the RWQCB requirements that all flows up to 5.9 mgd go through the enhancement wetlands based on the requirements of the Enclosed Bays and Estuaries Policy and to maintain existing and future treatment requirements.

This approach was reviewed during a public meeting on March 30, 2017 and a City Council meeting on April 19, 2017. The presentations from these meetings are included in Appendix V.

1.3 PERMIT COMPLIANCE

The AWTF must comply with regulatory requirements established by its NPDES permit. For this Facility Plan, the major regulatory requirements that affect the operation of the AWTF were reviewed along with the AWTF's compliance record. A summary of the permitting issues that affect the proposed Facility Plan is provided below:

- **Flow Reconfiguration.** The permit approves and now requires a new flow configuration and discharge point. With the new configuration, effluent flows will no longer discharge directly from the chlorine contact basin to Humboldt Bay through Outfall 001. Instead, disinfected enhancement wetlands effluent will discharge through the future Outfall 003, which will serve as the new point of compliance. Outfall 003 will be constructed in the brackish marsh at the north end of the Arcata

Bay section of Humboldt Bay. Permit compliance for the flow reconfiguration is required by December 1, 2016; the City plans to request for an extension.

- **<u>Disinfection.</u>** Since 2013 there have been approximately 21 violations of the permit for disinfection related incidents including disinfection by-products, chlorine residual, or adequate bacteria removal. The permit includes approval for construction of a new ultraviolet light (UV) disinfection system, in place of the existing chlorine disinfection system. UV-disinfected effluent will then discharge through the future Outfall 003. Permit compliance for UV disinfection is required by December 1, 2016; the City plans to request for an extension. Additional considerations for the new UV system include:
  - Implementation of UV disinfection (see Figure 1.5) would eliminate the disinfection by products; however, the existing natural treatment system has a very low UV transmittance, which impacts the sizing of the UV needed to meet disinfection requirements.

Figure 1.5 Proposed UV Disinfection

  - The existing use of chlorine provides chemical treatment of biochemical oxygen demand (BOD) and seasonal hydrogen sulfide. Eliminating use of the chlorine will result in a shortfall of BOD removal capacity by approximately 600 to 1000 pounds per day (ppd).

- **<u>Wet Weather Flows.</u>** The permit does not completely define flow reconfiguration for wet weather flows. It prohibits discharge of flows greater than 5.9 million gallons per day (mgd) through Outfall 003. Therefore, by default, the difference will either need to be stored in the oxidation ponds or discharged on an emergency basis through Outfall 001. At a meeting with the RWQCB on June 27, 2016 they indicated that bypasses were an issue. Additional consideration to this issue is required. The use of the oxidation ponds to intermittently store water during high wet weather flows has been incorporated into the plan.

- **<u>Secondary Treatment.</u>** Ongoing permit violations of plant effluent limits for BOD (at least 18 violations for Biochemical Oxygen Demand (BOD) in the last 2 years) and suspended solids (at least 20 violations for Total Suspended Solids (TSS) since 2013) indicate a need for additional secondary treatment capacity. This compliance history paired with the anticipated capacity shortfall after moving away from chlorine further supports the need for treatment beyond the capacity of the existing land-based natural system.

- **<u>Dilution Credits.</u>** The future Outfall 003 is currently being modelled to determine if dilution credits are justifiable for the new discharge point. If credits are allowed, the effluent toxicity testing should produce more favorable results.

- **<u>Nutrients and Emerging Contaminants.</u>** Nutrients such as nitrogen and phosphorus have been identified as potential issues. The North Coast RWQCB is currently reviewing limits for these constituents, and at the June 27, 2016 meeting with the RWQCB, it was made clear that the City would receive ammonia limits in its next NPDES permit in 2017. Other permittees in the North Coast Region (e.g., City of Ferndale and City of Eureka) have also received more restrictive limits for ammonia and nutrients in recent NPDES permit renewals. RWQCB staff indicated that the City of Eureka's June 2016 permit was a good example of likely limits for the AWTF.

  Constituents of Emerging Concern (CECs) include pharmaceuticals and personal care products, industrial chemicals present at low concentrations, and endocrine-disrupting chemicals. In general, these and other low-concentration contaminants have been identified as potential future issues for both effluent discharges and recycled water application. It was determined, however, that permitting around CECs would likely not take affect within the 20-year planning window for this Facility Plan.

- **<u>Bacterial Quality of Humboldt Bay.</u>** The bacterial quality of Humboldt Bay was noted as a particular concern in the RWQCB Water Quality Control Plan for the North Coast Region (Basin Plan) due to the location of several of California's most important commercial oyster farms in the northern lobe of the estuary known as Arcata Bay. The Basin Plan identifies stormwater runoff and point source discharges as having the greatest impact on water quality in Arcata Bay. The effluent limitations for fecal coliform bacteria for the new Outfall 003 were retained from the previous permit and reflect water quality objectives for protection of shellfish harvesting areas.

1.4 EXISTING FACILITIES OVERVIEW

The existing AWTF facilities include headworks, primary clarifiers, oxidation ponds, treatment wetlands, enhancement wetlands, and chlorine disinfection. Solids removed in the primary clarifiers are treated in anaerobic digesters and solids drying beds.

Evaluation of hydraulic and process capacity requires establishing design flow and loads. The design flows were based on the design flow. The loads were determined by using historical data sets and adding a 20 percent growth factor to the 90 percent percentile load to account for planned development under the General Plan. The City originally anticipated a 10 percent community growth which was incorporated into the Draft Facility Plan. After further discussion with the City at the Council meeting on June 13, 2016, community growth estimates have been revised to be 20 percent. Updates to incorporate this additional growth factor have been included in this Facility Plan to some extent, however, updates to sizing of the capacity projects and their cost estimates will be fully incorporated during preliminary design.

The design flows and loads are shown in Table 1.1.

Table 1.1 AWTF Design Flow and Loads
Wastewater Treatment Facility Improvements Project
City of Arcata

	Flow (mgd)
Average Dry Weather Design Flow, mgd	2.3
Average Wet Weather Design Flow, mgd	5.0
Peak Wet Weather Design Flow, mgd	5.9
Peak Instantaneous Flow, mgd	16.5
Design Influent BOD_5 Load With 20% Growth, ppd	4,800
Design Influent TSS Load With 20% Growth, ppd	6,910
Design Influent Ammonia Load With 20% Growth, ppd	1,060

1.4.1 Hydraulic Capacity

In general the existing hydraulic capacity of the plant is limited and needs to be modified to meet the permit requirements for the following elements:

- Influent pumps and headworks.
- Primary clarifiers.
- Treatment wetlands and treatment wetlands pumping.
- Enhancement wetlands and enhancement wetlands pumping.

The AWTF hydraulic capacity of unit processes is shown in Figure 1.6. Note that the wetlands capacity is based on pump stations rather than the wetlands, and therefore are not rated on Figure 1.6. However, it has been noted that the treatment wetlands and enhancement wetlands perform best at steady, lower flows. For this reason, flows through the treatment and enhancement wetlands will be limited to 2.3 mgd. Hydraulic capacity upgrades including pump stations throughout the plant to provide a firm and reliable capacity up to the permitted wet weather flow of 5.9 mgd. During these peak wet flows, pond effluent is blended with wetland effluent prior to disinfection.

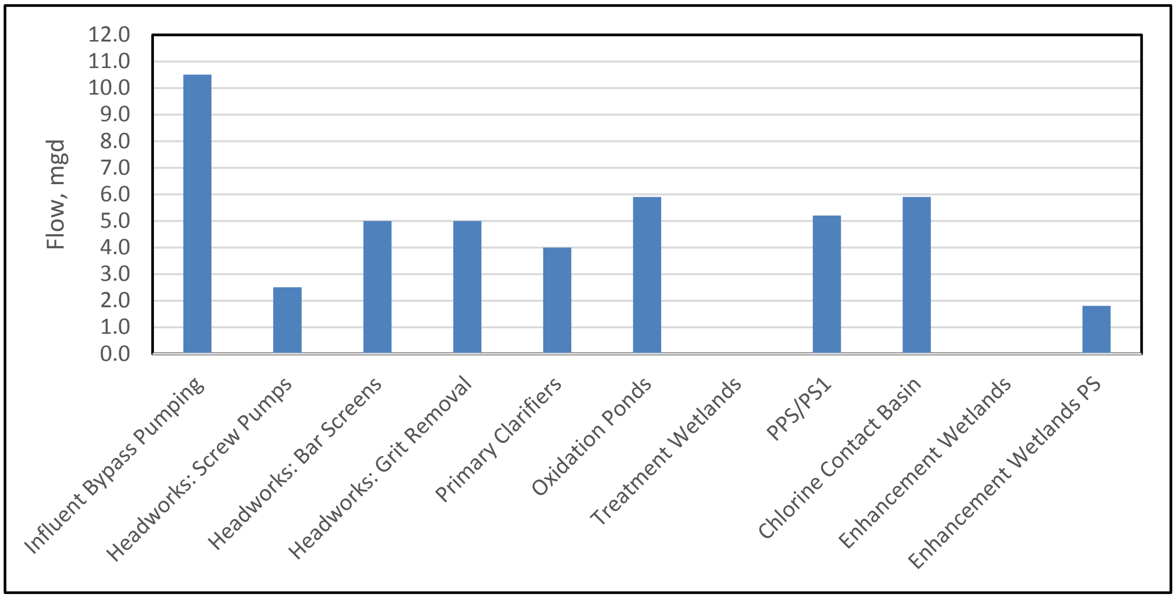


Figure 1.6 AWTF Hydraulic Capacity

1.4.2 Process Capacity

Using the design flow and loads presented in Table 1.1, a review of the existing facility process capacity found that secondary treatment capacity is limited for both BOD and ammonia removal. In the existing system, the oxidation ponds convert the organic load to solids and the wetlands remove the solids. These natural systems are impacted by loading, climate (including sunlight and temperature), and pond solids accumulation. Oxidation ponds, which utilize algae to provide oxygen, generally have a lower capacity to remove organics and nitrogen in the colder winter months when the amount of sunlight is limited.

Plant data confirmed that the natural system generally performed well during lower flow and warmer conditions. However, the treatment wetlands effluent regularly exceeded the permit solids level going into the AMWS enhancement wetlands, and subsequently into the chlorine contact basin prior to discharge. Plant data also showed that in higher flow, wet weather conditions, the system capacity, and permit requirements were exceeded regularly. When excess flow needs to be stored in the oxidation ponds, secondary treatment capacity within the ponds may also be diminished. In order to reduce the loading on the system and reliably meet the current permit requirements now and in the future, additional secondary treatment capacity will be required.

Using industry standards for allowable loading rates and removal rates, the capacity for BOD removal was determined for each process area, as shown in Table 1.2. The removal across each process can be added up for total removal expected. This total can be subtracted from the influent load to determine the capacity shortfall. Once the goal load for discharge is removed, the capacity shortfall is approximately 1,680 ppd of BOD as shown in Table 1.2. The allowable load for discharge is a little higher than the goal established for planning, however, the goal provides a factor of safety for reliable permit compliance.

Table 1.2 BOD Capacity in Existing System
Wastewater Treatment Facility Improvements Project
City of Arcata

Process	BOD load removal, (ppd)	BOD load (ppd) remaining
Influent With 20% Growth		4,800
Primary Clarifiers	1,320	3,480
Oxidation Ponds	1,150	2,330
Treatment Wetlands	340	1,990
Enhancement Wetlands	120	1,870
Disinfection		none if UV
Discharge Goal at 10 mg/L	190	1,680
BOD Capacity Shortfall		**1,680**

This capacity shortfall sets the requirements for evaluating alternatives that could be used to improve or supplement treatment capacity.

1.5 CONDITION ASSESSMENT

As part of this Facility Plan, the AWTF facilities were evaluated for their overall condition. The purpose of the condition assessment is to document the existing facility conditions and help establish priorities for the City's wastewater treatment plant repair and rehabilitation (R&R) CIP. The findings from the condition assessment were incorporated into the CIP.

In May 2015 a condition assessment was performed to assess the current condition of existing structures and equipment and document observations made by plant staff. In general, the plant appears to have been maintained as much as the maintenance budget has allowed. However, findings from the assessment indicate that a majority of the mechanical equipment has exceeded its expected life, and that major structures are also starting to approach the end of their useful life. Finally, plant staff indicated that some capital and maintenance projects had been deferred, pending the outcome of this project.

That has meant that staff has struggled to meet permit limits and keep existing equipment operational, while normally it may have been replaced.

Figure 1.7 provides a summary of the overall condition assessment rankings by unit process. Any process with a ranking greater than 3 (fair) requires some attention and rehabilitation or replacement in the near future.

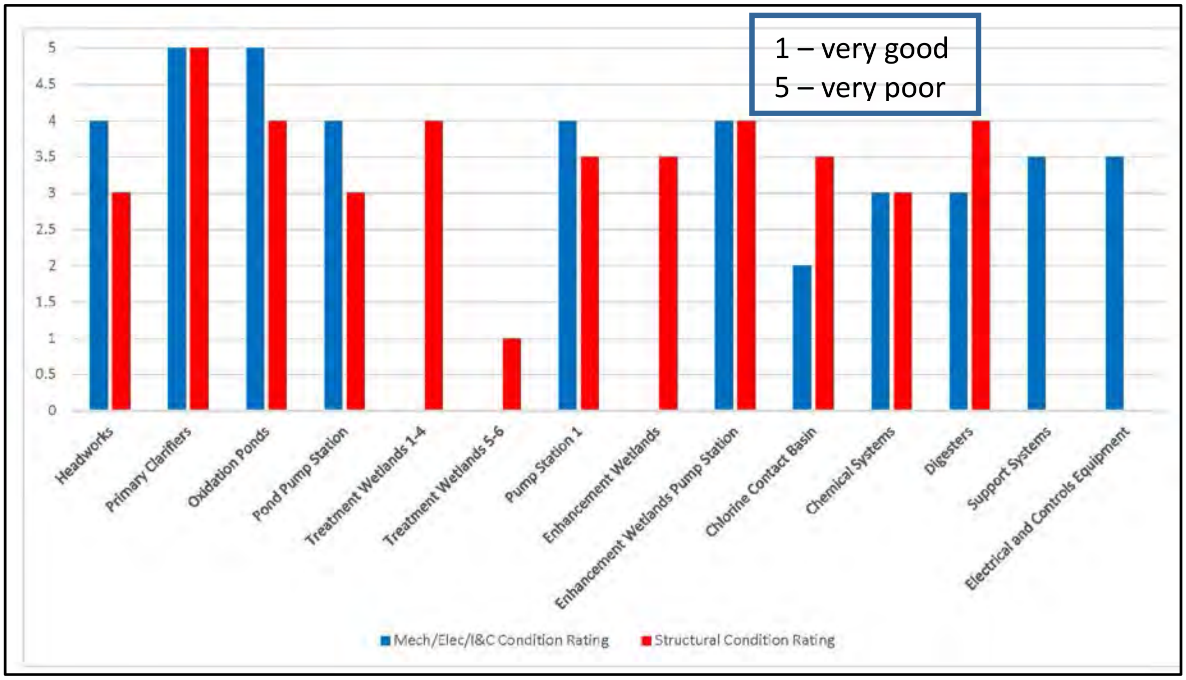


Figure 1.7 AWTF Facility Condition Rating

1.6 PHILOSOPHY IN DEVELOPING ALTERNATIVES AND CIP

Based on the findings of the existing facilities review of capacity and condition, paired with the need for permit compliance requires that the City develop a Capital Improvement Plan (CIP) to improve the system. This CIP must include a method to address the secondary capacity shortfall, which can be accomplished in a number of ways. The overall philosophy of the alternatives evaluation and CIP development can be summarized as follows:

- Achieve 100% Permit Compliance.
- Provide reliable capacity to meet current and General Plan future flow and loads.
- Maximize use of existing natural system.
- Address deferred maintenance.
- Address aging infrastructure.
- Provide optimal use of natural treatment system.

1.6.1 Summary of Common Improvements Needed

Based on the condition assessment and capacity evaluations, numerous facilities will need to be improved in the next ten years based on their expected useful life and current condition. In addition, there are many common elements needed for the new flow configuration.

1.6.1.1 Permit Required Projects

The following common projects are required by the 2012 NPDES permit.

- **Outfall 003 and Flow Configuration**: The NPDES permit establishes a flow configuration to convert to a single pass disinfection system and discharge through a new outfall (Outfall 003) of 5.9 mgd. Piping, screening, pumps, and pump station modifications are required to switch to single pass flow through the system. The location of Outfall 003 is shown in Figure 1.8.

Figure 1.8 New and Existing Outfall Locations

- **UV Disinfection:** A new UV disinfection system will be constructed for disinfection of secondary effluent up to 5.9 mgd. The UV process will eliminate the disinfection by-product formation and permit violations that are occurring with the use of chlorine.

1.6.1.2 Replace/Repair Aging Infrastructure

The following projects are needed to address aging infrastructure:

- **Headworks Improvements**: The recommended headworks improvement is to replace structural and mechanical assets due to age and condition, and to upsize the capacity to handle design peak wet weather flow (PWWF) of 5.9 mgd. Replacing the headworks structure will also raise the hydraulic grade line at the start of the plant, allowing downstream facilities to flow by gravity and minimizing the need for additional pumping.

- **Primary Clarifiers**: The two primary clarifiers are currently rated at 4.0 mgd and 1.0 mgd each, and the visual condition assessment rated the average mechanical, electrical and I&C condition as very poor. The recommended improvement is to replace structural and mechanical assets due to age and condition. As part of this improvement the primary sludge and scum pumps would also be replaced.
- **Anaerobic Digesters and Sludge Heating/Mixing System**: The two anaerobic digesters are almost 60 years old. The external visual condition assessment rated the average structural condition as fair but the internal structural condition is unknown. The sludge heating and mixing system appears to be in good to fair condition. The recommended improvement is to improve structural and mechanical assets in phases.

1.6.1.3 Address Deferred Maintenance and Maximize Existing Natural System

The following projects will restore the natural treatment processes:

- **Oxidation Pond Improvements**: Solids accumulation in the oxidation ponds is affecting treatment and hydraulic capacity. Between one to two feet of solids in each pond is anticipated needing dredging, dewatering, and disposal in order to return the ponds to original design intent. Reconfiguration of the pond transfer structures is recommended for better flow distribution and improvement of storage capacity.
- **Treatment Wetland Nos. 1 through 4 Solids and Vegetation Maintenance**: Solids accumulation and heavy vegetation growth in Treatment Wetland Nos. 1 through 4 is affecting treatment and hydraulic capacity. Some solids removal, regrading of the deep and shallow water zones, and vegetation replanting is anticipated in the four older treatment wetlands in order to return them to original design intent (Figure 1.9). No maintenance project is currently planned in Treatment Wetland Nos. 5 and 6 due to their recent construction.
- **Treatment Wetland 7**: Construction of new Treatment Wetland No. 7 is recommended. This project would convert an existing aquaculture pond into a new 2.3 acre treatment wetland, increasing the hydraulic capacity of the treatment wetlands from 1.8 mgd to 2.3 mgd. This project may require additional permitting requirements.

Figure 1.9 Treatment Wetlands will be improved

- **Enhancement Wetlands Improvements:** Solids accumulation and heavy vegetation growth in the enhancement wetlands is affecting treatment and hydraulic capacity. As Waters of the State, major regrading or any activities that significantly reduce water quality or habitat will not be allowed in the enhancement wetlands. Vegetation maintenance, new baffles, and new inlet/outlet structures will be completed in all three enhancement wetlands in order to improve treatment and hydraulic efficiency and capacity.

1.6.1.4 Provide Reliable Capacity

The following projects address capacity limitations:

- **Pump Stations Improvements**: There are numerous pump stations that need replacement due to age and insufficient capacity. These include the emergency pond pump station, which should be modified for adding suction and discharge piping to allow the pump station to pump out of Pond 1 and into Pond 2 for Pond 1 storage control. Other pump station improvements included pond pump station and pump station 1, treatment wetlands No 4 pump station, treatment wetlands pump station 2 and the enhancement wetlands pump station.

- **Secondary Capacity Augmentation:** A secondary process capacity augmentation project is required to address the capacity shortfall of the existing processes, especially without the chemical treatment removal that occurs with the chlorination process that is being retired. The alternatives for this project are discussed in the next section.

1.7 SECONDARY TREATMENT ALTERNATIVES

Identification of secondary treatment options is needed to address the BOD capacity shortfall. This task was completed in phases. The first phase consists of a preliminary screening of new secondary treatment options to be used in conjunction with the existing natural system for pretreatment, parallel treatment, or post treatment. Any of these treatment options deemed feasible were further discussed and evaluated with the City.

1.7.1 Preliminary Screening of Secondary Treatment Options

There are several treatment processes that can be used to provide additional secondary treatment capacity, either alone or in combination with other processes, in order to achieve desired effluent water quality. Table 1.3 provides a list of secondary treatment processes that are commonly considered, along with the constituents they most commonly remove. Removal of ammonia and total nitrogen was considered for future flexibility in meeting ever increasingly stringent permit requirements. Based on the June 27, 2016 meeting with the RWQCB, it is expected that ammonia removal will be required in the 2017 NPDES permit.

Table 1.3 Secondary Processes Meeting Permit Discharge Requirements
Wastewater Treatment Facility Improvements Project
City of Arcata

Process	Ability To Remove		
	Organics (BOD)(1)	Ammonia(2)	Total Nitrogen(2)
Suspended Growth			
Activated Sludge (oxidation ditch)	√	√	√
Attached Growth			
Trickling Filters	√		
Nitrifying Trickling Filters		√	
Denitrification Filters			√
Land Based Systems			
Ponds (Aerated or Not)	√	Summer only	
Vegetated Wetlands	√	Limited	If nitrified before
Open water wetlands	√	Some	If nitrified before

Notes:
(1) Current permit discharge requirement.
(2) Anticipated future permit discharge requirement.

While there are variations of activated sludge processed such as Oxidation Ditch, Conventional Activated Sludge, Sequencing Batch Reactors, or a Membrane Bioreactor that adds a membrane filter, the biological treatment process is the same. Similarly, there are various attached growth processes that incorporate different types of media that the biological growth attaches to, but the treatment process is essentially the same.

In addition to the secondary processes presented above, there are some physical and chemical processes that could be considered. There are several approaches that could be taken with any additional treatment process: 1) pre-secondary treatment (pretreatment) by adding processes before the existing pond/wetlands system, 2) parallel secondary treatment, and 3) post-secondary treatment (post treatment, after the pond/wetlands). Each alternative considered needs to fit with a final UV disinfection step, as the City Council has affirmed several times the decision to move away from chlorine and instead use UV. Initial options that fall into each of these categories are shown in Table 1.4.

Table 1.4 Initial Screening of Pre, Parallel and Post Treatment Options
Wastewater Treatment Facility Improvements Project
City of Arcata

	Treatment Option	Adds BOD capacity	Removes ammonia	Improves final UVT	Reliable	Move forward
Pretreatment	Chemically Enhanced Primary	< 400 ppd	No	No	Yes	No - high O&M cost
	Aeration	yes	limited	No	Yes	Yes
	Trickling Filter	yes	only if 2-stage	No	Yes	No
	Activated Sludge	Yes	Yes	No - TM degrades	Yes	No
Parallel	Additional Ponds/Wetlands	Yes	Summer only	No	Maybe	No - no room
	Rehabilitate Ponds/Wetlands	Yes - not enough	Summer only	No	Maybe	Yes
	Trickling Filter	Yes	only if 2-stage	No	Yes	Yes
	Activated Sludge	Yes	Yes	Yes	Yes	Yes
Post Treatment	Trickling Filter/Nitrifying Trickling filter	Yes	only if 2-stage	No	No - cold affects performance	No - not as flexible
	Submerged Biofilter	Not proven	Need to pilot	No	Unknown	No
	Ozone/Biological active Filtration	Yes	Maybe - must pilot	Not needed	Maybe - must pilot	No -Need to pilot
	Filtration	< 400 ppd	No	Maybe	Yes	No -Need to pilot

Of the options considered, there are only a few that Carollo recommends carrying forward for a variety of reasons. Any process that requires piloting at the AWTF was eliminated to meet the accelerated schedule for permit compliance. Any process that is not yet a proven technology with full-scale installation experience was also eliminated early in the alternatives analysis. Several processes would not provide enough capacity (such as chemically enhanced primary treatment and filtration. Attached growth processes were considered less reliable and less flexible for meeting future ammonia and nutrient removal requirements. In addition, attached growth processes do not improve UV transmittance

(UVT), which makes UV disinfection more expensive. Additional pond and wetland processes require additional land and no land is available.

The options carried forward are:

- The viable pretreatment alternative to be further considered is aeration in Pond 2.
- The viable parallel treatment alternatives to be further considered are rehabilitation of the ponds/wetlands, trickling filters, and activated sludge.
- None of the post treatment alternatives will be further considered.

At the November 5 and 6, 2015 facility plan capacity workshop with the City staff and City consultant Bob Gearheart (with AMRI), a more detailed analysis of parallel secondary treatment options was discussed, including:

- Conventional activated sludge (CAS) aeration basins.
- Extended aeration activated sludge (oxidation ditch).
- Trickling filters.
- Modifying existing oxidation ponds to a Biolac system or aerated lagoons.

As discussed at the workshop, modifying the existing oxidation ponds to a Biolac system or aerated lagoons was deemed not feasible due to constructability issues with the berms and pond depths. During the November 2015 workshop, discussion of the treatment options included a number of considerations including performance, footprint, constructability, operation and maintenance requirements, and economic factors. A summary of the non-economic evaluation is outlined in Table 1.5. A summary of the economic evaluation is outlined in Table 1.6.

Table 1.5 Secondary Treatment Options Evaluation of Non-Economic Factors
Wastewater Treatment Facility Improvements Project
City of Arcata

	Criteria Scale: 1 (least favorable) to 3 (most favorable)					
Option	**Safety**	**Meets Permit**	**Ease of O&M**	**Construct-ability**	**Reliability**	**Ammonia Removal**
Conventional Activated Sludge	2	3	1	3	3	2
Extended Aeration – Oxidation Ditch	2	3	3	2	3	3
Trickling Filters	3	1	3	2	1	1

Table 1.6	Secondary Treatment Options Evaluation of Economic Factors Wastewater Treatment Facility Improvements Project City of Arcata					
	Criteria Scale: 1 (least favorable) to 3 (most favorable)					
Option	Construction Cost	Footprint	Operator Attention	Power Cost	Sludge Production	Maintenance Requirement
Conventional Activated Sludge	3	3	1	1	1	1
Extended Aeration – Oxidation Ditch	2	1	2	2	2	3
Trickling Filters	1	2	3	3	3	2

Given the need to identify a system that is simple to operate, low maintenance and yet provides high reliability in meeting a high quality effluent, the preferred alternative was an extended aeration oxidation ditch process, shown in Figure 1.10. Compared to the oxidation ditch, conventional activated sludge requires greater operator attention and complexity; trickling filters do not provide as much reliability for treatment nor flexibility for future regulations; oxidation pond modifications have a greater risk of permit violations during long-term operation and do not allow for storage of peak wet weather flows in Pond 1.

Figure 1.10 Example of Proposed Oxidation Ditch Secondary Treatment

1.7.2 Project Alternative Development

The viable options identified in the screening process were further refined as project alternatives that address how the facility would perform as a system. Project alternatives consider facility-specific issues such as flow routing, hydraulic and treatment capacity of individual processes, and process improvement or replacement needs based on condition assessment. The goal of each project alternative is to provide a facility that maximizes use of the existing natural system while meeting treatment and permit compliance objectives.

Based on the findings of the preliminary and secondary screening as well as feedback received at presentations made to City Staff, the public and City Council in April 2016, three project alternatives were developed.

1.7.2.1 Alternative 1 - Existing System Rehabilitation

This alternative improves the existing natural treatment system with no supplemental secondary treatment process. This alternative does not provide the required capacity to meet the BOD capacity shortfall. In the past the shortfall was made up by use of chlorine for supplemental BOD removal. This alternative will not provide year-round nitrification removal, and therefore will not be able to meet the anticipated monthly average ammonia requirements. This alternative was conceptualized by AMRI and further evaluated by Carollo to meet treatment and permit compliance objectives. Pond solids would be removed, the treatment wetlands would be improved, and Treatment Wetlands No. 7 would be constructed. Aeration would be added to the ponds to provide some supplemental capacity, but a 1000 ppd BOD removal deficiency at 20 percent growth projection is still anticipated. Based on the feedback from the June 2016 meeting with the RWQCB, this alternative is no longer considered viable. The Alternative 1 flow schematic is shown in Figure 1.11.

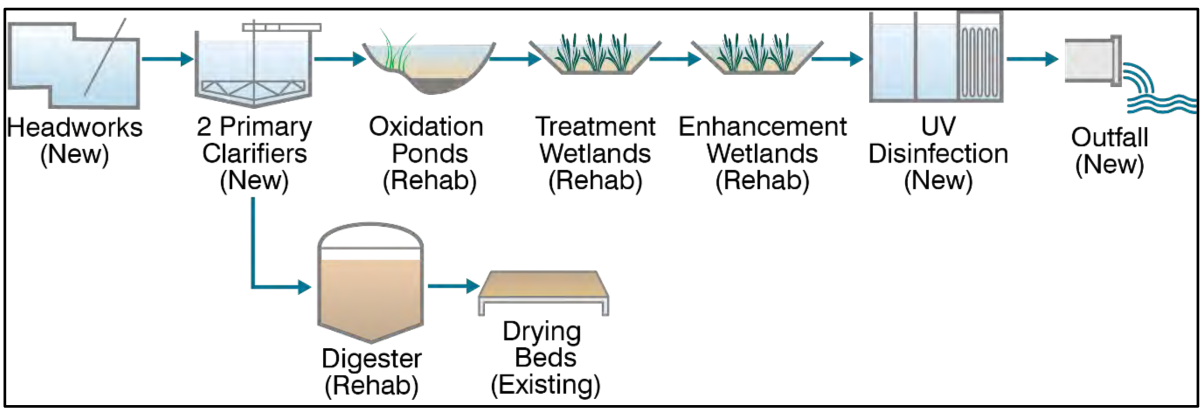


Figure 1.11 Alternative 1 - Existing System Rehabilitation

1.7.2.2 Alternative 2 - Existing System with Side-Stream Treatment

This alternative provides a side-stream secondary treatment process parallel to the ponds and treatment wetlands that returns flow upstream of the enhancement wetlands. The ponds and treatment wetlands would continue treating the majority of the plant influent flow and would be improved, just as in Alternative 1. The side-stream treatment process would treat a portion of the plant influent flow as needed for supplemental BOD and year-round partial nitrification treatment capacity. An oxidation ditch is the planned side-stream treatment technology and would be operated at approximately 0.5 mgd during dry weather and able to handle additional flows during wet weather or during periods of pond turnover. Both effluents would normally blend before passing through the enhancement wetlands and UV disinfection. Based on the feedback from the June 2016 meeting with the RWQCB, this alternative is no longer considered viable. The Alternative 2 flow schematic is shown in Figure 1.12.

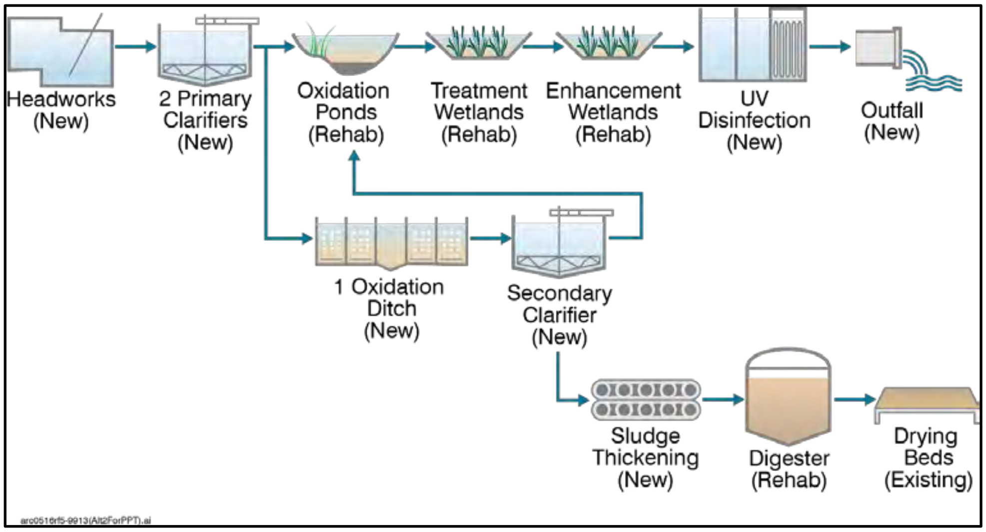


Figure 1.12 Alternative 2 - Existing System with Side Stream Treatment

1.7.2.3 Alternative 3 - Existing System with Parallel Treatment

This alternative provides a parallel secondary treatment process to the ponds, treatment wetlands, and enhancement wetlands. The natural system train and parallel process train would each treat a portion of the plant influent flow at variable percentages to provide a blended effluent meeting treatment objectives. The natural system would continue treating the majority of the plant influent flow up to available hydraulic and treatment capacity and would be improved, just as in Alternative 1 with the exception of the pond aerators, which are not necessary. The parallel process train, currently planned as oxidation ditches followed by secondary clarifiers, would provide BOD and year-round full nitrification treatment capacity to handle the remainder of the hydraulic capacity needs and to meet specific blended water quality requirements. The parallel process would be sized to turn down to 0.5 mgd in dry weather and be able to handle up to 4.1 mgd of wet weather flow. Natural system effluent and parallel process effluent would combine prior to UV disinfection. The higher quality water (higher UVT) produced by the oxidation ditch system and blended with the natural treatment system allows the UV disinfection system to be downsized. Based on the feedback from the June 2016 meeting with the RWQCB, this alternative is no longer considered viable. The Alternative 3 flow schematic is shown in Figure 1.13.

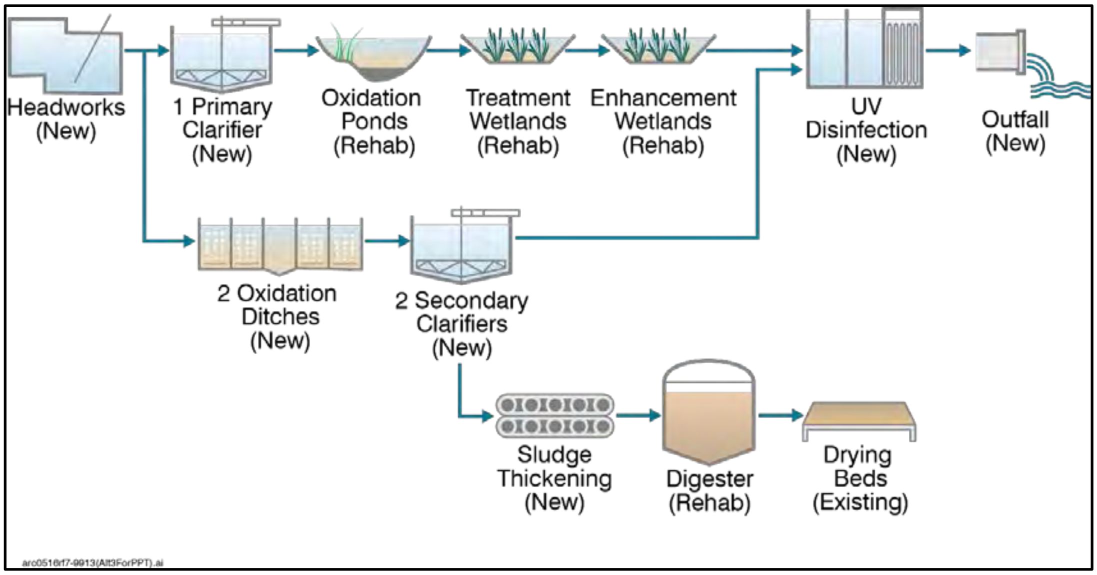


Figure 1.13 Alternative 3 - Existing System with Parallel Treatment

1.7.2.4 Alternative 4 – Enhanced Natural System with Parallel Treatment

As noted above, a new alternative 4 was developed to address the upcoming nutrient removal requirements, and the need for plant effluent flows to be routed through the enhancement wetlands. This alternative provides both an upgrade to the existing pond / wetland treatment system and a parallel secondary treatment process. The natural system train and parallel process train would each treat a portion of the plant influent flow at variable percentages to provide a blended effluent meeting treatment objectives. The natural system would continue treating the majority of the plant influent flow up to available hydraulic and treatment capacity. The parallel process train, currently planned as oxidation ditches followed by secondary clarifiers, would provide BOD and year-round full nitrification treatment capacity to handle the remainder of the hydraulic capacity needs and to meet specific blended water quality requirements. Natural system effluent and parallel process effluent would be combined prior to UV disinfection and discharge through the enhancement wetlands to the new brackish marsh outfall. The Alternative 4 flow schematic is shown in Figure 1.14.

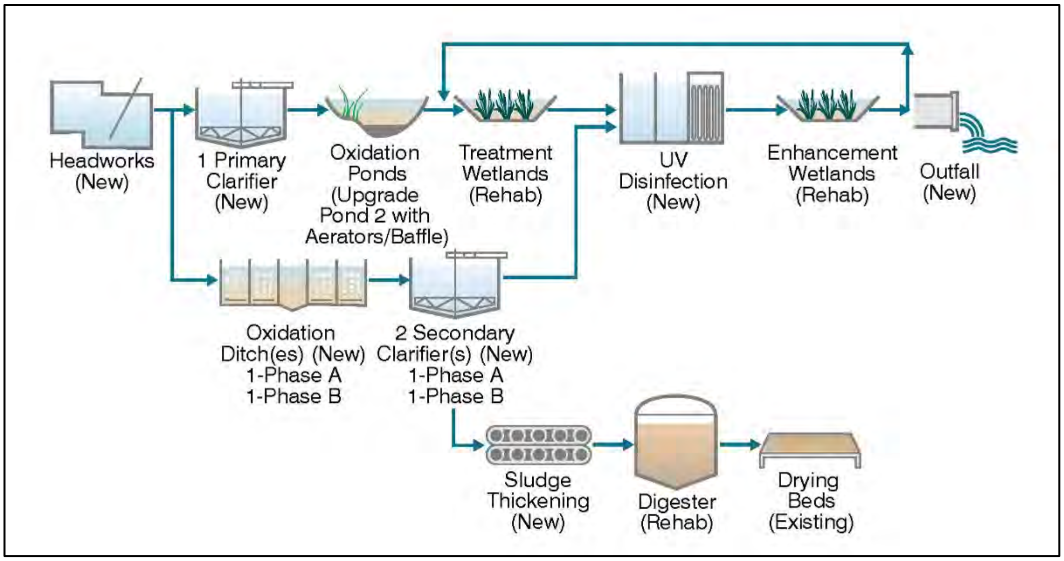


Figure 1.14 Alternative 4 - Enhanced Natural System with Parallel Treatment

1.7.3 Alternative Comparison and Recommendation

A comparison of the alternatives using non-economic factors is summarized in Table 1.7.

Table 1.7 Summary of Alternative Comparison for Non-Economic Factors
Wastewater Treatment Facility Improvements Project
City of Arcata

	Criteria Scale: 1 (least favorable) to 4 (most favorable)				
Alternative	**Meets Permit**	**Ease of O&M**	**Construct-ability**	**Reliability**	**Ammonia Removal**
1. Existing System Rehabilitation	1	4	1	1	1
2. Existing System with Side-stream Treatment	2	1	2	2	2
3. Existing System with Parallel Treatment	3	3	3	4	4
4 Enhanced natural system with parallel treatment	4	2	4	3	3

The alternatives are also compared based on economic criteria (project cost, operation and maintenance cost, and overall lifecycle cost) as shown in Table 1.8. Costs presented in this Facility Plan are project costs and include construction, engineering, legal, administrative, and permitting costs, as well as estimating contingencies. The costs are presented in 2016 dollars and are based on a San Francisco Engineering News Record Construction Cost Index. Costs are not escalated to future years. Cost estimates presented in the Draft Facility Plan were developed based on 10 percent community growth that was originally anticipated by the City. Cost estimate updates to reflect the 20 percent growth projection are shown with an additional 10 percent of the original secondary and solids costs.

Alternative 4, Enhanced natural system with a parallel secondary treatment process, provides the highest rankings for permit compliance, and constructability. It is ranked second with respect to reliability and future compliance with ammonia removal (which may also help reduce effluent toxicity), only due to the reliance on the existing oxidation pond upgrades. Alternative 4 is anticipated to meet the requirements of the Enclosed Bays and Estuaries Policy by treating the full flow to 5.9 mgd through the enhancement wetland. This alternative is anticipated to have the highest capital cost and nearly the highest operation costs. This alternative would eventually require the largest footprint in the treatment plant, although the second oxidation ditch might be smaller if the pond improvements are successful.

Table 1.8 Cost Comparison of Treatment Alternatives
Wastewater Treatment Facility Improvements Project
City of Arcata

Alt.	Description	Total Project Cost With 10% Growth(1)	Total Project Cost With 20% Growth(1,4)	O&M Cost		Lifecycle Cost(3,4)
				Annual(2)	Present Worth(3)	
1	Existing System Rehabilitation	$35.1	$35.2	$0.67	$5.7	$40.9
2	Existing System Rehabilitation with Side-stream Treatment	$44.7	$45.7	$0.75	$6.4	$52.1
3	Existing System Rehabilitation with Parallel Treatment	$43.8	$45.5	$0.43	$3.7	$49.2
4	Enhanced natural system with parallel treatment	--	$52.4	$0.78	$13.6	$66.1

Notes:
(1) Costs are based on 2016 dollars, in millions, using SFENR construction cost index.
(2) Annual O&M costs include only differential O&M costs, and do not include O&M costs which are common to all alternatives (such as influent pumping).
(3) Lifecycle cost is total project cost plus present worth value of annual O&M costs. Annual O&M costs were converted to present worth value based on 3 percent inflation rate, 6 percent discount rate, and 10-year analysis period.
(4) Estimated total project cost and lifecycle cost is updated with additional anticipated growth subsequent to the June 13, 2016 Council meeting. Additional cost for 20% growth projection based on adding 10% to secondary and solids costs.

Alternative 3, rehabilitation of the existing natural system with a parallel secondary treatment process, provides highest ranking with respect to ammonia removal (which may also help reduce effluent toxicity), and the second highest rankings for permit compliance, operations and maintenance, constructability, and reliability. Alternative 3 is anticipated to meet current permit requirements for enhancement through advanced secondary treatment with nitrification, providing full BOD treatment capacity without disinfection byproduct violations, as well as meeting future ammonia permit limits year-round. It appears it will not meet all permit requirements, because it does not meet the requirements of the Enclosed Bays and Estuaries Policy. This alternative is anticipated to be lower in capital cost than

Alternative 2 or 4 as some project elements can be eliminated or decreased. This alternative is anticipated to require the largest footprint in the treatment plant.

Alternative 1, rehabilitation of the existing natural system, fairs poorly because the BOD treatment capacity is limited in the existing natural system and therefore creates risk for permit violations. Additionally, during construction of the improvements to Alternative 1, there is a higher risk of violations due to additional stress on an already under-capacity system. Project elements to increase BOD treatment capacity include sludge removal in Ponds 1 and 2, adding aerators to Pond 2, and construction of Treatment Wetland No. 7; however, even with these improvements there will be a BOD treatment capacity shortfall with the elimination of chlorine. This would result in permit violations and mandatory minimum penalties. Increasing the growth projection from 10 to 20 percent increases the BOD treatment capacity shortfall, which will be difficult to address in Alternative 1 without an additional secondary treatment process. Furthermore, future ammonia permit limits may not be met year-round with Alternative 1 without an additional nitrification process. Per discussions with the RWQCB, effluent discharge bypassing enhancement is a violation of permit requirements. Alternative 1 currently requires up to 3.6 mgd to bypass the Enhancement Wetlands due to capacity limitations, which does not meet permit objectives.

In Alternative 2, the BOD treatment capacity shortfall would be supplemented by the side-stream secondary treatment process of one oxidation ditch and one secondary clarifier. Increasing the growth projection from 10 to 20 percent increases the BOD treatment capacity shortfall, which could be addressed in Alternative 2 by increasing capacity in the oxidation ditch, or adding a second unit. Alternative 2 also does not meet current permit requirements for enhancement In addition, this alternative is anticipated to have slightly higher capital cost as it requires the most project elements.

Based on these comparisons, both economic and non-economic, Carollo and LACO recommend proceeding with preliminary design of Alternative 4 with options to phase the implementation.

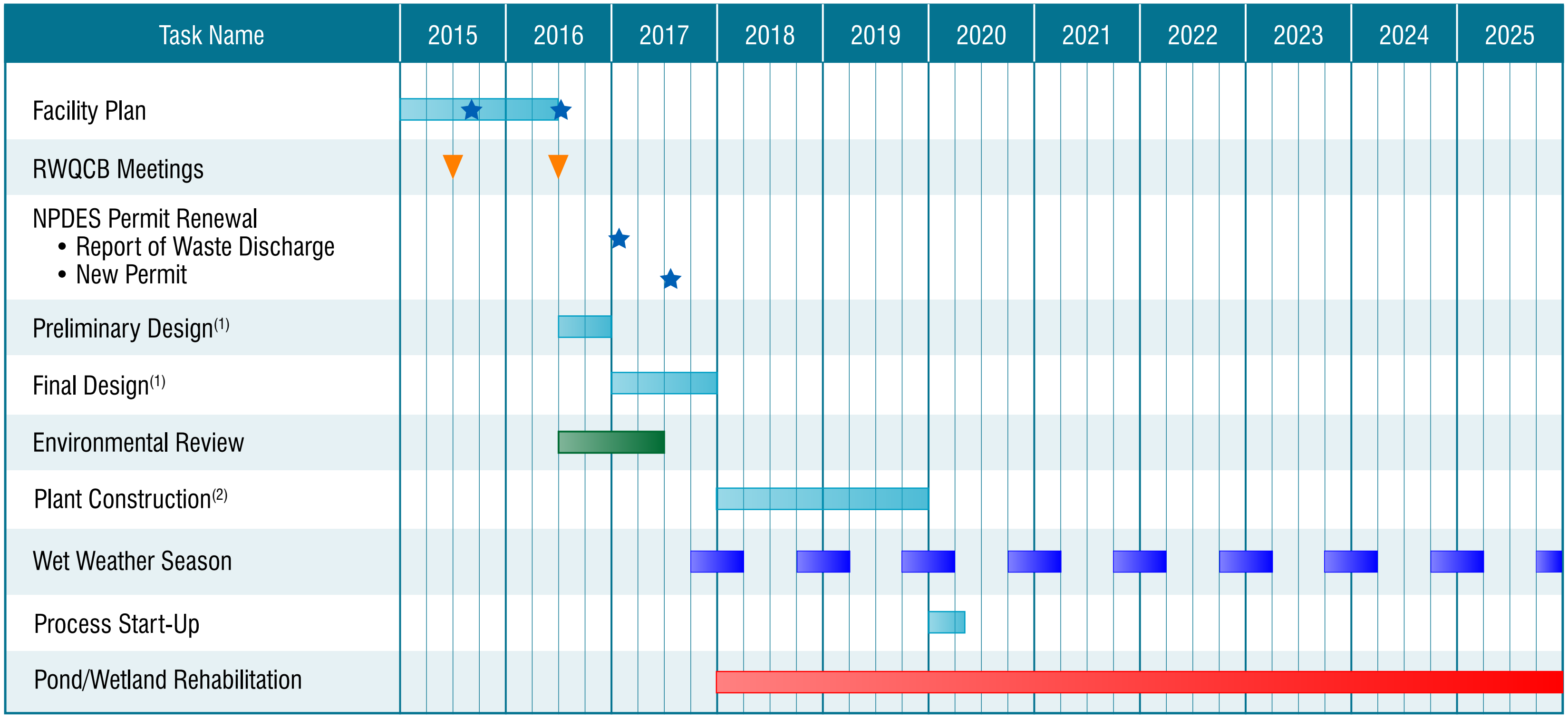
1.8 NEXT STEPS AND IMPLEMENTATION SCHEDULE

The AWTF will undergo a number of changes over the next 20 years in order to both meet permit requirements and address the ongoing needs of maintaining this vital City asset. The recommended project as outlined above will meet permit requirements, address R&R needs, and address capacity for the AWTF including the following:

- Preliminary and final design
- A Report of Waste Discharge was submitted to the RWQCB in January 2017 to start permit renewal. A new NPDES permit is expected in 2017.
- Environmental review and permitting.
- Funding Application Process for State Revolving Fund program for loans and grants.

- Bidding and award.
- Construction and start up.

A preliminary implementation schedule is shown in Figure 1.15. The schedule has been extended to account for the need to get the current facility plan approved, and then complete preliminary and final design. Construction (of the majority of the mechanical and structural elements) is shown in 2019 through 2021, with final commissioning and startup in late 2021. The construction will cover the dry weather periods of both 2019/2020 and 2020/2021, and should allow for all the work to be completed while maintaining the existing plant in operation. Wet weather periods are also shown in the schedule as construction during these periods is difficult. The Pond and Wetlands rehabilitation is shown as a separate line item as these projects may be performed by City staff as opposed to a contractor and due to the extended construction time expected. The wetlands in particular will take longer to rehabilitate due to the need to regrade during dry season, plant and let the plants get established (approximately a 2 year cycle before performing as expected).



NOTES:
(1) To be finalized after completion of the Facility Plan.
(2) Construction schedule is preliminary, constraints TBD.

UPDATED IMPLEMENTATION SCHEDULE

FIGURE 1.15

CITY OF ARCATA
WASTEWATER TREATMENT PLANT IMPROVEMENTS PROJECT

REGULATORY REQUIREMENTS AND PERMIT COMPLIANCE

2.1 INTRODUCTION

The City of Arcata (City) owns the wastewater collection, treatment, and disposal facilities that serve approximately 16,800 residents, including 8,000 students, in the service area (City and the unincorporated community of Glendale). The Arcata Wastewater Treatment Facility (AWTF) is located at 600 South G Street in Arcata, Humboldt County, California. The AWTF in its varying forms has been discharging to Humboldt Bay since about 1949. The AWTF currently discharges treated wastewater to Humboldt Bay in conjunction with enhanced treatment occurring in the Arcata Marsh Wildlife Sanctuary (AMWS), which are constructed freshwater wetlands adjacent to the treatment facility.

The AWTF is recognized around the world for providing sustainable treatment with community and environmental benefits. Within the City's sustainability goals and initiatives that impact environmental, economic, and social realms ("triple bottom line"), National Pollutant Discharge Elimination System (NPDES) permit compliance is at the core of each category. Permit compliance protects the environment, reduces economic risk from violation penalties, and promotes a safe community.

The AWTF provides primary and secondary treatment followed by disinfection. Primary treatment facilities include influent pumping, mechanical bar screens, grit removal, and primary clarifiers. Primary solids are sent to anaerobic digesters, sludge drying beds, and sludge composting. Secondary treatment is accomplished through two oxidation ponds in series, followed by six treatment marshes operating in parallel. Currently, secondary effluent is disinfected with chlorine gas and dechlorinated with sulfur dioxide prior to discharge. Under the existing flow configuration, for about 9 months every year, a portion of the treated effluent is sent to the AMWS for enhanced treatment while the remainder is discharged to Humboldt Bay via Outfall 001. Effluent out of the AMWS is returned to the chlorine contact basin for a second step of disinfection and dechlorination. The result is disinfected secondary effluent that does not receive all the enhancement benefits of the AMWS and is chlorinated multiple times, increasing the opportunity for formation of disinfection byproducts above water quality objectives.

2.2 PURPOSE

The purpose of this chapter is to:

- Discuss compliance history of the AWTF leading up to the current NPDES permit, including review of available compliance data in the last three years to identify current permit issues.
- Review the current NPDES permit compliance requirements.

- Discuss potential future permit requirements in the State and for Humboldt Bay dischargers.

2.3 BACKGROUND

Adopted on May 16, 1974, Resolution No. 74-43, known as the Enclosed Bays and Estuaries Policy, prohibits the discharge of municipal wastewater and industrial process water to enclosed bays and estuaries "unless the discharge enhances the quality of the receiving water above that which would occur in the absence of the discharge." The Enclosed Bays and Estuaries Policy enhancement criteria is defined as, "…(1) Full uninterrupted protection of all beneficial uses which could be made of the receiving water body in the absence of all point source discharge(s) along with (2) a demonstration by the applicant that the discharge, through the creation of new beneficial uses or fuller realization, enhances water quality for those beneficial uses which could be made of the receiving water in the absence of all point source discharges..."

In 1983, the Regional Water Board adopted Resolution No. 83-9, granting the City of Arcata a waiver, as defined in Chapter I, Paragraph A of the Bays and Estuaries Policy, permitting continued [Humboldt] Bay discharge. Resolution No. 83-9 found that the marsh disposal alternative meets the definition of enhancement set forth in State Board Order No. 79-20 because the waste would achieve secondary treatment standards, create no adverse impacts to present beneficial uses and the discharge would create new beneficial uses and wildlife habitat. As a result, the AMWS is an integral part of the AWTF and a valued part of the Arcata community providing numerous non-contact recreation and educational opportunities.

In 2012, the AWTF began operating under a new National Pollutant Discharge Elimination System (NPDES) permit that specifically addressed several long-term issues regarding disinfection, treatment units, and outfalls. The new permit enabled changes to be made to improve wastewater treatment, protect beneficial uses, increase energy efficiency, reduce chemical usage, and reduce the potential for permit violations. The NPDES Permit (No. CA0022713) and Waste Discharge Requirements Order (No. R1-2012-0031) were issued by the North Coast Regional Water Quality Control Board (RWQCB), and became effective on August 1, 2012. The permit was subsequently modified in 2015. The permit will be up for renewal on August 1, 2017.

The permit approves a new flow configuration and discharge point. Effluent flows will no longer discharge directly to Humboldt Bay (Outfall 001), but will be discharged after enhanced treatment in the AMWS. The new point of compliance and outfall (Outfall 003) will be to the brackish marsh adjacent to the AMWS, which discharges into a slough at the north end of the Arcata Bay portion of Humboldt Bay. The permit also includes approval of a new disinfection process using ultraviolet light (UV) disinfection facilities prior to Outfall 003. Until the improvements are complete, the AWTF is operating under interim effluent limits for discharge to Outfall 001, which are essentially the same as the final compliance requirements for Outfall 003. Discharge requirements for the intermediate discharge point to the AMWS (Outfall 002) are also noted in the permit. The location of the facilities and outfalls are shown in Figure 2.1. The major water quality standards established in the NPDES permit are shown in Table 2.1. The NPDES/WDR permit is included in Appendix A for a complete list of required standards.

Table 2.1 Summary of 2012 NPDES Requirements
Wastewater Treatment Facility Improvements Project
City of Arcata

Constituent	Average Monthly	Average Weekly	Max Daily
Flow, mgd	2.3 average dry weather 5.0 average wet weather 5.9 peak wet weather		
Outfall 001 - Humboldt Bay (Final/Interim limits)			
BOD_5, mg/L	45/30	65/45	
TSS, mg/L	66/30	95/45	
Fecal Coliform MPN/100 ml	14		43
Dichlorobromomethane, ug/l	0.56		1.12
Outfall 003 - Brackish Marsh			
BOD_5, mg/L	30	45	
TSS, mg/L	30	45	
Fecal Coliform MPN/100 ml	14		43
Outfall 002 - AMWS			
BOD_5, mg/L	45	65	
TSS, mg/L	66	95	

2.4 PERMIT COMPLIANCE HISTORY

Since the original plant design, the regulatory climate and enforcement world has significantly changed. Mandatory minimum penalties were implemented by the State Water Resources Control Board (SWRCB) in 1999, and began to be enforced in 2006. Today, the

AWTF RECONFIGURATION AND OUTFALL LOCATIONS

FIGURE 2.1

CITY OF ARCATA

WASTEWATER TREATMENT FACILITY IMPROVEMENTS PROJECT

carollo

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regulatory climate is increasingly stringent. Occasional permit non-compliance is no longer acceptable to the SWRCB, environmental conservation groups, or the general public.

The mission of the SWRCB is:

> ***To preserve, enhance, and restore the quality of California's water resources and drinking water for the protection of the environment, public health, and all beneficial uses, and to ensure proper water resource allocation and efficient use, for the benefit of present and future generations.***

The SWRCB and the nine RWQCBs are charged with protecting water quality. Doing so requires regular updates to regulatory requirements based on the latest research and data. As a result, NPDES permits are consistently getting more stringent over time.

2.4.1 2004-2015 Compliance Review and Permit Violations

A review of available information from 2004 to 2015 was conducted to understand the history of permit compliance and permit violations at the AWTF.

Based on review of the 2012 permit and input from the City, a history of permit violations from 2004 to 2011 are summarized:

- On June 12, 2008, the North Coast RWQCB issued Administrative Civil Liability (ACL) Order No. R1-2008-0048 to the Permittee assessing a civil liability of $104,000 for violations of Order No. R1-2004-0036 for the period from June 22, 2004, to March 31, 2007. Most violations of waste discharge requirements in this time period were related to discharges of biochemical oxygen demand (BOD), total suspended solids (TSS), percent removal, coliform bacteria, copper, and cyanide, and for sewer system overflows. A portion of the liability is being held in abeyance pending resolution of legal matters, a portion has been paid to the State Water Pollution Cleanup and Abatement Account, and a portion was suspended pending satisfactory completion of a Supplemental Environmental Project and two collection system projects proposed by the Permittee.
- On May 19, 2010, an ACL Compliant was issued to the Permittee for five sanitary sewer overflows and copper effluent violations. ACL sought for the alleged violations totaled $83,300.
- In 2011, Mandatory Minimum Penalties (MMPs) of $9,000 were assessed for percent removal, coliform bacteria, and copper violations.

The 2013 and 2014 Annual Wastewater Treatment Reports for the AWTF were briefly reviewed to identify any potential compliance issues for Outfall 001. The 2014 report noted 27 incidences of non-compliance issues for the Outfall 001 requirements including:

- Effluent limit violations on 18 occasions, including 1 noncompliant sample for disinfection, 1 noncompliant sample for BOD removal, and several excursions of effluent TSS. It was noted that weather, and the current drought have impacted the plant operation, and may have been a contributing issue for the TSS violations.

- A brief excursion in the disinfection of the final effluent in August 2014 for up to 10 minutes resulted in incomplete disinfection. This resulted in effluent fecal coliform counts of 49 MPN/100ml.
- One chronic whole effluent toxicity test in March 2014 that appeared to indicate effluent toxicity.
- Exceedances of the plant effluent copper requirement have historically been an issue. Seven times the monthly average was exceeded and twice the daily maximum was exceeded. However, according to plant staff, these exceedances have, for the most part, been resolved due to the fact that water effects ratios (WERs) have been applied to the effluent copper limitations for Outfalls 001 and 002. It is anticipated that a WER will also be applied to Outfall 003. Therefore these have not been included in the 18 violations counted above.
- Exceedances of the Dichlorobromomethane limit twice for daily maximum and twice for monthly maximum in July and October 2014.

In 2013, there were 22 effluent limit violations for Outfall 001. Most of these were similar to the issues reported in the 2014 Annual Report.

On June 15, 2015 the State Board Office of Enforcement conducted an inspection of City wastewater facilities under the Statewide General Waste Discharge Requirements for Sanitary Sewer Systems to assist the Regional Board in enforcement action. Although the inspection was primarily conducted for compliance with the sanitary sewer system permit, the inspectors also reviewed a handful of NPDES discharge violations during the inspection and indicated that they would be reviewing violations since June 2012 for enforcement action including assessment of Mandatory Minimum Penalties (MMPs). Table 2.2 summarizes the violations by year and location from 2013 to 2015. Appendix B shows all of the violations that have occurred since the last ACL was issued.

Although MMPs are not being assessed for violations at Outfall 002 since the AMWS receiving water is not designated a water of the United States, water quality compliance at Outfall 002 is still crucial. Violations of discharge standards at Outfall 002 could be subject to discretionary penalties. A review of the 2013 and 2014 annual reports indicate 13 exceedances of discharge specifications for Outfall 002 (10 for copper and 3 for BOD).

Exceedance of the copper effluent limit was addressed in a Water Effects Ratio (WER) study submitted to the Regional Board in December of 2012, and a modified permit was issued in November 2014. The State Board has indicated that MMPs will be assessed for the period that the WER was under review.

The City projects that the pending ACL for violations since June 2012 may total greater than $200,000, with no administrative action for violations at Outfall 002.

Table 2.2 Summary of NPDES Discharge Violations From 2013 to 2015[1]
Wastewater Treatment Facility Improvements Project
City of Arcata

Year	Compliance Location	Number of Violations	Parameter	CIP Project Addressing Violation
2013	Outfall 001	3	Total Suspended Solids[2]	Secondary Treatment, Hydraulic Capacity
		5	Dichlorobromomethane	UV
		4	Chronic Toxicity	Uncertain[3]
		1	pH	UV, Secondary Treatment
2014	Outfall 001	15	Total Suspended Solids[2]	Secondary Treatment, Hydraulic Capacity
		4	Dichlorobromomethane	UV
		2	Chronic Toxicity	TBD - Mixing Zone Dilution Credit
		1	pH	UV, Secondary Treatment
		1	Chlorine	UV
		1	Fecal Coliform	UV
	Outfall 002	5	Biological Oxygen Demand[4]	Secondary Treatment
2015	Outfall 001	2	Total Suspended Solids[2]	Secondary Treatment, Hydraulic Capacity
		8	Dichlorobromomethane	UV
		2	Chronic Toxicity	Uncertain[3]
	Outfall 002	13	Biological Oxygen Demand[4]	Secondary Treatment
		2	Chlorine	UV

Notes:
(1) Summary table excludes copper violations which have been addressed by the WER and subsequent modified permit in November 2014. Non-water quality violations including deficient reporting, deficient monitoring, and order conditions are also excluded.
(2) Total Suspended Solids (TSS) violations include concentration, loading, and/or percent removal parameters.
(3) A mixing zone dilution credit (if granted) at the new outfall location or the addition of conventional secondary treatment may help with compliance.
(4) Biological Oxygen Demand (BOD) violation of concentration.

2.5 CURRENT PERMIT COMPLIANCE REQUIREMENTS

The 2012 NPDES permit outlines the approved AWTF flow reconfiguration upgrade, including the use of UV disinfection upstream of the new discharge point (Outfall 003). The new flow configuration and discharge point will replace the existing configuration which discharges directly to Humboldt Bay at Outfall 001. The new discharge point will allow for mixing and controlled discharge of freshwater into the wetlands and tidal section of Arcata Bay. The compliance schedule adopted with the permit for the new discharge point and disinfection system includes the following milestones:

- New discharge point and UV disinfection system shall be completed prior to December 1, 2016. An updated compliance schedule will be discussed later in Chapter 8, Capital Improvements Program.
- RWQCB shall be notified 30 days prior to the use of Outfall 003.
- Prior to operation of the new UV disinfection system, the City shall provide written verification of the UV disinfection system capacity based on National Water Research Institute (NWRI) validation testing.
- Prior to operation of the new UV disinfection system, the City shall provide an operation and maintenance plan detailing how the system complies with NWRI guidelines (Note that the NWRI guidelines do not apply to effluent disinfection as they were written specifically for reuse standards and further discussion with the RWQCB will be required).

2.5.1 Water Quality Standards

The current NPDES permit recognizes the transition from the current Outfall 001 to the proposed Outfall 003, but essentially requires the same effluent limits for both interim (current) conditions and final compliance. The effluent discharge requirements for final compliance are summarized in Tables 5 and 6 of the NPDES permit, and limits for the interim condition are summarized in Table 7 of the NPDES permit. For reference, the NPDES permit is provided as Appendix A. A flow reconfiguration and disinfection upgrade project is proposed in order to meet these effluent standards, as the City has indicated that permit compliance is crucial.

Since 2012 there have been approximately 20 violations of the permit for disinfection by-products (dichlorobromomethane), at least one violation for chlorine residual, and at least one violation for coliform (bacteria). Implementation of UV disinfection would eliminate the disinfection by products; however, the existing natural treatment system has a very low UV transmittance, which impacts the sizing of the UV needed to meet disinfection requirements. The main indicator of the level of disinfection will be the Fecal Coliform criteria:

- Average monthly - 14 MPN/100 ml.
- Maximum daily - 43 MPN/100 ml.

Ongoing permit violations of plant effluent limits for biological oxygen demand (BOD) (at least 12 violations for BOD in the last 2 years) and suspended solids (at least 21 violations for total suspended solids (TSS) since 2012) indicate a need for additional secondary treatment capacity beyond that of the existing natural system.

2.5.2 Flow Reconfiguration Project

As previously discussed, a portion of the of the disinfected secondary effluent is currently routed to the AMWS enhancement wetlands, returned to the chlorine contact basin (CCB) for a second step of chlorine disinfection and dechlorination, and discharged through Outfall 001. One feature of the flow reconfiguration project is that the future configuration will be based on the enhancement wetlands flows being brought back to the AWTF for blending with treatment wetlands effluent prior to disinfection and discharge. All plant flows up to 5.9 million gallons per day (mgd) will be routed to UV disinfection prior to discharge through Outfall 003.

The flow reconfiguration as described in the permit places the UV system downstream of the enhancement wetlands, right before the new discharge compliance point at the brackish marsh. A second option was initially considered for this initial planning study, which is to place the UV disinfection system after the Allen and Hauser wetlands, but upstream of the Gearheart wetland. This configuration would allow for a final buffer before discharge to the brackish marsh. This buffer in the Gearheart wetland would provide a safety factor in case of any issues with the UV system including equipment failure or power outage. Any issue with the UV system could trigger the closing of the final effluent gate to the brackish marsh outfall (003) and subsequent containment of any undisinfected effluent. Provisions could be included in the plant improvement project for a portable pump to be purchased and available to pump the contents of the Gearheart marsh back to the pond system for retreatment, if needed. This concept of a safety factor was also discussed at the initial meeting with the North Coast RWQCB. However, this alternate configuration is not recommended due the following factors:

- The original concept retains a single point of compliance downstream of all enhancement wetlands.
- The original concept provides the benefit of the longer detention time through the complete wetland system prior to discharge.
- The return of any undisinfected flow would require significant pumping to drain the Gearheart Wetland of undisinfected effluent.
- The revised flow reconfiguration concept would require modifications to the existing wetlands transfer structures, which would add cost to the project.

- The new brackish marsh discharge will provide additional protection if the existing tide gate is modified in a future project to provide isolation of the effluent discharge.

Therefore, the flow reconfiguration with UV immediately upstream of Outfall 003 is recommended.

2.6 FUTURE REGULATORY CONSIDERATIONS

The current permit will be open for renewal in 2017, and could include additional discharge requirements or other provisions. The following list outlines future regulatory issues that should be considered in planning and future design for the AWTF:

- **Nutrients.** Nutrients such as nitrogen and phosphorus have been identified as potential issues. The North Coast RWQCB is currently reviewing limits for these constituents, and they will probably be added to future discharge permits. Ammonia discharge standards in freshwater have been regulated by the EPA since 2013. North Coast dischargers are beginning to be regulated for ammonia and nitrogen discharge standards. The City of Ferndale has an ammonia limit of 1.0 milligrams per liter (mg/L) and a nitrate limit of 10 mg/L in their current permit requirement. They are however an inland stream discharger.

  The City of Eureka originally was permitted as an ocean discharge and their NPDES permit used an ammonia limit (as nitrogen) of 0.6 mg/L as the Basin Plan water quality objective. Due to the dilution credit granted Eureka, the resulting effluent limit was not prohibitive. However, Eureka just received a new permit in June 2016, which eliminated their dilution credit, and determined that they were a Humboldt Bay (estuarine) discharger and as such would be required to meet bay discharge standards. Their new permit includes effluent limits on ammonia, with an average monthly ammonia limit of 4.1 mg/L ammonia (as nitrogen), and a daily limit of 10 mg/L ammonia (as nitrogen). In addition, it was determined that the discharge was subject to the Enclosed Bays and Estuaries Policy, which requires a finding of enhancement in order to allow a bay discharge.

  Arcata's current NPDES permit requires monitoring for total ammonia and nitrate to determine the assimilative capacity of the receiving water for these nutrients and to generate background data for these constituents for a future Reasonable Potential Analysis.

- **Wet Weather Flows.** The permit does not completely define the flow reconfiguration for peak wet weather flows. It prohibits discharge of flows greater than 5.9 mgd to new Outfall 003. Therefore, flows above 5.9 mgd must be either stored in the ponds and wetlands or discharged on an emergency basis to existing Outfall 001. In the latter case, the existing chlorine and sulfur dioxide gas system would need to remain on-line and be used for disinfection of wet weather flows. Once the new UV system is on-line, additional improvements to the existing disinfection and dechlorination systems might be considered to meet any future permit requirements. Since the City has already taken significant steps to address and reduce inflow and infiltration while wet weather peak flows have persisted, handling of wet weather flow will require additional definition and potentially additional improvements to meet permit compliance.

- **Dilution Credits.** New Outfall 003 is currently being modelled to determine if any dilution credits might be justifiable for the AWTF effluent discharge. If dilution credits are allowed, then the effluent toxicity lab results might be more favorable and exhibit a lower number of failed tests.

- **pH.** The pH of the AWTF is influenced by the natural treatment system; the pH has dipped at times during "split basin" mode of operation, when the AMWS flows are returned to the chlorine contact basin. It is generally thought that the chlorination / dechlorination process is responsible for the lowered pH so this might only be a future issue for wet weather flows. The effluent pH will also impact the ammonia toxicity of the effluent. Any process changes should allow for pH control.

- **Emerging Contaminants.** Constituents of emerging concern (CECs) are pharmaceuticals and personal care products, industrial chemicals present at low concentrations, and chemicals that may affect hormone status ("endocrine disruptors.") In general these and other low concentration contaminants have been identified as potential future issues both for effluent discharges and recycled water production. Most of the research work to date has consisted of limited monitoring, especially for recycled water and drinking water supplies. The fate of these contaminants in a natural system is not clearly understood and therefore may require monitoring by the RWQCB in a future permit revision. It was determined, however, that permitting around CECs would likely not take affect within the 20-year planning window for this Facility Plan.

- **Bacterial Quality of Humboldt Bay.** The bacterial quality of Humboldt Bay was noted as a particular concern in the RWQCB Water Quality Control Plan for the North Coast Region (Basin Plan) due to the location of several of California's most important commercial oyster farms in the northern lobe of the estuary known as Arcata Bay. The shellfish harvest areas are classified by the California Department of Health Services according to several criteria, including their proximity to pollutant sources and the Department's knowledge that such areas are (or are not) of suitable sanitary quality. The Basin Plan identifies stormwater runoff and point source discharges as having the greatest impact on water quality in Arcata Bay. The Basin Plan noted that anytime there was a storm of more than a half inch of rainfall, the bacterial quality was impacted and shellfish harvesting was prohibited. The effluent limitations for fecal coliform bacteria for the new Outfall 003 were retained from the previous permit and reflect water quality objectives for protection of shellfish harvesting areas.

2.7 MEETINGS WITH NORTH COAST RWQCB

An initial meeting was held with the RWQCB staff to discuss the project in June 2015. The project objectives and NPDES permit requirements were reviewed during the meeting. A subsequent meeting took place on June 27, 2016. At that time the Wastewater Treatment Facility Improvements project draft Facility Plan was reviewed, and current NPDES permit requirements were discussed with the RWQCB.

The main points from the discussion were:

- Board staff wants to see bypass of flows greater than 5.9 mgd eliminated, including I&I reduction to reduce peak flows and reduce total volume to be stored.
- UV disinfection design criteria were discussed and it was proposed that UV disinfection will be based on a minimum UVT of 35 percent. City needs input on design dose and disinfection objectives, including coliform or virus reduction,
- Board staff indicated a requirement to have the total flow receive treatment through the enhancement wetlands. They noted that the Enclosed Bays and Estuaries Policy requires enhancement of the receiving water as a condition of discharge, including polishing of the effluent. The City and City's consultant noted that enhancement wetlands do not have the capacity for 5.9 mgd peak wet weather flow, and no land is available for additional wetland construction.
- Board staff indicated that Arcata could expect an ammonia limit in their next permit (in 2017) similar to Eureka, based on the similar Humboldt Bay discharge. The City will be required to do a Reasonable Potential Analysis (RPA) to develop the limit based on salinity, pH and other factors at the point of discharge. Board staff noted that they were no longer considering the bay a drinking water source, so nitrates (or total nitrogen) reduction was not required.

Implementation schedule was discussed, and Board staff indicated that since the NPDES permit expires in July 2017, a Report of Waste discharge should be filed at least 6 months before the permit expiration (by January 2017).

2.8 NORTH COAST RWQCB REPORT OF WASTE DISCHARGE SUBMITTAL

After the June 2016 Facility Plan was submitted to the City, the City prepared and submitted a Report of Waste Discharge (ROWD) to the RWQCB in January 2017. The submittal of the ROWD is the first step in the renewal of the facilities discharge permit (NPDES). A copy of the required ROWD forms and supplemental ROWD information is included in Appendix T. The ROWD information outlined the hydraulic and treatment capacity issues and provided a schedule for compliance. In addition, it included a proposed UV disinfection dose of either 35 or 50 mJ/cm^2 depending on the disinfection criteria for the discharge. The second request related to the disinfection system was the request for split compliance for disinfection compliance indicator organism. The City requested that the disinfection criteria should be applied just downstream of the UV disinfection process (Outfall 002), prior to discharge to the enhancement wetlands. All other compliance parameters would be achieved downstream of the enhancement wetlands (Outfall 003).

At the date of this revision, the RWQCB had not made any comments on the ROWD, or the supplemental information, and an updated permit is not expected until later in 2017.

FLOW AND LOAD EVALUATION

3.1 INTRODUCTION

This chapter discusses the plant influent flow and load the Arcata Wastewater Treatment Facility (AWTF) was designed for, as well as the flow and loads that are expected over the 20- year planning horizon.

3.2 EXISTING FACILITY DESIGN FLOW AND LOADS

The AWTF currently treats municipal wastewater from the City of Arcata to meet treatment standards and discharge requirements established by the North Coast Regional Water Quality Control Board (RWQCB). These requirements are outlined in the City's National Pollutant Discharge Elimination System (NPDES) permit, which was last renewed in 2012.

Table 3.1 provides a summary of the current plant permitted influent flows in million gallons per day (mgd).

Table 3.1 AWTF Influent Permit Flow Summary
Wastewater Treatment Facility Improvements Project
City of Arcata

	Flow (mgd)
Average Dry Weather Design Flow	2.3
Average Wet Weather Design Flow	5.0
Peak Wet Weather Design Flow	5.9
Peak Instantaneous Flow	16.5

According to the 1987 "City of Arcata Wastewater Treatment Plant Modifications" record drawings, the AWTF was designed for an average annual plant influent biochemical oxygen demand (BOD) loading of 4,100 pounds per day and total suspended solids (TSS) loading of 3,400 pounds per day for a design population of 19,056 in 1992. This loading was originally designed for the existing primary treatment facility and for secondary treatment provided by "sedimentation and stabilization" Oxidation Pond Nos. 1 through 3 (total of 49 acres) and a shallow "marsh" (4 acres), followed by the enhancement wetlands (30 acres). The treatment wetlands (TWs) were constructed sometime after the 1987 modifications project in phases that occupied a portion of Oxidation Pond 3. The last phase, TW Nos. 5 and 6, were constructed in 2012 from the remainder of Oxidation Pond 3.

The 1987 design average annual plant influent flow of 2.3 mgd and design maximum month plant influent flow of 5.9 mgd correspond to the permitted average dry weather flow and permitted peak wet weather flow, respectively (see Table 3.2).

Table 3.2 AWTF Design Flow and Loads per 1987 Drawings Wastewater Treatment Facility Improvements Project City of Arcata	
	Design criteria
Average Annual Design Flow, mgd	2.3
Maximum Month Design Flow, mgd	5.9
Influent Average Annual BOD_5, ppd	4,100
Influent Average Annual TSS, ppd	3,400
Design Population	19,056

The State Department of Finance population estimate for the City of Arcata in January 2015 was 18,085, and for January 2016 was 18,695 (including Glendale connections). The influent flows and loads have changed since 1987 due to conservation efforts in recent years and changing characteristics of the community, such as the growth of food industries such as microbreweries. It is important when developing a facility plan to consider the current loading as well as the potential for future changes.

During development of the Draft Facility Plan, anticipated community growth has been a discussion item that needs to be finalized. The City originally anticipated a 10 percent growth in the community based on the General Plan's redevelopment plans and planned growth at Humboldt State University. For the purposes of the Draft Facility Plan evaluation, a 10 percent growth was originally assumed. After further discussion with the City at the Council meeting on June 13, 2016, followed by input from the City's Community Director, the community growth is anticipated to be 20 percent from now through buildout. Updates in the Final Facility Plan address this additional growth factor. Due to the conservation efforts seen in recent years, the growth is primarily anticipated to impact influent loading to the WWTP, and will not change the design flows.

3.3 INFLUENT FLOW EVALUATION

The following daily influent flow data sets were provided to Carollo by both the City and the City's consultant, Arcata Marsh Research Institute (AMRI):

- Plant Influent (Point 1) flow from January 1988 to December 2015, provided by AMRI.
- Plant Influent (Point 1) flow from January 2003 to September 2015, provided by the City.

A comparison of the two flow data sets indicated that the data was of the same origin and originally collected by the City. The flow data was plotted and the percentile flows were tabulated. For influent flow from January 1988 to December 2015, the permitted design peak wet weather flow of 5.9 mgd corresponds to between a 98th and 99th percentile, and the permitted design average dry weather flow of 2.3 mgd corresponds to a 68th percentile.

For influent flow from January 2003 to September 2015, the permitted design peak wet weather flow of 5.9 mgd corresponds to a 99th percentile and the permitted design average dry weather flow of 2.3 mgd corresponds to a 77th percentile. For both data sets, the permitted design average wet weather flow of 5.0 mgd corresponds to a 97th percentile.

The data was also analyzed for duration of high influent peak flow periods. Within the period of record, the two highest peak flow durations occurred at the beginning and the end of December 1996. During each of these periods, plant influent flows higher than 5.9 mgd occurred for an average of 8 consecutive days, corresponding to about 71 to 76 million gallons (MG) of total influent flow. The flow data for these periods is included in Appendix C.

3.4 INFLUENT LOAD EVALUATION

The following influent concentration data sets were provided to Carollo by both the City and AMRI:

- Plant Influent (Point 1) BOD from January 1988 to December 2015, provided by AMRI.
- Plant Influent (Point 1) BOD from July 2003 to September 2015, provided by the City.
- Plant Influent (Point 1) TSS from January 1988 to December 2015, provided by AMRI.
- Plant Influent (Point 1) TSS from July 2003 to October 2015, provided by the City.
- Plant Influent (Point 1) Ammonia (NH_3) from February 2011 to August 2013, provided and collected by AMRI.
- Plant Influent (Point 1) NH_3 from April 2013 to December 2015, provided by the City.

A comparison of the concentration data sets provided by the City and AMRI indicated noticeable variability between the data sets. The City indicated that the data they provided is compliance data sent to the Regional Board, and directed Carollo to primarily use the City data for analysis despite a shorter period of record than for the AMRI data. Data from the entire period of record (by City and AMRI) was used for comparison with City data.

The daily influent BOD, TSS and NH3 concentration and corresponding flow data were used to calculate daily influent loads. The 90th percentile concentrations and loads were then calculated. Carollo recommends using 90th percentile loads as the basis of design for evaluating capacity of existing facilities and for sizing new secondary treatment processes. To evaluate treatment capacity of secondary treatment facilities, BOD load is the primary design parameter. BOD load was evaluated two ways: actual 90th percentile load, and a calculated equivalent load based on 90th percentile concentration at a design flow.

For City data from 2003 to 2015, the actual 90th percentile BOD load is 4,000 pounds per day (ppd), which is shown in Table 3.3. This value appears reasonable compared with the observed monthly median influent BOD load over the entire period of record, as seen in Figure 3.1. For City data from 2003 to 2015, the calculated load based on a 90th percentile BOD concentration of 280 mg/L is too conservative. At the permitted design average dry weather flow of 2.3 mgd, the calculated equivalent load would be 5370 lb/d, which is much higher than the observed monthly median influent BOD load for the entire period of record. The recommended loads for TSS and ammonia are also listed in Table 3.1 and were developed from the same actual data.

The recommended design plant influent loads are summarized in Table 3.3.

Table 3.3 Recommended Design Plant Influent Loads
Wastewater Treatment Facility Improvements Project
City of Arcata

Constituent	90th Percentile Influent Load (1), ppd	Design Influent Load With 10% Growth (2), ppd	Design Influent Load With 20% Growth (3), ppd
BOD	4,000	4,400	4,800
TSS	5,760	6,340	6,910
NH_3	880	970	1,060

Notes:
(1) Based on City daily sample data from 2003 to 2015 for BOD and TSS, and from 2013 to 2015 for NH_3.
(2) Assumed City of Arcata growth projection in Draft Facility Plan.
(3) Assumed City of Arcata growth projection in Final Facility Plan per June 13, 2016 City Council meeting.

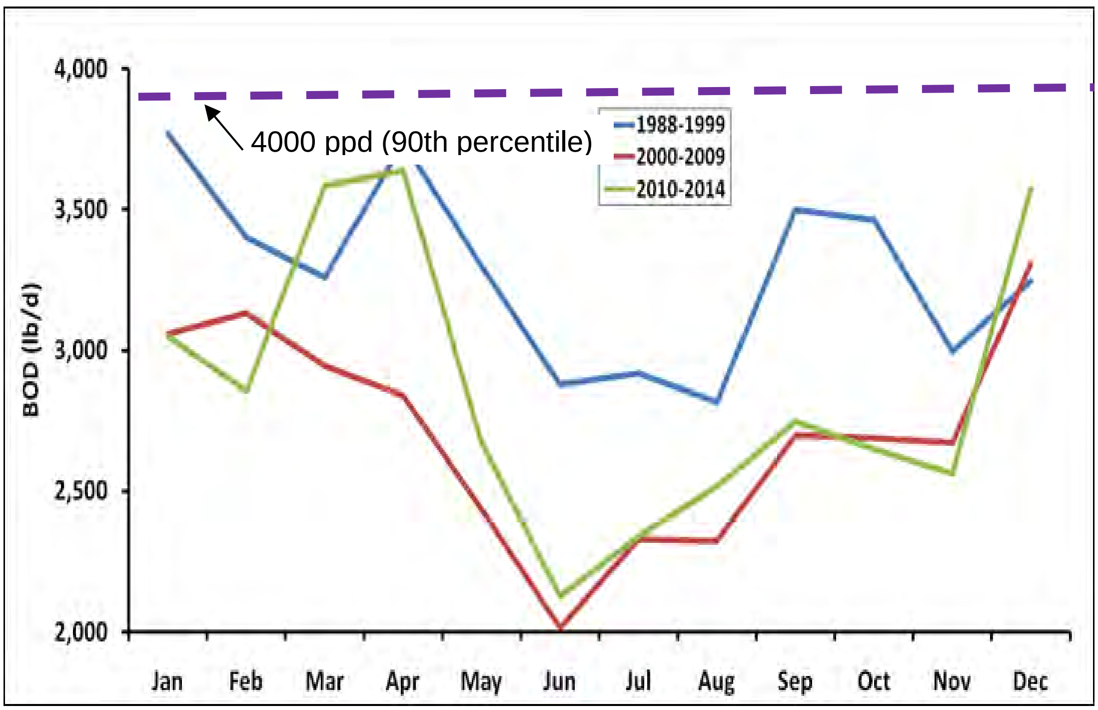

Figure 3.1 Plant Influent BOD (Monthly Median), City and AMRI Data

Plots of the influent data are included in Appendix C.

EXISTING FACILITIES AND CAPACITY EVALUATION

4.1 INTRODUCTION

This chapter provides an overview of the existing facilities at the Arcata Wastewater Treatment Facility (AWTF) and includes the following sections:

- An existing facilities description summarizing the general function and configuration of the treatment facilities at the AWTF.
- A capacity assessment summarizing the hydraulic and treatment capacities of the major liquid treatment unit processes at the AWTF.

4.2 FACILITY OVERVIEW

In order to maintain compliance with the discharge permit, municipal waste from the City of Arcata is treated through a series of unit processes at the AWTF. Figures 4.1 and 4.2 show the site layout and unit process flow schematic for the ATWF, respectively. Table 4.1 provides a summary of the current plant permit influent flows in million gallons per day (mgd). Appendix D includes process flow diagrams for the AWTF facilities (from *AWTF Operations and Maintenance Manual*).

Table 4.1 AWTF Influent Permit Flow Summary
Wastewater Treatment Facility Improvements Project
City of Arcata

	Flow (mgd)
Average Dry Weather Design Flow	2.3
Average Wet Weather Design Flow	5.0
Peak Wet Weather Design Flow	5.9
Peak Instantaneous Flow	16.5

4.3 EXISTING FACILITIES DESCRIPTION

The following sections provide a brief description of the existing flow configuration and hydraulic treatment capacity of the AWTF.

LEGEND

Existing Ponds

- AMWS Enhancement Wetlands
- Oxidation Ponds
- Treatment Marsh
- Brackish Marsh
- Wastewater Treatment Facility

AWTF Facilities

1. Main Office
2. Influent Storm Pump
3. Influent Screw Pumps
4. Bar Screens

AWTF Facilities (Continued)

5. Grit Chamber
6. Primary Clarifiers
7. Primary Anaerobic Digester
8. Secondary Settling Digester
9. Sludge Drying Beds
10. Generator Building
11. Boiler Room
12. Chlorine Storage Building
13. Chlorine Contact Basin

N

0 300 600 Feet

EXISTING AWTF SITE LAYOUT

FIGURE 4.1

CITY OF ARCATA

WASTEWATER TREATMENT FACILITY IMPROVEMENTS PROJECT

carollo

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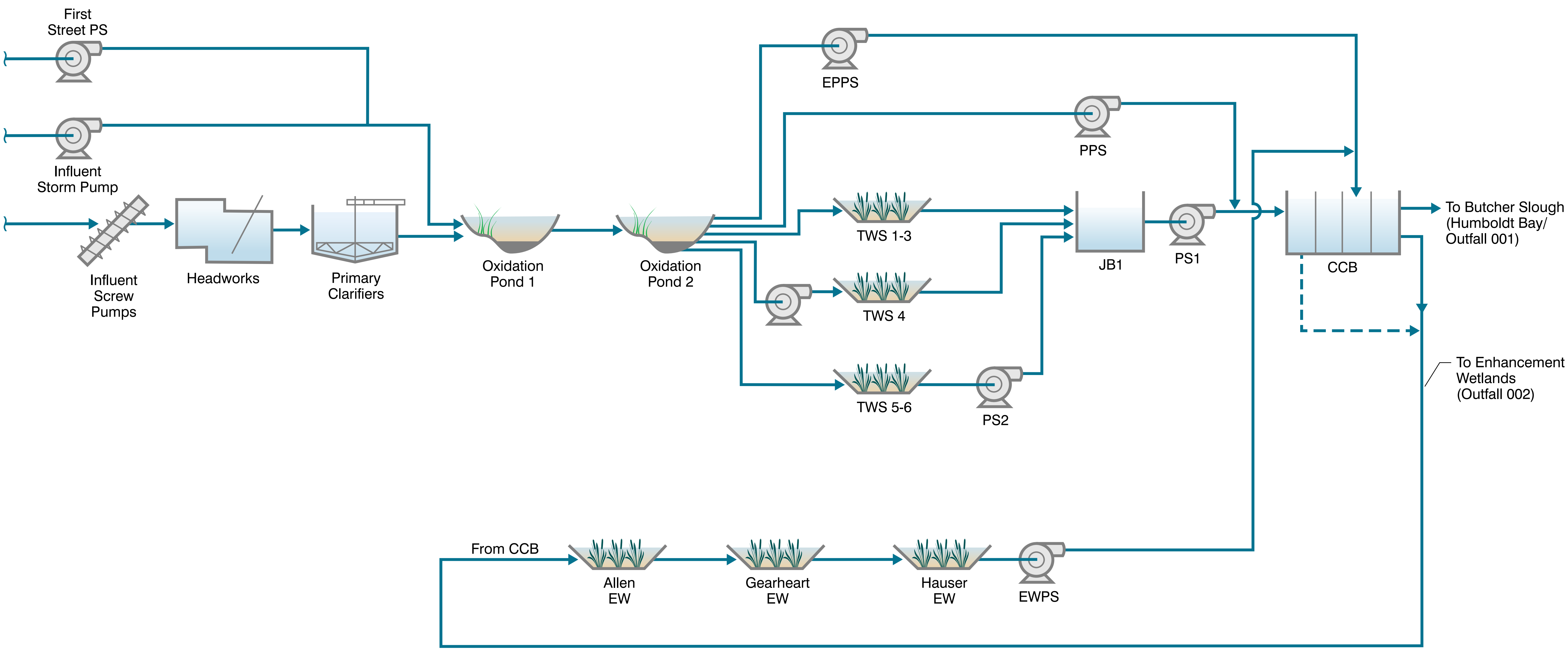

EXISTING AWTF FLOW SCHEMATIC

FIGURE 4.2

CITY OF ARCATA

WASTEWATER TREATMENT FACILITY IMPROVEMENTS PROJECT

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4.3.1 Headworks

The headworks facility provides screening and grit removal of raw sewage that is pumped from the service area. The headworks facility is comprised of the following:

- Two 2.5-mgd Archimedes screw pumps.
- Two 5.0-mgd mechanically-cleaned bar screens that drop screenings into a single belt conveyor for transport to a roll-off bin.
- A parshall flume for flow metering.
- A grit removal system including a horizontal-flow grit chamber with grit pumping and grit classification.

4.3.2 Primary Clarifiers

The primary treatment facilities consist of two primary clarifiers, with a total treatment capacity of 5.0 mgd. Flow from the headworks is split to the primary clarifiers after grit removal:

- Clarifier No. 1 has a 26-foot diameter and a design treatment capacity of 1.0 mgd. It is fed by a 12-inch diameter influent pipeline.
- Clarifier No. 2 has a 60-foot diameter and a design treatment capacity of 4.0 mgd. It is fed by a 24-inch diameter influent pipeline.

The clarifiers are center-feed, peripheral-withdrawal type clarifiers. In the clarifiers, suspended solids gradually settle to the bottom of the tanks as primary sludge. Mechanical scrapers collect settled sludge and skimmer arms collect floatable scum in the primary clarifiers. Three primary sludge pumps pump solids from the bottom of the primary clarifiers to the primary anaerobic digester. Scum collected on the surface of the primary clarifiers passes through a liquid/solid separator and the scum solids are transferred to a roll-off bin for disposal.

4.3.3 Influent Bypass Pumping

Influent flows greater than the 5.0 mgd headworks capacity bypass both the headworks facility and primary clarifiers and are pumped, via the First Street Pump Station (located offsite) and the Influent Storm Pump (at the Headworks), directly to the oxidation ponds. These pumps provide peak wet weather flow capacity and redundancy for the headworks screw pumps.

4.3.4 Oxidation Ponds and Pond Pumping

Primary effluent and influent bypass flows are conveyed by gravity to two facultative oxidation ponds for secondary treatment and stabilization. Secondary treatment is provided through a series of both biological and chemical reactions in both aerobic and anaerobic environments within the ponds. The two oxidation ponds have a total surface area of

46 acres (ac) and a total storage and treatment volume of 89 million gallons (MG). The normal mode of operation is in series, where primary effluent is routed to Oxidation Pond 1 and then flows by gravity through transfer structures to Oxidation Pond 2. Pond influent and effluent piping is also set up to operate in parallel if needed.

Dry weather effluent from Oxidation Pond 2 typically flows by gravity to the treatment wetlands for further secondary treatment. Flow in excess of the treatment wetlands capacity is piped to the wet well of the Pond Pump Station (PPS) for discharge to the chlorine contact basin (CCB). In high wet-weather flow scenarios, the Emergency Pond Pump Station (EPPS) can also be used. These pump stations are described in further detail in the capacity evaluation section of this chapter.

4.3.5 Treatment Wetlands and Effluent Pumping

Effluent from the oxidation ponds flows by gravity to Treatment Wetlands 1 through 3 and 5 through 6 for further secondary treatment. A small portion of the oxidation pond effluent is also pumped to Treatment Wetland 4, a shallow pilot wetland cell. The 9.7 acres of treatment wetlands reportedly have a capacity to treat 3.3 mgd, which is based on a minimum hydraulic retention time (HRT) of 4 days. Each treatment wetland has one or two influent distribution boxes with manually-adjustable weir gates that are set to control the flow split from the oxidation ponds. The treatment wetlands are currently operated in parallel.

Treatment wetlands effluent is pumped to the CCB for disinfection. There are two main pump stations that collect flow from the treatment wetlands for pumping to the CCB and enhancement wetlands: the wetlands Pump Station 1 (PS1), and the wetlands Pump Station 2 (PS2). These are described in further detail in the capacity evaluation section of this chapter.

4.3.6 Disinfection

Effluent from the ponds or treatment wetlands is pumped to the CCB. Disinfected effluent flows by gravity to either the enhancement wetlands or is discharge to Humboldt Bay. Currently all pond and treatment wetland flows go through the CCB, in either a split or combined mode, described in more detail in Chapter 7. The design capacity of the CCB is 5.9 mgd based on a 30 minutes of contact time.

4.3.7 Enhancement Wetlands

The Enhancement Wetlands are hydraulically limited to 1.7 mgd, which is the capacity of the Enhancement Wetlands Pump Station (EWPS). The AWTF operates three enhancement wetlands in series that have a total surface area of 33 acres and approximately 22 MG of storage. Enhancement wetlands effluent is currently pumped back to the CCB via the EWPS for disinfection and discharge.

4.4 EXISTING HYDRAULIC CAPACITY SUMMARY

This section provides a summary of the existing hydraulic capacity for the liquid treatment facilities at the AWTF. A summary of the existing process treatment capacity evaluation is discussed later in this chapter.

4.4.1 Existing Hydraulic Profile

The existing plant hydraulic profile was summarized as part of the undated AWTF Operations and Maintenance Manual project. For reference, these profiles are provided in Appendix E.

4.4.2 Influent Pumping

There are several influent pump stations serving the AWTF:

- **First Street Pumps.** The First Street Pumps are variable speed, natural-gas driven pumps that are used when influent flow to the treatment plant is greater than 5.0 mgd (capacity of headworks and primary clarifiers). Each of the pumps has a design capacity of 5.5 mgd.
- **Influent Storm Pump.** The Influent Storm Pump is a variable speed, diesel pump that diverts influent flow greater than 5.0 mgd from the headworks influent wet well directly to the oxidation ponds. The Influent Storm Pump has a capacity of 5.0 mgd.
- **Influent Screw Pumps.** The Influent Archimedes Screw Pumps each have the capacity to lift 2.5 mgd from the headworks influent wet well to the headworks bar screens.

Table 4.2 summarizes the firm influent pumping capacity.

Table 4.2 Influent Pumping Capacity Summary
Wastewater Treatment Facility Improvements Project
City of Arcata

Pump Station	Firm Capacity (mgd)
Influent Bypass Pumping[(1)]	10.5
Headworks Influent Screw Pumps[(2)]	2.5

Notes:
(1) Combined firm pumping capacity of the First Street Pumps and the Influent Storm Pump. Assumes the largest unit is out of service.
(2) Assumes the largest unit is out of service.

While it appears that there is sufficient influent pumping capacity, much of the influent flow would need to be bypassed around the headworks and primary clarifiers if one of the screw pumps is taken out of service. Upsizing the screw pumps would increase the reliability of the preliminary and primary treatment facilities. The screw pumps could either be replaced in kind or with another type of pump. Plant staff has indicated a preference for submersible pumps.

4.4.3 Headworks

With the exception of the influent screw pumps, the headworks facility appears to have sufficient hydraulic capacity to accommodate the original design flow of 5.0 mgd:

- **Bar Screens.** There are two bar screens and each screen was originally designed to handle 5.0 mgd. The actual channel hydraulic capacity was not evaluated.
- **Grit Chamber.** There is one grit chamber that was originally designed to handle flow up to 5.0 mgd. However, plant staff has indicated that the unit has difficulty handling wet weather flows, so the current capacity is less than 5.0 mgd. There is no redundancy (which is not uncommon), so channel isolation gates are used to shut off flow to the grit chamber if maintenance is required.
- **Grit Pumping.** There are two grit pumps (one duty, one standby). Each pump has the capacity to transfer 200 gallons per minute (gpm) of grit slurry from the bottom of the grit chamber to the grit classifier, which is sufficient to accommodate the original 5.0-mgd design flow.
- **Grit Classification.** There is a single grit classifier, so maintenance would require shutting down flow to the grit chamber. If this is operationally problematic, a redundant classifier could be installed as part of a headworks rehabilitation project.

4.4.4 Primary Treatment

The two primary clarifiers have a total surface area of approximately 3,400 square feet (sf). In most cases, only primary clarifier No. 2 is used. At the design flow rate of 5.0 mgd, the overflow rate through primary clarifier No. 2 was calculated to be approximately 1,770 gallons per day per square foot (gpd/sf), which is much lower than the industry-standard recommendation of 3,000 gpd/sf at peak wet weather flow. However, plant staff has indicated that removal rates and process performance drops significantly at flow rates greater than 4.2 mgd.

4.4.5 Oxidation Ponds

Effluent from the primary clarifiers flows by gravity in a 30-inch pipeline to the oxidation ponds, which are normally operated in series. Plant staff has indicated that the transfer structures between Oxidation Ponds 1 and 2 cause a hydraulic bottleneck during wet weather events. To relieve this bottleneck, the oxidation ponds are operated in a modified parallel mode when the influent bypass pumping is initiated. Additionally, as a fail-safe to mitigate the potential for overflow of Oxidation Pond 1, a spillway was constructed in the berm shared with Oxidation Pond 2. The ponds have a total volume of 89 million gallons (MG) and an average constructed depth of 5.5 feet. At the PWWF of 5.9 mgd when the ponds are empty of sludge, they have 14 days of detention time. The peak flow detention time may be insufficient depending on the plant loading, season, and weather. At the average flow of 2.3 mgd when the ponds are empty of sludge, the oxidation pond detention time is over 35 days, which should be sufficient for secondary treatment.

Due to deferred sludge maintenance over the last 30 years, current estimates of solids buildup in the ponds range from one to two feet in each pond. Assuming an average solids buildup of 1.5 feet, the peak flow detention time at 5.9 mgd is 10 days and the average flow detention time at 2.3 mgd is 26 days.

4.4.6 Treatment Wetlands

Effluent from the oxidation ponds flows by gravity to the treatment wetlands, which are operated in parallel. Per information provided in the AWTF Operations and Maintenance (O&M) Manual, the weirs in the distribution boxes are manually adjusted to maintain the desired flow split through the six treatment wetlands. These adjustments are made on a regular basis, although the flow split is difficult to maintain, since each set of treatment wetlands can treat a different flow rate.

Treatment Wetland Nos. 1 through 6 have a total volume of 13.2 MG and an average operating depth of 3.8 feet when empty of solids or vegetation. At the PWWF of 5.9 mgd, they have 2.0 days of detention time, which is reportedly considered insufficient for treatment capacity. A more typical design value for wetlands systems is on the order of four days, which is approximately 3.0 mgd.

Due to deferred sludge and vegetation maintenance over the last 30 years, operating depth is assumed to be reduced. The City and AMRI report that reliable treatment capacity of Treatment Wetland Nos. 1 through 6 is typically about 1.8 mgd. In order to manage this capacity deficiency, flows greater than 1.8 mgd to 5.9 mgd can be pumped around the treatment wetlands.

4.4.7 Secondary Effluent Pumping

The effluent pump stations pump secondary-treated effluent from the oxidation ponds, the treatment wetlands, or the enhancement wetlands for discharge into the CCB. A summary of the measured effluent pumping capacities is provided in Appendix F.

4.4.7.1 <u>PPS and PS1</u>

The PPS and PS1 are sited adjacent to each other, within a common structure. The pump station wet well has an interior divider wall with an isolation gate. When the gate is open, the pumps are supplied via a common wet well. During normal operation, however, the slide gate is closed and the two wet wells are hydraulically isolated from one another.

In the normal mode of operation, the PPS lifts flow from Oxidation Pond 2 to the CCB, and consists of three 1.8-mgd pumps, with a firm pumping capacity of 2.9 mgd. PS1 lifts flow from Treatment Wetlands 1 through 4 to the CCB and consists of three 1.2-mgd pumps with a firm capacity of 2.3 mgd.

4.4.7.2 EPPS

The EPPS lifts flow from Oxidation Pond 2 to the CCB. The EPPS is typically operated to supplement the capacity of the PPS during extremely high flow scenarios. The EPPS consists of two 3.6-mgd pumps, one duty, and one standby.

4.4.7.3 PS2

PS2 was originally piped to lift flow from Treatment Wetlands 5 and 6 to the CCB. However, pumping directly to the CCB has shown to disrupt the flow-paced chlorine injection system. In order to correct this problem, temporary piping was installed to re-route the discharge from the CCB to Junction Box 1, which flows by gravity into the wet well of PS1. PS2 consists of two 1.7-mgd pumps, one duty, and one standby.

4.4.7.4 EWPS

The EWPS (also known as the Hauser Pump Station) lifts effluent from the Hauser Enhancement Wetland to the CCB. The EWPS consists of three 1.5-mgd pumps and originally had a firm pumping capacity of approximately 3.0 mgd. However, the pumps are failing and the most recent testing indicated a firm pumping capacity of 1.2 mgd. Two of the pumps are controlled with variable frequency drives (VFDs) and the third is fixed speed.

The pumps are operating at the end of the pump curves, which is not ideal and may be one of the reasons for operational issues with this pump station. Additionally, the pump curve is not in alignment with measured flow values, which indicates that the pump impellers have experienced some wear and are not operating on their published curves.

4.4.7.5 Effluent Pumping Summary

Table 4.3 summarizes the effluent pumping capacity.

4.4.8 Chlorine Contact Basin

Effluent from the oxidation ponds and treatment wetlands is pumped to the CCB via the PPS and PS1. In wet weather conditions, the EPPS is also used to lift flow to the CCB. At the flow rate of 5.9 mgd, flow through the CCB has a contact time of 30 minutes, which is typically sufficient for effluent discharge.

The main points of the hydraulic analysis include the following:

- The estimated hydraulic detention time is based on combined basin mode in the CCB with no return flow from the Enhancement Wetlands.
- The CCB effluent weir sets the elevation in the basin and is not submerged at 5.9 mgd.

- There is very little head loss through the CCB.

Table 4.3 Effluent Pumping Capacity Summary
Wastewater Treatment Facility Improvements Project
City of Arcata

Pump Station	Firm Capacity(1) (mgd)
PPS	2.9
PS1	2.3
EPPS(2)	3.6
PS2(3)	1.7
EWPS	1.2

Notes:
(1) Assumes the largest unit is out of service.
(2) The EPPS is only operated during periods of peak wet weather and was not included in the overall secondary effluent pumping capacity per the City's request.
(3) PS2 does not discharge directly to the CCB, so the capacity was not included in the overall secondary effluent pumping capacity.

4.4.9 Enhancement Wetlands

Disinfected treatment wetlands effluent flows by gravity in a 30-inch pipeline from the CCB to the enhancement wetlands, which are typically operated in series. A hydraulic capacity analysis was completed by AMRI in order to better understand the feasibility of the flow reconfiguration project.

The main points of the AMRI hydraulic analysis include the following:

- Treatment wetlands effluent flows by gravity through the chlorine contact basin and the enhancement wetlands to the EWPS wet well, which serves as the downstream control point. As discussed above, the EWPS pumps effluent back to the CCB for further disinfection and discharge through Outfall 001.
- Most of the head loss in this portion of the hydraulic profile occurs at the sharp-crested weirs in the distribution boxes and junction structures. Weir elevations were taken from the 1984 drawings and should be confirmed.
- There do not appear to be any hydraulic capacity bottlenecks in between the chlorine contact basin and the EWPS wet well at the modeled PWWF of 5.9 mgd.

4.4.10 Hydraulic Capacity Summary

Table 4.4 provides a summary of the existing hydraulic capacity at the AWTF.

The main hydraulic capacity limitations or bottlenecks are the following areas:

- Headworks pumps - lack redundancy.

- The single Primary clarifier limits capacity at peak flows.
- Treatment wetlands and effluent pump stations lack capacity to accommodate permit peak flows.
- Enhancement wetland effluent pumps station lack capacity to accommodate permit peak flows.
- There is concern that the enhancement wetlands would not provide any treatment at flows greater than 2.3 mgd.

Table 4.4 Existing Flow Capacity Summary
Wastewater Treatment Facility Improvements Project
City of Arcata

Unit Process	Hydraulic Capacity (mgd)
Influent Bypass Pumping(1)	10.5
Headworks: Pumping(1)	2.5
Headworks: Bar Screens(2)	5.0
Headworks: Grit Removal(2)	5.0
Primary Clarifiers(2)(3)	4.0
Oxidation Ponds(4)	5.9
Treatment Wetlands(5)	2.3
Pond and Treatment Wetlands Effluent Pumping(6)	5.2
Chlorine Contact Basin	5.9
Enhancement Wetlands	2.3
Enhancement Wetlands Pumping(7)	1.8

Notes:
(1) Assumes largest pump is out of service.
(2) Influent flow in excess of 5.0 mgd is bypassed around the headworks facility and primary clarifiers and routed directly to the oxidation ponds.
(3) Capacity based on a single primary clarifier.
(4) Capacity is based on 15-day detention time.
(5) Flow in excess of 2.3 mgd is pumped directly from Oxidation Pond 2 to the Chlorine Contact Basin.
(6) The sum of the capacities of three PS1 pumps and two PPS pumps in parallel, which is the firm pumping capacity under the current operational arrangement. The PS2 pumping capacity was not considered because it does not discharge directly to the CCB.
(7) Flow in excess of 1.8 mgd design capacity is discharged from the CCB, through Outfall 001 and into Humboldt Bay.

4.5 NATURAL SYSTEM TREATMENT CAPACITY EVALUATION

4.5.1 Process Capacity Background

The existing treatment processes at the City of Arcata Wastewater Treatment Facility (WWTF) were constructed in 1987, with some facility improvements since then including conversion of one oxidation pond to treatment wetlands. The need for a comprehensive approach to facility improvements was first addressed during the initial development of this facility plan project in September 2015. During review with the City, it was noted that the WWTF may have a secondary treatment capacity shortfall that impacts the ability to reliably meet permit requirements. The treatment capacity shortfall was initially reviewed with City staff during a phone conference on October 29, 2015, and then addressed in a follow-up workshop on November 5 and 6, 2015. The presentation from that phone conference and the workshop presentation are included in Appendix G.

Several indications point to the need for evaluating secondary treatment capacity. As discussed in Chapter 2, the plant has experienced operational issues related with treatment capacity, including NPDES discharge violations of both BOD and TSS. Treatment capacity, as well as hydraulic capacity and detention time, have likely been impacted by 30 years of solids accumulation. Deferred vegetation maintenance in the wetland system (treatment wetlands and enhancement wetlands) has also impacted the ability for the wetlands to remove solids and maintain optimum flow capacity.

The City is planning an operational conversion of the natural system to a single-pass flow mode to pass up to 2.3 mgd through the enhancement wetlands, as well as a disinfection process change from chlorination to UV disinfection. In addition, recent UV transmittance (UVT) data collected for this project indicated that the natural system has a low UVT at certain times of the year which substantially increases the UV disinfection cost.

This section summarizes the analysis of available plant flow and constituent concentration data for evaluating current secondary treatment capacity at the WWTF. Plant data analysis was used both to confirm existing WWTF treatment capacity and to provide the basis of design for new and upgraded plant processes recommended for the WWTF Improvements Project. Conceptual design criteria recommendations for new and upgraded plant processes are discussed in Chapter 6, Alternatives.

4.5.2 BOD Loading Criteria

The basis for evaluating current treatment capacity of the existing natural system was determined by analyzing a combination of design criteria and available plant data, and confirmed by discussions with City staff and AMRI.

Typical wastewater treatment BOD loading criteria in a natural system varies depending on a variety of factors including the treatment purpose, climate (sunlight and temperature), solids accumulation, vegetation management, and short circuiting. The primary treatment purpose of oxidation ponds are to remove organic loading (BOD and ammonia), while the primary treatment purpose of treatment wetlands are to remove solids. The enhancement wetlands provide effluent polishing prior to Bay discharge, as well as additional benefits such as wildlife habitat creation and recreation.

Published values for design BOD loading in an oxidation pond can range from 35 to 125 ppd/acre due to a variety of climates and facility conditions ("Natural System for Waste Management and Treatment," Reed et al). For Northern California, Carollo recommends an oxidation pond loading criteria of 25 ppd/acre for non-aerated ponds, which has been confirmed at Napa Sanitation District and other Northern California facilities. This loading level has been confirmed to provide an effluent that can meet an average monthly effluent discharge limit of 30 milligrams per liter (mg/L) BOD_5 and 30 mg/L TSS. The AWTF Oxidation Ponds 1 and 2 have a total of 46 acres and an average depth of 5.5 ft. Aerated ponds typically have a minimum of 6.5 feet depth (2 m; Reed et al). Pond 1 has eight mechanical aerators that are in poor condition and several have not been used for a number of years; Pond 2 does not have aerators. Based on a 25 pounds per day (ppd) BOD/acre design criteria, maximum BOD loading to the oxidation ponds should be 1,150 ppd without aerators.

Published values for design BOD loading in a constructed wetland depends on whether the wetlands are fully vegetated or open water free water surface (FWS) type ("Manual - Constructed Wetlands Treatment of Municipal Wastewaters Constructed," U.S. EPA, September 2000). For a fully vegetated FWS wetland, maximum BOD loading of 35 ppd/acre (40 kg/ha-d) is recommended if a secondary effluent BOD standard of 30 mg/L is to be met. For an open water FWS wetland, maximum BOD loading ranges from 40 to 54 ppd (45 to 60 kg/ha-d). The AWTF treatment wetlands were designed primarily for solids removal and only Treatment Wetlands 1 and 2 have depths greater than 4 feet, which is typically necessary for open water surface FWS wetlands. Treatment Wetlands 1-6 have a total of 9.7 acres, not including emergent vegetation. Based on a 35 ppd BOD/acre design criteria, maximum BOD loading to Treatment Wetlands Nos. 1 through 6 should be 340 ppd. In the future, if 2.3 acres of Treatment Wetlands 7 is constructed, maximum BOD loading to Treatment Wetlands 1 through 7 should be 420 ppd.

Historically, the three Enhancement Wetlands (EWs) in conjunction with the chlorine contact basin have been providing year-round supplemental BOD and TSS treatment capacity, despite not being designed for those functions. Solids have been accumulating in the EWs for almost 30 years while percent removal of BOD has been diminishing with time. This phenomenon has been observed and analyzed by both the City and AMRI over the last 10 years. It is suspected that an internal load is increasing due to breakdown of accumulated material, reducing the treatment potential of the EWs. The EWs are designated Waters of the State which are regulated by State Water Board Resolution No. 2008-0026 to protect all waters of the State from dredge and fill activities. The City has indicated that vegetation maintenance and baffle installation will be allowed activities, which could help with treatment capacity and improvement of short circuiting issues. Current EW BOD treatment capacity is estimated by AMRI to be about 120 ppd, but may decrease in the future without solids removal.

4.5.3 Secondary Treatment Capacity Shortfall

The 10 percent growth projection developed in the Draft Facility Plan results in a design influent loading of 4,400 ppd. The design criterion for the existing primary clarifiers is 30 percent BOD removal (1987 Record Drawings). This is also a typical design criteria for new primary clarifiers. This results in an Oxidation Pond influent loading of 3,080 ppd BOD. Subtracting out the anticipated BOD removal in the Oxidation Ponds (1,150 ppd), Treatment Wetlands Nos. 1 through 6 (340 ppd), Enhancement Wetlands (120 ppd), and meeting an Outfall 002 effluent discharge limit goal of 30 mg/L (575 ppd at 2.3 mgd) results in a BOD treatment capacity shortfall of 895 ppd at Outfall 002. Meeting an Outfall 003 effluent discharge goal of 10 mg/L (192 ppd at 2.3 mgd) results in a predicted BOD treatment capacity shortfall of 1,280 ppd at Outfall 003. Note that this capacity shortfall analysis assumes the natural system is performing optimally with routine solids and vegetation maintenance conducted. With deferred maintenance of the natural system over the last 30 years, the predicted BOD treatment capacity shortfall is 1,280 ppd. Future construction of Treatment Wetland No. 7 could reduce the shortfall by 80 ppd and addition of aerators to Pond 2 could reduce the shortfall by approximately 600 ppd, leaving a BOD treatment capacity shortfall of at least 600 ppd at Outfall 003. This analysis is summarized in Table 4.5.

Following this evaluation in the Draft Facility Plan, the City revised its growth estimate to a 20 percent growth projection, which increases the BOD treatment capacity shortfall from 600 ppd to 1000 ppd even with additional Pond 2 aeration and construction of Treatment Wetland No. 7.

Independently, AMRI provided the City an analysis of a secondary treatment capacity shortfall of 1,150 to 2,017 ppd BOD during higher flow and higher BOD loading months of the year, in "AWTF Treatment Capacity Evaluation and Additional Treatment Recommendations," September 2015.

It has been documented that the plant is currently treating the BOD treatment capacity shortfall, inadvertently, by use of chlorine during combined basin operating mode (chlorinating both TW and EW effluents in the Chlorine Contact Basin), which is required about nine months every year (typically during wet weather seasons). Chlorine is a strong oxidizer and typically reduces the organics and BOD level to permit requirements. The City has the ability to increase chlorine dosage as needed. However, disinfection byproducts maybe created from the oxidation reaction, leading to violations of dichlorobromomethane. This is one reason the City has decided to limit the use of chlorine and switch to UV for disinfection.

Table 4.5 BOD Treatment Capacity Shortfall Summary Wastewater Treatment Facility Improvements Project City of Arcata			
Unit Process	**Estimated BOD Removal (ppd)**	**Remaining BOD At 10% Growth (ppd)**	**Remaining BOD At 20% Growth (ppd)**
Plant Influent	N/A	4,400	4,800
Primary Clarifiers(1)	1,320	3,080	3,480
Oxidation Ponds(2)	1,150	1,930	2,330
Treatment Wetlands Nos. 1-6(3)	340	1,590	1,990
Enhancement Wetlands(4)	120	1,470	1,870
Outfall 003 Discharge Goal @ 10 mg/L	192	1,280	1,680
BOD Shortfall		1,280	1,680
Additional Pond 2 Aeration	600	680	1,080
Adding Treatment Wetland No. 7(3)	80	600	1,000

Notes:
(1) Assumes 30% BOD removal in Primary Clarifiers.
(2) Assumes 25 ppd/acre removal in Oxidation Ponds, at 46 acres total for both ponds.
(3) Assumes 35 ppd/acre removal in Treatment Wetlands, at 9.7 acres in TW 1-6 and 2.3 acres in future TW 7.
(4) Capacity estimated by AMRI based on current removal.

Plant data confirms that the natural system without chlorine generally performs well at lower flow conditions. Figure 4.3 shows a typical example of this, that at a plant influent flow of 1.4 mgd (September 2015), BOD removal was primarily achieved in the oxidation ponds, and TSS removal was primarily achieved in the treatment wetlands. Plant influent BOD at this time was less than 3500 ppd.

Figure 4.4 shows that at plant influent flow of 1.5 mgd when operating in combined basin mode, some BOD removal occurred in the Oxidation Ponds and Treatment Wetlands No. 6, and a significant amount of BOD removal occurred due to chlorination prior to the Enhancement Wetlands. A decrease in 100 mg/L BOD corresponds to 1,250 ppd BOD removal due to chlorination. The City and AMRI analyzed the BOD and chlorine consumption data from 2009 to 2015 and confirmed that during this time while operating in combined basin mode, an average of 730 ppd of BOD removal was achieved by chlorine usage, while peak BOD removal periods could reach 1000 ppd or higher.

In comparison, influent BOD loading in the spring (typically from January through April) is generally greater than 3,500 ppd of BOD. These months also correspond to higher plant influent flows. The higher plant influent loading corresponds to a higher influent loading of the oxidation ponds beyond recommended loading criteria. As shown in Figure 4.5, Oxidation Pond 1 influent BOD loading from 2010 to 2015 is between 35 and 50 ppd/acre (monthly median). Furthermore, higher flows in the wet weather season (generally October to May) result in reduced treatment capacity in the oxidation ponds and the treatment wetlands due to decreased detention time, shifting additional loading to the enhancement wetlands. As seen in Figure 4.6, BOD loading to the Enhancement Wetlands during the wet weather season has been increasing over the last 25 years. Vegetation growth and solids accumulation in the wetland system over the last 30 years impacts the capacity shortfall.

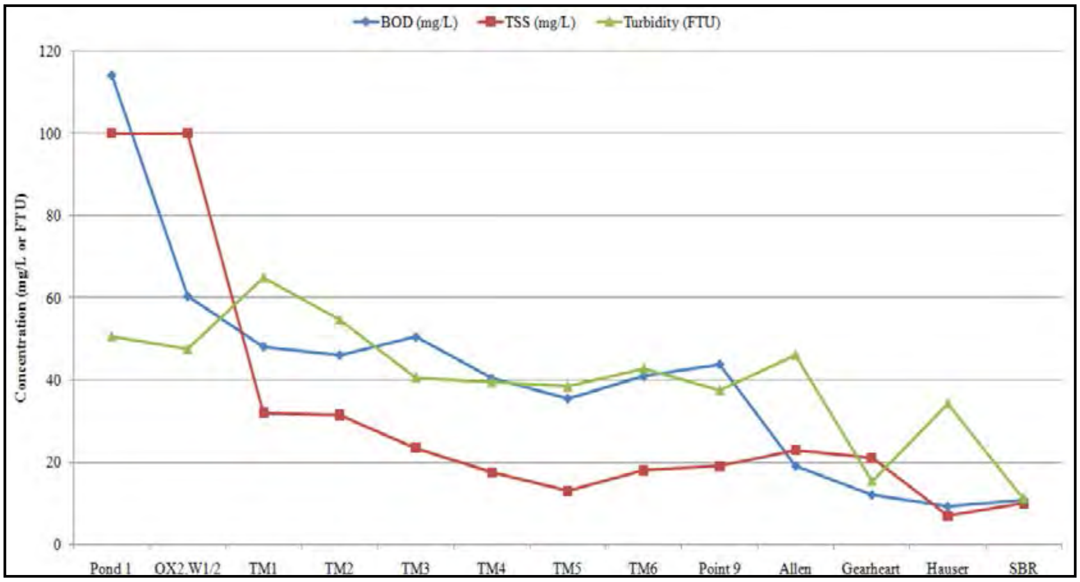


Figure 4.3 Plant Permit Performance At Lower Flows

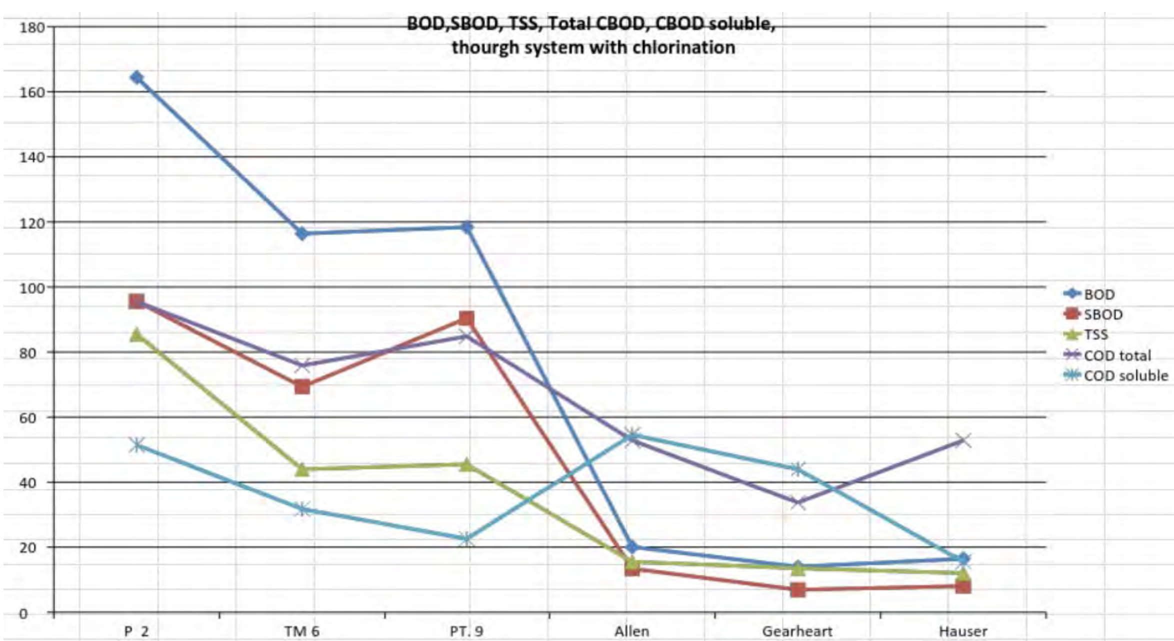


Figure 4.4 BOD Concentration (mg/L) Profile at AWTF (AMRI data, November 2015 at 1.5 mgd).

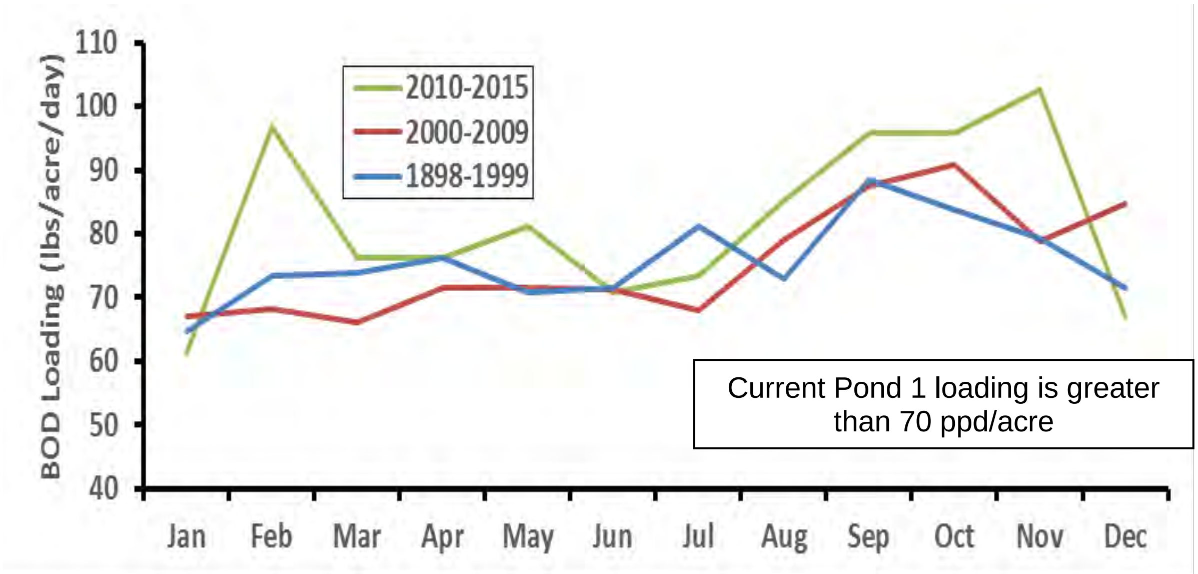


Figure 4.5 Oxidation Pond 1 Influent BOD Loading (Monthly Median)

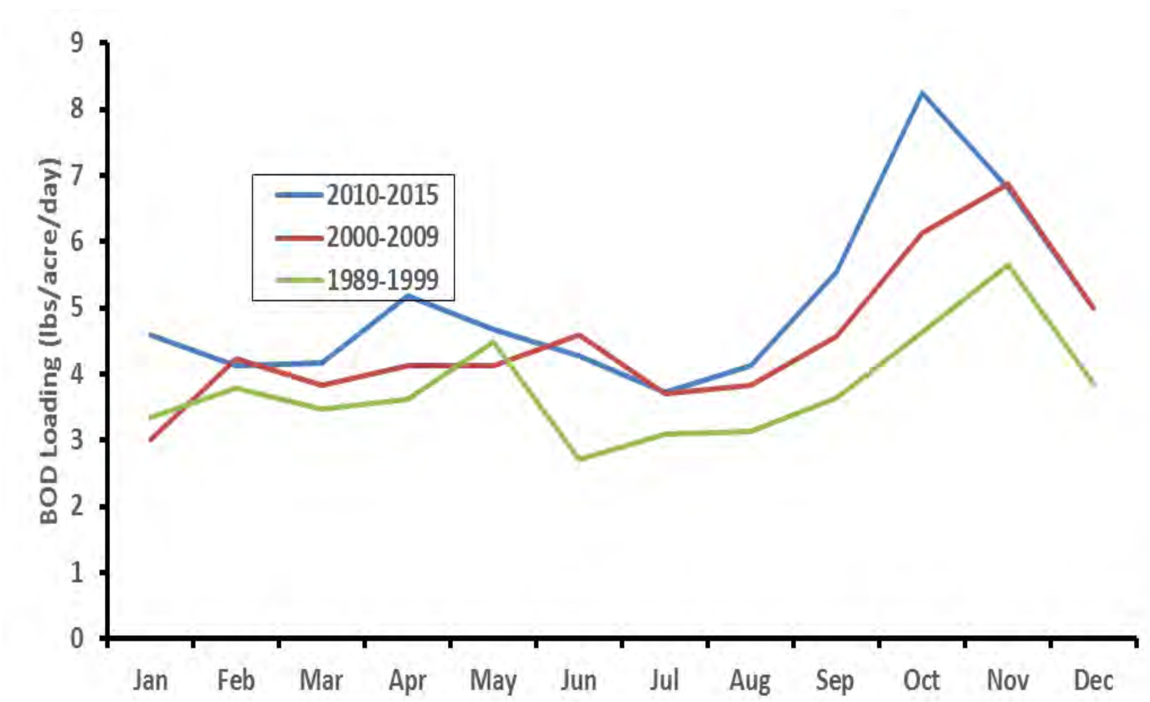


Figure 4.6 Enhancement Wetlands Influent BOD Loading (Monthly Median)

4.6 KEY FINDINGS AND RECOMMENDATIONS

The key findings and recommendations from the capacity evaluation include the following:

- **Headworks.** The reliable headworks capacity should be increased to 5.9 mgd to minimize the need to bypass preliminary and primary treatment. The following modifications would be required:
  - Replace the two existing 2.5-mgd screw pumps with two new 5.9-mgd pumps. The pumps could either be replaced in kind or replaced with submersible pumps. Pump selection should be completed during the pre-design phase of the project.
  - Evaluate replacement of the grit chamber with a new vortex grit chamber, which could handle a wider range of flows.
- **Pond and Treatment Wetlands Effluent Pump Stations.** This appears to be an operationally-intensive area of the AWTF, with multiple pump stations and changing weir elevations into and out of the treatment wetlands. Recommend that the treatment wetland pump stations be consolidated in an effort to simplify operations while adding operational flexibility. It is proposed that PS1 be upgraded to pump treatment wetlands flow to enhancement wetlands, with pond pump station remaining for peak wet weather flows.
- **Additional Secondary Treatment.** The BOD treatment capacity shortfall outlined in Table 4.5 needs to be addressed in facility planning and capital improvement program project alternatives. As noted above, addition of aerators in Pond 2 will and addition of Treatment Wetland No. 7 will improve the secondary treatment capacity of the facility, but a deficit of 1000 ppd is still anticipated with a 20 percent growth projection.

CONDITION ASSESSMENT

5.1 INTRODUCTION

The original Arcata Wastewater Treatment Facility (AWTF) was constructed in the late 1950s. A photo of the original plant is shown in Figure 5.1. The AWTF has been upgraded throughout the years, with the last major upgrade project completed in 1986 (CH2M HILL 1984). The project included a new headworks facility with screening and grit removal, a chlorine contact basin and chemical storage building, effluent pump stations and a new generator building. Since that project, smaller projects have included upgrades to the oxidation ponds, treatment and enhancement wetlands, digesters, pond aerators, and the addition of a standby generator.

Figure 5.1 Original Arcata Wastewater Treatment Plant (Circa 1958)

In May 2015, a condition assessment was performed to assess the current condition of existing structures and equipment and document observations made by plant staff. In general, the plant appears to have been maintained as much as the maintenance budget has allowed. However, findings from the assessment indicate that a majority of the mechanical equipment has exceeded its expected life, and that major structures are also starting to approach the end of their useful life. Finally, plant staff indicated that some capital and maintenance projects had been deferred, pending the outcome of this project. That has meant that staff has struggled to meet permit limits and keep as much of the existing facilities equipment operational as possible even though it should have been replaced.

5.2 PURPOSE

The purpose of the condition assessment is to document the existing facility conditions and help establish priorities for the City's wastewater treatment plant repair and rehabilitation (R&R) capital improvements program (CIP). The findings outlined in this chapter will be incorporated into the CIP presented in Chapter 6.

5.3 APPROACH

The approach used to assess the condition of the assets at the AWTF is described in the following sections.

5.3.1 Asset Inventory

An "asset" is generally defined as a complete physical component of a facility that enables service to be provided, is critical to plant operation, and/or has a value greater than $10,000. Below-ground assets (process piping) were not evaluated. Above-ground assets include structures, as well as mechanical, electrical, and instrumentation and controls (I&C) equipment and devices.

The AWTF assets were organized into a spreadsheet by unit process. The spreadsheet was configured to provide a complete summary of the asset inventory, including: asset description, design criteria, installation year (if known) and condition ranking. The ranking, estimates of remaining life and replacement costs will be used in Chapter 6 to develop the R&R CIP for the treatment facilities.

The asset inventory was developed using the 1984 CH2M HILL WWTP Modification Drawings (CH2M HILL, 1984), the 2003 Wastewater Treatment Plant Evaluation (SHN 2003) and the City's undated Operations and Maintenance (O&M) manual. The main process areas are shown on Figure 4.1 in Chapter 4.

5.3.2 Replacement Timing

5.3.2.1 <u>Original Useful Life</u>

The expected life or Original Useful Life (OUL) is the number of years an asset is expected to be in service as a function of asset type (i.e., mechanical, structural, or electrical). It is used to aid in the determination of the remaining life of an asset. The OUL estimates for different types of assets are presented in Table 5.1.

Table 5.1	Estimated OUL Based on Asset Category Wastewater Treatment Facility Improvements Project City of Arcata
Asset Category	**Original Useful Life[1]**
Civil/Sitework	50
Structural	
General/Other	50
Concrete	50
Fiberglass	25
Steel	25
Plastic	10
Mechanical	
General/Other	20
Valves	20
Pumps - Wastewater	15
Chemical Equipment	15
Coolers/Air Conditioners/Fans	15
Electrical	
General/Other	30
Motor Control Centers	30
Variable Frequency Drives	15
Instrumentation	**10**

Note:
(1) These values are selected based on a combination of the IIMM, Edition 2006, USEPA guides, other industry references, and Carollo experience.

These OULs were estimated based on industry standard guidelines published by the American Water Works Association (AWWA), the Water Environment Federation (WEF), and the American Society of Civil Engineers (ASCE). The International Infrastructure Management Manual (IIMM) and Carollo's internal discipline-specific experience were also referenced.

5.3.2.2 Condition Scoring System and Remaining Life

The remaining life of an asset is important because this helps determine project prioritization for the development of the R&R CIP. Two factors contributed to the determination of the remaining life of each asset:

- The year of equipment installation.
- Field notes taken during the visual condition assessment.

After the site visit, the assets were evaluated and the condition of each asset was ranked on a one-through-five ranking scale, based on the IIMM. In the IIMM, condition is expressed in terms of the amount of repair needed to bring an asset to like-new condition. The definitions for the one-through-five condition ranking system from the IIMM are shown in Table 5.2. During and after the site assessment, the Carollo/LACO team asked questions and requested additional information regarding maintenance and performance history, documented design criteria, installation date, and typical condition parameters that could be used to standardize the procedure for future assessments. The assessments were visual assessments only and did not include diagnostic testing or entry into confined spaces.

Table 5.2 Condition Ranking Scale
Wastewater Treatment Facility Improvements Project
City of Arcata

Ranking(1)	Description(1)	Percentage of Asset Requiring Rehabilitation(1)(2)
1	Very good condition.	0%
2	Good, only minor defects.	10%
3	Fair to poor condition, maintenance required to return to accepted level of service.	20%
4	Poor, requires rehabilitation.	40%
5	Very poor or failed, asset unserviceable.	90%

Notes:
(1) Adapted from the International Infrastructure Management Manual. The IIMM manual is produced by a not-for-profit organization in New Zealand that develops asset management best practice publications (See http://www.nams.org.nz/).
(2) "Percentage of asset requiring rehabilitation" is that percentage of the value of the asset needed to return the asset to a condition ranking of one.

Assets that were identified to be in need of replacement within the 20-year planning horizon were incorporated into the asset inventory, which forms the backbone of the R&R CIP. Assets in good condition and that will not need to be replaced within the next 20 years will not be included in the R&R CIP.

5.4 VISUAL CONDITION ASSESSMENT RESULTS

The results of the ranking for each process area are summarized in Table 5.3 and outlined in more detail in the descriptions below. Pictures of the main process areas, including structures and equipment, are included in Appendix H, and are used to illustrate the process area ratings. An asset inventory with rankings is in included in Appendix I.

Table 5.3 Summary of Process Area Rankings
Wastewater Treatment Facility Improvements Project
City of Arcata

Process	Average Condition - Mech./Elec./I&C	Average Condition - Structural	Average Remaining Mech./ Structural Useful Life
Headworks	4 - Poor	3 - Fair	<5 / 20
Primary Clarifiers	5 - Very Poor	5 - Very Poor	<5 / <5
Oxidation Ponds	5 - Very Poor	4 - Poor	10 / 30
Pond Pump station	4- Poor	3 - Fair	<5 / 10
Treatment Wetlands 1 to 4	NA	4 - Poor	Varies
Treatment Wetlands 5 & 6	NA	1- Very Good	
Pump Station 1	4 - Poor	3 - Fair to 4 Poor	<5 / 20
Enhancement Wetlands	NA	4 - Poor	Varies
Enhancement Wetland PS	4 - Poor	4 - Poor	<5 / 10
Chlorine Contact Basin	2 - Good	3 - Fair to 4 Poor	10 / 20
Chemical System	3 - Fair	3 - Fair	<10 / 20
Digesters	3 - Fair	4 - Poor	10 / <5
Support Systems	3 - Fair	NA	<5 / 10
Electrical and Control Systems	3 - Fair to 4 - Poor	NA	<5 / NA

5.4.1 Headworks

The headworks facility consists of influent pumping, screening, flow measurement, and grit removal. The headworks were constructed in the 1984 project (CH2M HILL 1984). Overall, the headworks are in need of a major upgrade due to the condition of the equipment, which is approximately 30 years old and rated as poor.

5.4.1.1 <u>Influent Pumping</u>

The influent screw pumps were rated as poor to very poor. Although the pumps are operational, they may be close to failure, based on the age, and observed condition. The pumps are open trough, Archimedean screw type units, which have a capacity of 2.5 million gallons per day (mgd) each. Redundancy is provided by a diesel driven bypass pump that can pump from the influent raw sewage wet well directly to the oxidation ponds. In addition, the First Street Pump Station can pump wet weather flows directly to the oxidation ponds.

The influent screw pumps are near or at the end of their life, and will likely require major maintenance if they are not replaced in the near term. For the purposes of this project, it was assumed that the pumps would be replaced with similar units, although the type of pump should be evaluated during predesign. Plant staff has indicated a preference for submersible pumps, and may be interested in a retrofit for the headworks pumps with submersible units. When the pumps are replaced it is recommended that a redundant pump be provided.

5.4.1.2 Influent Bar Screens

The influent bar screens were rated as poor to very poor and are worn beyond their service life. In addition, the bar spacing is wider than current standards, and will allow stringy rag type material to pass and collect in downstream processes. Like most California facilities, the plant staff is starting to see an increase in disposable baby wipes in the influent flow, which accumulate in the primary clarifiers and digesters, leading to additional maintenance. Each bar screen is sized for the full plant flow and, therefore, has sufficient redundancy. The screening conveyor is worn and has no redundancy.

A screenings washer/compactor was previously installed in order to reduce the water and fecal matter in the screenings. The unit subsequently failed and was removed by plant staff after mechanical failure. The failed unit will need to be replaced in order to achieve the required dry solids and pass the "paint test" required for disposal of the screening material.

5.4.1.3 Flow measurement

The influent flow is measured in a parshall flume using an ultrasonic level sensor. Based on limited observations, the condition of the parshall flume insert is rated as fair. The measurement range of the flume should be verified in future predesign to confirm that it is operational for the range of dry and wet weather flows. The condition of the instrumentation was not observed. The flow measurement was reportedly upgraded prior to the 2003 Plant Evaluation.

5.4.1.4 Grit Removal

The overall grit removal system was rated as poor and the tank was rated as very poor. It consists of a flat bottom, shallow grit separation tank, grit pumps, and a grit cyclone-classifier unit. This type of grit removal tank is no longer recommended and has been replaced in most installations. It generally has poor performance and has limited functionality for plants that experience a wide range of flows, such as the AWTF. It should be replaced during any headworks rehabilitation work. The grit handling system is similar to the equipment that would be specified and provided today. In general, all components have been well maintained, but are beyond their service life, and rated poor to very poor. While the grit pumps have adequate redundancy, they should be replaced. The grit cyclone/classifier was replaced in 2003. It has had major component replacement and appears to be nearing the end of its service life (15 years).

5.4.1.5 Miscellaneous Headworks Components

The miscellaneous headworks components, including gates used for flow isolation and distribution, were rated as poor. They are original and are either at the end of useful life or have failed. Staff has noted that some gates have failed or are stuck and cannot be operated.

5.4.1.6 Headworks Structure

The headworks structure appeared to be visually in good shape based on the 30-year life and was given a fair rating. Based on review of the original construction drawings, it was noted that the structure is pile supported, and appears to have been designed based on the industry practice and code at that time for design and construction.

5.4.1.7 Headworks Electrical/Controls

The headworks electrical system is fed from a single motor control center A (MCC A) in the generator building. The controls for all equipment were designed to provide monitoring and alarms at the control panel in the operations building. The equipment condition and service life is described further in the Plant Electrical and Controls section below.

5.4.2 Primary Clarifiers

The plant has two primary clarifiers:

- Clarifier No. 1: 26-foot diameter unit.
- Clarifier No. 2: 60-foot diameter unit.

Generally, Clarifier No. 2 is used continuously and Clarifier No. 1 is used intermittently for peak wet weather flows. The units seem sufficient for the design flows, although the peak loading rates may result in reduced performance. Overall the units are rated as poor to very poor, especially based on age.

5.4.2.1 Clarifier Mechanism

The age of the clarifier sludge collector mechanism in Clarifier No. 2 is unknown. It appears older and reportedly is in need of major rehabilitation or replacement. The clarifier sludge collector mechanism in Clarifier No. 1 appears newer, and is not used very often, and is therefore in better shape. The drive type and age of each drive is unknown. The coating for the mechanism in unit No. 2 has failed and was reportedly failing in 2002. The Clarifier No. 2 mechanism is rated as very poor. Reportedly a large crack is visible in the center column when the unit is out of service. The Clarifier No. 1 unit is rated as poor due to its observed condition. The structures are rated as very poor based on their age.

5.4.2.2 Sludge Pumping

The primary sludge pumps are progressing cavity type pumps. The age of the primary sludge pumps is unknown. Corrosion was observed on the bases. At least one pump has been rebuilt in the last 10 years. The high pressure shutoff switches on the pumps are functional, but very old. These are rated as fair to poor.

5.4.2.3 Scum Pumps and Scum System

The scum pumps and scum collector/concentrator are approximately 15 years old. They are rated as fair to poor condition.

5.4.2.4 Primary Clarifier Structure

The Clarifier No. 1 structure appears to have been built around 1957 based on records provided by the City that indicate piles for the structure were driven around that time. Clarifier No. 2 was added later, although the date is unknown. Both units are shown in drawings dated 1971. The condition of both units is poor to very poor based on the age, concrete corrosion and cracking of the effluent launders. The walkways and handrail on Clarifier No. 1 do not meet current codes for worker safety. The interior coating on both units has failed and exposed the concrete to sulfide corrosion at the water surface. The structure will need to be replaced when the mechanism is replaced due to age and requirements to meet current building codes.

5.4.3 Oxidation Ponds

The oxidation ponds have been in service since the plant was originally put in service in the 1950s. Originally there was one large pond, and later it was subdivided into Ponds 1, 2, and 3. The ponds are shown as one large pond in the 1979 Winzler and Kelly Project (WK, 1979). There is little documentation on pond construction, except that they were formed from native materials, likely using cut and fill construction methods.

The ponds have the following physical characteristics:

- **Pond No. 1.** Average operating depth is 4 to 6 feet, area is approximately 24 acres, and the total volume is 46 million gallons (MG).
- **Pond No. 2.** Average operating depth is 4 to 6 feet, area is approximately 22 acres, and the total volume is 43 MG.

With the exception of effluent pumping and aerators, there is very little equipment in the oxidation ponds. Flow enters Pond No. 1 from the primary clarifiers, and is transferred by gravity to Pond No. 2. The transfer structures are generally overflow structures with only manual weirs. Recently, the transfer structures from Pond No. 2 to treatment wetlands Nos. 5 and 6 have been upgraded with automated weirs that are controlled based on pond level. The oxidation ponds are rated as very poor for mechanical equipment and very poor for structural condition.

The ponds reportedly operate at a depth of 4 to 6 feet. The actual depth and therefore the volume is reportedly impacted by biosolids or sludge accumulation. The amount of sludge in the ponds is difficult to estimate, although the most recent survey indicates that solids range from 6-inches to 3 feet, and average about 10 to 12 inches over the area of the ponds. Since the ponds are fairly shallow, the impact of solids accumulation can be significant. Accumulated sludge in the ponds can lead to degradation of effluent quality, especially due to pond turn-over events that re-suspend solids in the water, and reduction in pond detention times.

The overall process performance of the oxidation ponds is evaluated elsewhere in this report. The main process concern has been the treatment capacity of this process once the plant is reconfigured to a one pass system. The ponds provide the secondary process for the AWTF, especially biochemical oxygen demand (BOD) removal. The pond treatment process should be evaluated together with the treatment wetlands to ensure that permit requirements can be meet with this process at the design flowrates. Reported issues include potential short circuiting in pond No. 2 from inlet to outlets, low BOD removal from ponds during certain times of the year, and variable pond outlet nitrogen concentrations. In addition, algae production in the ponds contributes to total suspended solids (TSS) increase in the pond effluent.

5.4.3.1 Pond Aerators

Eight mechanical pond aerators are located in Pond No. 1, based on recent satellite photography. Note that the O&M manual mistakenly indicates they are located in Pond No. 2. The aerator controls were upgraded in 2008, when dissolved oxygen control was added to save energy. The existing units are in poor condition, and several have not been used for a number of years.

The 2003 plant evaluation indicated that four aerators were located in Pond No. 1, and several additional aerators were yet to be installed. The overall purpose and use of the aerators should be clarified, since aerator installation can be costly due to the electrical improvements required to support aerator installation.

The aerators are the type with a propeller that creates vacuum and discharges air into the pond surface. These units are inefficient and generally used in ponds that require little aeration, and some mixing. The pond aerators could be replaced with horizontal type units that will improve aeration and mixing. They could be used to create flow patterns that reduce and prevent short circuiting. The location and size of the replacement units can be defined in subsequent predesign work. The condition of the aerator electrical service is not known, although some of the transformers reportedly may need replacement.

5.4.3.2 Pond Pump Station (PPS)

The PPS pulls from Pond No. 2 and discharges to the chlorine contact basin (CCB). It was built as part of the 1984 upgrade project and shares a common wall with Pump Station 1 (PS1), which is discussed later in this chapter. The wet well of the two pump stations can either be separated or combined via an isolation slide gate on the interior wall of the structure. The pump station structure is in fair condition, and has had some corrosion.

The vertical turbine pumps appear to be in poor to very poor condition, and are at the end of their service life. These pumps need to be replaced. The type and size of the replacement pumps should be reviewed during the next predesign phase of work.

The condition of the electrical service for these units and the controls is unknown. It has been suggested that these pumps should be retrofit with variable frequency drives (VFDs) in order to vary the pump speed and capacity and control wet well level.

5.4.3.3 <u>Emergency Pond (2) Pump Station (EPPS)</u>

The EPPS provides for a failsafe operation, and can pump directly from Pond No. 2 to the CCB. The pumps are self-priming centrifugal type units. Staff reported that the emergency pumps and piping were refurbished in 1996 and are rated as fair. The complete scope of the rehabilitation is unknown, but the units appear to be ready for service.

5.4.4 Treatment Wetlands

The treatment wetlands (TWs) have very little mechanical equipment or structures. Each wetland has one or two inlet structures, or in one case an inlet pump station, from Pond No. 2. The treatment wetlands were first planted and brought on line at different dates, and therefore are at different levels of maturity. The condition of each wetland is outlined below:

- TW Nos. 1 and 2 were first created by building berms in the 1984 modifications project. Average depth is approximately 4 feet. It is not known when they were planted, but the vegetation in both cells appears mature, very dense and reportedly has become so thick, that most of the vegetation is floating. In addition, these cells were never graded, or leveled, and reportedly the east side of TW No. 1 is deeper. Based on this report and visual observations, the condition is rated as poor to very poor, and is in need of a major vegetation management removal and replanting project. These cells appear to be fed from Pond No. 2 from two inlet structures per TW.

- TW No. 3 was created sometime after 1 and 2, and has fairly dense, floating vegetation. While it is not as dense or overgrown as 1 and 2, it is also rated poor due to the lack of grading and open water for reaeration. It should be scheduled for vegetation management once 1 and 2 have been graded, revegetated, and are back online. This cell is feed from a single inlet structure from Pond No. 2.

- TW No. 4 appears to have been built in the location of the sludge drying beds shown in the 1984 project. This cell is fairly shallow, less than 3 feet, and is fairly densely planted. A portion of this cell has floating plants as well. It is feed from a single pump, located in the eastern TW 1 inlet structure. It has been used as a pilot and demonstration cell over the years. It should be deepened if it is to be used as a treatment wetland. Otherwise it can be maintained as a pilot cell. This wetland was not rated based on it use as a demonstration wetland.

  TW Nos. 5 and 6 were constructed in 2012 from Pond No. 3 (Figure 5.2) and brought online in 2013. These TWs were designed with a series of deep settling zones, followed by intermediate depth zones to be covered by floating wetland plants similar to the other TWs, followed by shallow zones with rooted wetland plants such as bull rush. The shallow zones help to distribute flow, while the deeper zones allow for some reaeration. The cells are divided using interlocking vinyl sheet piling. The vegetation is fairly dense, but there is some deeper, more open water, less dense areas in the beginning and middle of each cell. These cells are fed directly from Pond No. 2, from single inlet structures. The grading and planting conceptual design is shown in Appendix J, based on correspondence from Dr. Robert Gearheart. These cells are rated as fair to good and should have ongoing vegetation maintenance to maintain this rating.

Figure 5.2 Treatment Wetlands (Circa 1989)

- TW No. 7 has been planned since the creation of TW Nos. 5 and 6. It is recommended that TW No. 7 be constructed fairly soon. Once constructed, it will provide additional treatment capacity and will allow for other cells to be removed from service for replanting.

The overall process performance of the treatment wetlands is evaluated elsewhere in this report. The main process concern has been the hydraulic capacity of this process once the plant is reconfigured to a one pass system, especially at the design flowrates. The process should be evaluated together with the oxidation ponds to ensure that permit requirements can be meet with this process at the design flowrates. Reported treatment issues with the treatment wetlands include short circuiting from inlet to outlet, uneven flow distribution between treatment wetlands, and low effluent dissolved oxygen levels in conjunction with hydrogen sulfide generation. In addition, some wetland cells may be underperforming compared to others, due to the short circuiting and dense vegetation. The older treatment wetlands 1 to 4 are rated as poor due to deferred maintenance and inconsistent configuration, and treatment wetlands 5 and 6 are rated as very good based on the recent construction.

5.4.4.1 <u>Pump Station 1</u>

Pump Station No. 1 (PS1) receives flow from TW Nos. 1 through 4 and discharges to the CCB. It was constructed as part of the 1984 project. The equipment in the pump station was rated as poor and the structure as fair to poor. The vertical turbine type pumps are at the end of their life and need to be replaced. These could possibly be replaced with submersible type pumps, which can be evaluated during the predesign stage of the project.

The condition of the structural and electrical is unknown. Currently the pumps operate in an off/on mode, based on level, with a lead lag and standby pumps. Two of the pumps have VFDs in order to vary the pump speed and capacity to control wet well level.

5.4.4.2 <u>Pump Station 2</u>

Pump Station No. 2 (PS2) receives flow from TW Nos. 5 and 6 and was originally constructed to discharge directly to the CCB, but are now redirected back to Junction Box 1 which conveys flow to Pump Station 1. This pump station was originally constructed in 1990s by City staff to serve Oxidation Pond 3 storm flows and then repurposed for TW Nos. 5 and 6 in 2012. Therefore, the pumps are older and maybe at the end of their life. Pump station hydraulics should be reviewed during predesign to confirm the capacity still matches the required capacity, since the flow has been redirected. Reportedly the pump station is shallow and would need to be deeper in order to handle design gravity wet weather flows flow from the wetlands. The structure was completed by plant staff, and is not pile supported as required. The pumps are rated as poor and the structure as poor to failed.

The condition of the structural and electrical is unknown. Based on the O&M manual these pumps have VFDs and can be controlled to maintain wet well level.

5.4.4.3 <u>Inlet and Outlet Structures</u>

The condition of the inlet and outlet structures for the TWs was reviewed briefly during the site inspection. They appear to be in fair condition given their age.

5.4.5 Enhancement Wetlands

The enhancement wetlands are the main feature of the Arcata Marsh and Wildlife Sanctuary (AMWS). The AMWS consists of three freshwater wetlands: Allen, Gearheart, and Hauser enhancement marshes or wetlands. The wetlands receive treatment wetlands effluent that is regulated to be equivalent to a secondary treated wastewater effluent. The wetlands provide polishing of the treatment wetlands effluent while providing habitat for a diverse number of organisms, and recreation opportunities.

5.4.5.1 Enhancement Wetlands

The enhancement wetlands (EWs) were constructed from native materials in much the same manner as the TWs. They operate in series, connected by a series of effluent lines, with inlet and outlet structures. The EWs were not surveyed in detail for this report, but previous reports were reviewed to determine if there were any improvements that had been identified for the wetland operation. The main feature noted was the potential for short circuiting, based on the vegetation and construction of channels that may lead to reduced detention time. Therefore the EWs are rated as poor, and improvements that maximize the hydraulic detention time are included in the capital improvement program.

The overall process performance of the enhancement wetlands is evaluated elsewhere in this report. The main process concern has been the hydraulic capacity of this process once the plant is reconfigured to a one pass system, especially at the design flowrates. The process should be evaluated together with the treatment wetlands to ensure that permit requirements can be meet with this process at the design flowrates. Reported treatment issues with the enhancement wetlands include short circuiting from inlet to outlet and low effluent dissolved oxygen levels in conjunction with hydrogen sulfide generation. In addition, algae production in the wetlands may contribute to TSS increase in the enhancement wetland effluent. Therefore they are rated at fair to poor based on deferred maintenance, flow short circuiting, and transfer structure issues.

5.4.5.2 Enhancement Wetlands Effluent (Hauser) Pump Station

The Enhancement Wetlands Pump Station (EWPS) or Hauser PS was constructed as part of the 1984 plant modifications. It consists of three vertical turbine pumps located in a concealed wet well in the public access area of the AMWS. The pumps were rated as poor and will need to be replaced to provide the capacity for the new flow configuration. The use of the existing wet well will be further reviewed as part of the preliminary design for the UV disinfection and flow reconfiguration project.

In general the structure appears to be in fair to poor condition based on the age. The structure is pile supported, and does not appear to have any settlement issues. The way the pumps were concealed makes the PS maintenance difficult, and contributes to the poor rating. Three large hatches were placed over the vertical turbine pumps, so they could be removed, but the space is a confined space with limited access. Other types of pumps including submersible type might be considered to allow for ease of maintenance, and to reduce the access issues.

The pump station intake or inlet structure includes two inlets that draw at different elevations from the Hauser wetland. One inlet is clogged and has not worked for over a decade. These combine in an inlet box into a single inlet line into the PS wet well. The 16-

inch inlet lines will need to be checked to confirm they provide the required capacity for the flow reconfiguration. The inlet structure is also pile supported. Plant staff has added a manual coarse screen in the outlet from the box to remove larger debris before it enters the wet well. The need for an automated screen will be reviewed in predesign.

The PS discharges to the existing CCB, for disinfection prior to discharge at Outfall 001. The piping will be retained for future diversion to the existing outfall if needed. New piping and valves will be added to allow discharge to the new UV disinfection facility and then gravity flow to Outfall 003.

5.4.6 Disinfection

The existing disinfection system consists of the CCB, chlorine storage and feed building and associated equipment. The system was constructed in the 1984 improvements project. The conditions of the major elements are outlined below.

5.4.6.1 <u>CCB</u>

The CCB consists of two 4-pass basins that can be operated in series or combined modes. The basin is a pile supported, cast in place concrete structure with concrete masonry block divider walls. The structure condition appeared to be fair to poor based on the age of construction, and the divider wall construction. The divider walls are reinforced grout filled walls that may not have structural capacity for a seismic event. The handrail was observed to be in good condition. The condition of the isolation gates and appurtenances is poor with some gates that are difficult to operate. The chemical induction mixers and mechanical equipment are nearly 20 years old and rated as fair.

5.4.6.2 <u>Chemical Storage and Feed Facilities</u>

The disinfection chemical storage and feed system is based on ton cylinder liquid chlorine (CL2) and sulfur dioxide (SO2) tanks. The tanks are connected in parallel to provide sufficient capacity. The condition of the system was not assessed in detail since it was assumed it would be phased out, or operated intermittently once the new UV system was implemented. It was noted that the current ton cylinder storage building was in fairly good shape, and might be repurposed for other uses once the system is off-line. It could be used for a liquid chemical system. It consists of a pile supported slab with CMU walls, and fairly tall peaked roof open building structure.

5.4.6.3 <u>Miscellaneous Chlorine Disinfection Facilities</u>

The miscellaneous facilities and their condition are noted below:

- Chemical residual analyzers - fair condition.
- CCB sample pumps replaced on a regular basis using disposable units - fair condition.

- CCB gates - poor condition.
- Chlorine and Sulfur dioxide induction mixers are newer and are rated as good.

5.4.7 Solids Handling and Treatment

The solids handling and treatment facilities include primary and secondary digesters; digester mixing and heating facilities; sludge drying beds and compost operation; and digester gas handling. The condition of these facilities is outlined below.

5.4.7.1 Digesters Structure

The digesters were constructed as part of the original plant in the late 1950s. The primary digester was upgraded in the 1984 project, including increasing the overall height. Floating gas holder roofs were added at that time as well. The condition of the digester structure appears to be poor, although they have not been inspected by a structural engineer. The condition of the dome roof is unknown, but it is known that has been inspected and the exterior recoated as some point. The condition of the covers interior was not observed, although the 2003 plant evaluation also recommended an inspection and coating if required. Due to the lack of redundancy, this inspection may be difficult, and therefore has been put off by plant staff.

Staff noted that the digesters have been cleaned recently, in both 2002 and 2014. No reports were available on the condition of the digesters once they were cleaned.

5.4.7.2 Digester Mixing and Heating

The heating and mixing system for Digester No. 1 was upgraded in 2002 (Rotamix nozzles) and in 2013 (new mixing nozzles and mixing / recirculation pumps). The condition of this equipment appears to be good to fair. The boiler was reportedly replaced in 1998 or 1999. Issues with the existing digester gas piping were noted in the 2003 plant evaluation, and should be confirmed.

5.4.7.3 Sludge Drying Beds

The sludge drying beds were built as part of the 1984 project. These beds were covered with a canopy type roof. The condition of these original drying beds was rated as fair. Plant staff noted that additional drying beds could be used, or replaced with mechanical dewatering equipment.

5.4.7.4 <u>Compost Operation</u>

The components of the sludge and green waste compost process were not reviewed during the condition assessment and plant site walk.

5.4.8 Plant Electrical and Controls

The plant electrical and control systems are generally in fair to poor shape due the age of the equipment. Reportedly buried conduit has deteriorated in many locations, and now is just bare wire. Reportedly, the wire and cabling is need of replacement as well. The majority of the electrical equipment and control systems are the original equipment installed as part of the 1984 project.

The plant control system is outdated and does not provide some of the current labor saving features that are found in almost all systems today. These include:

- Remote operation. Currently, most equipment must be controlled at the process area only, and little if any equipment may be remotely operated.
- Remote access. This would allow alarm conditions to be reviewed by the facility manager without having to visit the plant.
- Data collection and logging. This would aid in monthly reporting and maintenance planning.
- Compatibility with new controls. Currently, new equipment with programmable logic controller (PLC) based controls cannot be integrated into the existing system.
- The system does not have the ability to integrate the collection system monitoring and control systems.

The rating of the major system components is noted below:

- Power Distribution - The MCC equipment was installed in the 1984 project, and is mostly original. The main plant MCC equipment is located in the standby generator building. The equipment including MCCs and transfer switch is in fair condition.
- Standby Generator - The plant main standby generator was replaced by staff in a recent in-house project. The installation looks good, and is reportedly working well. The unit is 250-kW. The new unit is in good condition. An older, smaller, 150-kW unit is available as a backup, although its condition is unknown.
- Plant power feed - The condition of the plant power feeder from the utility was not reviewed, although plant staff has noted the main transformer is old. Staff reportedly tests the oil in each transformer in order to anticipate transformer failure and replacement needs.

5.5 SUMMARY OF PLANT CONDITIONS

Overall the plant assets and equipment is in fair to poor condition. While this will not be a surprise to plant and City staff, it does indicate a need to complete a comprehensive update the existing capital improvement plan to bring the assets into better ratings. Therefore, in addition to the current project to meet the conditions of the discharge permit, ongoing projects will be required to rehabilitate the aging infrastructure and maintain the ability to meet permit requirements. The recommended CIP is provided as Chapter 6.

5.6 REFERENCES

- CH2M Hill 1984 - Wastewater Treatment Plant Modifications 1984.
- WK 1997 - Winzler and Kelly 1997.
- SHN 2003 - 2000/2002 Wastewater Treatment Plant Evaluation 2003.
- O&M - Arcata Wastewater Treatment Facility Operation and Maintenance Manual ND.

ALTERNATIVES

6.1 INTRODUCTION

Based on the findings of the previous chapters, there is a need to develop and evaluate alternatives that meet current and future treatment objectives and permit compliance requirements. Drivers for these alternatives include:

- Current permit requirements (new flow configuration with enhancement requirement and UV implementation).
- Ongoing permit violations.
- Need to repair/rehabilitate aging infrastructure.
- Deferred maintenance of the existing ponds and wetlands system including build-up of solids and materials causing an internal load.
- Identified shortfall in secondary treatment capacity with elimination of chlorine.
- Future regulations on ammonia/nutrients.
- Future sea level rise and flooding concerns.

This chapter describes the project options considered and the methodology for selection of recommended alternatives that best meet the multiple goals of the City.

6.2 BASIS FOR ALTERNATIVES

The design flow and loads were determined in Chapter 2 and are shown in Table 6.1. These loads include a 20 percent growth factor over existing 90th percentile loads. This allows for confidence in sizing facilities to be able to meet permit requirements in most conditions that will be seen by the Arcata Wastewater Treatment Facility (AWTF).

All alternatives should provide reliable treatment capacity for design load, provide flexibility to meet future regulatory requirements (such as ammonia removal), and must be able to fit on the existing site since additional bay fill is not permitted and additional land is not available near the AWTF. Furthermore, as discussed in the June 27, 2016 meeting with the RWQCB, the Enclosed Bays and Estuaries Policy requires effluent enhancement prior to discharge; bypassing enhancement is no longer acceptable based on current permit requirements.

It is recognized that the existing natural land based system is a point of pride in the community and heralded as a model of sustainable, land-based treatment. Therefore, it is desirable to continue using the pond and wetland system to the best of their abilities and to improve them through solids removal and vegetation management to increase their reliability.

Table 6.1 Design Flow and Loads With 20% Growth Projection Wastewater Treatment Facility Improvements Project City of Arcata	
Average Dry Weather Design Flow, mgd	2.3
Peak Wet Weather Design Flow, mgd	5.9
Design Influent BOD_5 Load, ppd	4,800
Design Influent TSS Load, ppd	6,910
Design Influent Ammonia Load, ppd	1,060

6.3 SUMMARY OF COMMON IMPROVEMENTS NEEDED

Based on the findings of Chapter 5, Condition Assessment, numerous facilities will need to be improved based on their expected useful life and current condition. In addition, there are many common elements needed for the new flow configuration. Common elements for all alternatives include:

- **Headworks Improvements**: The headworks are currently rated at 5.0 million gallons per day (mgd) and the visual condition assessment rated the average mechanical, electrical and I&C condition as poor. The recommended headworks improvement is to replace structural and mechanical assets due to age and condition, and to upsize the capacity to handle design peak wet weather flow (PWWF) of 5.9 mgd. Replacing the headworks structure will also raise the hydraulic grade line at the start of the plant, allowing downstream facilities to flow by gravity and minimizing the need for additional pumping.

- **Primary Clarifiers**: The two primary clarifiers are currently rated at 4.0 mgd and 1.0 mgd each, and the condition assessment rated the mechanical, structural, electrical and I&C condition as very poor, especially based on their age. The recommended improvement is to replace structural and mechanical assets due to age and condition. The capacity of the primary clarifiers will vary depending on the project alternative requirements.

- **Primary Sludge and Scum Pumps**: The age of the primary sludge pumps are unknown and the scum pumps are 15 years old. Visual condition assessment rated the average mechanical, electrical and I&C condition as fair to poor. The recommended improvement is to replace the primary sludge and scum pumps due to condition along with the primary clarifiers. The capacity of the primary sludge and scum pumps will vary depending on the project alternative requirements.

- **Oxidation Pond Nos. 1 and 2 Solids Removal and Transfer Structure Reconfiguration**: Solids accumulation in the oxidation ponds is affecting treatment and hydraulic capacity. Up to one foot of solids in each pond is anticipated needing dredging, dewatering, and disposal in order to return the ponds to original design intent. Reconfiguration of the pond transfer structures is recommended for better flow distribution and improvement of storage capacity.

- **Emergency Pond Pump Station**: The existing pump station has a firm capacity of 3.6 mgd and pumps peak wet weather flows above 5.9 mgd from Oxidation Pond No. 2 to the chlorine contact basin, for discharge through Outfall 001. Plant staff reported that the pumps are older, but in good condition due to low operating hours. Recommended improvements include adding suction and discharge piping to allow the pump station to pump out of Pond 1 and into Pond 2 for Pond 1 storage control; pump rehabilitation is not anticipated to be needed.

- **Treatment Wetland Nos. 1 through 4 Solids and Vegetation Maintenance**: Solids accumulation and heavy vegetation growth in Treatment Wetland Nos. 1 through 4 is affecting treatment and hydraulic capacity. Solids and vegetation removal, regrading of the deep and shallow water zones, and vegetation replanting is anticipated in the four older treatment wetlands in order to return them to original design intent. No maintenance project is currently planned in Treatment Wetland Nos. 5 and 6 due to their recent construction. Treatment Wetland No. 4 will require substantial regrading to deepen and provide the same capacity as the other treatment wetlands.

- **Treatment Wetland No. 4 Influent Pumps and Treatment Wetlands Pump Station 2**: These pumps will need to be further evaluated during preliminary design to determine whether pump replacement is required or whether pumps can be demolished with rehabilitation of the other treatment wetlands improvements.

- **Enhancement Wetlands Improvements:** Solids accumulation and heavy vegetation growth in the enhancement wetlands is affecting treatment and hydraulic capacity. As Waters of the State, major regrading or any activities that significantly reduce water quality or habitat will not be allowed in the enhancement wetlands. Vegetation maintenance, new baffles, and new inlet/outlet structures is anticipated in all three enhancement wetlands in order to improve treatment and hydraulic efficiency and capacity.

- **Pond Pump Station/Pump Station 1**: Pond Pump Station has an existing firm capacity of 2.9 mgd and Pump Station 1 (Treatment Wetland PS) has an existing firm capacity of 2.3 mgd. The visual condition assessment of both pump stations rated the average mechanical, electrical and I&C condition as poor (score of 4), and structural condition as fair to poor (score of 3 and 4). The recommended improvement is to replace mechanical assets due to age and condition and to upgrade the combined wet well in order to improve flow by gravity upstream. The new capacity of each pump station will vary depending on the project alternative requirements.

- **Enhancement Wetlands (Hauser) Pump Station:** Enhancement Wetlands Pump Station originally had a firm capacity of 3.0 mgd, but recent pump capacity tests have derated the capacity to 1.2 mgd. The visual condition assessment of both pump stations rated the average structural, mechanical, electrical and I&C condition as poor (score of 4). The recommended improvement is to replace mechanical assets due to age and condition. The new capacity of the pump station and capacity of the discharge pipe to the new UV system will vary depending on the project alternative requirements. In general, it is agreed by the City, AMRI, and Carollo that the Enhancement Wetlands will perform best at steady lower flows. Holding the flow to 2.3 mgd for Alternatives 1, 2 and 3 was recommended. However this should be considered again during preliminary design given the RWQCB position (stated at the 6/27/16 meeting) that all flow must pass through the enhancement wetlands to meet the definition of enhancement. Further inspection of the existing 16-inch pump station discharge piping during Preliminary Design is also recommended to confirm condition and any rehabilitation required. Based on the most recent alternative (No. 4), it is recommended that the pump station be sized for up to 5.9 mgd.

- **Anaerobic Digesters and Sludge Heating/Mixing System**: The two anaerobic digesters are almost 60 years old. The external visual condition assessment rated the average structural condition as fair but the internal structural condition is unknown. The sludge heating and mixing system appears to be in good to fair condition. The recommended improvement is to improve structural and mechanical assets in phases. The required project elements and recommended implementation schedule will vary depending on the project alternative requirements.

- **Outfall 003**: New Outfall 003 at the Brackish Marsh and effluent piping from the UV disinfection system will be sized for 5.9 mgd.

- **UV Disinfection:** A new UV disinfection system will be constructed for disinfection of secondary effluent up to 5.9 mgd. The design criteria of the UV system will vary depending on the project alternative requirements. UV disinfection is further discussed in Chapter 7, Disinfection Alternatives.

6.4 IDENTIFICATION OF SECONDARY TREATMENT OPTIONS

Identification of secondary treatment options is needed to address the secondary treatment capacity shortfall. This task was completed in phases. The first phase consists of a preliminary screening of new secondary treatment options to be used in conjunction with the existing natural system for pretreatment, parallel treatment, or post treatment. Any of these treatment options deemed feasible were further discussed and evaluated with the City.

6.4.1 Preliminary Screening of Secondary Treatment Options

There are several treatment processes that can be used to provide additional secondary treatment capacity, either alone or in combination with other processes, in order to achieve desired effluent water quality. Table 6.2 provides a list of secondary treatment processes that are commonly considered, along with the constituents they most commonly remove.

Table 6.2 Secondary Processes Meeting Permit Discharge Requirements
Wastewater Treatment Facility Improvements Project
City of Arcata

Process	Ability To Remove		
	Organics (BOD)[(1)]	**Ammonia[(2)]**	**Total Nitrogen[(2)]**
Suspended Growth			
Activated Sludge	√	√	√
Attached Growth			
Trickling Filters	√		
Nitrifying Trickling Filters		√	
Denitrification Filters			√
Land Based Systems			
Ponds (Aerated or Not)	√	Summer only	
Vegetated Wetlands	√	limited	If nitrified before
Open Water Wetlands	√	Some	If nitrified before

Notes:
(1) Current permit discharge requirement.
(2) Anticipated future permit discharge requirement.

While there are variations of activated sludge processed such as oxidation ditch, conventional activated sludge, sequencing batch reactors, or a membrane bioreactor that adds a membrane filter, the biological treatment process is the same. Similarly, there are various attached growth processes that incorporate different types of media that the biological growth attaches to, but the treatment process is essentially the same.

In addition to the secondary processes presented above, there are some physical and chemical processes that could be considered. There are several approaches that could be taken with any additional treatment process: 1) pre-secondary treatment (pretreatment) by adding processes before the existing pond/wetlands system, 2) parallel secondary treatment, and 3) post-secondary treatment (post treatment, after the pond/wetlands). Each alternative considered needs to fit with a final UV disinfection step, as the City Council has affirmed several times the decision to move away from chlorine and instead use UV. Initial options that fall into each of these categories are shown in Table 6.3.

Of the options considered, there are only a few that Carollo recommends carrying forward for a variety of reasons, as discussed below. Any process that requires piloting at the

AWTF was eliminated to meet the accelerated schedule for permit compliance. Any process that is not yet a proven technology with full-scale installation experience was also eliminated early in the alternatives analysis.

Table 6.3 Initial Screening of Pre, Parallel and Post Treatment Options
Wastewater Treatment Facility Improvements Project
City of Arcata

	Treatment Option	Adds BOD Capacity	Removes Ammonia	Improves Final UVT	Reliable	Move Forward
Pretreatment	Chemically Enhanced Primary	< 400 ppd	No	No	Yes	No - high O&M cost
	Aeration	yes	limited	No	Yes	Yes
	Trickling Filter	yes	only if 2-stage	No	Yes	No
	Activated Sludge	Yes	Yes	No - TM degrades	Yes	No
Parallel	Additional Ponds/Wetlands	Yes	Summer only	No	Maybe	No - no room
	Rehabilitate Ponds/Wetlands	Yes - not enough	Summer only	No	Maybe	Yes
	Trickling Filter	Yes	only if 2-stage	No	Yes	Yes
	Activated Sludge	Yes	Yes	Yes	Yes	Yes
Post Treatment	Trickling Filter/Nitrifying Trickling filter	Yes	only if 2-stage	No	No - cold affects performance	No - not as flexible
	Submerged Biofilter	Not proven	Need to pilot	No	Unknown	No
	Ozone/Biological active Filtration	Yes	Maybe - must pilot	Not needed	Maybe - must pilot	No -Need to pilot
	Filtration	< 400 ppd	No	Maybe	Yes	No -Need to pilot

Pretreatment:

- Chemical pretreatment in the primaries would add a significant operations cost with only an additional 10 percent removal of BOD across the primaries, which does not meet the shortfall.
- The existing Pond 1 aerators could remove BOD if they were functioning and designed for the appropriate conditions (e.g. pond depth, location). In the new flow routing, Pond 1 will be used for both treatment and storage at peak wet weather flows. Therefore, the use of aerators in Pond 1 is not recommended due to variable operating depth. Pond 2 will be used for only treatment, and thus adding aerators to Pond 2 will be considered.

- Trickling filters, while a proven and effective treatment process, are poor processes upstream of UV, and do not have the flexibility to remove ammonia or nitrogen unless more than one unit is installed in series.
- Activated sludge upstream of the existing natural system would improve water quality, but to be most effective as pretreatment it would have to be sized for the full flow which would require a high O&M cost due to aeration requirements. One disadvantage is that improved UV Transmittance (UVT) from activated sludge effluent would degrade across the existing natural system.

<u>Parallel Treatment:</u>

- Additional ponds or wetlands could provide the needed BOD treatment; however, land is not available for building new ponds or wetlands sufficient to meet the capacity shortfall. As Waters of the State, the AMWS cannot be modified to function as treatment wetlands since significant regrading would be required to create alternating deep and vegetated zones. Additional ponds or wetlands would not provide year-round ammonia or nitrogen removal, since the natural removal process is dependent on temperature and sunlight.
- Trickling filters, while a proven and effective treatment process, are poor processes upstream of UV, and do not have the flexibility to remove ammonia or nitrogen unless put in series. However they were carried through the initial screening.
- Activated Sludge processes provide both BOD and ammonia/nutrient removal and provide the most flexibility for additional treatment. As parallel treatment the process could be sized for a portion of the full flow which would reduce O&M cost due to aeration requirements.

<u>Post Treatment:</u>

- A weakness of any attached growth process (trickling filters or nitrifying trickling filters) is that they are sensitive to temperature. If the ponds and wetlands are located upstream of an attached growth process, the system will have unreliable performance in the winter months. Additionally, ammonia removal in attached growth processes has been shown to be difficult following ponds and wetlands (e.g. City of Stockton). In the summer months while ponds are reducing ammonia, the biological organisms are being starved, leading to violations in the fall when additional treatment is needed. Additionally, lightly loaded trickling filters (e.g. nitrifying trickling filters) are prone to attracting snails that strip the biological process from the media. Additional operations expenses are required to control the snails.
- A submerged biofilter is another attached growth process that was considered. However, it is our opinion that the same ammonia starving issue that happens with nitrifying trickling filters and potential poor performance in the cold months will likely happen with submerged biofilters.

- Biological active filtration paired with ozone has shown the ability to produce high quality water. However, it is unknown how such a process would perform on pond/wetland effluent. This process would require piloting. From experience at other installations, the process can be fairly expensive. In addition, the use of ozone requires special operation training and attention. Therefore, this alternative is not considered further.
- Filtration is a common process to add after secondary treatment to produce a high quality water. However, filtration following pond/wetland processes has been shown to be more difficult, requiring much lower loading rates (more filters) and high chemical (coagulant) doses in Cities of Napa, Sunnyvale, and Stockton. Additionally, it is only likely to reduce BOD by approximately 20 milligrams per liter (mg/L) or less than 400 ppd. Pilot testing would be required to determine the UVT after filtration as well as the acceptable filter loading rate and coagulant dose.

Summary of Initial Screening:

- The viable pretreatment alternative to be further considered is aeration in Pond 2.
- The viable parallel treatment alternatives to be further considered are rehabilitation of the ponds/wetlands, trickling filters, and activated sludge.
- None of the post treatment alternatives will be further considered.

6.4.2 Further Screening of Parallel Secondary Treatment Options

At the November 5 and 6, 2015 facility plan capacity workshop with the City staff and City consultant Bob Gearheart (with AMRI), a more detailed analysis of parallel secondary treatment options was discussed, including:

- Conventional activated sludge (CAS) aeration basins.
- Extended aeration activated sludge (oxidation ditch).
- Trickling filters.
- Modifying existing oxidation ponds to a Biolac system or aerated lagoons.

As discussed at the workshop, modifying the existing oxidation ponds to a Biolac system or aerated lagoons was deemed not feasible due to constructability issues with the berms and pond depths. For workshop discussion purposes, preliminary design criteria were presented for the remainder of the options in order to present comparative information. Hence, preliminary design criteria were developed based on flow design criteria shown in Table 6.4. These preliminary design criteria are outlined in Table 6.4. Note that following the November 2015 workshop, additional City flow and load data was provided to Carollo in order to further refine the load design criteria to the values presented in Table 6.4.

During the November 2015 workshop, discussion of the treatment options included a number of considerations including performance, footprint, constructability, operation and maintenance requirements, and economic factors. A summary of the non-economic evaluation is outlined in Table 6.5. A summary of the economic evaluation is outlined in Table 6.6. At the workshop, the preferred secondary treatment process selected by the City was an extended aeration oxidation ditch. The information presented in the workshop is included in Appendix G.

Table 6.4 Preliminary Design Criteria for Parallel Secondary Treatment Options Wastewater Treatment Facility Improvements Project City of Arcata

Item	Option		
	Conventional Activated Sludge	Oxidation Ditch	Trickling Filters
Primary Clarifiers - Quantity & Diameter(1)	2 @ 40 ft	N/A	2 @ 40 ft
Aeration Basins - Quantity & Volume	2 @ 0.23 MG	2 @ 1.44 MG	N/A
Trickling Filters - Quantity, Height & Diameter	N/A	N/A	2 @ 20 ft high, 60 ft diameter
Secondary Clarifiers - Quantity & Diameter	2 @ 70 ft	2 @ 70 ft	2 @ 70 ft
Effluent BOD (mg/L)	10	20	30
Effluent TSS (mg/L)	10	20	30
Effluent Ammonia (mg/L)	Same as influent(2)	<1	Same as influent(2)

Notes:

(1) Primary clarifiers are not a required process upstream of the oxidation ditch alternative; however, they may be recommended with project alternatives depending on flow configuration requirements.

(2) In this analysis, additional volume for nitrification was not included with CAS or trickling filters; nitrification in an oxidation ditch can be achieved without additional volume.

Table 6.5 Secondary Treatment Options Evaluation of Non-Economic Factors Wastewater Treatment Facility Improvements Project City of Arcata

Option	Criteria Scale: 1 (least favorable) to 3 (most favorable)					
	Safety	Meets Permit	Ease of O&M	Construct-ability	Reliability	Ammonia Removal
Conventional Activated Sludge	2	3	1	3	3	2
Extended Aeration – Oxidation Ditch	2	3	3	2	3	3
Trickling Filters	3	1	3	2	1	1

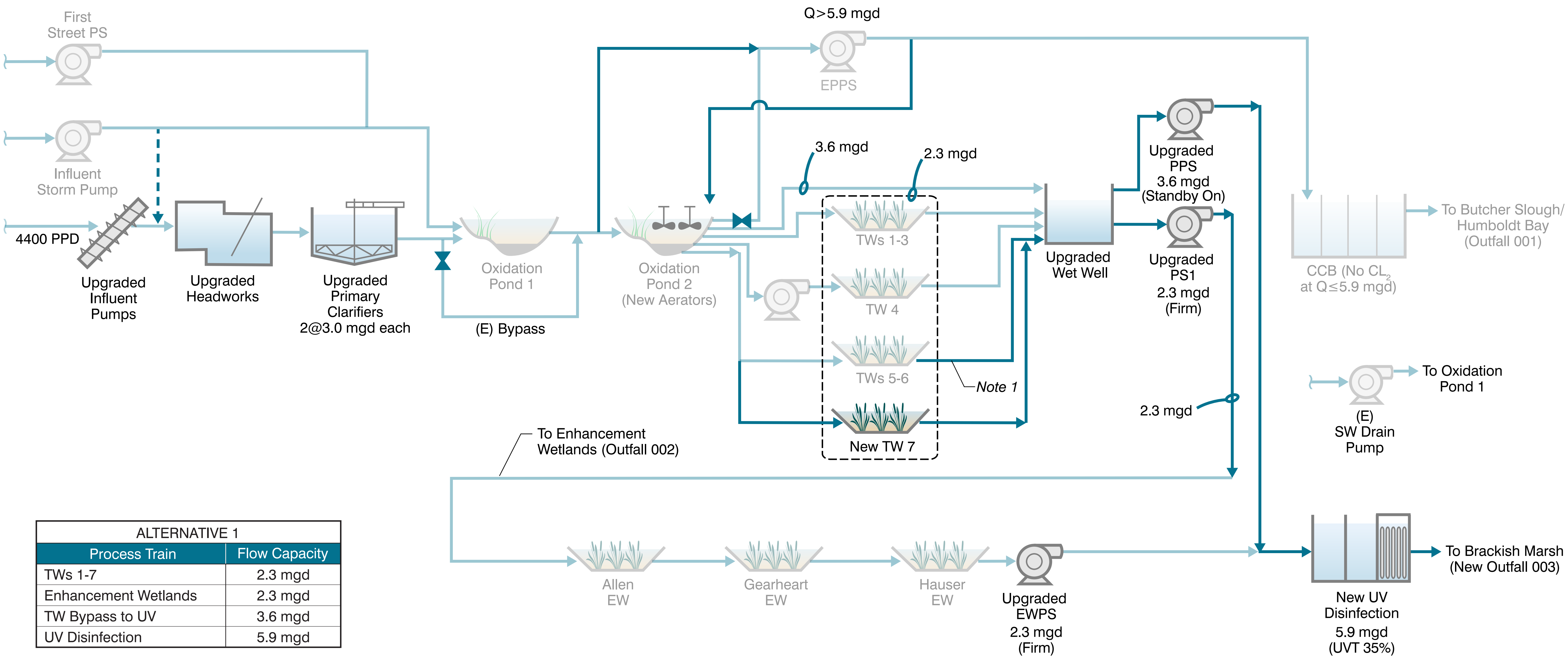
Table 6.6	Secondary Treatment Options Evaluation of Economic Factors Wastewater Treatment Facility Improvements Project City of Arcata					
	Criteria Scale: 1 (least favorable) to 3 (most favorable)					
Option	**Construction Cost**	**Footprint**	**Operator Attention**	**Power Cost**	**Sludge Production**	**Maintenance Requirement**
Conventional Activated Sludge	3	3	1	1	1	1
Extended Aeration – Oxidation Ditch	2	1	2	2	2	3
Trickling Filters	1	2	3	3	3	2

6.5 PROJECT ALTERNATIVE DEVELOPMENT AND COMPARISON

The most viable options identified in the screening process were further refined as project alternatives that address how the facility would perform as a system, since system performance affects the viability of any one process. Project alternatives consider facility-specific issues such as flow routing, hydraulic and treatment capacity of individual processes, and process improvement or replacement needs based on condition assessment. The goal of each project alternative is to provide a facility that maximizes use of the existing natural system while meeting treatment and permit compliance objectives.

Based on the findings of the preliminary and secondary screening as well as feedback received at presentations made to City Staff, the public and City Council in April 2016, three project alternatives were originally developed:

- Alternative 1, Existing System Rehabilitation. This alternative improves the existing natural treatment system with no supplemental secondary treatment process. This alternative does not provide the required capacity to meet the BOD capacity shortfall. In the past the shortfall was made up by use of chlorine for supplemental BOD removal. This alternative will not provide year-round nitrification removal. This alternative was conceptualized by AMRI and further evaluated by Carollo to meet treatment and permit compliance objectives. Aeration would be added to the ponds and Treatment Wetland No. 7 would be constructed to provide some supplemental capacity, but a 1000 ppd BOD removal deficiency at 20 percent growth projection is still anticipated. The Alternative 1 flow schematic is shown in Figure 6.1.
- Alternative 2, Existing System with Side-stream Treatment. This alternative provides a side-stream secondary treatment process parallel to the ponds and treatment wetlands that returns flow upstream of the enhancement wetlands. The ponds and treatment wetlands would continue treating the majority of the plant influent flow. The side-stream treatment process would treat a portion of the plant influent flow as needed for supplemental BOD and year-round partial nitrification treatment capacity. Both effluents would normally blend before passing through the enhancement



ALTERNATIVE 1	
Process Train	Flow Capacity
TWs 1-7	2.3 mgd
Enhancement Wetlands	2.3 mgd
TW Bypass to UV	3.6 mgd
UV Disinfection	5.9 mgd

Notes:
1. Eliminate Pump Station 2 and upgrade PPS/PS1 Wet Well to allow flow by gravity from TWs 5-6.

LEGEND
- New Piping
- Existing Piping
- Normally Closed Valve

PROPOSED ALTERNATIVE 1
FLOW SCHEMATIC

FIGURE 6.1

CITY OF ARCATA
WASTEWATER TREATMENT FACILITY IMPROVEMENTS PROJECT

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wetlands and UV disinfection. The Alternative 2 flow schematic is shown in Figure 6.2.

- Alternative 3, Existing System with Parallel Treatment. This alternative provides a parallel secondary treatment process to the ponds, treatment wetlands, and enhancement wetlands. The natural system train and parallel process train would each treat a portion of the plant influent flow at variable percentages to provide a blended effluent meeting treatment objectives. The natural system would continue treating the majority of the plant influent flow up to available hydraulic and treatment capacity. The parallel process train, currently planned as oxidation ditches followed by secondary clarifiers, would provide BOD and year-round full nitrification treatment capacity to handle the remainder of the hydraulic capacity needs and to meet specific blended water quality requirements. Natural system effluent and parallel process effluent would combine prior to UV disinfection. The Alternative 3 flow schematic is shown in Figure 6.3.

6.5.1 Alternative Descriptions

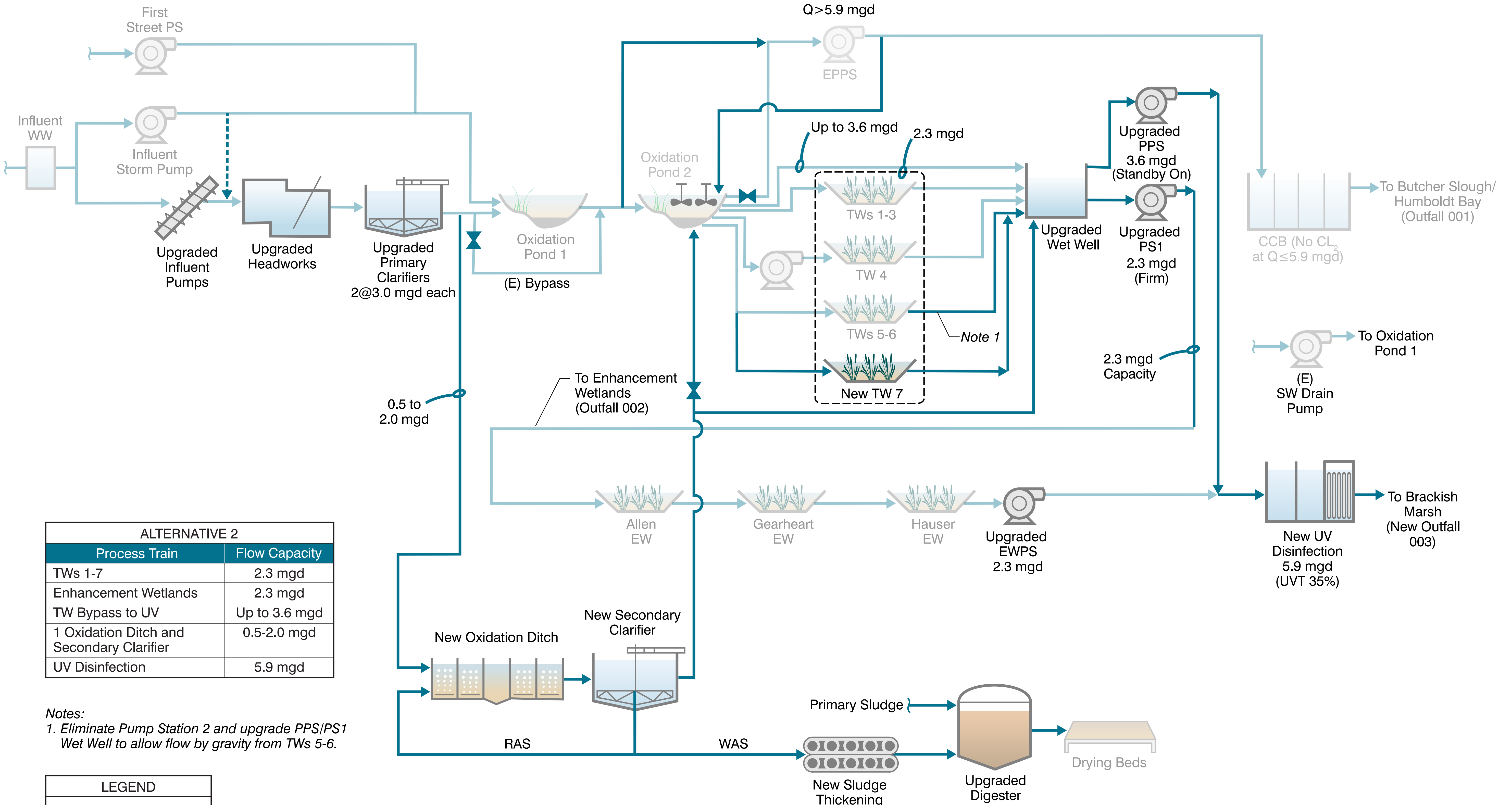
Descriptions for each project alternative are described in detail below, and a comparison of their design criteria is summarized in Appendix K.

6.5.1.1 Alternative 1 - Existing System Rehabilitation

In Alternative 1, the oxidation ponds would normally handle up to 5.9 mgd, with wet weather flows greater than 5.9 mgd stored in Oxidation Pond 1, or in an emergency, sent to the existing chlorine contact basin for disinfection and discharge through existing Outfall 001. Flow to the treatment wetlands would be limited to 2.3 mgd with new Treatment Wetland No. 7 online; flows in excess of 2.3 mgd would bypass the treatment wetlands and be blended with treatment wetlands effluent prior to being sent to the enhancement wetlands. Any excess blended flows would be routed directly to the influent side of the new UV disinfection and blended with the enhanced wetlands effluent. Disinfected effluent would be discharged through new Outfall 003.

Alternative 1 includes the following elements:

- Headworks improvements rated at 5.9 mgd.
- Replace existing primary clarifiers with two new primary clarifiers rated at 3.0 mgd each. This sizing would allow process redundancy at the design average flow condition of 2.3 mgd, with overall capacity for the design PWWF condition of 5.9 mgd. Replace existing primary sludge and scum pumps with new pumps sized for two new 3.0 mgd primary clarifiers.
- Emergency Pond Pump Station improvements, oxidation ponds improvements, Treatment Wetland Nos 1 through 4 maintenance, evaluation of Treatment Wetland No. 4 influent pumps and Pump Station 2, and enhancement wetlands improvements are recommended as previously described in Section 1.3.



ALTERNATIVE 2	
Process Train	**Flow Capacity**
TWs 1-7	2.3 mgd
Enhancement Wetlands	2.3 mgd
TW Bypass to UV	Up to 3.6 mgd
1 Oxidation Ditch and Secondary Clarifier	0.5-2.0 mgd
UV Disinfection	5.9 mgd

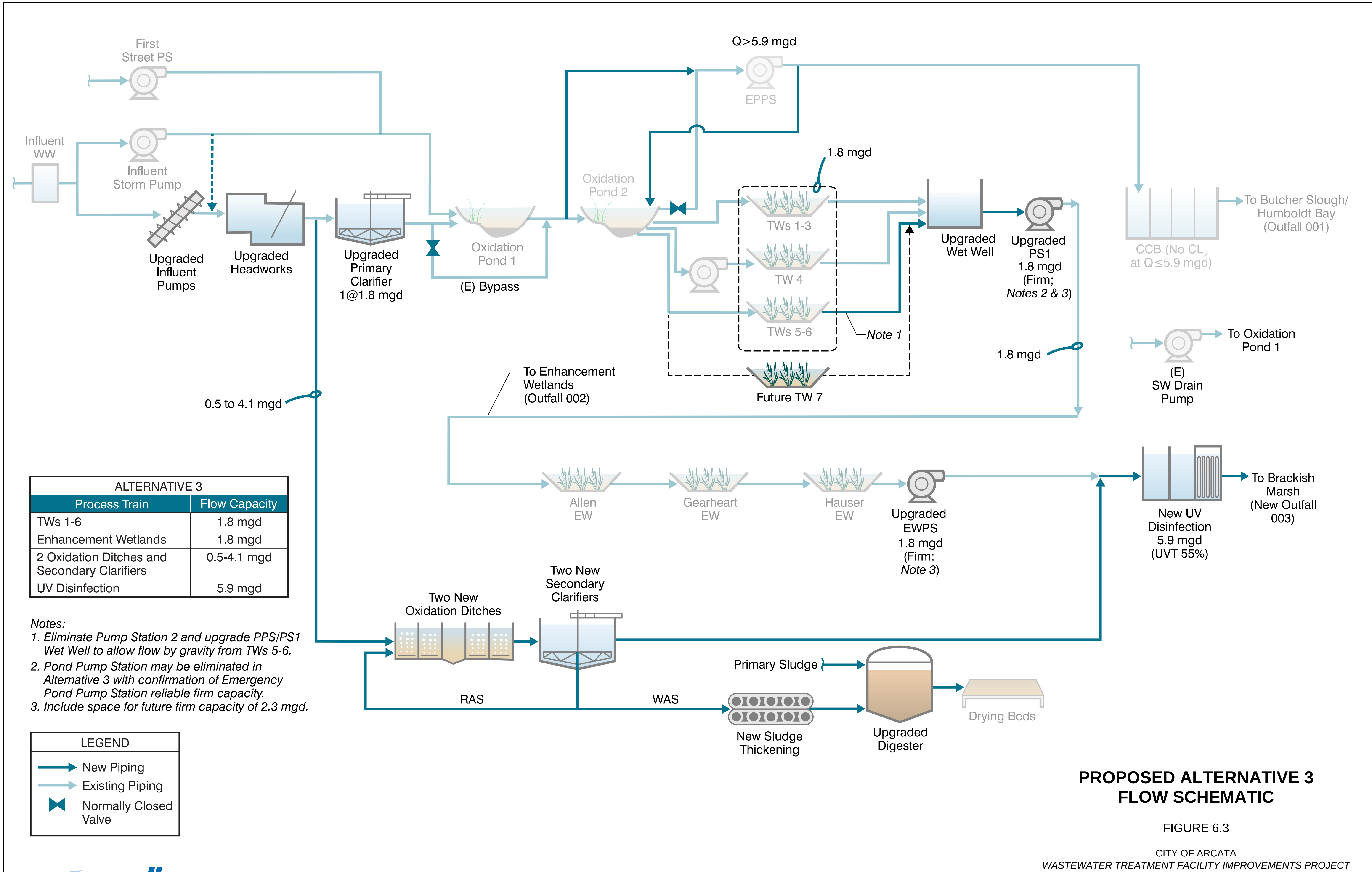
Notes:
1. Eliminate Pump Station 2 and upgrade PPS/PS1 Wet Well to allow flow by gravity from TWs 5-6.

LEGEND
- New Piping
- Existing Piping
- Normally Closed Valve

PROPOSED ALTERNATIVE 2
FLOW SCHEMATIC

FIGURE 6.2

CITY OF ARCATA
WASTEWATER TREATMENT FACILITY IMPROVEMENTS PROJECT



ALTERNATIVE 3

Process Train	Flow Capacity
TWs 1-6	1.8 mgd
Enhancement Wetlands	1.8 mgd
2 Oxidation Ditches and Secondary Clarifiers	0.5-4.1 mgd
UV Disinfection	5.9 mgd

Notes:

1. *Eliminate Pump Station 2 and upgrade PPS/PS1 Wet Well to allow flow by gravity from TWs 5-6.*
2. *Pond Pump Station may be eliminated in Alternative 3 with confirmation of Emergency Pond Pump Station reliable firm capacity.*
3. *Include space for future firm capacity of 2.3 mgd.*

PROPOSED ALTERNATIVE 3 FLOW SCHEMATIC

FIGURE 6.3

CITY OF ARCATA
WASTEWATER TREATMENT FACILITY IMPROVEMENTS PROJECT

- New Oxidation Pond No. 2 aerators are recommended to improve aeration and mixing while preventing short circuiting. The eight existing propeller-type mechanical aerators in Pond No. 1 are in poor condition and several have not been used for a number of years. New mechanical aerators (horizontal type) are recommended to be installed in Pond No. 2 to improve pond mixing, reduce short circuiting, and provide additional BOD treatment capacity of Pond No. 2 by 600 ppd.
- Construction of new Treatment Wetland No. 7 is recommended. This project would convert an existing aquaculture pond into a new 2.3-acre treatment wetland, increasing the hydraulic capacity of the treatment wetlands from 1.8 mgd to 2.3 mgd. As discussed in Chapter 4, constructing Treatment Wetland No. 7 is anticipated to increase the BOD treatment capacity of the treatment wetlands from 340 ppd to 420 ppd.
- The recommended Treatment Wetlands Pump Station 1 improvement is to replace the existing 2.3-mgd firm capacity pumps with new 2.3-mgd firm capacity pumps due to age and condition. This sizing matches the anticipated capacity of the treatment wetlands after construction of Treatment Wetland No. 7. The recommended Pond Pump Station improvement is to replace the existing 2.9-mgd firm capacity pumps with new pumps due to age and condition so that the pump station will have 3.6 mgd capacity with the standby pump running. Improvement of the combined wet well is also recommended so that Treatment Wetland Nos. 5 and 6 can flow by gravity into the pump station, eliminating Pump Station 2.
- The recommended Enhancement Wetlands (Hauser) Pump Station improvement is to replace the existing 1.2-mgd firm capacity pumps with new 2.3-mgd firm capacity pumps to match the new flow routing capacity through the enhancement wetlands. Additional pump station improvements include adding a mechanical bar screen on the pump station inlet and strainers on the discharge line.
- Upgrade and reconfiguration of the sludge digestion system is recommended to accommodate additional primary sludge associated with increasing primary clarifier capacity. Project elements will be refined during preliminary design but may include digester cover rehabilitation and digester tank modifications.
- New UV disinfection system sized for 35 percent UVT as described in Chapter 7.

6.5.1.2 Alternative 2 - Existing System with Side-stream Treatment

In Alternative 2, plant influent flow up to 5.9 mgd would be routed to the primary clarifiers before splitting to either the natural system train (oxidation ponds and treatment wetlands) or the side-stream secondary treatment train. Normally flows up to 2.3 mgd would be treated by the oxidation ponds and Treatment Wetland Nos. 1 through 7, while minimum flow (i.e. 0.5 mgd) would be treated by the side-stream secondary treatment train. Effluent from the side-stream treatment could be brought back into the treatment wetlands to take advantage of denitrification that would occur, or could be blended with treatment wetlands effluent, depending on operational needs. During pond turnover or other seasonal periods when the natural system capacity is limited, the side-stream secondary treatment train could be ramped up to handle up to 2.0 mgd. The two secondary effluents would be combined and 2.3 mgd sent to the enhancement wetlands. Any flows greater than 2.3 mgd would be blended with enhancement wetlands effluent and then disinfected with the new UV system. Disinfected effluent up to 5.9 mgd would be discharged through new Outfall 003. Wet weather flows above 5.9 mgd would be stored in Oxidation Pond 1, or in an emergency sent to the existing chlorine contact basin for disinfection and discharge through existing Outfall 001.

The facility improvements for Alternative 2 are similar to Alternative 1, with the exception of the following:

- Construct a side-stream secondary treatment process to handle the BOD treatment capacity shortfall and provide partial nitrification. Currently the recommended process for Alternative 2 is one new oxidation ditch and one new secondary clarifier sized for 2.0 mgd capacity, with the ability to turn flow down to 0.5 mgd. If Alternative 2 proceeds into Preliminary Design, the hydraulic and treatment capacity requirements can be refined.
- New Oxidation Pond No. 2 aerators are also recommended in Alternative 2 to improve aeration and mixing while preventing short circuiting, while reducing the treatment capacity required by the side-stream secondary treatment process.
- Upgrade and reconfiguration of the sludge digestion system is recommended to accommodate additional sludge associated with the new secondary treatment project. Project elements will be refined during preliminary design but may include digester cover rehabilitation, digester tank modifications, and heater/boiler upgrade.
- New secondary sludge thickening equipment will be required to accommodate additional sludge associated with the new secondary treatment project. Currently the project element includes one gravity belt thickener sized for sludge from one 2.0 mgd oxidation ditch and secondary clarifier.

6.5.1.3 Alternative 3 - Existing System with Parallel Treatment

In Alternative 3, the natural system (oxidation ponds, treatment wetlands, and enhancement wetlands) would normally handle up to 1.8 mgd year-round. The basis of this capacity is maintaining reliable year-round treatment and permit compliance based on existing design criteria and operational experience. Plant influent flow above 1.8 mgd and less than 5.9 mgd would be routed to the new parallel secondary treatment train. The two secondary effluents would be blended prior to disinfection with the new UV system and discharge through new Outfall 003. Blending proportions could be adjusted to achieve desired effluent water quality. Wet weather flows above 5.9 mgd would be stored in Oxidation Pond 1, or in an emergency sent to the existing chlorine contact basin for disinfection and discharge through existing Outfall 001.

The facility improvements for Alternative 3 are similar to Alternatives 1 and 2, with the exception of the following:

- Replace existing primary clarifiers with one new primary clarifier rated at 1.8 mgd. This sizing would match the hydraulic capacity of the treatment wetlands and enhancement wetlands without providing standby capacity, though space could be provided for future addition of a second clarifier. The primary clarifier capacity in Alternative 3 is smaller than in Alternatives 1 and 2 because oxidation ditches do not require upstream treatment with primary clarifiers. This Alternative would also replace existing primary sludge and scum pumps with new pumps sized for the new 1.8 mgd primary clarifier.
- Oxidation Pond No. 2 aerators are not required with Alternative 3.
- Construction of new Treatment Wetland No. 7 is not required as part of the 10-year CIP for Alternative 3, but is a recommended future project for overall reliability.
- For Alternative 3, the recommended Pond Pump Station improvement is to replace the existing 2.9-mgd firm capacity pumps with new 1.8-mgd firm capacity pumps. Improvement of the wet well is also recommended so that Treatment Wetland Nos. 5-6 can flow by gravity into the pump station, eliminating Pump Station 2. In Alternative 3, Treatment Wetlands Pump Station 1 may be eliminated since flows above 1.8 mgd (Treatment Wetlands hydraulic and treatment capacity) would first be routed to the parallel secondary treatment train, with peak wet weather flows above 5.9 mgd routed via the Emergency Pond Pump Station.
- For Alternative 3, the recommended Enhancement Wetlands (Hauser) Pump Station improvement is to replace the existing 1.2-mgd firm capacity pumps with new 1.8-mgd firm capacity pumps to match the flow routing capacity through the enhancement wetlands. Additional pump station improvements include adding a mechanical bar screen on the pump station inlet and strainers on the discharge line.
- New UV disinfection system sized for 55 percent UVT as described in Chapter 7.
- Construct a parallel secondary treatment process to handle the design influent BOD load and provide full nitrification for up to 4.1 mgd. Currently the recommended process for Alternative 3 is two new oxidation ditches and two new secondary clarifiers, each sized for 2.0 mgd capacity with the ability to turn flow down to 0.5 mgd. If Alternative 3 proceeds into Preliminary Design, the hydraulic and treatment capacity requirements can be refined.
- Upgrade and reconfiguration of the sludge digestion system is recommended to accommodate additional sludge associated with the new larger secondary treatment project. Project elements will be refined during preliminary design but may include digester cover rehabilitation, digester tank modifications, and heater/boiler upgrade.

- New secondary sludge thickening equipment will be required to accommodate additional sludge associated with the new secondary treatment project. Currently the project element includes one gravity belt thickener sized for sludge from two 2.0 mgd oxidation ditches and two secondary clarifiers.

6.5.2 Comparison of Alternatives

The three alternatives each have advantages and disadvantages from economic and non-economic factors. The economic factors (project cost and operations/maintenance cost) and project implementation considerations will be further discussed in Chapter 8, Capital Improvements Program. Non-economic advantages and disadvantages of the three alternatives are:

- <u>Alternative 1 - Existing System Rehabilitation</u>: BOD treatment capacity is limited in the existing natural system. Project elements to increase BOD treatment capacity include sludge removal in Ponds 1 and 2, adding aerators to Pond 2, and construction of Treatment Wetland No. 7; however, even with these improvements there will be a BOD treatment capacity shortfall with the elimination of chlorine. This would result in permit violations and mandatory minimum penalties. Increasing the growth projection from 10 to 20 percent increases the BOD treatment capacity shortfall, which will be difficult to address in Alternative 1 without an additional secondary treatment process. Furthermore, future ammonia and total nitrogen permit limits may not be met year-round with Alternative 1 without an additional nitrification process. As previously discussed, effluent discharge bypassing enhancement is a violation of permit requirements. Alternative 1 currently requires up to 3.6 mgd to bypass the Enhancement Wetlands due to capacity limitations, which does not meet permit objectives.
- <u>Alternative 2 - Existing System with Side-stream Treatment</u>: Like Alternative 1, project elements to increase natural system BOD treatment capacity in Alternative 2 include sludge removal in Ponds 1 and 2, adding aerators to Pond 2, and construction of Treatment Wetland No. 7; however, a BOD treatment capacity shortfall would be supplemented by the side-stream secondary treatment process of one oxidation ditch and one secondary clarifier. Increasing the growth projection from 10 to 20 percent increases the BOD treatment capacity shortfall, which could be addressed in Alternative 2 by increasing capacity in the oxidation ditch. Alternative 2 is anticipated to meet current permit requirements for enhancement through advanced secondary treatment with nitrification, providing full BOD treatment capacity without disinfection byproduct violations, as well as meeting future ammonia and total nitrogen permit limits year-round. However, this alternative is anticipated to be the highest capital cost as it requires the most project elements.
- <u>Alternative 3 - Existing System with Parallel Treatment</u>: In Alternative 3, sludge removal in Ponds 1 and 2 is recommended to increase natural system hydraulic capacity and BOD treatment capacity. The natural system will still provide a baseload

secondary treatment, but the addition of the parallel secondary treatment process of two oxidation ditches and two secondary clarifiers means that Pond 2 aerators would not be needed. Treatment Wetland No. 7 is still recommended for construction in the 10-year CIP to improve reliability. Increasing the growth projection from 10 to 20 percent increases the BOD treatment capacity shortfall, which could be addressed in Alternative 3 by increasing capacity in one or both oxidation ditches. Alternative 3 is anticipated to meet current permit requirements for enhancement through advanced secondary treatment with nitrification, providing full BOD treatment capacity without disinfection byproduct violations, as well as meeting future ammonia and total nitrogen permit limits year-round. This alternative is anticipated to be lower in capital cost than Alternative 2 as some project elements can be eliminated or decreased. This alternative is anticipated to require the largest footprint in the treatment plant.

- The advantages and disadvantages of the alternatives are summarized in Table 6.7.

Table 6.7 Summary of Alternative Comparison for Non-Economic Factors
Wastewater Treatment Facility Improvements Project
City of Arcata

	Criteria Scale: 1 (least favorable) to 3 (most favorable)				
Alternative	**Meets Permit (Enhancement and No Bypass)**	**Ease of O&M**	**Construct -ability**	**Reliability**	**Meets Future Ammonia Removal**
1. Existing System Rehabilitation	1	3	1	1	1
2. Existing System with Side-stream Treatment	2	1	2	2	2
3. Existing System with Parallel Treatment	3	2	3	3	3

6.6 EXPANDED ALTERNATIVE

After the facility plan was finalized in June 2016, the City met with the North Coast Regional Water Quality Control Board (RWQCB) to discuss the Facility Plan and NPDES permit requirements on June 27, 2016. In response to feedback received at that meeting from the RWQCB, additional work was identified in order to complete the facility planning phase and to guide the City in selection of a preferred project alternative. Specifically, the feedback received from the RWQCB included the following:

- Enhancement of flows up to the 5.9 mgd peak wet weather capacity is a permit requirement in accordance with the Enclosed Bays and Estuaries Policy (State Water Board Resolution No. 74-43).
- The City will receive ammonia limits in the next NPDES permit in 2017. The RWQCB indicated that limits similar to those given to Eureka would be likely.

- Bypass of wet weather flows is an issue requiring further consideration.

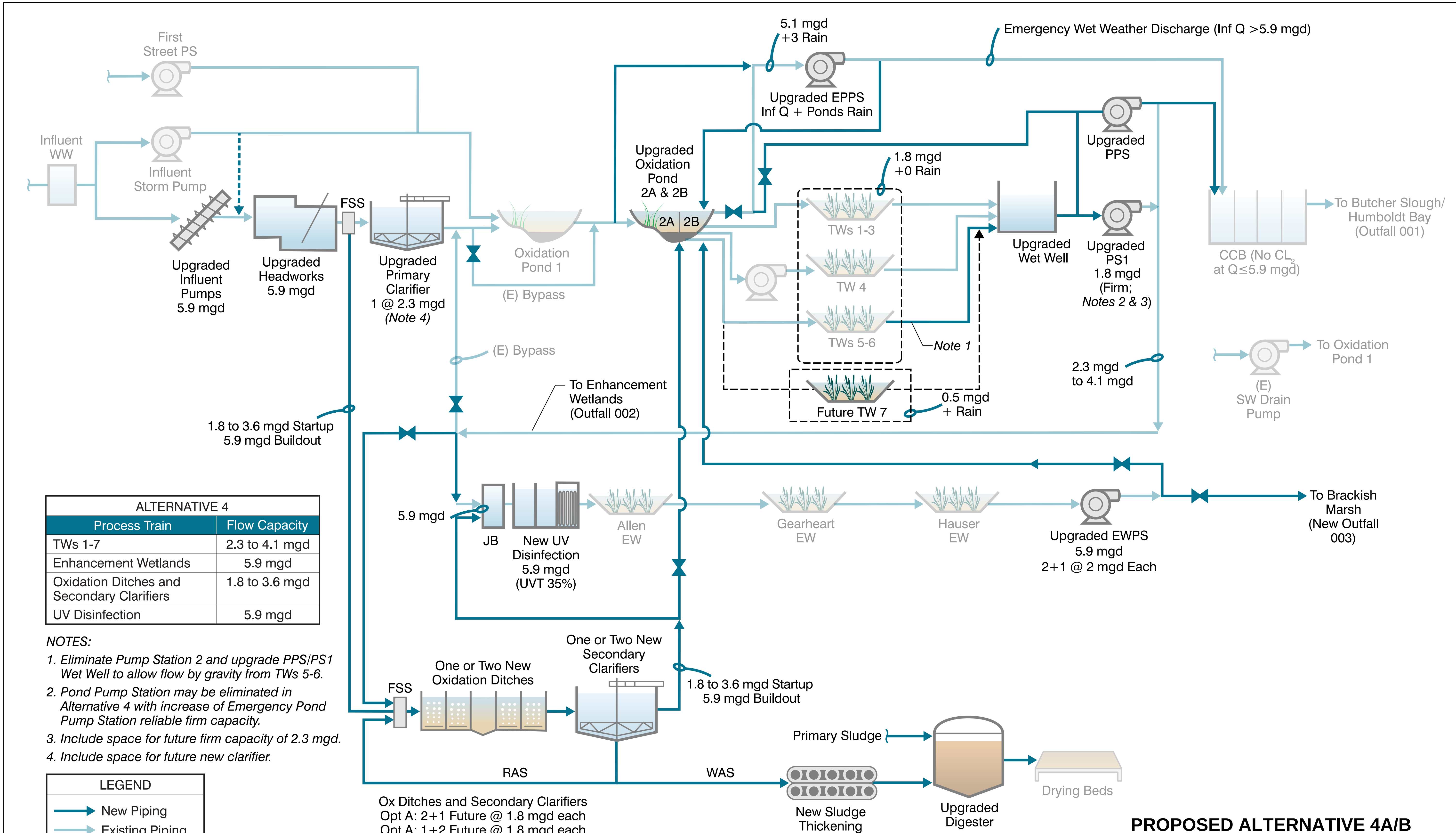
Accordingly, a new project Alternatives No. 4, was developed, to meet these additional objectives. Based on the feedback by the RWQCB, the original Alternatives 1-3 would not meet the requirements anticipated in the new NPDES permit.

6.6.1 Alternative 4 Upgraded Existing System with Parallel Treatment

This alternative provides both an upgrade to the existing pond / wetland treatment system and a parallel secondary treatment process. The natural system train and parallel process train would each treat a portion of the plant influent flow at variable percentages to provide a blended effluent meeting treatment objectives. The natural system would continue treating the majority of the plant influent flow up to available hydraulic and treatment capacity. The parallel process train, currently planned as oxidation ditches followed by secondary clarifiers, would provide BOD and year-round full nitrification treatment capacity to handle the remainder of the hydraulic capacity needs and to meet specific blended water quality requirements. Natural system effluent and parallel process effluent would combine prior to UV disinfection. The Alternative 4 flow schematic is shown in Figure 6.4.

The following assumptions for Alternative No. 4 were made:

- All flows up to 5.9 mgd will be routed through the Enhancement Wetlands. Hydraulic optimization of flow routing through the Enhancement Wetlands may be accomplished in parallel mode rather than the existing series mode, which will be further evaluated during preliminary design.
- The City will need to comply with year-round ammonia effluent discharge limits in the next NPDES permit in 2017. Assumed that limits will be similar to City of Eureka's that were adopted in June 2016: average monthly total ammonia nitrogen of 4.1 mg/L, and maximum daily total ammonia nitrogen of 10 mg/L.
- Emergency wet weather discharge for flows above 5.9 mgd needs to be addressed.
- Currently permitted facility design instantaneous peak wet weather flow of 16.5 mgd needs to be addressed.
- Rainfall accumulation and discharge for the natural system (oxidation ponds, treatment wetlands, and enhancement wetlands) needs addressed.
- Locating the new UV Disinfection System upstream of the Enhancement Wetlands is preferred, for the following reasons:
  - Moves point of compliance upstream of the Enhancement Wetlands; split compliance or a phased approach may need to be considered. Limited ability to perform maintenance in the Enhancement Wetlands as Waters of the State could diminish future water quality (and hence UV disinfection capability).
  - Facility hydraulic profile starting at the headworks could be lowered (construction and operations and maintenance [O&M] cost savings).



ALTERNATIVE 4	
Process Train	**Flow Capacity**
TWs 1-7	2.3 to 4.1 mgd
Enhancement Wetlands	5.9 mgd
Oxidation Ditches and Secondary Clarifiers	1.8 to 3.6 mgd
UV Disinfection	5.9 mgd

NOTES:

1. *Eliminate Pump Station 2 and upgrade PPS/PS1 Wet Well to allow flow by gravity from TWs 5-6.*
2. *Pond Pump Station may be eliminated in Alternative 4 with increase of Emergency Pond Pump Station reliable firm capacity.*
3. *Include space for future firm capacity of 2.3 mgd.*
4. *Include space for future new clarifier.*

LEGEND

- New Piping
- Existing Piping
- Normally Closed Valve

PROPOSED ALTERNATIVE 4A/B FLOW SCHEMATIC

FIGURE 6.4

CITY OF ARCATA
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- Flow configuration requires shorter flow routing with one bridge crossing (not two), resulting in construction and O&M cost savings.

- Recently collected plant UVT data suggests that UVT of Treatment Wetlands effluent is anticipated to be lower than originally thought (35 percent in Alternative 4; 55 percent in Alternative 3).

6.6.2 Alternative 4 Development

Alternative 4 was developed to meet the requirements of the RWQCB, and the assumptions listed above. During follow-up review with the City and AMRI, this alternative was further developed to allow for phased implementation depending on the level of treatment provided by upgrades proposed for the exiting oxidation ponds.

6.6.2.1 Oxidation Pond Upgrades

As part of the development of Alternative 4, the City conducted an independent review of the oxidation pond's ability to meet the future discharge requirements. The review was conducted by a pond treatment expert with the purpose to study potential upgrades of the existing ponds to address the expected requirements of the RWQCB. The Pond Improvements study is included in Appendix U. The main recommendations from the study are outlined below:

- Pond 1 can be used for wet weather equalization. Facilities should be installed to control the depth in Pond 1.
- Pond 2 should be divided into 2 cells of equal volume and designed as partial mix aerated ponds. A baffle wall between the two sections would reduce short circuiting. The concept proposed in the review was to divide the ponds diagonally using interlocking plastic sheet pile. The influent section (2A) would be in the southwest portion of pond 2 section, and the effluent section would be in the northeast section.
- Aerators would be added to Pond 2A and 2B. The concept proposed in the review was to install ten 15 HP aerators in each section of pond 2 for a total of 300 HP. The aerators would be operated to maintain dissolved oxygen in the ponds.
- Provide alkalinity addition for the pond process to meet the requirements of ammonia removal (nitrification). Pond pH should be maintained at 7 in Pond 2A/2B using the alkalinity addition.

The recommended aeration would provide the ability to meet permit limits during low flow months, but may be compromised during higher wet weather flows and colder months. The report noted that predicted ammonia removal, between 4 to 6 mg/l, could be achieved at 2.3 mgd at temperatures down to 6 degrees C. Therefore the recommended pond improvements have some risk in meeting a permit requirement of 4 mg/L.

The exact configuration of the pond improvements will be finalized during the design phase of the project, although enough detail was developed in order to develop budget costs for the recommended improvements. In addition, the original pond improvements including removal of pond solids, and transfer structure modifications are still required.

6.6.2.2 Alternative 4 Elements

In Alternative 4, the natural system (oxidation ponds, treatment wetlands, and enhancement wetlands) would normally handle dry weather flows of 1.8 mgd and up to 2.3 mgd during peak wet weather flows. The basis of this capacity is maintaining reliable year-round treatment and permit compliance based on existing design criteria and operational experience. Plant influent flow above 2.3 mgd and less than 5.9 mgd would be routed to the new parallel secondary treatment train. The two secondary effluents would be blended prior to disinfection with the new UV system and discharge through new Outfall 003. Blending proportions could be adjusted to achieve desired effluent water quality. Wet weather flows above 5.9 mgd would be stored in Oxidation Pond 1, or in an emergency sent to the existing chlorine contact basin for disinfection and discharge through existing Outfall 001.

The proposed elements and flow schematic for Alternative 4 are shown in the Figure 6.4. During the development of this alternative it was decided to phase the construction of alternative 4, into Phase 4A and 4B.

The main features of Alternative No. 4 are outlined below:

- Headworks replacement rated at 5.9 mgd.
- Replace existing primary clarifier with a new unit rated at 2.3 mgd. In addition, space will be reserved for a future unit.
- Upgraded oxidation pond 2 as outlined above, including the creation of 2 partial mixed aerated cells.
- Emergency pond pump station improvements including piping to pump out pond 1 prior to wet weather.
- Construction of Treatment Wetlands No.7.
- Upgrades to pond pump station and pump station 1 to provide capacity and replace aging pumps.
- Construct a parallel secondary treatment process, in two phases:
  - Phase 4A would include one oxidation and secondary clarifier sized for a raw sewage flow of 1.8 mgd.
  - Phase 4B would include a second oxidation and secondary clarifier sized for a raw sewage flow of 1.8 mgd.
  - The size of the Phase 4B treatment capacity could be adjusted based on the results of the pond improvements and the ability of the ponds to meet permit limits.

- New UV disinfection system sized for a flow of 5.9 mgd at 35 percent UVT, as described in Chapter 7.
- Upgrades to the digesters, similar to alternative 3.
- New secondary sludge thickening equipment as noted in alternative 3.
- New or upgraded enhancement wetland pump station sized for a flow of 5.9 mgd. Pump station would pump directly to the new brackish marsh (outfall 003).

6.6.2.3 Alternative 4 Phasing

The development of Alternative 4 considered phasing of the alternative to reduce the initial capital costs and increased operating costs. Phase 4A would include all the improvements except only one oxidation ditch and secondary clarifier would be constructed. Provisions would be included to add a second oxidation ditch and secondary clarifier in Phase 4B. The phased approach would allow the City to complete the upgrades to the existing oxidation ponds, then quantify the treatment capacity of the upgraded oxidation ponds.

6.6.2.4 Alternative 5

Alternative 5 was developed to provide the City with the costs for an alternative to Alternative 4 that did not include pond modifications. It is based on three oxidation ditches and secondary clarifiers. This alternative was not considered, and was developed only for comparison of capital and operating costs.

6.6.3 Comparison of Alternative 3 and 4

A comparison of expanded Alternative 4 with the original Alternative 3 (with two oxidation ditches and two secondary clarifiers) is outlined in Table 6.8.

The three main difference between Alternative 3 and 4 include:

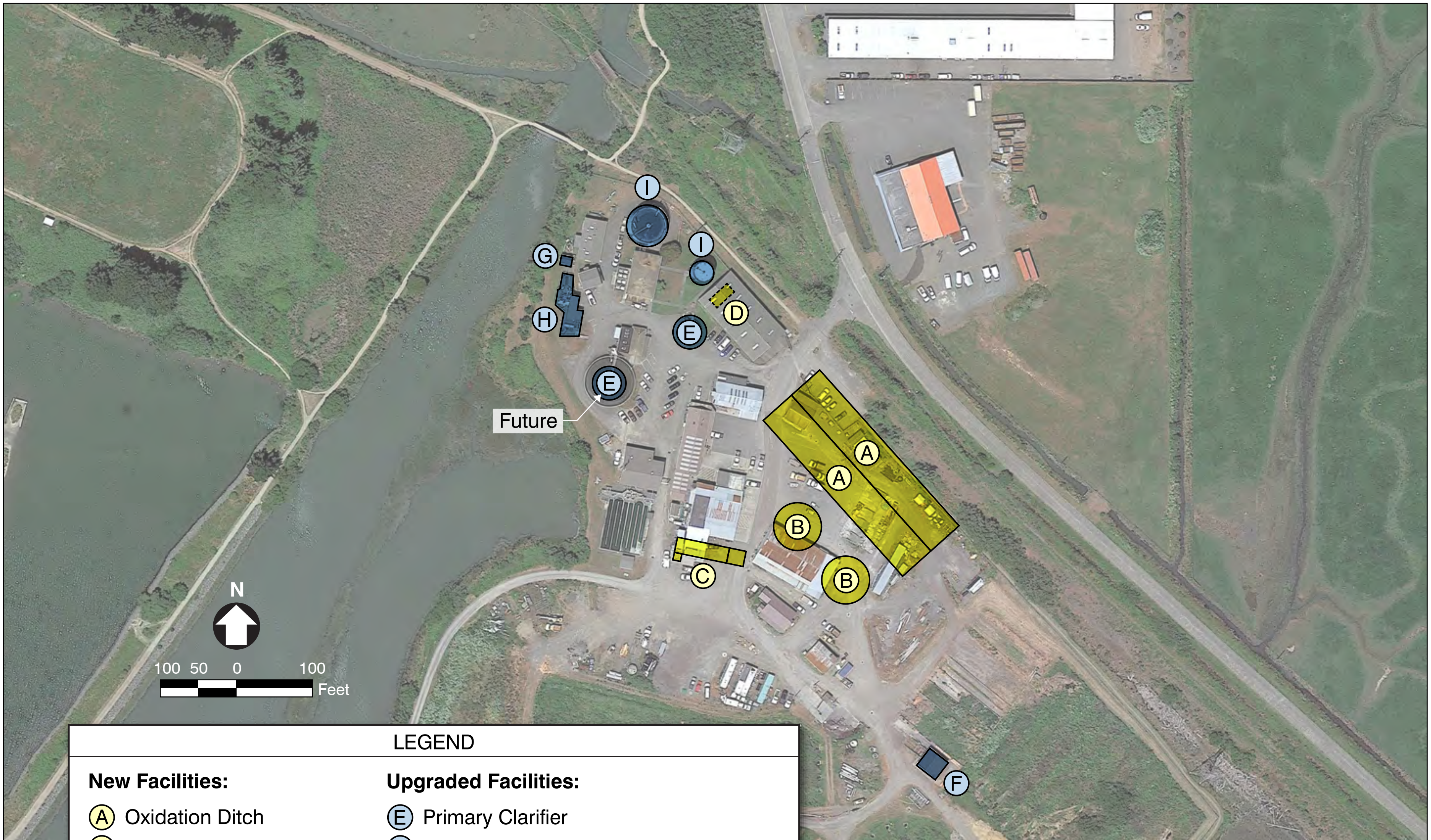
- Oxidation pond improvements in Alternative 4 are substantial in terms of costs, both capital and maintenance.
- UV system in Alternative 4 would be designed for lower UVT and higher dose, increasing costs.
- Enhancement wetlands pump station in Alternative 4 would be sized for flows up to 5.9 mgd.

Alternative 3 and 4 are anticipated to require the largest footprint in the treatment plant. A conceptual facilities site plan for these alternative is shown in Figure 6.5.

Table 6.8 Comparison of Alternative 3 and 4 Elements
Wastewater Treatment Facility Improvements Project
City of Arcata

Process Area	Alternative 3 Design Criteria	Alternative 4 Design Criteria	Advantages	Disadvantages	Comment
Oxidation Pond Improvement	Not required	Aerators sized for BOD and ammonia removal (300 HP)	Increase the ability to meet ammonia removal requirements.	Higher power costs and higher maintenance costs	Improvements may still not meet permit requirements year round
Oxidation Ditches and Secondary Clarifiers	0.5 to 4.1 mgd	1.8 to 3.6 mgd	Ability to meet anticipated year-round ammonia removal requirements	Larger footprint; Higher construction cost	Element will be phased
UV Disinfection	55% UVT; 35 mJ/cm^2 (1)	35% UVT; 50 mJ/cm^2 (1)	Keeps UV at plant; ability to meet disinfection requirements at all blending ratios	Larger footprint (additional lamps); Higher construction and O&M cost	Higher dose anticipated with higher pond to oxidation ditch blending ratio
Primary Clarifiers	1.8 mgd	2.3 mgd	Provides capacity up to treatment capacity of Treatment Wetlands (after future No. 7 online)	Larger footprint; Higher construction cost	Maintain space for a second redundant unit in future
Enhancement Wetlands (Hauser) Pump Station	1.8 mgd	5.9 mgd + Rainfall	Meets requirements of Enclosed Bays and Estuaries Policy and provides wet weather discharge	Larger footprint (additional pumps); Higher construction and O&M cost	Design for future sea level rise
Pump Station 1	1.8 mgd	Up to 2.3 mgd + Rainfall	Provides discharge capacity up to treatment capacity of Treatment Wetlands and wet weather discharge	Larger footprint (additional pumps); Higher construction and O&M cost	Will no longer pump directly to Chlorine Contact Basin
Emergency Pond Pump Station	Not evaluated	Influent flow to Natural System + Rainfall	Allows for wet weather storage in Oxidation Pond No. 1 and emergency wet weather discharge	Larger footprint (additional pumps); Higher construction and O&M cost	Emergency wet weather discharge via Chlorine Contact Basin and Outfall 001 only for flows > 5.9 mgd

Note:
(1) Additional analysis required to confirm that dose meets virus reduction concerns of RWQCB. Plant UVT data should continue to be collected and any seasonal variations, including differences in Enhancement Wetlands effluent and Treatment Wetlands effluent, should continue to be monitored.



LEGEND

New Facilities:

- (A) Oxidation Ditch
- (B) Secondary Clarifier
- (C) UV System and Effluent PS
- (D) Gravity Belt Thickener

Upgraded Facilities:

- (E) Primary Clarifier
- (F) Pond Pump Station and Pump Station 1
- (G) Influent Storm Pump
- (H) Influent Pumps and Headworks
- (I) Digester and Sludge Dewatering

Note: Alternative 3 shown due to largest facility footprints required.

CONCEPTUAL FACILITIES SITE PLAN

FIGURE 6.4

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The City developed an aerial view of the Alternative 4 facilities that outline the area of the existing corporation yard that would be used for the new parallel secondary treatment facilities. This is shown on Figure 6.6.

Figure 6.6 Conceptual Aerial View of Improvements. (From City of Arcata)

The costs of these alternatives are outlined in Chapter 8.

DISINFECTION SYSTEM EVALUATION

7.1 INTRODUCTION

This chapter provides an overview of the existing and proposed disinfection facilities at the Arcata Wastewater Treatment Facility (AWTF) and includes the following:

- Existing facilities description summarizing the general function and configuration of the chlorine and sulfur dioxide disinfection/dechlorination facilities at the AWTF.
- Proposed ultraviolet (UV) light disinfection facility evaluation and design criteria for the two treatment system alternatives.
- Summary and recommendations for the proposed UV disinfection system.

7.2 BACKGROUND

The City of Arcata operates the AWTF, which consists of headworks with screening and grit removal, primary clarification, oxidation ponds and treatment wetlands secondary treatment and polishing enhancement wetlands. Discharges from the AWTF are currently regulated by the National Pollutant Discharge Elimination System (NPDES) Order No. R1-2012-0031, which became effective on August 1, 2012, and will expire on July 31, 2017.

The beneficial uses of the receiving bay include habitat for shorebirds, waterfowl, raptors, and migratory birds, oyster farming, and recreational use. The complete list of beneficial uses is included in the NPDES Permit, Appendix A Table F-3 (Facility Plan Appendix A).

The existing secondary effluent is first disinfected and then discharged to the enhancement wetlands, then returned to the plant for a second disinfection step before discharge to Humboldt Bay (Outfall 001). The discharge permit outlines a disinfection and flow configuration upgrade that is based on a once-through flow system, with UV disinfection following the enhancement wetlands, and then discharge to a new discharge point at the brackish marsh (Outfall 003).

7.3 PURPOSE

The purpose of this evaluation is to provide a description of alternative UV effluent disinfection systems including sizing, equipment selection, conceptual layout, construction, and operation costs, and proposed implementation plan. The existing chlorine disinfection system is also described, and the impact on effluent treatment is outlined. The alternative disinfection projects are included in Chapter 6 and the capital improvements program described in Chapter 8 of this report.

7.4 DESIGN CRITERIA

The effluent disinfection system design criteria based on the current NPDES permit are listed In Table 7.1. The effluent limitations for fecal coliform bacteria at new Outfall 003 to Humboldt Bay were retained from the previous permit. These limitations, which are described below, reflect water quality objectives for bacteria established by the Basin Plan for protection of shellfish harvesting areas. The Basin Plan criteria are based on recommendations of the National Shellfish Sanitation Program for shellfish growing areas that are affected by point source discharges.

The NPDES permit requires that treated wastewater discharged to Humboldt Bay meet the following fecal coliform bacteria criteria:

- The median fecal coliform concentration shall not exceed a Most Probable Number (MPN) of 14 organisms per 100 mL in a calendar month.
- Not more than 10 percent of samples collected in a 30-day period shall exceed an MPN of 43 organisms per 100 mL.

Table 7.1 UV Effluent Disinfection System Design Criteria
Wastewater Treatment Plant Improvements Project
City of Arcata

Indicator Organism	Unit	Value
Fecal coliform	MPN/100 ml	14$^{(1)}$, 43$^{(2)}$
Flow		
Annual average dry weather	mgd	2.3
Average wet weather$^{(3)}$	mgd	5.0
Maximum month$^{(3)}$	mgd	5.9
Peak hour wet weather$^{(4)}$	mgd	16.5

Notes:
(1) Monthly Median.
(2) Not more than 10% of samples collected in a 30-day period shall exceed 43 MPN/100mL.
(3) UV effluent disinfection system capacity limit.
(4) Overall facility capacity limit including storage, UV disinfection, and wet weather discharge system.

7.5 EXISTING DISINFECTION SYSTEM

Treatment equivalent to secondary treatment is accomplished using two oxidation ponds followed by six treatment wetlands. Detention time in the AWTF, prior to Allen, Gearheart and Hauser enhancement wetland, is approximately 40 days during average dry weather design flow periods when the system is well-maintained. Currently, effluent is disinfected with chlorine and dechlorinated with sulfur dioxide prior to discharge. Under the existing AWTF configuration, treated effluent from the AWTF can be combined with effluent from the AMWS, disinfected, and split, flowing by gravity either to Humboldt Bay or again through the AMWS. The result is disinfected secondary effluent, but not all effluent receives the benefit of enhanced wetland treatment through the AMWS before discharge to Humboldt Bay. In this mode of disinfection, effluent may actually be chlorinated multiple times, increasing the opportunity to form disinfection byproducts at levels above water quality objectives.

The existing disinfection system, including chlorine (Cl_2) gas disinfection followed by sulfur dioxide (SO_2) gas dechlorination, was constructed in 1984. Two banks of three one-ton Cl_2 gas cylinders are connected in parallel to provide a duty and standby supply of Cl_2 gas for disinfection. The chlorine gas feeders receive both a flow and residual signal for gas pacing and control. Gas induction units installed at the chlorine contact basin provide vacuum to transfer gas to the wastewater flow while providing mixing.

The 2003 plant evaluation (SHN 2003) noted that the system was near its maximum capacity to handle peak wet weather flows. At that time, measures were recommended to reduce chlorine use. It was noted that any capacity increases or upgrades of the existing gas systems would trigger the need to comply with current National Fire Protection Association (NFPA) standards.

7.5.1 Chlorine Contact Basin

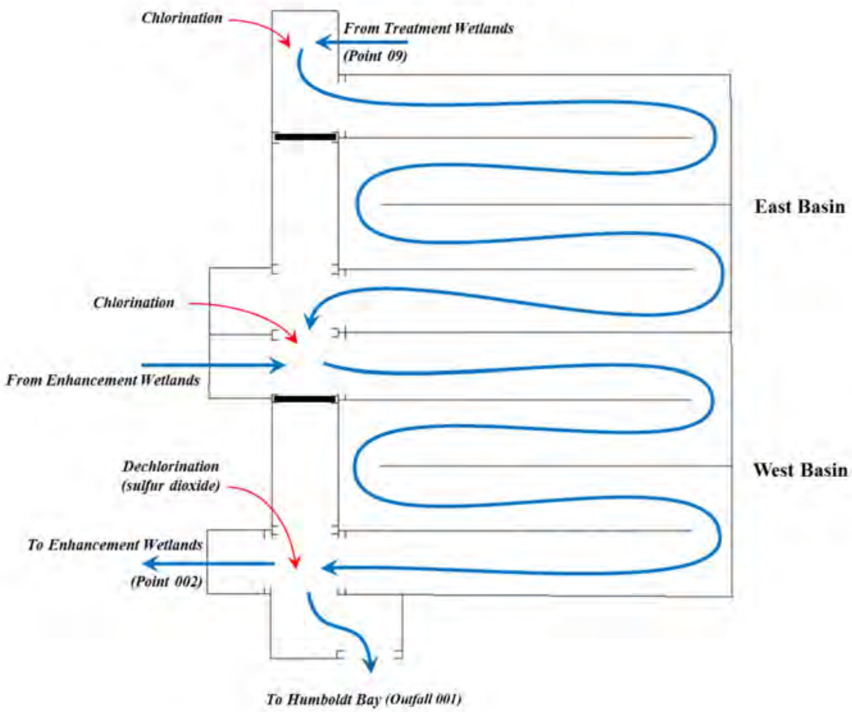
The existing disinfection system includes a chlorine contact basin (CCB) constructed in 1984. The basin can operate as one or two tanks, labelled the east and west basins in the plant O&M manual. The approximate volume for each basin is 185,400 gallons. The detention time at 2.3 million gallons per day (mgd) is listed as 58 minutes, while the detention time at 5.9 mgd is listed as 30 minutes.

The plant operates the basin in two modes: Split or Combined Mode, which is shown schematically in Figure 7.1.

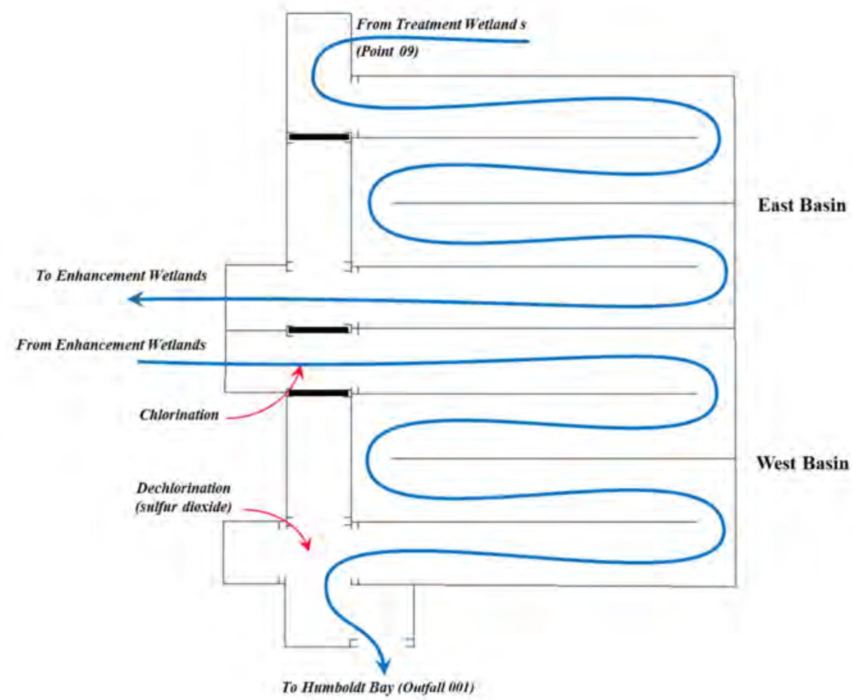
In the combined mode, flow from the treatment wetlands enter the east side, and is dosed with chlorine at the entrance to this first section. The flow then joins with the flow returned from the enhancement wetlands, mixed, and dosed a second time with chlorine. The combined flow is dechlorinated, then is split to return a portion of the flow to the enhancement wetlands, with the rest of the flow going to discharge through Outfall 001.

In split mode, flow from the treatment wetlands enters the east side, is not dosed with chlorine, and then goes to the enhancement wetlands. The return flow from the enhancement wetlands is dosed with chlorine for a first time as it enters the west basin section, then goes through the basin, is dechlorinated, and discharged to Outfall 001.

The combined mode is the normal operating mode, especially when flows exceed the capacity of the enhancement wetlands effluent pump station. This mode is especially important during wet weather flows. The split mode is used during low flows, or dry



COMBINED MODE



SPLIT MODE

CHLORINE CONTACT BASIN OPERATIONAL MODES

FIGURE 7.1

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weather. It has the advantage of reducing the chlorine usage to the amount needed to disinfect the flow at Outfall 001 and reducing the potential formation of disinfection by-products.

7.5.2 Chlorine and Sulfur Dioxide Use and Impact

The AWTF currently uses approximately 225 pounds per day (ppd) of chlorine and 160 ppd of sulfur dioxide for disinfection and dechlorination, based on 2014 data. The daily average chemical use by month for the last 5 years is included in Appendix L. Chlorination also appears to impact water quality by reducing effluent BOD and suspended solids. Information from the City and AMRI indicate that at times the BOD reduction can range from 700 to 1400 ppd.

7.6 PROPOSED ULTRAVIOLET LIGHT DISINFECTION

Ultraviolet (UV) light disinfection has been proposed for the AWTF discharge based on a series of pilot tests conducted by the City and the Arcata Marsh Research Institute (AMRI). The current Waste Discharge and NPDES permit provides general requirements for replacing the existing chlorination disinfection system with a UV system. The proposed UV system design requirements for the three project alternatives are outlined in this Section.

7.6.1 UV System Sizing Criteria

The UV system sizing criteria is listed in Table 7.2. The basis for the dose is outlined below:

7.6.1.1 Design UVT

A design UVT of 35 percent was originally recommended for the UV system sizing based on a review of the available data collected to date. The original pilot UVT data is summarized in the project memorandum included in Appendix M. The UVT may seem low compared to filtered secondary effluent, but is consistent with effluent expected from other wetlands or natural systems.

Plant staff purchased a UVT meter in April 2015 and started to collect UVT data across the plant including the treatment and enhancement wetlands effluents. It was recommended that UVT sampling be continued to establish a long term history of UVT. This is especially important because it was projected that the UVT would vary seasonally. Based on the longer detention times during summer dry weather flows, it was thought that the effluent would have lower UVT levels as more organic materials decay in the wetlands and release humic type compounds. In the winter it was thought that the organic material would be diluted with rain water that falls on the system. The lower detention times due to the higher wet weather flows may also reduce the concentration of material.

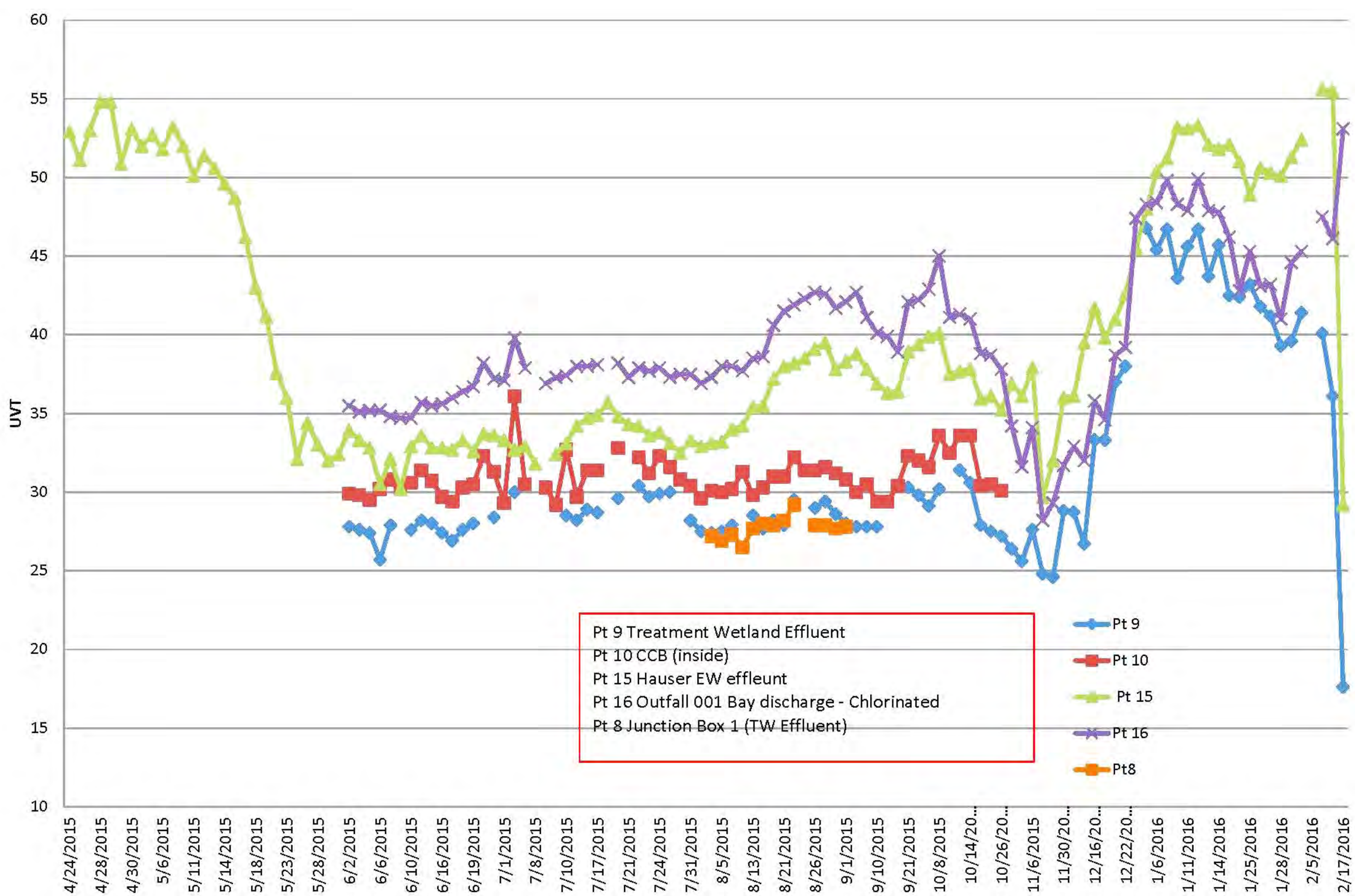
Table 7.2 UV System Sizing Design Criteria
Wastewater Treatment Plant Improvements Project
City of Arcata

Indicator Organism	Unit	Value
Fecal coliform(1)	MPN/100 mL	14(2), 43(3)
Flow		
Annual average	mgd	2.3
Maximum month(4)	mgd	5.9
UV Transmittance (UVT)		
Alternatives 1, 2, and 4	%	35
Alternative 3	%	55
Dose(5)		
Alternatives 1 and 2	mJ/cm^2	Minimum T1 dose: 17 mJ/cm^2. Minimum MS2 dose: 35 mJ/cm^2 (6).
Alternative 3 and 4	mJ/cm^2	Minimum T1 dose: N/A (7). Minimum MS2 dose: 50 mJ/cm^2 (6).

Notes:
(1) Shellfish Harvesting Waters, EPA Quality Criteria for Water, 1986.
(2) Monthly Median.
(3) Not more than 10% of samples collected in a 30-day period shall exceed the listed value.
(4) UV facility capacity.
(5) The typical recommended test organism used for validating UV systems is MS2 coliphage (MS2) to mimic polio virus; however, using MS2 validation data for disinfection of bacteria results in potential under dosing since bacteria (coliforms) react differently to UV disinfection than MS2. Some UV manufacturers have performed validation work using proven bacteria surrogates such as T1 coliphage (T1).
(6) Additional analysis required to confirm that dose meets virus reduction concerns of RWQCB.
(7) Fecal coliform reduction required for Alternative 3 may exceed reliable T1 validation reduction.

The data collected to date is shown in Figure 7.2. In general, the pond/wetland system UVT is fairly low, around 30 to 35 percent in the dry months, and around 45 to 55 percent in the wet months. The higher UVT may possibly be due to dilution of the soluble humic material which would raise the UVT in the wet months.

An alternative UV system design has been proposed for Alternative 3 based on a blended effluent concept, where the lower wetland effluent (UVT 35%) would be blended with the higher oxidation ditch secondary treatment process effluent (estimated UVT of 65%). The blending is envisioned during the dry weather, lower flow periods of the year. The resulting blended effluent UVT is estimated at a minimum of 55 percent. The other design criteria including the peak flow of 5.9 million gallons per day (mgd), a dose of 35 millijoules per square centimeter (mJ/cm^2), with 50 percent redundancy, remain the same. The higher UVT results in a reduction in lamps from 528 to 336 and a corresponding reduction in power demand from 136 to 84 kW.



UVT DATA

FIGURE 7.2

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As noted in Chapter 2, at the June 27, 2016 meeting with the RWQCB, UV disinfection design criteria was proposed to be based on a minimum UVT of 35 percent regardless of the Alternative.

7.6.1.2 Design Dose

The selection of the design UV dose is outlined below. The current permit lists the required minimum dose as 50 mJ/cm^2 which was may have been based on protection of the bay oyster farming operation. The first criterion for a design dose is that the discharge must provide bacteria reduction, specifically to meet the fecal coliform level required in the discharge permit. In an initial meeting with the RWQCB, Arcata City staff, LACO and Carollo (June 23, 2015), RWQCB staff indicated a specific concern about virus kill. The discussion focused on the disinfection of coliphage, but without any specific effluent target. In the meeting with the RWQCB on June 27, 2016, there was discussion about a future virus reduction requirement. Virus reduction would require a higher design UV dose than for bacteria reduction alone. The City will need additional input from the State (RWQCB and Division of Drinking Water) on the design dose and disinfection objectives during preliminary design. The design dose discussion that follows is based on the current permit requirement for bacteria (fecal coliform) reduction. Design dose will need to be revised during preliminary design when additional information is provided by the State.

To properly size a UV system, the dose must be determined for each target organism (bacteria and/or virus, in this case). Different organisms (e.g., bacteria, virus, and protozoa) have measurably different sensitivities to UV disinfection. For example, viruses tend to be more resistant to UV disinfection than bacteria. Much of the UV system validation work that has been completed to date has been for water reuse applications in California, where virus inactivation is the primary goal. For these applications, the ideal and recommended test organism is MS2 coliphage (MS2); however, using MS2 validation data for disinfection of bacteria results in potential under dosing since bacteria (coliforms) react differently to UV disinfection than MS2. Some manufacturers (Calgon Carbon, Ozonia, and Wedeco) have performed validation work using proven bacteria surrogates such as T1 coliphage (T1). For cases where manufacturers have not validated their system based on T1, MS2 validations can be allowed with some degree of conservatism. To account for the difference between the dose-response curves of the organisms, higher dose levels will be specified for systems validated with MS2. Based on systems that have been validated by Carollo using both MS2 and T1, the ratio between the two varies depending on the UVT and the reactor efficiency.

Figure 7.3 below shows the MS2/T1 dose ratio for two different UV reactors that range between 1.63 and 2.06 at this project's design UVT of 35 percent. For the higher MS2/T1 ratio of 2.06, a T1 dose of 1.0 mJ/cm^2 is equivalent to an MS2 dose of 2.06 mJ/cm^2.

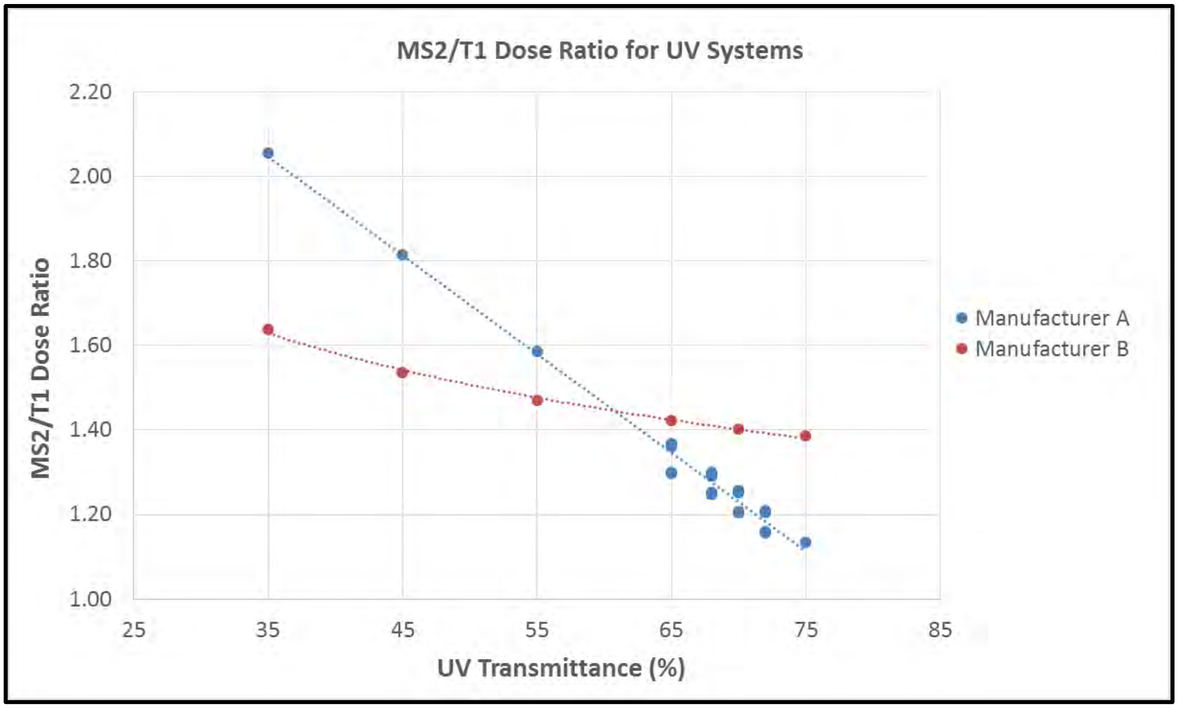


Figure 7.3 MS2/T1 Dose Ratio For UV Systems

The first step is to address the permit limits. The permit requirement for this project is a median fecal coliform concentration that should not exceed 14 MPN per 100 ml on a monthly basis and a daily limit that should not exceed more than 10 percent of samples exceeding 43 MPN per 100 mL. Previous UV studies of the Arcata Marsh have indicated the maximum marsh effluent fecal coliform concentration is in the 10,000 MPN per 100 mL range. Therefore, the UV system is required to provide a minimum 2.85 log reduction of fecal coliform to meet the permit limit of 14 to treat effluent from the natural system (Alternatives 1 and 2). Typically, Carollo's recommended sizing approach is to design a UV system to disinfect fecal coliform to approximately one log below the permit limit; however, due to this project's already low permit limit, a half log will be added as a safety factor. This level of conservatism has worked well for our clients and provides plant staff greater flexibility when operating the UV system.

Using T1 as a surrogate for fecal coliform, and knowing that T1 has a similar UV sensitivity as fecal coliform, the proper dose for 2.85 log reduction of coliform can be determined. T1 has a UV sensitivity of 5 mJ/cm^2/log inactivation; a fecal coliform log inactivation of 3.35 (2.85 + 0.50 safety factor) thus represents a T1 dose of 16.75 mJ/cm^2. Converting this T1 dose to a MS2 dose using the MS2/T1 ratio of 2.06 from above, the validated MS2 dose will be 34.5 mJ/cm^2. Therefore, the specified MS2 dose for an equivalent log inactivation of fecal coliform is 35 mJ/cm^2.

For Alternative 3, a similar dose analysis is required for blended effluents from the natural system and the oxidation ditch/secondary clarifier treatment train. The fecal coliform concentration from the oxidation ditch/secondary clarifier effluent may be as high as

2,000,000 MPN per 100 mL range. Depending on the blending ratio, a typical fecal concentration from the blended effluents might be 1,000,000 MPN per 100 mL with a UVT of 50 to 55%. The dose analysis for this scenario results in a fecal coliform log inactivation of 5.35 (4.85 plus 0.50 safety factor) for a T1 design dose of 27.11 mJ/cm^2. However, T1 validation is generally limited to 5 log inactivation as anything above this is not reliable. Hence, for Alternative 3 an equivalent MS2 design dose of 50 mJ/cm^2 is specified.

The second step of the dose analysis is to address the RWQCB concerns regarding virus kill. As part of preliminary design, the dose necessary to reduce indigenous virus (measured as coliphage) in the UV effluent should be determined. This would be done with a collimated beam test on the Arcata enhancement marsh effluent, at dose values dependent on the desired test organism. There are two types of native coliphage in effluent, F-specific and somatic). F-specific (F+) coliphage has a similar UV sensitivity to MS2; therefore, recommended dose levels are 0, 5, 10, 15, 20, 30 and 40 mJ/cm^2. Somatic coliphage has a similar UV sensitivity to T1; therefore, recommended dose levels are 0, 2.5, 5, 7.5, 10, 15 and 20 mJ/cm^2.

7.6.1.3 <u>Equipment Reliability</u>

Equipment reliability must also be considered when designing a UV system since the regulatory standards for shellfish harvesting waters are stringent. The industry standard reference for UV is the National Water Research Institute (NWRI) Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse (UV Guidelines), Third Edition. This document recommends a standby bank per channel or standby channel be installed to ensure that the specified UV dose is provided under worst-case conditions with one bank of lamps out of service. For this project we recommend one standby bank for the single channel design.

7.6.2 Proposed UV Equipment Selection

Several UV manufacturers have had their equipment validated to UVT levels down to 35 percent and lower and can be used for this application. The equipment selected for evaluation in this Facility Plan was the Trojan UV3000Plus system. It was successfully tested in 2011 during a pilot study conducted by Trojan, AMRI, and plant staff. The Pilot Study Report is included in Appendix N, and indicated that the fecal coliform requirement could be meet with a dose as low as 20 mJ/cm^2. The method used to calculate the dose during the pilot study is proprietary and is based on a March 2012 Validation report for low UVT applications. The validation report was reviewed as part of this study.

A number of dose levels were reviewed to determine the recommended equipment configuration for this Facility Plan. A summary of the configuration is included in Table 7.3, for dose levels of 35, 50, and 100 (mJ/cm^2).

Table 7.3 Trojan UV3000Plus System Configurations(1)
Wastewater Treatment Facility Improvements Project
City of Arcata

	Design Parameters			
Minimum UV Transmittance	35%	55%	35%	35%
Minimum MS2 Dose (mJ/cm^2)	35	35	50	100
Configuration:				
Number of Channels	1	2	1	2
Number of Duty Banks/Channel	2	2	3	8
Number of Standby Banks/Channel	1	1	1	0
Number of UV Modules/Bank	22	7	20	26
Number of Lamps/UV Module	8	8	8	8
Total Number of Lamps	**528**	**336**	**640**	**1664**
Total Power Consumption (kW)	**136**	**87**	**165**	**429**

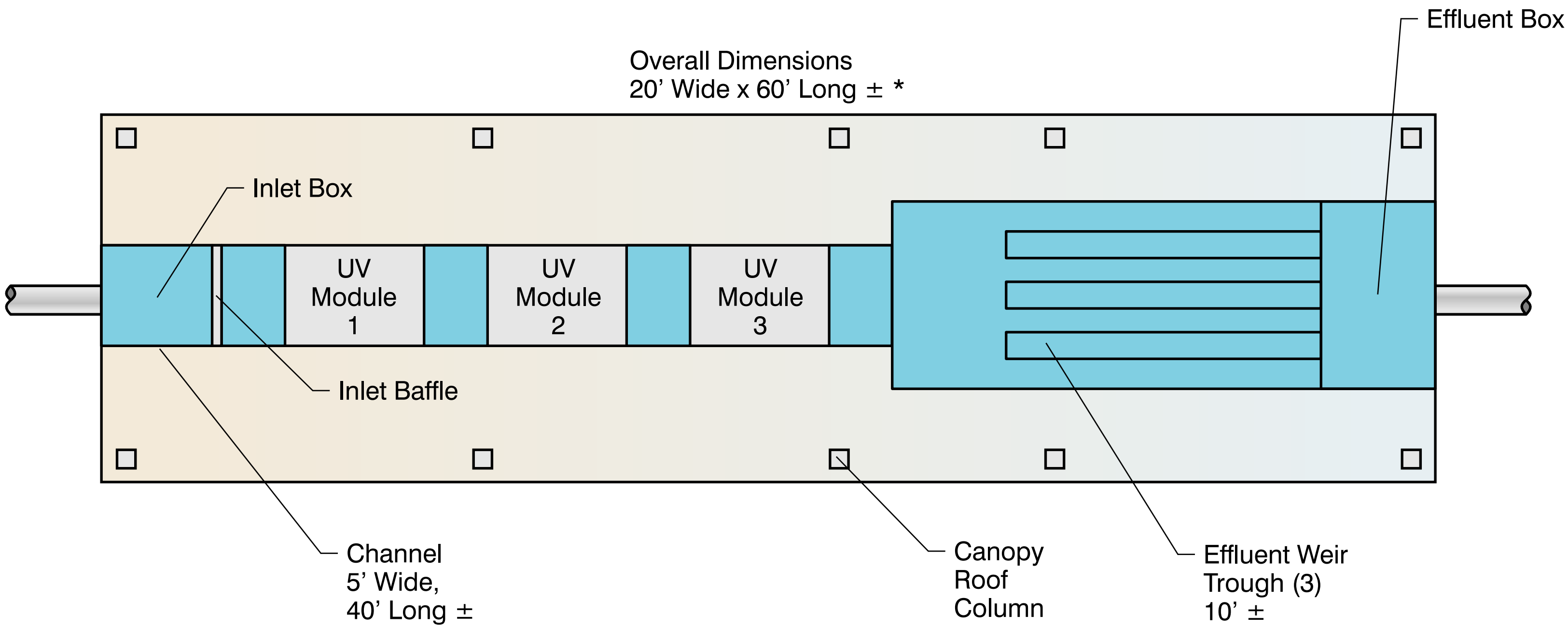
Notes:
(1) Design assumes an End of Lamp Life Factor of 0.90 and a Fouling Factor of 0.95.

7.6.3 UV Conceptual Flow Configuration and Layout

The concept envisioned by the City during the pilot testing and outlined in the NPDES permit is to disinfect the Hauser Marsh effluent using UV disinfection, prior to discharge to the new outfall 003 at the brackish marsh. It was originally proposed that the system would be located at the outlet of the Hauser enhancement wetland. Based on the review of this location it was decided that the new UV system would be located on the plant site adjacent to the CCB. This will allow the system to match the industrial look of the existing facilities and provide additional security.

7.6.3.1 Conceptual Layout for 35% UVT

The conceptual plan and section for the 35 percent UVT alternative is shown on Figures 7.4 and 7.5 to illustrate the UV system design. The conceptual plan is based on the Trojan proposal for 35 mJ/cm^2 dose with redundancy. If a dose of 50 mJ/cm^2 is required the facility then it will require an additional UV equipment bank, a longer overall channel, and a larger footprint.



NOTE:
* Small electrical enclosure will also be required (6' x 6' ±).

UV DISINFECTION SYSTEM CONCEPTUAL PLAN (35% UVT)

FIGURE 7.4

CITY OF ARCATA
WASTEWATER TREATMENT FACILITY IMPROVEMENTS PROJECT

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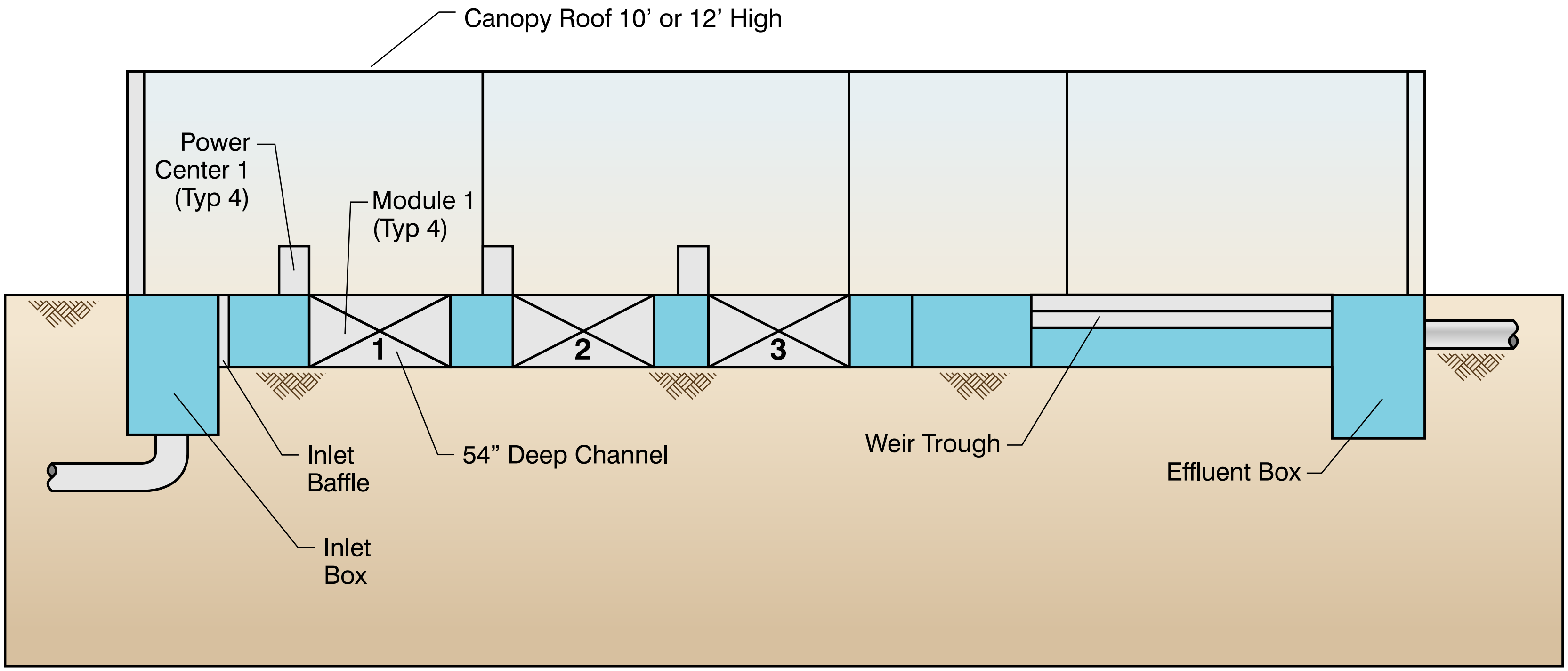

UV DISINFECTION SYSTEM CONCEPTUAL SECTION

FIGURE 7.5

CITY OF ARCATA
WASTEWATER TREATMENT FACILITY IMPROVEMENTS PROJECT

carollo

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The concept shows a single 5 feet wide channel with three banks (2 duty and 1 standby) system. The influent flow would be pumped into the channel in an inlet box, and should include a flow distribution baffle (not shown). The flow will pass the three reactor banks and flow over the effluent finger weirs. A total weir length of approximately 60 to 70 feet will be required to minimize the water surface fluctuation (1-inch maximum) during average to peak flows. The preliminary overall dimensions are shown on the plan. On each side of the channel, a walkway will be provided for access and maintenance. The Section, Figure 7.5, illustrates one concept for the protection of the facility with a sloped canopy type roof for sun and rain protection over the walkways and channel. The entire area could be enclosed with a guard rail type barrier, which would allow worker protection at a lower cost. It could also be fully enclosed in a structure at additional cost. A photograph of a similar UV system in an operating plant shows the canopy roof over UV channels on Figure 7.6. The architecture and alternatives for enclosure will be reviewed during preliminary design.

Figure 7.6 Typical Canopy Roof Over UV Channels (Windsor, California)

The UV equipment maintenance would be completed using a rolling gantry type crane to lift the modules or banks from the channels. The specific Trojan reactor has an effective sleeve cleaning system, but additional cleaning of the modules and the channel is needed. Modules would be removed for cleaning on a weekly to monthly (or longer) frequency, depending upon site-specific conditions. The major equipment maintenance, including bulb replacement, would be completed on an annual basis. Channel cleaning requires high pressure washing to remove algae and debris. Therefore open access to the channel will be required with the equipment removed and storage adjacent to the channel.

A small electrical and control building would also be required. The size for electrical enclosure might be in the range of 6 feet square. If a 150 to 180 kW standby generator is required, the size might double. The electrical and standby requirements will be finalized in preliminary design.

7.6.3.2 Conceptual Layout for 55% UVT

The UV facility conceptual layout was updated for the projected 55 percent UVT, and will be smaller than for 35 percent due to the decrease in the number of lamps. The updated design is based on a 2 channel system. Each channel will have a capacity of up to 2.95 mgd. Therefore during most of the year, only one channel will be in service at a time. A two channel design will allow for channel and equipment maintenance. An updated layout for 55 percent UVT is shown on Figure 7.7.

7.6.4 UV System Costs

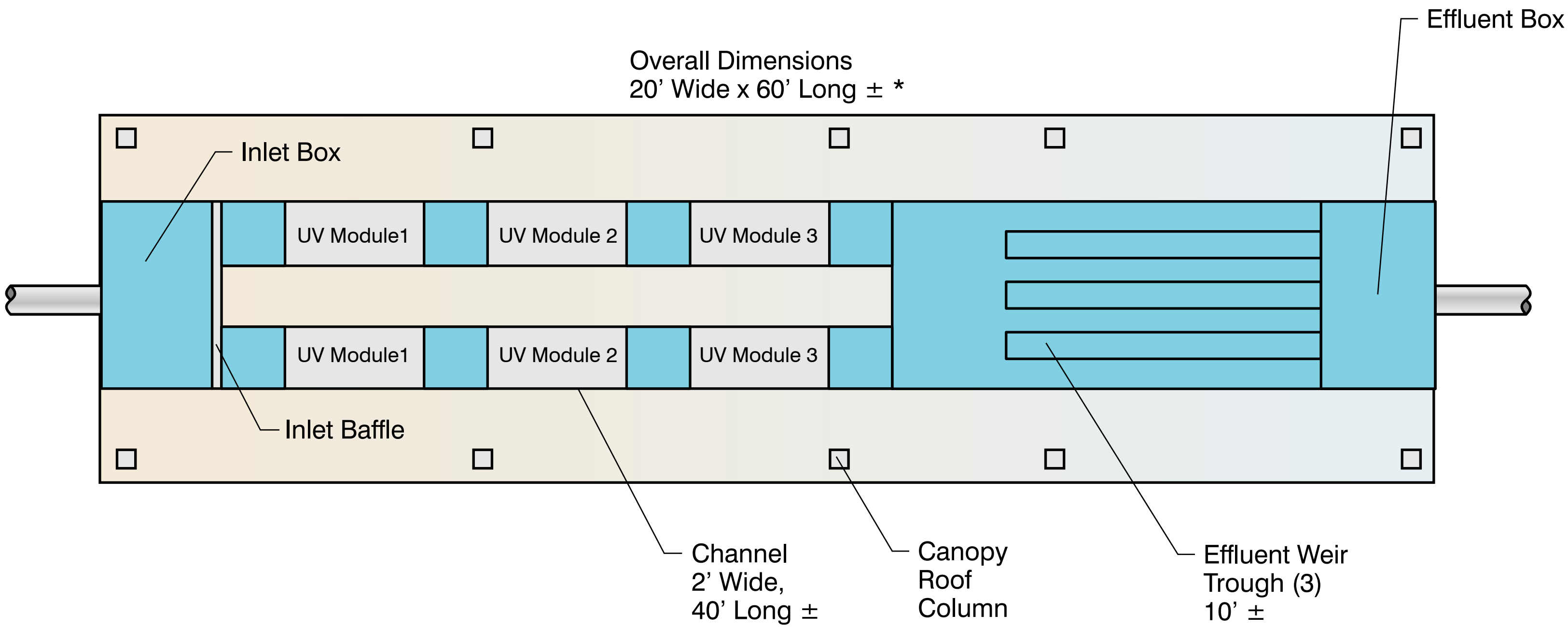
The UV equipment cost to meet the 35 or 50 mJ/cm^2 dose at 35 or 55 percent UVT, with or without redundancy, is outlined in Table 7.4. The cost is based on budget proposals from Trojan for the UV3000Plus system. These costs illustrate the increasing cost with redundancy and with higher dose. The estimated construction cost is based on recent experience for standalone system projects where the costs range from 3 to 5 times the equipment cost.

Table 7.4 Trojan UV Equipment and Construction Cost Comparison Wastewater Treatment Facility Improvements Project City of Arcata

Item	35 mJ/cm^2 Dose No Redundancy	35 mJ/cm^2 Dose With Redundancy	50 mJ/cm^2 Dose With Redundancy	35 mJ/cm^2 Dose With Redundancy
UVT, percent	35	35	35	55
UV Disinfection Equipment Cost	800,000	$1,090,000	$1,310,000	$786,000
Total Construction Costs:				
Low range (3 times equipment)	$2,400,0000	$3,270,000	$3,930,000	$2,360,000
High range (5 times equipment)	$4,000,000	$5,450,000	$6,550,000	$3,930,000

Note:
(1) Equipment sizing is based on an End of Lamp Life Factor of 0.90 and a Fouling Factor of 0.95.

For reference, the equipment cost for a 100 mJ/cm^2 dose is approximately 2.5 times the cost for a 50 mJ/cm^2 system with redundancy. This higher dose is normally only required for a tertiary recycled water application with high incidence of public contact.



NOTE:
* Small electrical enclosure will also be required (6' x 6' ±).

UV DISINFECTION SYSTEM CONCEPTUAL PLAN (55% UVT)

FIGURE 7.7

CITY OF ARCATA
WASTEWATER TREATMENT FACILITY IMPROVEMENTS PROJECT

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The updated Trojan proposal lists the equipment cost for a UVT of 55% at $785,500 with redundancy. The estimated construction cost will be 3 to 5 times the equipment cost, and range from $2,360,000 to $3,930,000 using the same installation cost factors. This reduces the cost by $910,000 to $1,520,000 for the higher UVT.

Preliminary estimates of operating costs were prepared for the 35 and 50 mJ/cm^2 dose levels with redundancy, and are outlined in Table 7.5. The assumptions for the costs are included in the table and are based on our analysis of the system and input from Trojan.

Table 7.5 Trojan UV O&M Cost Basis and Estimate
Wastewater Treatment Facility Improvements Project
City of Arcata

Description	35 mJ/cm^2 Dose at 35% UVT	50 mJ/cm^2 Dose at 35% UVT	35 mJ/cm^2 Dose at 55% UVT
UVT, percent	35	35	55
Lamp Replacement	$250	$250	$250
Ballast Replacement	$400	$400	$400
Wiper Replacement	$15	$15	$15
Quartz Sleeve Replacement	$80	$80	$80
Chemical Usage	$300	$300	$300
UV Sensor Replacement	$1,000	$1,000	$1,000
Interest Rate	6.00%		
Project Life, years	15		
Electricity Rate (kWh)	$0.10		
Labor Rate (per hour)	$50.00		
Annual Parts and Replacement Cost	$112,000	$113,000	$47,700
Annual Labor Cost	$29,600	$34,100	$25,200
Annual Energy Cost	$67,800	$92,300	$29,500
Total Annual Cost	**$209,000**	**$239,000**	**$102,000**
Note: All costs are based on redundant equipment			

The difference in annual O&M cost between the lower and higher dose values of 35 and 50 mJ/cm^2 is only $23,100, and is predominately due to the higher energy use at the 50 mJ/cm^2 dose. The higher dose system has 112 more UV lamps (21 percent) compared to the 35 mJ/cm^2 system. Using the O&M cost basis in Table 7.5, the life cycle costs were calculated for both systems. The operating cost of the system at 55 percent UVT is substantially less than at 35 Percent UVT, by over $107,000 per year. A comparison of the life cycle cost at the different UVTs is shown on Table 7.6. The higher UVT has a lower life cycle cost by over $2,000,000.

Table 7.6 UV System Net Present Worth Summary Wastewater Treatment Facility Improvements Project City of Arcata				
Equipment	**Equipment Cost(1)**	**Estimated Construction Cost(2)**	**Annual O&M Cost**	**Present Worth Life Cycle Cost(3)**
35 mJ/cm^2 Dose @ 35% UVT	$1,090,000	$4,360,000	$209,000	$6,390,000
35 mJ/cm^2 Dose @ 55% UVT	$785,000	$3,140,000	$102,200	$4.130,000
Difference	$305,000	$1,220,000	$107,800	$2,270,000
50 mJ/cm^2 Dose @ 35% UVT	$1,310,000	$5,240,000	$239,000	$7,560,000
35 mJ/cm^2 Dose @ 35% UVT	$1,090,000	$4,360,000	$209,000	$6,390,000
Difference	$220,000	$880,000	$30,000	**$1,170,000**

Notes:
(1) Based on redundant equipment and facilities.
(2) Based on 4 times the equipment cost.
(3) Life cycle based on 15 years and 6 percent interest.

7.6.5 UV System Procurement

The UV system will be included in the final design for the flow reconfiguration / disinfection improvements project. UV system equipment procurement can be can be implemented in a number of ways. The alternatives are reviewed below at a high level for consideration by the City. The method of UV system procurement will be reviewed with the City and selected during preliminary design.

7.6.5.1 Sole Source Design and Bid

In this option, a single design is prepared and bid based on a single manufacture/supplier's product. In some cases, owners and designers have selected one supplier to provide an equipment supply bid without a competitive process. This has been done in limited cases where the supplier's equipment provides some unique feature that is critical to the project. This might include, matching existing equipment, or some patented feature that is important to the success of the project, such as the method of sleeve cleaning, or pilot results that provide critical benefits. Based on the characteristics of the Trojan equipment, with patented cleaning system, and successful pilot testing results, this could be considered by the City. Depending of the City's plan for funding, this would still need to be approved by the funding source, such as State Revolving Loan Fund (SRF).

7.6.5.2 Traditional Design and Bid

The traditional design and bid format is complicated when bidding UV disinfection equipment due to the different configurations offered by different UV equipment supplier or manufacturers. When UV equipment designs were first being considered, this was the preferred method of procurement. The designer would design the facility around one supplier, including structural, mechanical, and electrical designs. In general the UV disinfection equipment was specified based on a performance specification allowing competitive bidding. The issue with this approach was that the equipment supplied sometimes required very different structural, mechanical, and electrical designs. Even when the contractor was required to take the differences into consideration in the bid, items were sometimes missed or left out for alternative UV systems. In some cases this has resulted in disputes and change orders.

To avoid this issue, designers have prepared multiple designs around two or three suppliers, providing in some cases, two or three complete UV system designs. This was costly to the owner, since the designer had three times the effort, especially for structural, and electrical design components. In most cases the General Contractor selected the equipment based on cost alone, and the owner had no say in equipment selection.

One variation on this approach is to base bid the one manufacture that is used in the development of the bid documents. The general contractor provides a cost for installing one base bid with the pre-selected supplier's equipment, and provides the added or deductive cost for supplying other equipment. This provides the Owner with the differences in the cost of construction for different alternative suppliers. This can help to cut down on changes, but forces the contractor to determine all the extra costs for the alternative equipment, including design revisions.

7.6.5.3 Evaluated Bid for UV Equipment

One solution that designers and owners now follow to avoid the issues with the traditional design approach, is an evaluated bid for UV equipment. The designer and owner first issue a package for bidding the UV disinfection equipment based on approximately a 30 percent design, and a performance based specification. The bid forms require not only the capital cost bid, but guaranteed power cost, lamp replacement costs, and chemical cost (if required). The results of the bid would then be used to complete a present worth analysis for each bidder. The bidder with the lowest present worth (or best overall value) would be selected. The owner would then contract with the supplier for the UV equipment supply based on this selection. In most cases the selected supply also includes an allowance for working with the owner and designer to complete the design. Then the installation could be bid to a general contractor based on the selected equipment supplier and design requirements. The equipment cost bid is then included in the general contractors bid, and is assigned to the General Contractor by the Owner once a General Contractor is selected. Carollo has used this approach on a number of UV installations, and generally has had good experience with the overall approach. In most cases it has resulted in a good installation bid, and allows the UV supplier to be part of the design team. This approach also helps to ensure that no details are missed in the design. In addition, it provides a system that has the best value to the Owner.

In an evaluated bid format, other factors can also be used in ranking a suppliers bid. These could be addressed in a weighting process and could include the following:

- Suppliers warranty and warranty terms.
- Proximity to factory authorized service center.
- Number of installation of the type proposed for owner.
- Recent installation issues or claims against the supplier.
- Validation experience.
- Regulatory acceptance of the technology if new or improved.

7.6.6 UV System Pretreatment

The Hauser enhancement wetland will require pretreatment including coarse screening and medium fine screening prior to the UV process.

The Hauser pump station modifications will include a coarse screen at the inlet structure to remove larger debris and vegetation prior to pumping. This will protect both the pumps and the UV system. An automatically cleaned type bar screen is proposed to facilitate operation. The type of bar screen and appropriate enclosure will be reviewed during preliminary design.

The pump station modifications should also include some type of protection for downstream UV system such as a strainer downstream of the pump station to remove material especially stringy algae and other organic material. The strainer will be sized to provide 200 to 500 micron strainer with automatic cleaning. The type of strainer best suited for wetland effluent including algae and vegetation solids will be reviewed during preliminary design.

7.7 EXISTING CHLORINE AND SULFUR DIOXIDE SYSTEM

The City of Arcata will phase out the existing chlorine and sulfur dioxide gas system as the primary disinfection process after the implementation of the new UV system. The existing system could still remain as a backup to the UV and for peak wet weather flow disinfection. This will require that the plant maintain the system and store chlorine and sulfur dioxide ton cylinders on site, especially during wet weather. It has been reported in the City's 2011 Risk Management Prevention Plan (RMPP), that the AWTF has been handling chlorine for over 25 years and has never experienced a release. As noted in the plan, the plant, on average, has fifteen (1 ton) chlorine cylinders on site. Typically six (6) cylinders are on-line and nine (9) are in storage. In addition, there are also six (6) sulfur dioxide containing cylinders on-site, with two (2) cylinders on-line and four (4) in storage. As part of the RMPP evaluation, plant staff determined that due to an annual average chlorine consumption of 1.5 - 2.0 tons per week, chemical supplier location (500 miles away), delivery delays due to road conditions and effluent disinfection requirements, that the amount of on-site chemical was necessary. While the amount of chemical stored on-site in this scenario can be reduced once the UV system is online, chlorine and sulfur dioxide will still need to be stored on-site, and ready for use during wet weather.

The system could be retrofit to a liquid chemical system for use during wet weather or as a redundant system to the new UV system. Note that this system would only be used for disinfection for the existing Outfall 001.

The reason to retrofit the system is to reduce the overall potential risk from the ton chlorine cylinder system. Commonly sodium hypochlorite and sodium bisulfite are used to retrofit gas systems. The benefit of using the liquid chemical is lower potential for release of hazardous gas, and a fairly simple chemical dosing system. The downside is that these chemicals are less stable, and degrade over time. Typically the hypochlorite is supplied as 15 to 25 percent and bisulfite as 15 to 45 percent. These can degrade over time to less than 10 percent strength in a matter of weeks. For example, depending on the temperature a 15 percent hypochlorite solution can degrade in half in 60 to 100 days.

The chemicals would be stored in high density polyethylene tanks. The tanks could be located in the existing chlorine gas storage area, with slight modifications to provide containment. Chemical metering pumps could be installed adjacent to the tanks, and used to pump chemical solution directly to the existing CCB. The existing chemical induction units could be reused for this application.

7.8 SUMMARY AND RECOMMENDATIONS

The proposed UV effluent disinfection system for the ATWF is outlined in this chapter.

The following items need to be reviewed or finalized during preliminary design:

- Final system sizing based on the expected design UVT: 35 or 55 percent.
- Final design dose based on collimated beam test on the Arcata enhancement marsh effluent and based on feedback from State on requirements to be protective of shellfish.
- UV system facility design requirements including the need for an enclosure or other type of weather protection and architectural treatment.
- Power supply and back-up power requirements.
- Procurement method and basis of design for equipment (sole source or other).
- Enhancement wetland (Hauser) pump station pretreatment equipment selection.

7.9 REFERENCES

SHN 2003 - 2000/2002 Wastewater Treatment Plant Evaluation, February 2003, SHN Consulting Engineers & Geologists Inc.

CAPITAL IMPROVEMENTS PROGRAM

8.1 INTRODUCTION

This chapter presents alternative capital improvements programs (CIP) for the City of Arcata Wastewater Treatment Facility (AWTF), as well as a summary of the associated project and operating costs. The 10-year CIP is a preliminary estimate of the City's required capital expenses over the next 10 years for alternative approaches to address permit and regulatory requirements, capacity limitations, rehabilitation, and repair (R&R) needs. Additional projects are identified in project elements for a second 10-year CIP (10 to 20-year CIP) that should be considered to address modernization and sea level rise requirements. It is an update to the preliminary 2014 wastewater CIP prepared by City staff, and the draft CIP presented in the original facility plan prepared in September 2015. This CIP is intended to assist the City in planning future budgets and making financial decisions for the City wastewater treatment infrastructure needs.

8.2 CIP DEVELOPMENT APPROACH

In an effort to distribute spending throughout the 20-year planning period, individual projects were identified and prioritized based on need and an acceptable approach to phasing the work. Three 10-year CIP treatment alternatives were prepared to provide the City with different options that provide different levels of risk for meeting NPDES permit requirements. The project drivers, the project prioritization approach, projects risks, and the project implementation strategy for the CIP projects are discussed below.

The five treatment alternative projects were described in Chapter 6, and include:

- Alternative 1 - Existing System Rehabilitation.
- Alternative 2 - Existing System Rehabilitation with Side-stream Treatment.
- Alternative 3 - Existing System Rehabilitation with Parallel Treatment.
- Alternative 4A/B – Existing System Rehabilitation with Oxidation Pond Treatment improvements and Phased Parallel Treatment.
- Alternative 5 – Existing System Rehabilitation with New Secondary Treatment.

8.2.1 Project Drivers and Prioritization

The AWTF CIP is comprised of five types of projects. These projects, including the methodology used for prioritization, are described in the following bullets.

- <u>Permit and Regulatory Projects.</u> The regulatory projects are those required by the current National Pollutant Discharge Elimination System (NPDES) permit and that address ongoing permit violations, including:

- Major disinfection upgrades for conversion from chlorine gas to ultraviolet light (UV) disinfection.
- Flow reconfiguration from a two-pass to a single-pass system to handle flows up to the permitted discharge flow of 5.9 million gallons per day (mgd).
- Capacity upgrade of the Enhancement Wetlands (Hauser) Pump Station for the new discharge point, and to handle flows up to 5.9 mgd through the enhancement wetlands (EW) (Alternative 4 and 5).
- Construction of a new outfall (Outfall 003) for the new discharge point into the brackish marsh.

The permit requires that these upgrades be brought online prior to December 1, 2016, which will be impossible for the City to meet. A more realistic compliance schedule is that some of these projects could be brought online by the end of 2021, but full rehabilitation of the wetlands (which is proposed under every alternative) will require a longer schedule and would likely not be complete until 2025. This alternative compliance schedule will need to be approved by the Regional Water Quality Control Board (RWQCB). Initial discussions were held June 27, 2016 with the RWQCB, where they acknowledged the need for additional implementation time.

- Capacity Projects. The capacity projects provide both hydraulic capacity in the flow reconfiguration project and secondary treatment capacity to meet capacity shortfall. The basis of design for the treatment capacity projects accommodate the projected growth expected by Arcata. As previously discussed, the City originally anticipated a 10 percent community growth which was incorporated into the Draft Facility Plan. After further discussion with the City at the Council meeting on June 13, 2016, community growth estimates have been revised to be 20 percent. Updates to incorporate this additional growth factor have been included in this Facility Plan to some extent, however, updates to sizing of the capacity projects and their cost estimates, will be fully incorporated during preliminary design.
- R&R Projects. The R&R projects were developed using information compiled during the condition assessment. The remaining useful life was estimated for all of the major assets at the AWTF. Replacement costs for structures and equipment with life expectancies of less than 20 years were grouped by unit process and incorporated into the CIP spreadsheet. These projects were mainly included in the 10-year CIP alternatives, although a few are spread out in the 10 to 20-year CIP timeframe to distribute spending.
- Modernization Projects: The modernization projects will increase energy efficiency and help to reduce labor costs by optimizing plant operations. One example is replacing the existing control system with a more modern supervisory control and data acquisition (SCADA) system. These generally have a lower priority, and are included in the 10 to 20-year CIP, given the more immediate plant needs and limited available funding.

- Sea Level Rise Projects: The sea level rise projects represent a placeholder for any additional projects required to address future sea level rise including additional flood protection levees or raising existing pond and wetland berm levees to protect critical infrastructure. These projects are considered more long-term, and are included in the 10 to 20-year CIP.

8.2.2 Project Costs

Costs presented in this Facility Plan are total project costs and include construction, engineering, legal, administrative, and permitting costs, as well as estimating contingencies. The costs are presented in today's dollars. Costs are not escalated to future years.

The costs used in the CIP program for the City of Arcata are developed based on preliminary budget costs for individual equipment times a project cost factor, or cost curve information for a unit process such as a primary clarifier.

The methodology for development of the construction and project cost factors is outlined in Appendix P.

Cost estimates presented in this chapter were developed based on 10 percent community growth that was originally anticipated by the City. Cost estimate updates to reflect the additional 10 percent growth factor are shown as an additional 10 percent of the original cost estimate.

8.2.3 Project Implementation

Project implementation activities can include predesign planning, final design, environmental permitting, project funding, bidding and award, construction, and commissioning. Project duration is a function of project complexity, which generally increases as a function of project cost.

Annual CIP costs were estimated for the 10-year CIP alternatives and the 20-year planning horizon using the project drivers defined above and the project durations established for each CIP project.

8.3 10-YEAR CIP ELEMENTS AND ALTERNATIVE COSTS

As discussed in Chapter 6, three different treatment capacity alternatives were reviewed. These treatment alternatives include UV facilities of different sizing as described in Chapter 7, but does not include the potential requirement to design for lower UVT or higher dose in all alternatives as discussed at the June 27, 2016 meeting with the RWQCB. At the June 27, 2016 meeting with the RWQCB, it was made clear that the City would be getting ammonia limits in its next NPDES permit in 2017. RWQCB staff indicated that the recent City of Eureka's June 2016 permit was a good example of likely limits. While it was suspected that ammonia limits may be coming, the alternatives were not originally set up to remove ammonia to monthly average limits in the 4 milligrams per liter (mg/L) range (Eureka levels). This new information means that only Alternative 3, which was designed to provide ammonia removal for up to 4 mgd, is likely to be able to meet this future requirement year round. The existing system can meet low ammonia levels in the summer months, but not during the colder winter months. The RWQCB also indicated that bypass of flows around the treatment and enhancement wetlands did not meet the intention and definition of enhancement. The existing system relies on bypasses during wet flows to prevent degradation of effluent quality. The difference in each treatment alternative estimated capital and project cost is outlined below:

- Alternative 1 includes only additional pond aerators to address plant capacity. It does not provide adequate treatment capacity for the projected design loads and therefore has the risk of permit violations. This alternative also does not provide for additional treatment to meet future ammonia reduction requirements that are expected in the 2017 permit (per 6/27/16 meeting with RWQCB). The operations and maintenance (O&M) costs include an estimate of ongoing permit violation penalties. The common elements outlined above including the permit required flow reconfiguration are included in the alternative costs. The UV system for this alternative is sized based on the lower UVT from the wetland effluent. In addition, the primary clarifiers are sized for the total plant design flow.

- Alternative 2 include additional treatment capacity including single oxidation ditch and secondary clarifier. The side-stream treatment will address the capacity shortfall, and provide partial ammonia removal. The side stream flows are combined with the pond/treatment wetland flows prior to the enhancement wetlands for up to a total capacity of 5.9 mgd. The common elements outlined above, including the permit required flow reconfiguration, are included in the alternative costs. The UV system for this alternative is sized based on the lower UVT from the wetland effluent. In addition, the primary clarifiers are sized larger for the total plant design flow. This alternative includes additional solids handling and thickening equipment for the additional solids generated by the side-stream treatment, prior to digestion in the existing digester.

- Alternative 3 includes additional treatment capacity including two oxidation ditches and secondary clarifiers. The parallel treatment will address the capacity shortfall, and provides ammonia removal. The parallel flows are combined with the pond/treatment and enhancement wetland flows prior to the new UV disinfection system for up to a total capacity of 5.9 mgd. The common elements outlined above including the permit required flow reconfiguration are included in the alternative costs. The UV system for this alternative is sized based on the higher UVT from the blended effluent. In addition, the primary clarifiers are sized smaller for only the pond and wetland plant design flow. This alternative includes additional solids handling and thickening equipment for the additional solids generated by the parallel treatment, prior to digestion in the existing digester.

- Alternative 4A/B includes additional treatment capacity including phasing in two oxidation ditches and secondary clarifiers. Phase A would include one oxidation ditch/secondary clarifier and oxidation pond treatment improvements, while Phase 4B would add a second oxidation ditch and secondary clarifier. The pond improvements with the parallel treatment additions will address the capacity shortfall, and provides ammonia removal, in a phased manner. The parallel flows are combined with the pond/treatment and treatment wetland flows prior to the new UV disinfection system for up to a total capacity of 5.9 mgd. The UV effluent flow would be routed through the enhancement wetlands, then to the new outfall (003) discharge. The common elements outlined above, including the permit required flow reconfiguration, are included in the alternative costs. The UV system for this alternative is sized based on the lower UVT from the blended effluent, since the ratio of the blend is unknown. In addition, the primary clarifier is sized smaller for only the pond and wetland plant design flow. This alternative includes additional solids handling and thickening equipment for the additional solids generated by the parallel treatment, prior to digestion in the existing digester.
- Alternative 5 was developed for comparison of project and operating costs. It would include the same facilities as Alternative 4A/B, except a third oxidation ditch would be constructed in lieu of the oxidation pond treatment improvements.

Descriptions for the major 10-year CIP projects listed in the new CIP are provided below. The 10-year CIP project, O&M and life-cycle costs are outlined in Table 8.1. A breakdown of construction and project cost estimates by project alternative for the proposed 10-year CIP is outlined in Appendix Q. The O&M cost projections are outlined in Appendix R. Based on the revised growth projection of 20 percent instead of 10 percent used in the Draft Facility Plan, costs have been revised for an additional 10 percent cost added to the cost of secondary and solids costs for each alternative.

Alternative 1 has the lowest lifecycle cost due to the lowest project cost, although it has higher projected O&M costs. Alternative 1 also has the highest risk of ongoing permit violations due to the treatment capacity shortfall, seasonal challenges in meeting future ammonia removal requirements, and the need to rely on bypass operations to meet secondary treatment standards.

Alternative 3 has the next lowest lifecycle cost, with higher project cost than Alternative 1 and the lowest O&M costs. Alternative 3 also has the lowest potential for permit violations due to its ability to meet treatment capacity and future ammonia removal requirements, as well as its ability to provide treatment/enhancement without requiring bypass operations.

Alternative 2 with the side-stream treatment alternative has the highest lifecycle costs due to the highest project and O&M costs. Alternative 2 also has a lower potential for permit violations than Alternative 1 due to its ability to meet treatment capacity and potentially meet future ammonia removal requirements (although this would need to be confirmed), as well as provide treatment/enhancement without requiring bypass operations.

Table 8.1 Cost Comparison of Treatment Alternatives
Wastewater Treatment Facility Improvements Project
City of Arcata

Alt.	Description	Total Project Cost With 10% Growth(1)	Total Project Cost With 20% Growth(1,4)	O&M Cost		Lifecycle Cost(3,4)
				Annual(2)	Present Worth(3)	
1	Existing System Rehabilitation	$35.1	$35.2	$0.67	$11.7	$46.9
2	Existing System Rehabilitation with Side-stream Treatment	$44.7	$45.7	$0.76	$13.3	$58.0
3	Existing System Rehabilitation with Parallel Treatment	$43.8	$45.5	$0.43	$7.6	$51.3
4 A/B	Existing System Rehabilitation with Oxidation Pond Treatment and Phased Parallel Treatment	--	$52.4	$0.78	$13.6	$66.1
5	Existing System Rehabilitation with Parallel Treatment	--	$51.8	$0.75	$13,1	$65.0

Notes:
(1) Costs are based on 2016 dollars, in millions, using the SFENR construction cost index.
(2) Annual O&M costs include only differential O&M costs, and do not include O&M costs which are common to all alternatives (such as influent pumping).
(3) Lifecycle cost is total project cost plus present worth value of annual O&M costs. Annual O&M costs were converted to present worth value based on 3 percent inflation rate, 6 percent discount rate, and 25-year analysis period.
(4) Estimated total project cost and lifecycle cost is updated with additional anticipated growth subsequent to the June 13, 2016 Council meeting. Additional cost for the 20% growth projection is based on adding 10% to the secondary and solids costs.

Alternative 4A/B has the highest lifecycle costs, and is only slightly higher than Alternative 5 due to the costs of the pond treatment additions. The annual O&M costs for alternative 4A/B are the highest of all alternatives, although they are similar to alternative 2. They are high due to the cost of pond aeration coupled with the oxidation ditch aeration.

8.3.1 UV Disinfection System Project

The UV disinfection system project (ID No. 1) will replace the existing chlorine gas disinfection system as the main disinfection process for the plant. The existing disinfection system will be retained for treatment of peak wet weather flows, and can also serve as a temporary back up should the UV be out of service. The project was proposed to the

Regional Water Quality Control Board (RWQCB) and made a requirement of the current discharge permit, and is ranked as the highest priority project. A more complete description of this project element is included in Chapter 7. The design UVT for the new UV disinfection system will be lower for Alternatives 1 and 2 (35%) and will result in higher equipment and construction costs. The design UVT for the new UV disinfection system for Alternative 3 is projected to be higher for the blended parallel system (55%) and will result in lower equipment and construction costs. The design UVT for Alternative 4A/B was reduced to 35% based on the potential ratio of pond to oxidation ditch effluent. However, the design criteria for UVT and UV dose will need to be finalized during preliminary design with additional input from the State to provide adequate protection for the shellfish beneficial use.

8.3.2 Treatment Wetland No. 7 Construction Project

The construction of Treatment Wetland No. 7 (ID No. 3) is required to increase the capacity of the treatment wetland process and allow for treatment wetlands to be removed from service for revegetation. It is a priority based on achieving the permit required flow reconfiguration project. This element is common to Alternatives 1 and 2.

8.3.3 Flow Reconfiguration Project

The flow reconfiguration project (ID No. 4) will allow the plant to treat flows up to 5.9 mgd in a single pass mode of operations, with a new discharge outfall to an existing brackish marsh that flows to Arcata Bay. This project was proposed to the RWQCB to improve the overall treatment process and is included in the current permit. The project includes four main elements outlined below:

- New piping to discharge UV disinfection effluent directly to the new outfall, sized for a capacity of 5.9 mgd.
- Replacement of the existing Enhancement Wetlands (Hauser) Pump Station with a higher capacity, more reliable pump station for discharge of enhancement wetlands effluent to the new UV disinfection process that will flow by gravity to the new outfall. Note the firm capacity varies between Alternatives 1 and 2, at 2.3 mgd and Alternative 3 at 1.8 mgd.
- Construction of a new discharge or outfall (Outfall 003) to the brackish marsh, for effluent disposal to the Arcata Bay portion of Humboldt Bay.
- Upgrade of the existing treatment wetlands pump stations (PS) 001 with higher capacity at 2.3 mgd, more reliable pump station for discharge of the treatment wetlands effluent to the enhancement wetlands in Alternatives 1 and 2 (ID Nos. 17 and 18). The capacity would only be updated to a capacity of 1.8 for Alternative 3.

8.3.4 Headworks R&R Projects

The short-term R&R projects address the aging headworks infrastructure. These projects are critical because the headworks facility has the potential to fail and create multiple problems ranging from overflows in the collection system to conveyance of screening and grit to downstream process. This set of projects include new influent pumps, new screens, a new grit tank, new grit handling equipment, and all the associated facilities for a complete and reliable headworks process. Specific project elements are outlined below.

- New influent pumps sized to handle a peak capacity of 5.9 mgd to replace the existing screw pumps. The existing pumps can handle a capacity of 5.0 mgd, with an emergency diesel driven pump providing backup. The existing pumps are at the end of their useful life and could fail in the near future. It has been noted that submersible type pumps should be considered for the replacement (ID No. 10).
- New bar screens for existing headworks, with associated screenings conveyor and screening washer compactor (ID No. 11).
- New grit removal structure and associated grit handling and treatment equipment. A new vortex grit removal system is proposed to improve grit removal over the range of flows treated at the plant (ID No. 12).

8.3.5 Primary Clarifiers Replacement Project

The existing primary treatment facilities contain some of the oldest assets at the AWTF. The primary clarifier replacement project includes replacement of both the larger and smaller units with one or two identical units each sized for the design wet weather flow of 2.3 mgd (ID No. 13). The second unit will provide redundancy, as well as provide for peak hour wet weather flows up to the 5.9 mgd design flow in Alternatives 1 and 2. In Alternative 3, one 1.8-mgd primary clarifier is proposed because oxidation ditches do not require upstream treatment with primary clarifiers. New support facilities including replacement sludge pumps would be provided. (ID No. 14.) In Alternative 4, a single Primary Clarifier is proposed with the same capacity as the treatment wetlands. Space would be reserved for an additional primary clarifier if required in the future.

8.3.6 Wetlands Revegetation Projects

The treatment wetlands revegetation projects (ID Nos. 26 and 27) are included in the ATWF CIP in order to recognize that the natural wetland process requires maintenance, although much different than mechanical equipment or structural maintenance. Wetlands require ongoing vegetation management, both on an annual basis and a recurring basis as the wetlands mature, especially the wetland plants. The revegetation project includes replanting and regrading of the oldest treatment wetland cells No. 1 to No 4 (ID No. 26). This work can be started once wetland cell No. 7 is created. Then, on a recurring basis, wetland cells can be removed from service and rehabilitated. Note that the concept for the rehabilitation is to remove from service, stop influent flows and dry the cell out as much as possible, remove all vegetation, regrade, then replant, slowly introducing wastewater to sustain the plant growth. It is expected that this may take up to three years per cell.

The enhancement wetlands also require vegetation management, and therefore should be included in the ongoing vegetation management program (ID No. 27), in order to maximize their service life prior to a complete revegetation. This element also includes flow improvements including baffles, and upgraded inlet/outlet structures.

In addition, vegetation management should be completed on all cells on a seasonal basis. This will include removal of trees and shrubs, or other non-wetland plants from wetlands cells.

8.3.7 Treatment Wetlands Pumping Configuration Project

The existing treatment wetland pump stations are at the end of their life for the installed mechanical equipment, and therefore require R&R. In addition, the existing pump station configuration has been based on adding pump stations as new wetland cells are added. Pump Station 1 was added when cells 1 and 2 first went into service. Then PS No. 2 was repurposed when cells 5 and 6 were added. The overall capacity of the treatment wetlands pump station would be upgraded to 2.3 mgd for alternatives 1 and 2 and only to 1.8 mgd for alternative 3.(ID Nos. 17 and 18).

8.3.8 Oxidation Pond Improvements Projects

There are three oxidation pond improvement projects included in the CIP, in addition, a significant O&M project to remove/reduce the existing solids built up in the ponds is required to maintain proper operation. Descriptions for these projects are provided in the following sections. These projects can either be combined as a single larger project or implemented separately.

8.3.8.1 Pump Station R&R Projects

The oxidation ponds provide the initial step in the secondary treatment process. Therefore these ponds are critical in meeting permit requirements. The pond pump station and the emergency pond pump station (EPPS) provide a positive means to convey flows from the ponds to the chlorine contact basin during periods of high wet weather flows. These should be rehabilitated as needed during the pond improvements projects. The pond pump station is upgraded (ID No. 19) in Alternatives 1 and 2 to 3.6 mgd capacity. The EPPS is in fairly good shape since it has not been used very often, so it will require less work than the other pump stations. In all alternatives, the EPPS piping will be modified to allow its use in pumping down Pond 1 to increase the available storage volume during peak wet-weather flows (ID No. 19).

8.3.8.2 Pond Transfer Structures and Piping Project

In addition, modification of the oxidation pond transfer structures and piping will be required to allow for a more controlled conveyance of flows to the treatment wetlands and to provide the flexibility to store a portion of the peak wet weather flows in the ponds (ID No. 20).

8.3.8.3 Original Aerator Replacement Project

The original pond aerator replacement project element was part of Alternative 1 and 2. Originally new horizontal aerators would be provided in Pond 2 for additional pond treatment capacity and assist in short circuit reduction in the shallow oxidation pond. Aerators may not be needed during the warmer, sunnier months from spring to fall, as the natural algae will aerate the pond content. The production of dissolved oxygen in the ponds by the algae assists natural bacteria in the ponds in breaking down the soluble and particulate wastes in the influent wastewater. During the colder, winter months, when natural sunlight is limited, aerators may be required to supplement the algae to provide dissolved oxygen (ID No. 24).

8.3.8.4 Revised Aerator Upgrade for Alternative 4

The revised pond treatment upgrade would create a two cell partially mixed aerated lagoon. FRP baffle wall would be added to separate Pond 2 into 2 equal volume cells. The baffle wall would be placed diagonally across the pond in order to improve short circuiting from the inlet to outlet of the pond. New aerators would be placed in both cells of Pond No. 2. The exact number and size would be finalized in design, but it was estimated that up to twenty – 15 horsepower units would be required to meet the pond aeration demands. Aerators would only be run as needed, as described above. During the summer they may not be needed, but would be required during the colder, winter period of the year.

8.4 10 TO 20-YEAR CIP ELEMENTS

8.4.1 Sea Level Rise Project

Another pond project has been identified based on the projected sea level rise in the Arcata area. The pond berms and levees may need to be raised in order to avoid flooding during king (of flood) tides. This project may or may not fall within the 20-year planning window, based on current projections (ID No. 25). It is included as a long-term project in the CIP as a placeholder.

8.4.2 Plant Modernization Projects

Two main plant modernization projects were identified as part of the condition assessment.

8.4.2.1 Control System / SCADA Improvements

The plant control system should be upgraded to a modern SCADA system (ID No. 35N). This will allow the plant staff to maximize their effort, without having to visit any piece of equipment or pump station for normal operations and alarm troubleshooting. This project can be implemented across the entire plant in one project, or can be implemented, one process area at a time or as part of each project described above. The latter approach will require that planning for the entire system be completed so that the pieces are integrated as they are implemented individually.

8.4.2.2 Lab and Control Building

The lab and control buildings should be upgraded (ID No. 30) during the 20-year CIP program to allow for upgrades including the SCADA upgrade. In addition, the building may require modifications to avoid flooding by sea level rise. This project is included as a placeholder in order so that it may be updated as additional requirements are determined.

8.5 FINDINGS AND RECOMMENDATIONS

The CIP alternatives presented in this chapter provide several approaches to the City CIP for the wastewater division of the Public Works Department. The alternative 10-year CIP projects and priorities are outlined to meet current permit requirements and near term R&R needs, and have different risks in reliably meeting the permit requirement. The longer term R&R needs, plant modernization requirements, and addressing sea level rise impacts would be part of a 10 to 20-year CIP program. The CIP needs to be integrated with existing capital improvements budgets and funding sources in order to meet the needs of the community and preserve this vital City asset.

The 10-year CIP should be reviewed by City staff and council and adopted by the Environmental Services and Public Works Departments. The permit-required CIP projects should be completed within the next 3 to 7 years, with the remainder of the projects implemented as soon as funds are available.

Presentations describing the CIP alternatives were made to City Council on April 20, June 6, and June 13, 2016. Presentation materials from these meetings are in Appendix S.

A meeting with the RWQCB discussing the CIP alternatives was conducted on June 27, 2016, during which the Board indicated that operational bypass of flows greater than 5.9 mgd should be eliminated. As discussed previously, the RWQCB also indicated that the City would be subject to ammonia reduction limitations in the next NPDES permit in 2017.

Based on economic and non-economic factors, Carollo and LACO originally recommended proceeding with preliminary design of Alternative 3. Alternative 3 is the only option that can reliably meet the future ammonia limit, while also providing adequate secondary treatment capacity to meet current permit requirements. Alternative 3 has the second lowest lifecycle cost, with slightly higher project cost than Alternative 1 but the lowest O&M costs. Alternative 3 has the lowest potential for permit violations of the three options due to its ability to meet treatment capacity and future ammonia removal requirements. It also could provide treatment/enhancement without requiring bypass operations, although it is not consistent with the Enclosed Bays and Estuaries Policy for flows up to 5.9 mgd that must flow through the enhancement wetlands. And like all the other alternatives, the existing wetlands systems are still utilized and rehabilitated under Alternative 3.

Follow-up review and development of Alternative 4A/B was completed in early 2017 based on feedback from the RWQCB regarding future permit requirements.

The following steps were taken to arrive at the consensus alternative:

- The oxidation pond treatment improvements were reviewed and revised based on the review completed by an outside expert. The improvements were developed to meet the anticipated discharge limits including the ability to remove ammonia.
- The City indicated a preference to phase in the parallel secondary treatment which will allow the benefits of the pond improvements to incorporate into the project. Therefore the second oxidation ditch could be constructed in a second phase, once the benefits of the oxidation pond upgrade could be established.

Based on these comparisons, both economic and non-economic, Carollo and LACO recommend proceeding with preliminary design of Alternative 4. It is the only alternative that will meet the RWQCB requirements enhancement.

This approach was reviewed during a public meeting on March 30, 2017 and at a council meeting on April 19, 2017. The presentations from these meetings are included in Appendix V. At that time the council provided direction to City staff to proceed with Alternative 4A/B design, to complete applications for state revolving loan funding (loans and grants) and to start the environmental review of the project impacts.

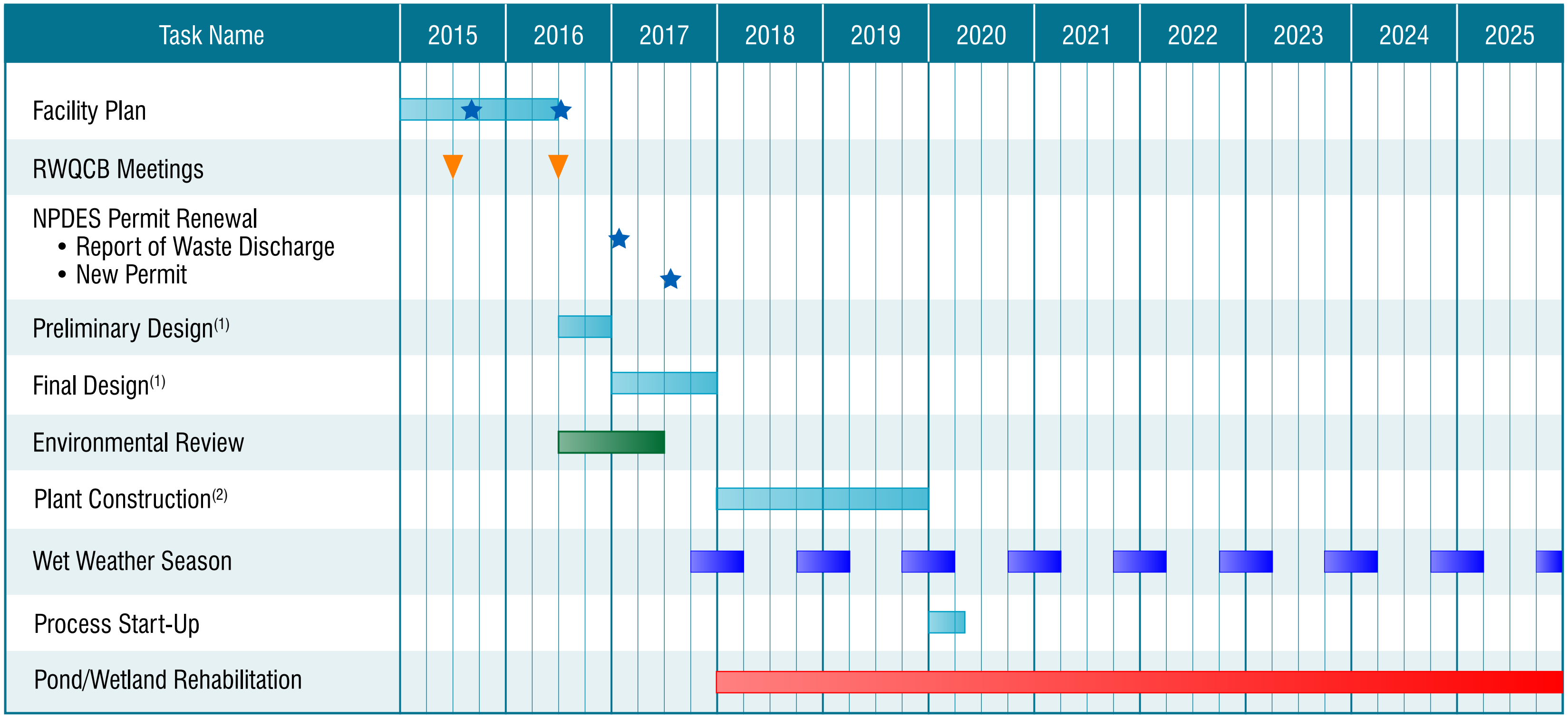
8.6 CIP IMPLEMENTATION AND NEXT STEPS

Implementation of the recommended project in this Facility Plan will require a significant amount of funding, time and effort for the City of Arcata. There are several key elements that should be considered in moving forward with implementation of this recommended CIP. These elements are included in the implementation schedule shown in Figure 8.1:

- CEQA / Environmental Review:
  - Approach and appropriate level of environmental review for overall plan and individual projects.
  - Proceed with CEQA for projects to be implemented in the near term.
- Funding and Financing:
  - Consider pursuing State Revolving Fund (SRF) loans to help pay for the proposed CIP improvement projects.
  - Develop a financial plan to determine the rate impacts of these projects.
  - Implement rate increases as required to fund the ongoing CIP requirements.

    - Research small and disadvantaged community funding sources for wastewater treatment project funding.
    - Proposition 1 Coastal Commission Grant - City should consider investigating obtaining grant funds to pay for sea level rise projects under the Proposition 1 Coastal Conservation Grant.
- RWQCB Discussions and NPDES Permit:
    - A Draft Report of Waste Discharge was submitted to the RWQCB by January 2017 to start permit renewal process. The RWQCB were requested to confirm UV design dose and disinfection objectives, including coliform or virus reduction.
    - Issuance of a new NPDES permit is expected sometime after the current permit expiration in July 2017.

The schedule in Figure 8.1 shows preliminary design starting in mid-2017 and final design beginning in the middle of 2018. Construction (of the majority of the mechanical and structural elements) is shown in 2019 to 2021, with final commissioning and startup in late 2021 and early 2022. The construction will cover the dry weather periods of both 2019 and 2020, and should allow for all the work to be completed while maintaining the existing plant in operation. Wet weather periods are also shown in the schedule as construction during these periods is difficult. The Pond and Wetlands rehabilitation is shown as a separate line item as these projects may be performed by City staff as opposed to a contractor and due to the extended construction time expected. The wetlands in particular will take longer to rehabilitate due to the need to regrade during dry season, plant and let the plants get established (approximately a 2-year cycle before performing as expected).



NOTES:
(1) To be finalized after completion of the Facility Plan.
(2) Construction schedule is preliminary, constraints TBD.

UPDATED IMPLEMENTATION SCHEDULE

FIGURE 8.1

CITY OF ARCATA
WASTEWATER TREATMENT PLANT IMPROVEMENTS PROJECT

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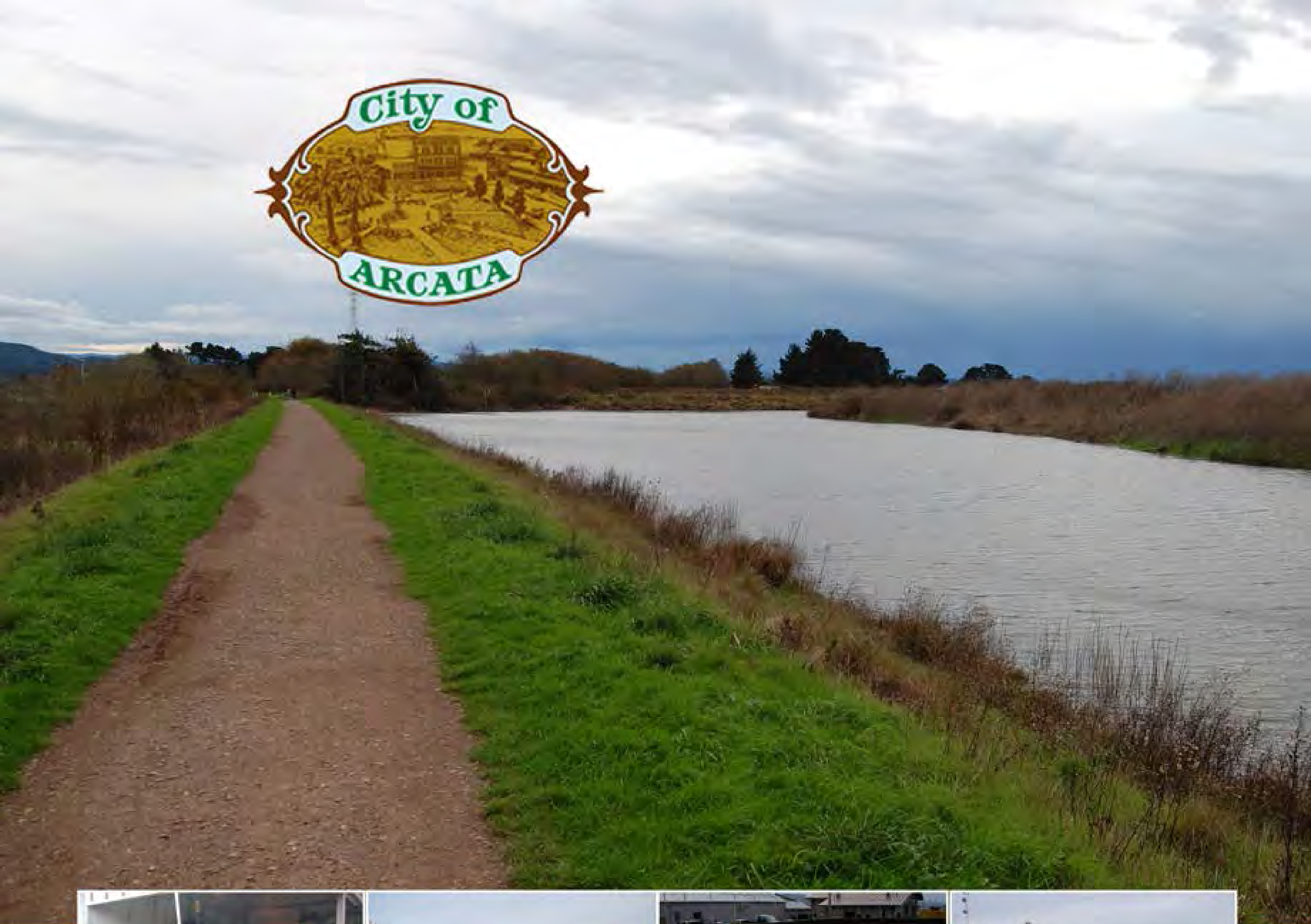

City of Arcata

Facility Plan Appendices

REVISED July 2017

CITY OF ARCATA

WASTEWATER TREATMENT FACILITY IMPROVEMENTS PROJECT

FACILITY PLAN

JULY 2017

REGISTERED PROFESSIONAL ENGINEER
DOUGLAS W. WING
No. 38950
CIVIL
STATE OF CALIFORNIA

07/27/2017

CITY OF ARCATA

WASTEWATER TREATMENT FACILITY IMPROVEMENTS PROJECT

LIST OF APPENDICES

APPENDIX A – NPDES PERMIT NO. CA0022713, ORDER NO. R1-2012-0031

ORDER NO. R1-2012-0031
NPDES NO. CA0022713
WDID NO. 1B82114OHUM

WASTE DISCHARGE REQUIREMENTS
FOR THE
CITY OF ARCATA
MUNICIPAL WASTEWATER TREATMENT FACILITY

The following Permittee is subject to waste discharge requirements as set forth in this Order:

Table 1. Permittee Information

Permittee	City of Arcata
Name of Facility	Arcata Wastewater Treatment Facility (WWTF)
Facility Address	600 South G Street
	Arcata, CA 95521
	Humboldt County
The U.S. Environmental Protection Agency (USEPA) and the Regional Water Quality Control Board have classified this discharge as a major discharge.	

Discharges by the City of Arcata from the Outfalls identified below are subject to waste discharge requirements as set forth in this Order.

Table 2. Discharge Location

Discharge Point/Outfall	Effluent Description	Discharge Point Latitude	Discharge Point Longitude	Receiving Water
001	secondary/equivalent to secondary treated wastewater	40° 51' 18" N	124° 5' 26.124" W	Humboldt Bay
002	equivalent to secondary treated wastewater	40° 51' 29" N	124° 5' 31.2504" W	Arcata Marsh Wildlife Sanctuary
003	secondary treated wastewater	40° 51' 40" N	124° 5' 37" W	Brackish Marsh, Humboldt Bay

Table 3. Administrative Information

This Order was adopted by the Regional Water Quality Control Board on:	June 7, 2012
This Order shall become effective on:	August 1, 2012
This Order shall expire on:	July 31, 2017
The Permittee shall file a Report of Waste Discharge in accordance with title 23, California Code of Regulations, as application for issuance of new waste discharge requirements no later than:	180 days prior to the Order expiration date (January 27, 2017)

IT IS HEREBY ORDERED, that Order No. R1-2004-0036 is rescinded upon the effective date of this Order except for enforcement purposes, and, in order to meet the provisions contained in division 7 of the Water Code (commencing with section 13000) and regulations adopted thereunder, and the provisions of the federal Clean Water Act (CWA) and regulations and guidelines adopted thereunder, the Permittee shall comply with the requirements in this Order.

I, Matthias St. John, Executive Officer, do hereby certify that this Order with all attachments is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, North Coast Region, on June 7, 2012.

____

Matthias St. John, Executive Officer

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I. Facility Information

The following Permittee is subject to waste discharge requirements as set forth in this Order.

Table 4. Facility Information

Permittee	City of Arcata
Name of Facility	Arcata Wastewater Treatment Facility
Facility Address	600 South G Street
	Arcata, CA 95521
	Humboldt County
Facility Contact, Title, Phone Number	Karen Diemer, Deputy Director, Environmental Services, (707) 825-8184
Mailing Address	736 F Street, Arcata, CA 95521
Type of Facility	Publicly Owned Treatment Works
Facility Design Flow	2.3 million gallons per day (mgd) (average dry weather design flow) 5.0 mgd (average wet weather design flow) 5.9 mgd (peak wet weather design flow) 16.5 mgd (wet weather Q_{max})

II. Findings

The California Regional Water Quality Control Board, North Coast Region (hereinafter the Regional Water Board), finds:

A. **Basis and Rationale for Requirements.** The Regional Water Board developed the requirements in this Order based on information submitted as part of the application for permit renewal submitted by the City of Arcata (hereinafter the City or Permittee), monitoring data submitted during the term of the Permittee's previous Order, and other available information. The Fact Sheet (Attachment F) contains facility information, legal authorities, and rationale for Order requirements. The Fact Sheet as well as Attachments A through E are hereby incorporated into this Order and constitute part of the Findings for this Order.

B. **Background.** The City is currently discharging pursuant to Order No. R1-2004-0036 and National Pollutant Discharge Elimination System (NPDES) Permit No. CA0022713. The Permittee submitted a Report of Waste Discharge, dated February 21, 2007, and applied for an NPDES permit renewal to discharge secondary treated wastewater from the Arcata waste water treatment facility (WWTF). The Permittee submitted an amended Report of Waste Discharge on December 15, 2011, incorporating a new primary point of discharge. The application was deemed complete on February 7, 2012.

C. Facility Description. The Permittee owns wastewater collection, treatment, and disposal facilities that serve a population of approximately 16,800 in the City of Arcata and the unincorporated community of Glendale. Additional background and facility information is provided in the Fact Sheet. Attachment B provides a map of the area around the facility. Attachment C provides a flow schematic of the facility.

D. Monitoring and Reporting. Section 122.48 requires that all NPDES permits specify requirements for recording and reporting monitoring results. Water Code sections 13267 and 13383 authorize the Regional Water Board to require technical and monitoring reports. The Monitoring and Reporting Program establishing monitoring and reporting requirements to implement federal and State requirements for the Arcata WWTF is provided in Attachment E.

III. Discharge Prohibitions

A. The discharge of waste to Humboldt Bay is prohibited unless the discharge is consistent with State Board Order No. 79-20 and Regional Water Board Resolution 83-9.

B. The discharge of any waste not disclosed by the Permittee or not within the reasonable contemplation of the Regional Water Board is prohibited.

C. Creation of pollution, contamination, or nuisance, as defined by Section 13050 of the California Water Code is prohibited.

D. The discharge of sludge or digester supernatant is prohibited, except as authorized under section VI.C.5.c of this Order (Sludge Disposal and Handling Requirements).

E. The discharge of untreated or partially treated waste (receiving a lower level of treatment than described in section II. B of the Fact Sheet) from anywhere within the collection, treatment, or disposal systems is prohibited, except as provided for in Prohibition III. I and in Attachment D, Standard Provision G (Bypass).

F. Any sanitary sewer overflow (SSO) that results in a discharge of untreated or partially treated wastewater to (a) waters of the State, (b) groundwater, or (c) land that creates pollution, contamination, or nuisance, as defined in Water Code section 13050 (m) is prohibited.

G. The discharge of waste at any point not described in Finding II. B of the Fact Sheet, Prohibition III.I., or otherwise not authorized by this or another permit issued by the State Water Board or another Regional Water Board is prohibited.

H. The mean daily dry weather flow of waste through the treatment plant in excess of 2.3 mgd measured daily and averaged over a calendar month is prohibited.

I. The Discharge of treated effluent at Outfall 001 is prohibited, other than that portion of the flow exceeding peak flows of 5.9 mgd. [1]

IV. Effluent Limitations and Discharge Specifications

A. Effluent Limitations

1. Final Effluent Limitations – Outfall 001 (Humboldt Bay)

a. The Permittee shall maintain compliance with the following final effluent limitations at Outfall 001, with compliance measured at Monitoring Location EFF-001, as described in the attached MRP. These limitations apply only to flows allowed in accordance with Prohibition III.I.

Table 5. Effluent Limitations for Outfall 001 (Humboldt Bay)

Parameter	**Units**	**Effluent Limitations**		
		Average Monthly[2]	**Average Weekly**[3]	**Maximum Daily**
BOD_5	mg/L	45	65	---
	lbs/day [4]	863	1304	---
TSS	mg/L	66	95	---
	lbs/day 4	1266	1822	---
Settleable Solids	mL/L	0.1	---	0.2
Fecal Coliform	MPN/100ml	14[5]		43[6]
Chlorine, Total Residual	mg/L	0.01		0.02
pH	s.u.	6.0 – 9.0 at all times		
Copper	µg/L	2.9	---	5.8

1 This Prohibition will take effect upon activation of the new disinfection system and implementation of discharges at Discharge Point 003, but no later than December 1, 2016.

2 Compliance with average monthly effluent limitations shall be based on averages derived from measurements in the calendar month.

3 Compliance with average weekly effluent limitations shall be based on averages derived from measurements in the calendar week (i.e., Sunday through Saturday).

4 Mass-based limitations are based on the dry weather design flow of the WWTF of 2.3 mgd. During wet weather periods, when influent flow exceeds the dry weather design flow rate, mass emission limitations shall be calculated using the concentration-based effluent limitations and the actual daily average effluent flow rate (not to exceed the average wet weather design flow rate of 5.0 mgd).

5 Median.

6 Not more than 10% of samples collected in a 30-day period shall exceed the daily maximum.

Table 5. Effluent Limitations for Outfall 001 (Humboldt Bay)

Parameter	Units	Effluent Limitations		
		Average Monthly[2]	Average Weekly[3]	Maximum Daily
Cyanide	µg/L	0.5	---	1.0
2,3,7,8-TCDD Equivalents	µg/L	1.3×10^{-8}	---	2.6×10^{-8}
Carbon Tetrachloride	µg/L	0.25	---	0.50
Dichlorobromomethane	µg/L	0.56	---	1.12
Bis(2-Ethylhexyl)Phthalate	µg/L	1.8	---	3.6

b. **Percent Removal:** The average monthly percent removal of BOD_5 and TSS shall not be less than 65 percent. Percent removal shall be based on the difference between weekly influent and effluent concentrations, as measured at Monitoring Locations INF-001 and EFF-001, averaged over each calendar month.

c. **Acute Toxicity:** There shall be no acute toxicity in treated wastewater discharged to Humboldt Bay. The Permittee will be considered compliant with this limitation when the survival of aquatic organisms in a 96-hour bioassay of undiluted effluent complies with the following.

i. Minimum for any one bioassay: 70 percent survival

ii. Median for any three or more consecutive bioassays: at least 90 percent survival

Compliance with this effluent limitation shall be determined in accordance with section V.A of the Monitoring and Reporting Program (Attachment E).

2. Final Effluent Limitations – Outfall 003 (Brackish Marsh/Humboldt Bay)

a. Thirty (30) days prior to initiation of the upgraded WWTF configuration, including use of the ultraviolet disinfection system, described under Finding II.B of the Fact Sheet, the Permittee shall submit written notification to the Executive Officer declaring the intent to operate and discharge using the upgraded configuration of the WWTF. Upon activation of the new configuration, the Permittee shall maintain compliance with the following effluent limitations at Outfall 003, with compliance measured at Monitoring Location EFF-003, as described in the attached MRP.

Table 6. Effluent Limitations for Outfall 003 (Brackish Marsh/Humboldt Bay)

Parameter	Units	Effluent Limitations		
		Average Monthly[2]	**Average Weekly[3]**	**Maximum Daily**
BOD_5	mg/L	30	45	---
	lbs/day [4]	575	863	---
TSS	mg/L	30	45	---
	lbs/day [4]	575	863	---
Settleable Solids	mL/L	0.1	---	0.2
Fecal Coliform	MPN/100ml	14[5]		43[6]
pH	s.u.	6.0 – 9.0 at all times		
Copper	µg/L	2.9	---	5.8
Cyanide	µg/L	0.5	---	1.0
2,3,7,8-TCDD Equivalents	µg/L	1.3 x 10-8	---	2.6 x 10-8
Carbon Tetrachloride	µg/L	0.25	---	0.50
Bis(2-Ethylhexyl)Phthalate	µg/L	1.8	---	3.6

b. **Percent Removal:** The average monthly percent removal of BOD_5 and TSS shall not be less than 85 percent. Percent removal shall be based on the difference between weekly influent and effluent concentrations, as measured at Monitoring Locations INF-001 and EFF-003, averaged over each calendar month.

c. **Acute Toxicity:** There shall be no acute toxicity in treated wastewater discharged to Humboldt Bay. The Permittee will be considered compliant with this limitation when the survival of aquatic organisms in a 96-hour bioassay of undiluted effluent complies with the following.

   i. Minimum for any one bioassay: 70 percent survival

   ii. Median for any three or more consecutive bioassays: at least 90 percent survival

Compliance with this effluent limitation shall be determined in accordance with section V.A of the Monitoring and Reporting Program (Attachment E).

3. Interim Effluent Limitations – Outfall 001 (Humboldt Bay)

a. Until the activation of the upgraded WWTF configuration or December 1, 2016, whichever is sooner, the Permittee shall maintain compliance with the following interim effluent limitations at Outfall 001, with compliance measured at Monitoring Location EFF-001, as described in the attached MRP.

Table 7. Interim Effluent Limitations for Outfall 001 (Humboldt Bay)

Parameter	Units	Effluent Limitations		
		Average Monthly[2]	Average Weekly[3]	Maximum Daily
BOD_5	mg/L	30	45	---
	lbs/day [4]	575	863	---
TSS	mg/L	30	45	---
	lbs/day [4]	575	863	---
Settleable Solids	mL/L	0.1	---	0.2
Fecal Coliform	MPN/100ml	14[5]		43[6]
Chlorine, Total Residual	mg/L	0.01		0.02
pH	s.u.	6.0 – 9.0 at all times		
Copper	µg/L	2.9	---	5.8
Cyanide	µg/L	0.5	---	1.0
2,3,7,8-TCDD Equivalents	µg/L	1.3×10^{-8}	---	2.6×10^{-8}
Carbon Tetrachloride	µg/L	0.25	---	0.50
Dichlorobromomethane	µg/L	0.56	---	1.12
Bis(2-Ethylhexyl)Phthalate	µg/L	1.8	---	3.6

b. **Percent Removal:** The average monthly percent removal of BOD_5 and TSS shall not be less than 85 percent. Percent removal shall be based on the difference between weekly influent and effluent concentrations, as measured at Monitoring Locations INF-001 and EFF-001, averaged over each calendar month.

c. **Acute Toxicity:** There shall be no acute toxicity in treated wastewater discharged to Humboldt Bay. The Permittee will be considered compliant with this limitation when the survival of aquatic organisms in a 96-hour bioassay of undiluted effluent complies with the following.

   i. Minimum for any one bioassay: 70 percent survival

   ii. Median for any three or more consecutive bioassays: at least 90 percent survival

   Compliance with this effluent limitation shall be determined in accordance with section V.A of the Monitoring and Reporting Program (Attachment E).

B. Discharge Specifications

1. Discharge Specifications – Outfall 002 (AMWS)

a. The Permittee shall maintain compliance with the following final discharge specifications at Outfall 002, with compliance measured at Monitoring Location EFF-002, as described in the attached MRP.

Table 8. Discharge Specifications for Outfall 002 (AMWS)

Parameter	Units	Discharge Specifications		
		Average Monthly[3]	Average Weekly[4]	Maximum Daily
BOD_5	mg/L	45	65	---
TSS	mg/L	66	95	---
pH	s.u.	6.0 – 9.0 at all times		
Settleable Solids	mL/L	0.1	---	0.2
Copper	ug/L	4.7	---	9.5
Chlorine, Total Residual[a]	mg/L	0.01		0.02

[a] Limitations for chlorine residual apply at all times. However, upon activation of the upgraded configuration, in the absence of chlorine usage prior to Discharge Point 002, it is assumed that there will be no chlorine residual at this discharge location.

2. Disinfection Process Requirements for Ultraviolet (UV) Disinfection System

Upon completion and testing of the UV disinfection system, the Permittee shall operate the UV disinfection to maintain compliance with bacteria Effluent Limitations at Outfall 003.

a. Prior to initial discharge at Outfall 003 the Permittee shall submit to the Executive Officer a copy of a letter from the UV supplier showing written acceptance of the UV system capacity for the Arcata WWTF, based upon the National Water Research Institute validation testing from the CDPH for the UV disinfection system supplied for the Arcata WWTF.

b. Prior to initial discharge at Outfall 003 the Permittee shall submit to the Executive Officer and CDPH, an operations and maintenance plan detailing how compliance with the National Water Research Institute's guidelines will be assured at all times.

c. The UV disinfection system shall be operated in accordance with an appropriate operations and maintenance plan.

C. Land Discharge Specifications and Reclamation Specifications

This section of the Order is not applicable to discharges from the City of Arcata Wastewater Treatment Plant, as treated wastewater is not reclaimed nor applied to land for the purpose of disposal.

V. Receiving Water Limitations

A. Surface Water Limitations

Receiving water limitations are based on water quality objectives contained in the Basin Plan and are a required to be addressed as part of this Order. However, a receiving water condition not in conformance with the limitation is not necessarily a violation of this order. Compliance with receiving water limitations shall be measured at monitoring locations described in the MRP (Attachment E). The Regional Water Board may require an investigation to determine cause and culpability prior to asserting a violation has occurred.

Discharges from the Arcata WWTF to Humboldt Bay shall not cause the following in the receiving waters:

1. The discharge shall not cause the dissolved oxygen concentration of the receiving water (Humboldt Bay) to violate the following objectives established by Table 3-1 of the Basin Plan.

    - 6.0 mg/L, minimum in any sample
    - 6.2 mg/L, 90 percent lower limit (90 percent or more of the monthly mean dissolved oxygen concentrations in a calendar year shall be greater than or equal to 6.2 mg/L)
    - 7.0 mg/L, 50 percent lower limit (50 percent or more of the monthly mean dissolved oxygen concentrations in a calendar year shall be greater than or equal to 7.0 mg/L)

2. As established by Table 3-1 of the Basin Plan, the discharge shall not cause the pH of receiving waters to be depressed below natural background levels nor raised above 8.5. Within this range, the discharge shall not cause the pH of the receiving waters to be changed at any time more than 0.2 units from that which occurs naturally.

3. The discharge shall not cause turbidity of receiving waters to be increased more than 20 percent above naturally occurring background levels.

4. The discharge shall not cause receiving waters to contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.

5. The discharge shall not cause receiving waters to contain floating materials, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.

6. The discharge shall not cause receiving waters to contain taste or odor producing substances in concentrations that impart undesirable tastes or odors to fish flesh or other edible products of aquatic origin, that cause nuisance, or that adversely affect beneficial uses.

7. The discharge shall not cause coloration of receiving waters that causes nuisance or adversely affects beneficial uses.

8. The discharge shall not contain suspended material in concentrations that result in deposition of material in receiving waters that cause nuisance or adversely affect beneficial uses.

9. The discharge shall not cause or contribute concentrations of biostimulants to the receiving water that promote objectionable aquatic growth to the extent that such growth causes nuisance or adversely affects beneficial uses.

10. The discharge shall not cause receiving waters to contain toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in humans, plants, animals, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, bioassays of appropriate duration, or other appropriate methods, as specified by the Regional Water Board.

11. The natural receiving water temperature shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water Board that such alteration in temperature does not adversely affect beneficial uses. The discharge shall not cause an increase of the receiving water by more than 5º F above natural receiving water temperature.

12. The discharge shall not cause an individual pesticide or combination of pesticides to be present in concentrations that adversely affect beneficial uses. The discharge must not cause bioaccumulation of pesticide, fungicide, wood treatment chemical, or other toxic pollutant concentrations in bottom sediments or aquatic life to levels which are harmful to human health. The discharge shall not cause the receiving waters to contain concentrations of pesticides in excess of the limiting concentrations in excess of the limiting concentrations established as Maximum Contaminant Levels by the Department of Health Services in title 22, Division 4, Chapter 15, section 64444 of the California Code of Regulations.

13. The discharge shall not cause receiving waters to contain oils, greases, waxes, or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise affect beneficial uses.

14. The discharge shall not cause concentrations of chemical constituents to occur in excess of the limiting concentrations established as Maximum Contaminant Levels by the Department of Health Services in title 22, Division 4, Chapter 15, Articles 4 and 5.5 of the California Code of Regulations.

B. Groundwater Limitations

The storage, use or disposal of wastewater or recycled water shall not cause or contribute to a statistically significant degradation of groundwater quality, cause exceedance of applicable water quality objectives or create adverse impacts to beneficial uses of groundwater.

VI. Provisions

A. Standard Provisions

1. **Federal Standard Provisions.** The Permittee shall comply with all applicable Standard Provisions included in Attachment D of this Order.

2. **Regional Water Board Standard Provisions.** The Permittee shall comply with the following Regional Water Board standard provisions.

   a. Failure to comply with provisions or requirements of this Order, or non-compliance with other applicable laws or regulations governing discharges from this facility, may subject the Permittee to administrative or civil liabilities, criminal penalties, and/or other enforcement remedies to ensure compliance. Additionally, certain instances of non-compliance may subject the Permittee to civil or criminal enforcement from appropriate local, state, or federal law enforcement entities.

   b. In the event the Permittee does not comply or will be unable to comply for any reason, with any prohibition, interim or final effluent limitation, reclamation specification, or receiving water limitation of this Order, the Permittee shall notify the Regional Water Board orally[7] within 24 hours of

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[7] Oral reporting means direct contact with a Regional Water Board staff person. The oral report may be given in person or by telephone. After business hours, oral contact must be made by calling the State Office of Emergency Services at (800) 852-7550 or the Regional Water Board spill officer at (707) 576-2220.

having knowledge of such noncompliance and shall confirm this notification in writing within 5 days, unless the Regional Water Board waives confirmation. The written notification shall state the nature, time, duration, and cause of noncompliance, and shall describe the measures being taken to remedy the current noncompliance and to prevent recurrence, including, where applicable, a schedule of implementation. Other noncompliance requires written notification, as described above, at the time of the normal monitoring report.

B. Monitoring and Reporting Program (MRP) Requirements

The Permittee shall comply with the MRP, and future revisions thereto, in Attachment E of this Order.

C. Special Provisions

1. Reopener Provisions

a. **Standard Revisions.** Conditions that necessitate a major modification of a permit are described in title 40, Code of Federal Regulations[8] section 122.62, which include the following:

i. When standards or regulations on which the permit was based have been changed by promulgation of amended standards or regulations or by judicial decision. Therefore, if revisions of applicable water quality standards are promulgated or approved pursuant to Section 303 of the CWA or amendments thereto, the Regional Water Board will revise and modify this Order in accordance with such revised standards.

ii. When new information that was not available at the time of permit issuance would have justified different permit conditions at the time of issuance.

b. **Reasonable Potential .** This provision allows the Regional Water Board to modify, or revoke and reissue, this Order if present or future investigations demonstrate that the Permittee governed by this Permit is causing or contributing to excursions above any applicable priority pollutant criterion or objective, or adversely impacting water quality and/or the beneficial uses of receiving waters.

[8] All further statutory references are to title 40 of the Code of Federal Regulations unless otherwise indicated.

c. **Whole Effluent Toxicity.** This Order requires the Permittee to investigate the causes of, and identify corrective actions to reduce or eliminate effluent toxicity through a TRE. This Order may be reopened to include a numeric chronic toxicity limitation, a new acute toxicity limitation, and/or a limitation for a specific toxicant identified in the TRE. Additionally, if a numeric chronic toxicity water quality objective or a new statewide implementation procedure is adopted by the State Water Board, this Order may be reopened.

d. **303(d)-Listed Pollutants.** This provision allows the Regional Water Board to reopen this Order to modify existing effluent limitations or add effluent limitations or other requirements for pollutants that are the subject of any future TMDL action.

e. **Water Effects Ratios (WERs) and Metal Translators.** This provision allows the Regional Water Board to reopen this Order if future studies undertaken by the Permittee provide new information and justification for applying a water effects ratio or metals translator to a water quality objective for one or more priority pollutants.

f. **Nutrients.** This Order establishes monitoring requirements for total nitrate and monitoring requirements for the effluent and receiving water for nutrients (i.e., ammonia, nitrate, and phosphorus). This provision allows the Regional Water Board to reopen this Order if future monitoring data indicates the need for effluent limitations for any of these parameters.

g. **Receiving Water Standards.** This provision allows the Regional Water Board to reopen this Order if future monitoring data indicates that the discharge has caused a violation of any applicable water quality standard for receiving waters adopted by the Regional Water Board or the State Water Board, as required by the federal Clean Water Act and regulations adopted thereunder.

2. Special Studies, Technical Reports and Additional Monitoring Requirements

a. Whole Effluent Toxicity.

In addition to a limitation for whole effluent acute toxicity, the MRP of this Order requires routine monitoring for whole effluent chronic toxicity to determine compliance with the Basin Plan's narrative water quality objective for toxicity. As established by the MRP, if either of the effluent limitations for acute toxicity is exceeded (a single sample with less than 70% survival or a three sample median of less than 90% survival) or a chronic toxicity monitoring trigger of either a single sample maximum of 2.0 TUc or a three sample median of 1.0 TUc (where TUc = 100/NOEC)[9] is exceeded, the Permittee shall conduct accelerated monitoring as specified in section V. of the MRP.

Results of accelerated toxicity monitoring will indicate a need to conduct a Toxicity Reduction Evaluation (TRE), if toxicity persists; or it will indicate that a return to routine toxicity monitoring is justified because persistent toxicity has not been identified by accelerated monitoring. TREs shall be conducted in accordance with the TRE Workplan prepared by the Permittee pursuant to Section VI.C.2.b of this Order, below.

b. **Toxicity Reduction Evaluations (TRE) Workplan.**

If not already submitted, the Permittee shall prepare and submit to the Regional Water Board Executive Officer a TRE Workplan **within 180 days** of the effective date of this Order. Upon approval, this plan shall be reviewed and updated as necessary in order to remain current and applicable to the discharge and discharge facilities. The workplan shall describe the steps the Permittee intends to follow if toxicity is detected, and should include at least the following items:

i. A description of the investigation and evaluation techniques that would be used to identify potential causes and sources of toxicity, effluent variability, and treatment system efficiency.

ii. A description of the facility's methods of maximizing in-house treatment efficiency and good housekeeping practices to ensure control of potential sources.

iii. If a toxicity identification evaluation (TIE) is necessary, an indication of the person who would conduct the TIEs (i.e., an in-house expert or an outside contractor).

c. **Toxicity Reduction Evaluations (TRE).**

The TRE shall be conducted in accordance with the following:

i. The TRE shall be initiated within 30 days of the date of completion of the accelerated monitoring test, required by Section V of the MRP, observed to exceed either the acute or chronic toxicity parameter.

[9] This Order does not allow any credit for dilution for the chronic condition. Therefore, a TRE is triggered when the effluent exhibits a pattern of toxicity at 100% effluent.

ii. The TRE shall be conducted in accordance with the Permittee's workplan.

iii. The TRE shall be in accordance with current technical guidance and reference material including, at a minimum, the USEPA manual EPA/833B 99/002.

iv. The TRE may end at any stage if, through monitoring results, it is determined that there is no longer toxicity observed.

v. The Permittee may initiate a TIE as part of the TRE process to identify the cause(s) of toxicity. As guidance, the Permittee shall use the USEPA acute and chronic manuals, EPA/600/6-91/005F (Phase I), EPA/600/R-92/080 (Phase II), and EPA-600/R-92/081 (Phase III).

vi. As toxic substances are identified or characterized, the Permittee shall continue the TRE by determining the source(s) and evaluating alternative strategies for reducing or eliminating the substances from the discharge. All reasonable steps shall be taken to reduce toxicity to levels consistent with chronic toxicity parameters.

vii. Many recommended TRE elements accompany required efforts of source control, pollution prevention, and storm water control programs. TRE efforts should be coordinated with such efforts. To prevent duplication of efforts, evidence of complying with requirements of recommendations of such programs may be acceptable to comply with requirements of the TRE.

viii. The Regional Water Board recognizes that chronic toxicity may be episodic and identification of a reduction of sources of chronic toxicity may not be successful in all cases. Consideration of enforcement action by the Regional Water Board will be based in part on the Permittee's actions and efforts to identify and control or reduce sources of consistent toxicity.

d. Arcata Marsh Wildlife Sanctuary (AMWS) Evaluation.

By November 1, 2012, the Permittee shall prepare and submit for Executive Officer approval, a workplan for ongoing evaluation of the beneficial uses identified by the Regional Water Board under section III of the Fact Sheet for the AMWS. The workplan shall be developed in accordance with guidance from, but not limited to 1) *Methods for Evaluating Wetland Condition; 2) Study Design for Monitoring Wetlands*, EPA-822-R-02-015, *Methods for Evaluating Wetland Condition: Developing an Invertebrate Index of Biological d. of the proposed Order* *has been modified to Integrity for Wetlands.* Office of Water, U.S. Environmental Protection Agency, Washington, DC. EPA-822-R-02-019, and 3) *Methods for Evaluating Wetland Condition: Using Amphibians in Bioassessments of Wetlands.* Office of Water, U.S. Environmental Protection Agency, Washington, DC. EPA-822-R-02-022, standard acceptable assessment tools and be of sufficient scope to demonstrate that the discharge of treated wastewater at Outfall 002 is protective of the beneficial uses of the AMWS. The workplan shall include, but not be limited to, an ongoing study to determine the following:

i. Overall ecological condition of AMWS using biological assessments;

ii. Nutrient levels/enrichment of the AMWS;

iii. Whether AMWS condition is improving, degrading, or staying the same over time;

iv. Seasonal patterns in AMWS conditions;

v. System stressors and associated thresholds (ie. how much the AMWS system can be disturbed without causing unacceptable changes in wetland system quality or degradation of beneficial uses).

The findings from these studies will be used for adaptive management to ensure the AMWS retains maximum treatment function while protecting beneficial uses.

3. Best Management Practices and Pollution Prevention

a. **Pollutant Minimization Program (PMP)**

The Permittee shall, as required by the Executive Officer, develop and conduct a PMP as further described below when there is evidence (e.g., sample results reported as detected, but not quantified (DNQ) when the effluent limitation is less than the method detection limit (MDL), sample results from analytical methods more sensitive than those methods required by this Order, presence of whole effluent toxicity, health advisories for fish consumption, results of benthic or aquatic organism tissue sampling) that a priority pollutant is present in the effluent above an effluent limitation and either:

i. A sample result is reported as DNQ and the effluent limitation is less than the RL; or

ii. A sample result is reported as ND and the effluent limitation is less than the MDL, using definitions described in Attachment A and reporting protocols described in MRP section X.B.4.

The PMP shall include, but not be limited to, the following actions and submittals acceptable to the Regional Water Board:

iii. An annual review and semi-annual monitoring of potential sources of the reportable priority pollutant(s), which may include fish tissue monitoring and other bio-uptake sampling;

iv. Quarterly monitoring for the reportable priority pollutant(s) in the influent to the wastewater treatment system;

v. Submittal of a control strategy designed to proceed toward the goal of maintaining concentrations of the reportable priority pollutant(s) in the effluent at or below the effluent limitation;

vi. Implementation of appropriate cost-effective control measures for the reportable priority pollutant(s), consistent with the control strategy; and

vii. An annual status report that shall be submitted as part of the Annual WWTF Report due March 1st to the Regional Water Board and shall include:

(a) All PMP monitoring results for the previous year;

(b) A list of potential sources of the reportable priority pollutant(s);

(c) A summary of all actions undertaken pursuant to the control strategy; and

(d) A description of actions to be taken in the following year.

4. Construction, Operation and Maintenance Specifications

a. The Permittee shall 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 this Order. Proper operation and maintenance includes adequate laboratory quality control and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems that are installed by the Permittee only when necessary to achieve compliance with the conditions of this Order. (section 122.41(e))

b. The Permittee shall maintain an updated Operation and Maintenance (O&M) Manual for the Facility. The Permittee shall update the O&M Manual, as necessary, to conform to changes in operation and maintenance of the Facility. The O&M Manual shall be readily available to operating personnel onsite and for review by state or federal inspectors. The O&M Manual shall include the following.

i. Description of the Facility's table of organization showing the number of employees, duties and qualifications and plant attendance schedules (daily, weekends and holidays, part-time, etc.). The description should include documentation that the personnel are knowledgeable and qualified to operate the treatment facility so as to achieve the required level of treatment at all times.

ii. Detailed description of safe and effective operation and maintenance of treatment processes, process control instrumentation and equipment.

iii. Description of laboratory and quality assurance procedures.

iv. Process and equipment inspection and maintenance schedules.

v. Description of safeguards to assure that, should there be reduction, loss, or failure of electric power, the Permittee will be able to comply with requirements of this Order.

vi. Description of preventive (fail-safe) and contingency (response and cleanup) plans for controlling accidental discharges, and for minimizing the effect of such events. These plans shall identify the possible sources (such as loading and storage areas, power outage, waste treatment unit failure, process equipment failure, tank and piping failure) of accidental discharges, untreated or partially treated waste bypass, and polluted drainage.

5. Special Provisions for Municipal Facilities (POTWs Only)

a. **Wastewater Collection Systems**

i. **Statewide General WDRs for Sanitary Sewer Systems**

On May 2, 2006, the State Water Board adopted State Water Board Order No. 2006-003-DWQ, Statewide General WDRs for Sanitary Sewer Systems. Order No. 2006-0003-DWQ requires all public agencies that currently own or operate sanitary sewer systems to apply for coverage under the General WDRs. The deadline for existing dischargers to apply for coverage under State Water Board Order No. 2006-003-DWQ was November 6, 2006. On February 20, 2008, the State Water Board adopted Order No. WQ 2008-0002-EXEC Adopting Amended Monitoring and Reporting Requirements for Statewide General Waste Discharge Requirements for Sanitary Sewer Systems. The Permittee shall maintain coverage under, and is separately subject to the requirements and enforcement of Order Nos. 2006-0003-DWQ and WQ-2008-0002-EXEC, and any future revisions thereto for operation of its wastewater collection system, which are not incorporated by reference herein.

ii. **Standard Provisions Applicable**

In addition to the coverage obtained under Order No. 2006-0003, the Permittee's collection system is part of the treatment system that is subject to this Order. As such, pursuant to federal regulations, the Permittee must properly operate and maintain its collection system [section 122.41(e)], report any non-compliance [section 122.41(l)(6) and (7)], and mitigate any discharge from the collection system that might violate this Order [section 122.41(d)].

iii. **Spills and Sanitary Sewer Overflows**

(a) The Permittee shall take all feasible steps to stop spills and sanitary sewer overflows (SSOs) as soon as possible. All reasonable steps should be taken to collect spilled material and protect the public from contact with wastes or waste-contaminated soil or surfaces.

(b) The Permittee shall report orally and in writing to the Regional Water Board staff all SSOs and unauthorized spills of waste. Spill notification and reporting shall be conducted in accordance with section X.E of the Monitoring and Reporting Program.

b. **Pretreatment of Industrial Waste**

i. The City shall be responsible and liable for the performance of all Control Authority pretreatment requirements contained in 40 CFR Part 403, including any subsequent regulatory revisions to Part 403. Where Part 403 or subsequent revision places mandatory actions upon the City as the Control Authority, but does not specify a timetable for completion of the actions, the City shall complete the required actions within six months from the issuance date of this permit or the effective date of the Part 403 revisions, whichever comes later. For violations of pretreatment requirements, the City shall be subject to enforcement actions, penalties, fines and other remedies by the U.S. Environmental Protection Agency (EPA) or other appropriate parties, as provided in the Act. EPA may initiate enforcement action against a nondomestic user for noncompliance with applicable standards and requirements as provided in the Act.

ii. The City shall enforce the requirements promulgated under sections 307(b), 307(c), 307(d) and 402(b) of the Act with timely, appropriate and effective enforcement actions. The City shall cause all nondomestic users subject to federal categorical standards to achieve compliance no later than the date specified in those requirements or, in the case of a new nondomestic user, upon commencement of the discharge.

iii. The City shall perform the pretreatment functions as required in 40 CFR Part 403 including, but not limited to:

(a) Implement the necessary legal authorities as provided in 40 CFR Part 403.8(f)(1);
(b) b. Enforce the pretreatment requirements under 40 CFR Part 403.5 and 403.6;
(c) c. Implement the programmatic functions as provided in 40 CFR Part 403.8(f)(2); and
(d) d. Provide the requisite funding and personnel to implement the pretreatment program as provided in 40 CFR Part 403.8(f)(3).

iv. The City shall submit annually a report to EPA Pacific Southwest Region, and the State describing its pretreatment activities over the previous year. In the event the City is not in compliance with any conditions or requirements of this permit, then the City shall also include the reasons for noncompliance and state how and when the City shall comply with such conditions and requirements. This annual report shall cover operations from January 1 through December 31 and is due on February 28 of each year. The report shall contain, but not be limited to, the following information:

(a) A summary of analytical results from representative, flow proportioned, 24-hour composite sampling of the POTW's influent and effluent performed with the techniques prescribed in 40 CFR Part 136 for those pollutants EPA has identified under section 307(a) of the Act, which are known or suspected to be discharged by nondomestic users. This will consist of an annual full priority pollutant scan, with quarterly samples analyzed only for those pollutants detected in the full scan Sampling and analysis for specific industrial users may be modified pursuant to federal pretreatment regulations at 40 CFR 12(e)(2), which allows a an industrial user to forego sampling of a pollutant regulated by the categorical pretreatment standard if the industrial user demonstrates that the pollutant is neither present in the discharge nor expected to be present in the discharge. The City is not required to sample and analyze for asbestos. Sludge sampling and analysis are covered in the sludge section of this permit. The City shall also provide any influent or effluent monitoring data performed with the techniques prescribed in 40 CFR Part 136 for non-priority pollutants which the City believes may be causing or contributing to interference or pass through.

(b) A discussion of Upset, Interference, or Pass Through incidents, if any, at the treatment plant which the City knows or suspects were caused by nondomestic users of the POTW system. The discussion shall include the reasons why the incidents occurred, the corrective actions taken and, if known, the name and address of the nondomestic user(s) responsible. The discussion shall also include a review of the applicable pollutant limitations, if any, to determine whether any additional limitations, or changes to existing requirements, may be necessary to prevent pass through or interference;

(c) An updated list of the City's significant industrial users (SIUs) including their names and addresses, and a list of deletions, additions, and SIU name changes keyed to the previously submitted list. The City shall provide a brief explanation for each change. The list shall identify the SIUs subject to federal categorical standards by specifying which set(s) of standards are applicable to each SIU. The list shall also indicate which SIUs are subject to local limitations;

(d) The City shall characterize the compliance status of each SIU by providing a list or table which includes the following information:

(i) Name of the SIU;

(ii) Category, if subject to federal categorical standards;

(iii) The type of wastewater treatment or control processes in place;

(iv) The number of samples taken by the POTW during the year;

(v) The number of samples taken by the SIU during the year;

(vi) For an SIU subject to discharge requirements for total toxic organics, whether all required certifications were provided;

(vii) A list of the standards violated during the year. Identify whether the violations were for categorical standards or local limits;

(viii) Whether the facility is in significant noncompliance (SNC) as defined at 40 CFR 403.12(f)(2)(vii) at any time during the year; and

(ix) A summary of enforcement or other actions taken by the City during the year to return the SIU to compliance. Describe the type of action, final compliance date, and the amount of fines and penalties collected, if any. Describe any proposed actions for bringing the SIU into compliance;

(a) A brief description of any programs the City implements to reduce pollutants from nondomestic users that are not classified as SIUs;

(b) A brief description of any significant changes in operating the pretreatment program which differ from the previous year including, but not limited to, changes concerning the program's administrative structure, local limits, monitoring program or monitoring frequencies, legal authority, enforcement policy, funding levels, or staffing levels;

(c) A summary of the annual pretreatment budget, including the cost of pretreatment program functions and equipment purchases; and

(d) A summary of activities to involve and inform the public of the program including a copy of the newspaper notice, if any, required under 40 CFR 403.8(f)(2)(vii).

v. The City shall submit a semiannual SIU noncompliance status report to EPA Pacific Southwest Region, and the State. The report shall cover the period of January 1 through June 30, and shall be submitted by July 31. The report shall contain:

(a) The name and address of all SIUs which violated any discharge or reporting requirements during the report period;

(b) A description of the violations including whether any discharge violations were for categorical standards or local limits;

(c) A description of the enforcement or other actions that were taken by the City to remedy the noncompliance; and

(d) The status of active enforcement and other actions taken by the City in response to SIU noncompliance identified in previous reports.

c. **Sludge Disposal and Handling Requirements**

i. Sludge, as used in this document, means the solid, semisolid, and liquid residues removed during primary, secondary, or advanced wastewater treatment processes. Solid waste refers to grit and screenings generated during preliminary treatment. Biosolids refers to sludge that has been treated, tested, and shown to be capable of being beneficially and legally used pursuant to federal and State regulations as a soil amendment for agriculture, silviculture, horticulture, and land reclamation activities.

ii. All collected sludges and other solid waste removed from liquid wastes shall be removed from screens, sumps, ponds, and tanks as needed to ensure optimal plant operation and disposed of in accordance with applicable federal and State regulations.

iii. The use and disposal of biosolids are separately required to comply with all the requirements in Part 503, which are enforceable by the USEPA, not the Regional Water Board. If during the life of this Order, the State accepts primacy for implementation of Part 503, the Regional Water Board may also initiate enforcement where appropriate.

iv. Sludge or biosolids that are disposed of in a municipal solid waste landfill or used as landfill daily cover shall separately meet the applicable requirements of Part 258, which are not incorporated by reference into this Order. In the annual self-monitoring report, the Permittee shall include the amount of sludge or biosolids disposed of, and the landfill(s) which received the sludge or biosolids.

v. The Permittee shall take all reasonable steps to prevent and minimize any sludge use or disposal contrary to the requirements of this Order that has a likelihood of adversely affecting human health or the environment.

vi. Solids and sludge treatment, storage, and disposal or reuse shall not create a nuisance, such as objectionable odors or flies, and shall not result in groundwater contamination.

vii. Solids and sludge treatment and storage sites shall have facilities adequate to divert surface water runoff from adjacent areas, to protect the boundaries of the site from erosion, and to prevent drainage from the treatment and storage site. Adequate protection is defined as protection from at least a 100-year storm.

viii. The discharge of sewage sludge, biosolids, and other waste solids shall not cause waste material to be in a position where it is, or can be, conveyed from the treatment and storage sites and deposited in the waters of the state.

ix. The beneficial use of biosolids by application to land as soil amendment is not covered or authorized by this Order. If applicable, for the discharge of biosolids from the wastewater treatment plant, the Permittee shall seek separate authorization to discharge under the requirements of the State Water Resources Control Board Water Quality Order No. 2004-0012–DWQ General Waste Discharge Requirements for the Discharge of Biosolids to Land or Use as a Soil Amendment In Agricultural, Silvicultural, Horticultural, and Land

Reclamation Activities (General Order), or other WDRs issued by the Regional Water Board, which are not incorporated by reference into this Order.

d. **Operator Certification**

Supervisors and operators of municipal WWTFs shall possess a certificate of appropriate grade in accordance with title 23, Cal. Code of Regs, section 3680. The State Water Board may accept experience in lieu of qualification training. In lieu of a properly certified WWTF operator, the State Water Board may approve use of a water treatment facility operator of appropriate grade certified by CDPH where water reclamation is involved.

e. **Adequate Capacity**

If the WWTF or effluent disposal areas will reach capacity within 4 years, the Permittee shall notify the Regional Water Board. A copy of such notification shall be sent to appropriate local elected officials, local permitting agencies, and the press. Factors to be evaluated in assessing reserve capacity shall include, at a minimum, (1) comparison of the wet weather design flow with the highest daily flow[10], and (2) comparison of the average dry weather design flow with the lowest monthly flow. The Permittee shall demonstrate that adequate steps are being taken to address the capacity problem. The Permittee shall submit a technical report to the Regional Water Board showing how flow volumes will be prevented from exceeding capacity, or how capacity will be increased, within 120 days after providing notification to the Regional Water Board, or within 120 days after receipt of Regional Water Board notification, that the WWTP will reach capacity within 4 years. The time for filing the required technical report may be extended by the Regional Water Board. An extension of 30 days may be granted by the Executive Officer, and longer extensions may be granted by the Regional Water Board itself. [CCR Title 23, section 2232]

6. Other Special Provisions

a. **Storm Water.** For the control of storm water discharged from the site of the WWTF, if applicable, the Permittee shall seek separate authorization to discharge under the requirements of the State Water Board's Water Quality Order 97-03-DWQ, NPDES General Permit No. CAS000001, Waste Discharge Requirements for Discharges of Storm Water

[10] Wet weather design flow will be included in a WWTF capacity assessment once the upgraded configuration is complete and Discharge Point 003 is in use.

Associated with Industrial Activities Excluding Construction Activities (or subsequent renewed versions of the General Permit), which is not incorporated by reference into this Order.

b. **Engineering and Antidegradation Analysis for Proposed Increased Wet Weather Treatment Capacity.** The treatment facility's current, documented, average wet weather treatment capacity is 5.0 mgd. Before the Regional Water Board can consider an increase in this figure, the Permittee shall submit an Engineering and Antidegradation Analysis, which (1) describes the hydraulic and treatment capacities of significant components of the WWTF and its associated collection system, (2) identifies the flow or treatment limiting component(s) of the WWTF and the collection system, (3) characterizes historical wet weather flows to the WWTF (frequency, duration, flow), (4) provides an analysis of impacts to the receiving water(s) resulting from the incremental increase in flow volume and mass of pollutants discharged, and (5) provides an antidegradation analysis to document consistency, or not, with applicable State and federal antidegradation regulations, guidance, and policy.

7. Compliance Schedules

Not Applicable.

VII. Compliance Determination

Compliance with the effluent limitations contained in section IV of this Order will be determined as specified below.

A. General.

Compliance with effluent limitations for priority pollutants shall be determined using sample reporting protocols defined in the MRP of this Order. For purposes of reporting and administrative enforcement by the Regional and State Water Boards, the Permittee shall be deemed out of compliance with effluent limitations if the concentration of the priority pollutant in the monitoring sample is greater than the effluent limitation and greater than or equal to the reporting level (RL). For purposes of reporting and administrative enforcement by the Regional and State Water Boards, the Permittee shall be deemed out of compliance with effluent limitations if the concentration of 2,3,7,8-TCDD Equivalents in the monitoring sample is greater than the effluent limitation and greater than or equal to the reported minimum level (ML).

B. Multiple Sample Data.

When determining compliance with an AMEL for priority pollutants, and more than one sample result is available, the Permittee shall compute the arithmetic mean unless the data set contains one or more reported determinations of "Detected, but Not Quantified" (DNQ) or "Not Detected" (ND). In those cases, the Permittee shall compute the median in place of the arithmetic mean in accordance with the following procedure.

1. The data set shall be ranked from low to high, ranking the reported ND determinations lowest, DNQ determinations next, followed by quantified values (if any). The order of the individual ND or DNQ determinations is unimportant.

2. The median value of the data set shall be determined. If the data set has an odd number of data points, then the median is the middle value. If the data set has an even number of data points, then the median is the average of the two values around the middle unless one or both of the points are ND or DNQ, in which case the median value shall be the lower of the two data points where DNQ is lower than a value and ND is lower than DNQ.

C. Average Monthly Effluent Limitation (AMEL).

If the average (or when applicable, the median determined by subsection B above for multiple sample data) of daily discharges over a calendar month exceeds the AMEL for a given parameter, this will represent a single violation, though the Permittee will be considered out of compliance for each day of that month for that parameter (e.g., resulting in 31 days of non-compliance in a 31-day month). If only a single sample is taken during the calendar month and the analytical result for that sample exceeds the AMEL, the Permittee will be considered out of compliance for that calendar month. The Permittee will only be considered out of compliance for days when the discharge occurs. For any one calendar month during which no sample (daily discharge) is taken, no compliance determination can be made for that calendar month.

D. Average Weekly Effluent Limitation (AWEL).

If the average (or when applicable, the median determined by subsection B above for multiple sample data) of daily discharges over a calendar week exceeds the AWEL for a given parameter, this will represent a single violation, though the Permittee will be considered out of compliance for each day of that week for that parameter, resulting in 7 days of non-compliance. If only a single sample is taken during the calendar week and the analytical result for that sample exceeds the AWEL, the Permittee will be considered out of compliance for that calendar week. The Permittee will only be considered out of compliance for days when the discharge occurs. For any one calendar week during which no sample (daily discharge) is taken, no compliance determination can be made for that calendar week.

E. Maximum Daily Effluent Limitation (MDEL).

If a daily discharge (or when applicable, the median determined by subsection B, above, for multiple sample data of a daily discharge) exceeds the MDEL for a given parameter, the Permittee will be considered out of compliance for that parameter for that 1 day only within the reporting period. For any 1 day during which no sample is taken, no compliance determination can be made for that day.

F. Instantaneous Minimum Effluent Limitation.

If the analytical result of a single grab sample is lower than the instantaneous minimum effluent limitation for a parameter, the Permittee will be considered out of compliance for that parameter for that single sample. Non-compliance for each sample will be considered separately (e.g., the results of two grab samples taken within a calendar day that both are lower than the instantaneous minimum effluent limitation would result in two instances of non-compliance with the instantaneous minimum effluent limitation).

G. Instantaneous Maximum Effluent Limitation.

If the analytical result of a single grab sample is higher than the instantaneous maximum effluent limitation for a parameter, the Permittee will be considered out of compliance for that parameter for that single sample. Non-compliance for each sample will be considered separately (e.g., the results of two grab samples taken within a calendar day that both exceed the instantaneous maximum effluent limitation would result in two instances of non-compliance with the instantaneous maximum effluent limitation).

ATTACHMENT A – DEFINITIONS

Arithmetic Mean (μ), also called the average, is the sum of measured values divided by the number of samples. For ambient water concentrations, the arithmetic mean is calculated as follows:

Arithmetic mean = $\mu = \Sigma x / n$ where: Σx is the sum of the measured ambient water concentrations, and n is the number of samples.

Average Monthly Effluent Limitation (AMEL): 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.

Average Weekly Effluent Limitation (AWEL): the highest allowable average of daily discharges over a calendar week (Sunday through Saturday), calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges measured during that week.

Bioaccumulative pollutants are those substances taken up by an organism from its surrounding medium through gill membranes, epithelial tissue, or from food and subsequently concentrated and retained in the body of the organism.

Carcinogenic pollutants are substances that are known to cause cancer in living organisms.

Coefficient of Variation (CV) is a measure of the data variability and is calculated as the estimated standard deviation divided by the arithmetic mean of the observed values.

Daily Discharge: Daily Discharge is defined as either: (1) the total mass of the constituent discharged over the calendar day (12:00 am through 11:59 pm) or any 24-hour period that reasonably represents a calendar day for purposes of sampling (as specified in the permit), for a constituent with limitations expressed in units of mass or; (2) the unweighted arithmetic mean measurement of the constituent over the day for a constituent with limitations expressed in other units of measurement (e.g., concentration).

The daily discharge may be determined by the analytical results of a composite sample taken over the course of one day (a calendar day or other 24-hour period defined as a day) or by the arithmetic mean of analytical results from one or more grab samples taken over the course of the day.

For composite sampling, if 1 day is defined as a 24-hour period other than a calendar day, the analytical result for the 24-hour period will be considered as the result for the calendar day in which the 24-hour period ends.

Detected, but Not Quantified (DNQ) are those sample results less than the RL, but greater than or equal to the laboratory's MDL.

Dilution Credit is the amount of dilution granted to a discharge in the calculation of a water quality-based effluent limitation, based on the allowance of a specified mixing zone. It is calculated from the dilution ratio or determined through conducting a mixing zone study or modeling of the discharge and receiving water.

Effluent Concentration Allowance (ECA) is a value derived from the water quality criterion/objective, dilution credit, and ambient background concentration that is used, in conjunction with the coefficient of variation for the effluent monitoring data, to calculate a long-term average (LTA) discharge concentration. The ECA has the same meaning as waste load allocation (WLA) as used in USEPA guidance (Technical Support Document For Water Quality-based Toxics Control, March 1991, second printing, EPA/505/2-90-001).

Enclosed Bays means indentations along the coast that enclose an area of oceanic water within distinct headlands or harbor works. Enclosed bays include all bays where the narrowest distance between the headlands or outermost harbor works is less than 75 percent of the greatest dimension of the enclosed portion of the bay. Enclosed bays include, but are not limited to, Humboldt Bay, Bodega Harbor, Tomales Bay, Drake's Estero, San Francisco Bay, Morro Bay, Los Angeles-Long Beach Harbor, Upper and Lower Newport Bay, Mission Bay, and San Diego Bay. Enclosed bays do not include inland surface waters or ocean waters.

Estimated Chemical Concentration is the estimated chemical concentration that results from the confirmed detection of the substance by the analytical method below the ML value.

Estuaries means waters, including coastal lagoons, located at the mouths of streams that serve as areas of mixing for fresh and ocean waters. Coastal lagoons and mouths of streams that are temporarily separated from the ocean by sandbars shall be considered estuaries. Estuarine waters shall be considered to extend from a bay or the open ocean to a point upstream where there is no significant mixing of fresh water and seawater. Estuarine waters included, but are not limited to, the Sacramento-San Joaquin Delta, as defined in Water Code section 12220, Suisun Bay, Carquinez Strait downstream to the Carquinez Bridge, and appropriate areas of the Smith, Mad, Eel, Noyo, Russian, Klamath, San Diego, and Otay rivers. Estuaries do not include inland surface waters or ocean waters.

Inland Surface Waters are all surface waters of the State that do not include the ocean, enclosed bays, or estuaries.

Instantaneous Maximum Effluent Limitation: the highest allowable value for any single grab sample or aliquot (i.e., each grab sample or aliquot is independently compared to the instantaneous maximum limitation).

Instantaneous Minimum Effluent Limitation: the lowest allowable value for any single grab sample or aliquot (i.e., each grab sample or aliquot is independently compared to the instantaneous minimum limitation).

Maximum Daily Effluent Limitation (MDEL) means the highest allowable daily discharge of a pollutant, over a calendar day (or 24-hour period). For pollutants with limitations expressed in units of mass, the daily discharge is 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 is calculated as the arithmetic mean measurement of the pollutant over the day.

Mean Daily Dry Weather Influent Flow is the average daily flow measured during the calendar month, which, based on flow measurement, is shown to be the lowest flow of the calendar year.

Median is the middle measurement in a set of data. The median of a set of data is found by first arranging the measurements in order of magnitude (either increasing or decreasing order). If the number of measurements (n) is odd, then the median = $X_{(n+1)/2}$. If n is even, then the median = $(X_{n/2} + X_{(n/2)+1})/2$ (i.e., the midpoint between the $n/2$ and $n/2+1$).

Method Detection Limit (MDL) is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero, as defined in title 40 of the Code of Federal Regulations, Part 136, Attachment B, revised as of July 3, 1999.

Minimum Level (ML) is the concentration at which the entire analytical system must give a recognizable signal and acceptable calibration point. The ML is the concentration in a sample that is equivalent to the concentration of the lowest calibration standard analyzed by a specific analytical procedure, assuming that all the method specified sample weights, volumes, and processing steps have been followed.

Mixing Zone is a limited volume of receiving water that is allocated for mixing with a wastewater discharge where water quality criteria can be exceeded without causing adverse effects to the overall water body.

Not Detected (ND) are those sample results less than the laboratory's MDL.

Ocean Waters are the territorial marine waters of the State as defined by California law to the extent these waters are outside of enclosed bays, estuaries, and coastal lagoons. Discharges to ocean waters are regulated in accordance with the State Water Board's California Ocean Plan.

Persistent pollutants are substances for which degradation or decomposition in the environment is nonexistent or very slow.

Pollutant Minimization Program (PMP) means waste minimization and pollution prevention actions that include, but are not limited to, product substitution, waste stream recycling, alternative waste management methods, and education of the public and businesses. The goal of the PMP shall be to reduce all potential sources of a priority pollutant(s) through pollutant minimization (control) strategies, including pollution prevention measures as appropriate, to maintain the effluent concentration at or below the water quality-based effluent limitation. Pollution prevention measures may be particularly appropriate for persistent bioaccumulative priority pollutants where there is evidence that beneficial uses are being impacted. The Regional Water Board may consider cost effectiveness when establishing the requirements of a PMP. The completion and implementation of a Pollution Prevention Plan, if required pursuant to Water Code section 13263.3(d), shall be considered to fulfill the PMP requirements.

Pollution Prevention means any action that causes a net reduction in the use or generation of a hazardous substance or other pollutant that is discharged into water and includes, but is not limited to, input change, operational improvement, production process change, and product reformulation (as defined in Water Code section 13263.3). Pollution prevention does not include actions that merely shift a pollutant in wastewater from one environmental medium to another environmental medium, unless clear environmental benefits of such an approach are identified to the satisfaction of the State or Regional Water Board.

Reporting Level (RL) is the ML (and its associated analytical method) chosen by the Permittee for reporting and compliance determination from the MLs included in this Order. The MLs included in this Order correspond to approved analytical methods for reporting a sample result that are selected by the Regional Water Board either from Appendix 4 of the SIP in accordance with section 2.4.2 of the SIP or established in accordance with section 2.4.3 of the SIP. The ML is based on the proper application of method-based analytical procedures for sample preparation and the absence of any matrix interferences. Other factors may be applied to the ML depending on the specific sample preparation steps employed. For example, the treatment typically applied in cases where there are matrix-effects is to dilute the sample or sample aliquot by a factor of ten. In such cases, this additional factor must be applied to the ML in the computation of the RL.

Satellite Collection System is the portion, if any, of a sanitary sewer system owned or operated by a different public agency than the agency that owns and operates the wastewater treatment facility that a sanitary sewer system is tributary to.

Source of Drinking Water is any water designated as municipal or domestic supply (MUN) in a Regional Water Board Basin Plan.

Standard Deviation (σ) is a measure of variability that is calculated as follows:

$$\sigma = (\sum[(x - \mu)^2]/(n - 1))^{0.5}$$

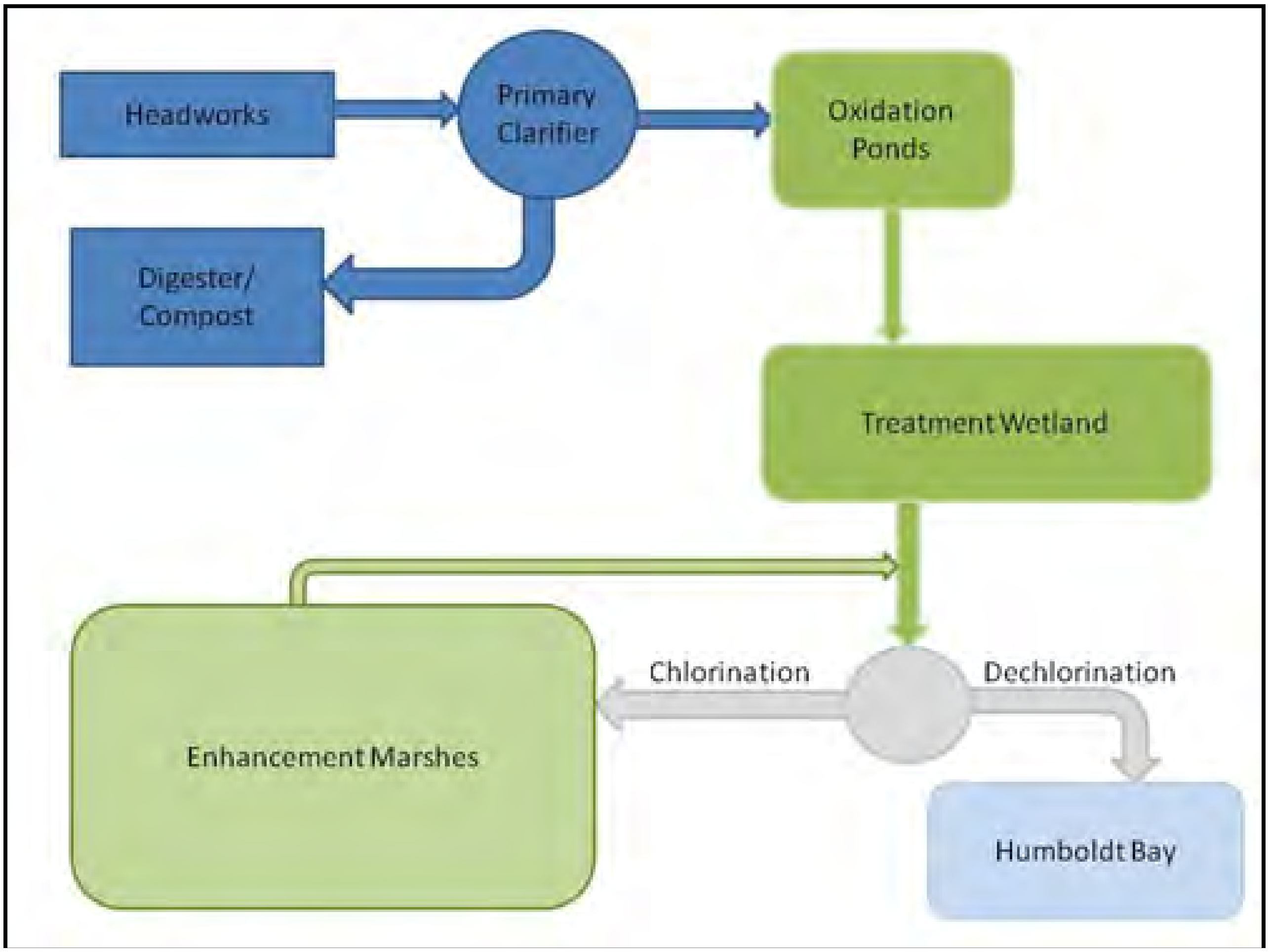
where:

- x is the observed value;
- μ is the arithmetic mean of the observed values; and
- n is the number of samples.

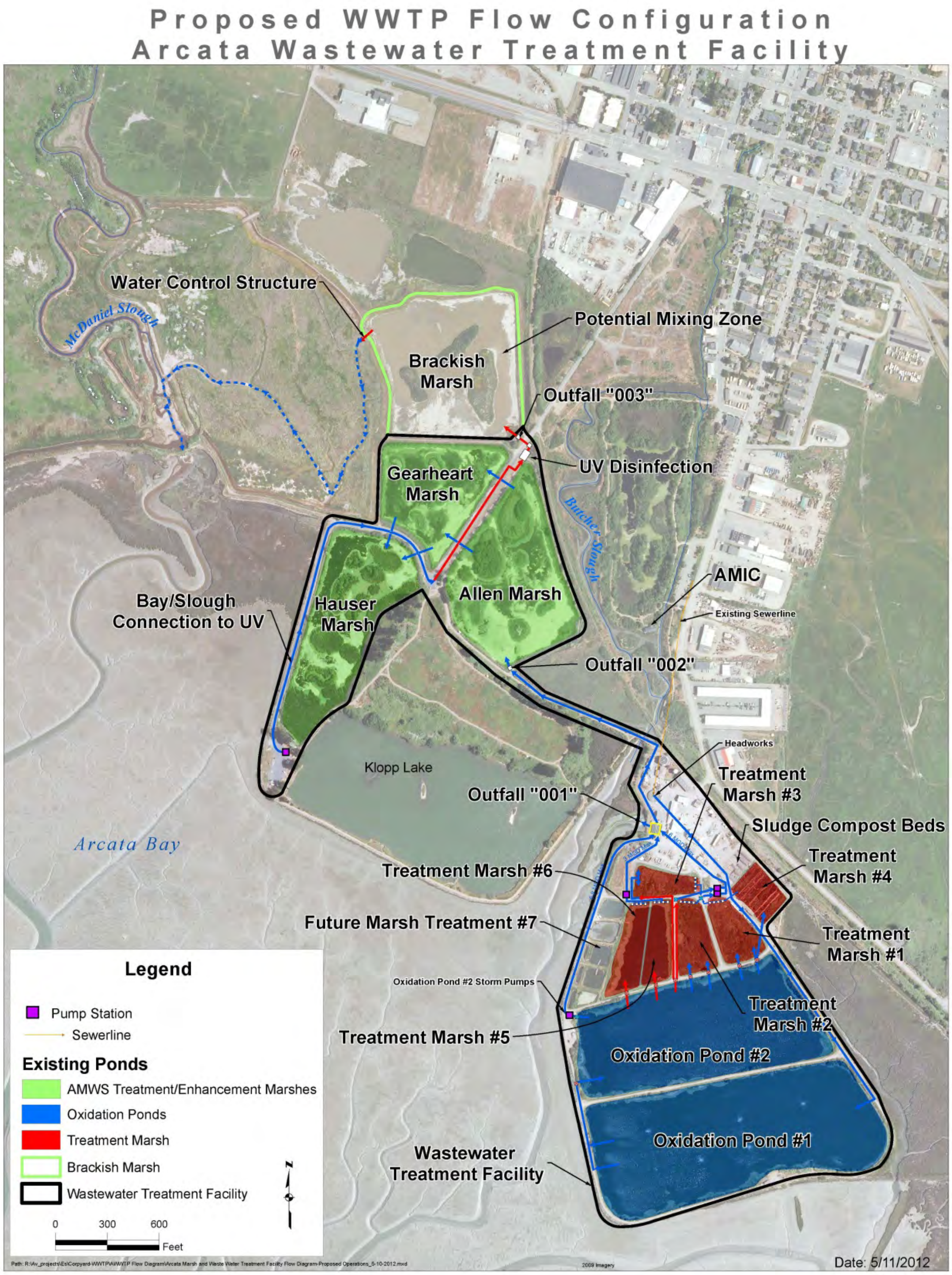
Toxicity Reduction Evaluation (TRE) is a study conducted in a step-wise process designed to identify the causative agents of effluent or ambient toxicity, isolate the sources of toxicity, evaluate the effectiveness of toxicity control options, and then confirm the reduction in toxicity. The first steps of the TRE consist of the collection of data relevant to the toxicity, including additional toxicity testing, and an evaluation of facility operations and maintenance practices, and best management practices. A Toxicity Identification Evaluation (TIE) may be required as part of the TRE, if appropriate. (A TIE is a set of procedures to identify the specific chemical(s) responsible for toxicity. These procedures are performed in three phases (characterization, identification, and confirmation) using aquatic organism toxicity tests.)

ATTACHMENT B – FACILITY MAP

ATTACHMENT C – EXISTING CONFIGURATION FLOW SCHEMATIC



ATTACHMENT C – UPGRADED CONFIGURATION FLOW SCHEMATIC



ATTACHMENT D – STANDARD PROVISIONS

I. STANDARD PROVISIONS – PERMIT COMPLIANCE

A. Duty to Comply

1. The Permittee must comply with all of the conditions of this Order. Any noncompliance constitutes a violation of the Clean Water Act (CWA) and the California Water Code and is grounds for enforcement action, for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application. (40 C.F.R. § 122.41(a).)

2. The Permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the CWA for toxic pollutants and with standards for sewage sludge use or disposal established under Section 405(d) of the CWA within the time provided in the regulations that establish these standards or prohibitions, even if this Order has not yet been modified to incorporate the requirement. (40 C.F.R. § 122.41(a)(1).)

B. Need to Halt or Reduce Activity Not a Defense

It shall not be 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 Order. (40 C.F.R. § 122.41(c).)

C. Duty to Mitigate

The Permittee shall take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this Order that has a reasonable likelihood of adversely affecting human health or the environment. (40 C.F.R. § 122.41(d).)

D. Proper Operation and Maintenance

The Permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the Permittee to achieve compliance with the conditions of this Order. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems that are installed by a Permittee only when necessary to achieve compliance with the conditions of this Order. (40 C.F.R. § 122.41(e).)

E. Property Rights

1. This Order does not convey any property rights of any sort or any exclusive privileges. (40 C.F.R. § 122.41(g).)

2. The issuance of this Order does not authorize any injury to persons or property or invasion of other private rights, or any infringement of state or local law or regulations. (40 C.F.R. § 122.5(c).)

F. Inspection and Entry

The Permittee shall allow the Regional Water Board, State Water Board, United States Environmental Protection Agency (USEPA), and/or their authorized representatives (including an authorized contractor acting as their representative), upon the presentation of credentials and other documents, as may be required by law, to (40 C.F.R. § 122.41(i); Wat. Code, § 13383):

1. Enter upon the Permittee's premises where a regulated facility or activity is located or conducted, or where records are kept under the conditions of this Order (40 C.F.R. § 122.41(i)(1));

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this Order (40 C.F.R. § 122.41(i)(2));

3. Inspect and photograph, at reasonable times, any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Order (40 C.F.R. § 122.41(i)(3)); and

4. Sample or monitor, at reasonable times, for the purposes of assuring Order compliance or as otherwise authorized by the CWA or the Water Code, any substances or parameters at any location. (40 C.F.R. § 122.41(i)(4).)

G. Bypass

1. Definitions

   a. “Bypass” means the intentional diversion of waste streams from any portion of a treatment facility. (40 C.F.R. § 122.41(m)(1)(i).)

   b. “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. (40 C.F.R. § 122.41(m)(1)(ii).)

2. Bypass not exceeding limitations. The Permittee may allow any bypass to occur which does not cause exceedances of effluent limitations, but only if it is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions listed in Standard Provisions – Permit Compliance I.G.3, I.G.4, and I.G.5 below. (40 C.F.R. § 122.41(m)(2).)

3. Prohibition of bypass. Bypass is prohibited, and the Regional Water Board may take enforcement action against a Permittee for bypass, unless (40 C.F.R. § 122.41(m)(4)(i)):

   a. Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage (40 C.F.R. § 122.41(m)(4)(i)(A));

   b. 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 back-up 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 preventive maintenance (40 C.F.R. § 122.41(m)(4)(i)(B)); and

   c. The Permittee submitted notice to the Regional Water Board as required under Standard Provisions – Permit Compliance I.G.5 below. (40 C.F.R. § 122.41(m)(4)(i)(C).)

4. The Regional Water Board may approve an anticipated bypass, after considering its adverse effects, if the Regional Water Board determines that it will meet the three conditions listed in Standard Provisions – Permit Compliance I.G.3 above. (40 C.F.R. § 122.41(m)(4)(ii).)

5. Notice

   a. Anticipated bypass. If the Permittee knows in advance of the need for a bypass, it shall submit a notice, if possible at least 10 days before the date of the bypass. (40 C.F.R. § 122.41(m)(3)(i).)

   b. Unanticipated bypass. The Permittee shall submit notice of an unanticipated bypass as required in Standard Provisions - Reporting V.E below (24-hour notice). (40 C.F.R. § 122.41(m)(3)(ii).)

H. Upset

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 operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation. (40 C.F.R. § 122.41(n)(1).)

1. 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 Standard Provisions – Permit Compliance I.H.2 below 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. (40 C.F.R. § 122.41(n)(2).).

2. Conditions necessary for a demonstration of upset. A Permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs or other relevant evidence that (40 C.F.R. § 122.41(n)(3)):

    a. An upset occurred and that the Permittee can identify the cause(s) of the upset (40 C.F.R. § 122.41(n)(3)(i));

    b. The permitted facility was, at the time, being properly operated (40 C.F.R. § 122.41(n)(3)(ii));

    c. The Permittee submitted notice of the upset as required in Standard Provisions – Reporting V.E.2.b below (24-hour notice) (40 C.F.R. § 122.41(n)(3)(iii)); and

    d. The Permittee complied with any remedial measures required under Standard Provisions – Permit Compliance I.C above. (40 C.F.R. § 122.41(n)(3)(iv).)

3. Burden of proof. In any enforcement proceeding, the Permittee seeking to establish the occurrence of an upset has the burden of proof. (40 C.F.R. § 122.41(n)(4).)

II. STANDARD PROVISIONS – PERMIT ACTION

A. General

This Order may be modified, revoked and reissued, or terminated for cause. The filing of a request by the Permittee for modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any Order condition. (40 C.F.R. § 122.41(f).)

B. Duty to Reapply

If the Permittee wishes to continue an activity regulated by this Order after the expiration date of this Order, the Permittee must apply for and obtain a new permit. (40 C.F.R. § 122.41(b).)

C. Transfers

This Order is not transferable to any person except after notice to the Regional Water Board. The Regional Water Board may require modification or revocation and reissuance of the Order to change the name of the Permittee and incorporate such other requirements as may be necessary under the CWA and the Water Code. (40 C.F.R. § 122.41(l)(3); § 122.61.)

III. STANDARD PROVISIONS – MONITORING

A. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. (40 C.F.R. § 122.41(j)(1).)

B. Monitoring results must be conducted according to test procedures under Part 136 or, in the case of sludge use or disposal, approved under Part 136 unless otherwise specified in Part 503 unless other test procedures have been specified in this Order. (40 C.F.R. § 122.41(j)(4); § 122.44(i)(1)(iv).)

IV. STANDARD PROVISIONS – RECORDS

A. Except for records of monitoring information required by this Order related to the Permittee's sewage sludge use and disposal activities, which shall be retained for a period of at least five years (or longer as required by Part 503), the Permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this Order, and records of all data used to complete the application for this Order, for a period of at least three (3) years from the date of the sample, measurement, report or application. This period may be extended by request of the Regional Water Board Executive Officer at any time. (40 C.F.R. § 122.41(j)(2).)

B. Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements (40 C.F.R. § 122.41(j)(3)(i));
2. The individual(s) who performed the sampling or measurements (40 C.F.R. § 122.41(j)(3)(ii));
3. The date(s) analyses were performed (40 C.F.R. § 122.41(j)(3)(iii));

4. The individual(s) who performed the analyses (40 C.F.R. § 122.41(j)(3)(iv));
5. The analytical techniques or methods used (40 C.F.R. § 122.41(j)(3)(v)); and
6. The results of such analyses. (40 C.F.R. § 122.41(j)(3)(vi).)

C. Claims of confidentiality for the following information will be denied (40 C.F.R. § 122.7(b)):

1. The name and address of any permit applicant or Permittee (40 C.F.R. § 122.7(b)(1)); and
2. Permit applications and attachments, permits and effluent data. (40 C.F.R. § 122.7(b)(2).)

V. STANDARD PROVISIONS – REPORTING

A. Duty to Provide Information

The Permittee shall furnish to the Regional Water Board, State Water Board, or USEPA within a reasonable time, any information which the Regional Water Board, State Water Board, or USEPA may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this Order or to determine compliance with this Order. Upon request, the Permittee shall also furnish to the Regional Water Board, State Water Board, or USEPA copies of records required to be kept by this Order. (40 C.F.R. § 122.41(h); Wat. Code, § 13267.)

B. Signatory and Certification Requirements

1. All applications, reports, or information submitted to the Regional Water Board, State Water Board, and/or USEPA shall be signed and certified in accordance with Standard Provisions – Reporting V.B.2, V.B.3, V.B.4, and V.B.5 below. (40 C.F.R. § 122.41(k).)

2. All permit applications shall be signed by either a principal executive officer or ranking elected official. For purposes of this provision, a principal executive officer of a federal agency includes: (i) the chief executive officer of the agency, or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrators of USEPA). (40 C.F.R. § 122.22(a)(3).).

3. All reports required by this Order and other information requested by the Regional Water Board, State Water Board, or USEPA shall be signed by a person described in Standard Provisions – Reporting V.B.2 above, or by a duly authorized representative of that person. A person is a duly authorized representative only if:

a. The authorization is made in writing by a person described in Standard Provisions – Reporting V.B.2 above (40 C.F.R. § 122.22(b)(1));

b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.) (40 C.F.R. § 122.22(b)(2)); and

c. The written authorization is submitted to the Regional Water Board and State Water Board. (40 C.F.R. § 122.22(b)(3).)

4. If an authorization under Standard Provisions – Reporting V.B.3 above is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of Standard Provisions – Reporting V.B.3 above must be submitted to the Regional Water Board and State Water Board prior to or together with any reports, information, or applications, to be signed by an authorized representative. (40 C.F.R. § 122.22(c).)

5. Any person signing a document under Standard Provisions – Reporting V.B.2 or V.B.3 above shall make the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations." (40 C.F.R. § 122.22(d).)

C. Monitoring Reports

1. Monitoring results shall be reported at the intervals specified in the Monitoring and Reporting Program (Attachment E) in this Order. (40 C.F.R. § 122.22(l)(4).)

2. Monitoring results must be reported on a Discharge Monitoring Report (DMR) form or forms provided or specified by the Regional Water Board or State

Water Board for reporting results of monitoring of sludge use or disposal practices. (40 C.F.R. § 122.41(l)(4)(i).)

3. If the Permittee monitors any pollutant more frequently than required by this Order using test procedures approved under Part 136 or, in the case of sludge use or disposal, approved under Part 136 unless otherwise specified in Part 503, or as specified in this Order, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR or sludge reporting form specified by the Regional Water Board. (40 C.F.R. § 122.41(l)(4)(ii).)

4. Calculations for all limitations, which require averaging of measurements, shall utilize an arithmetic mean unless otherwise specified in this Order. (40 C.F.R. § 122.41(l)(4)(iii).)

D. Compliance Schedules

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this Order, shall be submitted no later than 14 days following each schedule date. (40 C.F.R. § 122.41(l)(5).)

E. Twenty-Four Hour Reporting

1. The Permittee shall report any noncompliance that may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the Permittee becomes aware of the circumstances. A written submission shall also be provided within five (5) days of the time the Permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. (40 C.F.R. § 122.41(l)(6)(i).)

2. The following shall be included as information that must be reported within 24 hours under this paragraph (40 C.F.R. § 122.41(l)(6)(ii)):

   a. Any unanticipated bypass that exceeds any effluent limitation in this Order. (40 C.F.R. § 122.41(l)(6)(ii)(A).)

   b. Any upset that exceeds any effluent limitation in this Order. (40 C.F.R. § 122.41(l)(6)(ii)(B).)

3. The Regional Water Board may waive the above-required written report under this provision on a case-by-case basis if an oral report has been received within 24 hours. (40 C.F.R. § 122.41(l)(6)(iii).)

F. Planned Changes

The Permittee shall give notice to the Regional Water Board as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required under this provision only when (40 C.F.R. § 122.41(l)(1)):

1. The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source in section 122.29(b) (40 C.F.R. § 122.41(l)(1)(i)); or

2. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants that are not subject to effluent limitations in this Order. (40 C.F.R. § 122.41(l)(1)(ii).)

3. The alteration or addition results in a significant change in the Permittee's sludge use or disposal practices, and such alteration, addition, or change may justify the application of permit conditions that are different from or absent in the existing permit, including notification of additional use or disposal sites not reported during the permit application process or not reported pursuant to an approved land application plan. (40 C.F.R.§ 122.41(l)(1)(iii).)

G. Anticipated Noncompliance

The Permittee shall give advance notice to the Regional Water Board or State Water Board of any planned changes in the permitted facility or activity that may result in noncompliance with General Order requirements. (40 C.F.R. § 122.41(l)(2).)

H. Other Noncompliance

The Permittee shall report all instances of noncompliance not reported under Standard Provisions – Reporting V.C, V.D, and V.E above at the time monitoring reports are submitted. The reports shall contain the information listed in Standard Provision – Reporting V.E above. (40 C.F.R. § 122.41(l)(7).)

I. Other Information

When the Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Regional Water Board, State Water Board, or USEPA, the

Permittee shall promptly submit such facts or information. (40 C.F.R. § 122.41(l)(8).)

VI. STANDARD PROVISIONS – ENFORCEMENT

A. The Regional Water Board is authorized to enforce the terms of this permit under several provisions of the Water Code, including, but not limited to, sections 13385, 13386, and 13387.

VII. ADDITIONAL PROVISIONS – NOTIFICATION LEVELS

A. Publicly-Owned Treatment Works (POTWs)

All POTWs shall provide adequate notice to the Regional Water Board of the following (40 C.F.R. § 122.42(b)):

1. Any new introduction of pollutants into the POTW from an indirect discharger that would be subject to sections 301 or 306 of the CWA if it were directly discharging those pollutants (40 C.F.R. § 122.42(b)(1)); and

2. Any substantial change in the volume or character of pollutants being introduced into that POTW by a source introducing pollutants into the POTW at the time of adoption of the Order. (40 C.F.R. § 122.42(b)(2).)

3. Adequate notice shall include information on the quality and quantity of effluent introduced into the POTW as well as any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW. (40 C.F.R. § 122.42(b)(3).)

ATTACHMENT E – MONITORING AND REPORTING PROGRAM

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ATTACHMENT E – MONITORING AND REPORTING PROGRAM (MRP)

Title 40 of the Code of Federal Regulations section 122.48 requires that all National Pollutant Discharge Elimination System (NPDES) permits specify monitoring and reporting requirements. California Water Code (Water Code) sections 13267 and 13383 also authorize the Regional Water Quality Control Board (Regional Water Board) to require technical and monitoring reports. This MRP establishes monitoring and reporting requirements, which implement the federal and California regulations.

I. GENERAL MONITORING PROVISIONS

A. Composite samples may be taken by a proportional sampling device approved by the Executive Officer or by grab samples composited in proportion to flow. In compositing grab samples, the sampling interval shall not exceed 1 hour.

B. If the Permittee monitors any pollutant more frequently than required by this Order, using test procedures approved by title 40, Part 136, or as specified in this Order, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the monthly and annual discharger monitoring reports.

C. Laboratories analyzing monitoring samples shall be certified by the Department of Public Health (DPH; formerly the Department of Health Services), in accordance with the provision of Water Code section 13176, and must include quality assurance/quality control data with their reports.

D. Compliance and reasonable potential monitoring analyses shall be conducted using commercially available and reasonably achievable detection limits that are lower than the applicable effluent limitation. If no ML value is below the effluent limitation, the lowest ML shall be selected as the RL. Table E-1 lists the test methods the Permittee may use for compliance and reasonable potential monitoring to analyze priority pollutants with effluent limitations.

Table E-1. Test Methods and Minimum Levels for Priority Pollutants

CTR #	Constituent	Types of Analytical Methods Minimum Levels (µg/L)				
		GC[a]	GCMS[b]	ICPMS[c]	SPGFAA[d]	Colorimetric
6	Copper	---	---	0.5	2	---
14	Cyanide	---	---	---	---	5
16	2,3,7,8 TCDD (dioxin TEQ)	The Permittee shall use USEPA Method 1613				
21	Carbon Tetrachloride	0.5	---	---	---	---
27	Dichlorobromomethane	0.5	---	---	---	---
68	Bis(2-Ethylhexyl)Phthalate	---	5	---	---	---

[a] Gas Chromatography, [b] Gas Chromatography/Mass Spectroscopy, [c] Inductively Coupled Plasma/ Mass Spectroscopy, [d] Stabilized Platform Graphite Furnace Atomic Absorption

II. MONITORING LOCATIONS

The Permittee shall establish the following monitoring locations to demonstrate compliance with the effluent limitations, discharge specifications, and other requirements in this Order.

Table E-2. Monitoring Station Locations

Discharge Point/Outfall Location	Monitoring Location	Monitoring Location Description
---	INF-001	Location where representative samples of wastewater can be collected prior to treatment and following all significant input of wastewater to the treatment system.
001	EFF-001	Location where representative samples of treated wastewater, to be discharged to Humboldt Bay at Outfall 001, can be collected at a point after treatment, including chlorination/dechlorination, and before contact with the receiving water.
002	EFF-002	Location where representative samples of treated wastewater, to be discharged to the Arcata Marsh Wildlife Sanctuary (AMWS) at Outfall 002, can be collected before contact with the receiving water.
---	AMWS	Areas throughout the Arcata Marsh Wildlife Sanctuary representative of various wetland conditions in accordance with the Special Study Required under Order Section VI.C.2.d
003	EFF-003	Location where representative samples of treated wastewater, to be discharged to Humboldt Bay at Outfall 003, can be collected at a point after treatment, including UV disinfection, and before contact with the receiving water.
---	RSW-001, etc.	Receiving Water Location(s) within the brackish marsh representative of various zones of mixing within the marsh.

III. INFLUENT MONITORING REQUIREMENTS

A. Monitoring Location INF-001

1. The Permittee shall monitor influent to the wastewater treatment plant at Monitoring Location Name INF-001 as follows.

Table E-3. Influent Monitoring

Constituent	Reporting Units	Sample Type	Minimum Sampling Frequency	Required Analytical Method
BOD_5	mg/L	24-hr composite	Weekly [1]	Standard Methods
TSS	mg/L	24-hr composite	Weekly [1]	Standard Methods
Flow [2]	MGD	Continuous	Continuous	Meter

IV. EFFLUENT MONITORING REQUIREMENTS

A. Monitoring Locations EFF-001 and EFF-003

1. The Permittee shall monitor treated wastewater to be discharged to Humboldt Bay prior to contact with receiving water at Monitoring Locations EFF-001 and/or EFF-003 as appropriate, based upon active discharge from either or both locations as follows:

Table E-4. Effluent Monitoring, Monitoring Location EFF-001 and/or EFF-003

Parameter	Reporting Units	Sample Type	Minimum Sampling Frequency	Required Analytical Method
Flow [2]	mgd	Continuous	Continuous	Meter
BOD_5	mg/L	24-hr composite	Weekly	SM 5210 B
TSS	mg/L	24-hr composite	Weekly	SM 2540 D
Settleable Solids	mL/L/hr	Grab	Daily	SM 2540 F
Fecal Coliform Bacteria	MPN	Grab	Weekly	Standard Methods
pH	s.u.	Grab	Daily	40 CFR 136
Chlorine Residual	mg/L	Grab	Continuous	Standard Methods
Copper	µg/L	Grab	Monthly[3]	40 CFR 136
Hardness, Total (as $CaCO_3$) [4]	mg/L	Grab	Monthly[3]	Standard Methods
Cyanide	µg/L	Grab	Monthly[3]	40 CFR 136
TCDD Equivalents	pg/L	Grab	Quarterly[3]	Method 1613
Carbon Tetrachloride	µg/L	Grab	Quarterly[3]	40 CFR 136
Dichlorobromomethane	µg/L	Grab	Quarterly[3]	40 CFR 136

1 Monitoring of BOD_5 and TSS in influent shall coincide with monitoring of these parameters in effluent. For compliance determination, weekly and monthly averages will be based on the calendar weeks (Sunday through Saturday) and months.

2 For each month, the Permittee shall report the maximum daily and mean daily flow rates.

3 When Discharge Point 001 is used for high flows exceeding 5.9 mgd, effluent monitoring at EFF-001 shall be conducted annually.

4 Monitoring for hardness shall be conducted concurrently with effluent sampling for copper.

Table E-4. Effluent Monitoring, Monitoring Location EFF-001 and/or EFF-003

Parameter	Reporting Units	Sample Type	Minimum Sampling Frequency	Required Analytical Method
Bis(2-Ethylhexyl)Phthalate	µg/L	Grab	Quarterly[3]	40 CFR 136
Acute Toxicity [5]	% Survival	24-hr composite	Quarterly[3]	40 CFR 136
Chronic Toxicity [5]	TUc	Grab	Quarterly[3]	40 CFR 136
Chronic Toxicity (narrative)	Passed/ Triggered[6]			---
CTR Pollutants [7]	µg/L	Grab	Annually	40 CFR 136
Title 22 Pollutants [8]	µg/L	Grab	2x / permit cycle	40 CFR 136
Nitrate Nitrogen	mg/L N	Grab	Quarterly[3]	40 CFR 136
Ammonia Nitrogen	mg/L N	Grab	Quarterly[3]	40 CFR 136
Phosphorus, Total	mg/L P	Grab	concurrent with special study	40 CFR 136

B. Monitoring Location EFF-002

1. The Permittee shall monitor treated wastewater to be discharged to the AMWS at Monitoring Location EFF-002 as follows.

Table E-5. Effluent Monitoring, Monitoring Location EFF-002

Parameter	Reporting Units	Sample Type	Minimum Sampling Frequency	Required Analytical Method
Flow [2]	mgd	Continuous	Continuous	Meter
BOD_5	mg/L	24-hr composite	Weekly	SM 5210 B

5 Whole effluent acute and chronic toxicity shall be monitored in accordance with the requirements of section V of this Monitoring and Reporting Program.

6 The Permittee shall include reporting regarding compliance with the narrative toxicity objective in Receiving Water Limitation V.A.10 by reporting whether the chronic toxicity test "passed" or failed in relation to the chronic toxicity trigger of 2 TUc or a three sample median of 1 TUc (where TUc =100/NOEC). For narrative chronic toxicity reporting, "Passed" shall be reported when chronic toxicity effluent results do not trigger accelerated testing (e.g., a result of ≤ 1TUc = 100/NOEC). "Triggered" shall be reported when chronic toxicity effluent results trigger accelerated testing by exceeding the chronic toxicity trigger of 2 TUc = 100/NOEC or a three sample median of >1TUc.

7 CTR pollutants are those pollutants identified in the California Toxics Rule at title 40 section 131.38.

8 The title 22 pollutants are those pollutants for which the Department of Health Services has established Maximum Contaminant Levels (MCLs) at title 22, Division 4, Chapter 15, sections 64431 (Inorganic Chemicals) and 64444 (Organic Chemicals) of the California Code of Regulations.

Table E-5. Effluent Monitoring, Monitoring Location EFF-002

Parameter	Reporting Units	Sample Type	Minimum Sampling Frequency	Required Analytical Method
TSS	mg/L	24-hr composite	Weekly	SM 2540 D
Settleable Solids	mL/L/hr	Grab	Daily	SM 2540 F
pH	s.u.	Grab	Daily	40 CFR 136
Copper	µg/L	Grab	Monthly	40 CFR 136
Acute Toxicity	% Survival	24-hr composite	concurrent with special study	concurrent with special study

V. WHOLE EFFLUENT TOXICITY TESTING REQUIREMENTS

The three species selection process will be implemented upon the City's activation of the new disinfection system and implementation of discharges at Discharge Point 003. During the interim period, whole effluent toxicity testing will be performed with the most sensitive species identified during the most recent three species selection testing.

A. Acute Toxicity Testing

The Permittee shall conduct whole effluent acute toxicity testing to determine compliance with the effluent limitation for acute toxicity established by section IV. A. 1 of the Order.

1. **Test Frequency**. The Permittee shall conduct acute WET testing in accordance with the schedule established by this MRP, as summarized in section IV.A.1. and Table E-4, above.

2. **Sample Type**. For 96-hour static renewal or 96-hour static non-renewal testing, the effluent samples shall be 24-hr composite, representative of the volume and quality of the discharge from the facility, and collected at monitoring Location EFF-001 and EFF-003.

3. **Test Species**. Test species for acute WET testing at EFF-001 and EFF-003, where the discharge is to an estuarine environment, shall be an invertebrate, (percent survival and growth), and a vertebrate, (percent survival and growth), for at least the first two suites of tests conducted within 12 months after the effective date of the Order. After this screening period, monitoring shall be conducted using the most sensitive species. At least one time every five years, the Permittee shall re-screen with the two species identified above and continue routine monitoring with the most sensitive species. Species selected for testing shall be from the following table:

Species	Common Name
A. bahia	Mysids
T. pseudonana	Brown algae
C. variegatus	Sheepshead minnows
E. estuarius	Pill bugs
M. beryllina	Inland silverside
C. dubia	Water fleas
C. dilutus	Fly larvae
C. fluminea	Freshwater clam
D. magna	Daphnia
D. pulex	Daphnia
H. azteca	Side swimmers
L. variegatus	Freshwater polycheate
P. promelas	Fatheads
S. capricornutum	Green algae
A. abdida	Amphipod
A. affinis	Topsmelt
C. gigas	Oysters
H. costata	Mysids
H. rufiscens	Red abalone
M. edulis	Mussels
M. pyrifera	Kelp
N. arenaceodentata	Polycheate

4. **Test Methods**. The presence of acute toxicity shall be estimated as specified in *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms* (USEPA Report No. EPA-821-R-02-012, 5th edition or subsequent editions), or other methods approved by the Executive Officer.

5. **Test Dilutions.** Acute WET tests on effluent samples collected at Monitoring Locations EFF-001 and EFF-003, shall be conducted using a series of five dilutions of 12.5, 25, 50, 75, and 100 percent effluent. Dilution and control waters shall be receiving water samples collected beyond the influence of the discharges. Standard dilution water may be used if the above source exhibits toxicity.

6. **Test Failure.** If an acute toxicity test does not meet all test acceptability criteria, as specified in the test method, the Permittee shall re-sample and re-test as soon as possible, not to exceed 7 days following notification of test failure.

7. **Accelerated Monitoring.** If the result of any acute toxicity test fails to meet the single test minimum limitation (70 percent survival), and the testing meets all test acceptability criteria, the Permittee shall take two more samples, one within 14 days and one within 21 days following receipt of the initial sample result. If any one of the additional samples do not comply with the three sample median minimum limitation (90 percent survival), the Permittee shall initiate a Toxicity Reduction Evaluation (TRE) in accordance with section VI. C. 2. a of the Order. If the two additional samples are in compliance with the acute toxicity requirement and testing meets all test acceptability criteria, then a TRE will not be required. If the discharge stops before additional samples can be collected, the Permittee shall contact the Executive Officer within 21 days with a plan to demonstrate compliance with the effluent limitation.

8. **Notification.** The Permittee shall notify the Regional Water Board in writing 14 days after the receipt of test results exceeding the acute toxicity effluent limitation. The notification will describe actions the Permittee has taken or will take to investigate and correct the cause(s) of toxicity. It may also include a status report on any actions required by this Order, with a schedule for actions not yet completed. If no actions have been taken, the reasons shall be given.

9. **Reporting**. Test results for acute toxicity tests shall be reported according to section 12 (Report Preparation) of *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms* or in an equivalent format that clearly demonstrates that the Permittee is in compliance with effluent limitations, and other permit requirements.

B. Chronic Toxicity Testing

The Permittee shall conduct chronic toxicity testing to demonstrate compliance with the Basin Plan's water quality objective for toxicity. The Permittee shall meet the following chronic toxicity testing requirements:

1. **Test Frequency**. The Permittee shall conduct chronic WET testing at EFF-001 and/or EFF-003 in accordance with the schedule established by this MRP, as summarized in section IV.A.1. and Table E-4, above.

2. **Sample Type.** For 96-hour static renewal or 96-hour static non-renewal testing, effluent samples from Monitoring Locations EFF-001 and/or Eff-003 shall be grab samples that are representative of the volume and quality of the discharge from the facility. For toxicity tests requiring renewals, grab samples collected on consecutive days are required.

3. **Test Species.** Test species for chronic WET testing at EFF-001 and/or EFF-003, where the discharge is to an estuarine environment, shall be a vertebrate,

(percent survival and growth), an invertebrate (percent survival and growth), and a plant, (germination and germ-tube length test) in accordance with the species identified in the table contained in section V.A.3. above. Initial testing for the first two suites of tests, shall be conducted with a vertebrate, an invertebrate, and a plant species, and thereafter, monitoring can be reduced to the most sensitive species. At least once every five years, the Permittee shall rescreen once with the three species listed above, and continue to monitor with the most sensitive species.

4. **Test Methods.** The presence of chronic toxicity shall be estimated as specified in USEPA's Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Freshwater Organisms (USEPA Report No. EPA-821-R-02-013 or Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms EPA-821-R-02-014 or subsequent editions).

5. **Test Dilutions.** The chronic toxicity test shall be conducted using a series of at least five dilutions and a control. The series shall consist of the following dilution series: 12.5, 25, 50, 75, and 100 percent, and a control. Control and dilution water shall be receiving water collected at an appropriate location upstream of the discharge point. Laboratory water may be substituted for receiving water, as described in the USEPA test methods manual, upon approval by the Executive Officer. If the dilution water used is different from the culture water, a second control using culture water shall be used.

6. **Reference Toxicant.** If organisms are not cultured in-house, concurrent testing with a reference toxicant shall be conducted. Where organisms are cultured in-house, monthly reference toxicant testing is sufficient. Reference toxicant tests also shall be conducted using the same test conditions as the effluent toxicity tests (e.g., same test duration, etc.).

7. **Test Failure.** If either the reference toxicant test or the chronic toxicity test does not meet all test acceptability criteria, as specified in the test method, the Permittee shall re-sample and re-test as soon as possible, not to exceed 7 days following notification of test failure.

8. **Notification.** The Permittee shall notify the Regional Water Board in writing 14 days after the receipt of test results, which indicate the exceedance of the monitoring "trigger" for chronic toxicity.

9. **Accelerated Monitoring Requirements.** If the result of any chronic toxicity test exceeds either monitoring "trigger" of 1.0 TUc as a three-sample median, or 2.0 TUc as a single sample maximum, as specified in section VI.C.2.a. of the Order, and the testing meets all test acceptability criteria, the Permittee shall initiate

accelerated monitoring. Accelerated monitoring shall consist of four additional samples – with one test conducted approximately every week over a four week period. Testing shall commence within 14 days of receipt of initial sample results which indicated an exceedance of the chronic toxicity "trigger." If the discharge will cease before the additional samples can be collected, the Permittee shall contact the Executive Officer within 21 days with a plan to address elevated levels of chronic toxicity in effluent and/or receiving water. The following protocol shall be used for accelerated monitoring and TRE implementation:

a. If the results of four consecutive accelerated monitoring tests do not exceed the single sample maximum chronic toxicity "trigger" of 2.0 TUc, the Permittee may cease accelerated monitoring and resume regular chronic toxicity monitoring. However, if there is adequate evidence of a pattern of effluent toxicity, the Regional Water Board's Executive Officer may require that the Permittee initiate a TRE.

b. If the source(s) of the toxicity is easily identified (i.e. temporary plant upset), the Permittee shall make necessary corrections to the facility and shall continue accelerated monitoring until four (4) consecutive accelerated tests do not exceed the monitoring "trigger." Upon confirmation that the chronic toxicity has been removed, the Permittee may cease accelerated monitoring and resume regular chronic toxicity monitoring.

c. If the result of any accelerated toxicity test exceeds the monitoring "trigger", the Permittee shall cease accelerated monitoring and initiate a TRE to investigate the cause(s) and identify corrective actions to reduce or eliminate the chronic toxicity. Within thirty (30) days of notification by the laboratory of the test results exceeding the monitoring "trigger" during accelerated monitoring, the Permittee shall submit a TRE Action Plan to the Regional Water Board including, at minimum:

   i. Specific actions the Permittee will take to investigate and identify the cause(s) of toxicity, including a TRE WET monitoring schedule;

   ii. Specific actions the Permittee will take to mitigate the impact of the discharge and prevent the recurrence of toxicity; and

   iii. A schedule for these actions.

C. Chronic Toxicity Reporting

1. **Routine Reporting**. Test results for chronic WET tests shall be reported according to the appropriate acute and chronic guidance manuals and this

Monitoring and Reporting Program and shall be attached to the self-monitoring report. Test results shall include, at a minimum, for each test:

a. sample date(s)
b. test initiation date
c. test species
d. end point values for each dilution (e.g., number of young, growth rate, percent survival)
e. NOEC value(s) in percent effluent
f. IC15, IC25, IC40, and IC50 values (or EC15, EC25…etc.) in percent effluent
g. TUc values (100/NOEC)
h. Mean percent mortality (±s.d.) after 96 hours in 100 percent effluent (if applicable)
i. NOEC and LOEC values for reference toxicant test(s)
j. IC50 or EC50 value(s) for reference toxicant test(s)
k. Available water quality measurements for each test (e.g., pH, DO, temperature, conductivity, hardness, salinity, ammonia)
l. Statistical methods used to calculate endpoints.

2. **Quality Assurance Reporting.** Because the permit requires sub-lethal hypothesis testing endpoints from methods 1000.0, 1002.0, and 1003.0 in the test methods manual titled *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms* (EPA-821-R-02-013, 2002 or most recent edition), with-in test variability must be reviewed for acceptability and variability criteria (upper and lower PMSD bounds) must be applied, as directed under section 10.2.8 – *Test Variability* of the test methods manual. Under section 10.2.8, the calculated PMSD for both reference toxicant test and effluent toxicity test results must be compared with the upper and lower PMSD bounds variability criteria specified in Table 6 – *Variability Criteria (Upper and Lower PMSD Bounds) for Sublethal Hypothesis Testing Endpoints Submitted Under NPDES Permits*, following the review criteria in paragraphs 10.2.8.2.1 through 10.2.8.2.5 of the test methods manual. Based on this review, only accepted effluent toxicity test results shall be reported.

3. **Compliance Summary**: The results of the chronic toxicity testing shall be provided in the most recent self-monitoring report and shall include a summary table organized by test species, type of test (survival, growth or reproduction) and monitoring frequency (routine, accelerated or TRE) of toxicity data from at least three of the most recent samples. The final report shall clearly demonstrate

that the Permittee is in compliance with effluent limitations and other permit requirements.

VI. LAND DISCHARGE MONITORING REQUIREMENTS

This section is not applicable to the Arcata WWTF.

VII. RECLAMATION MONITORING REQUIREMENTS

This section is not applicable to the Arcata WWTF.

VIII. RECEIVING WATER MONITORING REQUIREMENTS

A. Monitoring Location AMWS

Monitoring of the AMWS shall be implemented in accordance with the workplan approved by the Executive Officer developed in accordance with section VI.C.2.d of the Order. Monitoring results required in accordance with the approved plan shall be submitted annually, by March 1 each year.

B. Monitoring Locations RSW-001, RSW-002, etc.

1. The Permittee shall monitor the receiving water at the following locations: RSW-001, RSW-002, etc. as follows.

Table E-6. Receiving Water Monitoring Requirements Brackish Marsh

Parameter	Units	Sample Type	Minimum Sampling Frequency	Required Analytical Method
Dissolved Oxygen	mg/L	Grab	Monthly	40 CFR 136
pH	s.u.	Grab	Monthly	40 CFR 136
Turbidity	NTU	Grab	Monthly	SM 2130 B
Temperature	ºC	Grab	Monthly	40 CFR 136
Hardness	mg/L $CaCO_3$	Grab	Monthly	40 CFR 136
Specific Conductance	μmhos/cm	Grab	Monthly	40 CFR 136
Total Dissolved Solids	mg/L	Grab	Monthly	SM 2540 C
Salinity	ppt	Grab	Monthly	Standard Methods
Nitrate	mg/L	Grab	Monthly	40 CFR 136
Floatables/discoloration	---	Visual	Monthly	--
CTR Priority Pollutants	μg/L	Grab	Annually	40 CFR 136
Title 22 Pollutants	μg/L	Grab	2x / permit cycle	40 CFR 136

IX. OTHER MONITORING REQUIREMENTS

A. Disinfection Process Monitoring for UV Disinfection System

Upon completion and approval of the UV disinfection system, the following monitoring requirements must be implemented.

1. **Monitoring.** The UV transmittance of the effluent from the UV disinfection system shall be monitored continuously and recorded. The operation UV dose shall be calculated from UV transmittance, UV intensity, turbidity, and exposure time, using lamp age and sleeve fouling factors.

2. **Reporting.** The Permittee shall report daily average and lowest daily transmittance and operational UV dose on its monthly monitoring reports. If the UV transmittance falls below 65 percent or UV dose falls below 50 mJ/cm^2, the event shall be reported to the Regional Water Board by telephone within 24 hours and documented in a narrative description to accompany the applicable routine monthly self monitoring report.

X. REPORTING REQUIREMENTS

A. General Monitoring and Reporting Requirements

1. The Permittee shall comply with all Standard Provisions (Attachment D) related to monitoring, reporting, and recordkeeping.

2. **Schedules of Compliance.** If applicable, the Permittee shall submit all reports and documentation required by compliance schedules that are established by this Order. Such reports and documentation shall be submitted to the Regional Water Board on or before each compliance date established by this Order. If noncompliance is reported, the Permittee shall describe the reasons for noncompliance and a specific date when compliance will be achieved. The Permittee shall notify the Regional Water Board when it returns to compliance with applicable compliance dates established by schedules of compliance.

3. **Special Study.** The Permittee shall submit all reports and documentation required by the special study established by this Order. Such reports and documentation shall be submitted to the Regional Water Board on or before each compliance date established by the Order. If noncompliance is reported, the Permittee shall describe the reasons for noncompliance and a specific date when compliance will be achieved. The Permittee shall notify the Regional Water Board when it returns to compliance with applicable compliance dates.

B. Self Monitoring Reports (SMRs)

1. The Permittee shall submit electronic Self-Monitoring Reports (eSMRs) using the State Water Board's California Integrated Water Quality System (CIWQS) Program Web site (http://www.waterboards.ca.gov/ciwqs/index.html). The CIWQS Web site will provide additional directions for SMR submittal in the event there will be service interruption for electronic submittal. The Permittee shall maintain sufficient staffing and resources to ensure it submits eSMRs that are complete and timely. This includes provision of training and supervision of individuals (e.g., Permittee personnel or consultant) on how to prepare and submit eSMRs.

2. The Permittee shall report in the SMR the results for all monitoring specified in this MRP under sections III through IX. The Permittee shall submit monthly SMRs including the results of all required monitoring using USEPA-approved test methods or other test methods specified in this Order. If the Permittee monitors any pollutant more frequently than required by this Order, the results of this monitoring shall be included in the calculations and reporting of the data submitted in the SMR.

3. **All monitoring results shall be submitted in conjunction with monthly SMRs due the first day of the second month following sample collection**. Monitoring periods for all required monitoring shall be completed according to the following schedule:

Table E-7. Monitoring Periods and Reporting Schedule

Sampling Frequency	Monitoring Period Begins On	Monitoring Period
Continuous	Permit effective date	All
Daily	Permit effective date	(Midnight through 11:59 PM) or any 24-hour period that reasonably represents a calendar day for purposes of sampling.
Weekly	Sunday following permit effective date or on permit effective date if on a Sunday	Sunday through Saturday
Monthly	First day of calendar month following permit effective date or on permit effective date if that date is first day of the month	1st day of calendar month through last day of calendar month
Quarterly	First day of calendar quarter following permit effective date or on permit effective date if that date is first day of the month	January 1 through March 31 April 1 through June 30 July 1 through September 30 October 1 through December 31
Annually	January 1 following permit effective date	January 1 through December 31
2x / Permit Cycle	December 1, 2016	Once on incoming tide, once on outgoing tide.

4. **Reporting Protocols.** The Permittee shall report with each sample result the applicable reported Minimum Level (ML) and the current Method Detection Limit (MDL), as determined by the procedure in Part 136.

   The Permittee shall report the results of analytical determinations for the presence of chemical constituents in a sample using the following reporting protocols:

   a. Sample results greater than or equal to the reported ML shall be reported as measured by the laboratory (i.e., the measured chemical concentration in the sample).

   b. Sample results less than the RL, but greater than or equal to the laboratory's MDL, shall be reported as "Detected, but Not Quantified," or DNQ. The estimated chemical concentration of the sample shall also be reported.

      For the purposes of data collection, the laboratory shall write the estimated chemical concentration next to DNQ as well as the words "Estimated Concentration" (may be shortened to "Est. Conc."). The laboratory may, if such information is available, include numerical estimates of the data quality for the reported result. Numerical estimates of data quality may be percent accuracy (+ a percentage of the reported value), numerical ranges (low to high), or any other means considered appropriate by the laboratory.

   c. Sample results less than the laboratory's MDL shall be reported as "Not Detected," or ND.

   d. Permittees are to instruct laboratories to establish calibration standards so that the ML value (or its equivalent if there is differential treatment of samples relative to calibration standards) is the lowest calibration standard. At no time is the Permittee to use analytical data derived from extrapolation beyond the lowest point of the calibration curve.

5. The Permittee shall submit SMRs in accordance with the following requirements:

   a. The Permittee shall arrange all reported data in a tabular format. The data shall be summarized to clearly illustrate whether the facility is operating in compliance with interim and/or final effluent limitations. The Permittee is not required to duplicate the submittal of data that is entered in a tabular format within CIWQS. When electronic submittal of data is required and CIWQS does not provide for entry into a tabular format within the system, the Permittee shall electronically submit the data in a tabular format as an attachment.

b. The Permittee shall attach a cover letter to the SMR. The information contained in the cover letter shall clearly identify any non-compliance with the requirements of the Order; discuss corrective actions taken or planned; and the proposed time schedule for corrective actions. Identified non-compliance must include a description of the requirement that was not complied with and a description of the noncompliance.

c. SMRs must be submitted to the Regional Water Board, signed and certified as required by the Standard Provisions (Attachment D), to the CIWQS Program Web site (http://www.waterboards.ca.gov/ciwqs/index.html). In the event that paper submittal of SMRs is required, the Discharge shall submit the SMR to the address listed below:

Regional Water Quality Control Board
North Coast Region
5550 Skylane Blvd., Suite A
Santa Rosa, CA 95403

C. Discharge Monitoring Reports (DMRs)

1. As described in Section X.B.1 above, at any time during the term of this permit, the State or Regional Water Board may notify the Permittee to electronically submit SMRs that will satisfy federal requirements for submittal of Discharge Monitoring Reports (DMRs). Until such notification is given, the Permittee shall submit DMRs in accordance with the requirements described below.

2. DMRs must be signed and certified as required by the standard provisions (Attachment D). The Permittee shall submit the original DMR and one copy of the DMR to the address listed below:

STANDARD MAIL	FEDEX/UPS/ OTHER PRIVATE CARRIERS
State Water Resources Control Board Division of Water Quality c/o DMR Processing Center PO Box 100 Sacramento, CA 95812-1000	State Water Resources Control Board Division of Water Quality c/o DMR Processing Center 1001 I Street, 15th Floor Sacramento, CA 95814

3. All discharge monitoring results must be reported on the official USEPA pre-printed DMR forms (EPA Form 3320-1). Forms that are self-generated will not be accepted unless they follow the exact same format of EPA Form 3320-1.

D. Other Reports

1. The Permittee shall report the results of any special studies, acute and chronic toxicity testing, TRE/TIE, and Pollution Minimization Plan required by Special Provisions – VI.C.2 and 3 of this Order. The Permittee shall report the progress in satisfaction of compliance schedule dates specified in Special Provisions – VI.C.7 of this Order. The Permittee shall submit reports with the first monthly SMR scheduled to be submitted on or immediately following the report due date in compliance with SMR reporting requirements described in subsection X.B. above.

2. Annual Report. The Permittee shall submit an Annual Report to the Regional Water Board for each calendar year. The report shall be submitted by March 1st of the following year. The report shall, at a minimum, include the following:

    a. Both tabular and, where appropriate, graphical summaries of the monitoring data and disposal records from the previous year. If the Permittee monitors any pollutant more frequently than required by this Order, using test procedures approved under title 40, section 136 or as specified in this Order, the results of this monitoring shall be included in the calculation and report of the data submitted SMR.

    b. A comprehensive discussion of the facility's compliance (or lack thereof) with all effluent limitations and other requirements of this Order, and the corrective actions taken or planned, which may be needed to bring the discharge into full compliance with the Order.

ATTACHMENT F – FACT SHEET

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ATTACHMENT F – FACT SHEET

As described in section II of this Order, this Fact Sheet includes the legal requirements and technical rationale that serve as the basis for the requirements of this Order.

This Order has been prepared under a standardized format to accommodate a broad range of discharge requirements for dischargers in California. Only those sections or subsections of this Order that are specifically identified as "not applicable" have been determined not to apply to this Permittee. Sections or subsections of this Order not specifically identified as "not applicable" are fully applicable to this Permittee.

I. PERMIT INFORMATION

The following table summarizes administrative information related to the facility.

Table F-1. Facility Information

WDID	1B82114OHUM
Permittee	City of Arcata
Name of Facility	City of Arcata Wastewater Treatment Facility (WWTF)
Facility Address	600 S. G Street
	Arcata, CA 95521
	Humboldt County
Facility Contact, Title and Phone	Karen Diemer, Deputy Director, (707)822-2200
Authorized Person to Sign and Submit Reports	Karen Diemer, Deputy Director, (707)822-2200
Mailing Address	736 F Street, Arcata, CA 95521
Billing Address	736 F Street, Arcata, CA 95521
Type of Facility	Publicly Owned Treatment Works (POTW)
Major or Minor Facility	Major
Threat to Water Quality	1
Complexity	A
Pretreatment Program	Y
Reclamation Requirements	N/A
Facility Permitted Flow	2.3 million gallons per day (mgd) (average dry weather flow)
Facility Design Flow	2.3 million gallons per day (mgd) (average dry weather design flow) 5.0 mgd (average wet weather design flow) 5.9 mgd (peak wet weather design flow) 16.5 mgd (wet weather Q_{max})
Watershed	Eureka Plain Hydrologic Unit
Receiving Water	Humboldt Bay and Arcata Marsh Wildlife Sanctuary
Receiving Water Type	Estuarine and Freshwater Wetlands

A. The City of Arcata (hereinafter City or Permittee) owns and operates the Arcata Wastewater Treatment Facility, a publicly-owned treatment works (POTW).

For the purposes of this Order, references to the "discharger" or "permittee" in applicable federal and State laws, regulations, plans, or policy are held to be equivalent to references to the Permittee herein.

B. The wastewater treatment facility (WWTF) discharges treated wastewater to Humboldt Bay in conjunction with enhanced treatment occurring in the Arcata Marsh Wildlife Sanctuary (AMWS), constructed freshwater wetlands adjacent to the treatment facility. Discharges from the WWTF are currently regulated by Regional Water Board Order No. R1-2004-0036, which was adopted on June 22, 2004, and expired on June 22, 2009, but has been administratively extended until this order takes effect.

C. The Permittee filed a Report of Waste Discharge and submitted an application for renewal of its Waste Discharge Requirements (WDRs) and National Pollutant Discharge Elimination System (NPDES) permit on February 19, 2007. The Permittee submitted an amended Report of Waste Discharge on December 15, 2011, incorporating a new primary point of discharge. The application was deemed complete on February 7, 2012.

II. FACILITY DESCRIPTION

The City owns the wastewater collection, treatment, and disposal facilities that serve approximately 16,800 people in the City of Arcata and the unincorporated community of Glendale. The WWTF is located at 600 South G Street in Arcata, Humboldt County, California. The City of Arcata WWTF in its varying forms has been discharging to Humboldt Bay since about 1949.[1]

A. Background

Adopted on May 16, 1974, Resolution No. 74-43, known as the Bays and Estuaries Policy, prohibits the discharge of municipal wastewater and industrial process water to enclosed bays and estuaries "unless the discharge enhances the quality of the receiving water above that which would occur in the absence of the discharge."[2] The Bays and Estuaries Policy enhancement criteria is defined as, "…(1) Full uninterrupted protection of all beneficial uses which could be made of the receiving

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1 City of Arcata, Pilot Study, draft Environmental Impact Report, July, 1979.

2 State Water Resources Control Board, Water Quality Control Policy For The Enclosed Bays and Estuaries of California, May 1974

water body in the absence of all point source discharge(s) along with (2) a demonstration by the applicant that the discharge, through the creation of new beneficial uses or fuller realization, enhances water quality for those beneficial uses which could be made of the receiving water in the absence of all point source discharges..."[3]

In the fall of 1974, the City of Arcata first began to pursue an exemption from the Bays and Estuaries Policy, and in the spring of 1977, the City brought forward a project consisting of a marsh treatment process with a discharge to Humboldt Bay.[4]

In 1979, after holding a fact-finding hearing, State Water Board issued Order 79-20, interpreting the provision of the Bays and Estuaries Policy that provided for an exemption from the discharge of municipal wastewater into an enclosed bay, such as Humboldt Bay. In that decision, the State Board concluded that there was a reasonable probability that the discharge of secondary, disinfected and dechlorinated effluent into Humboldt Bay, together with a treatment process which either created new beneficial uses or resulted in a fuller realization of existing beneficial uses, such as the marsh treatment process proposed by Arcata, could enhance the receiving water quality. The State Board further concluded that enhancement required: (1) full secondary treatment, with disinfection and dechlorination, of sewage discharges; (2) compliance with any additional NPDES permit requirements issued by the Regional Board to protect beneficial uses; and (3) the fuller realization of existing beneficial uses or the creation of new beneficial uses either by or in conjunction with a wastewater treatment project.[5] A pilot project funded by the State Water Resources Control Board in 1981 was designed and implemented by the City to demonstrate the effectiveness of wetland treatment in meeting water quality treatment standards. The final report from this pilot was accepted by the Regional Board[67].

In 1983, the Regional Water Board adopted Resolution No. 83-9, granting the City of Arcata a waiver, as defined in Chapter I, Paragraph A of the Bays and Estuaries Policy, permitting continued [Humboldt] Bay discharge. Resolution No. 83-9 found

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3 State Water Resources Control Board, Bill Dendy Memorandum to Regional Water Board Executive Officer David Joseph, October 21, 1974

4 City of Arcata, draft Wastewater Treatment, Water Reclamation, and Ocean Ranching, April 18, 1977

5 State Board Order No. 79-20, May 17, 1979

6 Gearheart, R.A.,B. Finney, S. Wilbur, J. Williams, D. Hill, and S. Sundberg, City of Arcata Marsh Pilot Project, Effluent Quality Results System Design Management, Project No: C-06-2270, State of California Water Resources Control Board, Sacramento, CA, 1983.

7 Gearheart, R.A., S. Wilbur, H. Holbrook, and M. Ives, City of Arcata Marsh Pilot Project, Wetland Bacteria Speciation and Harvesting Effect on Water Quality, Project No: 3-154-500-0, State of California Water Resources Control Board, Sacramento, CA, 1983.

that the marsh disposal alternative meets the definition of enhancement set forth in State Board Order No. 79-20 because the waste would achieve secondary treatment standards, create no adverse impacts to present beneficial uses and the discharge would create new beneficial uses and wildlife habitat.[8]

As constructed, the AMWS consists of three freshwater wetlands: Allen, Gearheart, and Hauser Marshes. These created marshes receive equivalent to secondary treated wastewater, provide enhanced treatment for discharges to Humboldt Bay, and create new beneficial uses, which would not exist in the absence of the discharge. The AMWS marshes (wetlands) provide enhanced water quality treatment while hosting a variety of cold water aquatic organisms and vegetation creating an extraordinary habitat for shorebirds, waterfowl, raptors and migratory birds. As a result, the AMWS is an integral part of the WWTF and a valued part of the Arcata community providing numerous non-contact recreation and educational opportunities.

B. Description of Wastewater and Biosolids Treatment or Controls

1. **Existing Treatment Configuration.** Primary wastewater treatment is accomplished with mechanical bar screens, a grit removal chamber, and two primary clarifiers. Primary solids are sent to two anaerobic digesters, sludge drying beds, and a sludge composting operation. Influent flows above 5.0 mgd are diverted around primary treatment directly to the oxidation ponds.

   Secondary treatment is accomplished using two oxidation ponds 22.4 and 17.3 acres in size respectively. A third oxidation pond (3.6 acres) has recently been converted into two treatment marshes to complement the existing four 2-acre treatment marshes, totaling six treatment marshes. Detention time in the WWTF, prior to enhanced treatment in the AMWS, is approximately 39 days during average dry weather design flow periods. Currently, effluent is disinfected with chlorine and dechlorinated with sulfur dioxide prior to discharge. Under the existing WWTF configuration, treated effluent from the WWTF is continuously commingled with effluent from the AMWS, disinfected and split, flowing by gravity either to Humboldt Bay or again through the AMWS. The result is disinfected secondary effluent, but not all effluent receives the benefit of enhanced treatment through the AMWS before discharge to Humboldt Bay and some effluent may actually be chlorinated multiple times increasing the opportunity to form disinfection byproducts above water quality objectives.

[8] Regional Water Board, Resolution 83-9, July 28, 1983

2. **Upgraded Treatment Configuration.** Under the upgraded WWTF configuration, waste will continue to enter the system through the headworks receiving primary and biosolids treatment comprised of mechanical bar screens, grit removal, two clarifiers, two anaerobic digesters, drying beds, and composting. Initial biological treatment also still be accomplished in the two oxidation ponds and 6 treatment marshes (4 treatment marshes are currently online; marshes 5 and 6 were constructed in 2011 and will be fully operational in 2013). The oxidation pond effluent flows to the six treatment marshes, which operate in parallel.

   Equivalent to secondary treated effluent will discharge at Outfall No. 002 to the AMWS for enhanced water quality treatment consistent with Resolution Nos. 79-20 and 83-9. Water flows through Allen, Gearheart and Hauser marshes in succession. At the design average dry weather flow, detention time in the AMWS will be approximately 60 days and results in full standard secondary treated effluent. The Permittee plans to construct a new ultraviolet (UV) disinfection system at the end of Hauser marsh. Key components of enhanced treatment provided by the AMWS are settling and clarification. Placement of the new UV disinfection system after AMWS treatment is fundamental to the efficiency and dependability of the new system, because UV disinfection relies upon transmission of the ultraviolet light throughout the water column. Although not contemplated at the time of adoption, the Regional Water Board finds the application of UV disinfection consistent with Resolution Nos. 79-20 and 83-9. Final engineering designs for the City's proposed UV disinfection system will be forwarded to the Regional Water Board upon completion. Within the effective period of this Order, treated effluent will be discharged immediately after UV disinfection through Outfall No. 003 into Humboldt Bay via the brackish marsh, which was constructed in 2008. Final designs for an attenuated/diffused discharge will also be completed and submitted to the Regional Water Board prior to flow being diverted to Outfall No. 003.

   The upgraded WWTF configuration will result in overall improvements to effluent quality discharged to Humboldt Bay because effluent will no longer be commingled; therefore all effluent of at least up to 5.9 MGD will receive enhanced treatment through the AMWS. In addition, chlorination will no longer be the primary form of disinfection so formation of disinfection byproducts will be greatly diminished. Treated effluent from Outfall No. 003 will enter Humboldt Bay in a diffuse manor due to the tidal mixing within the brackish marsh and subsequent flow though tidal marshes. The overall end result of the upgraded WWTF will be higher quality water entering Humboldt Bay.

C. Discharge Points and Receiving Waters

In conformance with State Board Order No. 79-20, and Regional Water Board, Resolution 83-9, the facility discharges to Humboldt Bay, a water of the United

States, in conjunction with enhanced treatment and the creation of beneficial uses associated with the AMWS, a fresh water marsh system. Humboldt Bay receiving water is estuarine.

D. Summary of Existing Requirements and Self-Monitoring Report (SMR) Data

Effluent limitations contained in the existing Order for discharges from Outfall 001 and Outfall 002 (Monitoring Locations EFF-001 and EFF-002) and representative monitoring data retrieved from monthly Self-Monitoring Reports from the term of the previous Order are summarized as follows:

Table F-2. Historic Effluent Limitations and Monitoring Data

Parameter	Units	Effluent Limitation			Monitoring Data (From 6/2004– To 11/2011)		
		Average Monthly	Average Weekly	Maximum Daily	Highest Average Monthly Discharge	Highest Average Weekly Discharge	Highest Daily Discharge
Outfall 001							
BOD_5	mg/L	30	45	60	20	20	24
Percent Removal, BOD	%	≥ 85	---	---	Minimum – 77% Removal		
TSS	mg/L	30	45	60	34	30	42
Percent Removal, TSS	%	≥ 85	---	---	Minimum – 59% Removal[9]		
Oil and Grease	mg/L	---	---	---	<5	---	<5
Fecal Coliform Bacteria	MPN/100 mLs	14[10]	---	43[11]	<2	---	4
pH	s.u.	6.0 - 9.0 at all times			Minimum – 6.0 Maximum – 7.1		
Settleable Solids	mL/L/hr	0.1	---	0.2	0.0	---	0.2
Acute Toxicity	% Survival	One sample minimum – 70% Three sample median – 90%			Minimum – 95% Survival		
Copper	μg/L	2.8	---	5.7	11	---	11
Zinc	μg/L	47	---	95	33	---	33
Cyanide	μg/L	0.5	---	1.0	4.3	---	4.3
Outfall 002							
BOD_5	mg/L	30	45	60	20	20	24
TSS	mg/L	30	45	60	34	30	42
Total Coliform Bacteria	MPN/100 mLs	23[2]		230	30	---	1,600

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9 This value represents the lowest reported value of the minimum percent removal of the pollutant. The Permittee violated the minimum percent removal requirement once during the permit term (May 2005).

10 Expressed as a 30-day median.

11 Not more than 10 percent of samples collected in a 30-day period shall exceed 43 MPN/100 ml.

Table F-2. Historic Effluent Limitations and Monitoring Data

Parameter	Units	Effluent Limitation			Monitoring Data (From 6/2004– To 11/2011)		
		Average Monthly	Average Weekly	Maximum Daily	Highest Average Monthly Discharge	Highest Average Weekly Discharge	Highest Daily Discharge
pH	s.u.	6.0 - 9.0 at all times			Minimum – 6.0 Maximum – 7.1		
Settleable Solids	mL/L/hr	0.1	---	0.2	0.0	---	0.2

Based on an analysis of data for the period from June 2004 through June 2008, oil and grease results were all reported as non-detect. The Regional Water Board has determined that because the pollutant has not been detected in the effluent discharged from the facility during the permit term, monitoring for the pollutant is no longer necessary and monitoring requirements have been eliminated from this Order.

E. Compliance Summary

On June 12, 2008, the Regional Water Board issued Administrative Civil Liability Order No. R1-2008-0048 to the Permittee assessing a civil liability of $104,000 for violations of Order No. R1-2004-0036 for the period from June 22, 2004, to March 31, 2007. Most violations of WDRs in this time period were related to discharges of BOD, TSS, percent removal, coliform bacteria, copper, and cyanide and for sewer system overflows (SSOs). A portion of the liability is being held in abeyance pending resolution of legal matters, a portion has been paid to the State Water Pollution Cleanup and Abatement Account, and a portion was suspended pending satisfactory completion of a Supplemental Environmental Project and two collection system projects proposed by the Permittee. On May 19, 2010, an Administrative Civil Liability Compliant was issued to the Permittee for five sanitary sewer overflows that resulted in mandatory penalties for copper effluent violations. Administrative civil liability sought for the alleged violations totaled $83,300.

F. Planned Changes

Planed changes at the WWTF include once through flow configuration and installation of a UV system prior to discharge at Outfall 003 as described under section II.B.2. of this Fact Sheet.

III. APPLICABLE PLANS, POLICIES, AND REGULATIONS

The requirements contained in this Order are based on the requirements and authorities described in this section. This section provides supplemental information, where appropriate, for the plans, policies, and regulations relevant to the discharge.

A. Legal Authorities

This Order is issued pursuant to section 402 of the federal Clean Water Act (CWA) and implementing regulations adopted by the U.S. Environmental Protection Agency (USEPA) and chapter 5.5, division 7 of the California Water Code (Water Code), commencing with section 13370. It shall serve as a NPDES permit for point source discharges from this facility to Humboldt Bay surface waters. This Order also serves as WDRs pursuant to article 4, chapter 4, division 7 of the Water Code (commencing with section 13260) for discharges from this facility to AMWS and proviso V.B Groundwater.

B. California Environmental Quality Act (CEQA)

Under Water Code section 13389, this action to adopt an NPDES permit is exempt from the provisions of CEQA, Public Resources Code sections 21100 through 21177. CEQA Guidelines Exemption 1 for Existing Facilities (Cal. Code of Regs., tit. 14, §15301) applies to "… the operation, repair, maintenance, permitting, leasing, licensing, or minor alteration of existing public or private structures, facilities, mechanical equipment, or topographical features, involving negligible or no expansion of use beyond that existing at the time of the lead agency's determination…" The environmental baseline for this action is considered the WWTF that existed upon adoption of this Order. Board action with regard to existing facilities is categorically exempt from the requirements of CEQA. The physical upgrades to the existing WWTF (i.e., construction of the UV system and diffused outfall in the brackish marsh) fall within the scope of minor alterations to existing public structures and facilities.

C. State and Federal Regulations, Policies, and Plans

1. **Water Quality Control Plans.** The Regional Water Board adopted a *Water Quality Control Plan for the North Coast Region* (hereinafter Basin Plan) that designates beneficial uses, establishes water quality objectives, and contains implementation programs and policies to achieve those objectives for all waters addressed through the plan. In addition, the Basin Plan implements State Water Resources Control Board (State Water Board) Resolution No. 88-63, which establishes State policy that all waters, with certain exceptions, should be considered suitable or potentially suitable for municipal or domestic supply. Beneficial uses established by the Basin Plan for receiving waters for discharges from the Arcata Wastewater Treatment Facility - Humboldt Bay (an estuarine environment) and the Arcata Marsh Wildlife Sanctuary (a fresh water marsh system), are presented in Table F-3.

Table F-3. Basin Plan Beneficial Uses

Outfall	Receiving Water	Beneficial Uses
001 and 003	Humboldt Bay	**Existing:** MUN - Municipal and Domestic Supply AGR - Agricultural Supply IND - Industrial Service Supply FRSH - Freshwater Replenishment NAV - Navigation REC-1 - Water Contact Recreation REC -2 - Non-Contact Water Recreation COMM - Commercial and Sport Fishing AQUA - Aquaculture COLD - Cold Freshwater Habitat MAR - Marine Habitat WILD - Wildlife Habitat RARE - Preservation of Rare, Threatened, or Endangered Species MIGR - Migration of Aquatic Organisms SPWN - Spawning, Reproduction, and/or Early Development SHELL - Shellfish Harvesting EST - Estuarine Habitat CUL - Native American Culture **Potential:** POW - Hydropower Generation PRO – Industrial Process Supply
002	AWMS	**Existing:** REC -2 - Non-Contact Water Recreation COLD - Cold Freshwater Habitat WILD - Wildlife Habitat WET – Wetland Habitat WQE – Water Quality Enhancement

The MUN beneficial use has not been designated for the AMWS, which exempts "water in systems designed or modified to collect or treat municipal or industrial wastewaters… provided that the discharge from such systems is monitored to assure compliance with all relevant water quality objectives as required by the Regional Boards." Requirements of this Order implement the Basin Plan and Resolution No. 88-63 (as revised by Resolution No. 2006-0008).

2. **Thermal Plan.** The State Water Board adopted the *Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Water and Enclosed Bays and Estuaries of California* (Thermal Plan) on May 18, 1972, and amended this plan on September 18, 1975. This plan contains temperature objectives for surface waters. Requirements of this Order implement the Thermal Plan.

3. **National Toxics Rule (NTR) and California Toxics Rule (CTR).** USEPA adopted the NTR on December 22, 1992, and later amended it on May 4, 1995 and November 9, 1999. About forty criteria in the NTR applied in California. On May 18, 2000, USEPA adopted the CTR. The CTR promulgated new toxics criteria for California and, in addition, incorporated the previously adopted NTR criteria that were applicable in the state. The CTR was amended on February 13, 2001. These rules contain water quality criteria for priority pollutants.

4. **State Implementation Policy.** On March 2, 2000, the State Water Board adopted the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* (State Implementation Policy or SIP). The SIP became effective on April 28, 2000 with respect to the priority pollutant criteria promulgated for California by the USEPA through the NTR and to the priority pollutant objectives established by the Regional Water Board in the Basin Plan. The SIP became effective on May 18, 2000 with respect to the priority pollutant criteria promulgated by the USEPA through the CTR. The State Water Board adopted amendments to the SIP on February 24, 2005 that became effective on July 13, 2005. The SIP establishes implementation provisions for priority pollutant criteria and objectives and provisions for chronic toxicity control. Requirements of this Order implement the SIP.

5. **Compliance Schedules and Interim Requirements.** In general, an NPDES permit must include final effluent limitations that are consistent with CWA section 301 and with title 40, Code of Federal Regulations[12] section 122.44(d). There are exceptions to this general rule. The State Water Board's *Policy for Compliance Schedules in National Pollutant Discharge Elimination System Permits* (Compliance Schedule Policy), which was adopted on April 15, 2008 (State Water Board Resolution No. 2008-0025) and became effective on August 27, 2008, allows compliance schedules for new, revised, or newly interpreted water quality objectives or criteria, or in accordance with a TMDL. All compliance schedules must be as short as possible, and may not exceed 10 years from the effective date of the adoption revision or new interpretation of the applicable water quality objective or criterion, unless a TMDL allows a longer schedule. The Regional Water Board, however, is not required to include a compliance schedule, but may adopt a Cease and Desist Order pursuant to Water Code section 13301 or a Time Schedule Order pursuant to Water Code section 13300 where it finds that the discharger is violating or threatening to violate the permit. The Regional Water Board will consider the merits of each case in determining whether it is appropriate to include a compliance schedule in a permit, and,

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[12] All further statutory references are to title 40 of the Code of Federal Regulations unless otherwise indicated.

consistent with the Compliance Schedule Policy, should consider the feasibility of achieving compliance, and must impose a schedule that is as short as possible to achieve compliance with the effluent limit based on the objective or criteria.

The Compliance Schedule Policy and the SIP do not allow compliance schedules for priority pollutants beyond May 18, 2010, except for new or more stringent priority pollutant criteria adopted by USEPA after December 17, 2008.

Where a compliance schedule for a final effluent limitation exceeds 1 year, the Order must include interim numeric limitations for that constituent or parameter, interim milestones and compliance reporting within 14 days after each interim milestone. The permit may also include interim requirements to control the pollutant, such as pollutant minimization and source control measures. This Order does not include compliance schedules, but does apply interim effluent limitations for Outfall 001 through November 30, 2016, or until activation of the upgraded WWTF configuration, whichever is sooner.

6. **Alaska Rule.** On March 30, 2000, USEPA revised its regulation that specifies when new and revised state and tribal water quality standards (WQS) become effective for CWA purposes [section 131.21, 65 Fed. Reg. 24641 (April 27, 2000)]. Under the revised regulation (also known as the Alaska Rule), new and revised standards submitted to USEPA after May 30, 2000, must be approved by USEPA before being used for CWA purposes. The final rule also provides that standards already in effect and submitted to USEPA by May 30, 2000, may be used for CWA purposes, whether or not approved by USEPA.

7. **Antidegradation Policy.** Section 131.12 requires that the State water quality standards include an antidegradation policy consistent with the federal policy. The State Water Board established California's antidegradation policy in State Water Board Resolution No. 68-16. Resolution No. 68-16 has been deemed to be consistent with the federal antidegradation policy where the federal policy applies under federal law. Resolution No. 68-16 requires that existing water quality be maintained unless degradation is justified based on specific findings. The Basin Plan implements, and incorporates by reference, both the State and federal antidegradation policies. The permitted discharge must be consistent with the antidegradation provision of section 131.12 and State Water Board Resolution No. 68-16. As discussed in detail in section IV.D.2. of this Fact Sheet, the permitted discharge is consistent with the antidegradation provision of section 131.12 and State Water Board Resolution No. 68-16.

8. **Anti-Backsliding Requirements.** Sections 402(o)(2) and 303(d)(4) of the CWA and federal regulations at section 122.44(l) prohibit backsliding in NPDES permits. These anti-backsliding provisions require that effluent limitations in a reissued permit must be as stringent as those in the previous permit, with some

exceptions in which limitations may be relaxed. Some effluent limitations in this Order have been removed or are less stringent than those in the previous Order. As discussed in detail in section IV.D.1. of this Fact Sheet, removal or relaxation of effluent limitations is consistent with the anti-backsliding requirements of the CWA and federal regulations.

9. **Endangered Species Act.** This Order does not authorize an act that results in the taking of a threatened or endangered species or any act that is now prohibited, or becomes prohibited in the future, under either the California Endangered Species Act (Fish and Game Code sections 2050 to 2097) or the Federal Endangered Species Act (16 U.S.C.A sections 1531 to 1544). This Order requires compliance with effluent limits, receiving water limits, and other requirements to protect the beneficial uses of waters of the State. The Permittee is separately responsible for meeting all requirements of the applicable Endangered Species Act.

D. Impaired Water Bodies on CWA 303(d) List

Section 303(d) of the federal CWA requires states to identify waterbodies that do not meet water quality standards and are not supporting their beneficial uses after implementation of technology-based effluent limitations on point sources. Each state must submit an updated list, the 303(d) List of Impaired Waterbodies, to USEPA by April of each even numbered year. In addition to identifying the waterbodies that are not supporting beneficial uses, the 303(d) list also identifies the pollutant or stressor causing impairment and establishes a schedule for developing a control plan to address the impairment. The USEPA requires the Regional Water Board to develop total maximum daily loads (TMDLs) for each 303(d) listed pollutant and water body contaminant. TMDLs establish the maximum quantity of a given pollutant that can be added to a water body from all sources without exceeding the applicable water quality standard for that pollutant and determine wasteload allocations (the portion of a TMDL allocated to existing and future point sources) for point sources and load allocations (the portion of a TMDL attributed to existing and future nonpoint sources) for nonpoint sources.

In October 2011, the USEPA provided final approval of the 303(d) list of impaired water bodies prepared by the State. The list identifies Humboldt Bay (Eureka Plan Hydrologic Unit) as impaired by dioxin toxic equivalents and polychlorinated biphenyls (PCBs). Pursuant to CWA section 303(d), when the Regional Water Board adopts TMDLs to address impairing pollutants in 303(d) listed waters, NPDES permits will implement those TMDLs. TMDLs establish the maximum quantity of a given pollutant that can be added to a water body from all sources without exceeding the applicable water quality standard for that pollutant and determine wasteload allocations (the portion of a TMDL allocated to existing and future point sources) for point sources and load allocations (the portion of a TMDL attributed to existing and future nonpoint sources) for nonpoint sources. The Regional Water Board expects to adopt TMDLs for dioxin toxic equivalents and PCBs for Humboldt Bay by 2019.

E. Other Plans, Polices and Regulations

1. **Storm Water.** All areas within the treatment facility drain to two storm drain inlets on the property where storm water is routed to the headworks. The State Water Board Water Quality Order No. 97-03-DWQ, NPDES General Permit No. CAS000001, Waste Discharge Requirements for Discharges of Storm Water Associated with Industrial Activities Excluding Construction Activities, does not require facilities to obtain coverage if storm water is captured and treated and/or disposed of within the facility's NPDES permitted process wastewater or if storm water is disposed of to evaporation ponds, percolation ponds, or combined sewer systems.

2. **Sanitary Sewer Systems.** On May 2, 2006, the State Water Board adopted State Water Board Order No. 2006-0003-DWQ, *Statewide General WDRs for Sanitary Sewer Systems.* The general permit is applicable to all "federal and state agencies, municipalities, counties, districts, and other public entities that own or operate sanitary sewer systems greater than one mile in length that collect and/or convey untreated or partially treated wastewater to a publicly owned treatment facility in the State of California." The purpose of the general permit is to promote the proper and efficient management, operation, and maintenance of sanitary sewer systems and to minimize the occurrences and impacts of sanitary sewer overflows. Section VI.C.5.a of the Order requires the Permittee must be separately covered under Order No. 2006-0003-DWQ.

3. **Discharge of Biosolids to Land.** On July 22, 2004, the State Water Board adopted State Water Board Order No. 2004-0012-DWQ, *General Waste Discharge Requirements for the Discharge of Biosolids to Land for Use as a Soil Amendment in Agricultural, Silvicultural, Horticultural, and Land Reclamation Activities*. The general waste discharge requirements establish standards for agronomic applications and the use of biosolids as a soil amendment or fertilizer in agriculture, forestry, and surface mining reclamation, and include provisions to mitigate significant environmental impacts. The Order requires the Permittee must be separately covered under Order No. 2004-0012-DWQ or other appropriate WDRs for the discharge of biosolids from the wastewater treatment plant. Section VI.C.5.c. of the Order requires the Permittee to seek coverage for biosolids management and disposal or reuse.

F. Provisions and Requirements Implementing State Law.

The requirements under Discharge Specifications and other sections of this Order (e.g., groundwater requirements) are included to implement State law only;

consequently, violations of these requirements are not subject to the enforcement remedies that are available for NPDES violations.

IV. RATIONALE FOR EFFLUENT LIMITATIONS AND DISCHARGE SPECIFICATIONS

The CWA requires point source dischargers to control the amount of conventional, non-conventional, and toxic pollutants that are discharged into the waters of the United States. The control of pollutants discharged is established through effluent limitations and other requirements in NPDES permits. There are two principal bases for effluent limitations in the Code of Federal Regulations: section 122.44(a) requires that permits include applicable technology-based limitations and standards; and section 122.44(d) requires that permits include water quality-based effluent limitations to attain and maintain applicable numeric and narrative water quality criteria to protect the beneficial uses of the receiving water.

A. Discharge Prohibitions

1. **Discharge Prohibition III.A.** The discharge of waste to Humboldt Bay is prohibited unless the discharge conforms to State Board Order No. 79-20 and Regional Water Board, Resolution 83-9.

   This prohibition is modified from the the prohibition contained in the previous Order (Order No. R1-2004-0036). The previous order contained a prohibition which stated, "[t]he discharge of waste to Humboldt Bay (Arcata Bay) is prohibited unless it is done in conjunction with the Arcata Marsh and Wildlife Sanctuary." Both the former and revised version of this prohibition, in part, justify an exception to State Water Board Resolution No. 74-43 (*Water Quality Control Policy for Enclosed Bays and Estuaries of California*) allowing the continued discharge from the Arcata WWTF to Humboldt Bay "only when a discharge enhances the quality of the receiving water above that which would occur in the absence of the discharge." Resolution No. 83-9 acknowledged that the discharge of treated wastewater in through the AMWS met the definition of "enhancement" as established by State Water Board Order WQ 79-20. Discharge Prohibition III. A ensures that this enhancement project will be continued and allows the Regional Water Board to continue to recognize an exception to State Water Board Resolution No. 74-43 for the Arcata WWTF.

2. **Discharge Prohibition III.B.** The discharge of any waste not disclosed by the Permittee or not within the reasonable contemplation of the Regional Water Board is prohibited.

   This prohibition is based on the Basin Plan, the previous Order, and State Water Board Order WQO No. 2002-0012 regarding the petition of WDRs Order No. 01-072 for the East Bay Municipal Utility District and Bay Area Clean Water

Agencies. In State Water Board Order No. WQO 2002-0012, the State Water Board found that this prohibition is acceptable in orders, but should be interpreted to apply only to constituents that are either not disclosed by the Permittee, or are not reasonably anticipated to be present in the discharge, but have not been disclosed by the Permittee. It specifically does not apply to constituents in the discharge that do not have "reasonable potential" to exceed water quality objectives.

The State Water Board has stated that the only pollutants not covered by this prohibition are those which were "disclosed to the permitting authority and … can be reasonably contemplated." [In re the Petition of East Bay Municipal Utilities District et al., (State Water Board, 2002) Order No. WQO 2002-0012, p. 24] In that Order, the State Water Board cited a case which held the Permittee is liable for the discharge of pollutants "not within the reasonable contemplation of the permitting authority ….whether spills or otherwise…" [Piney Run Preservation Assn. v. County Commissioners of Carroll County, Maryland (4th Cir. 2001) 268 F. 3d 255, 268.] Thus the State Water Board authority provides that, to be permissible, the constituent discharged (1) must have been disclosed by the Permittee and (2) can be reasonably contemplated by the Regional Water Board.

Whether or not the Permittee reasonably contemplates the discharge of a constituent is not relevant. What matters is whether the Permittee disclosed the constituent to the Regional Water Board or whether the presence of the pollutant in the discharge can otherwise be reasonably contemplated by the Regional Water Board at the time of Order adoption.

3. **Discharge Prohibition III.C.** Creation of pollution, contamination, or nuisance, as defined by Section 13050 of the Water Code is prohibited.

   This prohibition is retained from the previous Order and is based on section 13050 of the Water Code.

4. **Discharge Prohibition III.D.** The discharge of sludge or digester supernatant is prohibited, except as authorized under section VI.C.5.c. (Solids Disposal and Handling Requirements, section VI.C.5.c of the Order.)

   This prohibition is is retained from the previous Order (Order No. R1-2004-0036) and is based in restrictions on the disposal of sewage sludge found in federal regulations [Part 503 (Biosolids), Part 527 and Part 258] and title 27 of the California Code of Regulations (CCR).

5. **Discharge Prohibition III.E.** The discharge of untreated or partially treated waste from anywhere within the collection, treatment, or disposal systems is

prohibited, except as provided for in Prohibition III. I. and in Attachment D, Standard Provisions (Bypass).

This prohibition has been retained from the previous Order and is based on the Basin Plan to protect beneficial uses of the receiving water from unpermitted discharges, and the intent of the Water Code sections 13260 through 13264 relating to the discharge of waste to waters of the State without filing for and being issued an Order. This prohibition applies to spills not related to sanitary sewer overflows (SSOs) and other unauthorized discharges of wastewater within the collection, treatment, and disposal facilities. The discharge of untreated or partially treated wastewater from the collection, treatment, or disposal facility represents an unauthorized bypass pursuant to section 122.41(m) or an unauthorized discharge which poses a threat to human health and/or aquatic life, and therefore is explicitly prohibited by this Order.

6. **Discharge Prohibition III.F.** Any SSO that results in a discharge of untreated or partially treated wastewater to (a) waters of the State, (b) groundwater, or (c) land that creates pollution, contamination, or nuisance, as defined in Water Code section 13050(m) is prohibited.

   This prohibition applies to spills related to SSOs and is based on State standards, including section 13050 of the Water Code and the Basin Plan. This prohibition is consistent with the States' antidegradation policy as specified in State Water Board Resolution No. 68-16 (*Statement of Policy with Respect to Maintaining High Quality of Water in California*) in that the prohibition imposes conditions to prevent impacts to water quality, the degradation of water quality, negative effects on receiving water beneficial uses, and lessening of water quality beyond that prescribed in State Water Board or Regional Water Board plans and policies.

   Statewide General Waste Discharge Requirements for Sanitary Sewer Systems. Order No. 2006-0003-DWQ prohibits SSOs that result in the discharge of untreated or partially treated wastewater to waters of the United States and SSOs that cause a nuisance, compared to Prohibition III.E. of this Order, which prohibits SSO discharges that create nuisance or pollution to waters of the state, groundwater, and land for a more complete protection of human health. This prohibition (Prohibition III.F) is stricter than the prohibitions stated in State Water Board Order 2006-003-DWQ because high groundwater is prevalant in the North Coast Region, and many areas of this region rely on groundwater as a drinking water source. This prohibition protects the region's groundwater resources and is consistent with antidegradation policies.

7. **Discharge Prohibition III.G.** The discharge of waste at any point not described in Finding II.B of the Fact Sheet, Prohibition III.I., or otherwise not authorized by

this or another permit issued by the State Water Board or another Regional Water Board is prohibited.

This prohibition allows the Permittee to discharge waste only in accordance with WDRs. It is based on sections 301 and 402 of the federal CWA and section 13263 of the Water Code.

8. **Discharge Prohibition III.H.** The mean daily dry weather flow of waste through the treatment plant in excess of 2.3 mgd measured over a calander month is prohibited.

   This prohibition is based on the permitted flow and dry weather design flow of the WWTF.

9. **Discharge Prohibition III.I**. The Discharge of treated effluent at Outfall 001, is prohibited other than that portion of the flow exceeding peak flows of 5.9 mgd.[13]

   This prohibition is new and is based on Resolution No. 83-9, in which the Regional Water Board acknowleged that the discharge of treated wastewater through the AMWS met the definition of "enhancement" as established by State Water Board Order WQ 79-20. Discharge Prohibition III. I. ensures that water quality is enhanced by treatment through AMWS to the fullest extent possible prior to discharge to Humboldt Bay.

B. Technology-Based Effluent Limitations and Discharge Specifications

1. Scope and Authority

The CWA requires that technology-based effluent limitations be established based on several levels of controls:

a. Best practicable treatment control technology (BPT) represents the average of the best performance by plants within an industrial category or subcategory. BPT standards apply to toxic, conventional, and non-conventional pollutants.

b. Best available technology economically achievable (BAT) represents the best existing performance of treatment technologies that are economically

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[13] This Prohibition will take effect upon activation of the new disinfection system and implementation of discharges at Discharge Point 003, but no later than December 1, 2016.

achievable within an industrial point source category. BAT standards apply to toxic and non-conventional pollutants.

c. Best conventional pollutant control technology (BCT) represents the control from existing industrial point sources of conventional pollutants including BOD, TSS, fecal coliform, pH, and oil and grease. The BCT standard is established after considering the "cost reasonableness" of the relationship between the cost of attaining a reduction in effluent discharge and the benefits that would result, and also the cost effectiveness of additional industrial treatment beyond BPT.

d. New source performance standards (NSPS) represent the best available demonstrated control technology standards. The intent of NSPS guidelines is to set limitations that represent state-of-the-art treatment technology for new sources.

The Federal Water Pollution Control Act Amendments of 1972 (PL 92-500) established the minimum performance requirements for POTWs [defined in section 304(d)(1)]. Section 301(b)(1)(B) of that Act requires that such treatment works must, as a minimum, meet effluent limitations based on secondary treatment as defined by the USEPA Administrator.

Based on this statutory requirement, USEPA developed secondary treatment regulations, which are specified in section 133. These technology-based regulations apply to all municipal wastewater treatment plants and identify the minimum level of effluent quality attainable by secondary treatment in terms of biochemical oxygen demand (BOD_5), total suspended solids (TSS), and pH.

Following publication of the secondary treatment regulations, legislative history indicates that Congress was concerned that USEPA had not "sanctioned" the use of certain biological treatment techniques that were effective in achieving significant reductions in BOD_5 and TSS for secondary treatment. Therefore to prevent unnecessary construction of costly new facilities, Congress included language in the 1981 amendment to the Construction Grants statues [Section 23 of Pub. L. 97-147] that required USEPA to provide allowance for alternative biological treatment technologies such as trickling filters or waste stabilization ponds. In response to this requirement, definition of secondary treatment was modified on September 20, 1984 and June 3, 1985, and published in the revised secondary treatment regulations contained in section 133.105. These regulations allow alternative limitations for facilities using trickling filters and waste stabilization ponds that meet the requirements for "equivalent to secondary treatment." Equivalent to secondary treatment limitations allow *up to* 45 mg/L (monthly average) and *up to* 65 mg/L (weekly average) for BOD_5 and TSS.

Therefore, POTWs that use waste stabilization ponds, identified in section 133.103, as the principal process for secondary treatment and whose operation and maintenance data indicate that the TSS values specified in the equivalent to secondary regulations cannot be achieved, can qualify to have their minimum levels of effluent quality for TSS adjusted upwards.

Furthermore, in order to address the variations in facility performance due to geographic, climatic, or seasonal conditions in different States, the Alternative State Requirements (ASR) provision contained in section 133.105(d) was written. ASR allows States the flexibility to set permit limitations above the maximum levels of 45 mg/L (monthly average) and 65 mg/L (weekly average) for TSS from lagoons. However, before ASR limitations for suspended solids can be set, the effluent must meet the BOD limitations as prescribed by section 133.102(a). Presently, the maximum TSS value set by the State of California for lagoon effluent is 95 mg/L. This value corresponds to a 30-day consecutive average or an average over duration of less than 30 days.

Regulations promulgated in section 125.3(a)(1) require technology-based effluent limitations for municipal Permittees to be placed in NPDES permits based on secondary treatment standards or equivalent to secondary treatment standards. In order to be eligible for equivalent to secondary limitations, a POTW must meet all of the following criteria:

a. The principal treatment process must be either a trickling filter or waste stabilization pond.

b. The effluent quality consistently achieved, despite proper operations and maintenance, is in excess of 30 mg/L BOD_5 and TSS.

c. Water quality is not adversely affected by the discharge. (section 133.101(g).)

   The treatment works as a whole provides significant biological treatment such that a minimum 65 percent reduction of BOD_5 is consistently attained (30-day average).

2. Applicable Technology-Based Limitations and Specifications

Technology-based limitations established by the Order are summarized in Table F-4 below; and derivation of these limits is discussed in the following text.

Table F-4. Technology-Based Effluent Limitations

Parameter	Units	Effluent Limitations		
		Average Monthly	Average Weekly	Maximum Daily
Outfall 001 Interim Limitations				
BOD_5	mg/L	30	45	---
	lbs/day	575	863	---
TSS	mg/L	30	45	---
	lbs/day	575	863	---
BOD_5 and TSS Removal	85 percent (minimum)			
pH	s.u.	6.0 – 9.0 at all times		
Settleable Solids	mL/L	0.1	---	0.2
Outfall 001 Final Limitations				
BOD_5	mg/L	45	65	---
	lbs/day	863	1304	---
TSS	mg/L	66	95	---
	lbs/day	1266	1822	---
BOD_5 and TSS Removal	65 percent (minimum)			
pH	s.u.	6.0 – 9.0 at all times		
Settleable Solids	mL/L	0.1	---	0.2
Outfall 002 Final Specifications				
BOD_5	mg/L	45	65	
TSS	mg/L	66	95	
pH	s.u.	6.0 – 9.0 at all times		
Settleable Solids	mL/L	0.1	---	0.2
Outfall 003 Final Limitations				
BOD_5	mg/L	30	45	---
	lbs/day	575	863	---
TSS	mg/L	30	45	---
	lbs/day	575	863	---
BOD_5 and TSS Removal	85 percent (minimum)			
pH	s.u.	6.0 – 9.0 at all times		
Settleable Solids	mL/L	0.1	---	0.2

a. **BOD_5 and TSS Effluent Limitations and Specifications:** In its application for permit renewal (February 19, 2007), the Permittee requested the establishment of effluent limitations for BOD_5 and TSS based on equivalent to secondary standards. The Regional Water

Board has determined, however, that effluent limitations based on standard secondary treatment standards from the previous permit will be retained until the upgraded configuration is in place, because the WWTF has demonstrated sufficient compliance with these limitations under the existing configuration.

The City of Arcata uses waste stabilization ponds as the principal process providing significant biological treatment of municipal wastewater. In accordance with section 133.101, a facility that consists of a pond or a trickling filter system and cannot meet the secondary standards after proper operation and maintenance may be allowed to meet treatment equivalent to secondary limits. Under the upgraded WWTF configuration, all wastewater will flow through Outfall 002 to the AMWS and ultimately Outfall 003 to Humboldt Bay, except on rare occasions when the portion of flow exceeding 5.9 mgd is allowed to discharge at Outfall 001. Sampling at the location known as Pt. 9 represents the quality of effluent prior to enhanced treatment through the AMWS. Analysis was done with the Pt. 9 data from 2009 through 2011 to determine the 95^{th} percentile value for the 30-day averages of BOD and TSS. The 95^{th} percentile of 30-day averages for the 3-year period are BOD 78 mg/L and TSS 66 mg/L.

The City of Arcata effluent concentrations for BOD and TSS that are consistently achievable, based on the 95th percentile value, exceed the minimum level for standard secondary treated effluent. Therefore, the Permittee is eligible for alternative limits for treatment equivalent to secondary for Outfall 001 (under the upgraded configuration criteria) and Outfall 002. The maximum equivalent to secondary requirement for BOD concentration by wastewater treatment ponds provides for a 30-day TSS effluent limitation up to 45 mg/L. Because the 95th percentile effluent value of 78 mg/L exceeds the maximum of 45 mg/L, 45 mg/L is established in this permit as the average monthly final BOD effluent limitation. The alternative state requirement for TSS concentration by wastewater treatment ponds in California provides for a 30-day TSS effluent limitation up to 95 mg/L. Therefore, the 95th percentile effluent value of 66 mg/L is established in this permit as the average monthly final TSS effluent limitation.

Average weekly effluent limitations for BOD and TSS have also been established in the Order as required by section 122.45(d)(2), which states that effluent limitations for POTWs must be expressed as average weekly and average monthly limitations unless impracticable. In accordance with section 133.101, the average weekly limitations were calculated by multiplying the average monthly limitations by 1.5 to obtain a result of 68 mg/L for BOD. Because the maximum equivalent to secondary requirement for BOD concentration by wastewater treatment ponds provides for a weekly BOD effluent limitation up to 65 mg/L exceeding the value of 68 mg/L, 65 mg/L is established in this permit as the average weekly final BOD effluent limitation. The average weekly TSS limitation would be calculated by multiplying the average monthly limitation of 66 mg/L by 1.5 to obtain a result of 99 mg/L, which is greater than is allowable by the ASR for California; therefore in application of equivalent to secondary standards, this permit includes the maximum allowable concentration of 95 mg/L for the TSS weekly limitation. Technology-based limitations equivalent to secondary for Outfall 002 will be implemented under section IV.B. Discharge Specifications of this Order.

Equivalent to secondary treatment is consistent with WQ Order No. 79-20 because the revised secondary treatment regulations contained in section 133.105, published September 20, 1984 and June 3, 1985, determined that the revised standards were equivalent to the secondary standards for those WWTF meeting the technological requirements, as described above.

Full secondary treatment standards have been retained for Outfall 001 under the existing configuration and applied to Outfall 003, because the available data indicates that these standards can be met after enhanced wastewater treatment associated with the AMWS. Under Resolution No. 83-9, adopted in July 1983, the Regional Water Board granted a continued exception to the Bays and Estuaries Policy for the discharge from City of Arcata, recognizing that operation and design of the City's WWTF met the State Water Board's definition of enhancement in WQ Order No. 79-20. Water Quality Order No. WQ 79-20, the State Water Board clarified that enhancement requires secondary treatment, compliance with all NPDES permit requirements established by the Regional Water Board and the creation of new beneficial uses or the fuller realization of existing beneficial uses. As discussed in section II.A of this Fact Sheet, beneficial uses of the AMWS include water quality enhancement. Under the new configuration of the WWTF, all wastewater up to 5.9 mgd will pass through the AMWS, receiving the benefit of enhanced treatment and therefore, this Order imposes full secondary treatment effluent limitations at Outfall 003 into Humboldt Bay at the brackish marsh.

b. **<u>Percent Removal:</u>** Standard secondary treatment standards and equivalent to secondary treatment standards at Part 133 set respective minimum standards of 85% and 65% removal for BOD_5 and TSS. The minimum standard of 85% removal has been retained from the previous permit and applied to Outfall 001 (under the existing configuration) and applied to Outfall 003 because standard secondary treatment can be achieved for discharges to Humboldt Bay in association with enhanced treatment in AMWS. The equivalent to secondary minimum standard has been applied to Outfall 001 only for those rare occasions when the portion of flow exceeding 5.9 mgd is allowed to discharge directly to Humboldt Bay receiving water.

c. **<u>pH:</u>** The secondary treatment regulations at Part 133 apply to the discharge and require that pH be maintained between 6.0 and 9.0 standard units. Limitations for pH have been retained from the previous permit.

d. **<u>Daily Maximum Effluent Limitations for BOD and TSS:</u>** Daily maximum effluent limitations for BOD_5 and TSS are not retained as these limitations may not provide the most representative measure of compliance given the long retention time of the WWTF.

e. **<u>Mass-based Effluent Limitations:</u>** Mass-based effluent limitations for BOD_5 and TSS are retained for discharges to Humboldt Bay and are based on the facility design flow. The Regional Water Board has determined that mass based limitations, in addition to concentration based limitations, for BOD_5 and TSS are appropriate and consistent with EPA recommendations ensuring that dilution will not be used as a substitute for treatment and that the overall quantity of waste discharged does not increase beyond that allowed in accordance with the permitted flow. Inclusion of mass limitations is consistent with NPDES regulations at section 122.45 (f)(2), which do not preclude the simultaneous use of mass and concentration based limitations, while expressing a preference for mass based limitations.

The Clean Water Act explicitly permits the inclusion of both mass and concentration limits for the same pollutants. Section 122.44(f)(2) states: “Pollutants limited in terms of mass additionally may be limited in terms of other units of measurement, and the permit shall require the permittee to comply with both limitations.” The use of both mass and concentration-based limitations is essential to protecting water quality. The US EPA has stressed the importance of using both mass-based and concentration-based limitations in tandem, stating its belief “that most permit limitations standards and prohibitions must be expressed quantitatively in terms of mass in order to preclude the use of dilution as a substitute for treatment." 44 Fed. Reg. 32864-32865. For example, unless a flow limit is included in an NPDES permit, the design capacity of a POTW could be increased by re-rating, which would allow an increase in overall discharge of pollutants without triggering a permit modification or antidegradation analysis.

f. **Settleable Solids Effluent Limitations:** Effluent limitations for settleable solids are retained from the previous permit. Settleable solids generally constitute 40 to 65 percent of the suspended solids in domestic wastewaters and are measured volumetrically by quiescent settling of a one liter sample for one hour in an Imhoff cone (and are therefore expressed as mLs/L/hr). Method SM 2540F for the analysis of settleable solids describes a lower limit of measurement of settleable solids at 0.1 mL/L/hr, and therefore, the monthly average limitation established by this Order, reflects, in effect, a non-detectable (100 percent removal efficiency) level of settleable solids in the discharge. The Regional Water Board has determined based upon best professional judgment (BPJ) that secondary treatment and/ or equivalent to secondary treatment should remove settleable solids to non-detect levels, and therefore effluent limitations for this parameter are necessary to evaluate efficient operation of the treatment facility in addition to ensuring protection of aquatic life from adverse impacts of settleable material in the discharge. The Regional Water Board will continue to include limitations for settleable solids in all permits for municipal wastewater treatment plants in the North Coast Region.

C. Water Quality-Based Effluent Limitations (WQBELs)

1. Scope and Authority

Section 301(b) of the CWA and section 122.44(d) require that permits include limitations more stringent than applicable federal technology-based requirements where necessary to achieve applicable water quality standards. This Order contains requirements more stringent than secondary treatment requirements that are necessary to meet Basin Plan requirements and applicable water quality standards for protection of beneficial uses.

Section 122.44(d)(1)(i) mandates that permits include effluent limitations for all pollutants that are or may be discharged at levels that have the reasonable potential to cause or contribute to an exceedance of a water quality standard, including numeric and narrative objectives within a standard. A reasonable potential analysis (RPA) demonstrated reasonable potential for discharges from the Arcata WWTF to cause or contribute to exceedances of applicable water quality criteria for copper, cyanide, 2,3,7,8 TCDD equivalents, carbon tetrachloride, dichlorobromomethane, and bis(2-ethylhexyl)phthalate associated with discharges to Humboldt Bay. In addition, data analysis shows reasonable potential for copper to exceed criteria for the protection of aquatic life associated with AMWS.

Where reasonable potential has been established for a pollutant, but there is no numeric criterion or objective for the pollutant, water quality-based effluent limitations (WQBELs) must be established using: (1) USEPA criteria guidance under CWA section 304(a), supplemented where necessary by other relevant information; (2) an indicator parameter for the pollutant of concern; or (3) a calculated numeric water quality criterion, such as a proposed state criterion or policy interpreting the state's narrative criterion, supplemented with other relevant information, as provided in section 122.44(d)(1)(vi).

The process for determining reasonable potential and calculating WQBELs when necessary is intended to protect the beneficial uses of the receiving water as specified in the Basin Plan, and achieve applicable water quality objectives and criteria that are contained in other state plans and policies, or any applicable water quality criteria contained in the CTR and NTR.

2. **Applicable Beneficial Uses and Water Quality Criteria and Objectives**

   a. **Beneficial Uses.** Beneficial use designations for receiving waters for discharges from the Arcata WWTF are discussed in Finding III.C. of this Fact Sheet.

   b. **Basin Plan Water Quality Objectives.** In addition to the specific water quality objectives indicated above, the Basin Plan contains narrative objectives for color, tastes and odors, floating material, suspended material, settleable material, oil and grease, biostimulatory substances, sediment, turbidity, pH, dissolved oxygen, bacteria, temperature, toxicity, pesticides, chemical constituents, and radioactivity that apply to inland surface waters, enclosed bays, and estuaries. For waters designated for use as domestic or municipal supply (MUN), the Basin Plan establishes as applicable water quality criteria the Maximum Contaminant Levels (MCLs) established by the Department of Public Health for the protection of public water supplies at title 22 of the California Code of Regulations section 64431 (Inorganic Chemicals) and section 64444 (Organic Chemicals).

      Water quality criteria contained in the Basin Plan, including title 22 MCLs, are applicable to Humboldt Bay Outfall 001 and Outfall 003. Basin Plan criteria applicable to the beneficial uses created in the AMWS have been applied to Outfall 002.

c. **State Implementation Plan (SIP), CTR and NTR**. Water quality criteria and objectives applicable to receiving water are established by the California Toxics Rule (CTR), established by the UPEPA at section 131.38; and the National Toxics Rule (NTR), established by the USEPA at section 131.36. Criteria for most of the 126 priority pollutants are contained within the CTR and the NTR. Further, water quality criteria for the protection of freshwater aquatic life apply to Outfall 002 and, because Humboldt Bay is an estuarine environment, the more stringent of fresh and marine water quality criteria are applicable to Outfall 001 and Outfall 003.

3. Determining the Need for WQBELs

NPDES regulations at section 122.44 (d) require effluent limitations to control all pollutants which are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any State water quality standard. Further, the Basin Plan at section 3 p. 3-4, requires that "[a]ll waters shall be maintained free of toxic substances in concentrations that are toxic to …aquatic life".

a. Non-Priority Pollutants

i. **<u>Fecal Coliform Bacteria:</u>** Effluent limitations for fecal coliform bacteria for discharges to Humboldt Bay are retained from the previous permit. These limitations, which are described below, reflect water quality objectives for bacteria established by the Basin Plan for protection of shellfish harvesting areas. The Basin Plan criteria are based on recommendations of the National Shellfish Sanitation Program for shellfish growing areas that are affected by point source discharges.

Treated wastewater discharged to Humboldt Bay shall not contain concentrations of fecal coliform bacteria exceeding the following limitations.

(a) The median concentration shall not exceed a Most Probable Number (MPN) of 14 organisms per 100 mL in a calendar month, and

(b) Not more than 10 percent of samples collected in a calendar month shall exceed an MPN of 43 organisms per 100 mL.

ii. **<u>Chlorine:</u>** The Basin Plan establishes a narrative water quality objective for toxicity, stating that "[a]ll waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life." The Regional Water Board considers any chlorinated discharge as having the reasonable potential to cause or contribute to exceedances of this water quality objective for toxicity, and therefore, the Order establishes effluent limitations for chlorine.

USEPA has established the following criteria for chlorine-produced oxidants for protection of fresh water aquatic life. [Quality Criteria for Water 1986 (The Gold Book, 1986, EPA 440/5/-86-001)]

Chronic Criterion	Acute Criterion
0.011 mg/L	0.019 mg/L

The water quality criteria recommended by USEPA are, in effect, non-detectable concentrations by the common amperometric analytical method used for the measurement of chlorine, and therefore, in order to meet the Basin Plan's narrative water quality objective for toxicity, the Regional Water Board is establishing effluent limitations for chlorine that require concentrations of chlorine in the effluent at the point of discharge protective of aquatic life, which will apply at all times when chlorine is used within the system..

b. Priority Pollutants

The SIP establishes procedures to implement water quality criteria from the NTR and CTR and for priority, toxic pollutant objectives established in the Basin Plan. The implementation procedures of the SIP include methods to determine reasonable potential (for pollutants to cause or contribute to excursions above State water quality standards) and to establish numeric effluent limitations, if necessary, for those pollutants showing reasonable potential.

The SIP Section 1.3 requires the Regional Board to use all available, valid, relevant, and representative receiving water and effluent data and information to conduct a reasonable potential analysis (RPA). For this Order, the Regional Water Board has performed RPAs for discharges to Humboldt Bay, the AMWS, and the brackish marsh. The RPA for Humboldt Bay and the brackish marsh applies to estuarine environments, and therefore applies the more stringent of applicable fresh or marine water quality criteria. Effluent data generated during monitoring events on December 30, 2005 and May 3, 2006 at Outfall 001 and on September 9, 2009 and January 27, 2010 at Pt. 9 were used for RPAs.

Some freshwater water quality criteria are hardness-dependent; i.e., as hardness decreases, the toxicity of certain metals increases and the applicable water quality criteria become correspondingly more stringent. Receiving water hardness data were not available for Humboldt Bay or the brackish marsh in the vicinity of the outfalls. These are estuarine environments which are tidally influenced. Depending on the tide and season, theses receiving waters may range from a predominantly fresh water/low hardness environment to a predominantly marine, high hardness environment. Because receiving water hardness data was not available for the RPA for Outfall 001 or Outfall 003, Regional Water Board used a hardness value of 400 mg/L, which is the default high value for use in the RPA, as established in the CTR at section 131.38 (c) (4) (i). This value may not be protective in all circumstances, and as receiving water hardness data is generated, the permit may be reopened to incorporate additional or more restrictive limitations, if necessary.

Because the AMWS is created through Outfall 002 effluent, effluent hardness data was analyzed to determine a hardness value for use in the RPA for that outfall. An effluent hardness value of 66 mg/L $CaCO_3$ was the minimum hardness value reported in 29 acute toxicity tests conducted on the effluent between September 2004 and October 2007.

To conduct the RPAs, Regional Water Board staff identified the maximum observed effluent (MEC) and background (B) concentrations for each priority, toxic pollutant from effluent and receiving water data provided by the Permittee, and compared this information to the most stringent applicable water quality criterion (C) for each pollutant from the NTR, CTR, and the Basin Plan. Section 1.3 of the SIP establishes three triggers for a finding of reasonable potential.

Trigger 1. If the MEC is greater than C, there is reasonable potential, and an effluent limitation is required.

Trigger 2. If B is greater than C, and the pollutant is detected in effluent (MEC > ND), there is reasonable potential, and an effluent limitation is required.

Trigger 3. After a review of other available and relevant information, a permit writer may decide that a WQBEL is required. Such additional information may include, but is not limited to: the facility type, the discharge type, solids loading analyses, lack of dilution, history of compliance problems, potential toxic impact of the discharge, fish tissue residue data, water quality and beneficial uses of the receiving water, CWA 303 (d) listing for the pollutant, and the presence of endangered or threatened species or their critical habitat.

The RPA for discharges to Humboldt Bay (which includes the brackish marsh) demonstrated reasonable potential to cause or contribute to exceedances of applicable water quality criteria for bis(2-ethylhexyl)phthalate, copper, cyanide, TCDD equivalents, carbon tetrachloride, and dichlorobromomethane. The RPA for discharges at Outfall 002 demonstrated reasonable potential for copper. The following tables summarizes the RPA for each priority, toxic pollutant that has been measured in effluent in samples collected on December 30, 2005, May 3, 2006 and /or September 9, 2009 and January 27, 2010. No other pollutants with applicable, numeric water quality criteria from the NTR, CTR, and the Basin Plan (which includes the title 22 MCLs for protection of drinking water supplies in Humboldt Bay) were measured above non-detect (ND) concentrations.

Table F-5. Summary of RPA Results – Humboldt Bay

CTR #	Priority Pollutants	C or Most Stringent WQO/WQC (µg/L)	MEC or Minimum DL (µg/L)[14]	RPA Result	Reason
2	Arsenic	36	0.96	No	MEC<C & B is ND
5a	Chromium (III)	50	1	No	MEC<C & B is ND
6	Copper	3.7	7.5	**Yes**	MEC>C
7	Lead	8.5	0.59	No	MEC<C & B is ND
8	Mercury	0.050	0.0067	No	;MEC<C & B is ND
9	Nickel	8	3.7	No	MEC<C & B is ND
11	Silver	2.2	0.1	No	MEC<C & B is ND
12	Thallium	1.7	0.01	No	MEC<C & B is ND
13	Zinc	86	8	No	MEC<C & B is ND
14	Cyanide	1.0	4.3	**Yes**	MEC>C
16	2,3,7,8 TCDD	1.3E-08	5.77E-07	**Yes**	MEC>C
21	Carbon Tetrachloride	0.25	0.3	**Yes**	MEC>C
23	Chlorodibromomethane	0.40	0.2	No	MEC<C & B is ND
26	Chloroform	No Criteria	8	Uo	No Criteria
27	Dichlorobromomethane	0.56	1.2	**Yes**	MEC>C
34	Methyl Bromide	48	2.9	No	MEC<C & B is ND
36	Methylene Chloride	4.7	0.18	No	MEC<C & B is ND
39	Toluene	150	3.8	No	MEC<C & B is ND
68	Bis(2-Ethylhexyl)Phthalate	1.8	6.6	**Yes**	MEC>C
77	1,4-Dichlorobenzene	5.0	0.06	No	MEC<C & B is ND

[14] The Maximum Effluent Concentration (MEC) or maximum background concentration (B) is the actual detected concentration unless it is preceded by "<", in which case the value shown is the minimum detection level as the analytical result was reported as not detected (ND).

Table F-6. Summary of RPA Results – AMWS

CTR #	Priority Pollutants	C or Most Stringent WQO/WQC (µg/L)	MEC or Minimum DL (µg/L)[7]	RPA Result	Reason
2	Arsenic	50	0.96	No	MEC<C & B is ND
5a	Chromium (III)	50	0.54	No	MEC<C & B is ND
6	Copper	6.5	7.3	**Yes**	MEC>C
7	Lead	1.6	0.57	No	MEC<C & B is ND
8	Mercury	0.05	No Criteria	Uo	No Criteria
9	Nickel	37	4.4	No	MEC<C & B is ND
13	Zinc	84	4.4	No	MEC<C & B is ND
68	Bis(2-Ethylhexyl)Phthalate	1.8	No Criteria	Uo	No Criteria

4. WQBEL Calculations

Final WQBELs have been determined using the methods described in Section 1.4 of the SIP.

Step 1: To calculate the effluent limits, an effluent concentration allowance (ECA) is calculated for each pollutant found to have reasonable potential using the following equation, which takes into account dilution and background concentrations:

ECA = C + D (C – B), where

C = the applicable water quality criterion (adjusted for receiving water hardness and expressed as the total recoverable metal, if necessary)
D = dilution credit (here D= 0, as the discharge does not qualify for a dilution credit)
B = background concentration

Here, no credit for dilution is allowed at either outfall, which results in the ECA being equal to the applicable criterion (ECA = C).

Step 2: For each ECA based on an aquatic life criterion/objective (copper and cyanide), the long term average discharge condition (LTA) is determined by multiplying the ECA by a factor (multiplier), which adjusts the ECA to account for effluent variability. The multiplier depends on the coefficient of variation (CV) of the data set and whether it is an acute or chronic criterion/objective. Table 1 of the SIP provides pre-calculated values for the multipliers based on the values of the CV. When the data set contains less than 10 sample results (as for the Arcata WWTF), or when 80 percent or more of the data set is reported as non-detect (ND), the CV is set equal to 0.6. Derivation of the multipliers is presented in Section 1.4 of the SIP.

From Table 1 of the SIP, the ECA multipliers for calculating LTAs at the 99th percentile occurrence probability are 0.321 (acute multiplier) and 0.527 (chronic multiplier). The LTAs are determined as follows in Table F-11.

Table F-7. Determination of Long Term Averages

Pollutant	ECA		ECA Multiplier		LTA (µg/L)	
	Acute	Chronic	Acute	Chronic	Acute	Chronic
Outfall 001 and Outfall 003						
Copper	5.8	3.7	0.32	0.53	1.86	1.97
Cyanide	1	1	0.32	0.53	0.32	0.53

Step 3: WQBELs, including an average monthly effluent limitation (AMEL) and a maximum daily effluent limitation (MDEL) are calculated using the most limiting (lowest) LTA. The LTA is multiplied by a factor that accounts for averaging periods and exceedance frequencies of the effluent limitations, and for the AMEL, the effluent monitoring frequency. Here, the CV is set equal to 0.6, and the sampling frequency is set equal to 4 (n = 4). The 99th percentile occurrence probability was used to determine the MDEL multiplier and a 95th percentile occurrence probability was used to determine the AMEL multiplier. From Table 2 of the SIP, the MDEL multiplier is 3.11, and the AMEL multiplier is 1.55. Final WQBELs for copper and cyanide are determined as follows.

Table F-8. Determination of Final WQBELs Based on Aquatic Life Criteria

Pollutant	LTA (µg/L)	MDEL Multiplier	AMEL Multiplier	MDEL (µg/L)	AMEL (µg/L)
Outfall 001 and Outfall 003					
Copper	1.86	3.11	1.55	5.8	2.9
Cyanide	0.327	3.11	1.55	1.0	0.5
Outfall 002					
Copper	3.04	3.11	1.55	9.5	4.7

Final effluent limits presented above for copper at Outfall 001 and Outfall 003 are based on a receiving water hardness of 400 mg/L. Final effluent limits presented above for copper at Outfall 002 are based on a receiving water hardness of 66 mg/L.

Step 4: When the most stringent water quality criterion/objective is a human health criterion/objective (as for bis(2-ethylhexyl)phthalate, TCDD equivalents, carbon tetrachloride, and dichlorobromomethane), the AMEL is set equal to the ECA. From Table 2 of the SIP, when CV = 0.6 and n = 4, the MDEL multiplier at the 99th percentile occurrence probability equals 3.11, and the AMEL multiplier at the 95th percentile occurrence probability equals 1.55. The MDEL for protection of human health is calculated by multiplying the ECA by the ratio of the MDEL multiplier to the AMEL multiplier. Final WQBELs for TCDD equivalents, carbon tetrachloride, and dichlorobromomethane at Outfalls 001 and 003 are determined as follows.

Table F-9. Determination Final WQBELs Based on Human Health Criteria

Pollutant	ECA (µg/L)	MDEL/AMEL	MDEL (µg/L)	AMEL (µg/L)
TCDD Equivalents	1.3E-08	2.01	1.3E-08	2.6E-08
Carbon Tetrachloride	0.25	2.01	0.25	0.50
Dichlorobromomethane	0.56	2.01	0.56	1.12
Bis(2-Ethylhexyl)Phthalate	1.8	2.01	3.6	1.8

A summary of WQBELs established by the Order is given in the table below.

Table F-10. Summary of Water Quality-Based Effluent Limitations

Parameter	Units	Effluent Limitations	
		Average Monthly	Maximum Daily
Outfall 001 and Outfall 003			
Copper	µg/L	2.9	5.8
Cyanide	µg/L	0.5	1.0
TCDD Equivalents	µg/L	1.3×10^{-8}	2.6×10^{-8}
Carbon Tetrachloride	µg/L	0.25	0.50
Dichlorobromomethane[15]	µg/L	0.56	1.12
Bis(2-Ethylhexyl)Phthalate	µg/L	1.8	3.6
Chlorine, Total Residual[16]	mg/L	0.01	0.02
Fecal Coliform	MPN/100ml	14[17]	43[18]
Outfall 002			
Copper	µg/L	4.7	9.5

5. Whole Effluent Toxicity (WET)

Effluent limitations for whole effluent, acute and chronic toxicity, protect the receiving water from the aggregate effect of a mixture of pollutants that may be present in effluent. There are two types of WET tests – acute and chronic. An acute toxicity

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15 Dichlorobromomethane is not applied to discharges at Outfall 003 because, dichlorobromomethane is a byproduct of chlorination and when Outfall 003 is in use, disinfection will be accomplished using ultraviolet technology.

16 Chlorine Residual applies to discharges at Outfall 001 when chlorination is used to treat the effluent.

17 Median.

18 Not more than 10% of samples collected in a 30-day period shall exceed the daily maximum.

test is conducted over a short time period and measures mortality. A chronic test is conducted over a longer period of time and may measure mortality, reproduction, and/or growth. The Basin Plan establishes a narrative water quality objective for toxicity, requiring that all waters be maintained free of toxic substances in concentrations that are lethal to, or produce other detrimental responses in aquatic organisms. Detrimental responses may include, but are not limited to, decreased growth rate, decreased reproductive success of resident or indicator species, and/or significant alterations in population, community ecology, or receiving water biota. The previous Order included an effluent limitation for acute toxicity at Outfall 001 in accordance with the Basin Plan, which requires that the average survival of test organisms in undiluted effluent for any three consecutive 96-hour bioassay tests be at least 90 percent, with no single test having less than 70 percent survival. A summary of acute toxicity test results for survival of rainbow trout (*O. mykiss*) in 100 percent effluent at Outfall 001 for the period from September 2004 to October 2007 is provided in the following table.

Table F.11. Summary of Acute Toxicity Test Results

Date	Percent Survival	Date	Percent Survival
9/21/2004	100	8/21/2006	100
11/30/2004	100	10/9/2006	100
3/15/2005	95	3/21/2007	100
6/21/2005	100	4/9/2007	100
9/26/2005	100	9/17/2007	100
6/26/2006	100	10/22/2007	100

In addition to the Basin Plan requirements, section 4 of the SIP states that chronic toxicity limitations are required in permits for all discharges that will cause, have the reasonable potential to cause, or contribute to chronic toxicity in receiving waters. The previous Order included monitoring requirements for chronic toxicity at Outfall 001; effluent limitations were not included.

The Permittee initiated chronic toxicity testing using three species in 2005: topsmelt (*Atherinops affinis*), bay mussel (*Mytilus edulis*), and giant kelp (*Macrocystis pyrifera*). In the third quarter 2005, the effluent sample exhibited some toxicity affecting the giant kelp. The effects on the giant kelp also appeared in the fourth quarter of 2005, and first and second quarters of 2006. In the third quarter 2006, brown algae (*Thalassiosira pseudonana*) was used and showed no toxicity. Bay mussels showed no toxicity in second quarter 2005 and second and third quarters 2006.

The Permittee's chronic toxicity testing results collected during the term of the previous permit are summarized in the table below. A result of 1 or >1 indicates no increased toxicity beyond the control sample.

Table F-12. Chronic Toxicity Testing Summary Results.

Date	Chronic Toxicity Results[19] – Growth and Development (TUc)					
	P. promelas	*S. capricornutum*	*A. affinis*	*M. edulis*	*M. pyrifera*	*T. pseudonana*
9/26/2005	---	---	1	1	> 1	---
11/14/2005	---	---	1	1	> 1	---
3/17/2006	---	---	---	> 1	> 1	---
6/26/2006	---	---	---	1	1	---
7/27/2006	---	---	---	1	---	1
10/9/2006	---	---	---	---	---	1
3/21/2007	1	1	---	---	---	---
4/9/2007	---	> 1	---	---	---	---
6/25/2007	1	1	---	---	---	---

The receiving waters at Outfall 001 and Outfall 003 are estuarine and depending on tide and time of year, may range from a predominantly freshwater environment to a predominantly marine environment. Therefore, the Permittee when collecting samples for toxicity, shall also determine the characteristics of the receiving water at the time of sampling to ensure the proper test species and method are implemented to determine if the toxicity of the effluent from Outfalls 001 and 003 are described in detail in section V of the Monitoring and Reporting Program (Attachment E).

A chronic toxicity effluent limitation has not been included in the Order because the collected data does not indicate that the effluent has reasonable potential to cause, or contribute to chronic toxicity in receiving waters. This Order specifies the use of a numeric trigger for accelerated monitoring and implementation of a Toxicity Reduction Evaluation (TRE) in the event that persistent toxicity is detected. Attachment E of this Order requires annual chronic WET monitoring for demonstration that the discharge does not have the potential to cause, or contribute to chronic toxicity in the receiving water.

Section V.C.1.g of the MRP requires TUc to be calculated as 100/NOEC, where NOEC is the no observed effect concentration, for purposes of compliance with the effluent limitation. Although the federal requirements may provide for flexibility in

[19] In the Toxicity Report for Third and Fourth Quarters 2005, the Permittee indicated the bay mussel (*M.edulis*) was the most sensitive species. In the Toxicity Report for the Fourth Quarter 2006, the Permittee indicated their intent to begin three species screening with freshwater organisms.

determining how to calculate TUc for compliance purposes (e.g., 100/NOEC, 100/IC25, 100/EC25), USEPA Region IX recommends that effluent limitations and triggers be based on the NOEC when the permit language and chronic toxicity testing methods incorporate important safeguards that improve the reliability of the NOEC. These safeguards include the use of a dilution series (testing of a series of effluent concentrations) to verify and quantify a dose-response relationship and a requirement to evaluate specific performance criteria in order to determine the sensitivity of each chronic toxicity test. The goal is to demonstrate that each test is sensitive enough to determine whether or not the effluent is toxic or not.

The use of 100/IC25 or 100/EC25 as methods for calculating chronic toxicity are point estimates that automatically allow for a 25 percent effect before calling an effluent "toxic." The Basin Plan has a narrative objective for toxicity that requires that "all waters be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life." Allowance of a possible 25 percent effect would not meet the Basin Plan's narrative toxicity requirement. In addition, California has historically used the NOEC to regulate chronic toxicity for ocean discharges, thus it is fitting that the same method be used to regulate chronic toxicity in inland surface water discharges.

If sampling of the discharge demonstrates a pattern of toxicity exceeding the trigger, the Permittee is required to initiate a TRE, in accordance with an approved TRE work plan to determine whether the discharge is contributing chronic toxicity to the receiving water. Special Provision VI.C.2.a. requires the Permittee to submit to the Regional Water Board and maintain a TRE Work Plan for approval by the Executive Officer, to ensure the Permittee has a plan to immediately move forward with the initial tiers of a TRE, in the event effluent toxicity is encountered in the future. The provision includes requirements for TRE initiation if a pattern of toxicity is demonstrated.

D. Final Effluent Limitations

1. Satisfaction of Anti-Backsliding Requirements

This Order does not retain from the previous permit, the 85 percent removal, concentration or mass-based requirements for BOD_5 and TSS applied to final effluent limitations at Outfall 001. Neither does this Order retain the BOD_5 or TSS concentration based effluent specifications at Outfall 002. In their place, this Order establishes 65 percent removal and performance based limitations for BOD_5 and TSS requirements for discharges conforming to Prohibition III.I. The previous requirements were consistent with the minimum level of effluent quality attainable by standard secondary treatment, established at section 133.102; whereas the 65 percent removal and alternative BOD_5 and TSS requirements are consistent with the minimum level of effluent quality attainable by facilities meeting criteria for “treatment equivalent to secondary” established at section 133.105.

Facility specific criteria satisfies the anti-backsliding exceptions at both section 122.44 (l)(i)(A) and section 122.44 (l)(i)(B)(1). Section 122.44 (l)(i)(A) allows a permit to contain less stringent effluent limitations when material and substantial alterations or additions to the permitted facility occurred after permit issuance that justify the application of a less stringent effluent limitation. Section 122.44 (l)(i)(B)(1) allows a permit to contain less stringent effluent limitations when information is available that was not available at the time of permit issuance and that information would have justified the application of a less stringent effluent limitation at the time of permit issuance. In establishing equivalent to secondary requirements, the Regional Water Board has reviewed water quality monitoring data collected during the term of the previous permit from Pt. 9. The data shows that under the upgraded configuration required to take effect during the term of this Order, the minimum level of effluent quality attainable prior to polishing within the AMWS is consistent with treatment equivalent to secondary. Standard secondary treatment limitations have been retained as interim limitations at Outfall 001 until the upgrade and applied to Outfall 003 (the primary discharge point) under the upgraded configuration.

The daily maximum effluent limitations for BOD5 and TSS have been omitted from this Order. This relaxation of effluent limitations is consistent with the anti-backsliding requirements of the CWA and federal regulations. This permit change is governed by section 122.44(l)(i)(B)(1). Daily maximum limits are not necessary at this facility because BOD5 and TSS samples collected since 2006 demonstrate that the treated effluent routinely complied with the daily maximum effluent limitations. Daily maximum effluent limitations for BOD5 and TSS are not retained as these limitations are not specifically required under section 122.45(d)(2) and may not provide the most representative measure of compliance given the long retention time of the WWTF. Further, daily maximum limits are not specifically required to meet the minimum level of effluent quality that must be attained by the application of secondary treatment or equivalent to secondary treatment.

Although the Daily maximum limitations for BOD5 and TSS have been removed from this Order, the more stringent weekly and monthly requirements for those parameters have been retained. If future monitoring shows exceedances of these limitations, staff will evaluate the need to reinstate the daily maximum effluent limitation for BOD5 and TSS.
Effluent limitations for zinc and oil and grease have been removed from this Order because data did not demonstrate reasonable potential to cause or contribute to an excursion above the respective water quality criteria for zinc or

oil and grease. The relaxation of effluent limitations is consistent with the anti-backsliding requirements of the CWA and federal regulations, based on the consideration of new information (i.e., discharge monitoring reports and RPA).

This Order does not retain total coliform limitations at Outfall 002 from the previous permit. This relaxation of effluent limitations is consistent with the anti-backsliding requirements of the CWA and federal regulations, based on the consideration of new information provided by the Humboldt County Director of Environmental Health, contained in Attachment G, which indicates that application of disinfection at the exit from the AMWS rather than the entrance will not threaten public health or wellbeing. Fecal coliform limitations applicable to Humboldt Bay for the protection of shellfish and human health have been retained.

2. Satisfaction of Antidegradation Policy

Pursuant to the Antidegradation Policy, the lowering of water quality can be allowed only if beneficial uses are protected, and if there is a maximum benefit to the people of the state. Discharges regulated in accordance with this Order are for a publically owned treatment works (POTW). The increased costs of additional treatment that would otherwise be required to remove additional BOD5 and TSS beyond equivalent to secondary criteria prior to treatment within AMWS are not in the best interest of the public given that beneficial uses will still be protected; therefore the allowance of an incremental increase in degradation is found to be in the best interest to the people of the state.

The activities allowed in accordance with these modifications to the waste discharge requirements apply to existing facilities. Further, this Order permits only those discharges of waste that have received a minimum of equivalent to secondary treatment. Discharges from the WWTF will be required to maintain protection of the beneficial uses of the receiving waters and comply with applicable provisions of the Basin Plan. As described under section II.B.2. of this Fact Sheet, discharges regulated in accordance with this Order for the upgraded WWTF configuration will result in higher quality effluent discharges to Humboldt Bay than under the existing conditions.

3. Stringency of Requirements for Individual Pollutants

This Order contains both technology-based and water quality-based effluent limitations for individual pollutants. The technology-based effluent limitations consist of restrictions on BOD5, TSS, and pH. Restrictions on these pollutants are discussed in section IV.B of this Fact Sheet. This Order’s technology-based pollutant restrictions are not more stringent than the minimum, applicable federal technology-based requirements.

Water quality-based effluent limitations (WQBELs) have been scientifically derived to implement water quality objectives that protect beneficial uses. Both the beneficial uses and the water quality objectives have been approved pursuant to federal law and are the applicable federal water quality standards. To the extent that toxic pollutant water quality-based effluent limitations were derived from the CTR, the CTR is the applicable standard pursuant to section 131.38. The scientific procedures for calculating the individual water quality-based effluent limitations for priority pollutants are based on the CTR-SIP, which was approved by USEPA on May 18, 2000. Most beneficial uses and water quality objectives contained in the Basin Plan were approved under state law and submitted to and approved by USEPA prior to May 30, 2000. Any water quality objectives and beneficial uses submitted to USEPA prior to May 30, 2000, but not approved by USEPA before that date, are nonetheless “applicable water quality standards for purposes of the CWA” pursuant to section 131.21(c)(1). Specifically, this Order includes effluent limitations for fecal coliform, chlorine residual, copper, cyanide, 2,3,7,8-TCDD equivalents, carbon tetrachloride, dichlorobromomethane, and bis(2-ethylhexyl)phalate that are necessary to meet numeric objectives or protect beneficial uses. The rationale for including these limitations is explained in Section IV.C.3.

Collectively, this Order’s restrictions on mass and individual pollutants are no more stringent than required to implement the requirements of the CWA. However, to the extent any are more stringent than the CWA, the Regional Water Board has considered the factors in Water Code section 13263, including the provisions of Water Code section 13241, in establishing these requirements.

As indicated throughout this Fact Sheet, the effluent limitations established by this Order have been developed to protect beneficial uses of water identified in the Basin Plan for Humboldt Bay, tributaries thereto, and the wetland specific beneficial uses of the AMWS, all of which are contained within the Humboldt Bay hydrographic unit. Of the various potential pollutant sources contributing to water quality conditions within Humboldt Bay, the effluent limitations required by this Order provide reasonably achievable control factors for the WWTF contribution(s). Further, the Regional Water Board is not aware of any costs, required of the City to meet effluent limitations in this Order, which are beyond the scope of those 1) necessary to achieve upgrades proposed by the City, and/or 2) similar to costs undertaken by POTWs of similar or lessor size within the region. This Order does not authorize the use of recycled water; nor do these requirements accommodate any expansion for additional housing development, beyond which, the City may have been granted in previous Orders.

E. Interim Effluent Limitations

Interim effluent limitations for Outfall 001 established in Section IV.A.3 of the Order are effective until activation of the upgraded WWTF configuration through November 30, 2016, whichever is sooner.

F. Land Discharge Specifications

This section of the standardized permit is not applicable to the Arcata WWTF.

G. Reclamation Specifications

This section of the standardized permit is not applicable to the Arcata WWTF.

V. RATIONALE FOR RECEIVING WATER LIMITATIONS

A. Surface Water

CWA section 303(a-c) requires states to adopt water quality standards, including criteria where they are necessary to protect beneficial uses. The Regional Water Board adopted water quality criteria as water quality objectives in the Basin Plan. The Basin Plan states that "[t]he numerical and narrative water quality objectives define the least stringent standards that the Regional [Water] Board will apply to regional waters in order to protect the beneficial uses." The Basin Plan includes numeric and narrative water quality objectives for various beneficial uses and water bodies. This Order contains Receiving Surface Water Limitations based on the Basin Plan numerical and narrative water quality objectives for biostimulatory substances, bacteria, chemical constituents, color, dissolved oxygen, floating material, oil and grease, pH, pesticides, radioactivity, sediment, settleable material, suspended material, tastes and odors, temperature, toxicity, and turbidity.

B. Groundwater

1. The beneficial uses of the underlying ground water are municipal and domestic supply, industrial service supply, industrial process supply, agricultural supply, and freshwater replenishment to surface waters.

2. State Water Board Resolution No. 68-16, requires, in part, that whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality water will be maintained until it is demonstrated to the state that any changes will be consistent with maximum benefit to the people of the state, will not unreasonably affect beneficial uses of such water, and will not result in water quality less than prescribed in the policies.

VI. RATIONALE FOR MONITORING AND REPORTING REQUIREMENTS

Section 122.48 requires that all NPDES permits specify requirements for recording and reporting monitoring results. Water Code sections 13267 and 13383 authorize the Regional Water Board to require technical and monitoring reports. The Monitoring and Reporting Program (MRP), Attachment E of this Order, establishes monitoring and reporting requirements to implement federal and state requirements. The following provides the rationale for the monitoring and reporting requirements contained in the MRP for this facility.

A. Influent Monitoring

Influent monitoring requirements for BOD_5 and TSS are retained from the previous permit and are necessary to determine compliance with the technology based limitations for percent removal. Influent monitoring for flow is required to assess WWTF loading.

B. Effluent Monitoring

1. Effluent monitoring requirements for flow, BOD_5, TSS, settleable solids, fecal coliform bacteria, pH, chlorine residual, copper, total hardness, cyanide, 2,3,7,8-TCDD equivalents, carbon tetrachloride, dichlorobromomethane, bis(2-ethylhexyl)phthalate, and acute and chronic toxicity are necessary to detemine compliance with triggers, prohibitions, effluent limitations, and/or discharge specifications established by the Order.

2. Quarterly monitoring requirements for nutrients (ammonia nitrogen, nitrate nitrogen,) in the effluent have been established because nitrogen and phosporous containing compounds are a common component of domestic wastewaters and can have a directly toxic and/or detrimental biostimulatory effect on receiving waters. The Regional Water Board is including such monitoring requirements in the discharge permits of most POTWs in the North Coast Region to evaluate the need for effluent limitations for these pollutants.

3. Annual monitoring requirements for the 126 priority pollutants identified in the California Toxics Rule at section 131.38. CTR pollutants (CTR Pollutants) and the title 22 pollutants for which the Department of Health Services has established Maximum Contaminant Levels (MCLs) at title 22, Division 4, Chapter 15, sections 64431 (Inorganic Chemicals) and 64444 (Organic Chemicals) of the California Code of Regulations is required to evaluate reasonable potential for those pollutants to be present in the discharge at concentrations that may adversely impact beneficial uses of the receiving water.

4. Oil and grease monitoring has been discontinued because all discharge monitoring data reported during the permit term has been non-detect; there is no demonstration of reasonable potential for this parameter.

C. Whole Effluent Toxicity Testing Requirements

Whole effluent toxicity (WET) limitations and monitoring protect the receiving water quality from the aggregate effect of a mixture of pollutants in the effluent. Acute toxicity testing measures mortality in 100 percent effluent over a short test period, and chronic toxicity testing is conducted over a longer time period and may measure mortality, reproduction, and/or growth. This Order includes effluent limitations and monitoring requirements for acute toxicity; as well as monitoring requirements for chronic toxicity to determine compliance with the Basin Plan's narrative water quality objective for toxicity.

D. Receiving Water Monitoring

1. Arcata Marsh Wildlife Sanctuary (AMWS)

   The AMWS is a created wetland, with unique beneficial uses including non-contact water recreation, cold freshwater habitat, wildlife habitat, wetland habitat, and enhanced treatment of wastewater. Monitoring of the AMWS is required to evaluate the health and performance of the AMWS and demonstrate that the discharge of non-disinfected equivalent to secondary treated wastewater at Outfall 002 is protective of the beneficial uses of the AMWS.

2. Brackish Marsh

   Receiving water monitoring requirements for dissolved oxygen pH, turbidity, temperature, conductivity, total dissolved solids, salinity, nitrate, floatables/discoloration, and CTR priority pollutants are retained from the previous permit, as established in the Revised Monitoring and Reporting Program (revised July 17, 2007), but applied to the primary final discharge point in the brackish marsh rather than the larger area of Humboldt Bay. Further, this Order establishes monthly monitoring for hardness in the receiving water.

   Temperature: Monitoring of receiving water temperature is retained to assess the impact, if any, on the temperature of the receiving waters.

   Hardness: Because the toxicity of certain metals is hardness dependent (i.e., as hardness decreases, metals toxicity increases), monitoring of hardness in the receiving water is required on a monthly basis to allow calculation of water quality objectives and effluent limitations that are hardness dependent.

Monitoring of hardness in the receiving water should coincide with compliance monitoring for the hardness dependent metal with effluent limitations (copper) established by this Order.

Nutrients. Monitoring requirements for total ammonia, nitrate is required to characterize the assimilative capacity of the receiving water for these nutrients, to determine the impact of the discharge on the receiving water with respect to these parameters, and to generate background data for these constituents for future reasonable potential analyses.

CTR Pollutants. Water quality criteria for the CTR pollutants are applicable to Humboldt Bay, and therefore characterization of background conditions is necessary to assess impacts of the discharge. In addition, reasonable potential analyses, conducted in accordance with procedures established by the SIP, require characterization of background levels of the toxic pollutants.

Title 22 Pollutants. Water quality criteria for the title 22 pollutants are applicable to Humboldt Bay, and therefore characterization of background conditions is necessary to assess impacts of the discharge.

3. Groundwater.

The Order does not establish groundwater monitoring requirements.

E. Other Monitoring Requirements

Disinfection Process Monitoring for UV Disinfection System**.** This Order establishes operations monitoring for the UV disinfection system. These monitoring requirements are established to document proper operations and maintenance of the disinfection system for the upgraded WWTF configuration. This monitoring is intended to ensure adherence to proper standards for UV light dosage are implemented, adequate disinfection occurs, and maintain required bacterial monitoring at a weekly frequency..

VII. RATIONALE FOR PROVISIONS

A. Standard Provisions

Standard Provisions, which apply to all NPDES permits in accordance with section 122.41, and additional conditions applicable to specified categories of permits in accordance with section 122.42, are provided in Attachment D. The Permittee must comply with all applicable standard provisions and with those additional conditions that are applicable under section 122.42.

Section 122.41(a)(1) and (b) through (n) establish conditions that apply to all State-issued NPDES permits. These conditions must be incorporated into the permits either expressly or by reference. If incorporated by reference, a specific citation to the regulations must be included in the Order. Section 123.25(a)(12) allows the state to omit or modify conditions to impose more stringent requirements. In accordance with section 123.25, this Order omits federal conditions that address enforcement authority specified in sections 122.41(j)(5) and (k)(2) because the enforcement authority under the Water Code is more stringent. In lieu of these conditions, this Order incorporates by reference Water Code section 13387(e).

B. Regional Water Board Standard Provisions

In addition to the Federal Standard Provisions (Attachment D), the Permittee shall comply with the Regional Water Board Standard Provisions provided in Standard Provisions VI.A.2.

1. Order Provision VI.A.2.a identifies the State's enforcement authority under the Water Code, which is more stringent than the enforcement authority specified in the federal regulations [e.g. sections 122.41(j)(5) and (k)(2)].

2. Order Provision VI.A.2.b requires the Permittee to notify Regional Water Board staff, orally and in writing, in the event that the Permittee does not comply or will be unable to comply with any Order requirement. This provision requires the Permittee to make direct contact with a Regional Water Board staff person.

C. Special Provisions

1. Reopener Provisions

a. **Standard Revisions (Special Provisions VI.C.1.a).** Conditions that necessitate a major modification of a permit are described in section 122.62, which include the following:

   i. When standards or regulations on which the permit was based have been changed by promulgation of amended standards or regulations or by judicial decision. Therefore, if revisions of applicable water quality standards are promulgated or approved pursuant to Section 303 of the CWA or amendments thereto, the Regional Water Board will revise and modify this Order in accordance with such revised standards.

   ii. When new information that was not available at the time of permit issuance would have justified different permit conditions at the time of issuance.

b. **Reasonable Potential (Special Provisions VI.C.1.b).** This provision allows the Regional Water Board to modify, or revoke and reissue, this Order if present or future investigations demonstrate that the Permittee governed by this Permit is causing or contributing to excursions above any applicable priority pollutant criterion or objective, or adversely impacting water quality and/or the beneficial uses of receiving waters.

c. **Whole Effluent Toxicity (Special Provisions VI.C.1.c).** This Order requires the Permittee to investigate the causes of, and identify corrective actions to reduce or eliminate effluent toxicity through a TRE. This Order may be reopened to include a numeric chronic toxicity limitation, a new acute toxicity limitation, and/or a limitation for a specific toxicant identified in the TRE. Additionally, if a numeric chronic toxicity water quality objective or implementation policy is adopted by the State Water Board, this Order may be reopened to include those procedures and/ or a numeric chronic toxicity limitation based on the new objective(s).

d. **303(d)-Listed Pollutants (Special Provisions VI.C.1.d).** This provision allows the Regional Water Board to reopen this Order to modify existing effluent limitations or add effluent limitations for pollutants that are the subject of any future TMDL action.

e. **Water Effects Ratios (WERs) and Metal Translators (Special Provisions VI.C.1.e).** This provision allows the Regional Water Board to reopen this Order if future studies undertaken by the Permittee provide new information and justification for applying a water effects ratio or metal translator to a water quality objective for one or more priority pollutants.

2. **Special Studies and Additional Monitoring Requirements**

a. **Toxicity Reduction Evaluations (Special Provisions VI.C.2.a-c).**

The SIP requires the use of short-term chronic toxicity tests to determine compliance with the narrative toxicity objectives for aquatic life in the Basin Plan. Attachment E of this Order requires chronic toxicity monitoring for demonstration of compliance with the narrative toxicity objective.

In addition to WET monitoring, this provision requires the Permittee to submit to the Regional Water Board, if one has not already been submitted, a TRE Work Plan for approval by the Executive Officer, to ensure the Permittee has a plan to immediately move forward with the initial tiers of a TRE, in the event effluent toxicity is encountered in the future. The TRE is initiated by evidence of a pattern of toxicity demonstrated through the additional effluent monitoring provided as a result of an accelerated monitoring program.

b. Arcata Marsh Wetland Sanctuary (AMWS) Evaluation (Special Provision VI.C.2.d).

A special study is necessary to develop an appropriate monitoring and reporting plan for the AMWS. No approved plan is currently in place to provide adequate evaluation of the health and performance of the AMWS. Once in place, the approved plan will provided the basis for protection of beneficial uses in the AMWS.

3. Best Management Practices and Pollution Prevention

Provision VI.C.3.a is included in this Order as required by section 2.4.5 of the SIP. The Regional Water Board includes standard provisions in all NPDES permits requiring development of a Pollutant Minimization Program when there is evidence that a toxic pollutant is present in the effluent at a concentration greater than an applicable effluent limitation.

4. Construction, Operation, and Maintenance Specifications

Section 122.41(e) requires proper operation and maintenance of permitted wastewater systems and related facilities to achieve compliance with permit conditions. An up-to-date operation and maintenance (O&M) manual, as required by Provision VI.C.4.b of the Order, is an integral part of a well-operated and maintained facility.

5. Special Provisions for Municipal Facilities (POTWs Only)

a. Wastewater Collection Systems

i. **Statewide General WDRs for Sanitary Sewer Systems.** The State Water Board issued General Waste Discharge Requirements for Sanitary Sewer Systems, Water Quality Order No. 2006-0003-DWQ (General Order) on May 2, 2006. The General Order requires public agencies that own or operate sanitary sewer systems with greater than 1 mile of pipes or sewer lines to enroll for coverage under the General Order. The General Order requires agencies to develop sanitary sewer management plans (SSMPs) and report all SSOs, among other requirements and prohibitions.

Furthermore, the General Order contains requirements for operation and maintenance of collection systems and for reporting and mitigating sanitary sewer overflows. Inasmuch that the Permittee's collection system is part of the system that is subject to this Order, certain standard provisions are applicable as specified in Provisions VI.A.2.b and VI.C.5 of the Order. The Permittee must separately comply with both this Order, and with the General Order, which is not incorporated by reference into this Order. The Permittee and public agencies that are discharging wastewater into the facility were required to obtain enrollment for regulation under the General Order by December 1, 2006. The Permittee has enrolled under the General Order as required.

All NPDES permits for POTWs currently include federally required standard conditions to mitigate discharges (section 122.41(d)), to report non-compliance (section 122.41(1)(6) and (7)), and to properly operate and maintain facilities (section 122.41(e)). This provision is consistent with these federal requirements.

ii. **Sanitary Sewer Overflows.** This Order includes provisions (Provision VI.C.5.(a)(2), and Attachment D subsection I.C., I.D, V.E, and V.H.) to ensure adequate and timely notifications are made to the Regional Water Board and appropriate local, state, and federal authorities in case of sewage spills. In addition, as an Enrollee under General Order No. 2006-0003-DWQ, the Permittee is separately required to report SSOs to an online SSO database administered through the California Integrated Water Quality System (CIWQS) and via telefax when the online SSO database is not available. Detailed notification and reporting requirements for SSOs and sewage spills are specified in Attachment E subsection E (Monitoring and Reporting Program). The goal of these provisions is to ensure appropriate and timely response by the Permittee to SSOs to protect public health and water quality.

b. Pretreatment of Industrial Waste (Provision VI.C.5.b).

This provision is based on 40 CFR Part 403, (General Pretreatment Regulations for Existing and New Sources of Pollution.)

c. Sludge Disposal and Handling Requirements (Provision VI.C.5.c).

The disposal or reuse of wastewater treatment screenings, sludges, or other solids removed from the liquid waste stream is regulated by 40 CFR Parts 257, 258, 501, and 503, and the State Water Board promulgated provisions of title 27, California Code of Regulations. The Permittee has indicated that that all screenings, sludges, and solids removed from the liquid waste stream are currently disposed of off-site at a municipal solid waste landfill in accordance with all applicable regulations. See Fact Sheet section II.A for more detail.

d. Operator Certification (Provision VI.C.5.d).

This provision requires the WWTF to be operated by supervisors and operators who are certified as required by title 23, California Code of Regulations, section 3680 and is retained from the previous permit.

e. Adequate Capacity (Provision VI.C.5.e).

The goal of this provision is to ensure appropriate and timely planning by the Permittee to ensure adequate capacity for the protection of public health and water quality.   This provision is retained from the previous permit.

f. Statewide General WDRs for Discharge of Biosolids to Land (Provision VI.C.5.f).

This provision requires the Permittee to separately comply with the State's regulations relating to the discharge of biosolids to the land. The discharge of biosolids through land application is not regulated under this Order. Instead, the Permittee is required to obtain separate coverage under the State Water Board Order No. 2004-0012-DWQ, General Waste Discharge Requirements for the Discharge of Biosolids to Land as a Soil Amendment in Agricultural, Silvicultural, Horticultural, and Land Reclamation Activities (General Order). Coverage under the General Order, as opposed to coverage under this NPDES permit or individual WDRs, implements a consistent statewide approach to regulating this waste discharge.

6. Other Special Provisions

a. **Storm Water.** For the control of storm water discharged from the site of the wastewater treatment plant, the Discharge must separately seek coverage under the State Water Board's Water Quality Order 97-03-DWQ, if applicable.

b. **Engineering and Antidegration Analysis for Proposed Increased Wet Weather Treatment Capacity**. If the Permittee seeks to increase the permitted flow, the Permittee shall submit an analysis to document that that figure is an accurate representation of the capacity of wastewater collection and treatment components and to ensure that such an increase is consistent, or not, with applicable State and federal antidegradation regulations, guidance, and policy.

7. Compliance Schedules

This section is not applicable to the Arcata WWTF.

VIII. PUBLIC PARTICIPATION

The California Regional Water Quality Control Board, North Coast Region (Regional Water Board) is considering the issuance of waste discharge requirements (WDRs) that will serve as a National Pollutant Discharge Elimination System (NPDES) permit for the City of Arcata Wastewater Treatment Facility. As a step in the WDR adoption process, the Regional Water Board staff has developed tentative WDRs. The Regional Water Board encourages public participation in the WDR adoption process.

A. Notification of Interested Parties

The Regional Water Board has notified the Permittee and interested agencies and persons of its intent to prescribe waste discharge requirements for the discharge and has provided them with an opportunity to submit their written comments and recommendations. Notification was provided through the following posting on the Regional Water Board's Internet site at: http://www.waterboards.ca.gov/northcoast/public_notices/public_hearings/npdes_permits_and_wdrs.shtml on March 12, 2012.

B. Written Comments

The staff determinations are tentative until the final Order is adopted by the Regional Water Board. Interested persons are invited to submit written comments concerning these tentative WDRs. Comments must be submitted either in person or by mail to the Executive Office at the Regional Water Board at the address above on the cover page of this Order.

To be fully responded to by staff and considered by the Regional Water Board, written comments must have been received at the Regional Water Board offices by 5:00 p.m. on **April 12, 2012**

C. Public Hearing

The Regional Water Board will hold a public hearing on the tentative WDRs during its regular Board meeting on the following date and time and at the following location:

Date: June 7, 2012
Time: 9:00 AM
Location: Willow Creek Community Services District
Kimtu Cookhouse/Lodge
135 Willow Road
Willow Creek, California

Interested persons are invited to attend. At the public hearing, the Regional Water Board will hear testimony, if any, pertinent to the discharge, WDRs, and permit. Oral testimony will be heard; however, for accuracy of the record, important testimony should be in writing. When adopting this Order, the Regional Water Board, in the above referenced public meeting, heard and considered all comments pertaining to the discharge.

Please be aware that dates and venues may change. Our Web address is http://www.waterboards.ca.gov/northcoast where you can access the current agenda for changes in dates and locations.

D. Waste Discharge Requirements Petitions

Any aggrieved person may petition the State Water Resources Control Board to review the decision of the Regional Water Board regarding the final WDRs. The petition must be submitted within 30 days of the Regional Water Board's action to the following address:

State Water Resources Control Board
Office of Chief Counsel
P.O. Box 100, 1001 I Street
Sacramento, CA 95812-0100

E. Information and Copying

The Report of Waste Discharge (ROWD), related documents, tentative effluent limitations and special provisions, comments received, and other information are on file and may be inspected at the address above at any time between 8:30 a.m. and 4:45 p.m., Monday through Friday. Copying of documents may be arranged through the Regional Water Board by calling 707-576-2220.

F. Register of Interested Persons

Any person interested in being placed on the mailing list for information regarding the WDRs and NPDES permit should contact the Regional Water Board, reference this facility, and provide a name, address, and phone number.

G. Additional Information

Requests for additional information or questions regarding this order should be directed to Lisa Bernard at 707-576-2677 or lbernard@waterboards.ca.gov.

APPENDIX B – NPDES DISCHARGE VIOLATIONS 2012-2015

Violation ID	Occurred Date	Violation Type	(-) Violation Description	Corrective Action
1002471	12/19/2015	DMON	A single sample was collected for compliance with weekly monitoring requirements.	laboratory error the sample was analyzed for E. coli using the Quanti-Tray method. The result of the Quanti-Tray test was Total Coliform < 1.0 MPN/100 mL and E. coli < 1.0 MPN/100 ml. It can be reasoned that since fecal coliform is a total coliform that the result for fecal coliform is the same as the result for total coliform (1.0 MPN/100 mL). However, since the Quanti-Tray method is not approved for use in fecal coliform testing this result is not reported in the December 2015 SMR. The contract laboratory was contacted and the testing error was reviewed.
999429	10/31/2015	CAT1	Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) Monthly Average limit is 45 mg/L and reported value was 54 mg/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	A seasonal increase in BOD typically occurs in the fall due to a variety of factors in the natural treatment system. Under normal combined-basin operational mode effluent to Outfall-002 is treated with chlorine for disinfection and sulfur dioxide for dechlorination. Chlorination provides a small amount of BOD removal upstream of Outfall-002 and is advantageous in keeping the effluent from exceeding the discharge specifications for BOD. The City determined that it was beneficial to continue operating the treatment plant in single-pass mode through October in order to collect data to help us plan for future treatment plant upgrades where single pass mode will be the normal operation. During this time, the City was actively making operational decisions to achieve compliance with the discharge specifications for BOD at Outfall-002. Operational changes made to the treatment system, including chlorination of treatment marsh effluent upstream of Outfall-002, were somewhat successful at lowering BOD values at Outfall-002; however, discharge specifications were still exceeded. The City returned to combined-basin operation on October 30, 2015 in order to achieve improved water quality at Outfall-002 and to prepare for winter weather conditions.
999431	10/31/2015	CAT1	Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) Weekly Average limit is 65 mg/L and reported value was 66 mg/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	A seasonal increase in BOD typically occurs in the fall due to a variety of factors in the natural treatment system. Under normal combined-basin operational mode effluent to Outfall-002 is treated with chlorine for disinfection and sulfur dioxide for dechlorination. Chlorination provides a small amount of BOD removal upstream of Outfall-002 and is advantageous in keeping the effluent from exceeding the discharge specifications for BOD. The City determined that it was beneficial to continue operating the treatment plant in single-pass mode through October in order to collect data to help us plan for future treatment plant upgrades where single pass mode will be the normal operation. During this time, the City was actively making operational decisions to achieve compliance with the discharge specifications for BOD at Outfall-002. Operational changes made to the treatment system, including chlorination of treatment marsh effluent upstream of Outfall-002, were somewhat successful at lowering BOD values at Outfall-002; however, discharge specifications were still exceeded. The City returned to combined-basin operation on October 30, 2015 in order to achieve improved water quality at Outfall-002 and to prepare for winter weather conditions.
999430	10/31/2015	CAT2	Chlorine, Total Residual Monthly Average limit is 0.01 % and reported value was 0.05 % at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	chlorine was applied to treatment marsh effluent to treat approximately one-half of the historic chlorine demand. A continuous chlorine analyzer was configured to monitor total residual chlorine (TRC) in the first half of the contact basin prior to discharge at Outfall-002. A high chlorine alarm level was set at 0.5 mg/l Cl2 based on the assumption that TRC remaining at the monitoring point would have enough contact time to react out before discharge at Outfall-002. Daily grab samples were collected at Outfall-002 to confirm that chlorine was not present in Effluent-002 for compliance with TRC monitoring requirements. On 10/29/2015 the on-call operator responded to a high chlorine alarm. At 01:55 a.m. the chlorine analyzer was detecting a 0.7 mg/L Cl2 half way through the first pass of the contact basin and the TRC at Outfall-002 was 0.00 mg/L indicating that the chlorination rate was still well below chlorine demand. The chlorine feed rate was reduced by 10 lbs/day and the chlorine analyzer was set to high alarm at 0.8 mg/L. On 10/30/2015 at 11:32 a.m. a routine grab sample was collected and analyzed for TRC at Outfall-002 with a result of 0.32 mg/L Cl2. The chlorine feed rate was reduced. A grab sample was collected at Outfall-002 and analyzed at for TRC 11:55 a.m. to confirm the results of the previous sample analysis; TRC was measured at 0.31 mg/L Cl2. After confirming the results of the titration discharge at Outfall-002 was
1002472	10/31/2015	CAT2	Dichlorobromomethane Monthly Average limit is 0.56 ug/L and reported value was 3.2 ug/L at EFF-001.	the effluent limit throughout the compliance period. Dichlorobromomethane is a common disinfection byproduct and may be a result of chlorinating wastewater for disinfection. The City is in the planning stages of treatment plant upgrades which will replace chlorination with UV as the primary disinfectant. The City is required to begin using UV as the primary disinfectant no later than December 1, 2016.
999428	10/30/2015	CAT2	Chlorine, Total Residual Maximum Daily (MDEL) limit is 0.02 mg/L and reported value was 0.32 mg/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	chlorine was applied to treatment marsh effluent to treat approximately one-half of the historic chlorine demand. A continuous chlorine analyzer was configured to monitor total residual chlorine (TRC) in the first half of the contact basin prior to discharge at Outfall-002. A high chlorine alarm level was set at 0.5 mg/l Cl2 based on the assumption that TRC remaining at the monitoring point would have enough contact time to react out before discharge at Outfall-002. Daily grab samples were collected at Outfall-002 to confirm that chlorine was not present in Effluent-002 for compliance with TRC monitoring requirements. On 10/29/2015 the on-call operator responded to a high chlorine alarm. At 01:55 a.m. the chlorine analyzer was detecting a 0.7 mg/L Cl2 half way through the first pass of the contact basin and the TRC at Outfall-002 was 0.00 mg/L indicating that the chlorination rate was still well below chlorine demand. The chlorine feed rate was reduced by 10 lbs/day and the chlorine analyzer was set to high alarm at 0.8 mg/L. On 10/30/2015 at 11:32 a.m. a routine grab sample was collected and analyzed for TRC at Outfall-002 with a result of 0.32 mg/L Cl2. The chlorine feed rate was reduced. A grab sample was collected at Outfall-002 and analyzed at for TRC 11:55 a.m. to confirm the results of the previous sample analysis; TRC was measured at 0.31 mg/L Cl2. After confirming the results of the titration discharge at Outfall-002 was
1002473	10/28/2015	CAT2	Dichlorobromomethane Daily Maximum limit is 1.12 ug/L and reported value was 3.2 ug/L.	the effluent limit throughout the compliance period. Dichlorobromomethane is a common disinfection byproduct and may be a result of chlorinating wastewater for disinfection. The City is in the planning stages of treatment plant upgrades which will replace chlorination with UV as the primary disinfectant. The City is required to begin using UV as the primary disinfectant no later than December 1, 2016.
998559	8/31/2015	CAT2	Dichlorobromomethane Monthly Average limit is 0.56 ug/L and reported value was 5.5 ug/L at EFF-001.	Historical performance indicates that dichlorobromomethane occurs occasionally but not consistently, indicating that it is unlikely that dichlorobromomethane levels remained above the effluent limit throughout the compliance period. Dichlorobromomethane is a common disinfection byproduct and may be a result of chlorinating wastewater for disinfection. The City is in the planning stages of treatment plant upgrades which will replace chlorination with UV as the primary disinfectant.
998558	8/20/2015	CAT2	Dichlorobromomethane Daily Maximum limit is 1.12 ug/L and reported value was 5.5 ug/L at EFF-001.	Historical performance indicates that dichlorobromomethane occurs occasionally but not consistently, indicating that it is unlikely that dichlorobromomethane levels remained above the effluent limit throughout the compliance period. Dichlorobromomethane is a common disinfection byproduct and may be a result of chlorinating wastewater for disinfection. The City is in the planning stages of treatment plant upgrades which will replace chlorination with UV as the primary disinfectant.
995335	7/31/2015	CAT1	Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) Monthly Average limit is 45 mg/L and reported value was 55 mg/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	for disinfection and sulfur dioxide for dechlorination. This treatment provides a small amount of BOD removal upstream of Outfall-002 and is advantageous in keeping the effluent from exceeding the discharge specifications for BOD at Outfall-002. After switching from combined-basin into split-basin mode on 5/7/2015 Effluent-002 BOD spiked. The spike in BOD can likely be attributed to natural processes and the effluent not being chlorinated and dechlorinated. The City has determined that it is beneficial to continue operating the treatment plant in single-pass mode in order to collect data which will help us plan for future treatment plant upgrades where single pass mode will be the normal operation. During this time, the City is actively making operational decisions to achieve compliance with the discharge specifications for BOD at Outfall-002. Improvements to water quality typically take 2-3 weeks to manifest after an operational change is made to the natural treatment system. We continue to carefully monitor the water quality of Effluent-002 and make operational decisions that protect water quality.
995334	7/29/2015	DMON	The BOD sample collected at Outfall-002 on 7/29/2015 was analyzed past the official hold time due to insufficient oxygen depletion during the initial analysis.	The BOD sample collected at Outfall-002 on 7/29/2015 was analyzed past the official hold time due to insufficient oxygen depletion during the initial analysis. The sample was split and also analyzed in-house for process control purposes. The result of the in-house analysis was 45 mg/L as compared to the result of 41 mg/L obtained by the contract laboratory when the same sample was analyzed past the hold time. The result obtained by the contract laboratory for the sample run past the hold time was accepted as a reportable value.

995333	7/18/2015	CAT1	Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) Weekly Average limit is 65 mg/L and reported value was 68 mg/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	The City has determined that it is beneficial to continue operating the treatment plant in single-pass mode in order to collect data which will help us plan for future treatment plant upgrades where single pass mode will be the normal operation. During this time, the City is actively making operational decisions to achieve compliance with the discharge specifications for BOD at Outfall-002. Improvements to water quality typically take 2-3 weeks to manifest after an operational change is made to the natural treatment system. We continue to carefully monitor the water quality of Effluent-002 and make operational decisions that protect water quality.
994041	7/14/2015	Deficient Reporting	Several BOD and TSS percent removal calculations submitted to the Regional Water Quality Control Board between August 2013 and May 2015 are incorrect. NPDES permit CA0022713 calls for BOD and TSS percent removal to be calculated based on concentration. A recent audit conducted by the State Water Resources Control Board highlighted the fact that some of the BOD and TSS percent removal calculations submitted were based on mass-loading. A letter notifying the Regional Water Quality Control Board of the reporting errors was emailed to Justin Smith, RWQCB on 7/16/2015. A copy of the aforementioned letter is included in this SMR as an attachment.	BOD and TSS percent removal reporting errors occurred due to the improper use of an out-dated reporting template used by the City to calculate compliance statistics. While it is normal to check all reports for transcription errors prior to reporting, the quality control check rarely includes review of the formulas which auto-populate data for reporting purposes. The City implemented a plan to ensure that the correct reporting template is used by operational staff. The plan included staff training, deleting out-dated templates and files from computers, and a review of the formulas programmed into templates. Corrected percent removal data is reported in the attached letter Correction to Percent Removal Data Submitted Letter. It is important to note that the error did not result in any noncompliance being unreported. We are pleased to report that the corrected data shows that the City was in compliance with BOD percent removal requirements in December 2014 and with TSS percent removal requirements in February 2015, which had both previously been reported as noncompliance.
994042	6/30/2015	CAT1	Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) Monthly Average limit is 45 mg/L and reported value was 80 mg/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	BOD fluctuates in the natural treatment system due to a variety of environmental factors. High levels of nitrogenous BOD in the effluent of some treatment units is typical during late spring/early summer due to the presence of ammonia (from decomposing solids) and nitrifying bacteria in the treatment unit. Under normal combined-basin operational mode effluent to Outfall-002 is treated with chlorine for disinfection and sulfur dioxide for dechlorination. This treatment provides a small amount of BOD removal upstream of Outfall-002 and is advantageous in keeping the effluent from exceeding the discharge specifications for BOD at Outfall-002. After switching from combined-basin into split-basin mode on 5/7/2015 Effluent-002 BOD spiked. The spike in BOD can likely be attributed to natural processes and the effluent not being chlorinated and dechlorinated. The City has determined that it is beneficial to continue operating the treatment plant in single-pass mode in order to collect data which will help us plan for future treatment plant upgrades where single pass mode will be the normal operation. During this time, the City is actively making operational decisions to achieve compliance with the discharge specifications for BOD at Outfall-002. Improvements to water quality typically take 2-3 weeks to manifest after an operational change is made to the natural treatment system. We continue to carefully monitor the water quality of Effluent-002 and make operational decisions that protect water quality.
994040	6/27/2015	CAT1	Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) Weekly Average limit is 65 mg/L and reported value was 78 mg/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	BOD fluctuates in the natural treatment system due to a variety of environmental factors. High levels of nitrogenous BOD in the effluent of some treatment units is typical during late spring/early summer due to the presence of ammonia (from decomposing solids) and nitrifying bacteria in the treatment unit. Under normal combined-basin operational mode effluent to Outfall-002 is treated with chlorine for disinfection and sulfur dioxide for dechlorination. This treatment provides a small amount of BOD removal upstream of Outfall-002 and is advantageous in keeping the effluent from exceeding the discharge specifications for BOD at Outfall-002. After switching from combined-basin into split-basin mode on 5/7/2015 Effluent-002 BOD spiked. The spike in BOD can likely be attributed to natural processes and the effluent not being chlorinated and dechlorinated. The City has determined that it is beneficial to continue operating the treatment plant in single-pass mode in order to collect data which will help us plan for future treatment plant upgrades where single pass mode will be the normal operation. During this time, the City is actively making operational decisions to achieve compliance with the discharge specifications for BOD at Outfall-002. Improvements to water quality typically take 2-3 weeks to manifest after an operational change is made to the natural treatment system. We continue to carefully monitor the water quality of Effluent-002 and make operational decisions that protect water quality.
994039	6/20/2015	CAT1	Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) Weekly Average limit is 65 mg/L and reported value was 73 mg/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	BOD fluctuates in the natural treatment system due to a variety of environmental factors. High levels of nitrogenous BOD in the effluent of some treatment units is typical during late spring/early summer due to the presence of ammonia (from decomposing solids) and nitrifying bacteria in the treatment unit. Under normal combined-basin operational mode effluent to Outfall-002 is treated with chlorine for disinfection and sulfur dioxide for dechlorination. This treatment provides a small amount of BOD removal upstream of Outfall-002 and is advantageous in keeping the effluent from exceeding the discharge specifications for BOD at Outfall-002. After switching from combined-basin into split-basin mode on 5/7/2015 Effluent-002 BOD spiked. The spike in BOD can likely be attributed to natural processes and the effluent not being chlorinated and dechlorinated. The City has determined that it is beneficial to continue operating the treatment plant in single-pass mode in order to collect data which will help us plan for future treatment plant upgrades where single pass mode will be the normal operation. During this time, the City is actively making operational decisions to achieve compliance with the discharge specifications for BOD at Outfall-002. Improvements to water quality typically take 2-3 weeks to manifest after an operational change is made to the natural treatment system. We continue to carefully monitor the water quality of Effluent-002 and make operational decisions that protect water quality.
994043	6/13/2015	CAT1	Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) Weekly Average limit is 65 mg/L and reported value was 70 mg/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	BOD fluctuates in the natural treatment system due to a variety of environmental factors. High levels of nitrogenous BOD in the effluent of some treatment units is typical during late spring/early summer due to the presence of ammonia (from decomposing solids) and nitrifying bacteria in the treatment unit. Under normal combined-basin operational mode effluent to Outfall-002 is treated with chlorine for disinfection and sulfur dioxide for dechlorination. This treatment provides a small amount of BOD removal upstream of Outfall-002 and is advantageous in keeping the effluent from exceeding the discharge specifications for BOD at Outfall-002. After switching from combined-basin into split-basin mode on 5/7/2015 Effluent-002 BOD spiked. The spike in BOD can likely be attributed to natural processes and the effluent not being chlorinated and dechlorinated. The City has determined that it is beneficial to continue operating the treatment plant in single-pass mode in order to collect data which will help us plan for future treatment plant upgrades where single pass mode will be the normal operation. During this time, the City is actively making operational decisions to achieve compliance with the discharge specifications for BOD at Outfall-002. Improvements to water quality typically take 2-3 weeks to manifest after an operational change is made to the natural treatment system. We continue to carefully monitor the water quality of Effluent-002 and make operational decisions that protect water quality.

994038	6/6/2015	CAT1	Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) Weekly Average limit is 65 mg/L and reported value was 99 mg/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	BOD fluctuates in the natural treatment system due to a variety of environmental factors. High levels of nitrogenous BOD in the effluent of some treatment units is typical during late spring/early summer due to the presence of ammonia (from decomposing solids) and nitrifying bacteria in the treatment unit. Under normal combined-basin operational mode effluent to Outfall-002 is treated with chlorine for disinfection and sulfur dioxide for dechlorination. This treatment provides a small amount of BOD removal upstream of Outfall-002 and is advantageous in keeping the effluent from exceeding the discharge specifications for BOD at Outfall-002. After switching from combined-basin into split-basin mode on 5/7/2015 Effluent-002 BOD spiked. The spike in BOD can likely be attributed to natural processes and the effluent not being chlorinated and dechlorinated. The City has determined that it is beneficial to continue operating the treatment plant in single-pass mode in order to collect data which will help us plan for future treatment plant upgrades where single pass mode will be the normal operation. During this time, the City is actively making operational decisions to achieve compliance with the discharge specifications for BOD at Outfall-002. Improvements to water quality typically take 2-3 weeks to manifest after an operational change is made to the natural treatment system. We continue to carefully monitor the water quality of Effluent-002 and make operational decisions that protect water quality.
992445	5/31/2015	CAT1	Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) Monthly Average limit is 45 mg/L and reported value was 88 mg/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	BOD fluctuates in the natural treatment system due to a variety of environmental factors. High levels of nitrogenous BOD in the effluent of some treatment units is typical during late spring/early summer due to the presence of ammonia (from decomposing solids) and nitrifying bacteria in the treatment unit. Under normal combined-basin operational mode effluent to Outfall-002 is treated with chlorine for disinfection and sulfur dioxide for dechlorination. This treatment provides a small amount of BOD removal upstream of Outfall-002 and is advantageous in keeping the effluent from exceeding the discharge specifications for BOD at Outfall-002. After switching from combined-basin into split-basin mode on 5/7/2015 Effluent-002 BOD spiked. The spike in BOD can likely be attributed to the effluent not being chlorinated and dechlorinated. The City has determined that it is beneficial to continue operating the treatment plant in single-pass mode in order to collect data which will help us plan for future treatment plant upgrades where single pass mode will be the normal operation. During this time, the City is actively making operational decisions to achieve compliance with the discharge specifications for BOD at Outfall-002. Improvements to water quality typically take 2-3 weeks to manifest after an operational change is made to the natural treatment system. We continue to carefully monitor the water quality of Effluent-002 and make operational decisions that protect water quality.
992446	5/30/2015	CAT1	Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) Weekly Average limit is 65 mg/L and reported value was 120 mg/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	BOD fluctuates in the natural treatment system due to a variety of environmental factors. High levels of nitrogenous BOD in the effluent of some treatment units is typical during late spring/early summer due to the presence of ammonia (from decomposing solids) and nitrifying bacteria in the treatment unit. Under normal combined-basin operational mode effluent to Outfall-002 is treated with chlorine for disinfection and sulfur dioxide for dechlorination. This treatment provides a small amount of BOD removal upstream of Outfall-002 and is advantageous in keeping the effluent from exceeding the discharge specifications for BOD at Outfall-002. After switching from combined-basin into split-basin mode on 5/7/2015 Effluent-002 BOD spiked. The spike in BOD can likely be attributed to the effluent not being chlorinated and dechlorinated. The City has determined that it is beneficial to continue operating the treatment plant in single-pass mode in order to collect data which will help us plan for future treatment plant upgrades where single pass mode will be the normal operation. During this time, the City is actively making operational decisions to achieve compliance with the discharge specifications for BOD at Outfall-002. Improvements to water quality typically take 2-3 weeks to manifest after an operational change is made to the natural treatment system. We continue to carefully monitor the water quality of Effluent-002 and make operational decisions that protect water quality.
992448	5/23/2015	CAT1	Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) Weekly Average limit is 65 mg/L and reported value was 140 mg/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	BOD fluctuates in the natural treatment system due to a variety of environmental factors. High levels of nitrogenous BOD in the effluent of some treatment units is typical during late spring/early summer due to the presence of ammonia (from decomposing solids) and nitrifying bacteria in the treatment unit. Under normal combined-basin operational mode effluent to Outfall-002 is treated with chlorine for disinfection and sulfur dioxide for dechlorination. This treatment provides a small amount of BOD removal upstream of Outfall-002 and is advantageous in keeping the effluent from exceeding the discharge specifications for BOD at Outfall-002. After switching from combined-basin into split-basin mode on 5/7/2015 Effluent-002 BOD spiked. The spike in BOD can likely be attributed to the effluent not being chlorinated and dechlorinated. The City has determined that it is beneficial to continue operating the treatment plant in single-pass mode in order to collect data which will help us plan for future treatment plant upgrades where single pass mode will be the normal operation. During this time, the City is actively making operational decisions to achieve compliance with the discharge specifications for BOD at Outfall-002. Improvements to water quality typically take 2-3 weeks to manifest after an operational change is made to the natural treatment system. We continue to carefully monitor the water quality of Effluent-002 and make operational decisions that protect water quality.
992447	5/16/2015	CAT1	Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) Weekly Average limit is 65 mg/L and reported value was 83 mg/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	BOD fluctuates in the natural treatment system due to a variety of environmental factors. High levels of nitrogenous BOD in the effluent of some treatment units is typical during late spring/early summer due to the presence of ammonia (from decomposing solids) and nitrifying bacteria in the treatment unit. Under normal combined-basin operational mode effluent to Outfall-002 is treated with chlorine for disinfection and sulfur dioxide for dechlorination. This treatment provides a small amount of BOD removal upstream of Outfall-002 and is advantageous in keeping the effluent from exceeding the discharge specifications for BOD at Outfall-002. After switching from combined-basin into split-basin mode on 5/7/2015 Effluent-002 BOD spiked. The spike in BOD can likely be attributed to the effluent not being chlorinated and dechlorinated. The City has determined that it is beneficial to continue operating the treatment plant in single-pass mode in order to collect data which will help us plan for future treatment plant upgrades where single pass mode will be the normal operation. During this time, the City is actively making operational decisions to achieve compliance with the discharge specifications for BOD at Outfall-002. Improvements to water quality typically take 2-3 weeks to manifest after an operational change is made to the natural treatment system. We continue to carefully monitor the water quality of Effluent-002 and make operational decisions that protect water quality.
992689	4/30/2015	CAT2	Dichlorobromomethane Monthly Average limit is 0.56 ug/L and reported value was 2.5 ug/L at EFF-001.	Historical performance indicates that dichlorobromomethane occurs occasionally but not consistently, indicating that it is unlikely that dichlorobromomethane levels remained above the effluent limit throughout the compliance period. Dichlorobromomethane is a common disinfection byproduct and may be a result of chlorinating wastewater for disinfection. The City is in the planning stages of treatment plant upgrades which will replace chlorination with UV as the primary disinfectant. The City is required to begin using UV as the primary disinfectant no later than December 1, 2016.
991483	4/29/2015	DMON	This deficient monitoring violation applies to a single BOD sample collected at INF-001 on 4/29/2015.	The BOD sample collected on 4/29/2015 at monitoring location INF-001 was analyzed past to the official hold time due to anomalous test results of the initial analysis. The contract laboratory indicated that the result of the initial analysis was much lower than is typically seen in an influent sample during a dry weather period. Result of the subsequent analysis, although analyzed past the hold time, was accepted by the City as reportable since the result obtained by the contract laboratory mirrored the BOD result obtained by our in-house laboratory analysis of the same sample. The result of the BOD sample analyzed by the contract laboratory on 5/8/2015 was 200 mg/L while the in-house laboratory analysis of the same sample, analyzed on 4/30/2015, was 198 mg/L.
992687	4/7/2015	CAT2	Dichlorobromomethane Daily Maximum limit is 1.12 ug/L and reported value was 2.5 ug/L at EFF-001.	Historical performance indicates that dichlorobromomethane occurs occasionally but not consistently, indicating that it is unlikely that dichlorobromomethane levels remained above the effluent limit throughout the compliance period. Dichlorobromomethane is a common disinfection byproduct and may be a result of chlorinating wastewater for disinfection. The City is in the planning stages of treatment plant upgrades which will replace chlorination with UV as the primary disinfectant. The City is required to begin using UV as the primary disinfectant no later than December 1, 2016.

990184	3/11/2015	CTOX	Chronic Toxicity Single Sample Maximum limit is 2.0 TUc and reported value was 8 TUc at EFF-001.	Results of the first week of accelerated monitoring indicated that the City should cease accelerated monitoring and initiate a Toxicity Reduction Evaluation. However, subsequent testing shows that the effluent is back in compliance with numeric and narrative chronic toxicity conditions. A letter regarding chronic toxicity is included as an attachment to this SMR.
990182	2/28/2015	CAT2	Dichlorobromomethane Monthly Average limit is 0.56 ug/L and reported value was 1.6 ug/L at EFF-001.	Historical performance indicates that dichlorobromomethane occurs occasionally but not consistently, indicating that it is unlikely that dichlorobromomethane levels remained above the effluent limit throughout the compliance period. Dichlorobromomethane is a common disinfection byproduct and may be a result of chlorinating wastewater for disinfection. The City is in the planning stages of treatment plant upgrades which will replace chlorination with UV as the primary disinfectant. The City is required to begin using UV as its primary disinfectant no later than December 1, 2016.
990185	2/18/2015	CAT2	Dichlorobromomethane Maximum Daily (MDEL) limit is 1.12 ug/L and reported value was 1.6 ug/L at EFF-001.	Historical performance indicates that dichlorobromomethane occurs occasionally but not consistently, indicating that it is unlikely that dichlorobromomethane levels remained above the effluent limit throughout the compliance period. Dichlorobromomethane is a common disinfection byproduct and may be a result of chlorinating wastewater for disinfection. The City is in the planning stages of treatment plant upgrades which will replace chlorination with UV as the primary disinfectant. The City is required to begin using UV as its primary disinfectant no later than December 1, 2016.
993131	2/14/2015	CAT1	Total Suspended Solids (TSS) Weekly Average limit is 1200 lb/day and reported value was 1400 lb/day at EFF-001.	
993133	2/14/2015	CAT1	Total Suspended Solids (TSS) Weekly Average limit is 45 mg/L and reported value was 47 mg/L at EFF-001.	
990183	2/9/2015	CTOX	Chronic Toxicity 3-Sample Median limit is 0 Pass/Fail (Pass = 0, Fail = 1) and reported value was 1 Pass/Fail (Pass = 0, Fail = 1) at EFF-001.	Results for chronic WET testing in the first quarter of 2015 showed that there were no significant reductions in survival at the 100% effluent concentration resulting in 1 TUc for survival (where TUc =100/NOEC). However, there was a significant reduction in reproduction at the 100% effluent concentration; the reproduction NOEC was 75% effluent, resulting in a 1.3 TUc. The results of the Quarter 1 2015 chronic WET resulted in a 3-sample median >1.0 TUc for the reproduction test, a violation of the narrative condition in the NPDES permit and triggering accelerated monitoring. Accelerated monitoring was initiated on 3/11/2015 in accordance with the requirements of NPDES Permit CA0022713/Order No. R1-2012-0031, Attachment E, Provision V.B.9. A detailed report on chronic toxicity testing and accelerated monitoring is included as an attachment to this SMR.
1001930	12/31/2014	CAT1	Total Suspended Solids (TSS) Monthly Average limit is 30 mg/L and reported value was 37 mg/L at EFF-001.	
993132	12/31/2014	CAT1	Total Suspended Solids (TSS) Monthly Average limit is 970 lb/day and reported value was 1300 lb/day at EFF-001.	Internal TSS loading, from algal growth in open water portions of the Wastewater Treatment Plant (oxidation ponds and portions of the treatment wetlands), has resulted in higher than normal TSS concentration in the Treatment Plant Effluent. Changes have been made to the operational strategy in response to the high TSS concentration in the treatment system but the changes had little effect on the concentration of TSS in the Treatment Plant effluent. Despite high TSS concentrations, wet weather conditions experienced in February necessitated the need for high volume discharge in order to maintain Treatment Plant capacity. A decrease in TSS concentration was realized by the end of the month. This decrease was likely influenced by the large input of freshwater into the treatment system. Operational staff continues to make operational changes as necessary to maintain capacity within the treatment system and minimize discharges of TSS over the effluent limit. Additionally, Arcata Marsh Research Institute staff is researching possible treatment options to improve Treatment Plant performance.
985526	12/31/2014	CAT1	Total Suspended Solids (TSS) Percent Reduction limit is 85 % and reported value was 75 % at EFF-001.	High influent flows occur during periods of heavy rainfall due to inflow and infiltration (I&I) issues in the collection system. Flows from I&I have low TSS concentrations compared to typical treatment plant effluent. As such, influent TSS values tend to be lower during wet weather periods due to a dilution from I&I. The City has an active I&I reduction program with repairs being made to the collection system as allowable each budget year.
993130	12/27/2014	CAT1	Total Suspended Solids (TSS) Weekly Average limit is 1900 lb/day and reported value was 2900 lb/day at EFF-001.	
1001929	12/27/2014	CAT1	Total Suspended Solids (TSS) Weekly Average limit is 45 mg/L and reported value was 61 mg/L at EFF-001.	
1001927	12/13/2014	CAT1	Total Suspended Solids (TSS) Weekly Average limit is 1490 lb/day and reported value was 1565 lb/day at EFF-001.	
985525	12/4/2014	DMON	This deficient monitoring violation pertains to two samples collected for compliance purposes at EFF-001 and EFF-002 which were analyzed past the required hold time.	Laboratory records indicate that a sample collected on 12/4/2014 for compliance with pH monitoring requirements at Effluent-001 and Effluent-002 was analyzed past the 15 minute hold time. Hold time requirements were reviewed with laboratory staff. Based on discussions of typical laboratory routines it is likely that the sample was analyzed within the hold time period and that a transcription error led to the hold time exceedance, though there is no definitive evidence of this. A sample collected on 12/22/2014 for compliance with TSS monitoring requirements at Effluent-001 and Effluent-002 was analyzed past the 7 day hold time. Initially, the sample was analyzed by the contract laboratory on 12/28/2014. However, the result of the initial analysis did not agree with the result obtained by in-house laboratory analysis of the same sample. Further, a review of process control samples collected on the same day from upstream treatment units showed that none of the upstream processes, with the exception of the influent, had a TSS concentration as high as the value obtained by the contract laboratory. The City requested that the contract laboratory re-analyze the sample past the hold time. The result of the re-analysis agreed with the value obtained by the City's in-house laboratory and was within the range of TSS values that would be expected given the operating and weather conditions at the time the sample was collected. The City has determined that the sample result obtained upon re-analysis of the TSS sample collected on 12/22/2014 is representative of the water quality for the representative period. As such, the City is reporting TSS data obtained from the re-analysis for compliance purposes. The original TSS data point is reported in CIWQS with the QC code "Data rejected". The original TSS value is not included in any compliance calculations.
983586	11/30/2014	CAT2	Copper, Total Recoverable Monthly Average limit is 2.9 ug/L and reported value was 3.9 ug/L at EFF-001.	No corrective action taken. On 11/20/2014 the Regional Board approved Order No. R1-2014-0050 eliminating effluent limits for copper at Outfall-001.
983589	10/31/2014	Deficient Reporting	The City failed to self report an effluent limit exceedence.	A sample collected on 10/21/2014 for dichlorobromomethane had a result that exceeded the average monthly effluent limitation. The average monthly value was reported in the October 2014 SMR however, the City failed to enter a self-determined violation for the exceedance. Further, the City failed to recognize the effluent violation in the October 2014 SMR cover letter and noncompliance letter.

981413	10/31/2014	CAT1	Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) Monthly Average limit is 45 mg/L and reported value was 52 mg/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	Seasonal increase in BOD typically occurs in the Fall due to a variety of factors in the natural treatment system. Under normal combined-basin operational mode effluent to Outfall-002 is treated with chlorine for disinfection and sulfur dioxide for dechlorination. This treatment provides a small amount of BOD removal upstream of Outfall-002 and is advantageous in keeping the effluent from exceeding the discharge specifications for BOD at Outfall-002. The City determined that it was beneficial to continue operating the treatment plant in single-pass mode, during which Effluent-002 is not chlorinated and dechlorinated, in order to collect data which will help us plan for future treatment plant upgrades where single pass mode will be the normal operation. During the reporting period the City was actively making operational decisions and testing methods of nitrogenous BOD removal to achieve compliance with the discharge specifications for BOD at Outfall-002. On 10/23/2014 the City switched back to combined-basin mode in preparation for winter weather and because a decrease in BOD at Outfall-002 was not realized.
981410	10/31/2014	CAT2	Copper, Total Recoverable Monthly Average limit is 2.9 ug/L and reported value was 3.9 ug/L at EFF-001.	A Water Effect Ratio (WER) study for discharges of copper from Arcata Wastewater Treatment Plant was submitted to the Regional Water Quality Control Board in December 2012 for consideration of applying a site-specific WER for copper at Outfall-001. The WER was approved by the Board in November 2014.
981405	10/31/2014	CAT2	Copper, Total Recoverable Monthly Average limit is 4.7 ug/L and reported value was 7.9 ug/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	A Water Effect Ratio (WER) study for discharges of copper from Arcata Wastewater Treatment Plant was submitted to the Regional Water Quality Control Board in December 2012 for consideration of applying a site-specific WER for copper at Outfall-002. The WER was approved by the Regional Water Quality Control Board in November 2014.
983417	10/31/2014	CAT2	Dichlorobromomethane Monthly Average limit is 0.56 ug/L and reported value was 2.0 ug/L at EFF-001.	
981408	10/25/2014	CAT1	Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) Weekly Average limit is 65 mg/L and reported value was 70 mg/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	Seasonal increase in BOD typically occurs in the Fall due to a variety of factors in the natural treatment system. Under normal combined-basin operational mode effluent to Outfall-002 is treated with chlorine for disinfection and sulfur dioxide for dechlorination. This treatment provides a small amount of BOD removal upstream of Outfall-002 and is advantageous in keeping the effluent from exceeding the discharge specifications for BOD at Outfall-002. The City determined that it was beneficial to continue operating the treatment plant in single-pass mode, during which Effluent-002 is not chlorinated and dechlorinated, in order to collect data which will help us plan for future treatment plant upgrades where single pass mode will be the normal operation. During the reporting period the City was actively making operational decisions and testing methods of nitrogenous BOD removal to achieve compliance with the discharge specifications for BOD at Outfall-002. On 10/23/2014 the City switched back to combined-basin mode in preparation for winter weather and because a decrease in BOD at Outfall-002 was not realized.
981407	10/18/2014	CAT1	Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) Weekly Average limit is 65 mg/L and reported value was 70 mg/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	Seasonal increase in BOD typically occurs in the Fall due to a variety of factors in the natural treatment system. Under normal combined-basin operational mode effluent to Outfall-002 is treated with chlorine for disinfection and sulfur dioxide for dechlorination. This treatment provides a small amount of BOD removal upstream of Outfall-002 and is advantageous in keeping the effluent from exceeding the discharge specifications for BOD at Outfall-002. The City determined that it was beneficial to continue operating the treatment plant in single-pass mode, during which Effluent-002 is not chlorinated and dechlorinated, in order to collect data which will help us plan for future treatment plant upgrades where single pass mode will be the normal operation. During the reporting period the City was actively making operational decisions and testing methods of nitrogenous BOD removal to achieve compliance with the discharge specifications for BOD at Outfall-002. On 10/23/2014 the City switched back to combined-basin mode in preparation for winter weather and because a decrease in BOD at Outfall-002 was not realized.
981406	10/13/2014	DMON	QA/QC issues	The nitrate sample collected at EFF-001 on 10/13/2014 was analyzed approximately 10 minutes past the hold time. The results are reported in the October 2014 SMR with comments regarding the QA/QC issue. Effluent-001 was re-sampled for nitrate in November 2014.
981409	10/4/2014	CAT1	Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) Weekly Average limit is 65 mg/L and reported value was 74 mg/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	Seasonal increase in BOD typically occurs in the Fall due to a variety of factors in the natural treatment system. Under normal combined-basin operational mode effluent to Outfall-002 is treated with chlorine for disinfection and sulfur dioxide for dechlorination. This treatment provides a small amount of BOD removal upstream of Outfall-002 and is advantageous in keeping the effluent from exceeding the discharge specifications for BOD at Outfall-002. The City determined that it was beneficial to continue operating the treatment plant in single-pass mode, during which Effluent-002 is not chlorinated and dechlorinated, in order to collect data which will help us plan for future treatment plant upgrades where single pass mode will be the normal operation. During the reporting period the City was actively making operational decisions and testing methods of nitrogenous BOD removal to achieve compliance with the discharge specifications for BOD at Outfall-002. On 10/23/2014 the City switched back to combined-basin mode in preparation for winter weather and because a decrease in BOD at Outfall-002 was not realized.
978713	9/30/2014	CAT1	Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C) Monthly Average limit is 45 mg/L and reported value was 47 mg/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	HOLD
978709	9/30/2014	CAT2	Copper, Total Monthly Average limit is 4.7 ug/L and reported value was 5.7 ug/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	A Water Effect Ratio (WER) study for discharges of copper at Arcata Wastewater Treatment Facility outfalls was submitted to the Regional Water Quality Control Board in December 2012 for consideration of a site specific WER for discharges of copper at Outfall-002.
980068	8/30/2014	Order Conditions	A malfunction of a chlorine analyzer resulted in the discharge of approximately 208,000 gallons of incompletely disinfected effluent to Humboldt Bay. The discharge violates Prohibition III.E of Order No. R1-2012-0031.	Maintenance and calibration of the chlorine analyzer was performed and appear to correct the malfunction.

980069	8/30/2014	OEV	Fecal Coliform Maximum Daily (MDEL) limit is 43 MPN/100 mL and reported value was 49 MPN/100 mL at EFF-001.	The malfunctioning chlorine analyzer was repaired, calibrated, and returned to service.
977210	8/27/2014	DMON	This Deficient Monitoring Violation applies to TSS samples collected on 8/27/2014 at Inf-001, Eff-001 and Eff-002.	Due to a compressor failure in the refrigerator at the contract laboratory, the Total Suspended Solids samples collected on 8/27/2014 were not held at less than 6° C for the entire hold time. Results of the analyses were in the range typically expected and have been accepted by the City as representative of the influent and effluent waste streams at the time of sampling.
978710	7/31/2014	Deficient Reporting	A single sample was collected for compliance with quarterly monitoring requirements.	The City collected a sample for dichlorobromomethane on July 24, 2014. The results of the analysis was 5.7 ug/L, a violation of both monthly average and daily maximum effluent limits for discharges at Outfall-001. The daily maximum and average monthly values for this sample were reported in the July 2014 Self Monitoring Report (SMR). However, the City failed to enter self-determined violations for exceeding the monthly average and daily maximum effluent limits for dichlorobromomethane at Effluent-001. Further, the City failed to recognized the effluent violations in the July 2014 SMR Cover Letter and July 2014 Noncompliance Letter. The City is resolving this issue by making this Deficient Reporting Self-Determined Violation entry and by reporting Self-Determined Violations for exceeding the effluent limits for monthly average and daily maximum for dichlorobromomethane in this SMR.
975642	7/31/2014	CAT2	Copper, Total Recoverable Monthly Average limit is 4.7 ug/L and reported value was 4.8 ug/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	A single sample is collected for compliance with monthly monitoring requirements. A Water Effect Ratio (WER) study for discharges of copper was submitted to the Regional Water Quality Control Board in December 2012 for consideration of applying of a site-specific WER for discharges of copper at Outfall-002.
978711	7/31/2014	CAT2	Dichlorobromomethane Monthly Average limit is 0.56 ug/L and reported value was 5.7 ug/L at EFF-001.	Historical performance indicates that dichlorobromomethane occurs occasionally but not consistently, indicating that it is unlikely that dichlorobromomethane levels remained above the effluent limit throughout the compliance period. Dichlorobromomethane is a common disinfection byproduct and may be a result of chlorinating wastewater for disinfection. The City is in the planning stages of treatment plant upgrades which will replace chlorination with UV as the primary disinfectant. The City is required to begin using UV its primary disinfectant no later than December 1, 2016.
978712	7/24/2014	CAT2	Dichlorobromomethane Maximum Daily (MDEL) limit is 1.12 ug/L and reported value was 5.7 ug/L at EFF-001.	Historical performance indicates that dichlorobromomethane occurs occasionally but not consistently, indicating that it is unlikely that dichlorobromomethane levels remained above the effluent limit throughout the compliance period. Dichlorobromomethane is a common disinfection byproduct and may be a result of chlorinating wastewater for disinfection. The City is in the planning stages of treatment plant upgrades which will replace chlorination with UV as the primary disinfectant. The City is required to begin using UV its primary disinfectant no later than December 1, 2016.
975643	7/17/2014	DMON	A single sample is collected for compliance with weekly monitoring requirements.	Due to a sample handling error in the laboratory the result of the weekly 3x5 sample was reported as a range; <1.8 - 7.8 MPN/100mL. The results are considered valid and are within the normal range for Effluent-001. Corrective action by the contract laboratory consisted of review of test procedure with laboratory technician responsible for the error.
975641	7/9/2014	OEV	pH Instantaneous Minimum limit is 6.0 SU and reported value was 5.9 SU at EFF-001.	Historical performance indicates that pH decreases in the late summer and fall as plant material begins to break-down in the natural treatment system. Diurnal fluctuations in pH occur in the natural treatment system as plants takes up carbon dioxide during photosynthesis; indicating that it is unlikely that pH remained below the minimum throughout the compliance period.
971014	5/31/2014	CAT2	Copper, Total Monthly Average limit is 2.9 ug/L and reported value was 5.1 ug/L at EFF-001.	A Water Effect Ratio (WER) study for discharges of copper was submitted to the Regional Water Quality Control Board in December 2012 for consideration of a site-specific WER for discharges of copper at Effluent-001.
971015	5/31/2014	CAT2	Copper, Total Monthly Average limit is 4.7 ug/L and reported value was 5.1 ug/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	A Water Effect Ratio (WER) study for discharges of copper was submitted to the Regional Water Quality Control Board in December 2012 for consideration of a site-specific WER for discharges of copper at Effluent-002.
969589	5/23/2014	DMON	A deficient monitoring violation is being reported for failing to use the correct analytical method for ammonia nitrogen analysis, and for failing to collect pH and settleable solids samples at Outfall-001 and Outfall-002 on 4/5/2014.	Due to an operator error, the City failed to collect and analyze samples for pH and suspended solids at Outfall-001 and Outfall-002 on 4/5/2014. Monitoring requirements were reviewed with all operators with emphasis on frequency of sample collection and established time frames (e.g. daily is defined as midnight to 11:59 p.m., weekly is defined as Sunday-Saturday, etc.), and procedures for notifying management of deficient monitoring or other violations. The City of Arcata initiated monitoring for ammonia nitrogen in August 2012 and has subsequently collected, analyzed, and reported results for seven quarterly ammonia nitrogen samples. To date, all ammonia nitrogen samples have been analyzed using Standard Methods (20th edition) 4500-NH3 D without distillation, as specified in the method. During a recent review of 40 CFR Part 136 it has come to my attention that the federal regulation requires distillation of wastewater samples prior to analysis of ammonia nitrogen samples analyzed with Standard Methods 4500-NH3 D. All future ammonia nitrogen samples will be analyzed using Standard Methods 4500-NH3 D with distillation beginning with the sample collected on May 23, 2014 (Quarter 2, 2014). A letter documenting this monitoring deficiency is included as an attachment to this SMR.
969588	5/14/2014	CTOX	Chronic Toxicity 3-Sample Median limit is 1 TUc and reported value was 1.3 TUc at EFF-001.	A chronic Whole Effluent Toxicity (WET) test conducted 3/17/2014 showed a significant reduction in reproduction at 100% effluent concentration, resulting in a single-test TUc of 1.3 and a three-sample median greater than 1TUc for the reproduction test, triggering accelerated monitoring for chronic WET. The City was in receipt of initial sample results which indicated an exceedance of the chronic toxicity trigger on 3/27/2014. Accelerated monitoring commenced on April 14, 2014. The results of the three accelerated monitoring chronic WET tests conducted in April 2014 showed that there was no significant reduction in survival or reproduction at 100% effluent concentration (i.e., TUc = 1). Consequently, the three-sample median for chronic WET reproduction was back in compliance with narrative conditions after the second week of accelerated monitoring. A running summary of chronic WET test results and accelerated monitoring test reports are attached. Accelerated monitoring continued into May 2014.
981412	4/30/2014	Deficient Reporting	Failed to log a deficient monitoring violation in the April 2014 SMR.	The City failed to log a deficient monitoring violation in the April 2014 SMR for failure to collect pH and settleable solids samples on 4/5/2014 from EFF-001 and EFF-002. The City recognized the deficient monitoring violation in the April 2014 SMR cover letter and non-compliance summary letter but failed to make an entry for the violation into CIWQS. A deficient monitoring violation for the event is reported in the October 2014 SMR.
969587	4/30/2014	CAT2	Copper, Total Monthly Average limit is 2.9 ug/L and reported value was 5.6 ug/L at EFF-001.	A Water Effect Ratio (WER) study for discharges of copper was submitted to the Regional Water Quality Control Board in December 2012 for consideration of a site-specific WER for copper at Outfall-001.

969586	4/30/2014	CAT2	Copper, Total Monthly Average limit is 4.7 ug/L and reported value was 5.6 ug/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	A Water Effect Ratio (WER) study for discharges of copper was submitted to the Regional Water Quality Control Board in December 2012 for consideration of a site-specific WER for copper at Outfall-002.
981411	4/5/2014	DMON	Violation occurred in April 2014.	Due to an operator error, the City failed to collect and analyze samples for pH and settleable solids from EFF-001 and EFF-002 on 4/5/2014. The deficient monitoring violation was recognized in the April 2014 SMR cover letter and non-compliance letter but the City failed to enter the violation into CIWQS.
967699	3/31/2014	CAT2	Copper, Total Monthly Average limit is 2.9 ug/L and reported value was 7.6 ug/L at EFF-001.	A Water Effect Ratio (WER) study for discharges of copper was submitted to the Regional Water Quality Control Board in December 2012 for consideration of applying a site-specific WER for discharges of copper at Outfall-001.
967697	3/31/2014	CAT2	Copper, Total Monthly Average limit is 4.7 ug/L and reported value was 7.6 ug/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	A Water Effect Ratio (WER) study for discharges of copper was submitted to the Regional Water Quality Control Board in December 2012 for consideration of applying a site-specific WER for discharges of copper at Outfall-002.
967695	3/26/2014	DMON	Due to a laboratory error, the hold time requirement for compliance samples representative of Influent-001, Effluent-001 and Effluent-002 TSS was not met. The data is consistent with the ongoing TSS trend and a TSS sample collected the day previous.	Samples for TSS were analyzed one day past the official hold time due to a laboratory error at the contract laboratory.
983415	3/21/2014	CAT2	Dichlorobromomethane Daily Maximum limit is 1.12 ug/L and reported value was 2.0 ug/L at EFF-001.	
967698	3/17/2014	CTOX	Chronic Toxicity 3-Sample Median limit is 1 TUc and reported value was 1.3 TUc at EFF-001.	A chronic Whole Effluent Toxicity (WET) test conducted 3/17/2014 showed a significant reduction in reproduction at 100% effluent concentration, resulting in a single-test TUc of 1.3 and a three-sample median greater than 1TUc for the reproduction test, triggering accelerated monitoring for chronic WET. The City was in receipt of initial sample results which indicated an exceedance of the chronic toxicity trigger on 3/27/2014. Accelerated monitoring commenced on April 14, 2014.
967693	3/15/2014	CAT1	Total Suspended Solids (TSS) Weekly Average (Mean) limit is 1700 lb/day and reported value was 2000 lb/day at EFF-001.	Changes have been made to the operational strategy in response to the high TSS concentration in the treatment system however; realization of decreased TSS has been slow, mainly because of the slow changes inherent in a natural treatment process. Despite high TSS concentrations, wet weather conditions experienced in March necessitated the need for high volume discharge in order to maintain Treatment Plant capacity. With the exception of the TSS sample collected on 3/12/2014, TSS concentration in the effluent was within effluent limits and is trending downwards.
967700	3/15/2014	CAT1	Total Suspended Solids (TSS) Weekly Average (Mean) limit is 45 mg/L and reported value was 48 mg/L at EFF-001.	Changes have been made to the operational strategy in response to the high TSS concentration in the treatment system however; realization of decreased TSS has been slow, mainly because of the slow changes inherent in a natural treatment process. Despite high TSS concentrations, wet weather conditions experienced in March necessitated the need for high volume discharge in order to maintain Treatment Plant capacity. With the exception of the TSS sample collected on 3/12/2014, TSS concentration in the effluent was within effluent limits and is trending downwards.
967694	3/5/2014	CAT2	Copper, Total Daily Maximum limit is 5.8 ug/L and reported value was 7.6 ug/L at EFF-001.	A Water Effect Ratio (WER) study for discharges of copper was submitted to the Regional Water Quality Control Board in December 2012 for consideration of applying a site-specific WER for discharges of copper at Outfall-001.
966037	2/28/2014	CAT1	Total Suspended Solids (TSS) Monthly Average limit is 30 mg/L and reported value was 38 mg/L at EFF-001.	Internal TSS loading, from algal growth in open water portions of the Wastewater Treatment Plant (oxidation ponds and portions of the treatment wetlands), has resulted in higher than normal TSS concentration in the Treatment Plant Effluent. Changes have been made to the operational strategy in response to the high TSS concentration in the treatment system but the changes had little effect on the concentration of TSS in the Treatment Plant effluent. Despite high TSS concentrations, wet weather conditions experienced in February necessitated the need for high volume discharge in order to maintain Treatment Plant capacity. A decrease in TSS concentration was realized by the end of the month. This decrease was likely influenced by the large input of freshwater into the treatment system. Operational staff continues to make operational changes as necessary to maintain capacity within the treatment system and minimize discharges of TSS over the effluent limit. Additionally, Arcata Marsh Research Institute staff is researching possible treatment options to improve Treatment Plant performance.
966043	2/28/2014	CAT1	Total Suspended Solids (TSS) Monthly Average limit is 755 lb/day and reported value was 878 lb/day at EFF-001.	Internal TSS loading, from algal growth in open water portions of the Wastewater Treatment Plant (oxidation ponds and portions of the treatment wetlands), has resulted in higher than normal TSS concentration in the Treatment Plant Effluent. Changes have been made to the operational strategy in response to the high TSS concentration in the treatment system but the changes had little effect on the concentration of TSS in the Treatment Plant effluent. Despite high TSS concentrations, wet weather conditions experienced in February necessitated the need for high volume discharge in order to maintain Treatment Plant capacity. A decrease in TSS concentration was realized by the end of the month. This decrease was likely influenced by the large input of freshwater into the treatment system. Operational staff continues to make operational changes as necessary to maintain capacity within the treatment system and minimize discharges of TSS over the effluent limit. Additionally, Arcata Marsh Research Institute staff is researching possible treatment options to improve Treatment Plant performance.
966042	2/28/2014	CAT1	Total Suspended Solids (TSS), Percent Removal Monthly Average limit is 85 % and reported value was 84 % at EFF-001.	Internal TSS loading, from algal growth in open water portions of the Wastewater Treatment Plant (oxidation ponds and portions of the treatment wetlands), has resulted in higher than normal TSS concentration in the Treatment Plant Effluent. Changes have been made to the operational strategy in response to the high TSS concentration in the treatment system but the changes had little effect on the concentration of TSS in the Treatment Plant effluent. Despite high TSS concentrations, wet weather conditions experienced in February necessitated the need for high volume discharge in order to maintain Treatment Plant capacity. A decrease in TSS concentration was realized by the end of the month. This decrease was likely influenced by the large input of freshwater into the treatment system. Operational staff continues to make operational changes as necessary to maintain capacity within the treatment system and minimize discharges of TSS over the effluent limit. Additionally, Arcata Marsh Research Institute staff is researching possible treatment options to improve Treatment Plant performance.
966036	2/28/2014	CAT2	Copper, Total Monthly Average limit is 2.9 ug/L and reported value was 6.8 ug/L at EFF-001.	A Water Effect Ratio (WER) study for discharges of copper was submitted to the Regional Water Quality Control Board in December 2012 for consideration of applying of a site-specific WER for discharges of copper at Outfall-001.

966040	2/28/2014	CAT2	Copper, Total Monthly Average limit is 4.7 ug/L and reported value was 6.8 ug/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	A Water Effect Ratio (WER) study for discharges of copper was submitted to the Regional Water Quality Control Board in December 2012 for consideration of applying of a site-specific WER for discharges of copper at Outfall-002.
966039	2/25/2014	CAT2	Copper, Total Daily Maximum limit is 5.8 ug/L and reported value was 6.8 ug/L at EFF-001.	A Water Effect Ratio (WER) study for discharges of copper was submitted to the Regional Water Quality Control Board in December 2012 for consideration of applying of a site-specific WER for discharges of copper at Outfall-001.
966038	2/22/2014	CAT1	Total Suspended Solids (TSS) Weekly Average limit is 1500 lb/day and reported value was 2000 lb/day at EFF-001.	Internal TSS loading, from algal growth in open water portions of the Wastewater Treatment Plant (oxidation ponds and portions of the treatment wetlands), has resulted in higher than normal TSS concentration in the Treatment Plant Effluent. Changes have been made to the operational strategy in response to the high TSS concentration in the treatment system but the changes had little effect on the concentration of TSS in the Treatment Plant effluent. Despite high TSS concentrations, wet weather conditions experienced in February necessitated the need for high volume discharge in order to maintain Treatment Plant capacity. A decrease in TSS concentration was realized by the end of the month. This decrease was likely influenced by the large input of freshwater into the treatment system. Operational staff continues to make operational changes as necessary to maintain capacity within the treatment system and minimize discharges of TSS over the effluent limit. Additionally, Arcata Marsh Research Institute staff is researching possible treatment options to improve Treatment Plant performance.
984614	2/22/2014	CAT1	Total Suspended Solids (TSS) Weekly Average limit is 45 mg/L and reported value was 47 mg/L at EFF-001.	Internal TSS loading, from algal growth in open water portions of the Wastewater Treatment Plant (oxidation ponds and portions of the treatment wetlands), has resulted in higher than normal TSS concentration in the Treatment Plant Effluent. Changes have been made to the operational strategy in response to the high TSS concentration in the treatment system but the changes had little effect on the concentration of TSS in the Treatment Plant effluent. Despite high TSS concentrations, wet weather conditions experienced in February necessitated the need for high volume discharge in order to maintain Treatment Plant capacity. A decrease in TSS concentration was realized by the end of the month. This decrease was likely influenced by the large input of freshwater into the treatment system. Operational staff continues to make operational changes as necessary to maintain capacity within the treatment system and minimize discharges of TSS over the effluent limit. Additionally, Arcata Marsh Research Institute staff is researching possible treatment options to improve Treatment Plant performance.
966041	2/15/2014	CAT1	Total Suspended Solids (TSS) Weekly Average limit is 45 mg/L and reported value was 49 mg/L at EFF-001.	Internal TSS loading, from algal growth in open water portions of the Wastewater Treatment Plant (oxidation ponds and portions of the treatment wetlands), has resulted in higher than normal TSS concentration in the Treatment Plant Effluent. Changes have been made to the operational strategy in response to the high TSS concentration in the treatment system but the changes had little effect on the concentration of TSS in the Treatment Plant effluent. Despite high TSS concentrations, wet weather conditions experienced in February necessitated the need for high volume discharge in order to maintain Treatment Plant capacity. A decrease in TSS concentration was realized by the end of the month. This decrease was likely influenced by the large input of freshwater into the treatment system. Operational staff continues to make operational changes as necessary to maintain capacity within the treatment system and minimize discharges of TSS over the effluent limit. Additionally, Arcata Marsh Research Institute staff is researching possible treatment options to improve Treatment Plant performance.
964233	1/31/2014	CAT1	Total Suspended Solids (TSS) Monthly Average limit is 30 mg/L and reported value was 31 mg/L at EFF-001.	The Arcata Wastewater Treatment Plant has been experiencing an increase in the internal loading of total suspended solids due to the growth of algae in the open water portions of the treatment plant. This is due in part to the unusually warm and sunny weather and to the lack of rainfall. Operational staff and Arcata Marsh Research Institute staff are currently evaluating options for improving Treatment Plant performance.
964235	1/31/2014	CAT2	Copper, Total Monthly Average limit is 2.9 ug/L and reported value was 6.7 ug/L at EFF-001.	A Water Effect Ratio (WER) study for discharges of copper was submitted to the Regional Water Quality Control Board in December 2012 for consideration of a site-specific WER for copper at Effluent-001.
964234	1/31/2014	CAT2	Copper, Total Monthly Average limit is 4.7 ug/L and reported value was 6.7 ug/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	A Water Effect Ratio (WER) study for discharges of copper was submitted to the Regional Water Quality Control Board in December 2012 for consideration of a site-specific WER for copper at Effluent-002.
964232	1/13/2014	CAT2	Copper, Total Daily Maximum limit is 5.8 ug/L and reported value was 6.7 ug/L at EFF-001.	A Water Effect Ratio (WER) study for discharges of copper was submitted to the Regional Water Quality Control Board in December 2012 for consideration of a site-specific WER for copper at Effluent-001.
962767	12/31/2013	CAT2	Copper, Total Recoverable Monthly Average limit is 2.9 ug/L and reported value was 4.2 ug/L at EFF-001.	A Water Effect Ration (WER) study for discharges of copper was submitted to the Regional Water Quality Control Board in December 2012 for consideration of applying a site-specific WER for discharges of copper at EFF-001.
962763	12/18/2013	DMON	A deficient monitoring violation, with an occurrence date of December 18, 2013 is reported in this SMR in association with BOD samples collected at Influent-001, Effluent-001 and Effluent-002. Due to laboratory error the samples were incubated for six days prior to the final dissolved oxygen determination.	The results of the BOD tests were accepted as representative because the organic standard was well within the contract laboratory?s acceptance limits and because the sample values are consistent with historical values for the monitoring locations. The laboratory error was due to staffing changes implemented during the holidays. Corrective action taken by the contract laboratory included reviewing test procedures with the analyst responsible for the error and ensuring that the regular staff person is again scheduled to handle BOD analysis.
960857	11/30/2013	CAT2	Copper, Total Monthly Average limit is 2.9 ug/L and reported value was 4.9 ug/L.	A Water Effect Ratio (WER) study was submitted to the Regional Water Quality Control Board in December 2012 for consideration of a site-specific WER for discharges of copper at Effluent-001.
960856	11/30/2013	CAT2	Copper, Total Monthly Average limit is 4.7 ug/L and reported value was 4.9 ug/L at EFF-002. *** MMP Exempt Reason:This outfall does not discharge to a water of the U.S., therefore is not subject to CWC 13385.	A Water Effect Ratio (WER) study was submitted to the Regional Water Quality Control Board in December 2012 for consideration of a site-specific WER for discharges of copper at Effluent-002.
960855	11/8/2013	DMON	The BOD sample collected on 11/6/2013 was analyzed past the hold time due to laboratory error.	A technician working for the contract laboratory used by the City of Arcata dropped all of the BOD test bottles for sample location Inf-001 at the end of the 5-day holding period, before the samples could be analyzed for dissolved oxygen concentration. The contract laboratory used the remaining sample to set-up a new BOD test. Formal corrective action was not taken by the contract laboratory due to the nature of the incident.

962766	10/31/2013	Deficient Reporting	A deficient reporting violation, with an occurrence date of October 31, 2013 is reported in this SMR for failure to report CTR pollutant monitoring data in the October 2013 SMR. Samples for CTR pollutants were collected at regular intervals over a 10.5-hour period for use in local limits development. Further, average monthly and maximum daily values for carbon tetrachloride, dichlorobromomethane and bis (2-ethylhexyl) phthalate, obtained as a result of the local limits development project, were not reported in the October 2013 SMR. The City also failed to report settleable solids monitoring data for Outfall-002 on 10/29/2013 in the October SMR. Monitoring data for CTR pollutants collected as grab samples; calculated compliance data (i.e. average monthly, daily maximum) for carbon tetrachloride, dichlorobromomethane, bis (2-ethylhexyl) phthalate and; settleable solids data for Outfall-002 on 10/29/2013 are submitted in this SMR in tabular format as an attachment.	Reporting errors occurred in the October 2013 SMR due to a staffing shortage and failure to properly implement quality control review of the report. Quality control/report completeness review procedures will be reviewed with the appropriate staff to ensure that reporting errors do not occur in the future.
960859	10/31/2013	Deficient Reporting	The City of Arcata failed to submit daily Total Residual Chlorine data for monitoring location Effluent-002, TCDD-Equivalent data for monitoring location EFF-001, and an exceedance of the discharge standard for copper at EFF-002 in the October 2013 SMR. Furthermore, it has come to my attention that the copper violation at EFF-002 that was reported in the October 2013 SMR was reported with the incorrect units; the violation should have been reported in ug/L not as %.	Daily Total Residual Chlorine data for Effluent-002 and TCDD-Equivalents data for the reporting period 0f October 1-31, 2013 is included in this SMR as an attachment. A violation for the exceedance of the monthly average discharge standard for copper at EFF-002 in October 2013 is logged as a violation in this SMR.
960858	10/31/2013	CAT2	Copper, Total Monthly Average limit is 4.7 ug/L and reported value was 5.2 ug/L. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	A Water Effect Ratio (WER) study was submitted to the Regional Water Quality Control Board in December 2012 for consideration of a site-specific WER for discharges of copper at Effluent-002.
958994	10/31/2013	CAT2	Copper, Total Recoverable Monthly Average (Mean) limit is 2.9 ug/L and reported value was 5.2 ug/L at EFF-001.	A Water Effect Ration (WER) study for discharges of copper was submitted to the Regional Water Quality Control Board in December 2012 for consideration of applying a site-specific WER for discharges of copper at discharge monitoring location Outfall-001.
962765	10/31/2013	CAT2	Dichlorobromomethane Monthly Average limit is 0.56 ug/L and reported value was 1.4 ug/L at EFF-001.	Historical performance indicates that dichlorobromomethane occurs occasionally but not consistently, indicating that it is unlikely that dichlorobromomethane levels remained above the effluent limit throughout the compliance period. Dichlorobromomethane is a common disinfection byproduct and may be a result of chlorinating wastewater for disinfection. The City is in the planning stages of treatment plant upgrades which will replace chlorination with UV as the primary disinfectant. The City is required to begin using UV as its primary disinfectant no later than December 1, 2016.
962764	10/14/2013	CAT2	Dichlorobromomethane Daily Maximum limit is 1.12 ug/L and reported value was 1.4 ug/L at EFF-001.	Historical performance indicates that dichlorobromomethane occurs occasionally but not consistently, indicating that it is unlikely that dichlorobromomethane levels remained above the effluent limit throughout the compliance period. Dichlorobromomethane is a common disinfection byproduct and may be a result of chlorinating wastewater for disinfection. The City is in the planning stages of treatment plant upgrades which will replace chlorination with UV as the primary disinfectant. The City is required to begin using UV as its primary disinfectant no later than December 1, 2016.
957556	9/30/2013	CAT2	Copper, Total Monthly Average limit is 2.9 ug/L and reported value was 3.0 ug/L.	A Water Effect Ratio (WER) study for discharges of copper was submitted to the Regional Water Quality Control Board in December 2012 for consideration of applying of a site-specific WER for discharges of copper at the monitoring location Outfall-001.
957557	9/30/2013	CAT2	Copper, Total Monthly Average limit is 4.7 ug/L and reported value was 7.9 ug/L. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	A Water Effect Ration (WER) study for discharges of copper was submitted to the Regional Water Quality Control Board in December 2012 for consideration of applying a site-specific WER for discharges of copper at discharge monitoring location Outfall-002.
955721	8/31/2013	DMON	Sample analyzed past hold time.	The BOD sample collected at INF-001 on 8/21/2013 had excessive oxygen depletion during the initial analysis. This occurred because the sample volume used in the analysis was too large. The sample was reanalyzed past the official hold time using a smaller sample volume. Results obtained by the contract laboratory are similar to results obtained by our in-house laboratory for the same sample.
955719	8/31/2013	CAT2	Copper, Total Monthly Average limit is 2.9 ug/L and reported value was 4.3 ug/L.	A Water Effect Ratio (WER) study for copper was submitted to the Regional Water Quality Control Board in December 2012 for consideration of implementing site-specific WERs for copper at the City's discharge locations.
957554	8/31/2013	CAT2	Dichlorobromomethane Monthly Average limit is 0.56 ug/L and reported value was 2.2 ug/L.	Historical performance indicates that dichlorobromomethane occurs occasionally but not consistently, indicating that it is unlikely that dichlorobromomethane levels remained above the effluent limit throughout the compliance period. Dichlorobromomethane is a common disinfection byproduct and may be a result of chlorinating wastewater for disinfection. The City is in the planning stages of treatment plant upgrades which will replace chlorination with UV as the primary disinfectant. The City is required to begin using UV its primary disinfectant no later than December 1, 2016.

957553	8/30/2013	Deficient Reporting	A deficient reporting violation, with a date of August 30, 2013, is reported in this SMR for failure to identify in the August 2013 SMR two instances of permit non-compliance for effluent limit exceedances for dichlorobromomethane. The results of the sample were reported in the August 2013 SMR.	Effluent violations for dichlorobromomethane monthly average and daily maximum are reported in this SMR.
955722	8/21/2013	DMON	Sample analyzed past hold time.	The BOD sample collected at EFF-002 on 8/14/2013 had insufficient oxygen depletion during the initial analysis. This occurred because the sample was incorrectly labeled as an influent sample. The contract laboratory used a small sample volume, as instructed, anticipating high oxygen demand from an influent sample. The sample was reanalyzed past the official hold time using a larger sample volume. Results obtained by the contract laboratory are similar to results obtained by our in-house laboratory for the same sample. Samples were properly labeled in subsequent sampling events. The BOD sample collected at EFF-002 on 8/21/2013 had insufficient oxygen depletion during the initial analysis. This occurred because insufficient sample volume was used in the analysis. The sample was reanalyzed past the official hold time using a larger sample volume. Results obtained by the contract laboratory are similar to results obtained by our in-house laboratory for the same sample. The contract laboratory was instructed to use a larger sample volume in subsequent sampling events.
955720	8/16/2013	OEV	pH Instantaneous Minimum limit is 6.0 SU and reported value was 5.9 SU.	Historical performance indicates that pH decreases in the late summer and fall as plant material begins to break-down in the natural treatment system. PH fluctuates diurnally, as plant material takes up carbon dioxide from the wastewater during photosynthesis; indicating that it is unlikely that pH remained below the minimum throughout the compliance period.
955723	8/5/2013	DMON	Failure to meet Minimum Level for Priority Pollutant.	There was one instance of failing to meet narrative requirements specified in Waste Discharge Requirements for the City of Arcata. Due to matrix interference the sample collected for Bis (2-ethylhexyl) Phthalate had a dilution factor of 10. As a result, the reporting level for the constituent was raised above the minimum level specified in Table E-1 Test Methods and Minimum Levels for Priority Pollutants of the Monitoring and Reporting Program.
957555	8/5/2013	CAT2	Dichlorobromomethane Daily Maximum limit is 1.12 ug/L and reported value was 2.2 ug/L.	Historical performance indicates that dichlorobromomethane occurs occasionally but not consistently, indicating that it is unlikely that dichlorobromomethane levels remained above the effluent limit throughout the compliance period. Dichlorobromomethane is a common disinfection byproduct and may be a result of chlorinating wastewater for disinfection. The City is in the planning stages of treatment plant upgrades which will replace chlorination with UV as the primary disinfectant. The City is required to begin using UV its primary disinfectant no later than December 1, 2016.
957552	7/31/2013	Deficient Reporting	A deficient reporting violation, with an occurrence date of July 31, 2013, is reported in this SMR for failure to report the results of a Chronic Whole Effluent Toxicity (WET) test on Effluent-001 in the July 2013 SMR.	A summary table of WET testing results and complete laboratory reports for WET tests conducted in Quarter 3 2013 are attached.
954473	6/30/2013	Deficient Reporting	Failed to report daily Total Residual Chlorine data for Effluent-002 in the June 2013 Wastewater Monthly Report.	A table of daily Total Residual Chlorine data for Effluent-002 for the reporting period of June 1-31, 2013 is attached.
952200	6/24/2013	CTOX	Chronic Toxicity 3-Sample Median limit is 1.0 TUc and reported value was 1.3 TUc.	Results of week 3 of 4 of accelerated monitoring.
952201	6/10/2013	CTOX	Chronic Toxicity 3-Sample Median limit is 1.0 TUc and reported value was 1.3 TUc.	Results of week 2 of 4 of accelerated monitoring.
952199	6/3/2013	CTOX	Chronic Toxicity 3-Sample Median limit is 1.0 TUc and reported value was 1.3 TUc.	Results of week 1 of 4 of accelerated monitoring.
950312	5/31/2013	CAT2	Copper, Total Monthly Average limit is 2.9 ug/L and reported value was 3.9 ug/L.	A Water Effect Ratio (WER) study for discharges of copper was submitted tot he Regional Water Quality Control Board in December 2012 for consideration of applying a site-specific WER for discharges of copper at discharge monitoring location Outfall-001
950310	5/31/2013	CAT2	Dichlorobromomethane Monthly Average limit is 0.56 ug/L and reported value was 0.76 ug/L.	Historical performance indicates that dichlorobromomethane occurs occasionally but not consistently, indicating that it is unlikely that dichlorobromomethane levels remained above the effluent limit throughout the compliance period. Dichlorobromomethane is a common disinfection byproduct and may be a result of chlorinating wastewater for disinfection. The City is in the planning stages of treatment plant upgrades which will replace chlorination with UV as the primary disinfectant. The City is required to begin using UV its primary disinfectant no later than December 1, 2016.
950311	5/13/2013	CTOX	Chronic Toxicity 3-Sample Median limit is 0 Pass/Fail (Pass = 0, Fail = 1) and reported value was 1 Pass/Fail (Pass = 0, Fail = 1).	A chronic Whole Effluent Toxicity (WET) test conducted May 5-13, 2013 showed a significant reduction in reproduction at 100% effluent concentration, resulting in a single-test TUc of 1.3 and a three-sample median greater than 1TUc for the reproduction test, triggering accelerated monitoring for chronic WET. The City was in receipt of initial sample results which indicated an exceedance of the chronic toxicity trigger on May 21, 2013. Accelerated monitoring commenced on June 3, 2013.
948881	4/30/2013	CAT2	Copper, Total Monthly Average limit is 2.9 ug/L and reported value was 5.7 ug/L.	A Water Effect Ratio (WER) study for discharges of copper was submitted to the Regional Water Quality Control Board in December 2012 for consideration of applying a site-specific WER for discharges of copper at Outfall-001.
948882	4/30/2013	CAT2	Copper, Total Monthly Average limit is 4.7 ug/L and reported value was 5.7 ug/L. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	A Water Effect Ration (WER) study for discharges of copper was submitted to the Regional Water Quality Control Board in December 2012 for consideration of applying a site-specific WER for discharges of copper at discharge monitoring location Outfall-002.
984611	3/31/2013	CAT1	Total Suspended Solids (TSS) Monthly Average limit is 30 mg/L and reported value was 34 mg/L at EFF-001.	Flow rates throughout the treatment system were adjusted throughout the month in an effort to provide longer residence time in the treatment marshes. Actual decreases in total suspended concentration were not realized until the beginning of April.
947224	3/31/2013	CAT1	Total Suspended Solids (TSS) Monthly Average limit is 575 lb/day and reported value was 606 lb/day.	Flow rates throughout the treatment system were adjusted throughout the month in an effort to provide longer residence time in the treatment marshes. Actual decreases in total suspended concentration were not realized until the beginning of April.

947223	3/31/2013	CAT1	Total Suspended Solids (TSS), Percent Removal Monthly Average limit is 85 % and reported value was 82 %.	Flow rates throughout the treatment system were adjusted throughout the month in an effort to provide longer residence time in the treatment marshes. Actual decreases in total suspended concentration were not realized until the beginning of April.
947222	3/31/2013	CAT2	Copper, Total Monthly Average limit is 2.9 ug/L and reported value was 5.0 ug/L.	A Water Effect Ration (WER) study for discharges of copper was submitted to the Regional Water Quality Control Board in December 2012 for consideration of applying a site-specific WER for discharges of copper at discharge monitoring location Outfall-001.
947220	3/31/2013	CAT2	Copper, Total Recoverable Monthly Average limit is 4.7 ug/L and reported value was 5.0 ug/L at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs. Should be treated as Non15 discharge.	A Water Effect Ration (WER) study for discharges of copper was submitted to the Regional Water Quality Control Board in December 2012 for consideration of applying a site-specific WER for discharges of copper at discharge monitoring location Outfall-002.
946663	3/14/2013	Order Conditions	4. Standard Provision IV.A of Attachment D to Order No. R1-2012-0035 requires that records of all monitoring information be retained, including calibration and maintenance records. Primary facility representative indicated that flow meters have not been calibrated recently and flow meter calibration records could not be located for review.	
946654	3/14/2013	Order Conditions	Provision I.C. of the MRP requires that ?Laboratories analyzing monitoring samples shall be certified by the Department of Health Services, in accordance with the provisions of Water Code section 13176, and must include quality assurance/quality control data with their reports. c. The 15 minute hold time for pH was exceeded on numerous occasions during the period of review (November 2012 through February 2013).	
946652	3/14/2013	Order Conditions	Provision I.C. requires that ?Laboratories analyzing monitoring samples shall be certified by the Department of Health Services, in accordance with the provisions of Water Code section 13176, and must include quality assurance/quality control data with their reports.? a. The laboratory does not follow QA/QC procedures or written SOPs and has not recently conducted proficiency testing for in-house analyses (i.e., temperature, pH, chlorine residual, and dissolved oxygen).	
946653	3/14/2013	Order Conditions	Provision I.C.of the MRP requires that ?Laboratories analyzing monitoring samples shall be certified by the Department of Health Services, in accordance with the provisions of Water Code section 13176, and must include quality assurance/quality control data with their reports.? b. Analytical records for pH and chlorine residual analyses do not include the time of analysis to demonstrate that samples are analyzed within 15 minutes of sample collection.	
947225	3/5/2013	DMON	Due to a laboratory logging error at the contract laboratory the sample collected for compliance with quarterly monitoring requirements for carbon tetrachloride had a dilution factor of 5. As a result, the reporting level for that constituent was raised above the minimum level specified in Table E-1 Test Methods and Minimum Levels for Priority Pollutants of the Monitoring and Reporting Program. The laboratory report for quarterly compliance samples was received by the City of Arcata after the end of first quarter 2013 therefore we were unable to collect a resample during the monitoring period.	The contract laboratory has taken corrective action to ensure that the log-in error does not occur again in the future. Documentation of the laboratory error and correction action from the contract laboratory is included as an attachment to the March 2013 Monthly Report.

947221	3/5/2013	DMON	Due to a laboratory logging error at the contract laboratory the sample collected for compliance with quarterly monitoring requirements for dichlorobromomethane had a dilution factor of 5. As a result, the reporting level for that constituent was raised above the minimum level specified in Table E-1 Test Methods and Minimum Levels for Priority Pollutants of the Monitoring and Reporting Program. The laboratory report for quarterly compliance samples was received by the City of Arcata after the end of first quarter 2013 therefore we were unable to collect a resample during the monitoring period.	The contract laboratory has taken corrective action to ensure that the log-in error does not occur again in the future. Documentation of the laboratory error and correction action from the contract laboratory is included as an attachment to the March 2013 Monthly Report.
946661	2/28/2013	DMON	Records reviewed during 3/14/13 inspection revealed that effluent flow is not being recorded continuously as required by sections IV.A.1 (Table E-4) and IV. B.1 (Table E-5) of the MRP.	
944931	2/28/2013	CAT2	Copper, Total Monthly Average limit is 2.9 ug/L and reported value was 3.5 ug/L.	The City submitted a Water Effect Ratio study for discharges of copper to the Regional Water Quality Control Board in December 2012 with a request to re-open NPDES Permit No. CA0022713 for consideration of application of a site-specific WER for discharges of copper from monitorning locations at the Arcata Wastewater Treatment Plant.
946659	1/31/2013	DMON	Records reviewed during 3/14/13 inspection revealed that effluent flow is not being recorded continuously as required by sections IV.A.1 (Table E-4) and IV. B.1 (Table E-5) of the MRP.	
944432	1/31/2013	CAT2	Copper, Total Monthly Average limit is 2.9 ug/L and reported value was 3.5 ug/L at EFF-001.	The City of Arcata submitted a Water Effect Ratio (WER) study for discharges of copper to the Regional Water Quality Control Board in December 2012 with a request that the Board re-open NPDES Permit No. CA0022713 for consideration of applying a site-specific WER for copper for discharges from the Arcata Wastewater Treatment Facility.
946658	12/31/2012	DMON	Records reviewed during 3/14/13 inspection revealed that effluent flow is not being recorded continuously as required by sections IV.A.1 (Table E-4) and IV. B.1 (Table E-5) of the MRP.	
946657	12/31/2012	Deficient Reporting	Ammonia result for December 2012 not reported	
946656	12/31/2012	Deficient Reporting	The December 2012 eSMR is missing nitrate result for EFF-001	
942884	12/31/2012	Order Conditions	The City exceeded average monthly total residual chlorine discharge specifications at Outfall-002. Occurrence Date: 12/31/2012 Maximum Daily Effluent Limit: 0.02 mg/L Result: 0.08 mg/L	Outfall-002 is monitored continuously for the absence of total residual chlorine. However, for reporting purposes, a minimum of one grab sample is collected daily and analyzed for total residual chlorine. This reporting practice results in a high monthly average when one or more daily samples have a high total residual chlorine concentration. Continuous monitoring records indicate that with the exception of the 30-minute discharge of chlorinated effluent that occurred on December 1, 2012, total residual chlorine concentration at Outfall -002 during the month of December 2012 was 0.00 mg/L.
942890	12/31/2012	CAT2	2,3,7,8-TCDD (Dioxin) Monthly Average limit is 0.013 pg/L and reported value was 0.28 pg/L.	A single sample for 2,3,7,8-TCDD equivalents is collected for compliance with quarterly compliance requirements. Historical performance indicates that 2,3,7,8-TCDD equivalents occur occasionally but not consistently, indicating that it is unlikely that 2,3,7,8-TCDD equivalent levels remained above the effluent limit throughout the compliance period. Certain chemicals have been shown to form polychlorinated dibenzodioxin compounds during wastewater disinfection. The City is in the planning stages of treatment plant upgrade which will replace chlorination with UV as the primary disinfectant. The City is required to begin using UV as its primary disinfectant no later than December 1, 2016.
942893	12/31/2012	CAT2	Copper, Total Monthly Average limit is 2.9 ug/L and reported value was 3.7 ug/L.	On December 20, 2012 the City of Arcata submitted a final report titled ?Determination of the Water-Effect Ratio for Copper using Ceriodaphnia dubia in Toxicity Testing of Discharged Effluent at Outfalls in the Arcata Wastewater Treatment Facility? with a request that the Regional Water Quality Control Board reopen Order No. R1-2012-0031 for consideration of applying a site-specific WER to copper discharges from the Arcata Wastewater Treatment Facility.
942892	12/31/2012	CAT2	Dichlorobromomethane Monthly Average limit is 0.56 ug/L and reported value was 0.7 ug/L.	A single sample for dichlorobromomethane is collected each quarter for compliance with monitoring requirements. Historical performance indicates that dichlorobromomethane occurs occasionally but not consistently, indicating that it is unlikely that dichlorobromomethane levels remained above the effluent limit throughout the compliance period. Dichlorobromomethane is a common disinfection byproduct and may be a result of chlorinating wastewater for disinfection. The City is in the planning stages of treatment plant upgrades which will replace chlorination with UV as the primary disinfectant. The City is required to begin using UV its primary disinfectant no later than December 1, 2016.
942891	12/10/2012	CAT2	2,3,7,8-TCDD (Dioxin) Daily Maximum limit is 0.026 pg/L and reported value was 0.28 pg/L.	A single sample for 2,3,7,8-TCDD equivalents is collected for compliance with quarterly compliance requirements. Historical performance indicates that 2,3,7,8-TCDD equivalents occur occasionally but not consistently, indicating that it is unlikely that 2,3,7,8-TCDD equivalent levels remained above the effluent limit throughout the compliance period. Certain chemicals have been shown to form polychlorinated dibenzodioxin compounds during wastewater disinfection. The City is in the planning stages of treatment plant upgrade which will replace chlorination with UV as the primary disinfectant. The City is required to begin using UV as its primary disinfectant no later than December 1, 2016.
942886	12/8/2012	CAT1	Total Suspended Solids (TSS) Weekly Average limit is 1900 lb/day and reported value was 2200 lb/day at EFF-001.	Non-compliance occurred because actual effluent flow rate exceeded the maximum allowable flow rate used in the wet weather mass-loading emissions calculation.
942888	12/2/2012	CAT1	Settleable Solids Daily Maximum limit is 0.2 ml/L and reported value was 0.4 ml/L.	The City anticipates that this type of non-compliance will occur less often once Treatment Marshes 5 and 6 are fully established and in regular use since this will provide additional treatment capacity within the treatment marshes. Marshes 5 and 6 are expected to be in regular use after the next growing season.

942885	12/2/2012	CAT1	Settleable Solids Daily Maximum limit is 0.2 ml/L/hr and reported value was 0.4 ml/L/hr at EFF-002. *** MMP Exempt Reason:The receiving water for Outfall 002 is not designated as a water of the United States, so is not subject to MMPs.	Due to the high rainfall experienced during this time period the Oxidation Ponds were near capacity. The Pond 2 Storm Pumps were operated to expedite the flow of water through the treatment plant. High settleable solids are expected when Pond 2 Storm Pumps are operated since this diverts a portion of Pond 2 effluent around the treatment marshes and directly into the chlorine contact basin. The City anticipates that this type of non-compliance will occur less often once Treatment Marshes 5 and 6 are fully established and in regular use since this will provide additional treatment capacity within the treatment marshes. Marshes 5 and 6 are expected to be in regular use after the next growing season.
942894	12/1/2012	CAT2	Chlorine, Total Residual Daily Maximum limit is 0.02 mg/L and reported value was 0.05 mg/L at EFF-002. *** MMP Exempt Reason:This outfall does not discharge to a water of the U.S., therefore is not subject to CWC 13385.	The Wastewater Treatment Plant experienced an upset which resulted in the discharge of chlorinated effluent tat Outfall-002. The WWTP experienced a power surge which caused the Water Champ chemical feed pump that feeds sulfur dioxide to the chlorine contact basin to trip. For unknown reasons, the chemical feed pump failed to automatically reset after the power surge. Based on operational records, this incident lasted for 30 minutes. During this period of time approximately 16,400 gallons were discharged to Arcata Marsh and Wildlife Sanctuary through discharge point Effluent-002. The total residual chlorine concentration of a sample collected immediately after turning the chemical feed pump back on was 2.36 mg/L. A complete report documenting this upset was submitted to Lisa Bernard on December 5, 2012 and is included as an attachment in this self-monitoring report. By December 1, 2016 the City will complete treatment plant upgrades including the installation of a UV disinfection system for primary disinfection. Under the new configuration, Outfall-002 will no longer be chlorinate/dechlorinated.
942887	12/1/2012	CAT2	Chlorine, Total Residual Daily Maximum limit is 0.02 mg/L and reported value was 0.073 mg/L at EFF-001.	By December 1, 2016 the City will complete treatment plant upgrades including the installation of a UV disinfection system for primary disinfection. The current disinfection system will be evaluated leading up to treatment plant upgrades to determine if it will continue to be used for emergency discharges (i.e. flows greater than 5.9 MGD after Effluent-003 is established) or if an alternate disinfection system will be used.
946660	11/30/2012	DMON	Records reviewed during 3/14/13 inspection revealed that effluent flow is not being recorded continuously as required by sections IV.A.1 (Table E-4) and IV. B.1 (Table E-5) of the MRP.	
941291	11/30/2012	CAT2	Copper, Total Recoverable Monthly Average limit is 2.9 ug/L and reported value was 3.8 ug/L.	A Water Effect Ratio study for discharges of copper was submitted to the Regional Water Quality Control Board on December 20, 2012.
940074	10/31/2012	CAT2	Copper, Total Monthly Average limit is 2.9 ug/L and reported value was 3.2 ug/L.	A copper Water Effect Ratio (WER) study is underway. The WER study report is scheduled to be submitted to the Regional Water Quality Control Board on December 21, 2012.
938766	9/30/2012	CAT2	Copper, Total Monthly Average limit is 2.9 ug/L and reported value was 3.3 ug/L.	A copper Water Effect Ration (WER) study is underway. The WER study report is scheduled to be submitted to the Regional Water Quality Control Board on December 21, 2012.
938764	8/31/2012	CAT2	Carbon Tetrachloride Monthly Average (Mean) limit is 0.25 ug/L and reported value was 0.8 ug/L.	Carbon tetrachloride is a disinfection byproduct and may be a result of chlorinating wastewater for disinfection. Research has also shown that carbon tetrachloride is sometimes used for cleaning the inside of chlorine storage vessels and may end up as an impurity in chlorine. The City is in the planning stages of treatment plant upgrades which will replace chlorination with UV as the primary disinfectant. The City is required to begin using UV its primary disinfectant no later than December 1, 2016.
938765	8/31/2012	CAT2	Copper, Total Monthly Average (Mean) limit is 2.9 ug/L and reported value was 3.3 ug/L.	At this time the City has contracted for a copper Water Effects Ratio (WER) study to be performed on treatment plant effluent. The WER is scheduled to be submitted to the Regional Water Quality Control Board on December 21, 2012.
938762	8/31/2012	CAT2	Dichlorobromomethane Monthly Average limit is 0.56 ug/L and reported value was 2.2 ug/L.	Dichlorobromomethane is a common disinfection byproduct and may be a result of chlorinating wastewater for disinfection. The City is in the planning stages of treatment plant upgrades which will replace chlorination with UV as the primary disinfectant. The City is required to begin using UV its primary disinfectant no later than December 1, 2016.
938763	8/28/2012	CAT2	Carbon Tetrachloride Daily Maximum limit is 0.50 ug/L and reported value was 0.8 ug/L at EFF-001.	Carbon tetrachloride is a disinfection byproduct and may be a result of chlorinating wastewater for disinfection. Research has also shown that carbon tetrachloride is sometimes used for cleaning the inside of chlorine storage vessels and may end up as an impurity in chlorine. The City is in the planning stages of treatment plant upgrades which will replace chlorination with UV as the primary disinfectant. The City is required to begin using UV its primary disinfectant no later than December 1, 2016.
984608	8/28/2012	CAT2	Dichlorobromomethane Daily Maximum limit is 1.12 ug/L and reported value was 2.2 ug/L at EFF-001.	
935634	7/31/2012	CAT2	Copper, Total Recoverable Monthly Average (Mean) limit is 2.8 ug/L and reported value was 3.6 ug/L.	The City has initiated a Water-Effect Ratio (WER) study for copper. We anticipate that the study will conclude later this year.
931859	6/30/2012	CAT2	Copper, Total Recoverable Monthly Average limit is 2.8 ug/L and reported value was 4.2 ug/L.	WER for copper in project development stage.

APPENDIX C – FLOW AND LOAD DATA ANALYSIS

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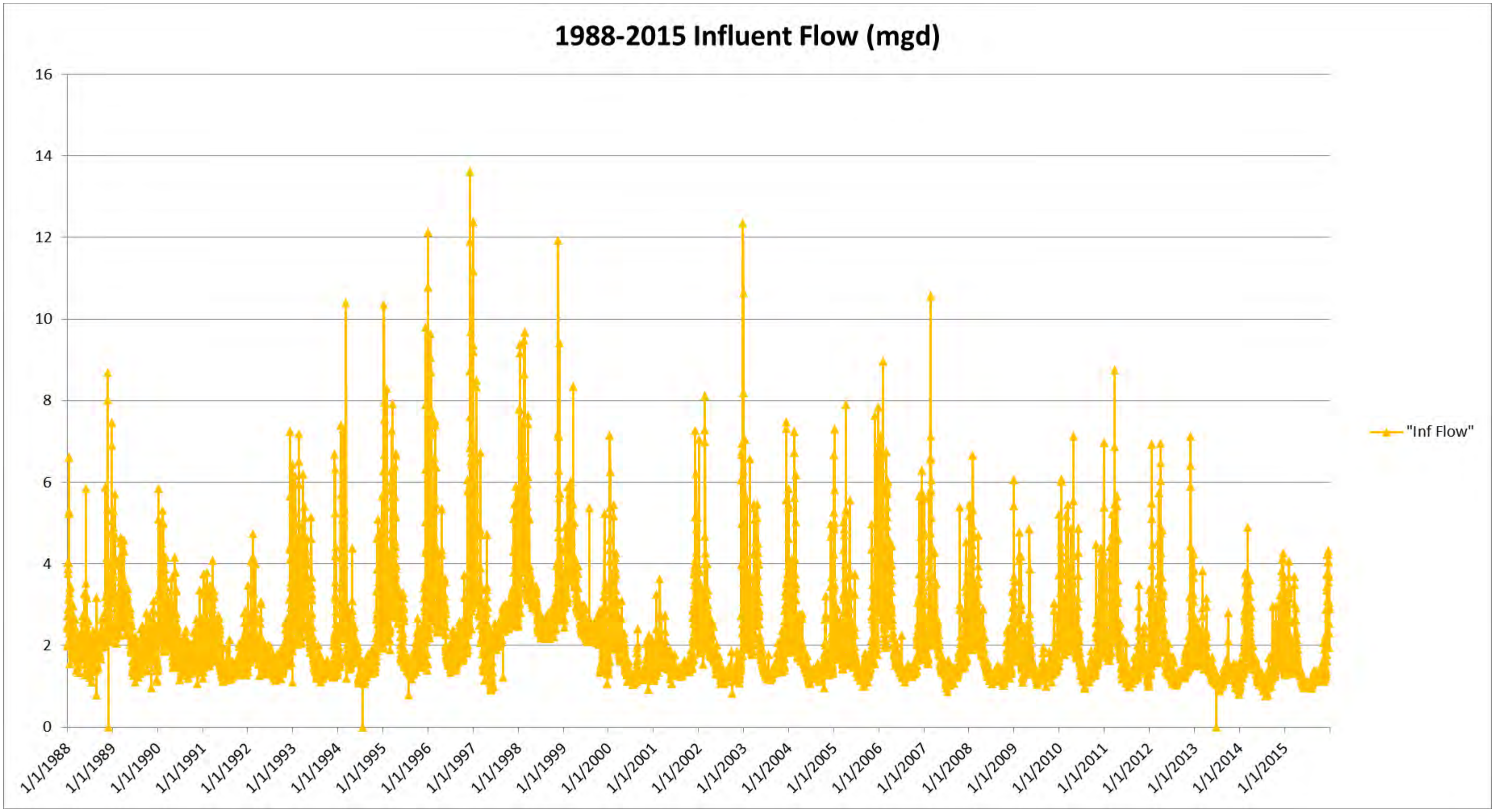
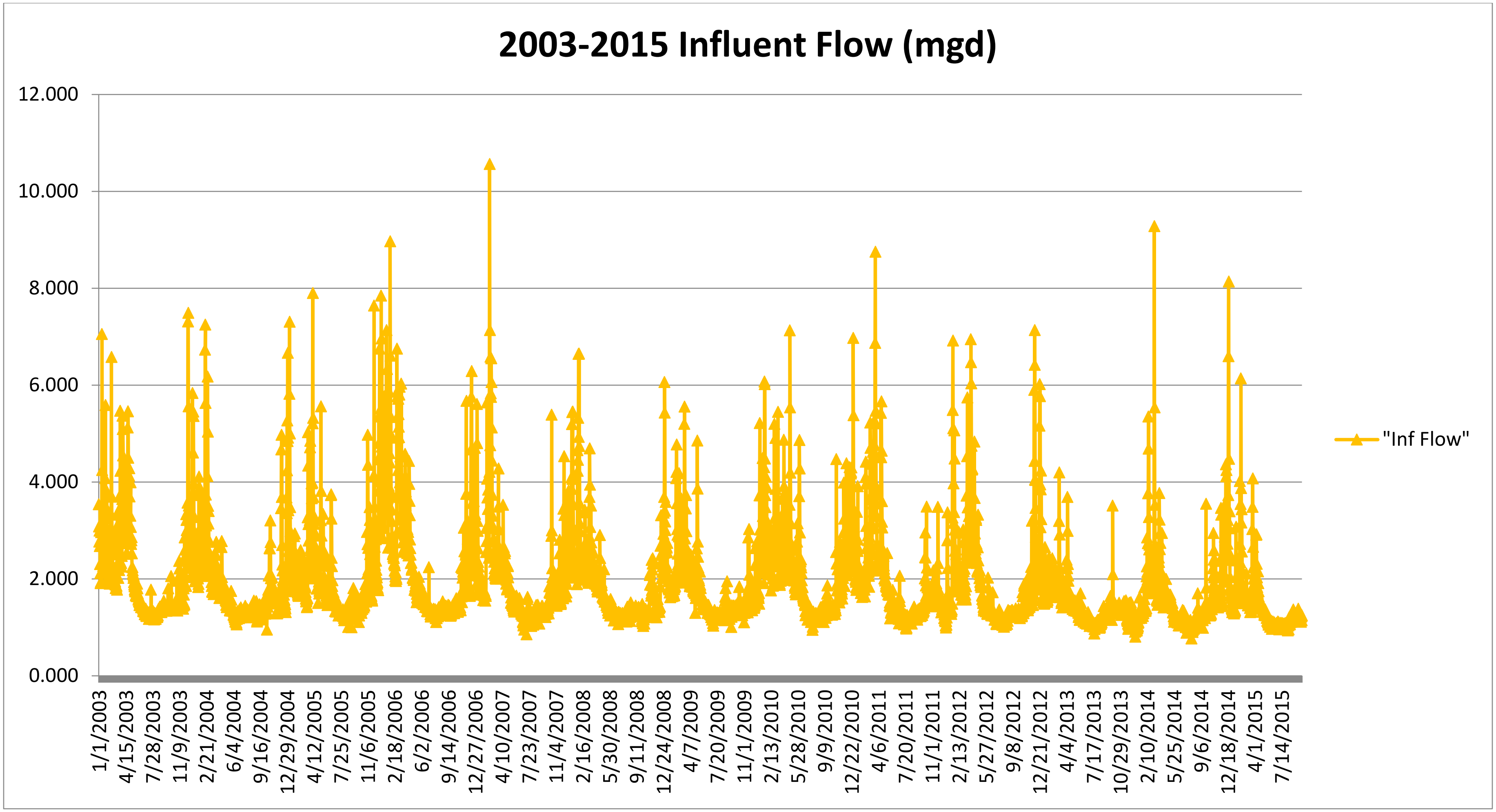
WASTEWATER TREATMENT FACILITY IMPROVEMENTS PROJECT
CITY OF ARCATA



1988-2015 Flow at Percentiles:

50	1.796	mgd
75	2.505	mgd
90	3.4364	mgd
95	4.277	mgd
98	5.67536	mgd
99	6.65164	mgd



2003-2015 Flow at Percentiles:

50	1.574	mgd
75	2.1855	mgd
90	3.1506	mgd
95	3.9903	mgd
99	5.93182	mgd

Example Peak Wet Weather Flows For Long Duration Dec 1996-Jan 1997

12/1/1996	3.785
12/2/1996	3.1
12/3/1996	3.183
12/4/1996	8.734
12/5/1996	7.603
12/6/1996	5.96
12/7/1996	6.849
12/8/1996	13.604
12/9/1996	11.912
12/10/1996	9.703
12/11/1996	6.527
12/12/1996	4.725
12/13/1996	3.97
12/14/1996	3.49
12/15/1996	3.332
12/16/1996	2.935
12/17/1996	2.947
12/18/1996	2.831
12/19/1996	2.404
12/20/1996	6.736
12/21/1996	7.054
12/22/1996	6.433
12/23/1996	5.991
12/24/1996	3.551
12/25/1996	3.505
12/26/1996	5.869
12/27/1996	6.515
12/28/1996	5.825
12/29/1996	6.923
12/30/1996	9.209
12/31/1996	11.178
1/1/1997	12.381

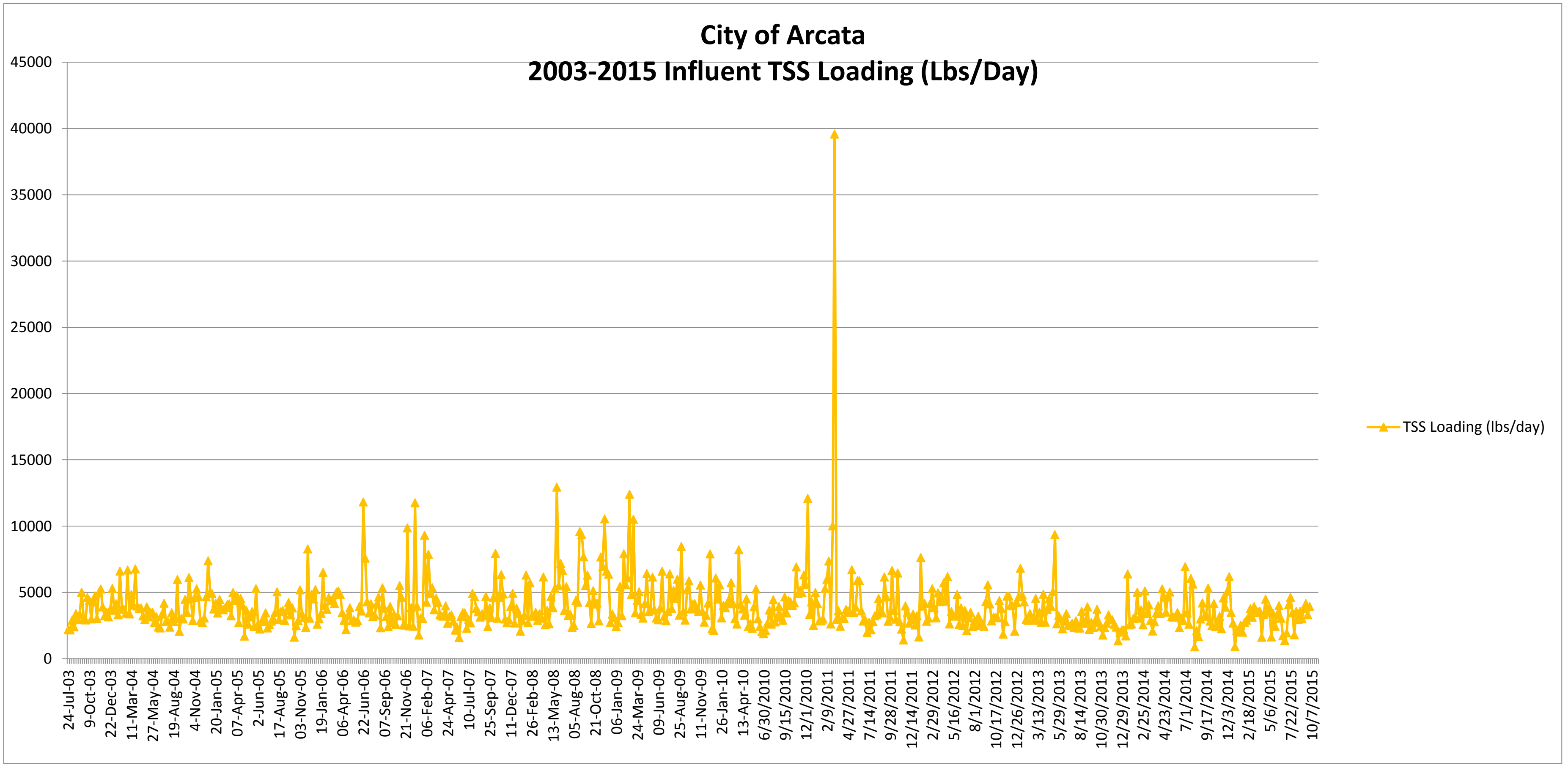
1/2/1997	9.368
1/3/1997	8.418
1/4/1997	5.969
1/5/1997	4.201
1/6/1997	4.182
1/7/1997	4.053
1/8/1997	3.567
1/9/1997	3.504
1/10/1997	3.388
1/11/1997	5.4
1/12/1997	3.191
1/13/1997	3.391
1/14/1997	3.169
1/15/1997	3.026
1/16/1997	3.321
1/17/1997	3.152
1/18/1997	3.325
1/19/1997	3.808
1/20/1997	4.403
1/21/1997	5.361
1/22/1997	4.557
1/23/1997	4.336
1/24/1997	5.726
1/25/1997	8.341
1/26/1997	8.488
1/27/1997	6.577
1/28/1997	5.744
1/29/1997	5.354
1/30/1997	4.979
1/31/1997	6.528

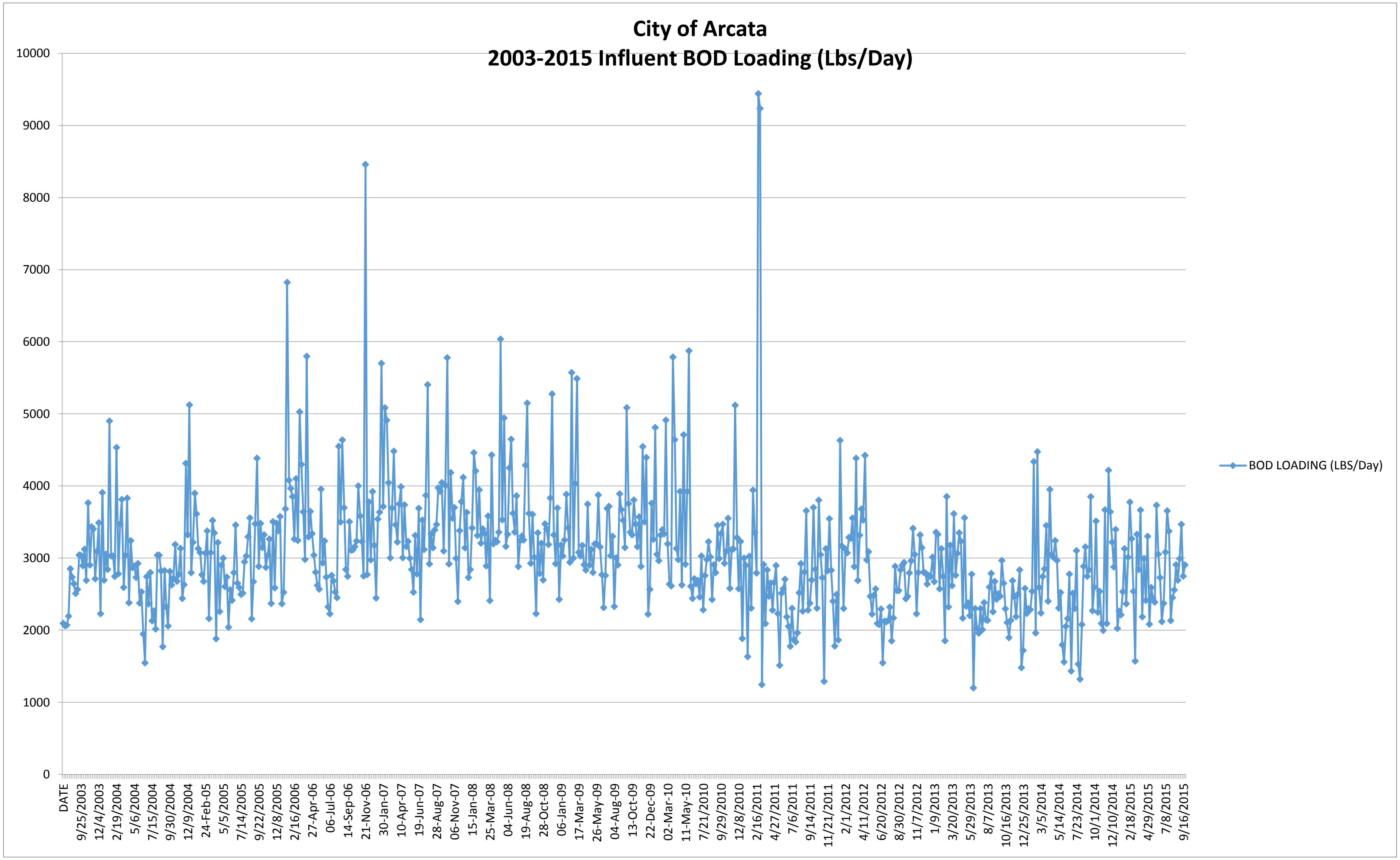
90th Percentile Influent (Pt 1) Concentration and Load

City Data Set 1988-2015 (Data by City and AMRI)			City Data Set 1988-2015 (Data by City and AMRI)			City Data Set 2003-2015[3] (Data by City)		
90th Percentile 1988-2015[1]:			90th Percentile Jul 2003-Sep/Oct2015:			90th Percentile Jul 2003-Sep/Oct 2015:		
BOD (mg/L)	268		BOD (mg/L)	276.1	Sep	BOD (mg/L)	280	Sep
TSS (mg/L)	329.6		TSS (mg/L)	337.2	Oct	TSS (mg/L)	390	Oct
NH3 (mg/L)	70.4					NH3 (mg/L)[5]	53.6	
Equiv Load at 2.3 MGD[2]						Equiv Load at 2.3 MGD[2]		
BOD (lb/d)	5140.8					BOD (lb/d)	5371.0	
TSS (lb/d)	6322.4					TSS (lb/d)	7481.0	
NH3 (lb/d)	1350.0					NH3 (lb/d)	1028.2	
90th Percentile 1988-2015[1]:			90th Percentile Jul 2003-Sep/Oct2015:			90th Percentile Jul 2003-Sep 2015[4]:		
BOD (lb/d)	4556.9		BOD (lb/d)	3893.8	Sep	BOD (lb/d)	3940	
TSS (lb/d)	5703.5		TSS (lb/d)	5023.2	Oct	TSS (lb/d)	5760	
NH3 (lb/d)	898.6					NH3 (lb/d)[5]	880	

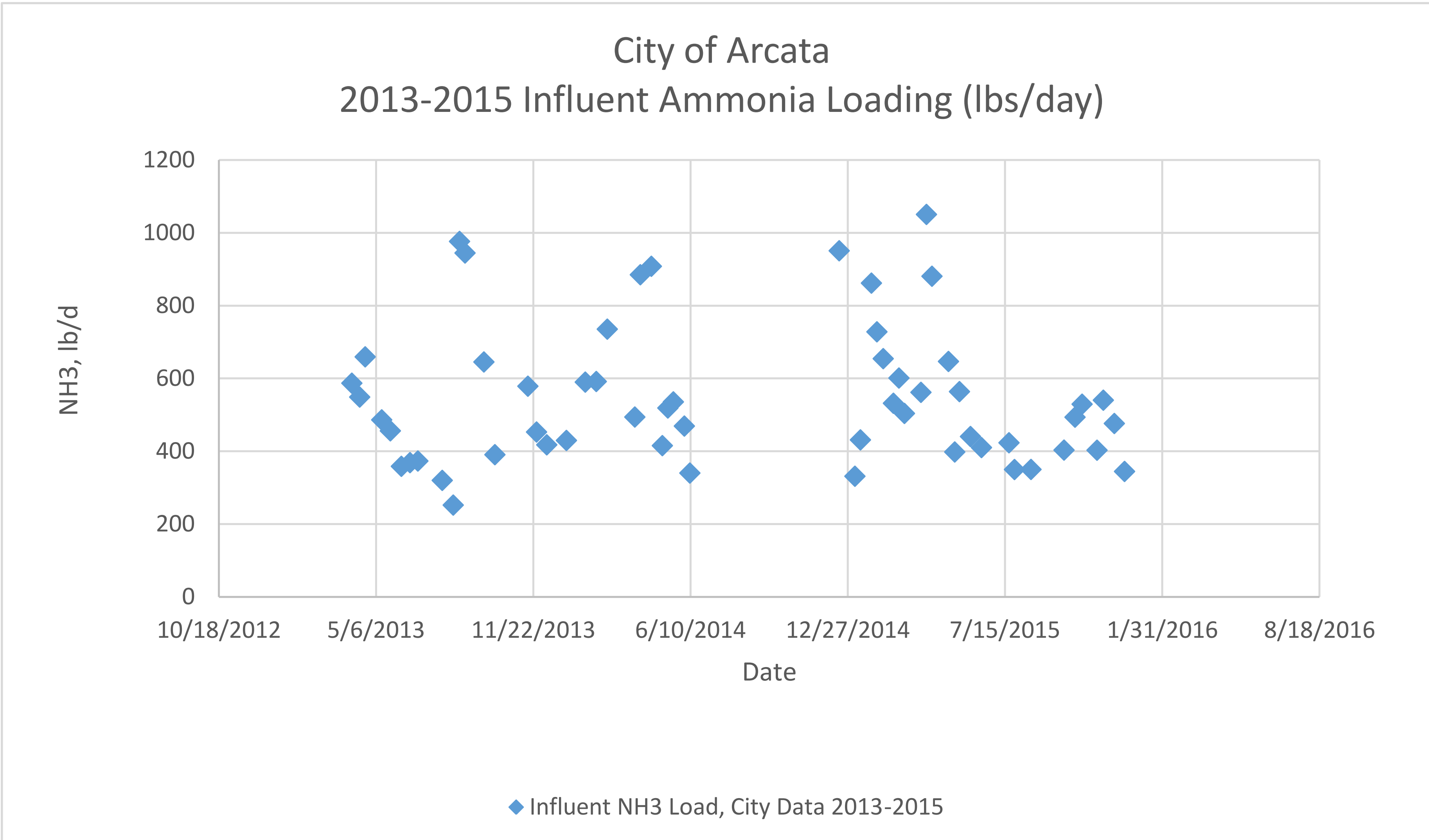
Notes:

1. BOD and TSS data (by City) provided from Jan 1988 to Dec 2015. NH3 data (by City+AMRI) provided from Feb 2011 to Dec 2015.
2. Based on the 90th percentile concentration and a peak dry weather flow of 2.3 MGD.
3. City data set from 2003 to 2015 is compliance data sent to the Regional Board. Use for flow and load projections per City on 1/27/16.
4. Flow data provided in this data set only through Sep 2015.
5. City ammonia data provided from Apr 2013 to Dec 2015. AMRI data was deleted from this data set.


City of Arcata
2003-2015 Influent TSS Loading (Lbs/Day)
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
24-Jul-03
9-Oct-03
22-Dec-03
11-Mar-04
27-May-04
19-Aug-04
4-Nov-04
20-Jan-05
07-Apr-05
2-Jun-05
17-Aug-05
03-Nov-05
19-Jan-06
06-Apr-06
22-Jun-06
07-Sep-06
21-Nov-06
06-Feb-07
24-Apr-07
10-Jul-07
25-Sep-07
11-Dec-07
26-Feb-08
13-May-08
05-Aug-08
21-Oct-08
06-Jan-09
24-Mar-09
09-Jun-09
25-Aug-09
11-Nov-09
26-Jan-10
13-Apr-10
6/30/2010
9/15/2010
12/1/2010
2/9/2011
4/27/2011
7/14/2011
9/28/2011
12/14/2011
2/29/2012
5/16/2012
8/1/2012
10/17/2012
12/26/2012
3/13/2013
5/29/2013
8/14/2013
10/30/2013
12/29/2013
2/25/2014
4/23/2014
7/1/2014
9/17/2014
12/3/2014
2/18/2015
5/6/2015
7/22/2015
10/7/2015
TSS Loading (lbs/day)



City of Arcata
2003-2015 Influent BOD Loading (Lbs/Day)
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
DATE
9/25/2003
12/4/2003
2/19/2004
5/6/2004
7/15/2004
9/30/2004
12/9/2004
24-Feb-05
5/5/2005
7/14/2005
9/22/2005
12/8/2005
2/16/2006
27-Apr-06
06-Jul-06
14-Sep-06
21-Nov-06
30-Jan-07
10-Apr-07
19-Jun-07
28-Aug-07
06-Nov-07
15-Jan-08
25-Mar-08
04-Jun-08
19-Aug-08
28-Oct-08
06-Jan-09
17-Mar-09
26-May-09
04-Aug-09
13-Oct-09
22-Dec-09
02-Mar-10
11-May-10
7/21/2010
9/29/2010
12/8/2010
2/16/2011
4/27/2011
7/6/2011
9/14/2011
11/21/2011
2/1/2012
4/11/2012
6/20/2012
8/30/2012
11/7/2012
1/9/2013
3/20/2013
5/29/2013
8/7/2013
10/16/2013
12/25/2013
3/5/2014
5/14/2014
7/23/2014
10/1/2014
12/10/2014
2/18/2015
4/29/2015
7/8/2015
9/16/2015
BOD LOADING (LBS/Day)



City of Arcata
2013-2015 Influent Ammonia Loading (lbs/day)
1200
1000
800
600
400
200
0
NH3, lb/d
10/18/2012
5/6/2013
11/22/2013
6/10/2014
12/27/2014
7/15/2015
1/31/2016
8/18/2016
Date
Influent NH3 Load, City Data 2013-2015

APPENDIX D – UNIT PROCESS FLOW DIAGRAMS

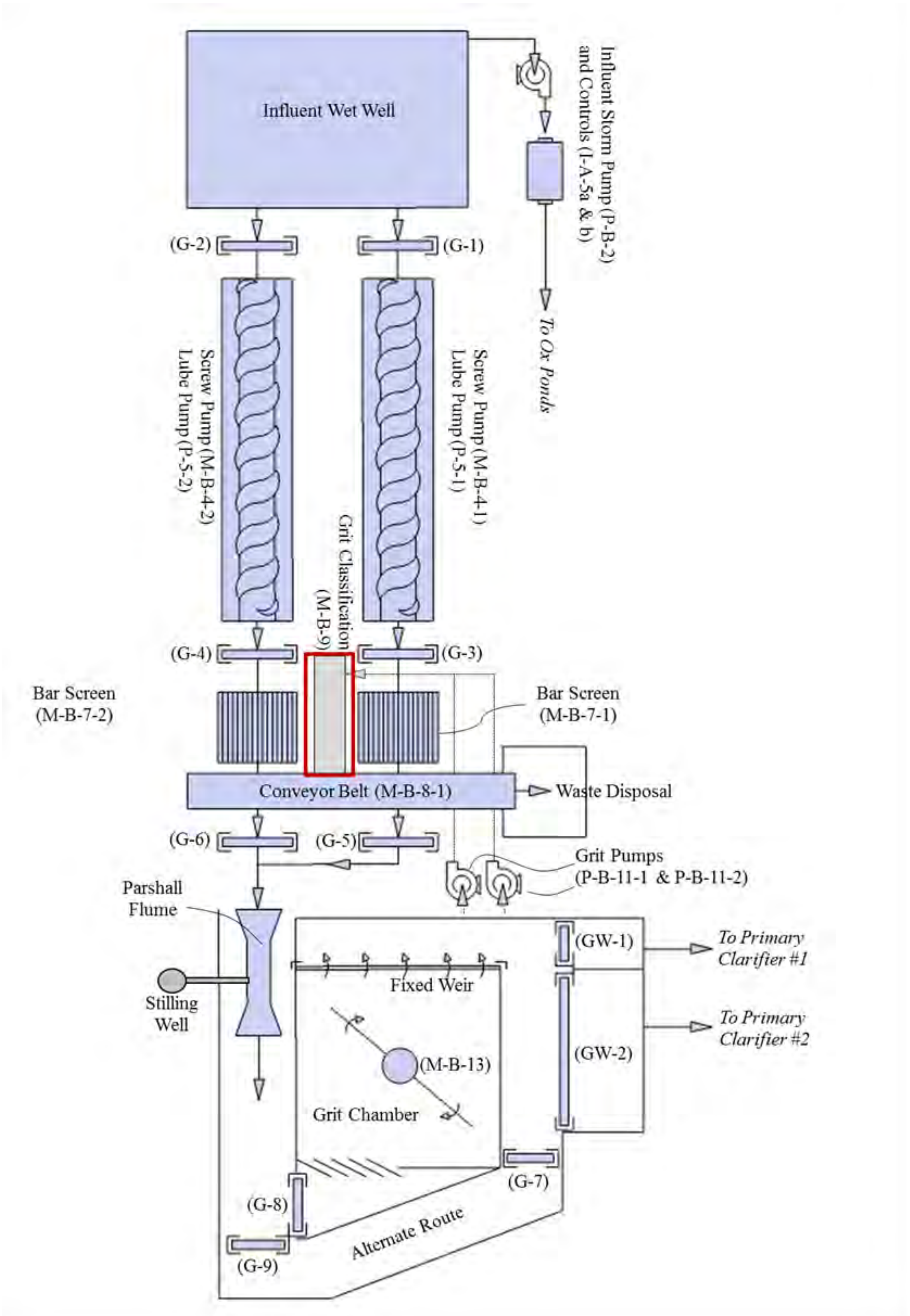


Figure D-1: Headworks Process Flow Schematic

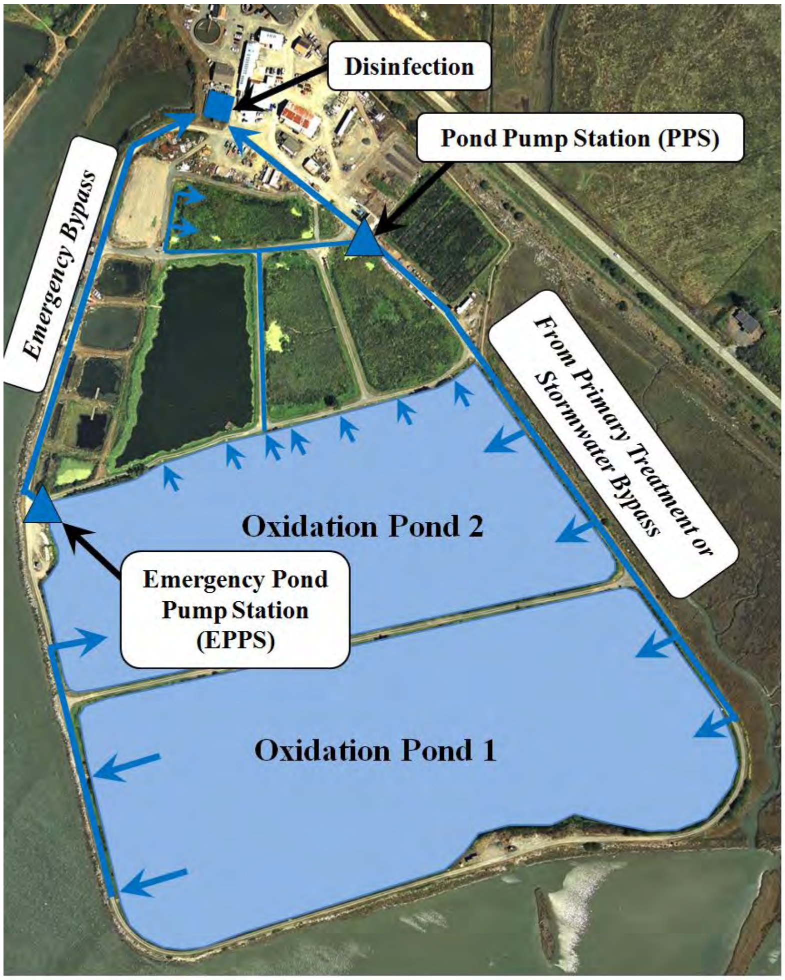


Figure D-2: Oxidation Ponds Site Aerial

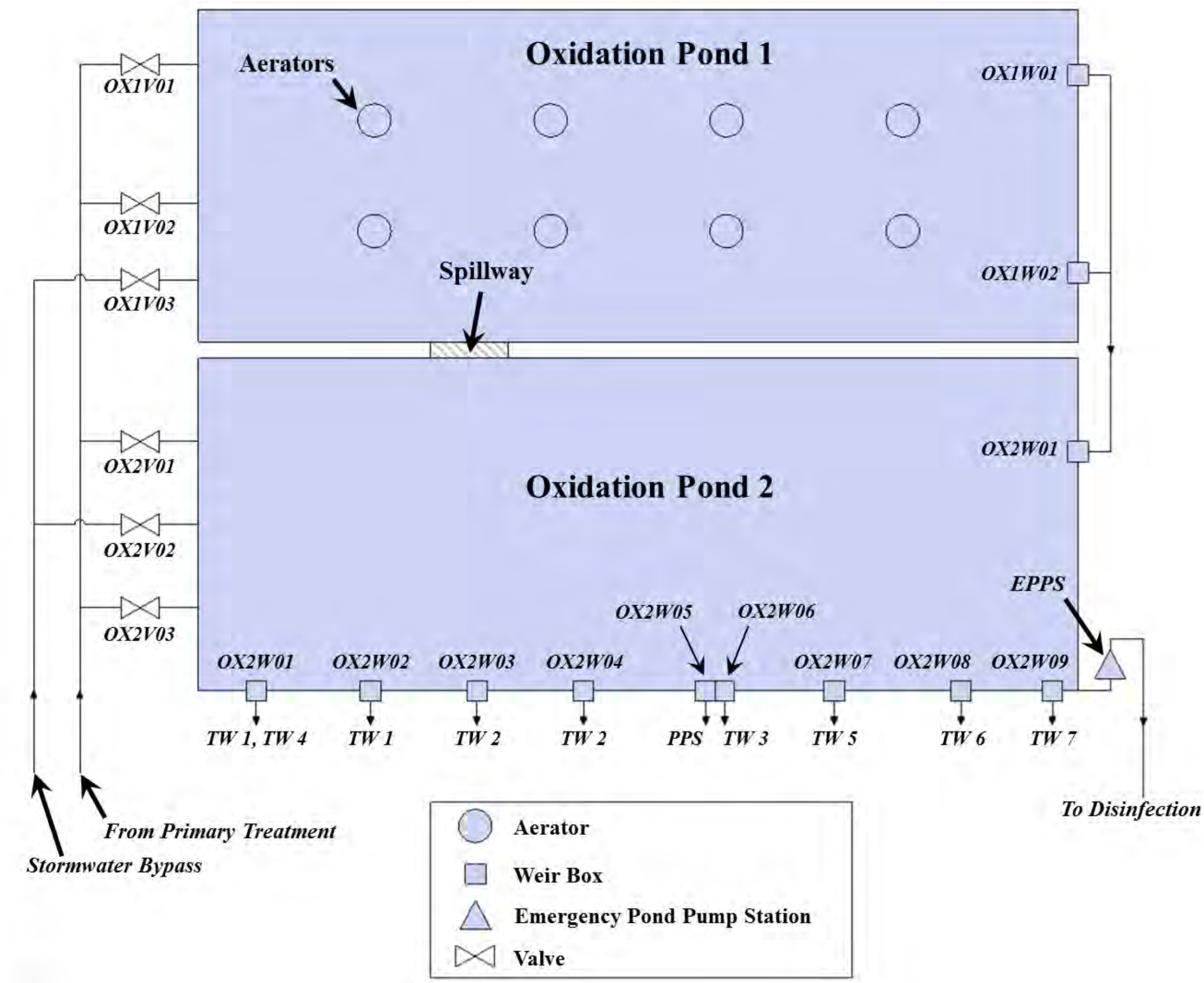


Figure D-3: Oxidation Ponds Process Flow Schematic

Figure D-4: Treatment Wetlands Site Aerial Showing Influent Weir Configurations

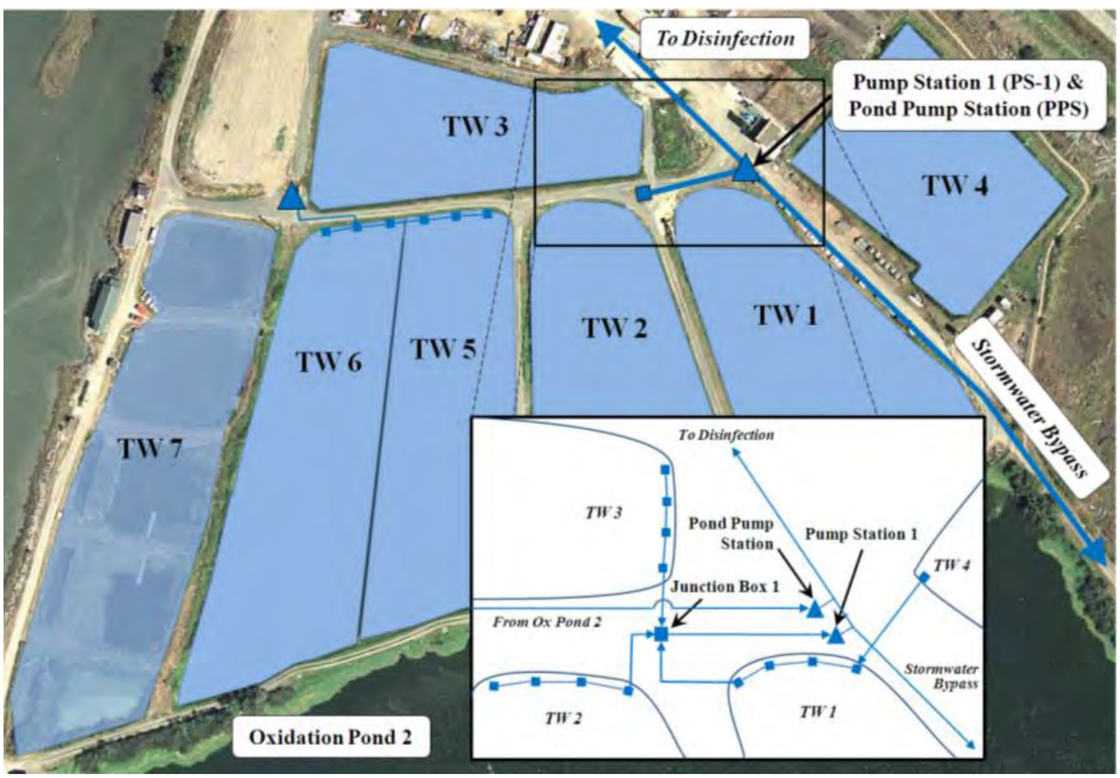


Figure D-5: Treatment Wetlands Site Aerial Showing Effluent Weir Configurations

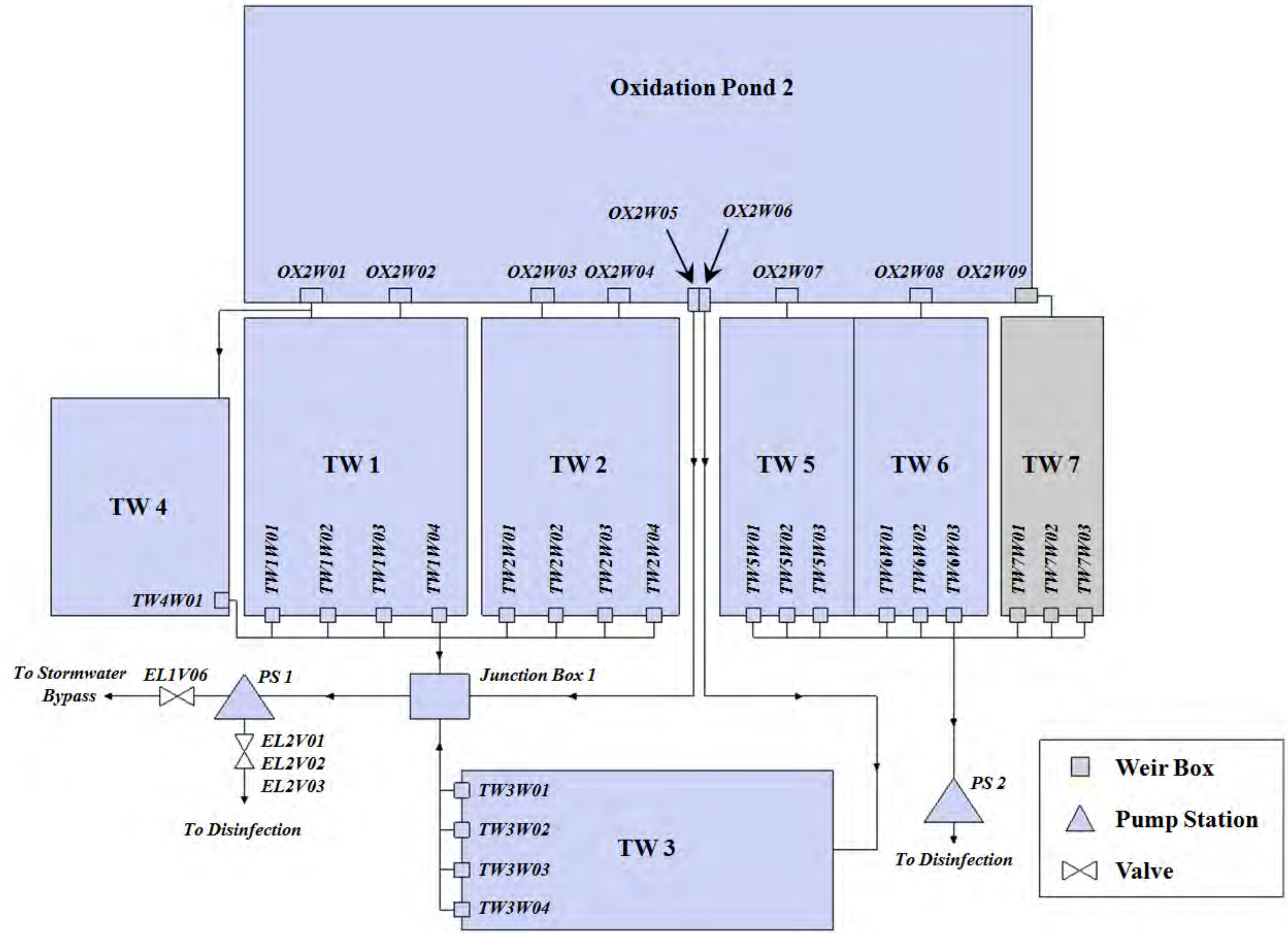


Figure D-6: Treatment Wetlands Process Flow Schematic

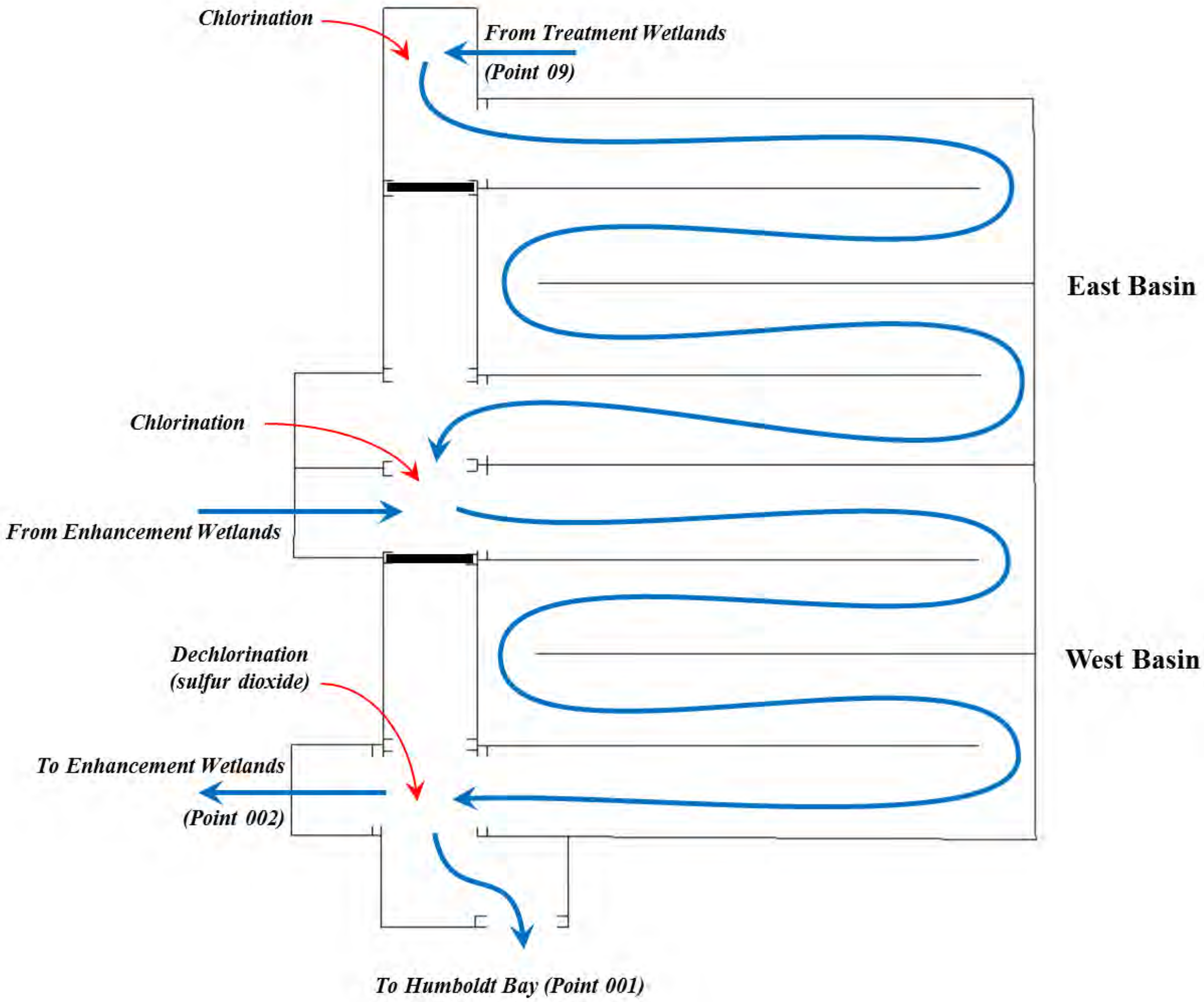


Figure D-7: Chlorine Contact Basin Process Flow Schematic - Combined Basin Mode

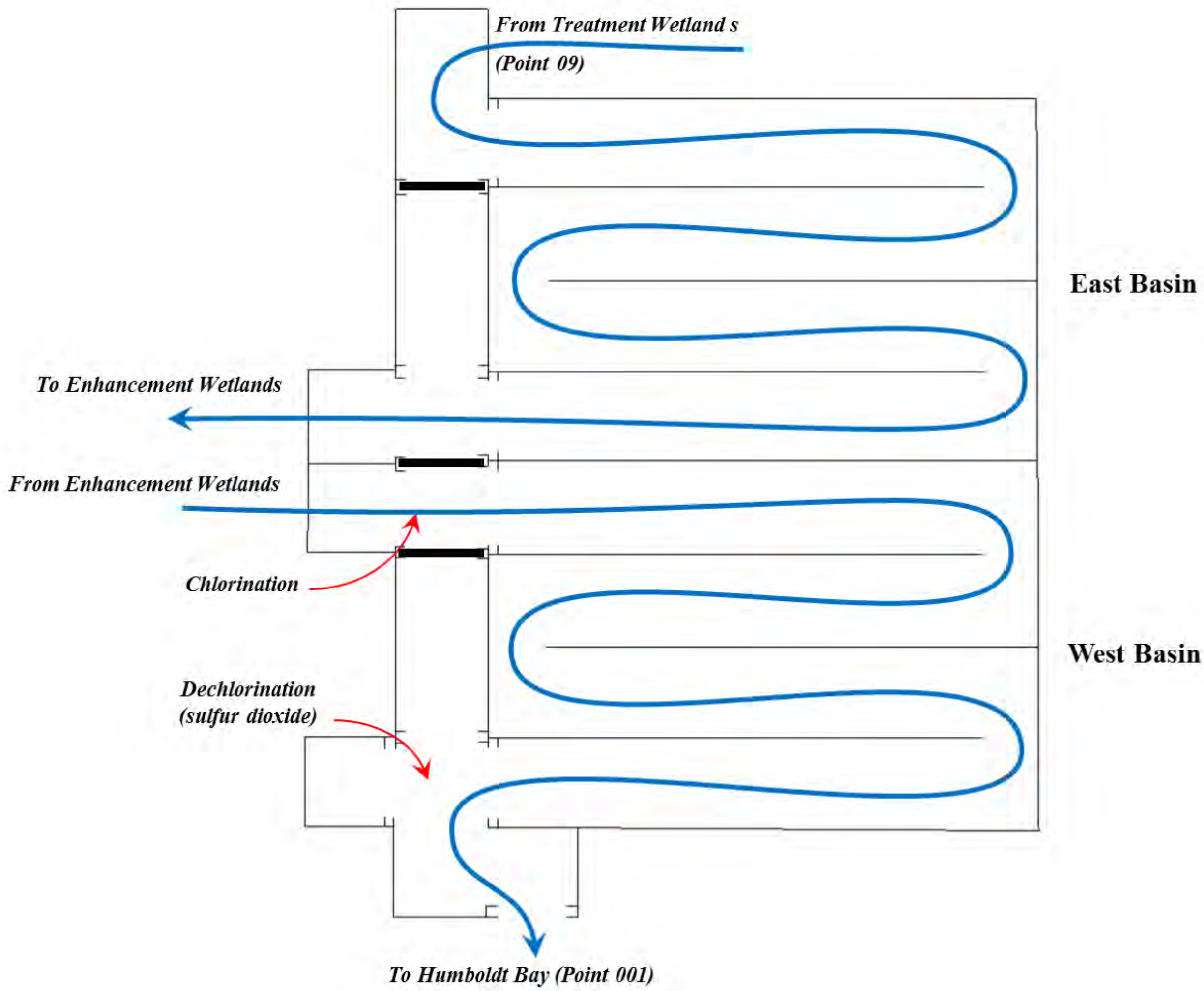


Figure D-8: Chlorine Contact Basin Process Flow Schematic - Split Basin Mode

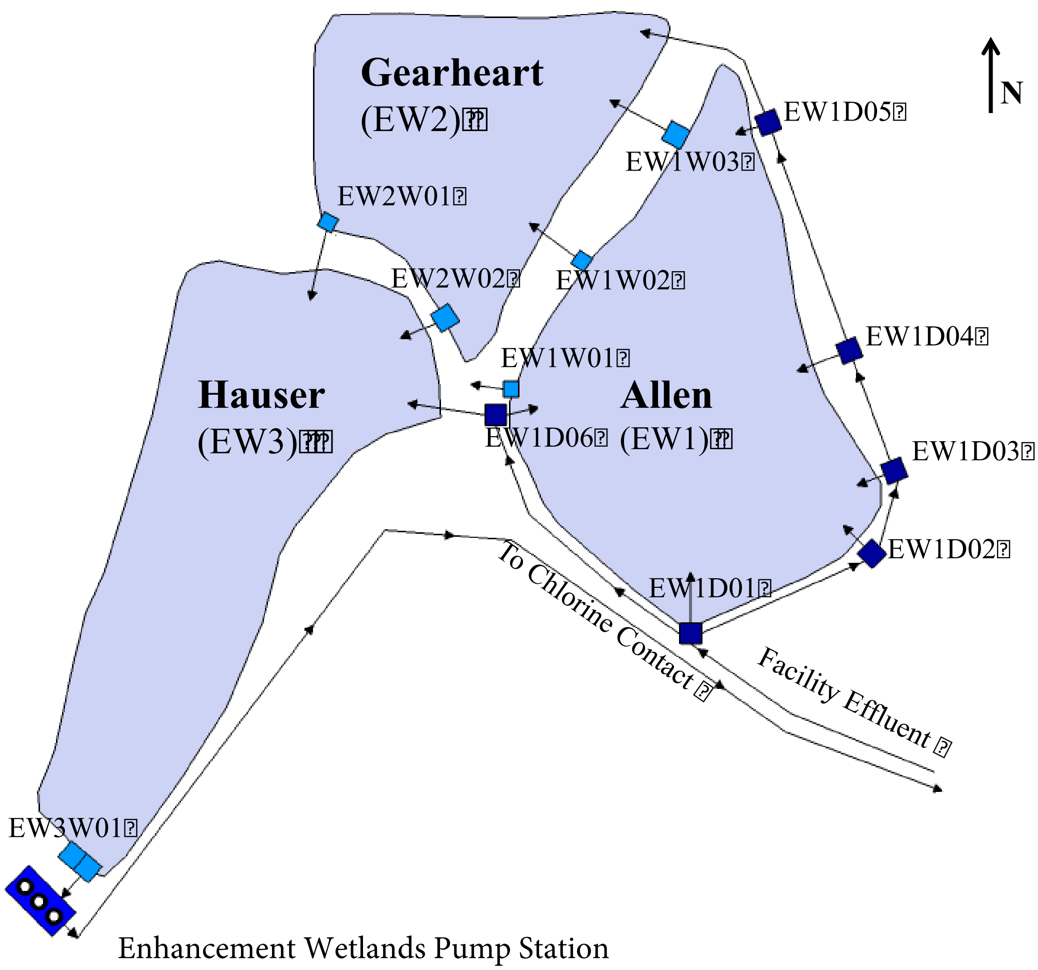
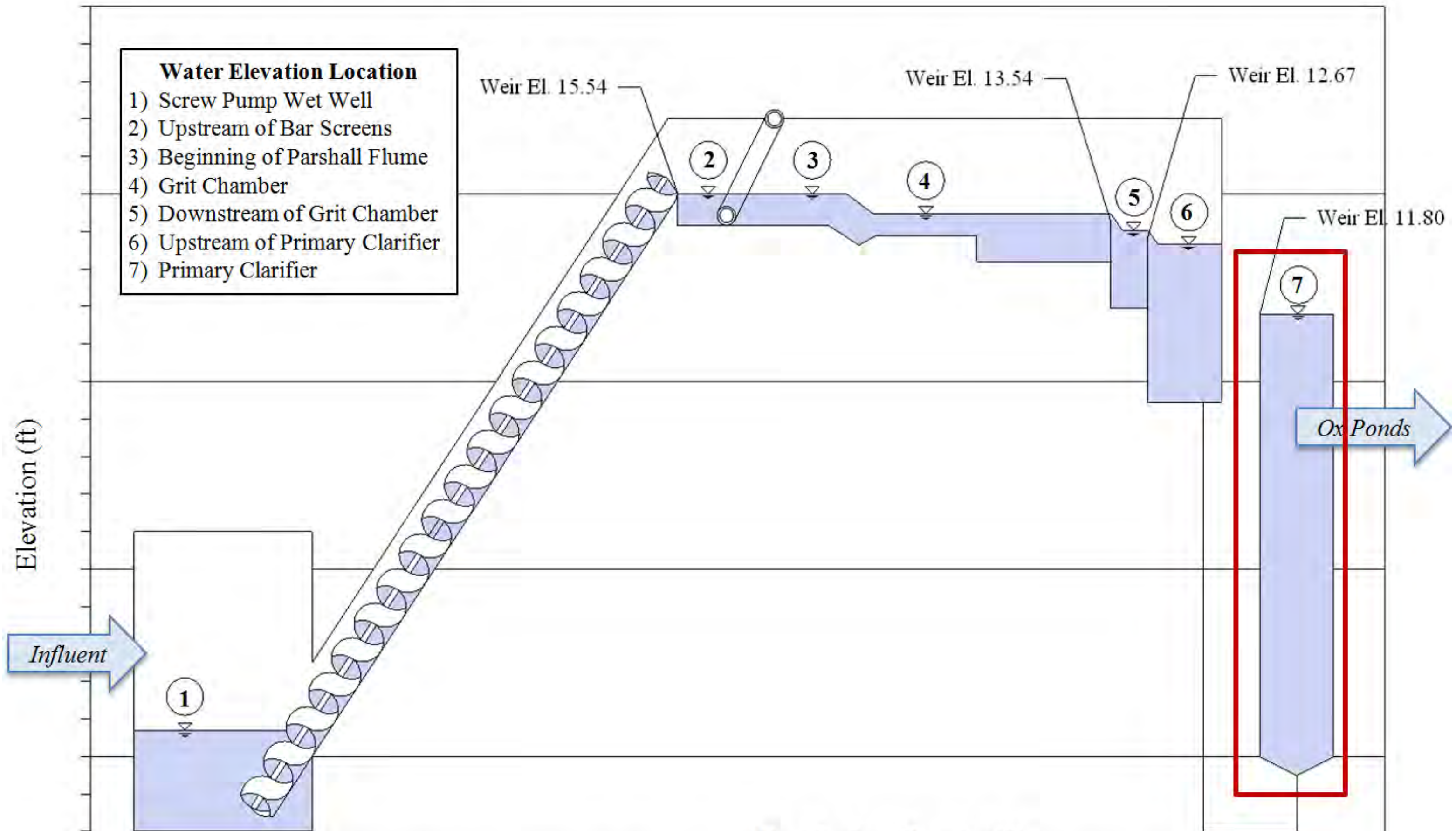


Figure D-9: Enhancement Wetlands Process Flow Schematic

APPENDIX E – EXISTING HYDRAULIC PROFILES



Water Surface Elevation (ft)

Condition	Total Influent Flow Rate	1	2	3	4	5	6	7
Min Month	1.0 MGD	0.10	14.02	13.99	13.65	12.88	11.89	11.87
Avg Annual	2.3 MGD	0.70	14.45	14.40	13.75	13.05	12.02	11.90
Peak Flow	16.5 MGD	1.75	15.07	14.99	13.87	13.29	12.42	11.94

Figure E-1: Hydraulic grade line of the headworks with the primary clarifiers highlighted by the red box.

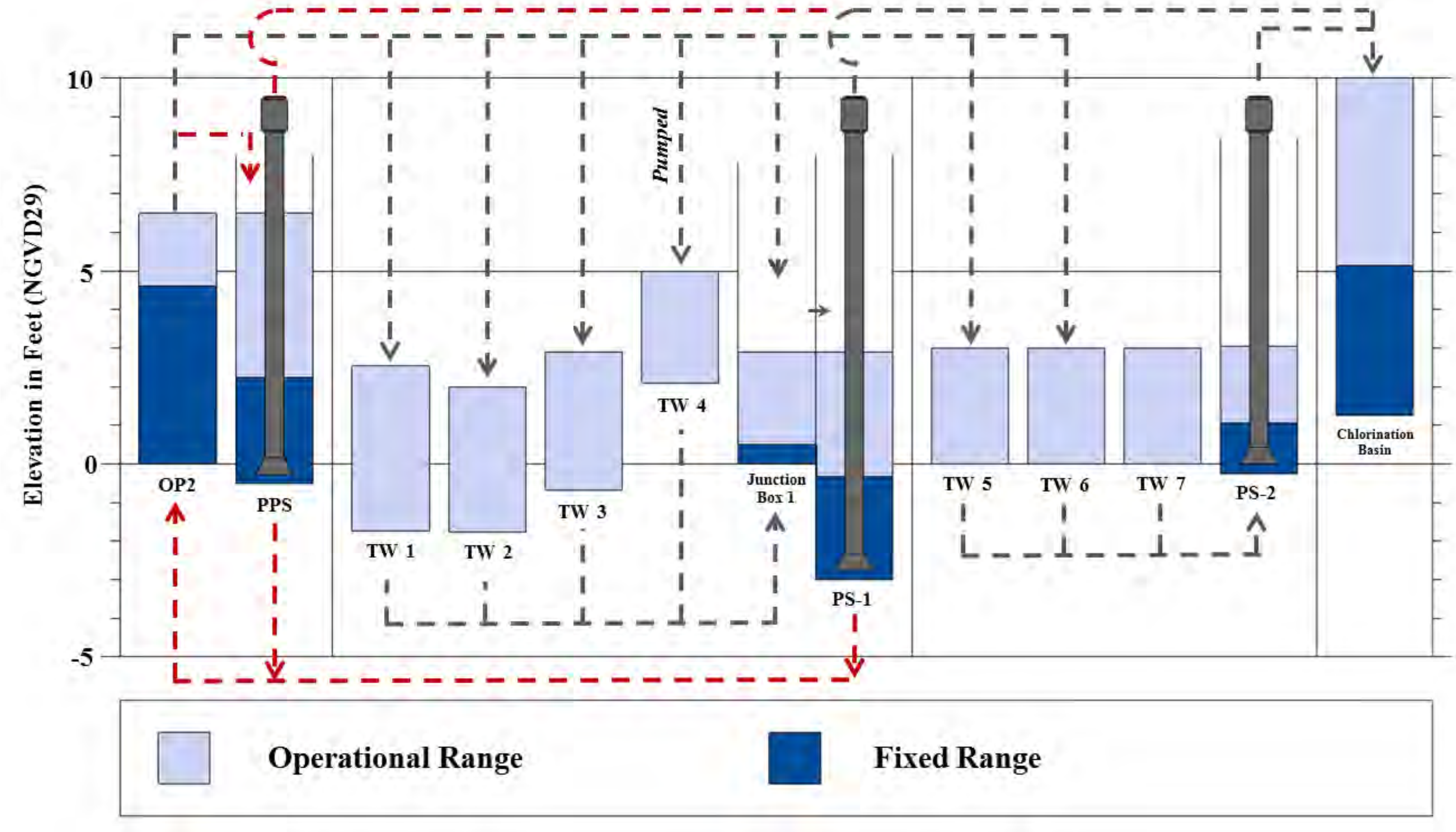


Figure E-2: Hydraulic gradeline for the TWs; red lines indicate abnormal flow routing alternatives

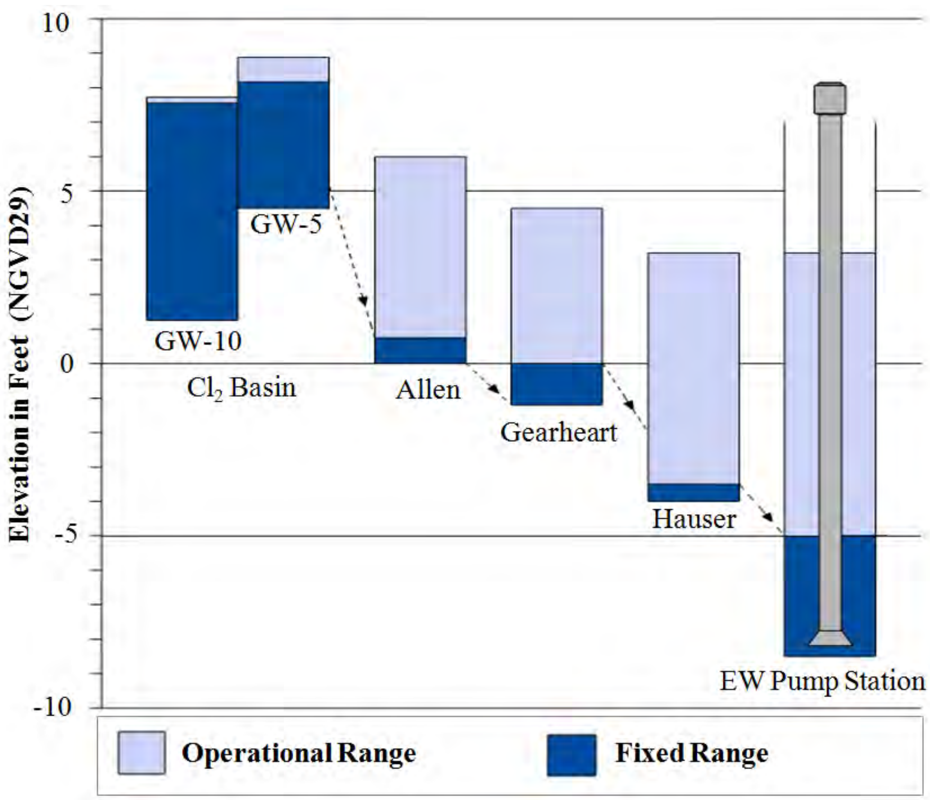


Figure E-3: Hydraulic grade lines for flow through EWs; see *Chapter XVII- Disinfection* for locations of GW-10 and GW-5 in the chlorine contact basin.

APPENDIX F – SUMMARY OF EXISTING SECONDARY EFFLUENT PUMPING CAPACITIES

Table F- 1. Operational flow measurements of different effluent pumping combinations in parallel.

Pump Combination	Flow (MGD)
1 PS-1	1.20
2 PS-1	2.30
3 PS-1	2.99
1 PS-2	1.5
2 PS-2	2.4
1 PPS	1.8
2 PPS	2.9
3 PPS	4.5
1 EPPS	4.2
2 EPPS	5.8
2 PS-1 + 1 PPS	4.5
3 PS-1 + 1 PPS	4.9
3 PS-1 + 3 PPS	6.0
2 PS-2 + 1 EPPS	5.9
2 PS-2 + 2 EPPS	7.6
3 PPS + 2 EPPS + 3 PS-1	13.6

APPENDIX G – PRESENTATION MATERIALS FROM THE OCTOBER AND NOVEMBER 2015 WORKSHOPS

City of Arcata
Wastewater Treatment Facility Improvements Project

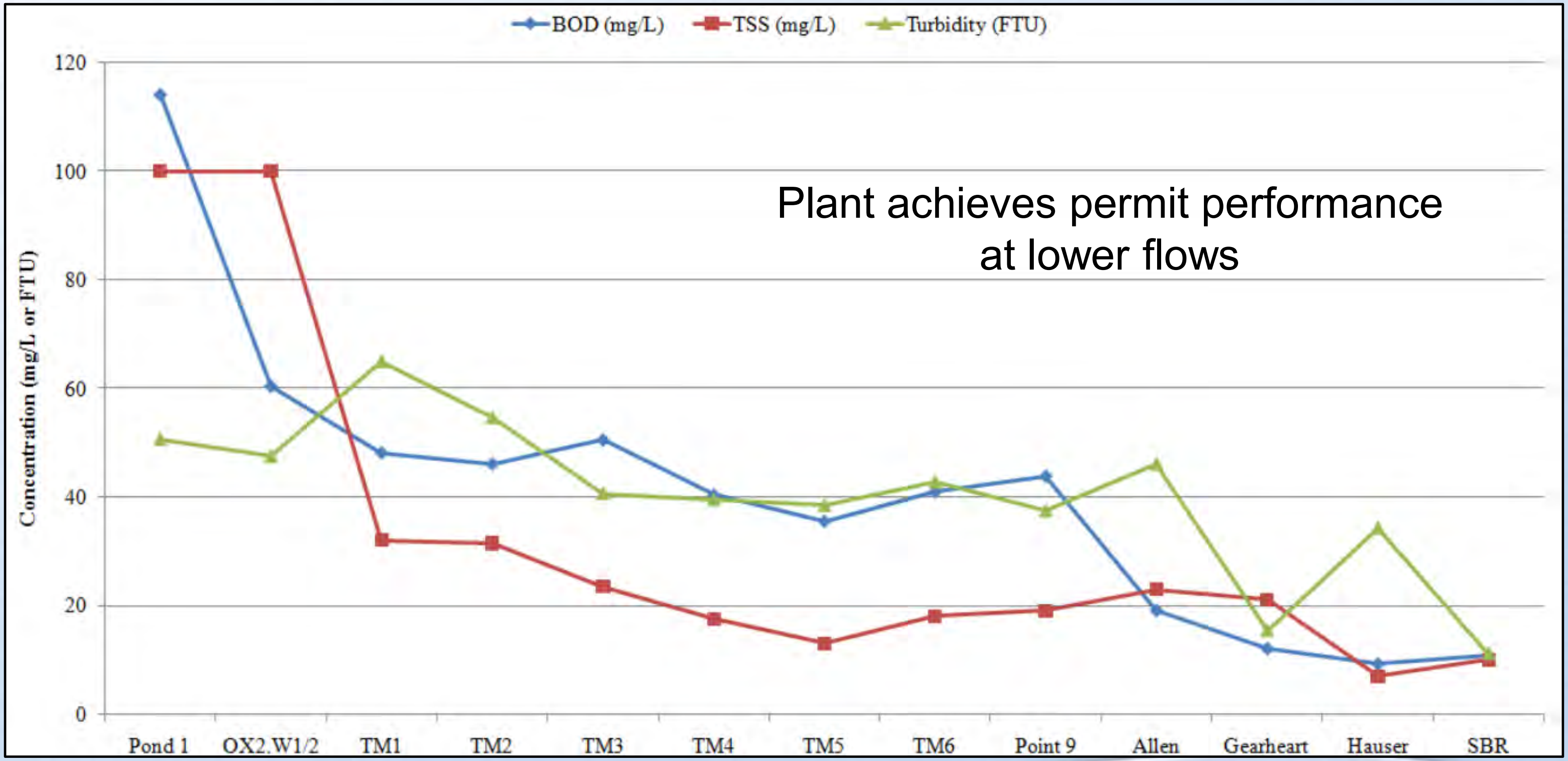
Update on Facility Plan Capacity Review

October 29, 2015

Agenda

- Treatment capacity – review of AMRI information
- Meeting Required Capacity – review concepts for workshop
- Disinfection – review of recent UVT data and impact of rainfall on wet weather flows
- Discuss agenda for workshop

Plant performance in September 2015 @ 1.4 MGD

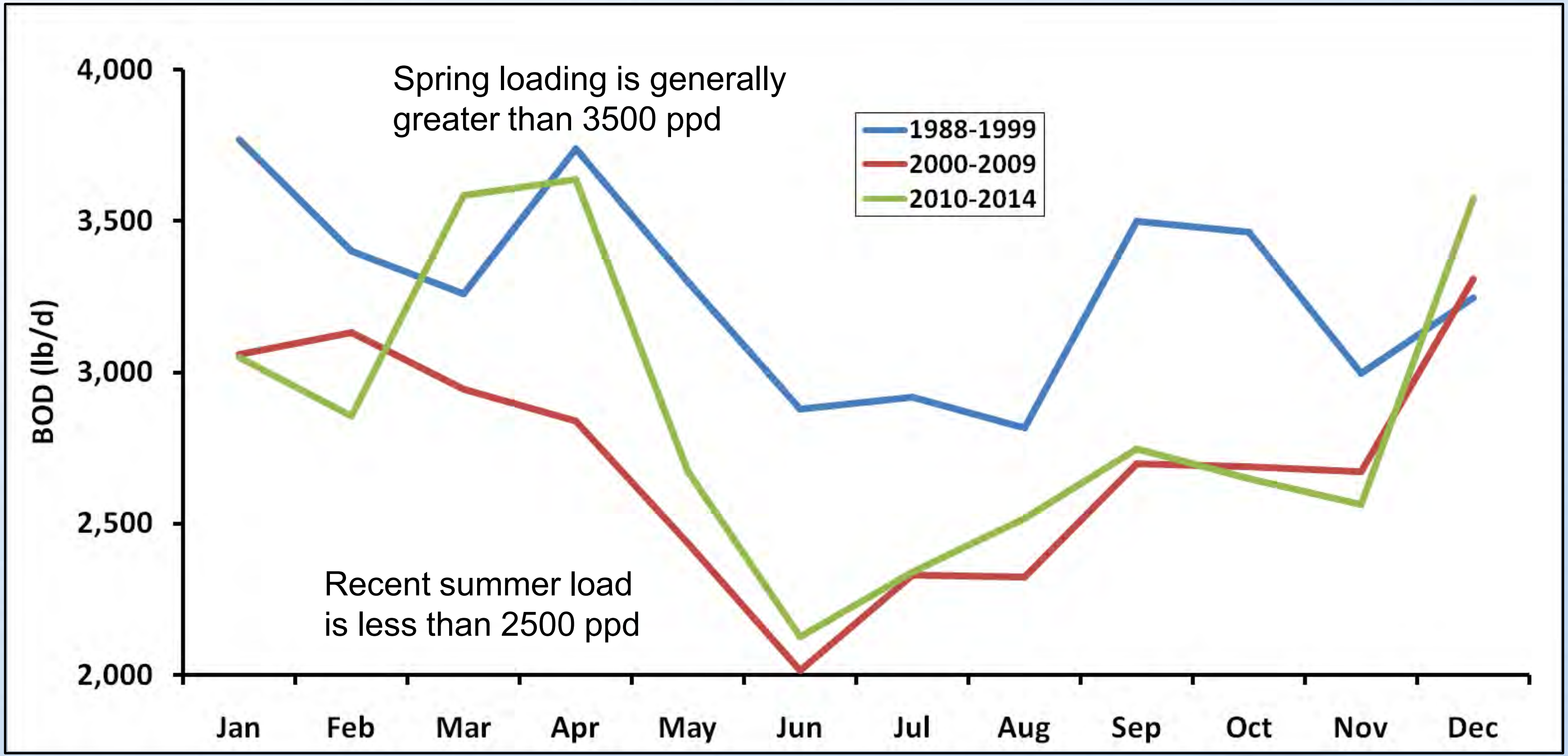


From 9/21/15 email from Bob Gearheart

City of
ARCATA

Plant Loading

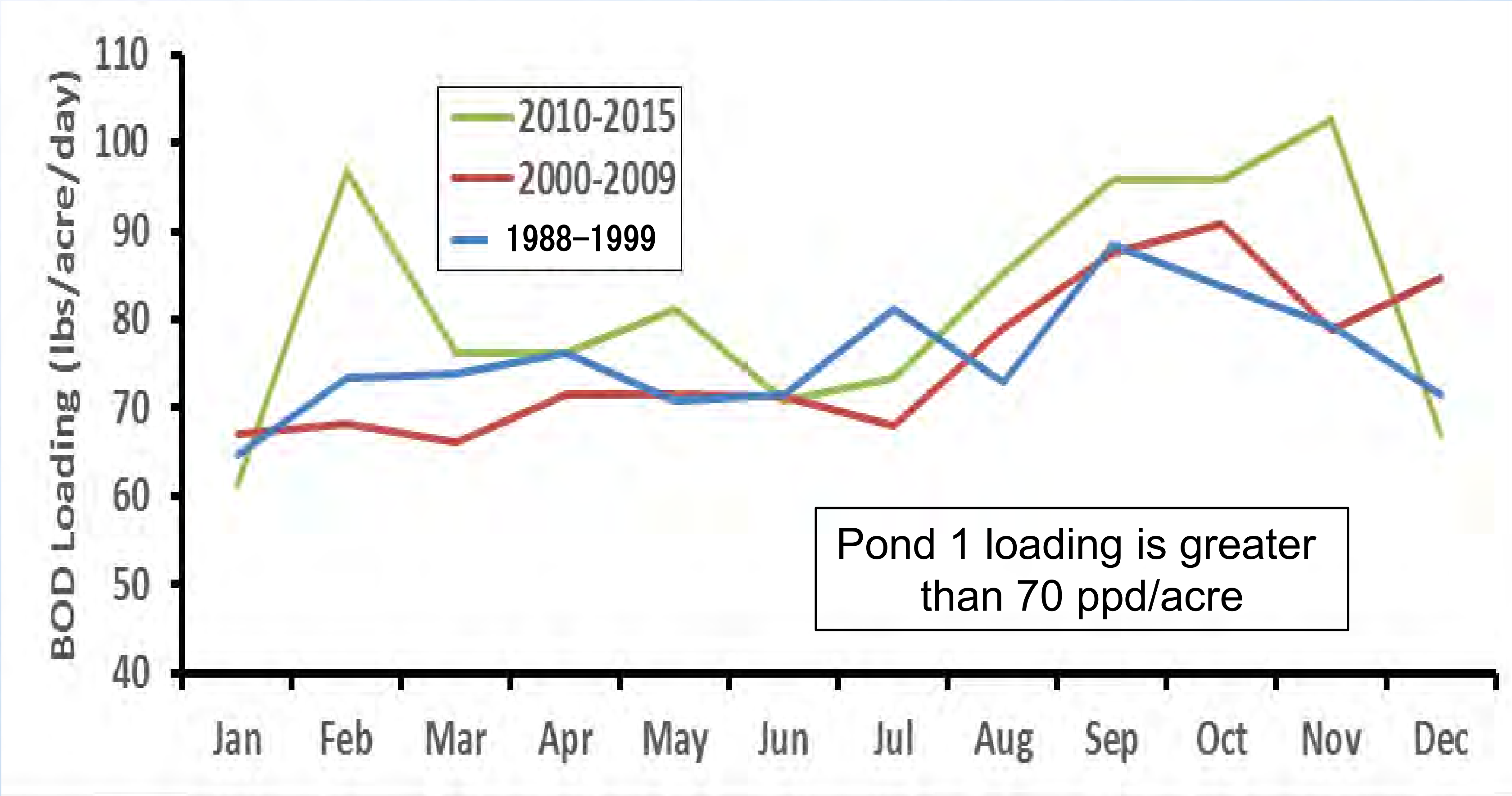
Monthly median treatment facility influent BOD loading (1)



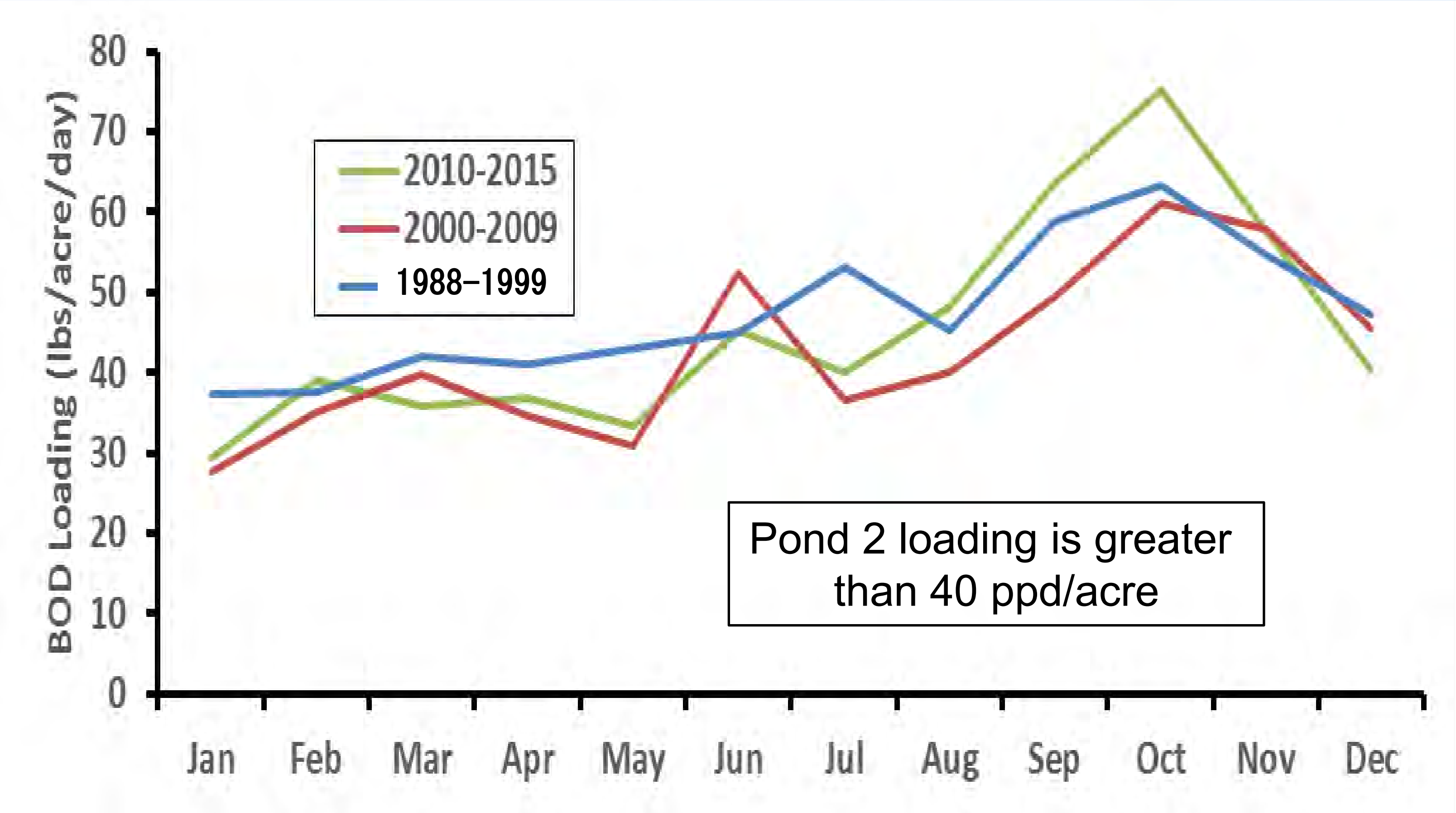
Note: 1. From "AWTF Treatment Capacity Evaluation and Additional Treatment Recommendations Swanson, Gearheart and Adabie Sept 2015

Pond Capacity

Monthly median pond 1 influent BOD loading

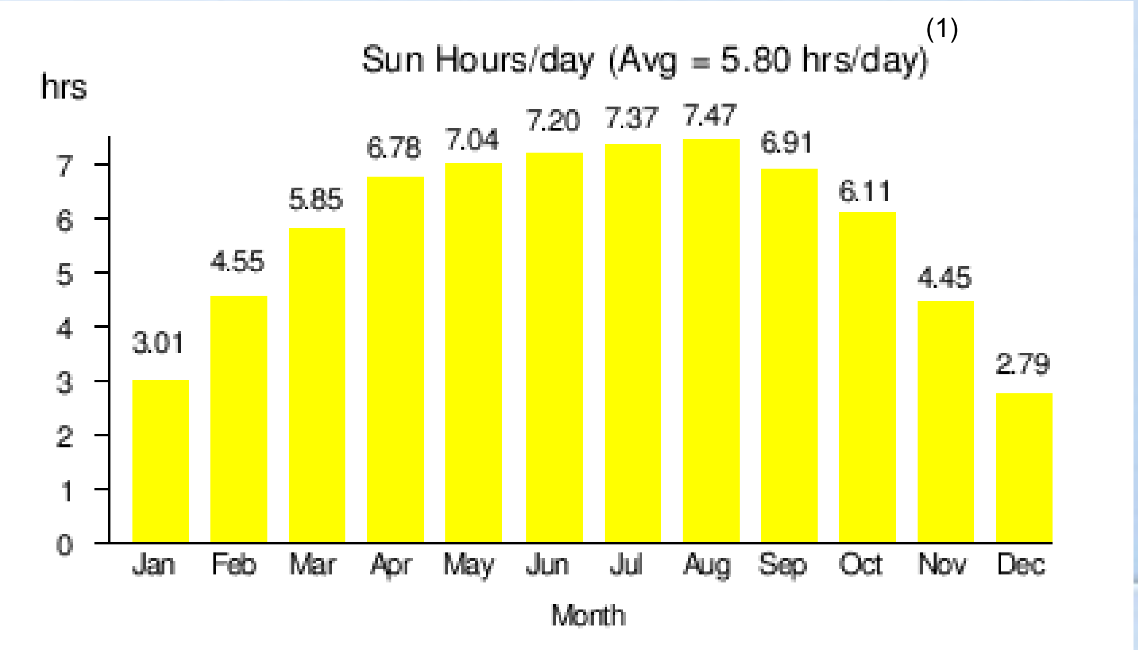


Monthly median pond 2 influent BOD loading



Pond wastewater treatment process

- Temperature dependent
- Amount of solar radiation or sunlight



Note: 1. Need to verify for Arcata using HSU data

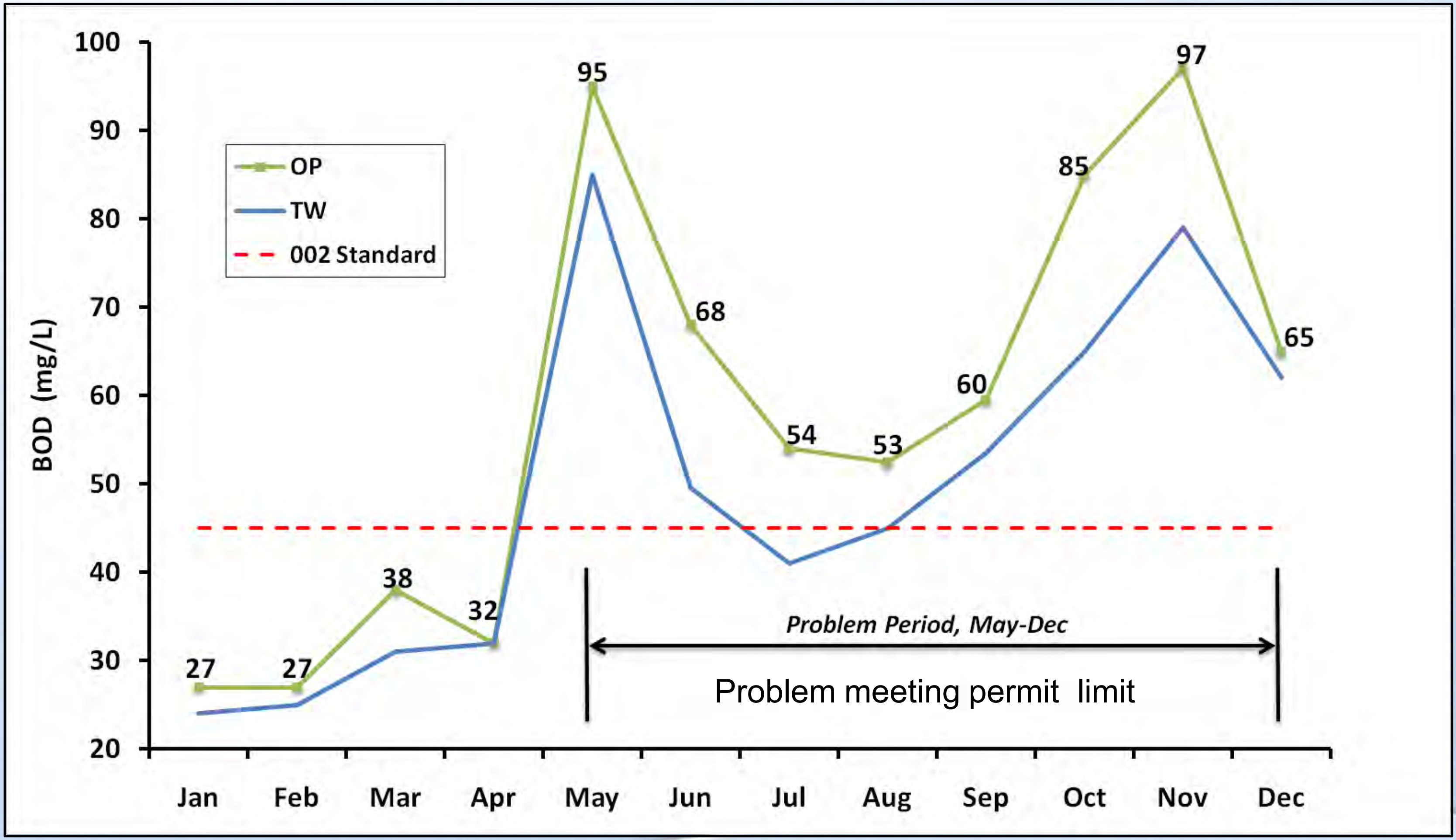
Typical Wastewater Treatment Pond BOD Loading Criteria

Type	Depth, ft	Detention Time, Days	Loading , PPD per acre	Effleunt- BOD mg/L	Effluent - TSS mg/L
Arcata Oxidation Pond	4.5	TBD	70 to 100	25 to 90	TBD
Oxidation Pond (1)	3 to 4.5	10 to 40	35 to 125	20 to 40	80 to 140
Facultative Ponds (1)	4.5 to 7.5	25 to 180	20 to 60	30 to 40	40 to 100
Partial Mix Aerated Lagoon (1)	6 to 18	7 to 20	45 to 180	30 to 40	30 to 60
From 1. Natural System For Waste Management and Treatment, Reed et al					

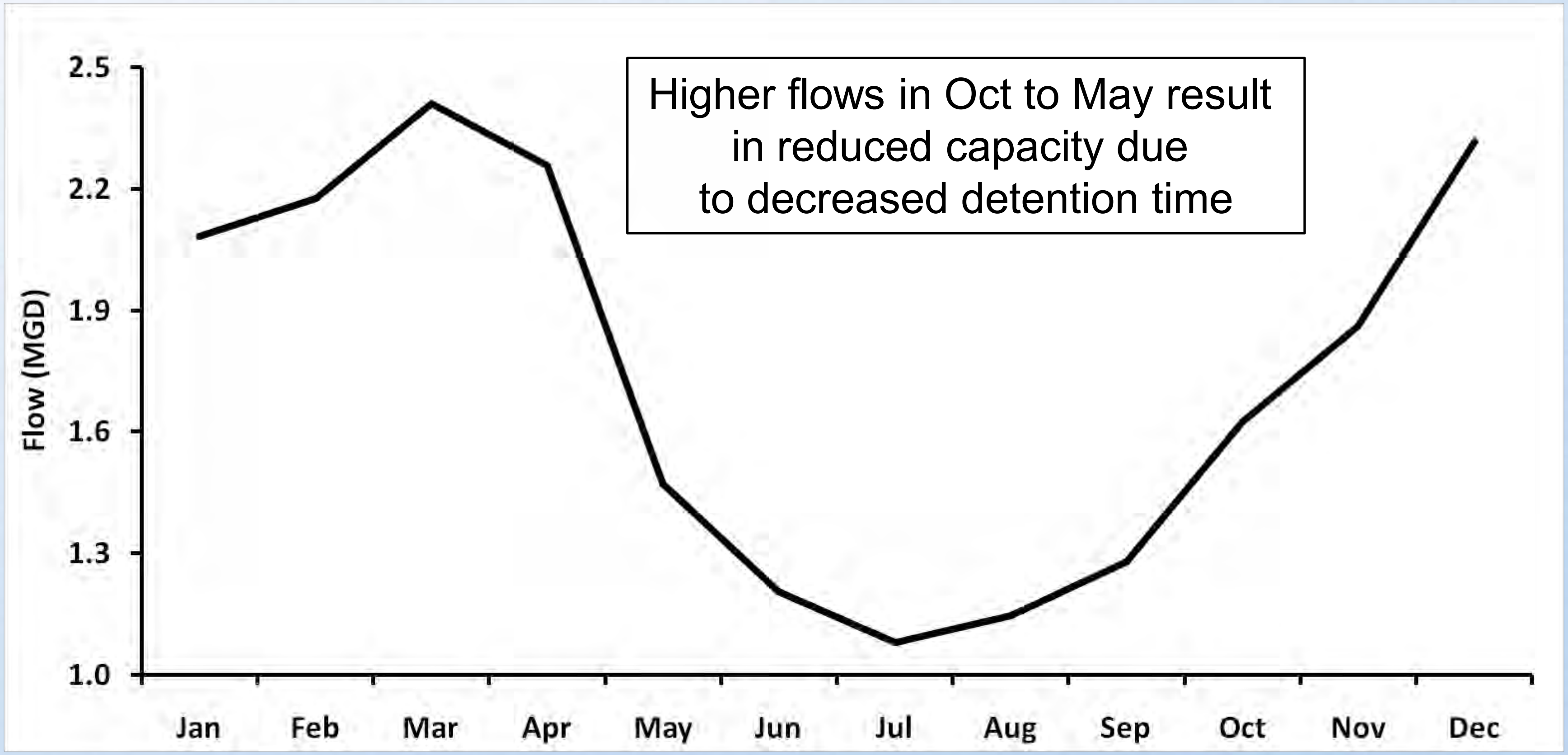
Carollo recommends 25 ppd/acre for Northern California

Treatment Wetland Capacity

Pond and TW Monthly Median Effluent BOD



Monthly median TW flows



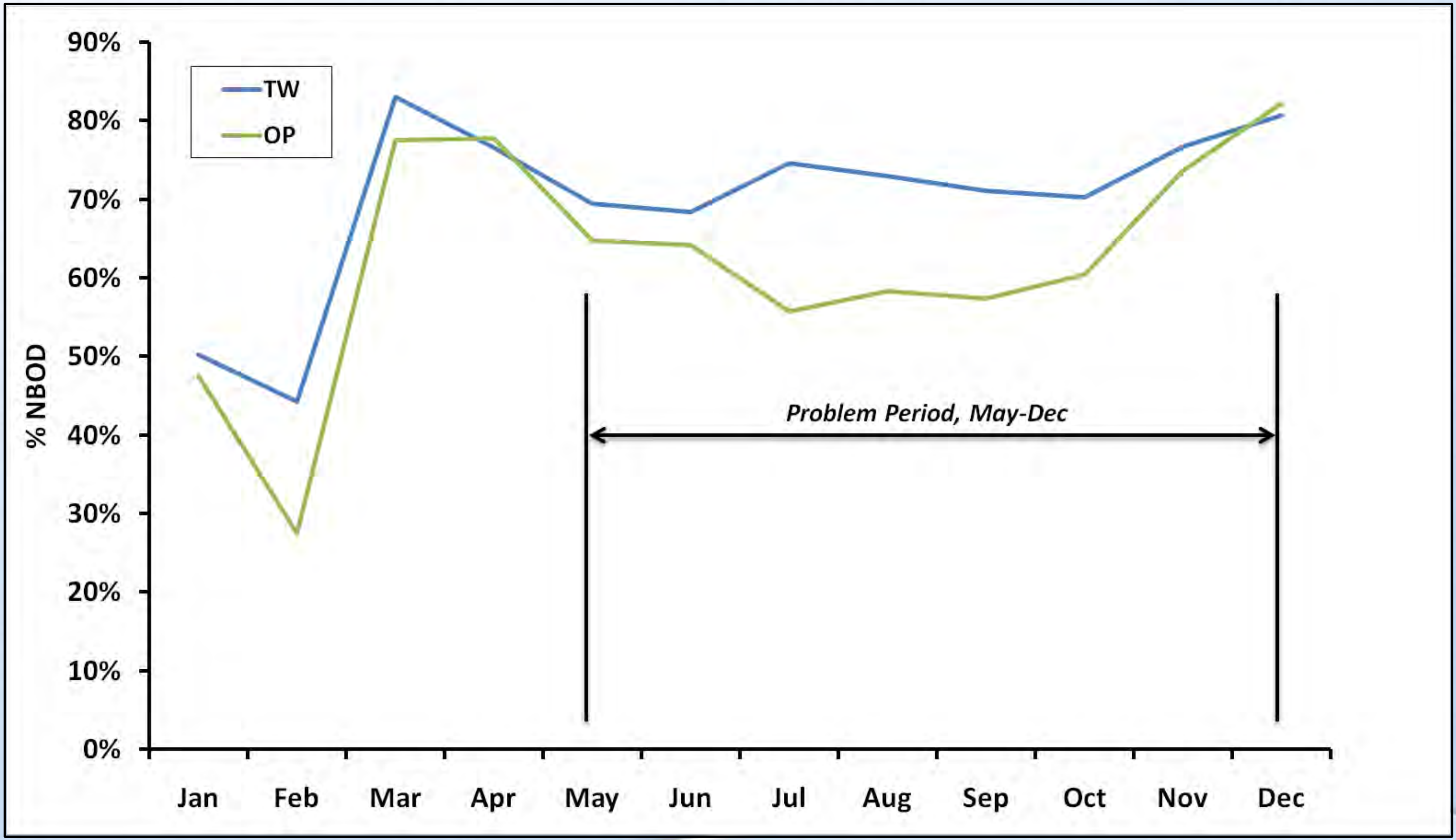
Treatment wetland capacity

	Detention Time, days	Depth, ft	Loading ppd/acre	Effluent BOD, mg/L	Effluent TSS, mg/L
Textbook(1)	7 to 15	1 to 3	100 -200	5 to 10	5 to 15
Arcata	3 to 8 for low to high flows	Varies - min depth 1 foot	TBD	25 to 85	10 to 40 for TM 5 and 6
1. Natural Systems for Waste Management and Treatment					

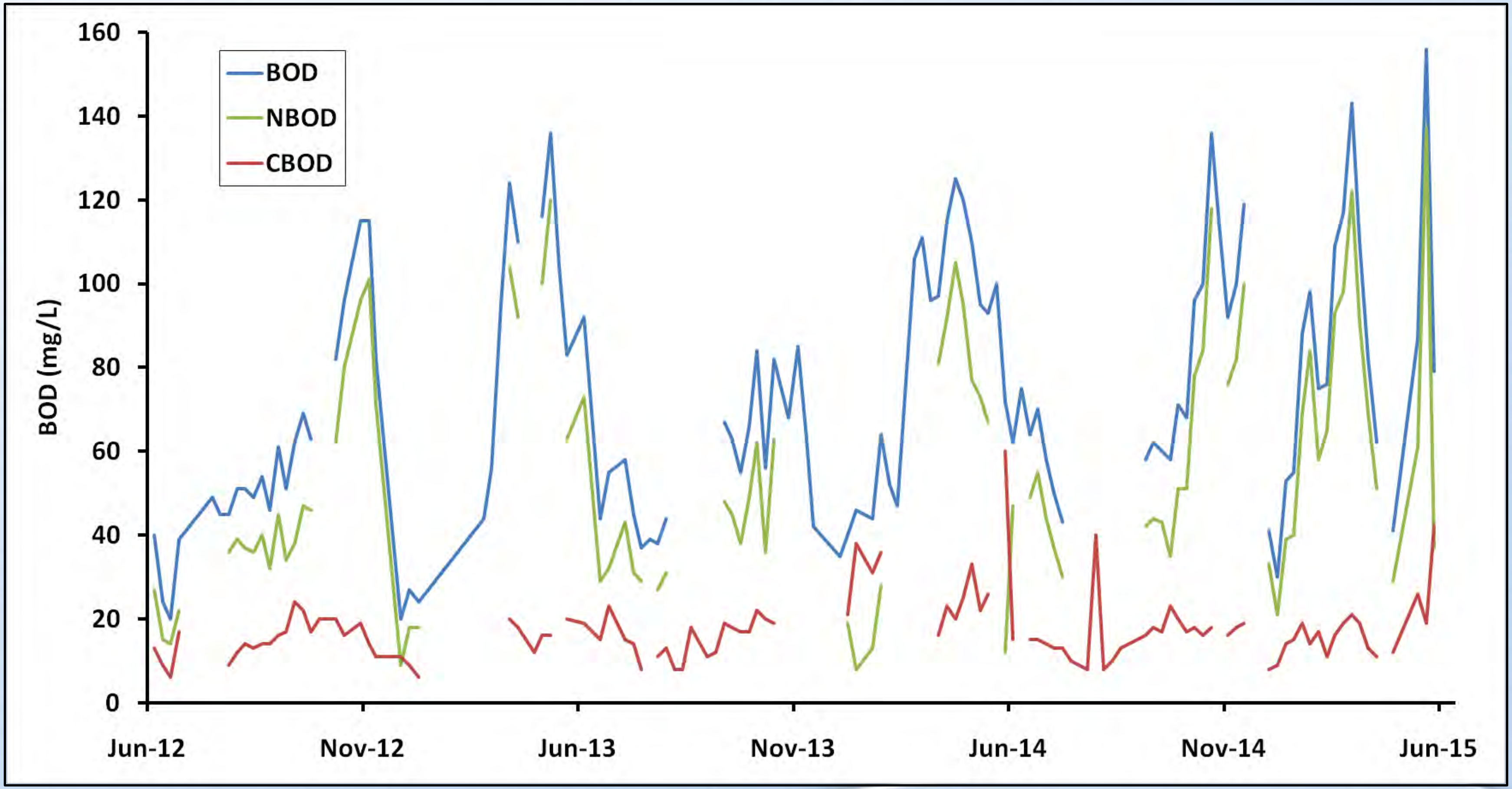
Nutrient (Nitrogen loads)

- Historic focus of RWQCB has been on permit and meeting BOD and TSS.
- Recent discussion on nutrients has indicated that ammonia and nutrients may be a future concern.
- Current data suggests that nitrogen loads impact plant capacity

Nitrogen BOD makes up a large portion of the BOD load

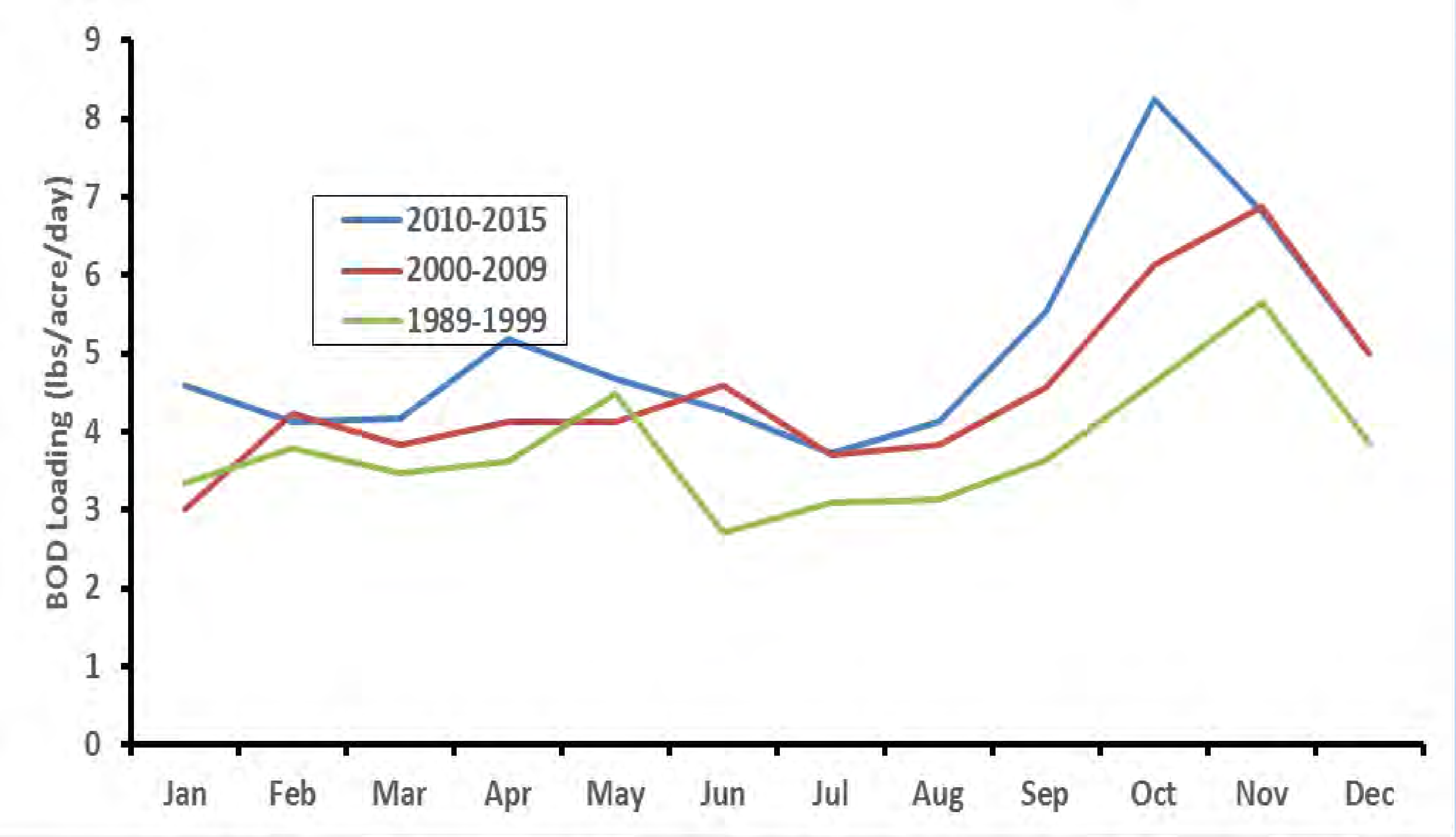


TW effluent BOD and relation to NBOD

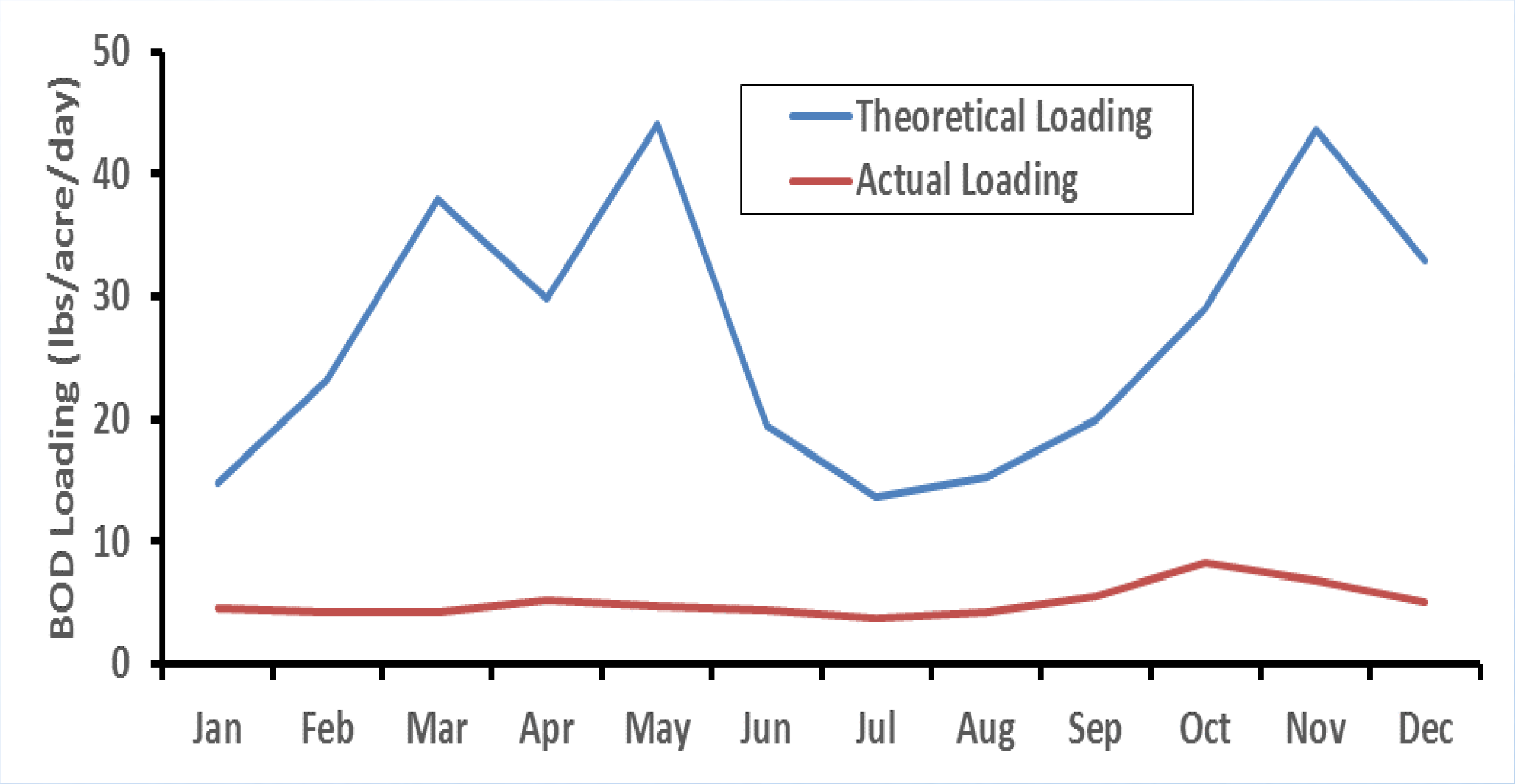


Enhancement Wetland Capacity

Historic EW loadings



Potential EW loadings may increase 4 to 5 times above the actual historic loadings



Enhancement wetland model – 30 mg/l limit

Inputs:

Date (mm/dd/yy): 1/1/13

Jan, Feb		Enhancement Wetland Effluent BOD Concentration (mg/L)														
		Influent BOD														
Flow Rate	HRT	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
1.0	11.9	1.7	2.5	3.4	4.2	5.1	5.9	6.7	7.6	8.4	9.3	10.1	10.9	11.8	12.6	13.5
1.1	10.8	1.8	2.8	3.7	4.6	5.5	6.5	7.4	8.3	9.2	10.2	11.1	12.0	12.9	13.8	14.8
1.2	9.9	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.1	16.1
1.3	9.1	2.2	3.2	4.3	5.4	6.5	7.6	8.7	9.7	10.8	11.9	13.0	14.1	15.1	16.2	17.3
1.4	8.5	2.3	3.5	4.6	5.8	7.0	8.1	9.3	10.4	11.6	12.7	13.9	15.1	16.2	17.4	18.5
1.5	7.9	2.5	3.7	4.9	6.2	7.4	8.6	9.9	11.1	12.3	13.6	14.8	16.0	17.3	18.5	19.7
1.6	7.4	2.6	3.9	5.2	6.5	7.8	9.1	10.5	11.8	13.1	14.4	15.7	17.0	18.3	19.6	20.9
1.7	7.0	2.8	4.1	5.5	6.9	8.3	9.6	11.0	12.4	13.8	15.2	16.5	17.9	19.3	20.7	22.0
1.8	6.6	2.9	4.3	5.8	7.2	8.7	10.1	11.6	13.0	14.5	15.9	17.4	18.8	20.3	21.7	23.2
1.9	6.2	3.0	4.5	6.1	7.6	9.1	10.6	12.1	13.6	15.1	16.7	18.2	19.7	21.2	22.7	24.2
2.0	5.9	3.2	4.7	6.3	7.9	9.5	11.1	12.6	14.2	15.8	17.4	19.0	20.5	22.1	23.7	25.3
2.2	5.4	3.4	5.1	6.8	8.5	10.2	11.9	13.6	15.3	17.0	18.8	20.5	22.2	23.9	25.6	27.3
2.4	4.9	3.6	5.5	7.3	9.1	10.9	12.8	14.6	16.4	18.2	20.0	21.9	23.7	25.5	27.3	29.2
2.6	4.6	3.9	5.8	7.7	9.7	11.6	13.5	15.5	17.4	19.3	21.3	23.2	25.1	27.1	29.0	30.9
2.8	4.2	4.1	6.1	8.1	10.2	12.2	14.3	16.3	18.3	20.4	22.4	24.4	26.5	28.5	30.5	32.6
3.0	4.0	4.3	6.4	8.5	10.7	12.8	14.9	17.1	19.2	21.3	23.5	25.6	27.7	29.9	32.0	34.1
3.2	3.7	4.5	6.7	8.9	11.1	13.4	15.6	17.8	20.0	22.3	24.5	26.7	28.9	31.2	33.4	35.6
3.4	3.5	4.6	6.9	9.3	11.6	13.9	16.2	18.5	20.8	23.1	25.4	27.8	30.1	32.4	34.7	37.0
3.6	3.3	4.8	7.2	9.6	12.0	14.4	16.8	19.2	21.6	24.0	26.3	28.7	31.1	33.5	35.9	38.3
3.8	3.1	4.9	7.4	9.9	12.4	14.8	17.3	19.8	22.3	24.7	27.2	29.7	32.1	34.6	37.1	39.6
4.0	3.0	5.1	7.6	10.2	12.7	15.3	17.8	20.4	22.9	25.5	28.0	30.5	33.1	35.6	38.2	40.7
4.2	2.8	5.2	7.8	10.5	13.1	15.7	18.3	20.9	23.5	26.1	28.8	31.4	34.0	36.6	39.2	41.8
4.4	2.7	5.4	8.0	10.7	13.4	16.1	18.8	21.4	24.1	26.8	29.5	32.2	34.8	37.5	40.2	42.9
4.6	2.6	5.5	8.2	11.0	13.7	16.5	19.2	21.9	24.7	27.4	30.2	32.9	35.7	38.4	41.1	43.9
4.8	2.5	5.6	8.4	11.2	14.0	16.8	19.6	22.4	25.2	28.0	30.8	33.6	36.4	39.2	42.0	44.8
5.0	2.4	5.7	8.6	11.4	14.3	17.1	20.0	22.9	25.7	28.6	31.4	34.3	37.2	40.0	42.9	45.7
5.5	2.2	6.0	9.0	11.9	14.9	17.9	20.9	23.9	26.9	29.9	32.9	35.8	38.8	41.8	44.8	47.8
6.0	2.0	6.2	9.3	12.4	15.5	18.6	21.7	24.8	27.9	31.0	34.1	37.2	40.3	43.4	46.5	49.6
6.5	1.8	6.4	9.6	12.8	16.0	19.2	22.4	25.6	28.8	32.0	35.3	38.5	41.7	44.9	48.1	51.3
7.0	1.7	6.6	9.9	13.2	16.5	19.8	23.1	26.4	29.7	33.0	36.3	39.6	42.9	46.2	49.5	52.8
7.5	1.6	6.8	10.1	13.5	16.9	20.3	23.7	27.0	30.4	33.8	37.2	40.6	43.9	47.3	50.7	54.1

City of
ARCATA

Additional Treatment Capacity

Additional TW BOD removal with optimal TW performance

Pt 002 BOD Permit Limit (mg/L)	45		
Flow Exceedance Probability	50%	10%	0.5%
Flow (MGD)	1.8	4	6
Pt 002 BOD Load (lb/d)	676	1,501	2,252
Problem Period	Jun-Sep	May, Oct-Nov	May, Oct-Nov
Median Monthly Pond 2 BOD (mg/L)	53	97	97
Pond 2 BOD Load (lb/d)	796	3,236	4,854
Total Required BOD Removal (lb/d)	120	1,735	2,602
Optimal TW BOD Removal (lb/d)	388	585	585
Remaining BOD Treatment (lb/d)	0	1,150	2,017
Remaining Treatment as NBOD (lb/d)	0	747	1,311
Remaining Treatment as N (lb/d)	0	218	382

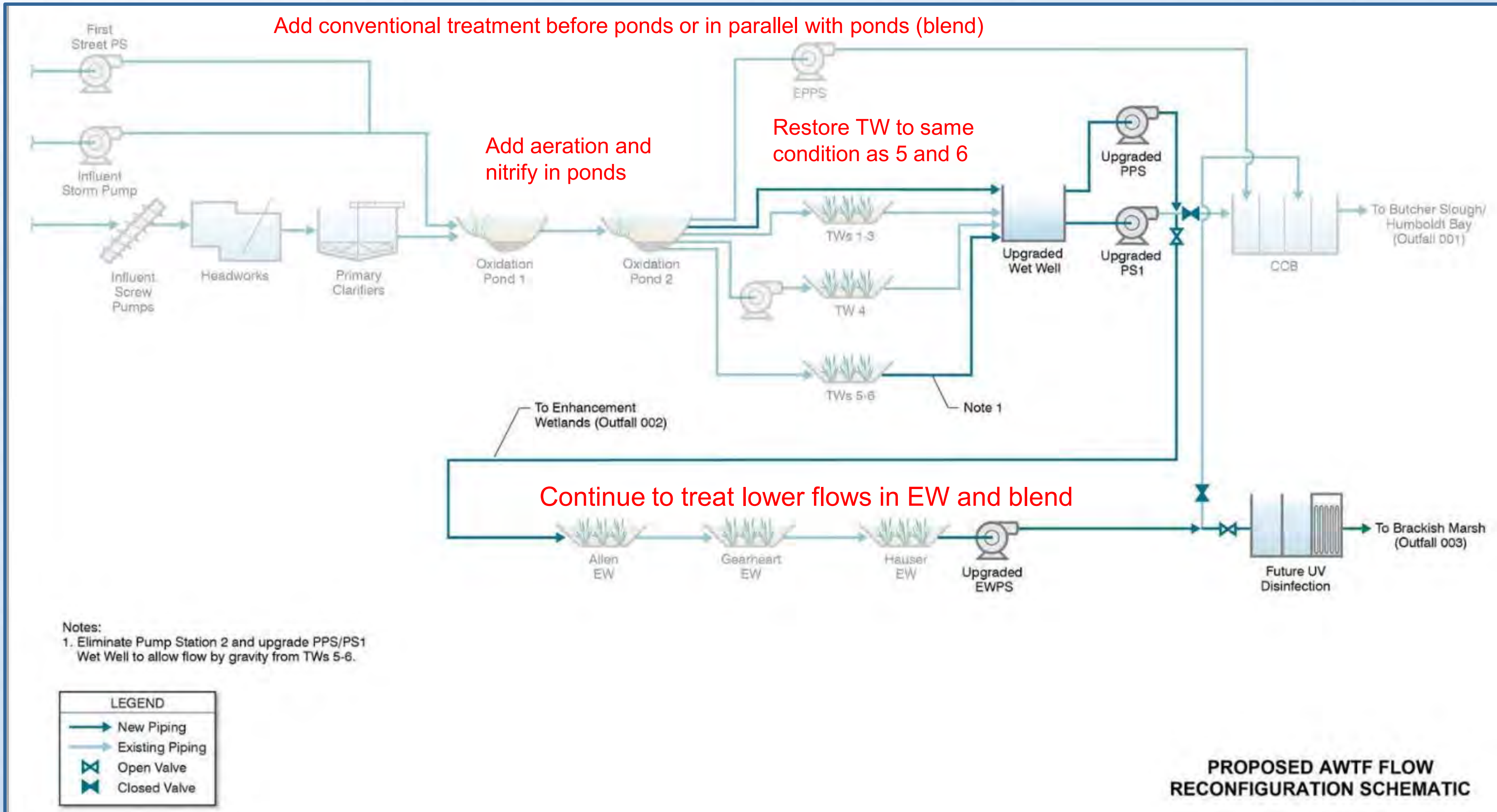
Capacity Issues

- Ponds
  - High Pond 1 BOD loading
  - Pond 2 short circuiting
  - Sludge accumulation and impact on capacity
  - Minimum volume to store wet weather flows
  - Do not nitrify in fall, winter and spring
- Treatment wetlands
  - Need to revegetate/regrade wetlands No. 1- 4.
  - Need more acreage beyond proposed No. 7
  - Require on-going vegetation management

Capacity issues, cont.

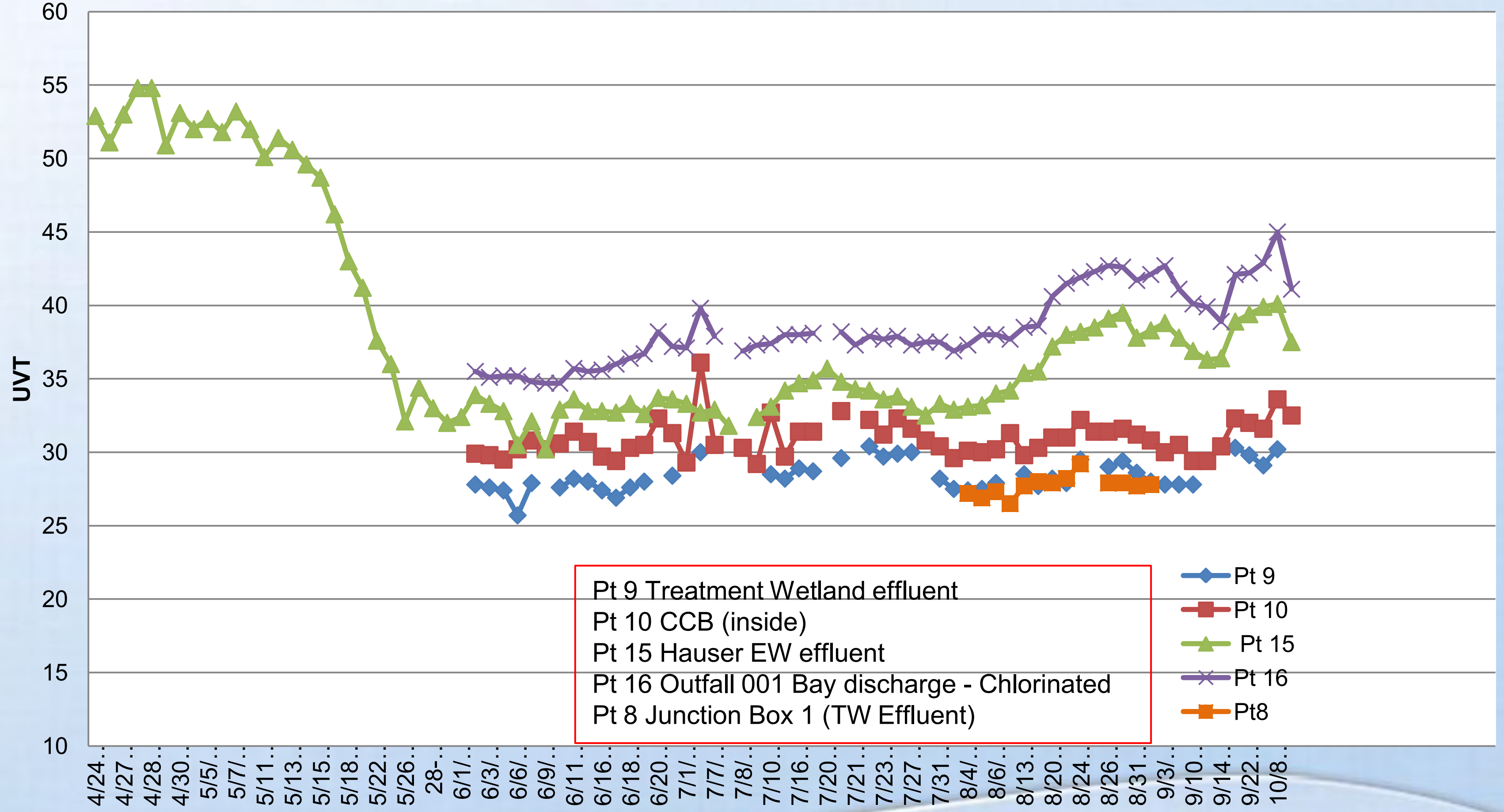
- Enhancement wetlands
  - Proposed flows are higher than ever designed
  - Short circuiting reduces detention time
  - Peak flows reduce detention time and predicted effluent BOD exceeds permit
  - Requires on-going vegetation management

Potential Capacity Improvements



Outfall 003 Disinfection

UVT Analysis – Design for lower than 35%. Lower 10th percentile – 32.5 for Pt 15



UV System Installation Cost Estimate – based on 35% UVT

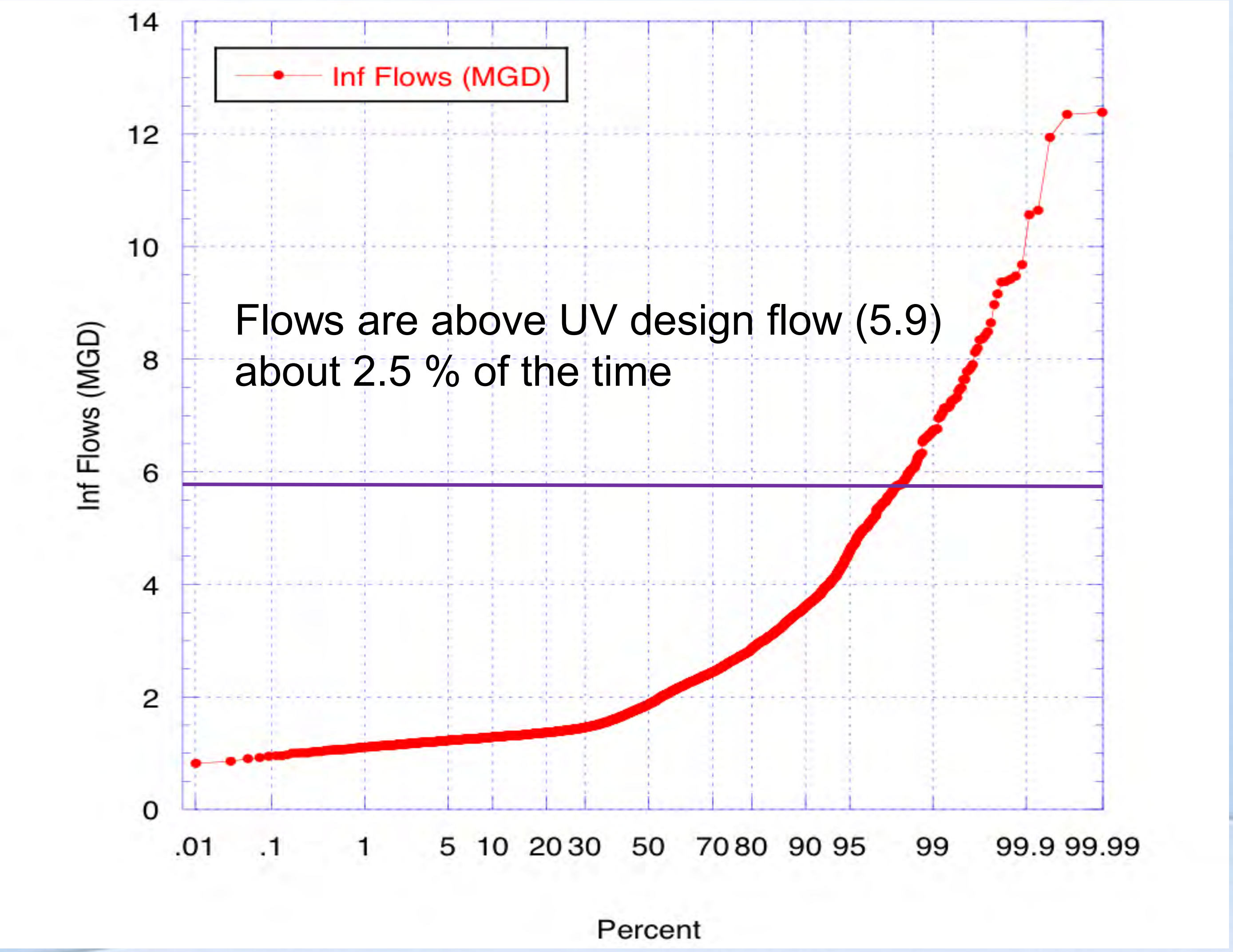
Dose (mJ/cm^2)	35	35 with Redundancy	50	50 with Redundancy
UV Disinfection Equipment Cost	$800,000	$1,090,000	$1,050,000	$1,310,000
Total Construction Costs:				
Low range (3 times equipment)	$2,400,000	$3,270,000	$3,150,000	$3,930,000
High range (5 times equipment)	$4,000,000	$5,450,000	$5,250,000	$6,550,000

Notes:
(1) Equipment sizing is based on an End of Lamp Life Factor of 0.90 and a Fouling Factor of 0.95.

Based on Trojan UV 3000Plus

Outfall 001 Disinfection

Influent Flows for Point 1 from 1997 – 2010



Impact of Rainfall on Plant Flows Dry Weather (1)

	Dry Weather					
Rainfall	1.3 MGD					
(in/day)	TW Flow	Pond Pump	Pt 001 Chlorine Disinfection.	Pt 002	UV Flow	Total
0.2	1.6	0.0	0.0	1.6	1.8	1.8
0.4	1.9	0.0	0.0	1.9	2.4	2.4
0.6	2.3	0.0	0.0	2.3	2.9	2.9
0.8	2.6	0.0	0.0	2.6	3.5	3.5
1.0	2.9	0.0	0.0	2.9	4.0	4.0
1.2	3.2	0.0	0.0	3.2	4.5	4.5
1.4	3.6	0.0	0.0	3.6	5.1	5.1
1.6	3.9	0.0	0.0	3.9	5.6	5.6
1.8	4.2	0.0	0.3	3.9	5.9	6.2
2.0	4.5	0.0	0.8	3.7	5.9	6.7
2.2	4.9	0.0	1.4	3.5	5.9	7.3
2.4	5.2	0.0	1.9	3.3	5.9	7.8
2.6	5.5	0.0	2.4	3.1	5.9	8.3
2.8	5.8	0.0	3.0	2.9	5.9	8.9
3.0	6.2	0.0	3.5	2.6	5.9	9.4

1. Expected and feasible flow rates through various parts of the Arcata WWTF based on influent flow rates of 1.3 and 2.3 MGD Halverson 11/2012

Impact of Rainfall on Plant Flows Design Flow

	Design Flow					
Rainfall	2.3 MGD					
(in/day)	TW Flow	Pond Pump	Pt 001 Chlorine Disinfection.	Pt 002	UV Flow	Total
0.2	2.6	0.0	0.0	2.6	2.8	2.8
0.4	2.9	0.0	0.0	2.9	3.4	3.4
0.6	3.3	0.0	0.0	3.3	3.9	3.9
0.8	3.6	0.0	0.0	3.6	4.5	4.5
1.0	3.9	0.0	0.0	3.9	5.0	5.0
1.2	4.2	0.0	0.0	4.2	5.5	5.5
1.4	4.6	0.0	0.2	4.4	5.9	6.1
1.6	4.9	0.0	0.7	4.2	5.9	6.6
1.8	5.2	0.0	1.3	3.9	5.9	7.2
2.0	5.5	0.0	1.8	3.7	5.9	7.7
2.2	5.9	0.0	2.4	3.5	5.9	8.3
2.4	6.2	0.0	2.9	3.3	5.9	8.8
2.6	6.2	0.3	3.4	3.1	5.9	9.3
2.8	6.2	0.6	4.0	2.9	5.9	9.9
3.0	6.2	1.0	4.5	2.6	5.9	10.4

Impact of Rainfall on Plant Flows
Wet Weather flow

	Wet Weather Flow					
Rainfall	6.4 MGD					
(in/day)	TW Flow	Pond Pump	Pt 001 Chlorine Disinfection.	Pt 002	UV Flow	Total
0.2	6.2	0.5	1.0	5.7	5.9	6.9
0.4	6.2	0.8	1.6	5.5	5.9	7.5
0.6	6.2	1.2	2.1	5.2	5.9	8.0
0.8	6.2	1.5	2.7	5.0	5.9	8.6
1.0	6.2	1.8	3.2	4.8	5.9	9.1
1.2	6.2	2.1	3.7	4.6	5.9	9.6
1.4	6.2	2.5	4.3	4.4	5.9	10.2
1.6	6.2	2.8	4.8	4.2	5.9	10.7
1.8	6.2	3.1	5.4	3.9	5.9	11.3
2.0	6.2	3.4	5.9	3.7	5.9	11.8
2.2	6.2	3.8	6.5	3.5	5.9	12.4
2.4	6.2	4.1	7.0	3.3	5.9	12.9
2.6	6.2	4.4	7.5	3.1	5.9	13.4
2.8	6.2	4.7	8.1	2.9	5.9	14.0
3.0	6.2	5.1	8.6	2.6	5.9	14.5

1. Expected and feasible flow rates through various parts of the Arcata WWTF based on influent flow rates of 6.4 MGD
Halverson 11/2012

Disinfection Issues

- Wetland effluent UVT and impact on UV system cost and size.
- Disinfection of peak flows
  - Need to turn on / off
  - Sits idle most of the time
  - Disinfection byproducts
  - Dechlorination required

Existing Pond Storage – City needs to confirm storage is available

Wrap up and review

- Capacity – limited by existing natural system footprint and environment
- Additional treatment options – needed to make up for shortfall, and to reliably meet permit
- Disinfection – need to address wet weather and increasing costs
- Workshop agenda – collaborate on items for discussion

Wrap up and Action Item

- Agenda for Workshop in November
- Logistics for Workshop in November
- Address treatment capacity shortfall
- Address UV and alternative disinfection
- Review comments and finalize Facility Plan
- Follow up with update for RWQCB

City of Arcata
Wastewater Treatment Facility Improvements Project

Update on Facility Plan Capacity Review

Questions / Comments Doug Wing
dwing@Carollo.com

City of Arcata
Wastewater Treatment Facility Improvements Project

Facility Plan Capacity Workshop

November 5-6, 2015

Agenda

Thursday PM

- Revisit project goals
- Review current flows, loads and capacity
- Treatment capacity options – conceptual size
- Meeting required capacity – flow charts
- Ranking and feedback on options
- Conceptual Costs
- Feedback

Agenda

Friday AM

- Disinfection criteria
- Disinfection options ranking
- Comparison of disinfection options
- Revisit treatment capacity flow options
- Discuss Facility Plan next steps

Friday PM

- Visit Petaluma Ellis Creek WRF

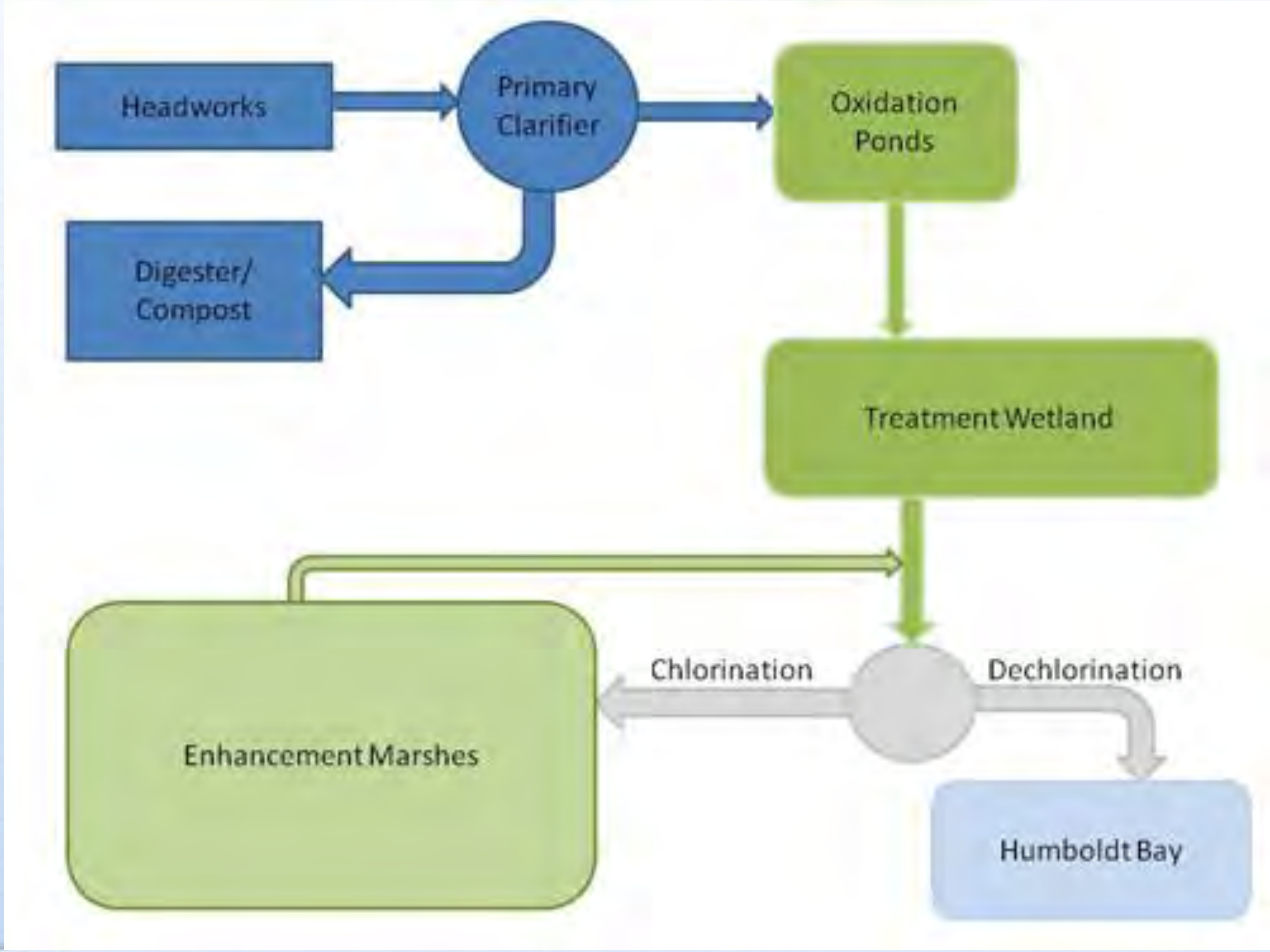
It started as a simple review

"It started with a simple case of peer review."

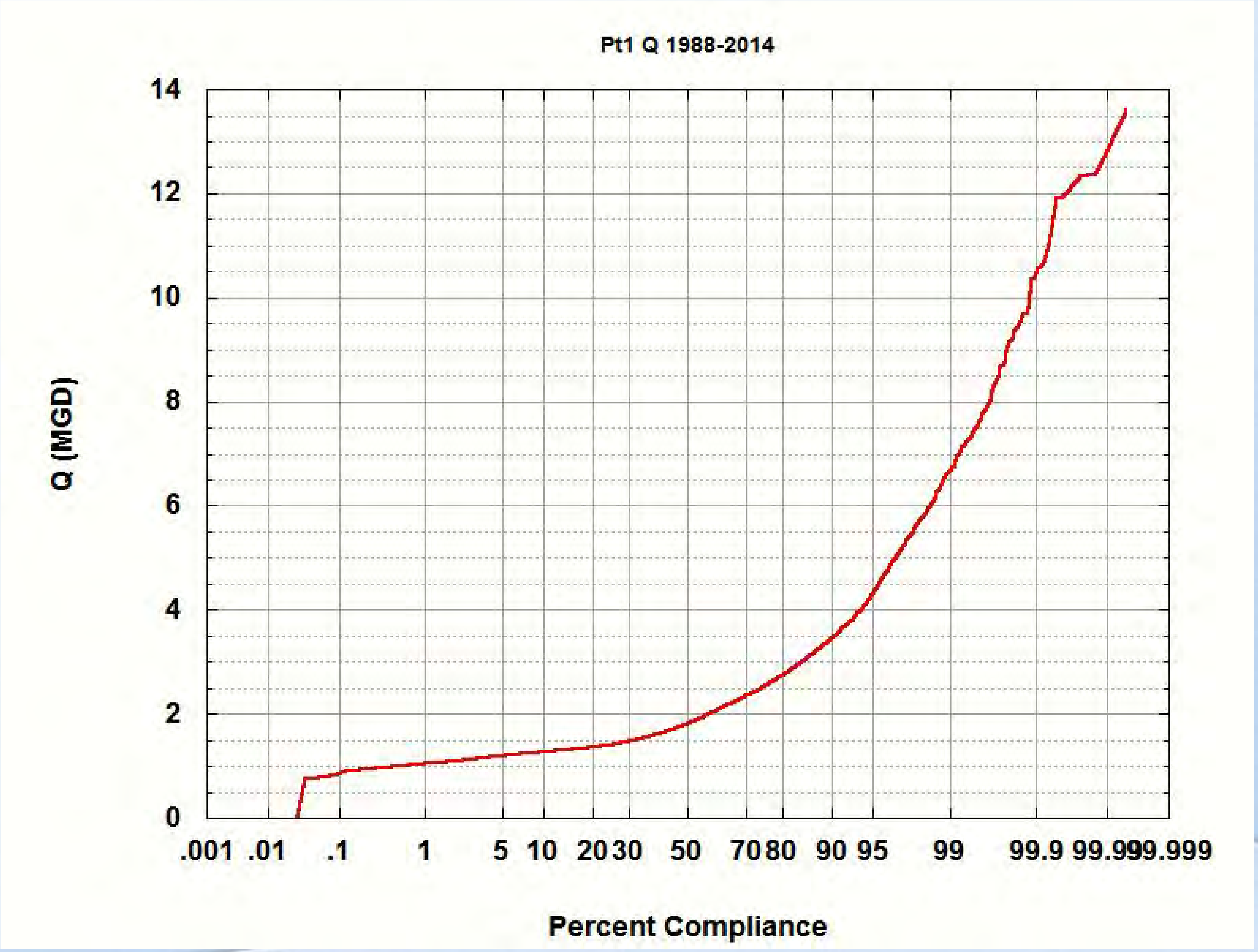
Facility Plan Task Objectives

1. Focus on permit required improvements
2. Capital improvements for AWTF
3. Approach to address:
    a. Aging infrastructure
    b. Energy efficiency
    c. Community needs
    d. CAPACITY NEEDS

Existing plant operation



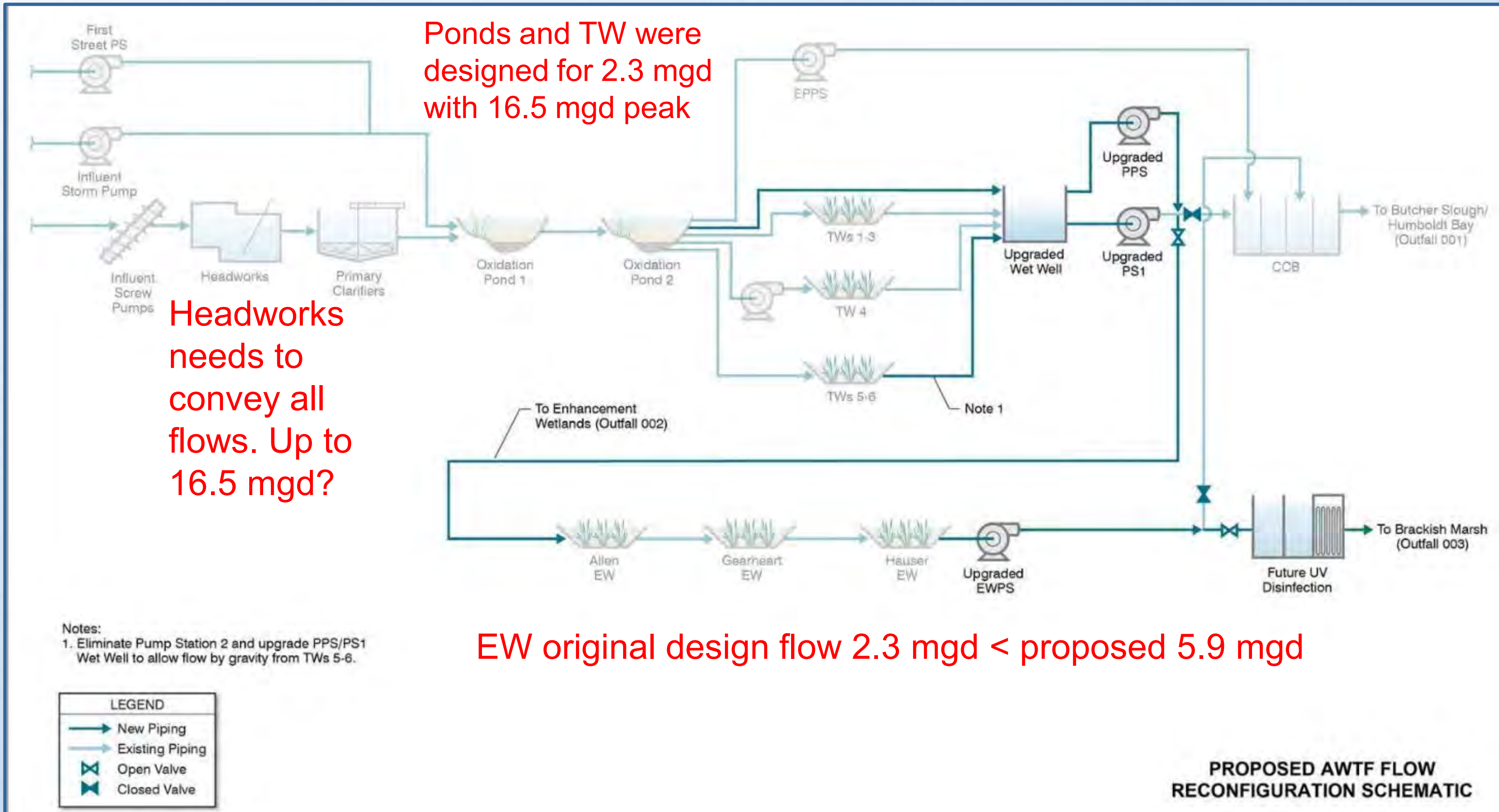
Point 1 Flow from 1988 – 2014



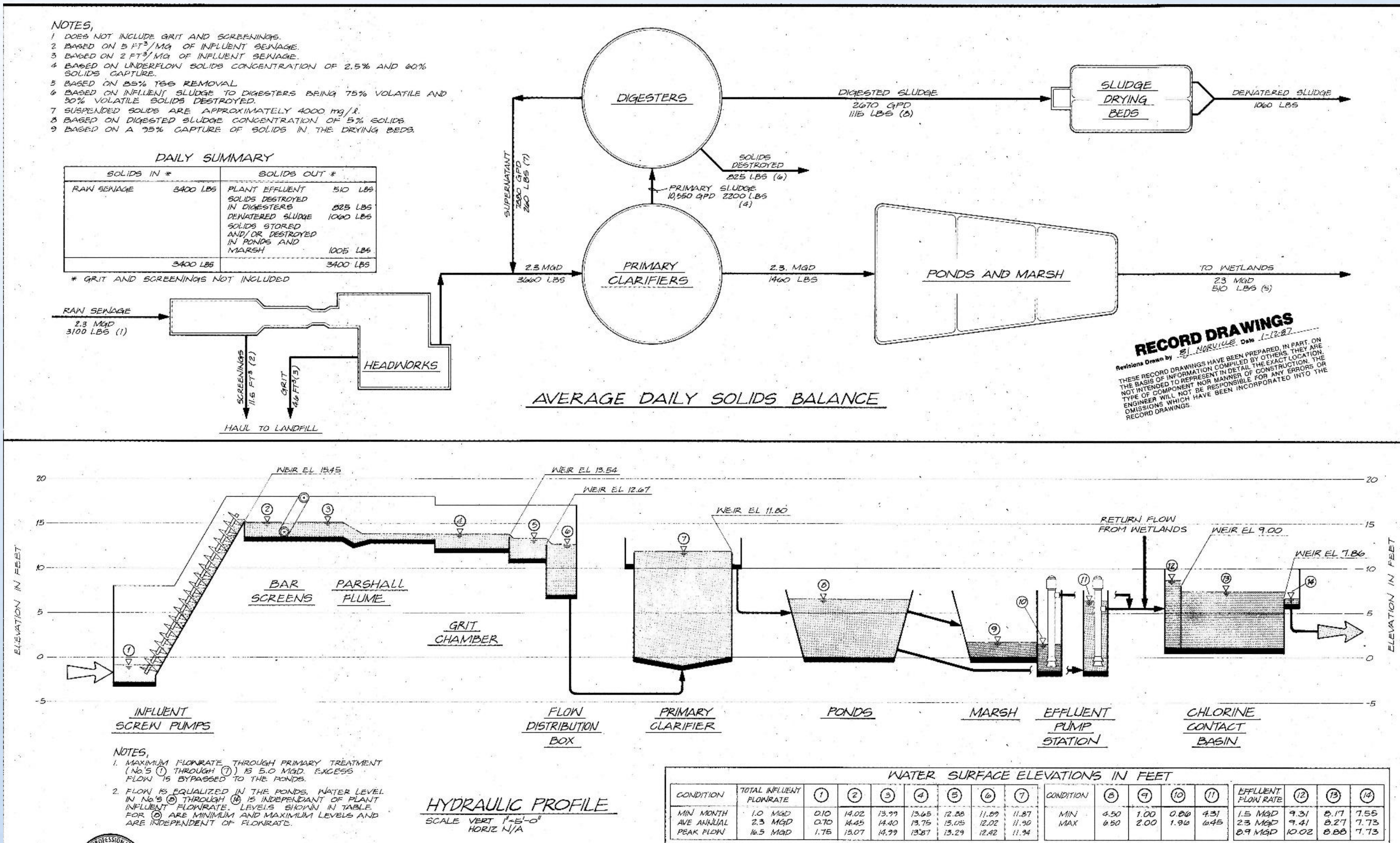
Current Permit Design Flows

- Current dry weather 1.4 mgd
- Permit design – 2.3 mgd
- Permit wet weather - 5.9 mgd
- Permit peak wet weather – 16.5 mgd

Existing design flow rates



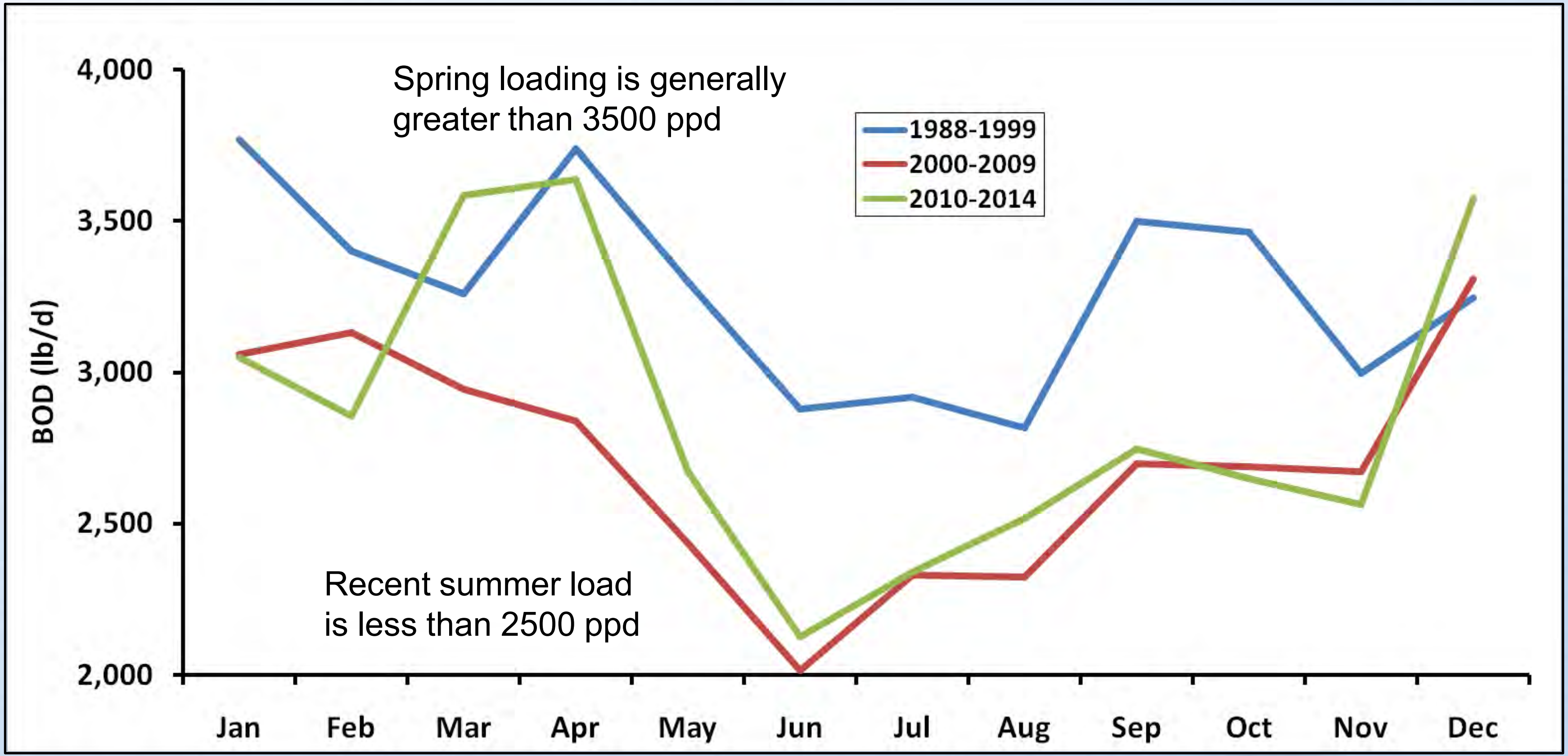
Original Hydraulic Design



Impact of flow on HRT

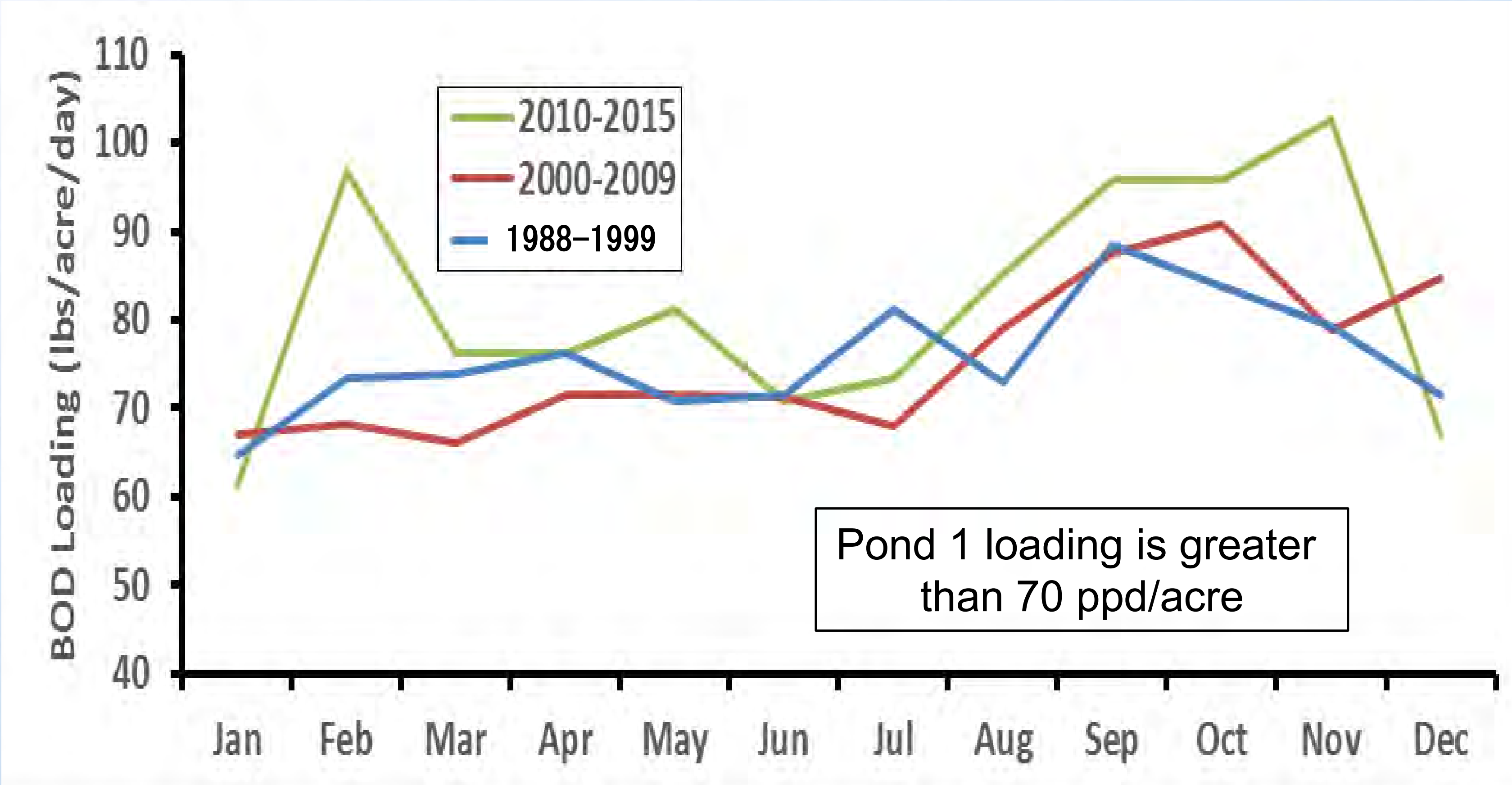
	Area	Typical Operating Depth	Min. Depth	Max. Depth	Typical Operating Volume	Min. Volume	Max. Volume	Storage	HRT for Low Flow (1.3 MGD)	HRT for Design Flow (2.3 MGD)	HRT for High Flow (4 MGD)
			Min	Ma		Min	Ma		1.3	2.3	4
	(ac	(ft)	(ft)	(ft)	(m	(m	(m	(m	(d)	(d)	(d)
Ponds											
Oxidation Pond 1	24	5.9	4.5	6.5	46	35	51	16	35.	20.	11.
Oxidation Pond 2	22	6	4.5	6.5	43	32	47	14	33.	18.	10.
Pond Total	46				89	67	97	30	**69**	**39**	**22**
Treatment											
TM 1	1.8	4.3	1	4.3	2.6	0.6	2.6	2.0	9.6	5.0	2.8
TM 2	1.9	4.6	1	4.6	2.9	0.6	2.9	2.3	9.6	5.0	2.8
TM 3	1.2	3.6	1	3.6	1.5	0.4	1.5	1.1	9.6	5.0	2.8
TM 4	0.9	2.9	1	2.9	0.9	0.3	0.9	0.6	4.3	4.3	4.3
TM 5	1.7	3	1	5.5	1.7	0.6	3.0	2.5	9.6	5.0	2.8
TM 6	1.9	3	1	5.5	1.9	0.6	3.4	2.8	9.6	5.0	2.8
TM 7											
TM Total (avg)	9.6				11	3	14	11	**8.3**	**4.8**	**3.2**
Enhancement Wetlands											
Allen	10	2.3	0.7	6	7	2	20		5.8	3.3	1.9
Gearheart	10	2.1	0.7	4.5	7	2	15		5.3	3.0	1.7
Hauser	10	3.7	0.7	5.5	12	2	18		9.3	5.2	3.0
EM Total	30	2.7			26	0	52	26	**20**	**11**	**7**
System Total								68	**97**	**55**	**32**

Monthly median treatment facility influent BOD loading (1)

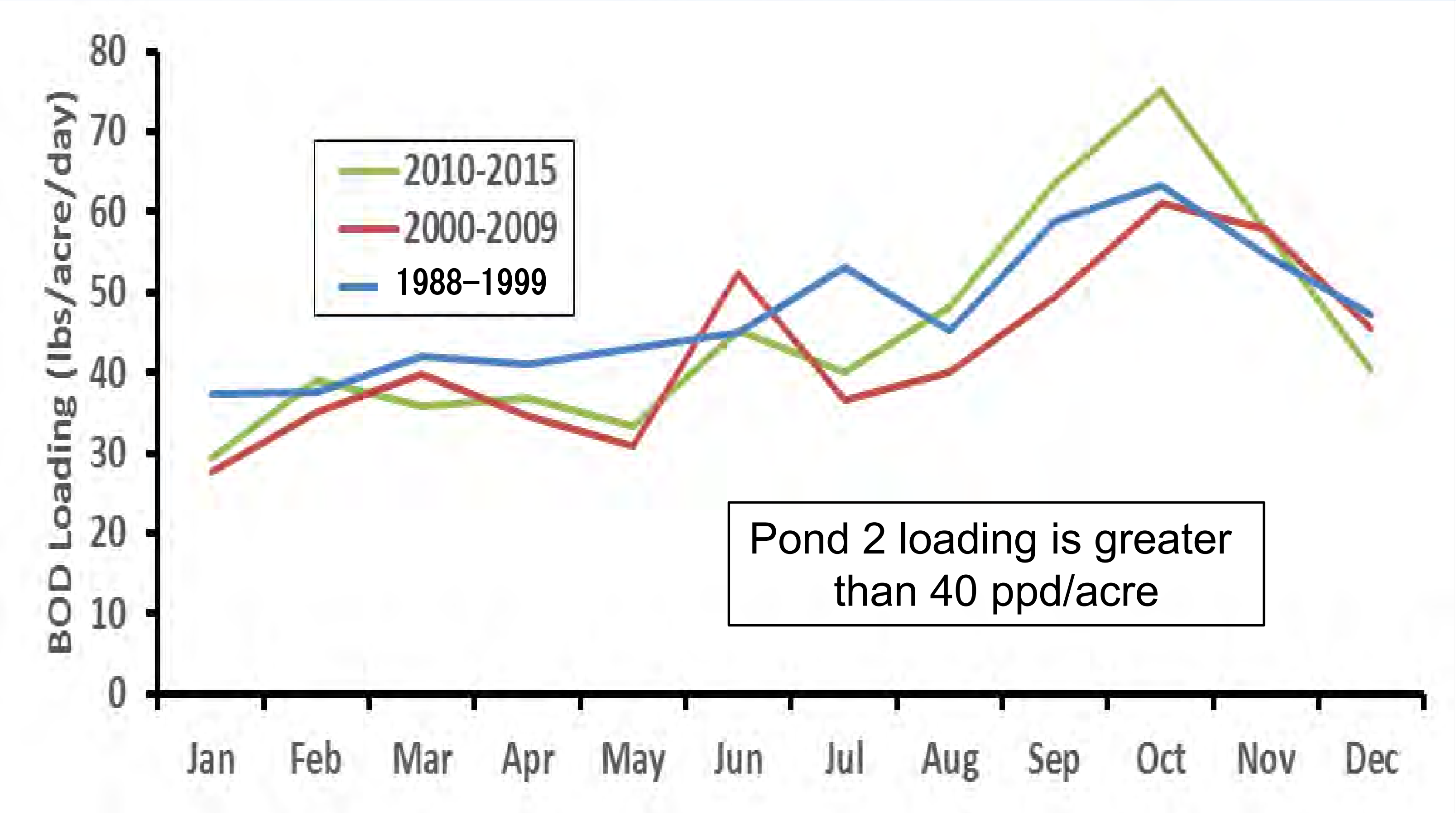


Note: 1. From "AWTF Treatment Capacity Evaluation and Additional Treatment Recommendations Swanson, Gearheart and Adabie Sept 2015

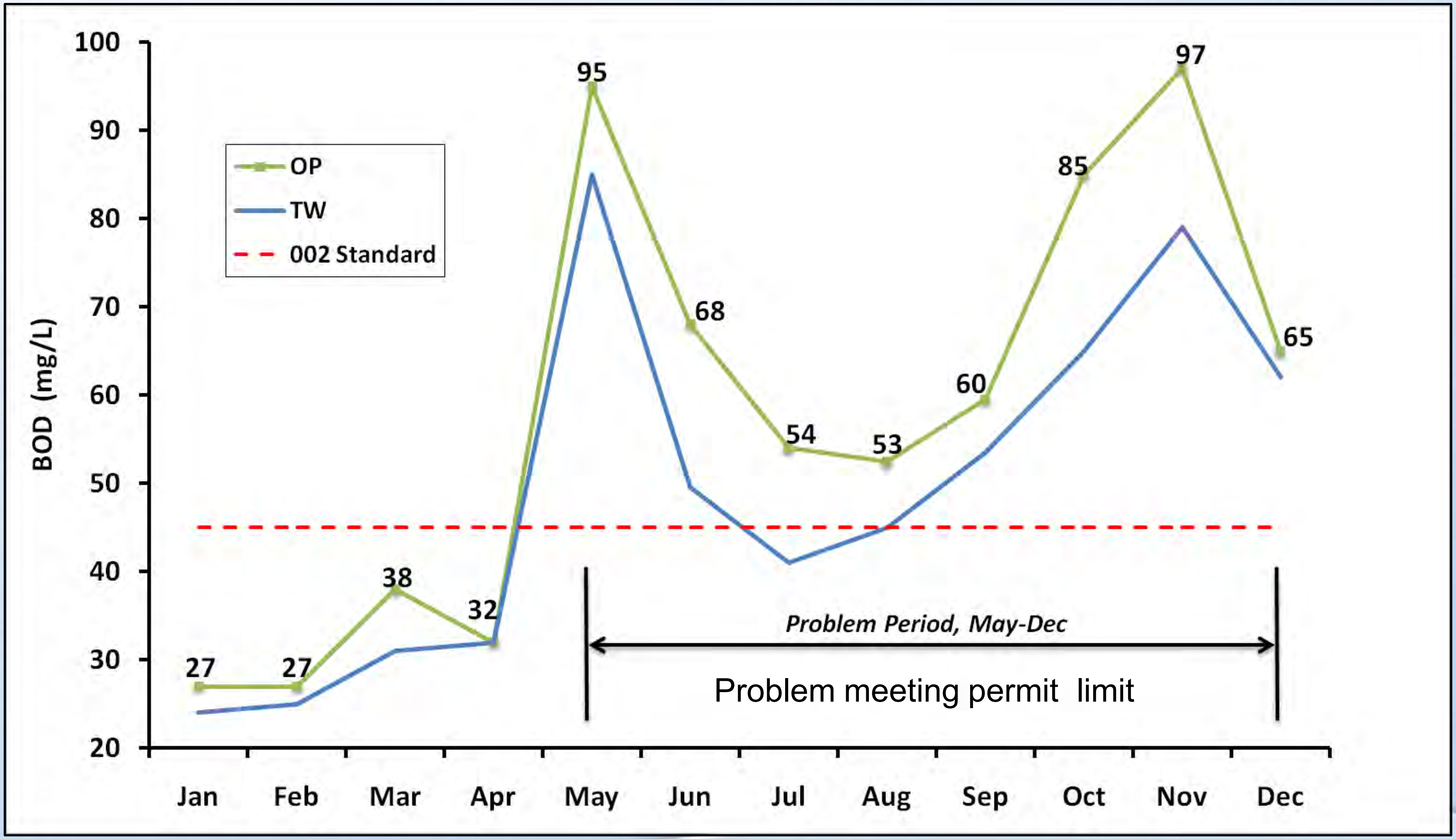
Monthly median pond 1 influent BOD loading



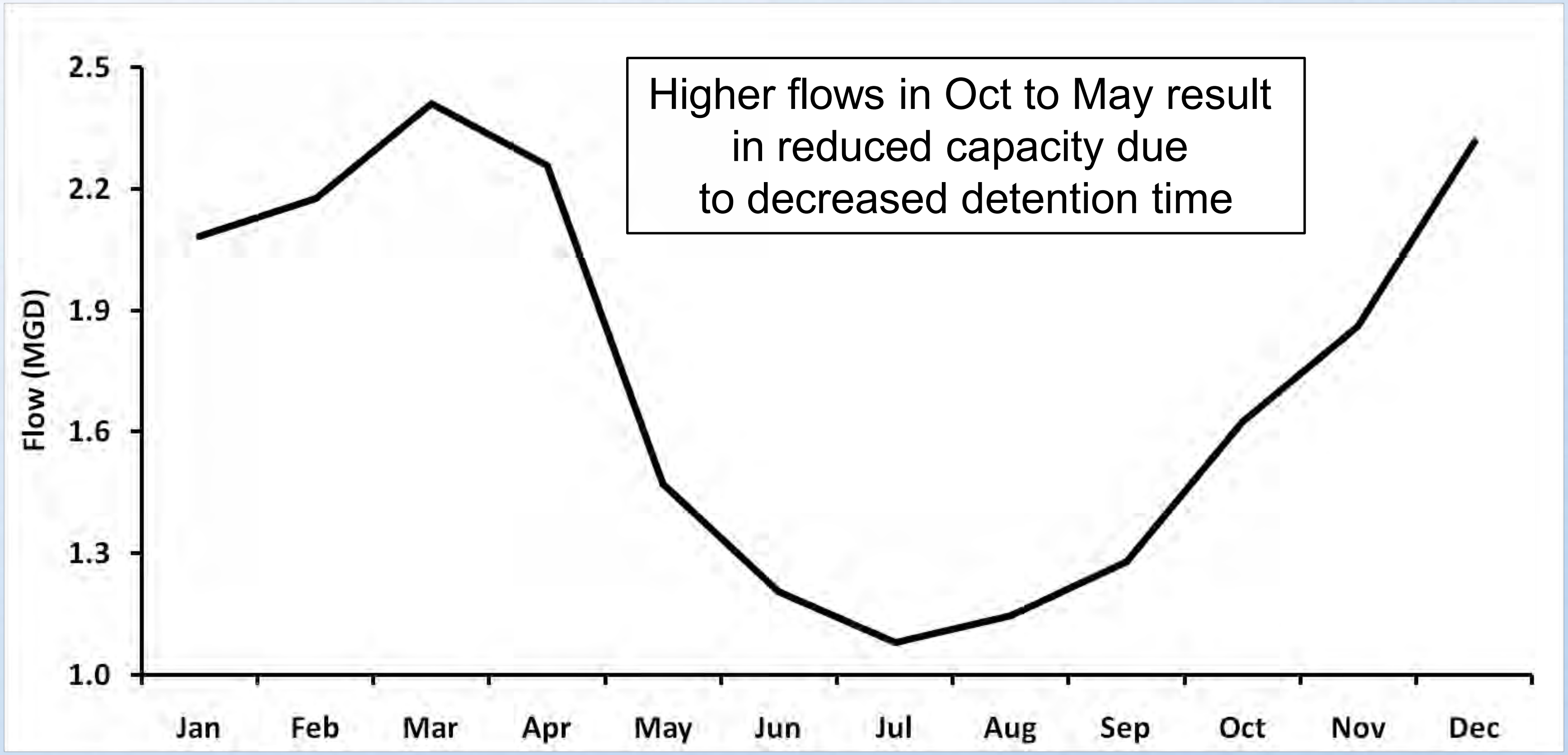
Monthly median pond 2 influent BOD loading



Pond and TW Monthly Median Effluent BOD



Monthly median TW flows



Secondary Treatment

Secondary Treatment Considerations

- Dry/wet weather flows
- Loads
- Permit & Compliance Points
- Options:
  - Flow Routing
    - Parallel, Series
    - Enhancement Wetlands
    - Blending
    - Discharges
  - Treatment Alternatives for BOD & TSS Removal
- Future Considerations e.g. nutrient removal

Proposed Design Flows

Secondary Treatment and Outfall 001 disinfection

- Dry weather design – 2.3 mgd < 74%
- Permit wet weather - 5.9 mgd < 92.5%
- Permit peak wet weather – 16.5 mgd

EW and Outfall 003 disinfection

- EW peak design – 2.3 mgd < 74%

Design Loads

- BOD

< 90% is less than 260 mg/L

<75% is less than 200 mg/L

< 50% is less than 190 mg/L

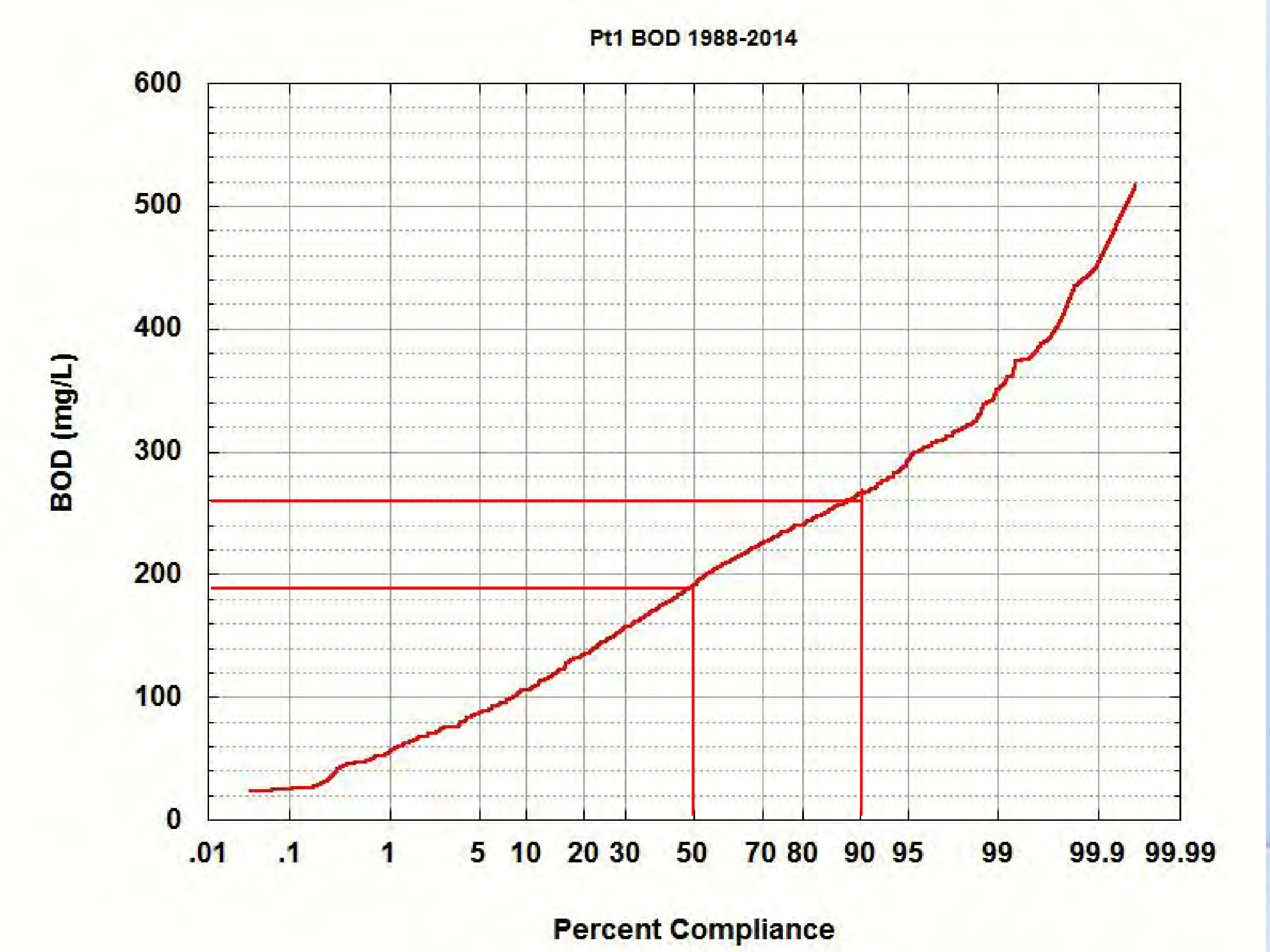
- TSS

< 90% is less than 325 mg/L

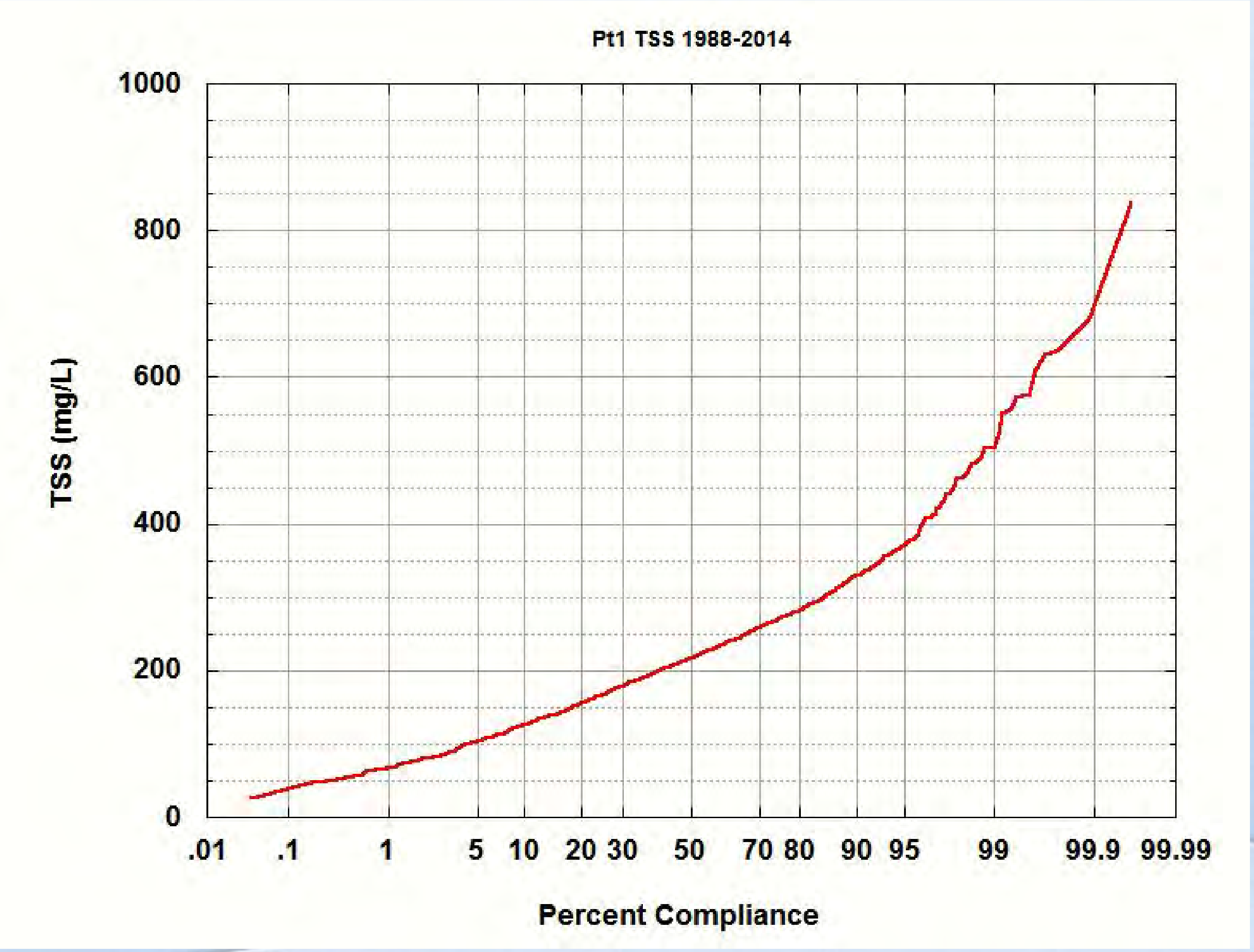
<75% is less than 225 mg

< 50% is less than 180

Point 1 BOD from 1988 – 2014

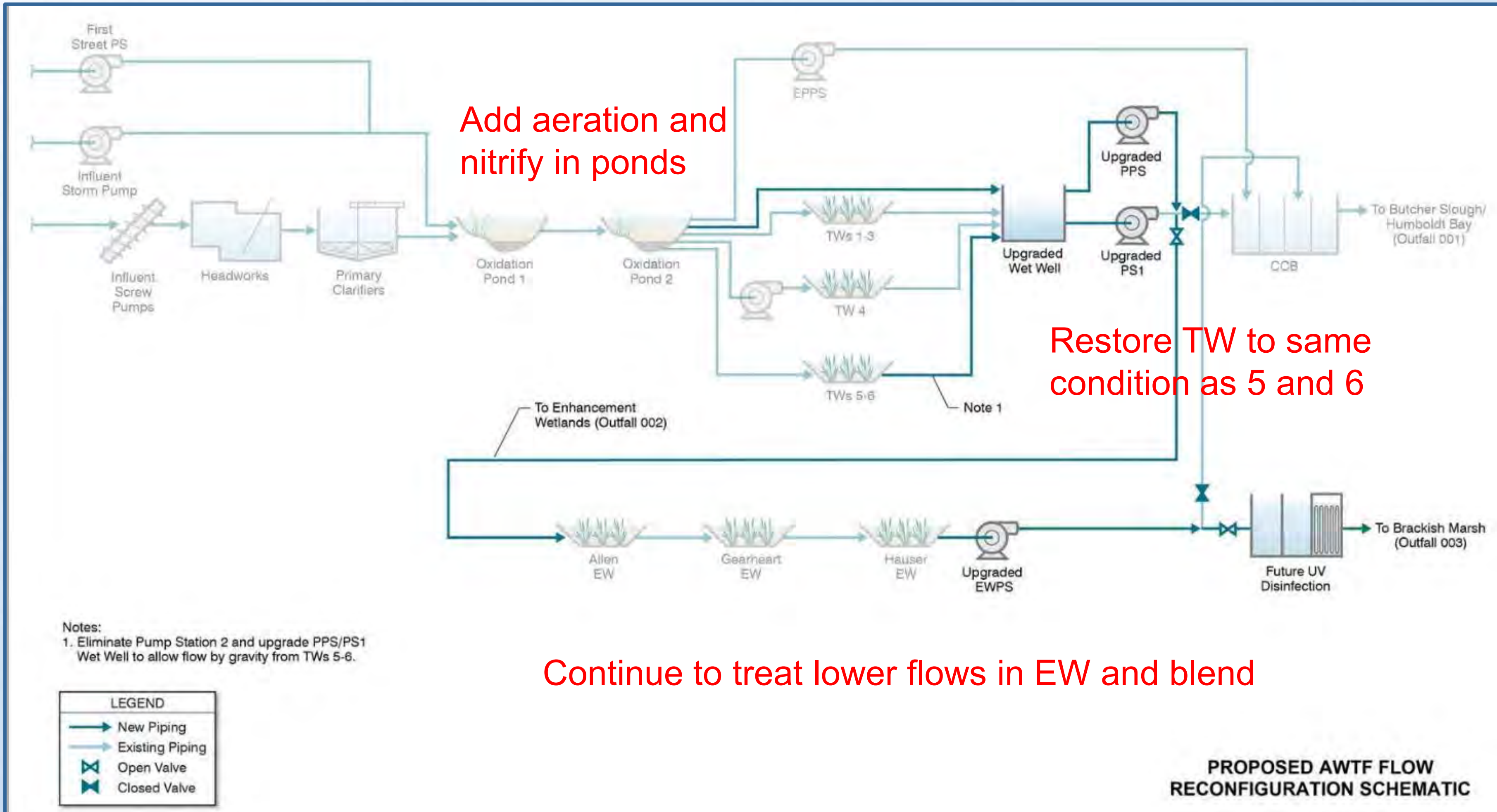


Point 1 TSS from 1988 – 2014



Potential capacity improvements

Add conventional treatment before ponds or in parallel with ponds (blend)



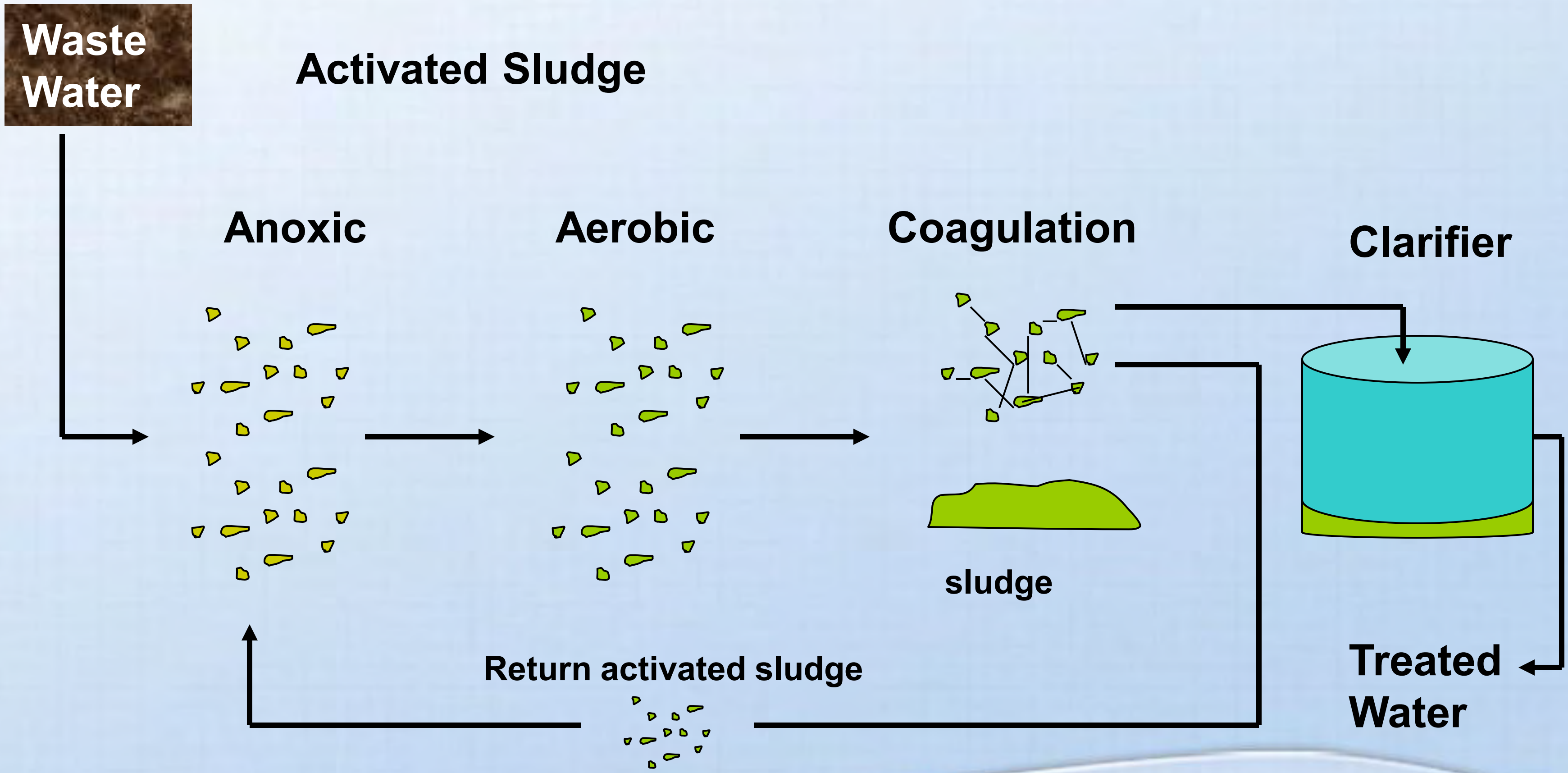
Secondary treatment processes

- BOD Removal
- Biological Processes - Dissolved Oxygen, MLSS, Sludge generation or Sloughing
  - Aeration Equipment - Blowers and Diffusers or Aerators, and Process Control
  - TF Equipment - Pumps, Ventilation & Odor Control
- Secondary Clarifiers
  - Return Activated Sludge - Pumps
  - Waste Activated Sludge - Pumps

Secondary treatment alternatives

- Conventional Activated Sludge (Aeration Basins, Blowers, Diffusers)
- Extended Aeration (Oxidation Ditch)
- Trickling Filters (Older rock media newer with Plastic Media)
- Oxidation Pond Modifications (Aerated lagoon, Biolac)

Suspended growth biological processes



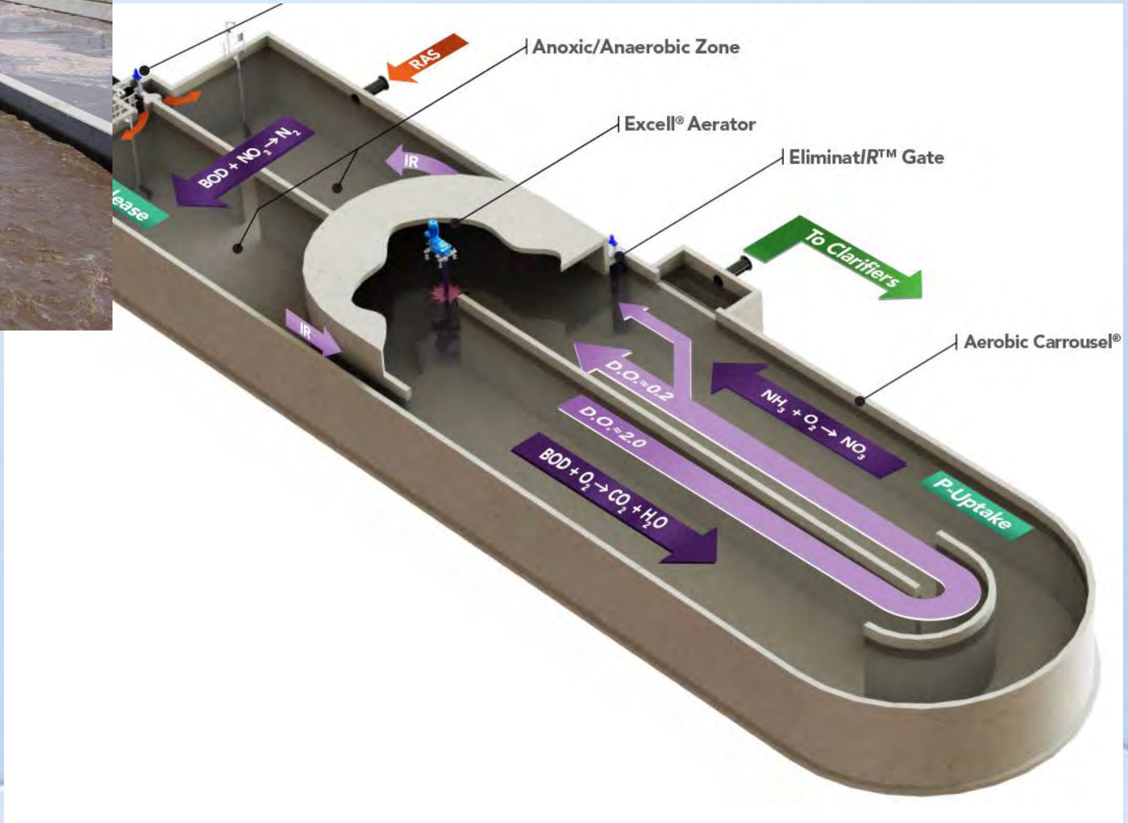
Anoxic – no dissolved oxygen

Conventional activated sludge

Membrane diffusers by Sanitaire

Extended aeration – Oxidation ditch

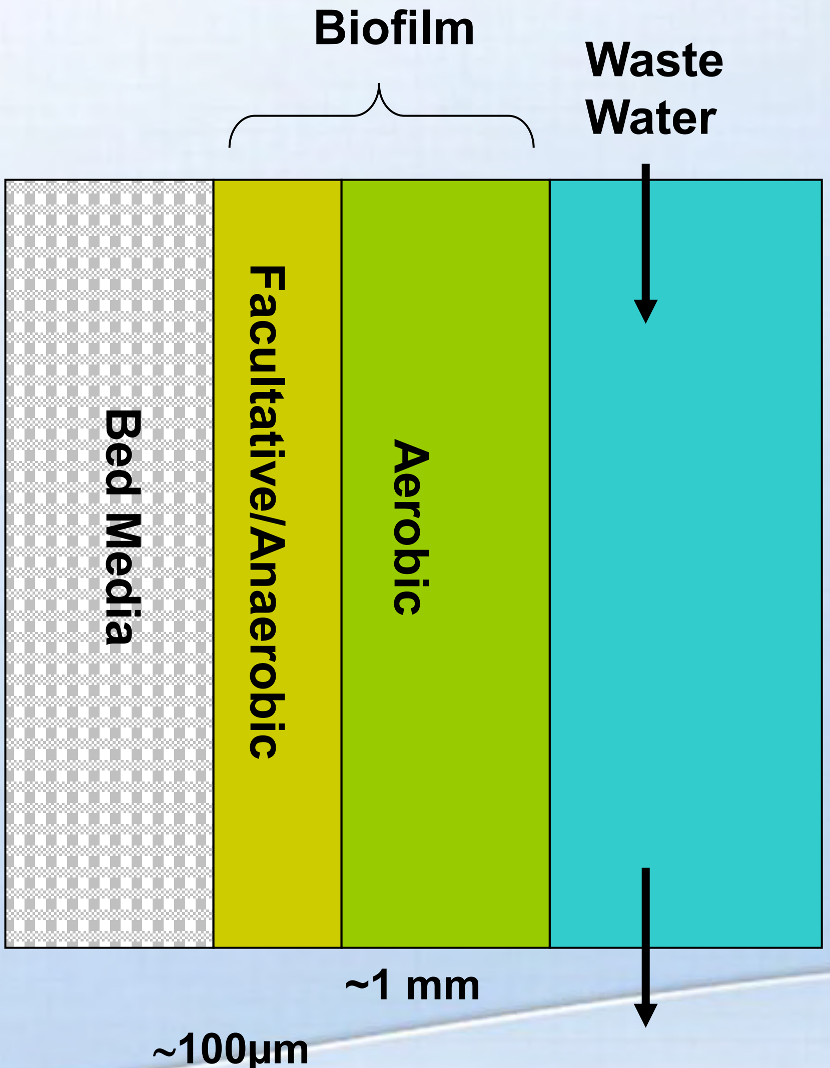
Extended Aeration - Oxidation Ditch



Extended Aeration - Oxidation Ditch

Extended aeration - Oxidation ditch

Fixed film biological processes



Fixed film biological processes

Trickling filter

Rotating biological contactor
(40% submerged rotates at 1-1.5 rpm)

Uses biofilm to treat water to remove BOD

Trickling Filters

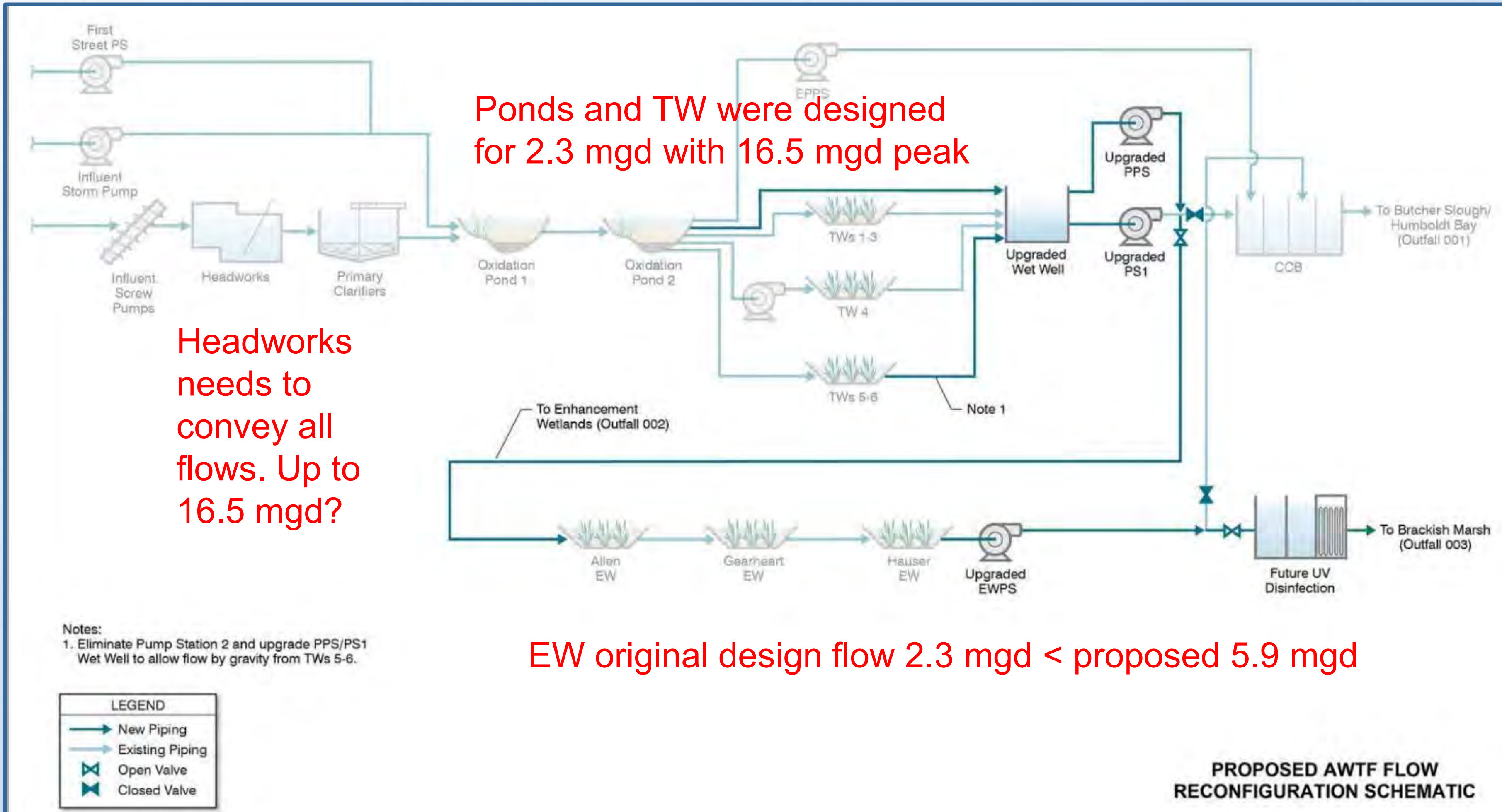
Plastic “Mixed Media” by Brentwood Industries

Pond – extended aeration

Pond – extended aeration

Vertical surface aerators

Existing design flow rates



Ponds and TW were designed for 2.3 mgd with 16.5 mgd peak

Headworks needs to convey all flows. Up to 16.5 mgd?

EW original design flow 2.3 mgd < proposed 5.9 mgd

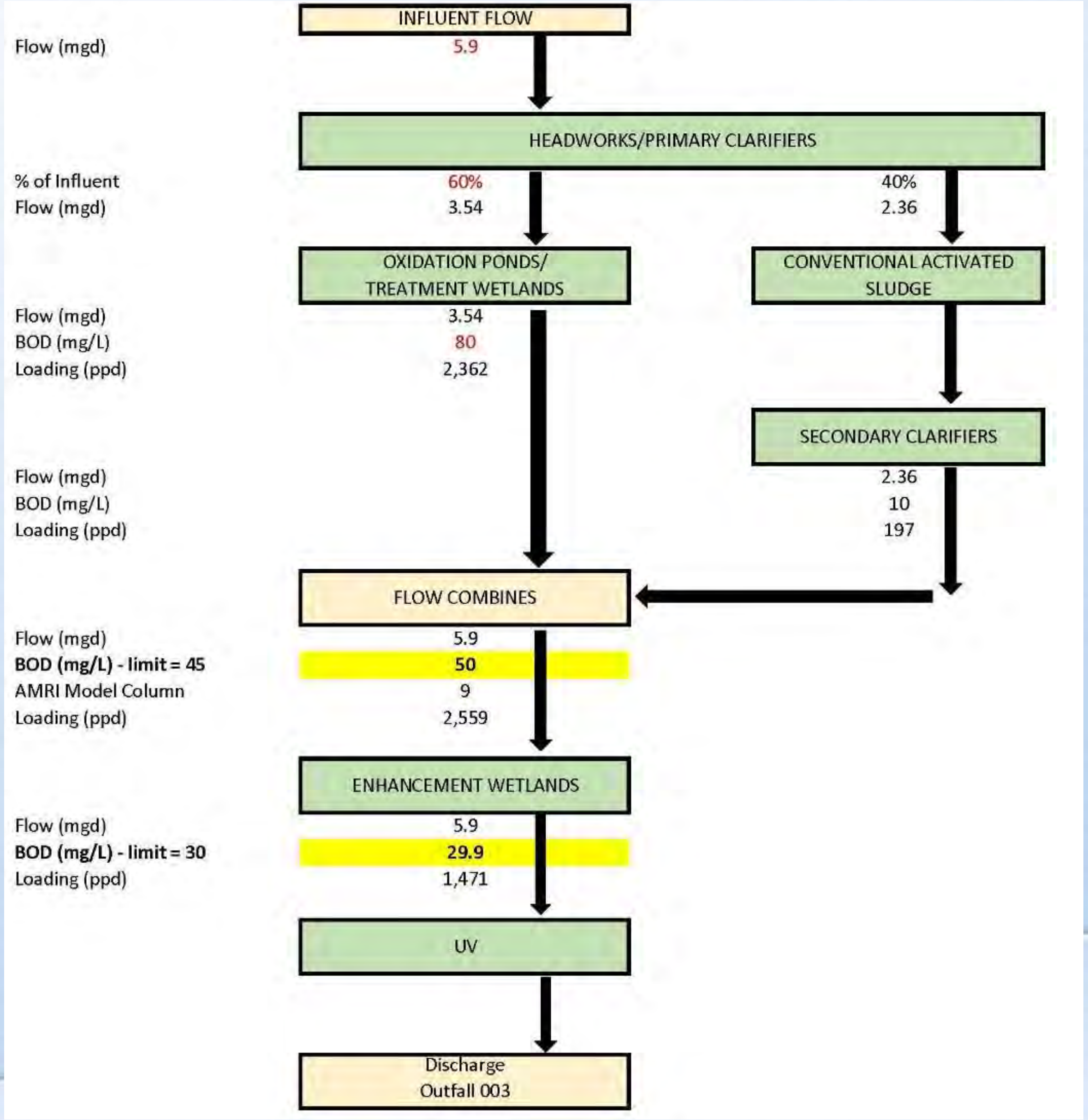
Design criteria for secondary treatment alternatives

Design Parameter	Average Value	90th Percentile
ADW Flow (mgd)	2.3	
PWW Flow (mgd)	5.9	5.0
Influent BOD Concentration (mg/L)	180	260
Influent TSS Concentration (mg/L)	200	325
Influent BOD Load (lb/d)	3500	
Influent TSS Load (lb/d)	3850	

Conceptual sizing of secondary treatment alternatives

	Alternative			
Item	Conventional Activated Sludge	Extended Aeration	Trickling Filters	Oxidation Pond Modifications
Primary Clarifiers - Quantity & Diameter	2 @ 40 ft ea	N/A	2 @ 40 ft ea	N/A
Aeration Basins - Quantity & Volume	2 @ 0.23 MG ea	2 @ 1.44 MG ea	N/A	2 @ 1.44 MG ea
Trickling Filters - Quantity, Height & Diameter	N/A	N/A	2 @ 20 ft H, 61 ft ea	N/A
Secondary Clarifiers - Quantity & Diameter	2 @ 70 ft ea	2 @ 70 ft ea	2 @ 70 ft ea	2 @ 70 ft ea
Effluent BOD (mg/L)	10	20	30	20
Effluent TSS (mg/L)	10	20	30	20
Effluent Ammonia (mg/L)	Same	<1	Same	<1

Alternative Flow Diagrams



Secondary treatment ranking criteria

- Economic
  - Construction cost
  - Footprint
  - Operator attention
  - Power cost
  - Sludge production
  - Maintenance requirements
- Non economic
  - Safety
  - Meets permit
  - Constructability
  - Reliability
  - Impact on GHG emissions

Secondary Treatment Alternatives
Ranking of Economic Criteria

	Criteria					
Alternative	Construction Cost	Footprint[A]	Operator Attention	Power Cost	Sludge Production	Maintenance Requirement
Conventional Activated Sludge	3/4	3	1		1	1
Extended Aeration – Oxidation Ditch	2	1	2/3		2/3	2/3
Trickling Filters	1	2	4	4	4	4
Oxidation Pond Modifications	3/4	4	2/3		2/3	2/3

1 = Least Favorable Rank/Score; 4 = Most Favorable Rank/Score

Note:
A. Footprint consideration includes primary clarifiers, if needed. Assumes modification of existing oxidation ponds.

Secondary Treatment Alternatives Ranking of Non-Economic Criteria

	Criteria					
Alternative	Safety	Meets Permit	Ease of O&M	Constructability	Reliability & Redundancy	Impact on GHG Emissions
Conventional Activated Sludge	2	4	1	4	3/4	
Extended Aeration – Oxidation Ditch	3/4	2/3	2/3	2	3/4	
Trickling Filters	1	1	4	3	1	
Oxidation Pond Modifications	3/4	2/3	2/3	1	2	

1 = Least Favorable Rank/Score; 4 = Most Favorable Rank/Score

Typical Costs for Secondary Treatment Alternatives at Preliminary Design Criteria

Alternative	Typical Construction Cost [1]
Conventional Activated Sludge	$ 7 to 10 M
Extended Aeration – Oxidation Ditch	$ 8 to 11 M
Trickling Filters	$ 12 to 15 M
Oxidation Pond Modifications	$ 8 to 11 M

Note:
1. In 2015 dollars. Typical construction cost for secondary treatment alternative, secondary clarifiers, and primary clarifiers (if applicable). Sized for design criteria.

Other topics

- Plant rehabilitation
- Treatment wetland rehabilitation
- Pond solids- dredging and removal

Feedback and wrap up

- Flows
- Loads
- Capacity needs
- Treatment options
- Flow diagrams and blending options
- Other ideas

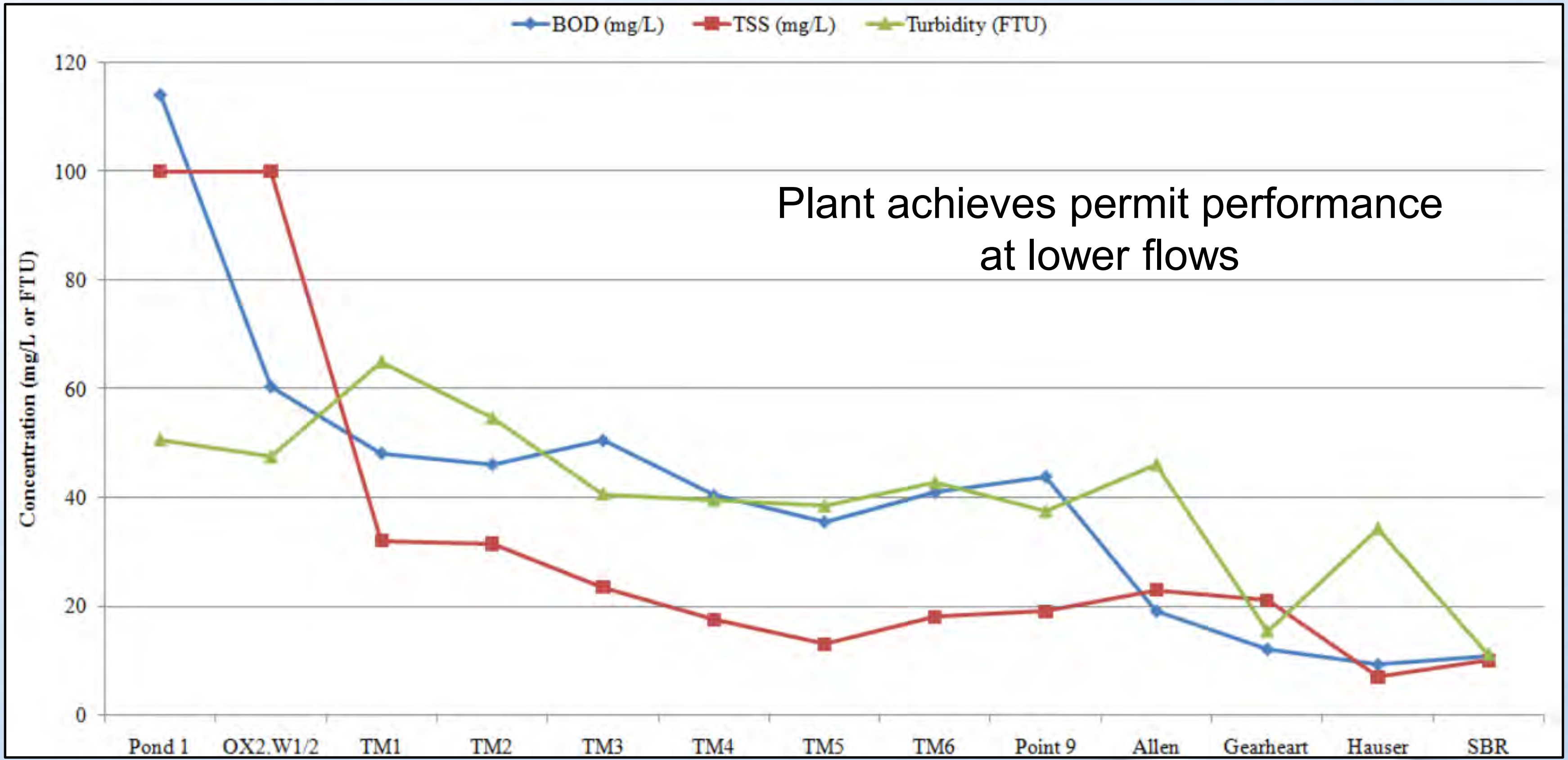
City of Arcata
Wastewater Treatment Facility Improvements Project

Facility Plan Capacity Workshop

November 5-6, 2015

Plant Loading

Plant performance in September 2015 @ 1.4 MGD

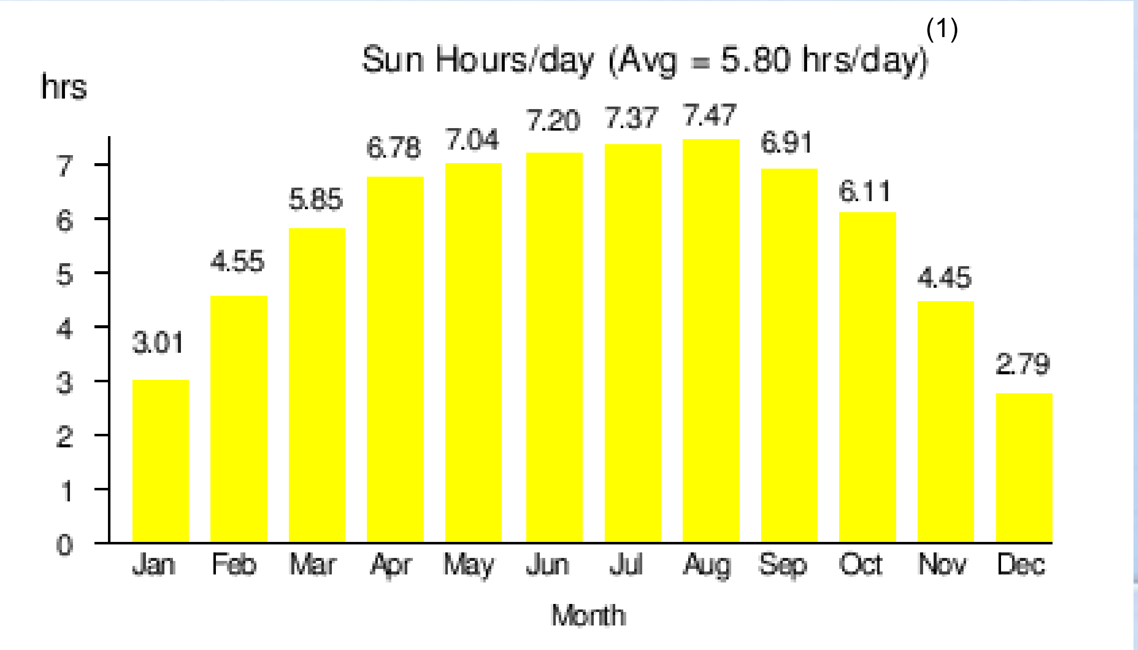


From 9/21/15 email from Bob Gearheart

Pond Capacity

Pond wastewater treatment process

- Temperature dependent
- Amount of solar radiation or sunlight



Note: 1. Need to verify for Arcata using HSU data

Typical Wastewater Treatment Pond BOD Loading Criteria

Type	Depth, ft	Detention Time, Days	Loading , PPD per acre	Effleunt- BOD mg/L	Effluent - TSS mg/L
Arcata Oxidation Pond	4.5	TBD	70 to 100	25 to 90	TBD
Oxidation Pond (1)	3 to 4.5	10 to 40	35 to 125	20 to 40	80 to 140
Facultative Ponds (1)	4.5 to 7.5	25 to 180	20 to 60	30 to 40	40 to 100
Partial Mix Aerated Lagoon (1)	6 to 18	7 to 20	45 to 180	30 to 40	30 to 60
From 1. Natural System For Waste Management and Treatment, Reed et al					

Carollo recommends 25 ppd/acre for Northern California

Treatment Wetland Capacity

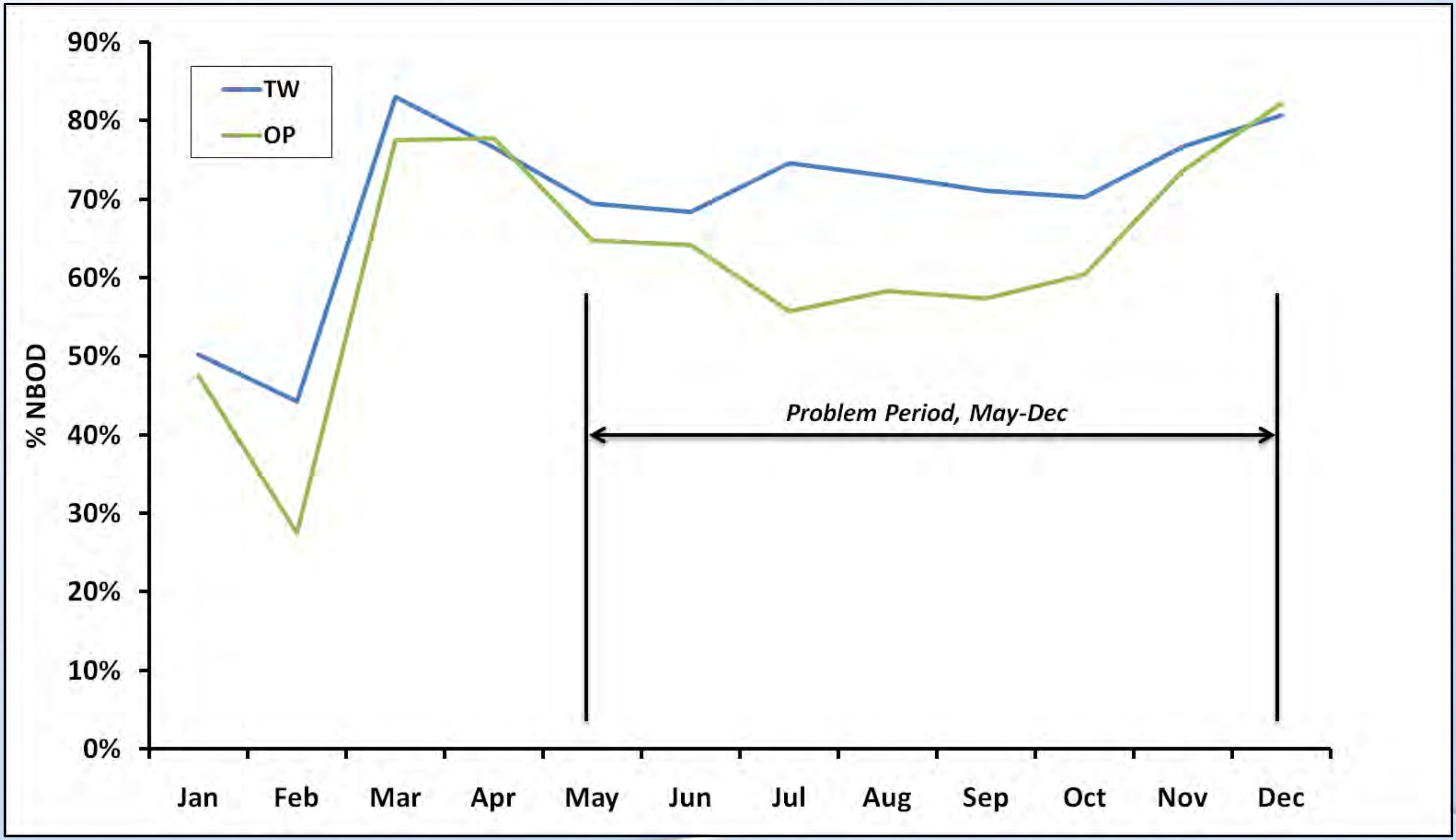
Treatment wetland capacity

	Detention Time, days	Depth, ft	Loading ppd/acre	Effluent BOD, mg/L	Effluent TSS, mg/L
Textbook(1)	7 to 15	1 to 3	100 -200	5 to 10	5 to 15
Arcata	3 to 8 for low to high flows	Varies - min depth 1 foot	TBD	25 to 85	10 to 40 for TM 5 and 6
1. Natural Systems for Waste Management and Treatment					

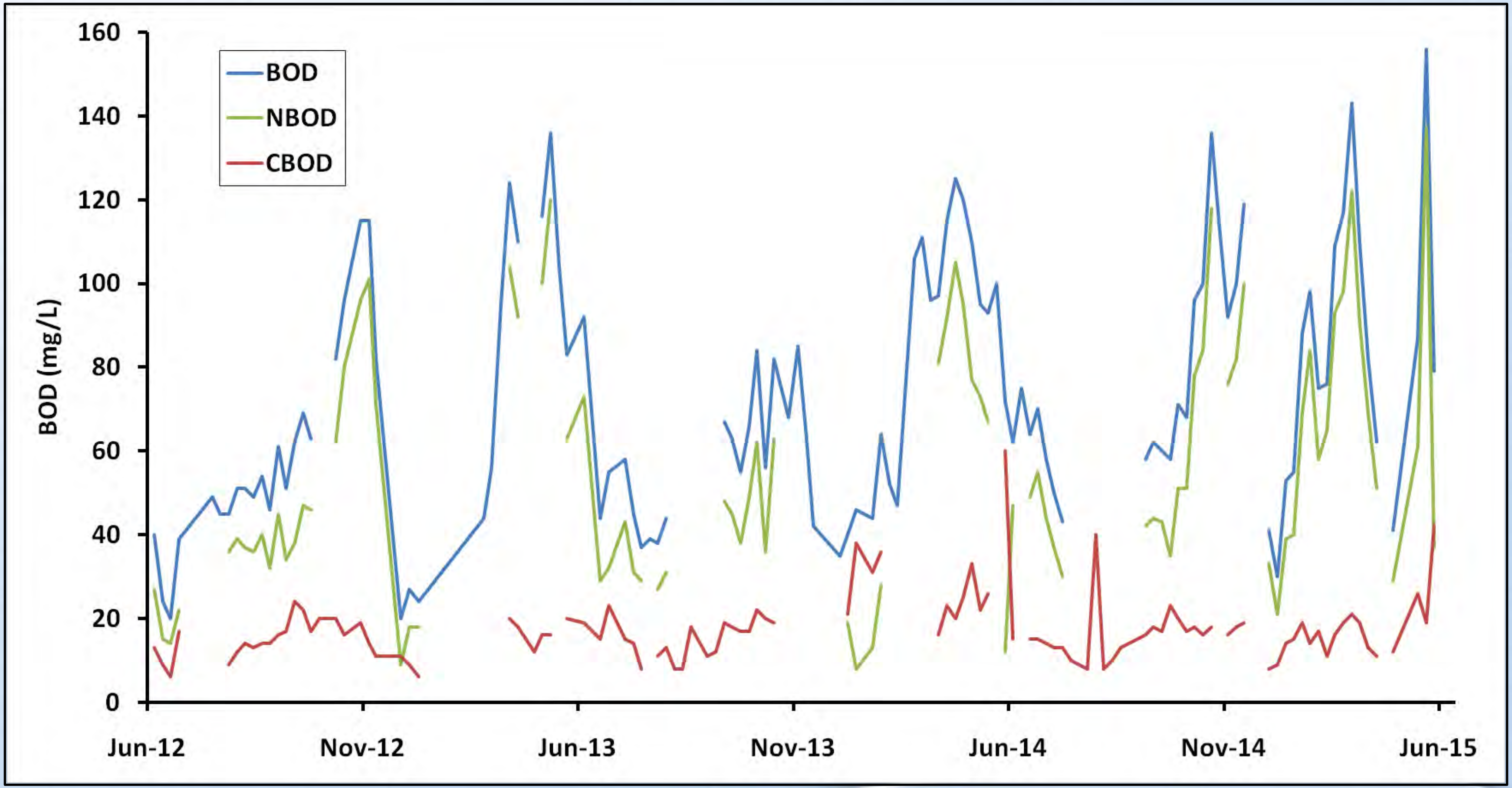
Nutrient (Nitrogen loads)

- Historic focus of RWQCB has been on permit and meeting BOD and TSS.
- Recent discussion on nutrients has indicated that ammonia and nutrients may be a future concern.
- Current data suggests that nitrogen loads impact plant capacity

Nitrogen BOD makes up a large portion of the BOD load



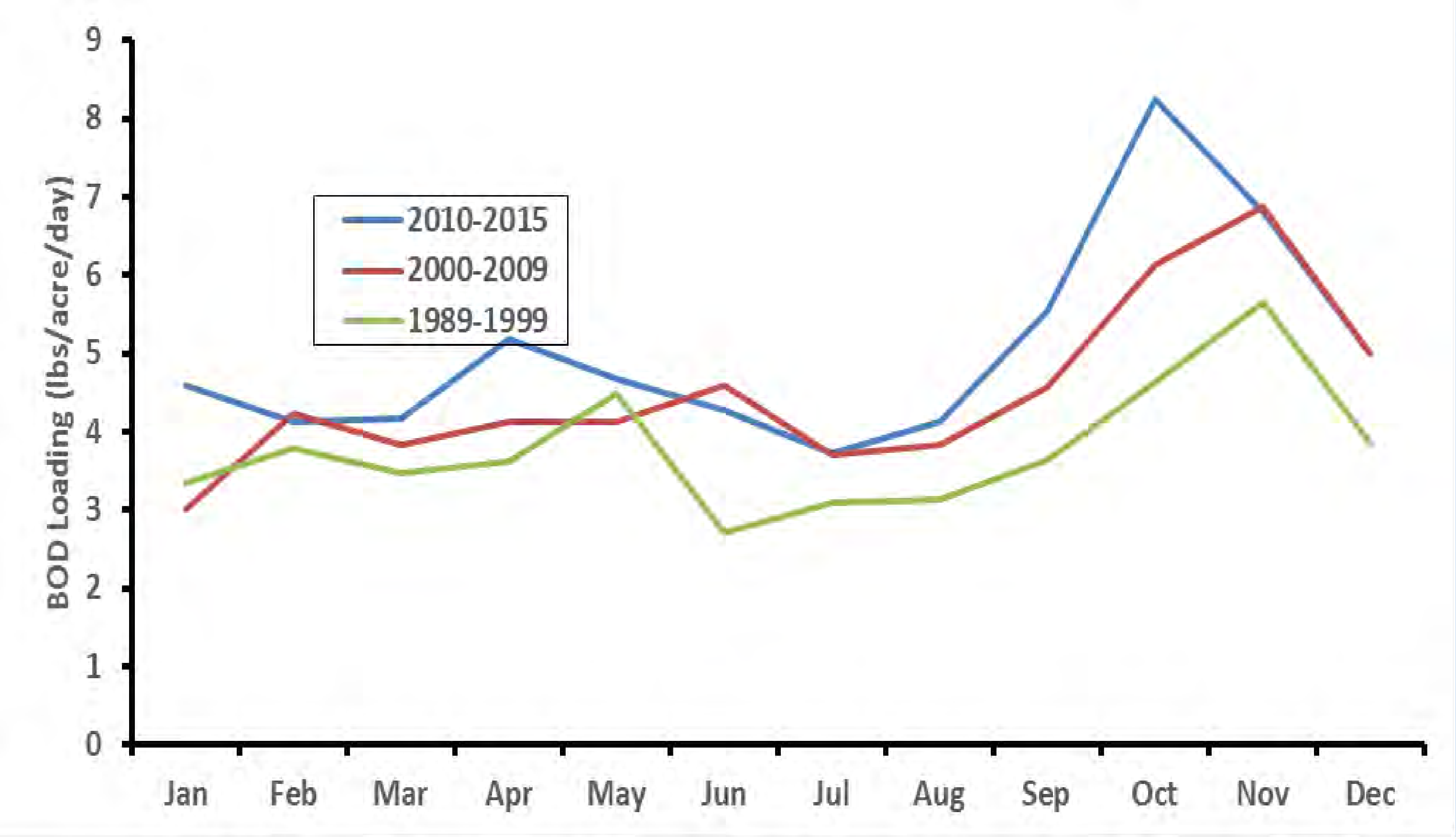
TW effluent BOD and relation to NBOD



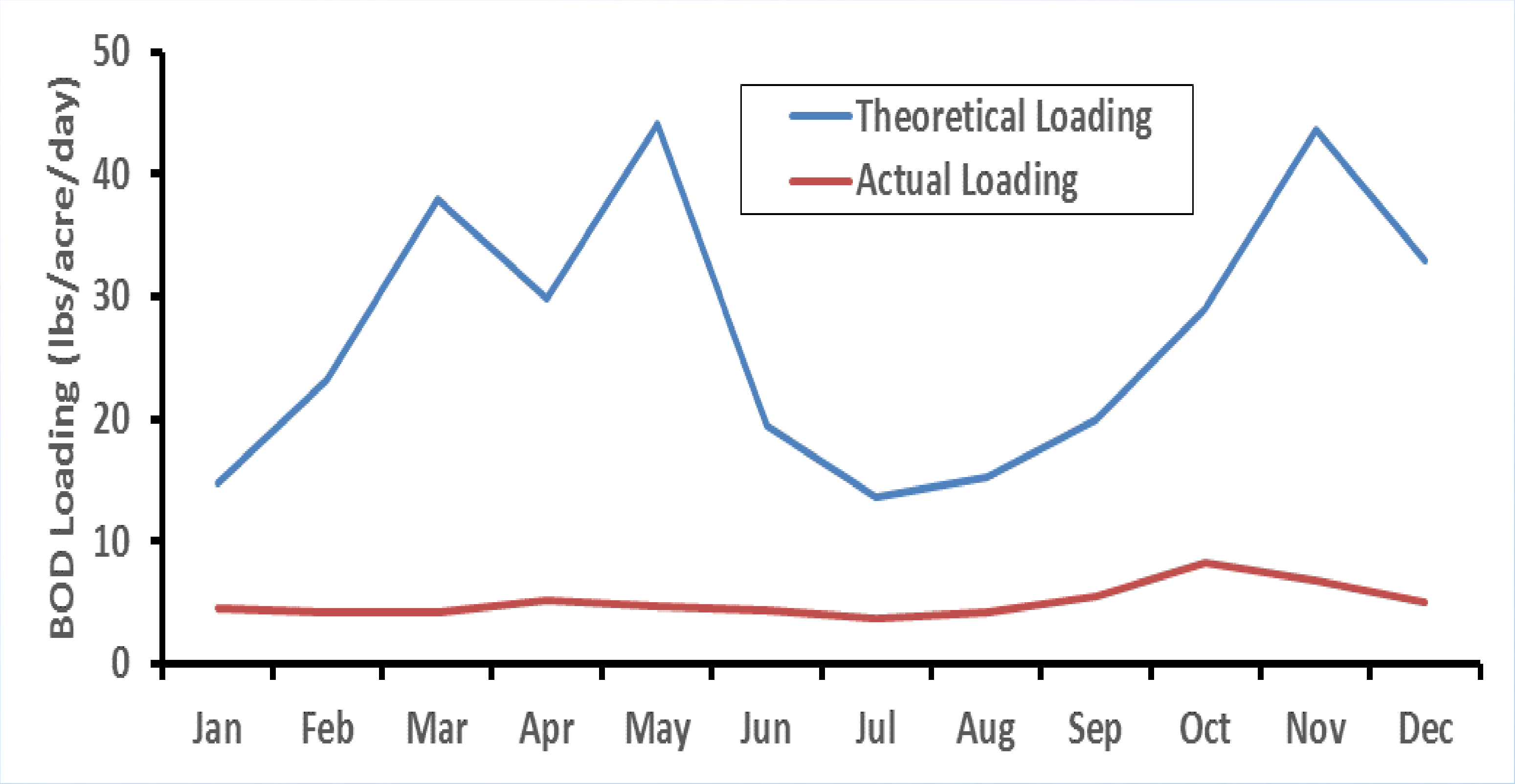
City of ARCATA

Enhancement Wetland Capacity

Historic EW loadings



Potential EW loadings may increase 4 to 5 times above the actual historic loadings



Enhancement wetland model – 30 mg/l limit

Inputs:

Date (mm/dd/yy): 1/1/13

Jan, Feb		Enhancement Wetland Effluent BOD Concentration (mg/L)														
		Influent BOD														
Flow Rate	HRT	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
1.0	11.9	1.7	2.5	3.4	4.2	5.1	5.9	6.7	7.6	8.4	9.3	10.1	10.9	11.8	12.6	13.5
1.1	10.8	1.8	2.8	3.7	4.6	5.5	6.5	7.4	8.3	9.2	10.2	11.1	12.0	12.9	13.8	14.8
1.2	9.9	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.1	16.1
1.3	9.1	2.2	3.2	4.3	5.4	6.5	7.6	8.7	9.7	10.8	11.9	13.0	14.1	15.1	16.2	17.3
1.4	8.5	2.3	3.5	4.6	5.8	7.0	8.1	9.3	10.4	11.6	12.7	13.9	15.1	16.2	17.4	18.5
1.5	7.9	2.5	3.7	4.9	6.2	7.4	8.6	9.9	11.1	12.3	13.6	14.8	16.0	17.3	18.5	19.7
1.6	7.4	2.6	3.9	5.2	6.5	7.8	9.1	10.5	11.8	13.1	14.4	15.7	17.0	18.3	19.6	20.9
1.7	7.0	2.8	4.1	5.5	6.9	8.3	9.6	11.0	12.4	13.8	15.2	16.5	17.9	19.3	20.7	22.0
1.8	6.6	2.9	4.3	5.8	7.2	8.7	10.1	11.6	13.0	14.5	15.9	17.4	18.8	20.3	21.7	23.2
1.9	6.2	3.0	4.5	6.1	7.6	9.1	10.6	12.1	13.6	15.1	16.7	18.2	19.7	21.2	22.7	24.2
2.0	5.9	3.2	4.7	6.3	7.9	9.5	11.1	12.6	14.2	15.8	17.4	19.0	20.5	22.1	23.7	25.3
2.2	5.4	3.4	5.1	6.8	8.5	10.2	11.9	13.6	15.3	17.0	18.8	20.5	22.2	23.9	25.6	27.3
2.4	4.9	3.6	5.5	7.3	9.1	10.9	12.8	14.6	16.4	18.2	20.0	21.9	23.7	25.5	27.3	29.2
2.6	4.6	3.9	5.8	7.7	9.7	11.6	13.5	15.5	17.4	19.3	21.3	23.2	25.1	27.1	29.0	30.9
2.8	4.2	4.1	6.1	8.1	10.2	12.2	14.3	16.3	18.3	20.4	22.4	24.4	26.5	28.5	30.5	32.6
3.0	4.0	4.3	6.4	8.5	10.7	12.8	14.9	17.1	19.2	21.3	23.5	25.6	27.7	29.9	32.0	34.1
3.2	3.7	4.5	6.7	8.9	11.1	13.4	15.6	17.8	20.0	22.3	24.5	26.7	28.9	31.2	33.4	35.6
3.4	3.5	4.6	6.9	9.3	11.6	13.9	16.2	18.5	20.8	23.1	25.4	27.8	30.1	32.4	34.7	37.0
3.6	3.3	4.8	7.2	9.6	12.0	14.4	16.8	19.2	21.6	24.0	26.3	28.7	31.1	33.5	35.9	38.3
3.8	3.1	4.9	7.4	9.9	12.4	14.8	17.3	19.8	22.3	24.7	27.2	29.7	32.1	34.6	37.1	39.6
4.0	3.0	5.1	7.6	10.2	12.7	15.3	17.8	20.4	22.9	25.5	28.0	30.5	33.1	35.6	38.2	40.7
4.2	2.8	5.2	7.8	10.5	13.1	15.7	18.3	20.9	23.5	26.1	28.8	31.4	34.0	36.6	39.2	41.8
4.4	2.7	5.4	8.0	10.7	13.4	16.1	18.8	21.4	24.1	26.8	29.5	32.2	34.8	37.5	40.2	42.9
4.6	2.6	5.5	8.2	11.0	13.7	16.5	19.2	21.9	24.7	27.4	30.2	32.9	35.7	38.4	41.1	43.9
4.8	2.5	5.6	8.4	11.2	14.0	16.8	19.6	22.4	25.2	28.0	30.8	33.6	36.4	39.2	42.0	44.8
5.0	2.4	5.7	8.6	11.4	14.3	17.1	20.0	22.9	25.7	28.6	31.4	34.3	37.2	40.0	42.9	45.7
5.5	2.2	6.0	9.0	11.9	14.9	17.9	20.9	23.9	26.9	29.9	32.9	35.8	38.8	41.8	44.8	47.8
6.0	2.0	6.2	9.3	12.4	15.5	18.6	21.7	24.8	27.9	31.0	34.1	37.2	40.3	43.4	46.5	49.6
6.5	1.8	6.4	9.6	12.8	16.0	19.2	22.4	25.6	28.8	32.0	35.3	38.5	41.7	44.9	48.1	51.3
7.0	1.7	6.6	9.9	13.2	16.5	19.8	23.1	26.4	29.7	33.0	36.3	39.6	42.9	46.2	49.5	52.8
7.5	1.6	6.8	10.1	13.5	16.9	20.3	23.7	27.0	30.4	33.8	37.2	40.6	43.9	47.3	50.7	54.1

Additional Treatment Capacity

Additional TW BOD removal with optimal TW performance

Pt 002 BOD Permit Limit (mg/L)	45		
Flow Exceedance Probability	50%	10%	0.5%
Flow (MGD)	1.8	4	6
Pt 002 BOD Load (lb/d)	676	1,501	2,252
Problem Period	Jun-Sep	May, Oct-Nov	May, Oct-Nov
Median Monthly Pond 2 BOD (mg/L)	53	97	97
Pond 2 BOD Load (lb/d)	796	3,236	4,854
Total Required BOD Removal (lb/d)	120	1,735	2,602
Optimal TW BOD Removal (lb/d)	388	585	585
Remaining BOD Treatment (lb/d)	0	1,150	2,017
Remaining Treatment as NBOD (lb/d)	0	747	1,311
Remaining Treatment as N (lb/d)	0	218	382

Capacity Issues

- Ponds
  - High Pond 1 BOD loading
  - Pond 2 short circuiting
  - Sludge accumulation and impact on capacity
  - Minimum volume to store wet weather flows
  - Do not nitrify in fall, winter and spring
- Treatment wetlands
  - Need to revegetate/regrade wetlands No. 1- 4.
  - Need more acreage beyond proposed No. 7
  - Require on-going vegetation management

Capacity issues, cont.

- Enhancement wetlands
  - Proposed flows are higher than ever designed
  - Short circuiting reduces detention time
  - Peak flows reduce detention time and predicted effluent BOD exceeds permit
  - Requires on-going vegetation management

City of Arcata
Wastewater Treatment Facility Improvements Project

Facility Plan Capacity Workshop

FRIDAY November 6, 2015

Agenda

Thursday PM

- Revisit project goals
- Review current flows, loads and capacity
- Treatment capacity options – conceptual size
- Meeting required capacity – flow charts
- Ranking and feedback on options
- Conceptual Costs
- Feedback

Agenda

Friday AM

- Disinfection criteria
- Disinfection options ranking
- Comparison of disinfection options
- Revisit treatment capacity flow options
- Discuss Facility Plan next steps

Friday PM

- Visit Petaluma Ellis Creek WRF

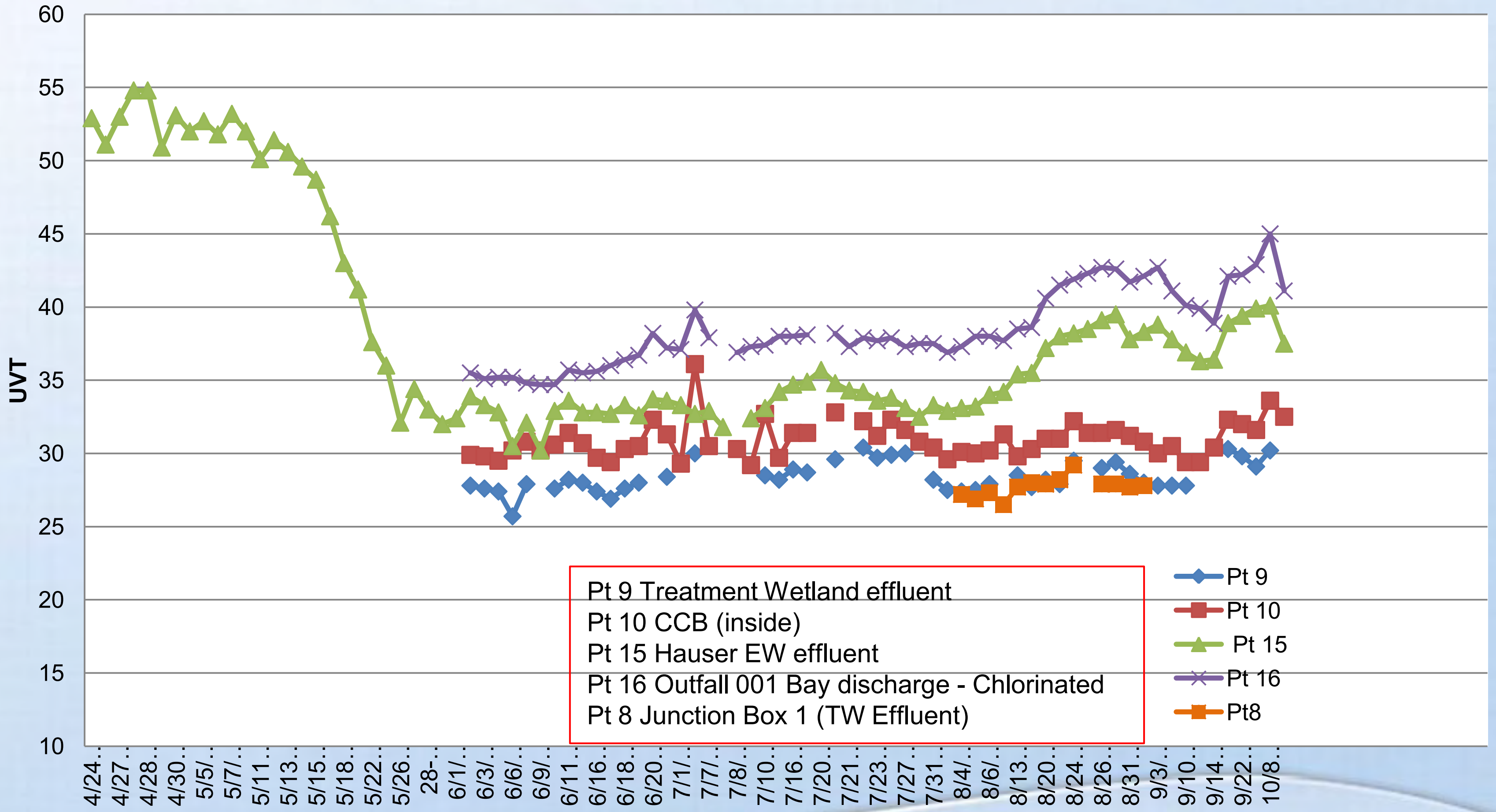
Facility Plan Task Objectives

1. Focus on permit required improvements
2. Capital improvements for AWTF
3. Approach to address:
   a. Aging infrastructure
   b. Energy efficiency
   c. Community needs
   d. CAPACITY NEEDS

Disinfection

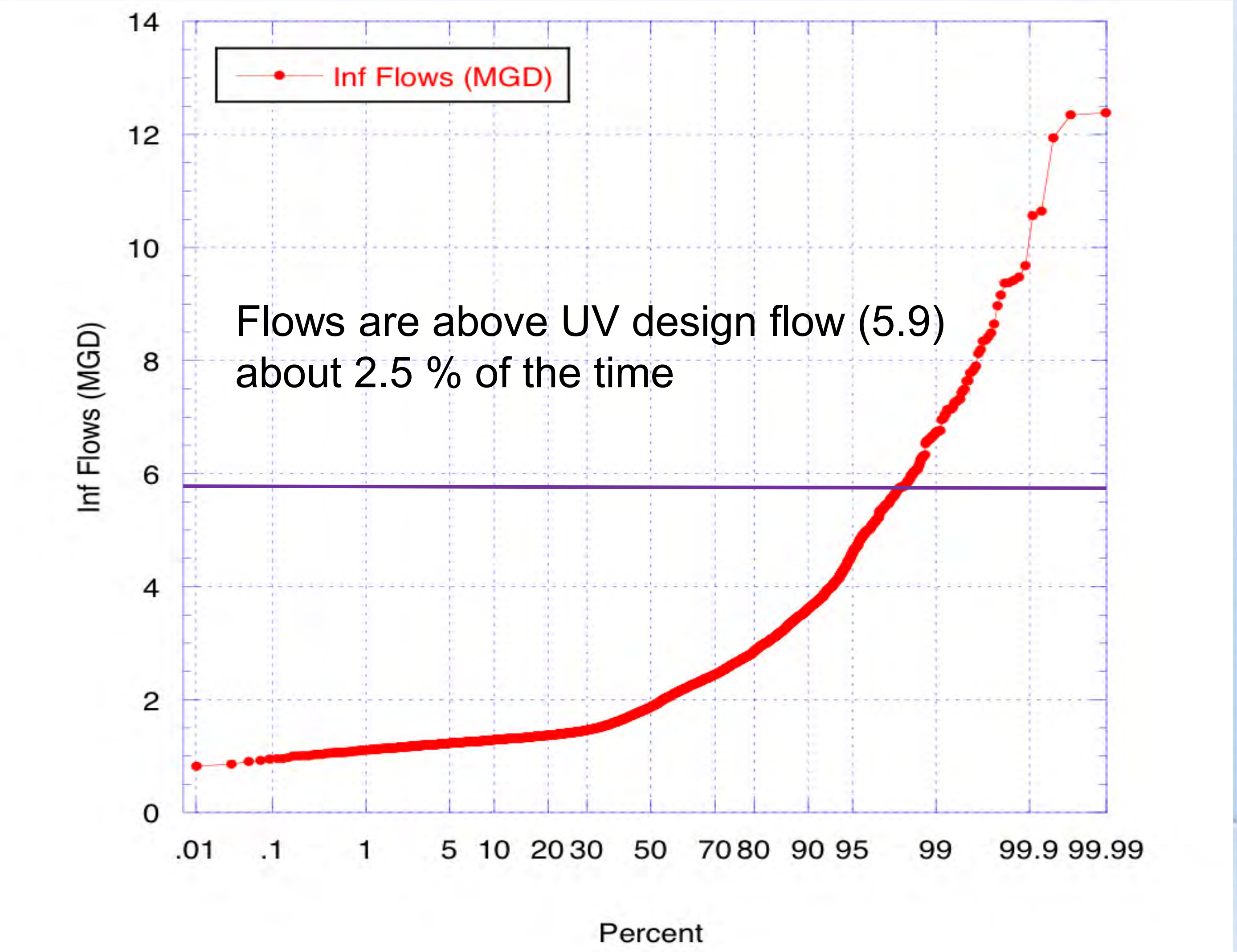
Outfall 003 Disinfection

UVT Analysis – Design for lower than 35%. Lower 10th percentile – 32.5 for Pt 15



Outfall 001 Disinfection

Influent Flows for Point 1 from 1997 – 2010



Impact of Rainfall on Plant Flows
Dry Weather [1]

	Dry Weather					
Rainfall	1.3 MGD					
(in/day)	TW Flow	Pond Pump	Pt 001 Chlorine Disinfection.	Pt 002	UV Flow	Total
0.2	1.6	0.0	0.0	1.6	1.8	1.8
0.4	1.9	0.0	0.0	1.9	2.4	2.4
0.6	2.3	0.0	0.0	2.3	2.9	2.9
0.8	2.6	0.0	0.0	2.6	3.5	3.5
1.0	2.9	0.0	0.0	2.9	4.0	4.0
1.2	3.2	0.0	0.0	3.2	4.5	4.5
1.4	3.6	0.0	0.0	3.6	5.1	5.1
1.6	3.9	0.0	0.0	3.9	5.6	5.6
1.8	4.2	0.0	0.3	3.9	5.9	6.2
2.0	4.5	0.0	0.8	3.7	5.9	6.7
2.2	4.9	0.0	1.4	3.5	5.9	7.3
2.4	5.2	0.0	1.9	3.3	5.9	7.8
2.6	5.5	0.0	2.4	3.1	5.9	8.3
2.8	5.8	0.0	3.0	2.9	5.9	8.9
3.0	6.2	0.0	3.5	2.6	5.9	9.4

1. Expected and feasible flow rates through various parts of the Arcata WWTF based on influent flow rates of 1.3 and 2.3 MGD
Halverson 11/2012

Impact of Rainfall on Plant Flows
Design Flow

	Design Flow					
Rainfall	2.3 MGD					
(in/day)	TW Flow	Pond Pump	Pt 001 Chlorine Disinfection.	Pt 002	UV Flow	Total
0.2	2.6	0.0	0.0	2.6	2.8	2.8
0.4	2.9	0.0	0.0	2.9	3.4	3.4
0.6	3.3	0.0	0.0	3.3	3.9	3.9
0.8	3.6	0.0	0.0	3.6	4.5	4.5
1.0	3.9	0.0	0.0	3.9	5.0	5.0
1.2	4.2	0.0	0.0	4.2	5.5	5.5
1.4	4.6	0.0	0.2	4.4	5.9	6.1
1.6	4.9	0.0	0.7	4.2	5.9	6.6
1.8	5.2	0.0	1.3	3.9	5.9	7.2
2.0	5.5	0.0	1.8	3.7	5.9	7.7
2.2	5.9	0.0	2.4	3.5	5.9	8.3
2.4	6.2	0.0	2.9	3.3	5.9	8.8
2.6	6.2	0.3	3.4	3.1	5.9	9.3
2.8	6.2	0.6	4.0	2.9	5.9	9.9
3.0	6.2	1.0	4.5	2.6	5.9	10.4

Impact of Rainfall on Plant Flows Wet Weather flow

	Wet Weather Flow					
Rainfall	6.4 MGD					
(in/day)	TW Flow	Pond Pump	Pt 001 Chlorine Disinfection.	Pt 002	UV Flow	Total
0.2	6.2	0.5	1.0	5.7	5.9	6.9
0.4	6.2	0.8	1.6	5.5	5.9	7.5
0.6	6.2	1.2	2.1	5.2	5.9	8.0
0.8	6.2	1.5	2.7	5.0	5.9	8.6
1.0	6.2	1.8	3.2	4.8	5.9	9.1
1.2	6.2	2.1	3.7	4.6	5.9	9.6
1.4	6.2	2.5	4.3	4.4	5.9	10.2
1.6	6.2	2.8	4.8	4.2	5.9	10.7
1.8	6.2	3.1	5.4	3.9	5.9	11.3
2.0	6.2	3.4	5.9	3.7	5.9	11.8
2.2	6.2	3.8	6.5	3.5	5.9	12.4
2.4	6.2	4.1	7.0	3.3	5.9	12.9
2.6	6.2	4.4	7.5	3.1	5.9	13.4
2.8	6.2	4.7	8.1	2.9	5.9	14.0
3.0	6.2	5.1	8.6	2.6	5.9	14.5

1. Expected and feasible flow rates through various parts of the Arcata WWTF based on influent flow rates of 6.4 MGD
Halverson 11/2012

Disinfection Issues

- Wetland effluent UVT and impact on UV system cost and size.
- Disinfection of peak flows
  - Need to turn on / off
  - Sits idle most of the time
  - Disinfection byproducts
  - Dechlorination required

Disinfection Considerations

- Flow Routing
- Disinfection Alternatives:
  - UV
  - Chlorine (Gas, Sodium Hypochlorite, Chloramination)
  - Ozone
- Evaluation of Alternatives:
  - Ranking of Criteria by Importance:
    - Safety
    - Chemicals
    - Lifecycle Cost
    - DBPs
    - Future Permit
  - Pair-Wise Evaluation

Alternative Flow Routing

UV Petaluma

Chlorine Gas

VSFCD Hypochlorite

On-Site Hypochlorite

Chloramine disinfection – Anhydrous Ammonia addition with chlorine

Ozone

Ozone

Disinfection alternatives ranking criteria

- Safety
- Chemicals
- Cost
- Disinfection byproducts
- Future permit

Disinfection Considerations

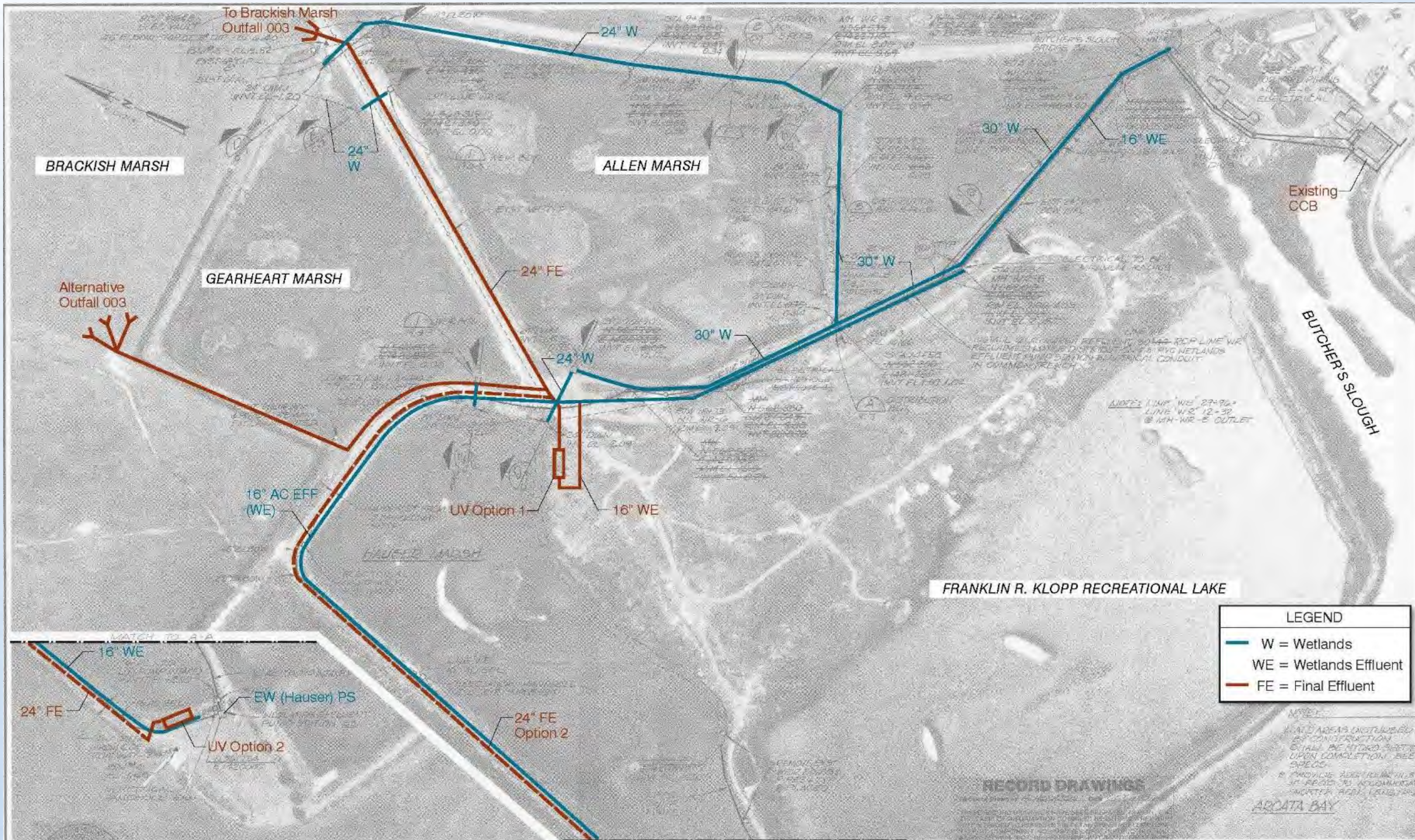
- Flow Routing
- Disinfection Alternatives:
  - UV
  - Chlorine (Gas, Sodium Hypochlorite, Chloramination)
  - Ozone
- Evaluation of Alternatives:
  - Ranking of Criteria by Importance:
    - Safety
    - Chemicals
    - Lifecycle Cost
    - DBPs
    - Future Permit
  - Pair-Wise Evaluation

Disinfection Alternatives Ranking

	Criteria				
Alternative	Safety	Chemicals	Lifecycle Cost	DBPs	Future Permit
UV	4	5	2	5	2
Chlorine – Gas (Existing)	1	2	5	1	4
Chlorine – Sodium Hypochlorite (Delivered)	3	2	3	1	4
Chlorine – Sodium Hypochlorite (Generated Onsite)	2-3	2	3	1	4
Chlorine - Chloramination	2-3	1	2-3	2-3	1
Ozone	3	4	1	4	5
Peracetic Acid	4	3	3	4	1

1 = Least Favorable Rank/Score; 5 = Most Favorable Rank/Score

UV Location



To Brackish Marsh Outfall 003
24" W
24" W
BRACKISH MARSH
ALLEN MARSH
30" W
16" WE
Existing CCB
GEARHEART MARSH
24" FE
30" W
Alternative Outfall 003
30" W
24" W
BUTCHER'S SLOUGH
16" AC EFF (WE)
UV Option 1
16" WE
FRANKLIN R. KLOPP RECREATIONAL LAKE
LEGEND
W = Wetlands
WE = Wetlands Effluent
FE = Final Effluent
16" WE
EW (Hauser) PS
24" FE
UV Option 2
24" FE Option 2
RECORD DRAWINGS

Wrap up and review

- Capacity – limited by existing natural system footprint and environment
- Additional treatment options – needed to make up for shortfall, and to reliably meet permit
- Disinfection – need to address wet weather and increasing costs
- Workshop agenda – collaborate on items for discussion

Wrap up and Action Item

- Address treatment capacity shortfall
- Address UV and alternative disinfection
- Provide draft chapter to Facility plan
- Review comments and finalize Facility Plan
- Follow up with update for RWQCB

City of Arcata
Wastewater Treatment Facility Improvements Project

Facility Plan Capacity Workshop

FRIDAY November 6, 2015

Petaluma Ellis Creek WRF

City of Arcata
Wastewater Treatment Facility Improvements Project

Update on Facility Plan Capacity Review

Questions / Comments Doug Wing
dwing@Carollo.com

Disinfection

UV System Installation Cost Estimate – based on 35% UVT

Dose (mJ/cm^2)	35	35 with Redundancy	50	50 with Redundancy
UV Disinfection Equipment Cost	$800,000	$1,090,000	$1,050,000	$1,310,000
Total Construction Costs:				
Low range (3 times equipment)	$2,400,000	$3,270,000	$3,150,000	$3,930,000
High range (5 times equipment)	$4,000,000	$5,450,000	$5,250,000	$6,550,000

Notes:
(1) Equipment sizing is based on an End of Lamp Life Factor of 0.90 and a Fouling Factor of 0.95.

Based on Trojan UV 3000Plus

Existing Pond Storage – City needs to confirm storage is available

APPENDIX H – PROCESS AREA PHOTOS

Appendix H - Condition Assessment Photos

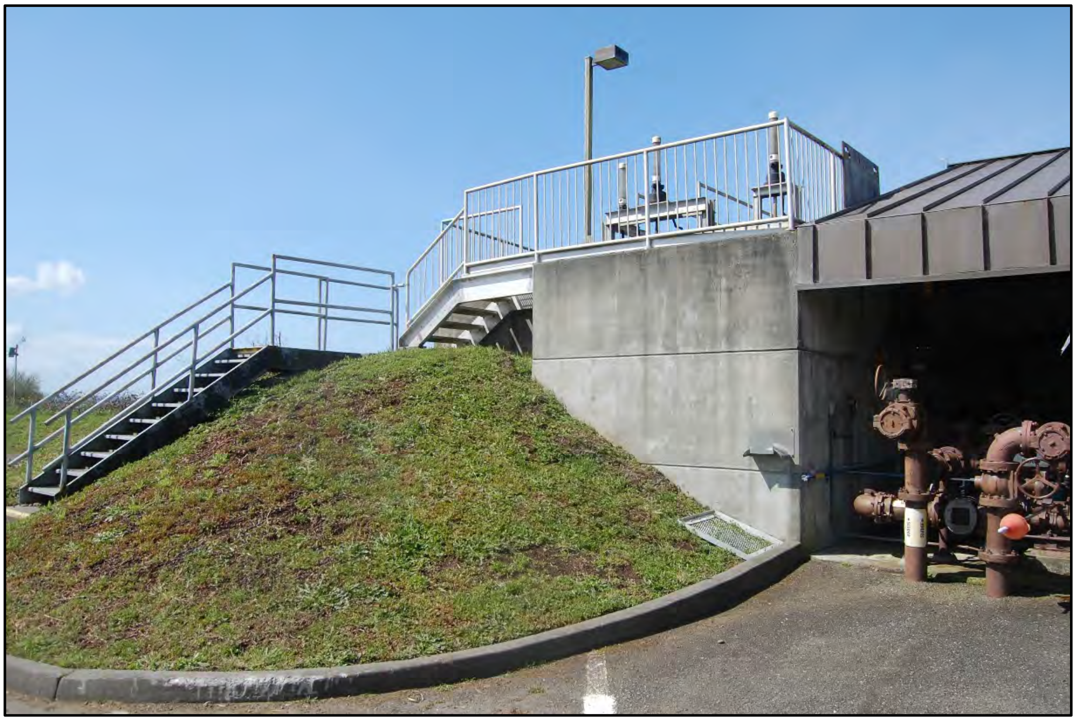


Photo 1 - Headworks - Grit Tank and Effluent Distribution Box

Photo 2 - Headworks - Grit Pumps, Screenings, and Grit Bin

Photo 03 - Headworks - Facing the Archimedes Screw Pumps

Photo 04 - Headworks - Screw Pump Close up.

Photo 05 - Headworks Grit Pump Room

Photo 06 - Headworks Grit Pump

Photo 07 - Headworks Grit Pump


Photo 08 - Headworks Grit Classifier


Photo 09 - Headworks Grit Classifier


Photo 10 - Headworks - Flume Channel


Photo 11 - Primary Clarifier No. 2 (larger unit)


Photo 12 - Primary Clarifier No. 2 - Effluent Weir and Scum Box

Photo 13 - Primary Clarifier No. 2 Drive Mechanism and Motor

Photo 14 - Primary Clarifier No. 2 - Hycor Grease and Scum Concentrator Unit

Photo 15 - Primary Clarifier No. 1

Photo 16 - Primary Clarifier No. 1 - Drive Mechanism

Photo 17 - Primary Clarifier No. 1 - Scum Beach and Effluent Weir

Photo 18 - Primary Clarifier No. 1 - Mechanism

Photo 19 - Primary Clarifier No. 1 - Exposed aggregate concrete

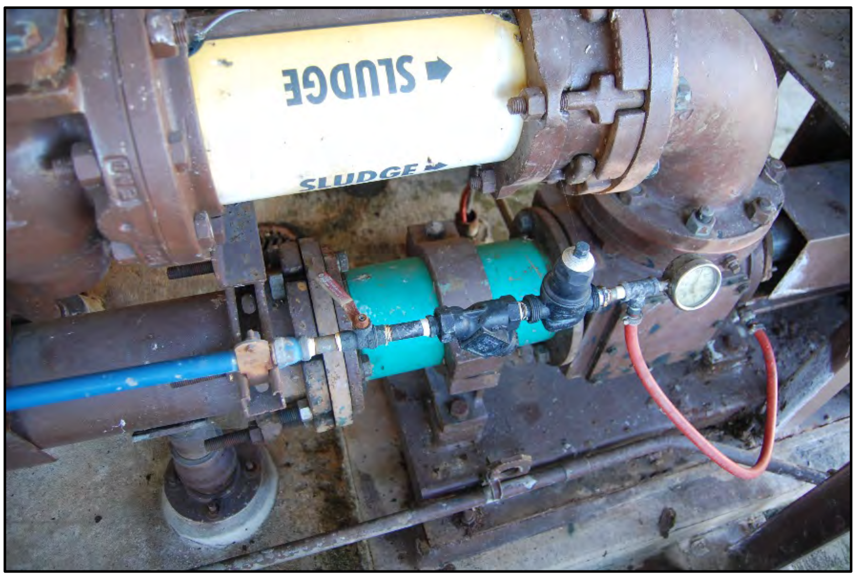


Photo 20 - Primary Clarifier Sludge Pumps

Photo 21 - Primary Clarifier Sludge Pumps

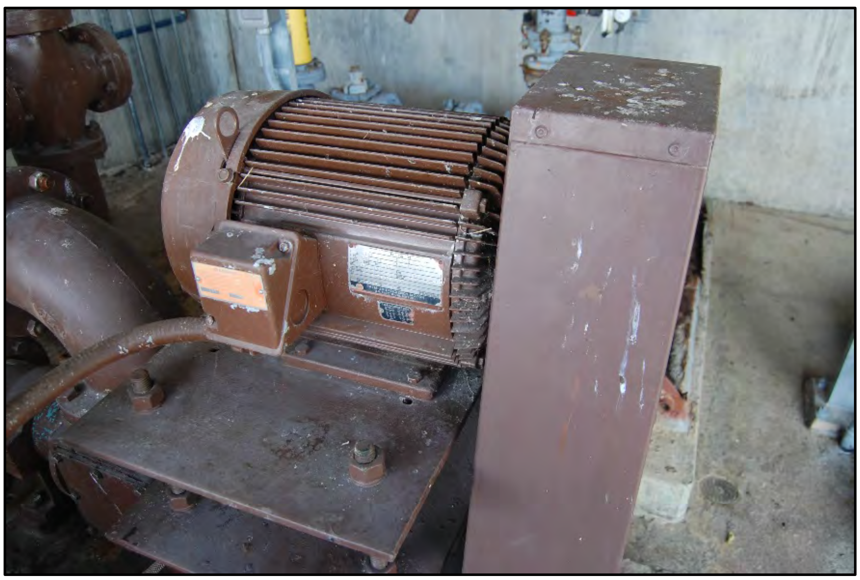


Photo 22- Primary Clarifier Sludge Pump Motor

Photo 23 - Pond 1 Shoreline

Photo 24 - Pond 1 aerators

Photo 25 - Pond 2 - Outlet side and weir structure

Photo 26 - Treatment wetland No. 1 - outlet structure.


Photo 27 - Treatment Wetlands 1 -


Photo 28 - Treatment Wetland 2- Inlet structure

Photo 29 - Treatment Wetland 2 - Effluent end looking toward ponds

Photo 30 - Treatment Wetland 3- Effluent box

Photo 31 - Treatment Wetlands Influent Box - Wetlands 4 feed pump

Photo 32 - Treatment Wetlands Influent Box - Automated weir


Photo 33 - Berm between Oxidation Pond No. 2 and Treatment Wetlands


Photo 34: Pond Pump Station and Pump Station 1


Photo 35 - Pond Pump Station and Pump Station 1


Photo 36 - Pond Pump Station and Pump Station 1

Photo 37 - Pond Pump Station and Pump Station 1


Photo 38 - Emergency Pond Pump Station


Photo 39 - Emergency Pond Pumps


Photo 40 - Treatment Wetlands Pump Station 2 - Treatment wetlands 5 and 6

Photo 41- Treatment Wetland 4 and 5 - FRP Interlocking sheets

Photo 42 - Hauser Wetland Pump Station - Inlet Structure

Photo 43- Enhancement Wetlands Pump Station - Inlet Manual Screen

Photo 44 - Hauser Effluent PS - Pump Station Vault

Photo 44- Enhancement Wetlands Pump Station

Photo 45- Enhancement Wetlands Pump Station


Photo 46 - Chlorine Contact Basin 1


Photo 47 - Chlorine Contact Basin 2

Photo 48 - Chlorinator Room


Photo 49 - Chlorine Contact Basin 3

Photo 50 - Chlorine Storage Building

Photo 51 - Chlorine Storage Building

Photo 52 - Chlorine Storage Building

Photo 53 - Chlorine Contact Basin LCP

Photo 54 - Chlorine residual analyzers

Photo 55 - Chlorine Contact Basin - Treatment wetland Influent piping and flowmeters

Photo 56 - Chlorine Contact Basin Drain Pump Station

Photo 57: Bypass Flowmeter

Photo 58 - Primary Digester

Photo 59 - Primary Digester Gas Piping

Photo 60 - Sludge Drying Beds

Photo 61 - Generator Building

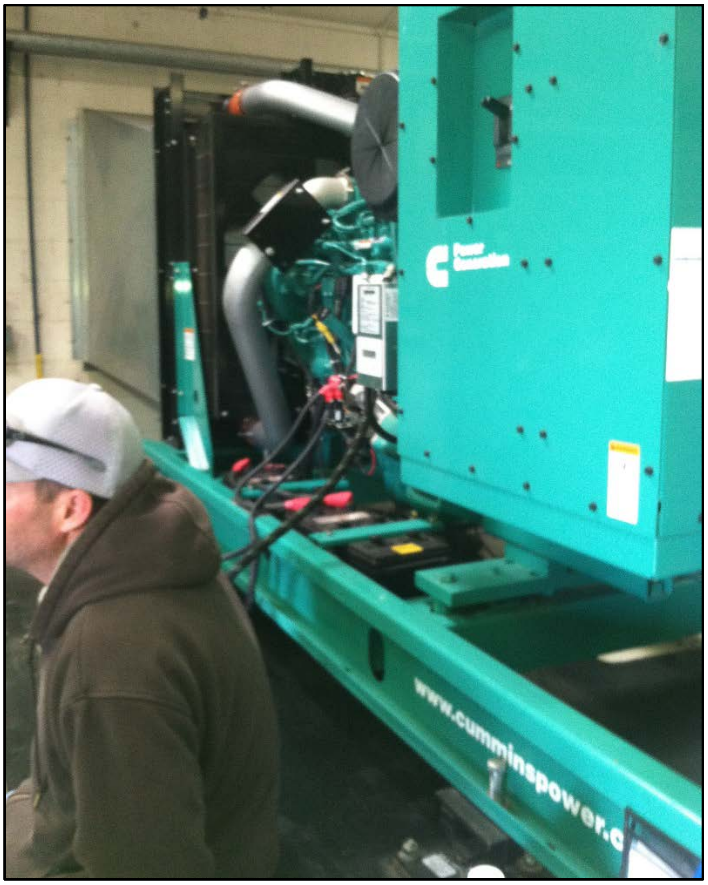


Photo 62 - Standby Generator

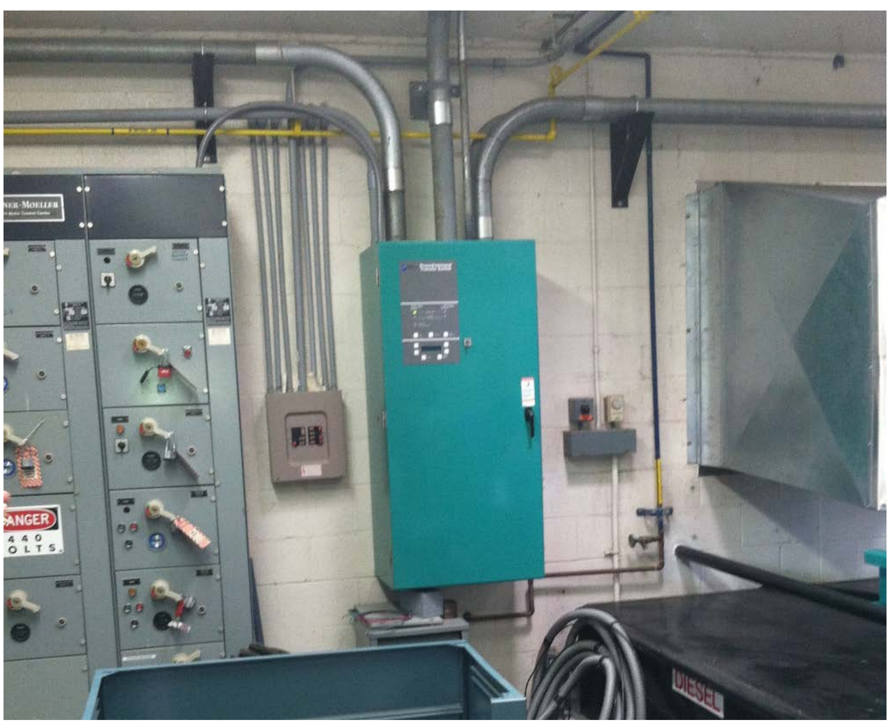


Photo 63 - Transfer Switch

Photo 64 - Main MCC

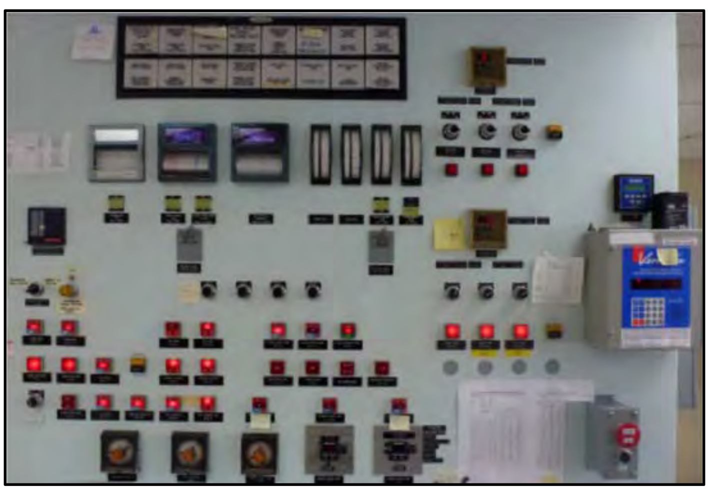


Photo 65 - Operator Control Panel

APPENDIX I – DETAILED ASSET INVENTORY AND RANKINGS

APPENDIX I AWTF Condition Assessment

WWTP Improvement Project
City of Arcada
Initial Installation Year 1984

Process	Asset Description	Equipment ID	Existing Design Criteria	Revised Design Criteria	Install Year	Condition	Comments
Collection System Pumping	First Street Pump 1	P-A-1	5.5 MGD each		1984	NR	Pump wastewater directly to OPs during high flow conditions. Engine driven propeller.
Collection System Pumping	First Street Pump 2	P-A-2	5.5 MGD each		1984	NR	Pump wastewater directly to OPs during high flow conditions. Engine driven propeller.
Collection System Pumping	Influent Storm Pump	P-B-2	5MGD		1984	3	Pump wastewater directly to OPs during high flow conditions. Variabale speed, Engine driven.
Headworks	Cast-in-place Concrete Structure	NA			1984	3	
Headworks	Influent Screw Pump #1 (East Side)	M-B-4-1	Screw Pump, 2.5MGD	Upsize to handle at least 3 mgd	1984	5	
Headworks	Influent Screw Pump #2 (West Side)	M-B-4-2	Screw Pump, 2.5MGD	Upsize to handle at least 3 mgd	1984	5	
Headworks	Mechanical Bar Screen (East Side)	M-B-7-1	5.9 MGD		1984	4	
Headworks	Mechanical Bar Screen (West Side)	M-B-7-2	5.9 MGD		1984	4	
Headworks	Screened Material Conveyor Belt	M-B-8-1			1984	4	
Headworks	Screening washer / compactor				TBD	5	Failed and removed by plant staff
Headworks	Barscreen Gates - 6 units 2 @ 50x57 and 4 @ 36x27				1984	3	
Headworks	Influent flume / flow transmitter				TBD	3	Accuracy TBD
Headworks	Grit Chamber		144 ft2 Horizontal Flow Chamber		1984	5	Assume replacement with vortex grit
Headworks	Grit Classfication Equipment	M-B-9			1984	4	Includes a Cyclone Separator and Grit Washer
Headworks	Grit Chamber Rake Equipment	M-B-13		Assume replace with vortex	1984	4	Assume replacement with vortex grit equipment
Headworks	Grit Removal Gates - 6 units 2 @ 12x18 and 3 @ misc				1984	3	
Headworks	5 Hp Grit Pump	P-B-11-1	200 GPM; In Operation		1984	4	Grit Chamber to Grit Classfication System
Headworks	5 Hp Grip Pump	P-B-11-2	200 GPM; Standby		1984	4	Grit Chamber to Grit Classfication System
Primary Clarifiers	Clarifier #1 Structure	M-C-2	0.04 MG Circular; 26' Diameter		1957	5	Bring on-line when flow exceeds 4 MGD or Clarifier #1 in maintenance
	Mechanism				TBD	5	Age TBD
Primary Clarifiers	Clarifier #2 Structure	M-C-1	0.25 MG Circular; 60' Diameter		1957	5	Operate when flow under 4 MGD
	Mechanism				TBD	4	Age TBD
Primary Clarifiers	Scum Concentrator / Pump				TBD	4	Added ???
Primary Clarifiers	Primary Sludge Pump #1	P-C-3-1	90 GPM; Manually Controlled		1984	4	Pump Sludge from Clarifier #1 to P-F-2 Primary Anaerobic Digester Transfer Pump
Primary Clarifiers	Primary Sludge Pump #2	P-C-3-2	90 GPM; Timer Controlled		1984	4	Pump Sludge from Clarifier #2 to P-F-2 Primary Anaerobic Digester Transfer Pump
Primary Clarifiers	Primary Sludge Pump #3	P-C-3-3	90 GPM; Timer Controlled		1984	4	Pump Sludge from Clarifier #2 to P-F-2 Primary Anaerobic Digester Transfer Pump

APPENDIX I AWTF Condition Assessment

WWTP Improvement Project
City of Arcada
Initial Installation Year 1984

Process	Asset Description	Equipment ID	Existing Design Criteria	Revised Design Criteria	Install Year	Condition	Comments
Anaerobic Digestion	Primary Anaerobic Digester Structure	AD1	0.3 MG, 45' * 28' Circular		1957	4	Gas holder cover replaced in 1984, 4000 gallons from Clarifier/day
Anaerobic Digestion	Secondary Settling Digester Structure	AD2	0.1 MG, 26' * 28' Circular		1957	4	Gas holder cover replaced in 1984
Anaerobic Digestion	Sludge Mixing/Transfer Pump	P-F-2	1160 GPM @ 40 ft		2002	2	Chopper type pump
Anaerobic Digestion	Heated Sludge Recirculation Pump	P-F-1-1	200 GPM @ 20 feet		2002	2	Chopper type pump
Anaerobic Digestion	Boiler/Heat Exchanger Combination		TBD		TBD	3	Age TBD
Anaerobic Digestion	Heated water recirc pump		80 gpm		TBD	3	Age TBD
Anaerobic Digestion	Digester waste gas burner		3-inch unit		TBD	3	Age TBD
Anaerobic Digestion	Sludge Recirculation Pump (Not In Operation)	P-F-1-2			1984	5	Pump sludge through boiler and back to Primary Digester.
Anaerobic Digestion	Sludge drying bed structure		XX SF		1984	3	Visual asseesment
Anaerobic Digestion	Compost facilities		TBD		TBD	3	Biosolids mixer and 2 blowers - condition TBD
Oxidation Ponds	Pond 1		24 Acres			3	24 acre - Depth 4.5 to 6.5 ft 46 MG volume
Oxidation Ponds	Pond 2		22 acres			3	22 acre - Depth 4.5 to 6.5 ft 43 MG volume
Oxidation Ponds	Pond 2 Aerators		TBD			4	Eight existing aerators
Oxidation Ponds	Pond Pump Station	PPS	Firm Capacity - 2.9 mgd Total Capacity - 4.5 mgd		1984	3	In use when effluent from OP2 exceeds maximum TW design flow of 2.3 MGD
Oxidation Ponds	Pond Pump Station Pump 1	P-E-9-1	1.8 mgd		1984	4	Vertical Turbine
Oxidation Ponds	Pond Pump Station Pump 2	P-E-9-2	1.8 mgd		1984	4	Vertical Turbine
Oxidation Ponds	Pond Pump Station Pump 3	P-E-9-3	1.8 mgd		1984	4	Vertical Turbine
Oxidation Ponds	PPS Influent Gate	ELIS01			1984	3	
Oxidation Ponds	PS-1 And PPS Wet Wells Mixing Gate	EL2S02			1984	3	
Oxidation Ponds	Emergency Pond Pump Station	EPPS	Firm Capacity - 3.6 mgd Total Capacity - 5.8 mgd		1984	3	Routing effluent from OP2 to disinfection when OP2 effluent exceeds the maximum combined pumping capacity of PPS, PS-1, PS-2 (8.4 MGD)
Oxidation Ponds	Emergency Oxidation Pond 2 Effluent Pump 1	P-E-9-4	3.6 mgd		1984	3	Combined Q - 5.9 MGD, Self prime Gorman Rupp
Oxidation Ponds	Emergency Oxidation Pond 2 Effluent Pump 2	P-E-9-5	3.6 mgd		1984	3	Self prime Gorman Rupp
Treatment Wetlands	Treatment Wetlands 1		1.8 acre		1985	4	1.8 acre Depth 4.3 feet
	Treatment Wetlands 2		1.9 acre		1985	4	1.9 acre Depth 4.6 feet
	Treatment Wetlands 3		1.2 acre		1985	4	1.2 acre Depth 3.6 feet
	Treatment Wetlands 4		0.9 acre		1985	ND	0.9 acre 0.9 feet
	Treatment Wetlands 5		1.7 acre		TBD	3	1.7 acre Depth 3 feet
	Treatment Wetlands 6		1.9 acre		TBD	3	1.9 acre Depth 3 feet
Treatment Wetlands	Treatment Wetland 7		TBD		Future	Future	Future Project
Treatment Wetlands	Pump Station 1	PS-1	Firm Capacity - 2.3 mgd Total Capacity - 3.0 mgd		1984	3	Pump TW 1-4 effluent from Junction Box 1 to disinfection
Treatment Wetlands	Pump Station 1 Pump 1	P-E-8-1	1.2 mgd		1984	4	1.2 MGD for 1 pump. Fixed Speed.
Treatment Wetlands	Pump Station 1 Pump 2	P-E-8-2	1.2 mgd; VFD		1984	4	2.3 MGD for 2 pumps. Variable Speed
Treatment Wetlands	Pump Station 1 Pump 3	P-E-8-3	1.2 mgd; VFD		1984	4	2.99 MGD for 3 pumps. Variable Speed.
Treatment Wetlands	Pump Station 1 Influent Gate	EL2S01			1984	3	
Treatment Wetlands	Treatment Wetlands 4 Pump 1					4	
Treatment Wetlands	Treatment Wetlands 4 Pump 2					4	
Treatment Wetlands	Pump Station 2	PS-2	Firm Capacity - 1.67 mgd Total Capacity - 2.4 mgd		1984	3	Pump effluent from TW 5-7 to Junction Box1 or to disinfection or TW3 influent
Treatment Wetlands	Pump Station 2 Pump 1	P-E-8-4	1.67 mgd; VFD		1984	4	Pump effluent from TW 5-7 to Junction Box1 or to disinfection or TW3 influent
Treatment Wetlands	Pump Station 2 Pump 2	P-E-8-5	1.67 mgd; VFD		1984	4	Pump effluent from TW 5-7 to Junction Box1 or to disinfection or TW3 influent

APPENDIX I AWTF Condition Assessment

WWTP Improvement Project
City of Arcada
Initial Installation Year 1984

Process	Asset Description	Equipment ID	Existing Design Criteria	Revised Design Criteria	Install Year	Condition	Comments
Enhancement Wetlands	Allen Enhancement Wetlands		10 acre			4	10 acre @ 2+ ft depth, Need to install baffles for short circuit
	Gearheart Enhancement Wetlands		10 acre			4	10 acre @ 2+ ft depth, Need to install baffles for short circuit
	Hauser Enhancement Wetlands		10acre			4	10 acre @ 3.5 ft depth, Need to install baffles for short circuit, need to revise outlet for effleunt PS
Enhancement Wetlands	Hauser Effluent Weir And Distribution Box - New Screen	EW3W01			1984	4	
Enhancement Wetlands	Enhancement Wetland Pump Station	EWPS	Firm Capacity - 1.8 mgd Total Capacity - 2.3 mgd	Firm Capacity - 6.0 mgd Total Capacity - 9.0 mgd	1984	3	Pump effluent from EW to disinfection. Future Firm Capacity needs to be 5.9 mgd.
Enhancement Wetlands	Influent Screen		N/A		N/A	5	Future project
Enhancement Wetlands	Effluent Stariner				N/A	NA	Future project
Enhancement Wetlands	EW Effluent Pump 1	P-E-40-1	1.5 mgd	3.0 mgd	1984	4	Current capacity is less than original design capacity
Enhancement Wetlands	EW Effluent Pump 2	P-E-40-2	1.5 mgd	3.0 mgd	1984	4	Current capacity is less than original design capacity
Enhancement Wetlands	EW Effluent Pump 3	P-E-40-3	1.5 mgd	3.0 mgd	1984	4	Current capacity is less than original design capacity
Enhancement Wetlands	Outfall 003					NA	Future project
Chlorination	Chlorine Contact Basin (East)		2.3 MGD split-basin mode		1984	3	
Chlorination	Chlorine Contact Basin (West		5.9 MGD combined-basin mode		1984	3	
Chlorination	Chlorinators				1984	3	
Chlorination	Sulfonators				1984	3	
Chlorination	Chlorine Piping				1984	3	
Chlorination	Sulfur Dioxide Piping				1984	3	In Operation
Chlorination	Chlorine mixer 1 (Water Champ)		3 HP		1984	2	Standby
Chlorination	Chlorine mixer 1 (Water Champ)		3 HP		1984	2	
Chlorination	Sulfur Dioxide mixer 1 (Water Champ)		3 HP		1984	2	
Chlorination	CCB Gates				1984	3	
Chlorination	Sample Pumps				1984	4	
Chlorination	Residual analyzers				1984	2	
Chlorination	Chemical building structure				1984	2	

APPENDIX J – DR. GEARHEART NOTES ON TREATMENT WETLANDS

Doug Wing

From: Bob Gearheart <bobgearheart@gmail.com>
Sent: Thursday, July 30, 2015 8:34 AM
To: Doug Wing; Erik Lust; Rachel Hernandez; Paul A. Gregson, P. E.
Subject: Responses to Doug's questions
Attachments: Arcata Upgrade-comments to Doug.pdf

Doug
I have attached a document that is our initial responses to your questions, there are elaborations on any of these if necessary. I have attached as my photos as possible to give you an idea of changes over the 35 yr period. There are several documents on the restoration of the treatment wetlands in terms of vegetation and biosolids removal.

Generally-three things which are not necessarily mutually exclusive

Excavate sections of vegetative mat-dry/compost-size filter press

Pump liquid/biosolid to pond 2-dry mat-transpire bound water-remove -till and cut removed by low pressure equipment-solid handling like above

Excavate with long reach-used sludge dredge from Eureka options above for mat.

Aerate in place with mobil generator/aerator to reduce BOD , h2S and ammonia levels
combinations of the above for biosolides.

More???

Bob
.

To: Doug Wing July 27, 2015
From: Bob Gearheart
Subject: Response to questions

The treatment wetland design concept was to serve as the treatment step prior to process through the enhancement marsh. This was based on the pilot project study (1979-1984) where one of the studies was to place weirs every 25 ft in a 200 ft cell and monitor for a year to obtain kinetic data on BOD, TSS, and ammonia removal. What we found was that majority (60 tom75%) of the TSS is removed in the first 2 days of HRT . This removed solid material which has been removed from by discrete and flocculent settling breaks down the VSS anaerobically releasing degradable organic byproducts. This addition of soluble BOD which has been contributed from this solubilized particulate BOD. The result is that the soluble BOD actually increases until the anaerobic bacteria in the water column and attached to plant stems and roots start to reduce soluble BOD. The treatment wetlands were designed to have a theoretical retention time of about 3 to 4 days and operated in parallel (due to space limitations). Table 1 shows these relationships as monitoring in Cell 8 of the pilot project, which had a constant input over the year.

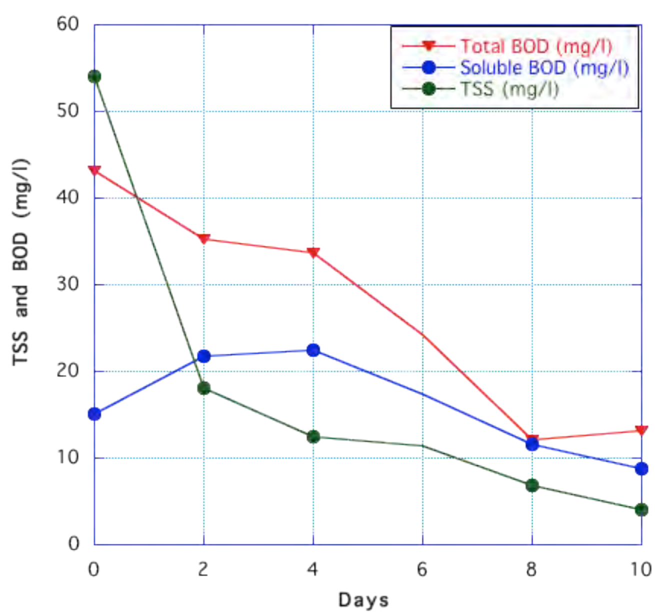


Table 1-Total BOD, soluble BOD and TSS sampled at internal points through Pilot Project. Internal points were related to the theoretical hydraulic retention time (d). (Pilot Project data 1984).

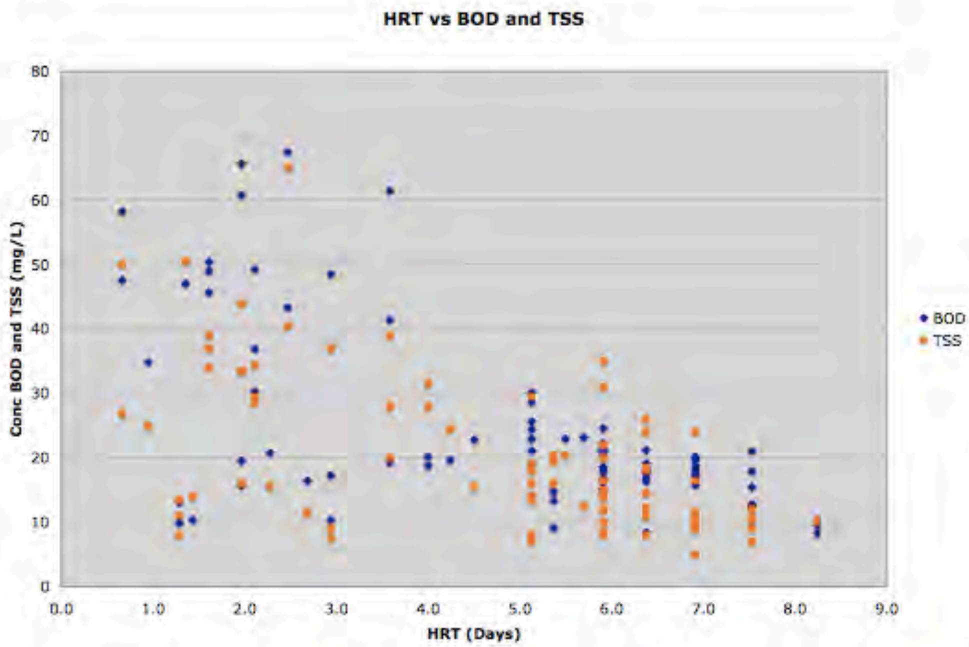
IMPORTANT RECOMMENDATIONS FROM AMRI

Studies performed on Treatment Marsh 3 (TM-3) in the summer and fall of 2008 demonstrated the effect of increasing the existing design theoretical HRT of 2 days to HRT's up to 8 days. The TM-3 influent BOD and TSS in the summer and early fall period ranged from 30 to 90 mg/l at hydraulic loading rates of 0.4 to 1.4 mad. The effect of increased hydraulic loading is to reduce the HRT through the treatment wetlands. The lower the HRT the less time there is in the treatment marsh for the TSS to settle and for the soluble BOD to degrade. The greater the HRT, lower hydraulic loading rate, the more time there is for solids to auto flocculate, settle, and decompose. This effect can be seen in Figure 1 where the HRT's of less than 4.0 days produce a highly variable effluent BOD and TSS, which in general is above the NPDES requirement of 30 mg/l BOD, and TSS. See following table

The proposed upgrade is to construct three new treatment marshes, which will double the amount of treatment marsh capacity to 11.5 acres from the existing 5.7 acres. The new treatment marshes will be constructed on the footprint of the existing Oxidation Pond 3 and the area of fishponds. The new treatment marshes will have upgraded influent manifold works and multiple outlet weirs. The wetlands will have several submerged beams normal to the flow pattern along with small open water waters. The combinations of these design elements will significantly improved the internal hydraulics, which along with increasing the HRT to above 4 days will increase treatment capacity. With the addition of three new wetlands the summer and fall average flow rate to each of the seven wetlands will be approximately 0.20 mgd or 1.4 mgd total flow. There will also be restoration and enhancement on both TM-1 and TM-2 as the new upgrade plan is implemented. New effluent weirs in TM-2 were installed in 2007 and similar influent weirs will be installed in TM-1 in the summer of 2009.

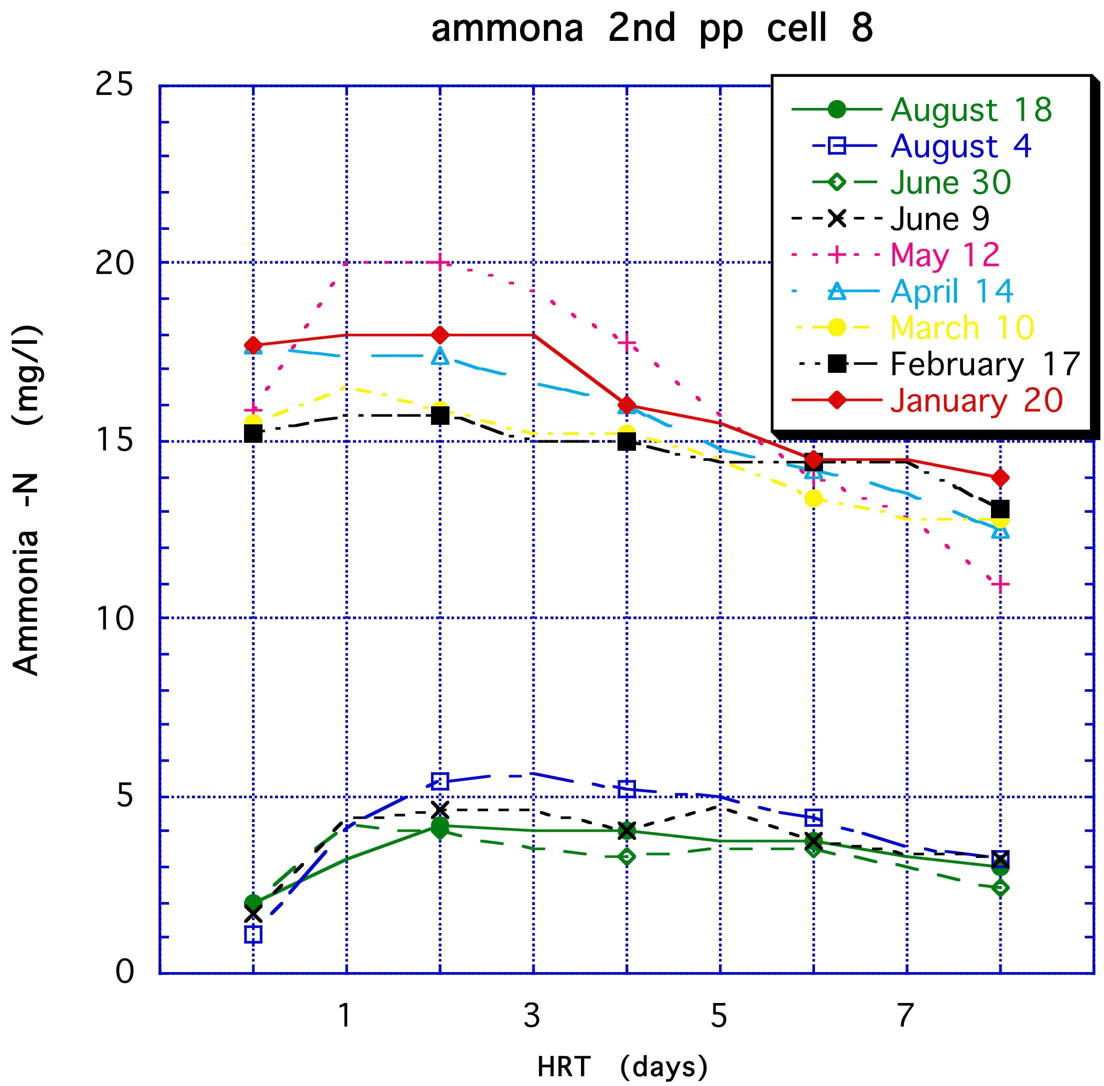
As of 2015 the storage capacity for settled suspended solids and detrital wetland accumulation is a maximum resulting in a significant decrease in HRT which does not allow for sufficient BOD removal. TSS is still removed since it is depended solely on flocculent and discrete settling velocities. There as been a reduction in TSS removal close to 40 to 50% removal is still being achieved.

Two have been build TM5 and TM6-waiting for approval for TM7

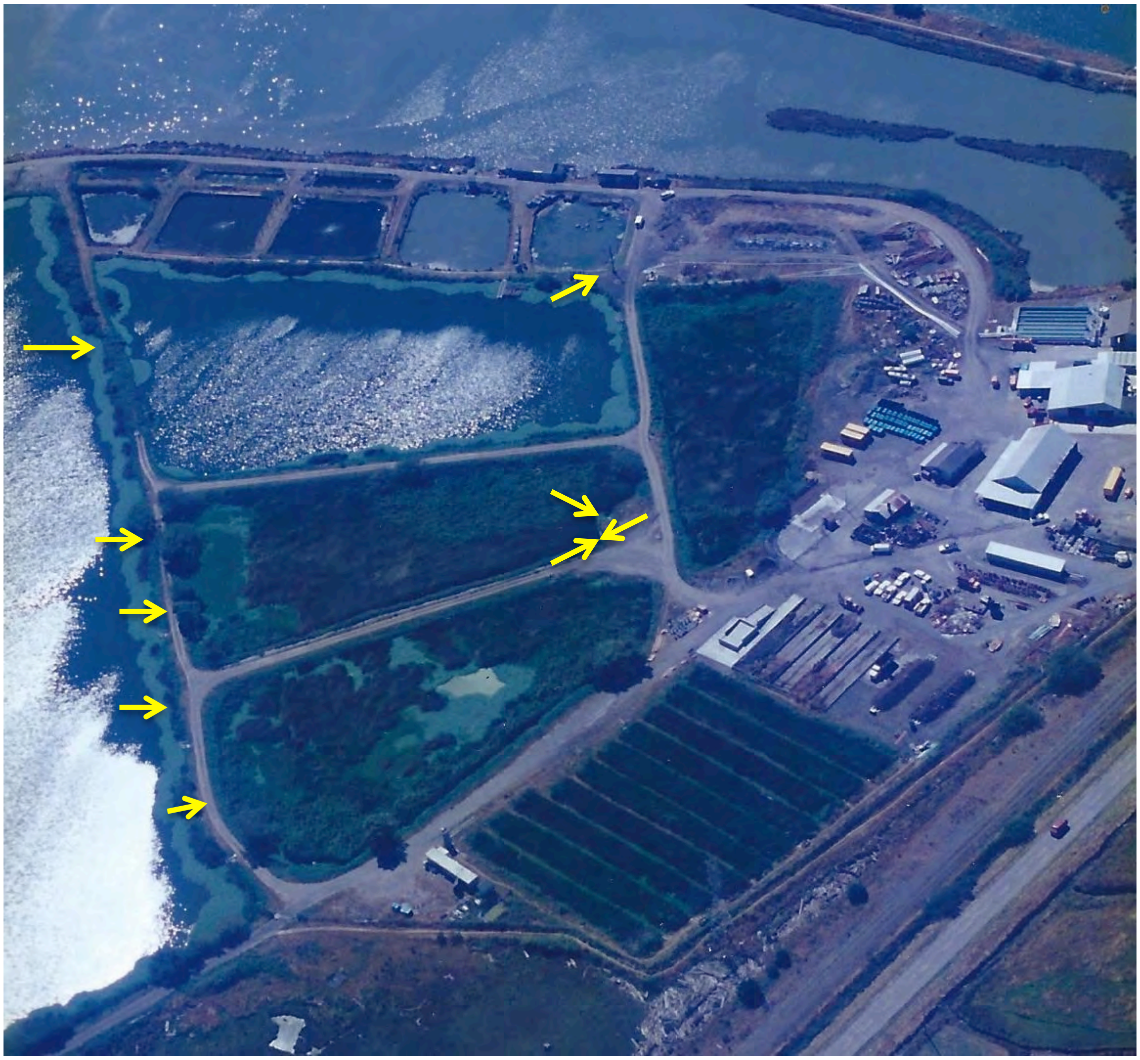


We performed an experiment with Treatment marsh 3 where we changed the flow rate to produce different HRTs. The graph above shows the response of changing the HRT over a range of 8 days.

Assumed volume 0.9504 millons of gallons, includes 30% plant material



ammona 2nd pp cell 8
Ammonia -N (mg/l)
HRT (days)
25
20
15
10
5
0
1
3
5
7
August 18
August 4
June 30
June 9
May 12
April 14
March 10
February 17
January 20



System Operation with box type effluent weirs from TM1 and 2, TM 3 directly to Pt8 Aroun 1988-89. Yellow arrows show influent and effluent pTreatmenet Wetland systems 1987 TM1 deeper channel/hole east side planting patterns showing rows of hardstem bulbush. Show Pilot project with different portions harvested to determine WQ effect.

Important to note is that TM! Was never leveled as a result there is deeper are along the east side, which has significantly affect the flow pattern and resultant removals. The upgrade option if proposed to levels the marsh where needed, place berms normal to the flow and excavate deeper regions for solids accumulations, TM5 and 6 model.

Above is what Hauser looked like during the construction period of Hauser Pump station. Graded flat except for the drainage channel on left side of pictures and deep channel next to the road out of picture on the left.

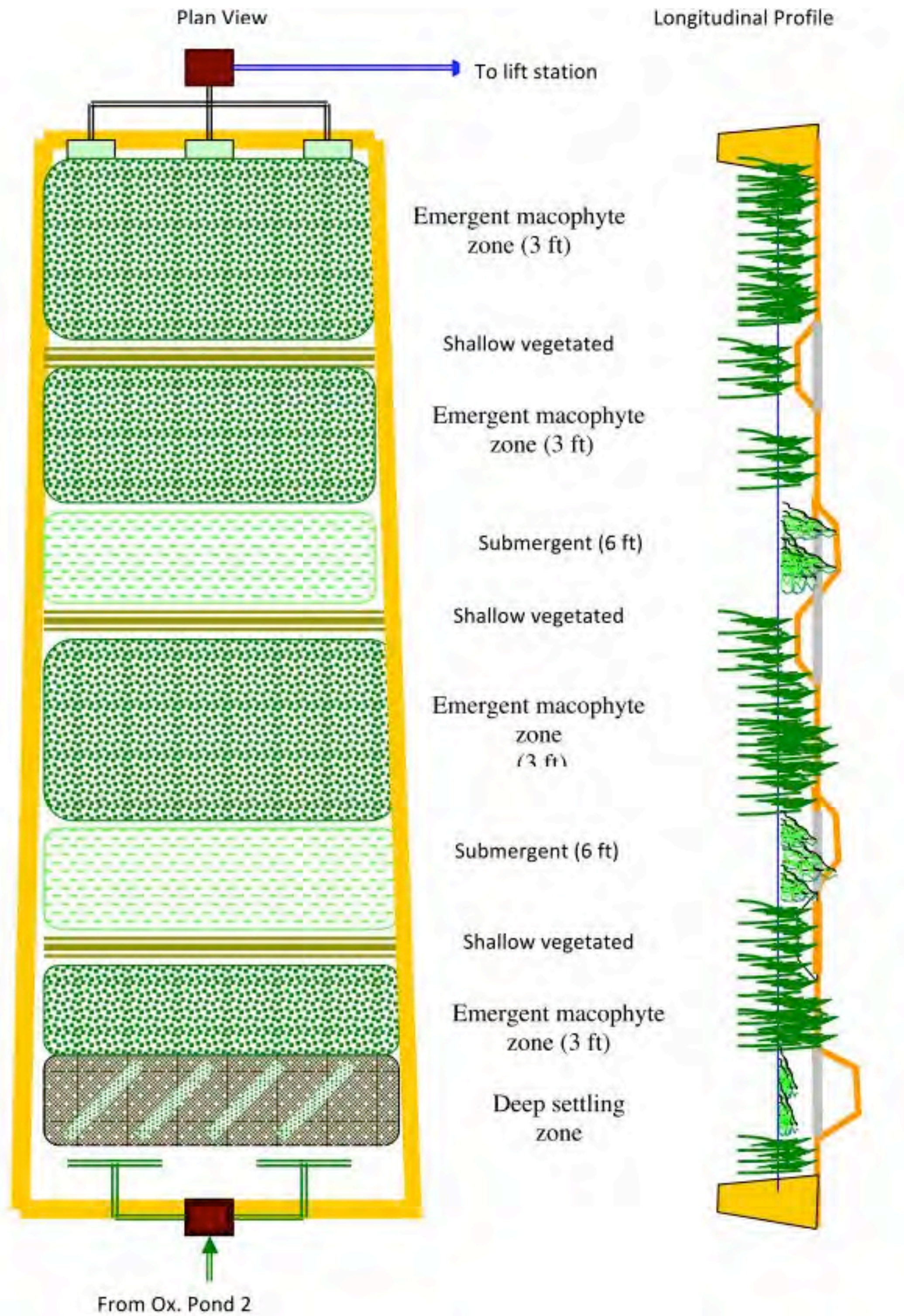
)
System Dimensions with 6 Treatment Marshes: Area, Volume, and Storage (HRT

	Area	Typical Operating Depth	Min. Depth	Max. Depth	Typical Operating Volume	Min. Volume	Max. Volume	Storage	HRT for Low Flow (1.3 MGD)	HRT for Design Flow (2.3 MGD)	HRT for High Flow (4 MGD)
			Min	Ma		Min	Ma		1.3	2.3	4
	(ac	(ft)	(ft)	(ft)	(m	(m	(m	(m	(d)	(d)	(d)
Ponds											
Oxidation Pond 1	24	5.9	4.5	6.5	46	35	51	16	35.	20.	11.
Oxidation Pond 2	22	6	4.5	6.5	43	32	47	14	33.	18.	10.
Pond Total	46				89	67	97	30	**69**	**39**	**22**
Treatment											
TM 1	1.8	4.3	1	4.3	2.6	0.6	2.6	2.0	9.6	5.0	2.8
TM 2	1.9	4.6	1	4.6	2.9	0.6	2.9	2.3	9.6	5.0	2.8
TM 3	1.2	3.6	1	3.6	1.5	0.4	1.5	1.1	9.6	5.0	2.8
TM 4	0.9	2.9	1	2.9	0.9	0.3	0.9	0.6	4.3	4.3	4.3
TM 5	1.7	3	1	5.5	1.7	0.6	3.0	2.5	9.6	5.0	2.8
TM 6	1.9	3	1	5.5	1.9	0.6	3.4	2.8	9.6	5.0	2.8
TM 7											
TM Total (avg)	9.6				11	3	14	11	**8.3**	**4.8**	**3.2**
Enhancement Wetlands											
Allen	10	2.3	0.7	6	7	2	20		5.8	3.3	1.9
Gearheart	10	2.1	0.7	4.5	7	2	15		5.3	3.0	1.7
Hauser	10	3.7	0.7	5.5	12	2	18		9.3	5.2	3.0
EM Total	30	2.7			26	0	52	26	**20**	**11**	**7**
System Total								68	**97**	**55**	**32**

Figure 1: Area, depth and calculated Hydraulic Retention Time for the treatment system with 6 treatment marshes. Assumptions: the flow remains in the range for the period. High Flow (4 MGD) occurs between 80-95% of the time (City of Arcata data from 2005-08).

Dimensions were obtained from the following sources and are documented in the MEMO on Operating Dimensions. Pond area and min max values for treatment marshes are from the Wastewater Treatment Plant Modifications CH2M Hill March 1984. Pond, treatment marsh, and enhancement wetland depths were physically measured during different studies conducted by AMRI.

The conceptual design form TM 5 and 6 is shown on the next page. We took information we learned from the Pilot Project (cell 8 and other cells) where we had baffles. Requiring the flow to gather in deeper regions and then flow over a shallow berm increases the nominal retention time (reducing short circuiting), enhances autoflocculation, and stratifies the flow vertically. The concept was to have three berms operating at 8 to 12 inches with deeper sections preceding shallow marsh prior to the berm. The deep section allow accumulation of solids that cen be anaerobically reduced. The open water become covered with floating aquatic plants,. With these sizes of wetland cells it is impossible to keep open water areas. It is not a problem though because we don't want sunlight to reignite algal populations.



Plan View
Longitudinal Profile
To lift station
Emergent macophyte zone (3 ft)
Shallow vegetated
Emergent macophyte zone (3 ft)
Submergent (6 ft)
Shallow vegetated
Emergent macophyte zone
Submergent (6 ft)
Shallow vegetated
Emergent macophyte zone (3 ft)
Deep settling zone
From Ox. Pond 2

Table 12 Experimental Water Quality Conditions-Oxidation Pond Effluent-Marsh Cell Influent (I) Characteristics and Marsh Cell 8 Effluent Characteristics

		BOD		NFR		Ammonia		Nitrate	
	DO	Effluent	%Removal	Effluent	%Removal	Effluent	%Removal	Effluent	%Remov
Influent	4.7	50.0		49.2		9.4		4.5	
Cell 1-50% Harvested Effluent	0.7	19.4	61	11.5	76	11.3	+20	2.2	51
Cell 2-100% Harvested	1.5	18.2	63	15.3	69	6.7	28	2.6	42
Cell 3-Not Harvested	1.5	11.1	78	9.7	80	4.3	54	5.9	+31
Cell 4-Alternating 10% Harvested	0.8-	12.5	75	7.7	84	8.0	15	3.8	15
Cell 5-Not Harvested	0.72	12.6	75	8.7	82	10.7	+14	3.1	31
Cell 6-2 Baffled Compartments	0.7	14.6	71	10.0	79	9.6	+ 2	2.7	40
Cell 7-4 Baffled Compartments	1.1	11.1	78	10.2	79	7.6	19	3.4	24
Cell 8-8 Baffled Compartments	1.1	10.0	86	8.6	82	8.3	11	3.2	29
Cell 9-50% Harvested Alternating 1/4	1.5	18.4	63	13.8	72	8.1	14	3.2	29
Cell 10-50% Harvested-Influent	1.4	10.3	79	13.6	72	6.6	29	2.8	37

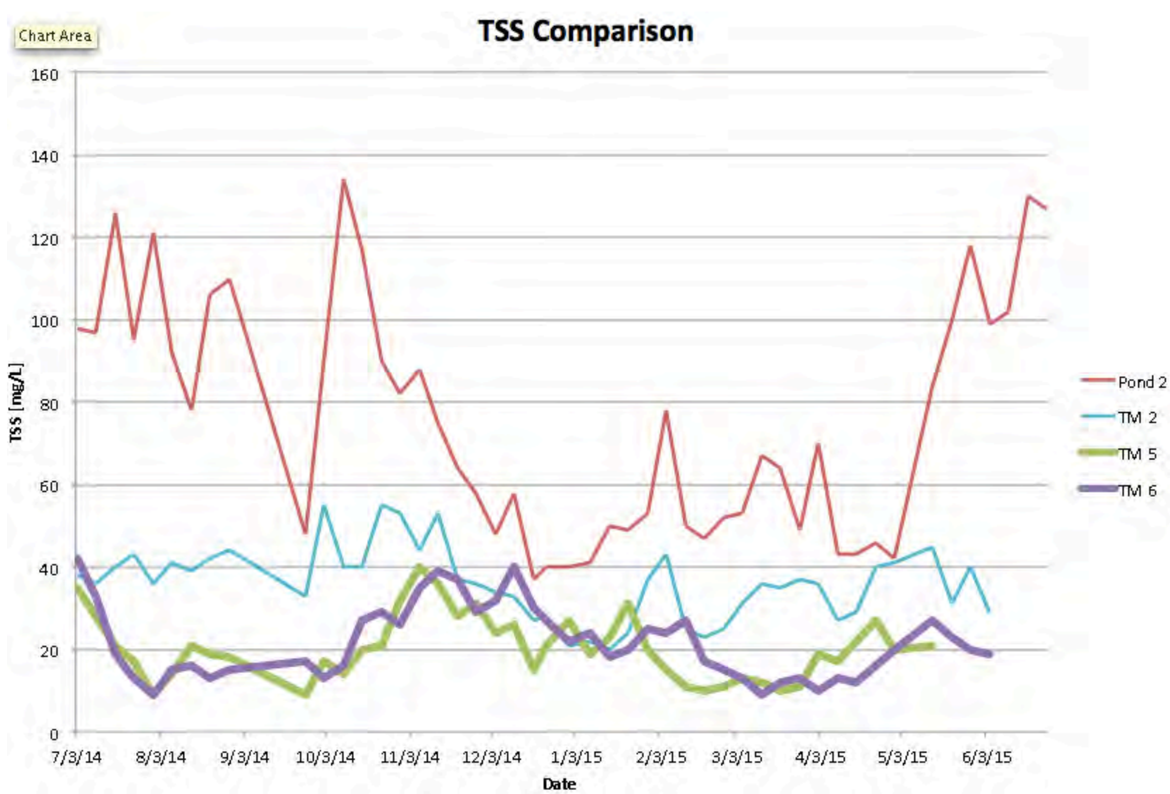
Table 12 shows the effect of different vegetation removal options in terms of how much and where in the flow sequence the vegetation is remove. The key cells to look at are cell 8-8 which had baffles every 25 ft for 8 cells with no vegetation removed. This cell had the highest BOD and TSS removal, basis for the TM 5 and 6 design.

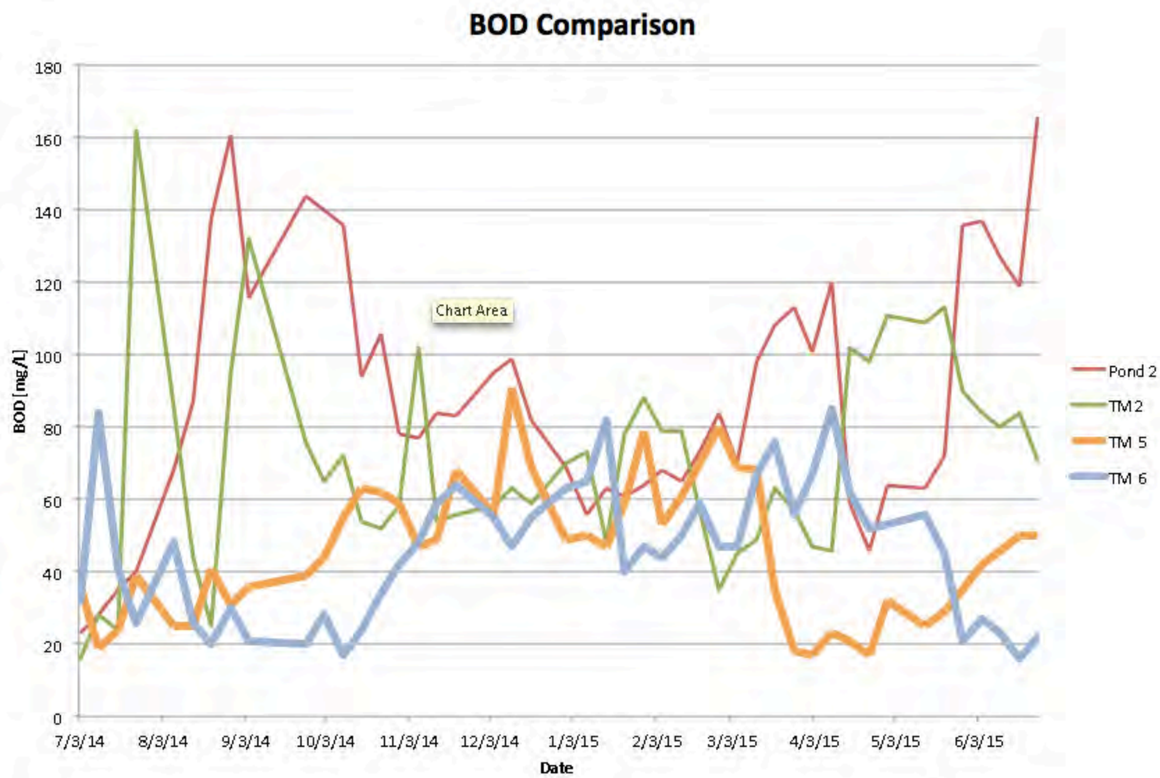
It also shows that harvesting strips such as every 25% and every 10 % has minimum impact on effluent WQ The effect of plants on ammonia removal is seen in the non-harvested cells Cell3 and 5. The 100% harvested Cell 1 had the worst WQ but still acceptable for an interim period.

Treatment Marsh 4 was constructed out of the original pilot project, which originally had twelve 200 by 20 ft cells with a 2 ft berm between each cell. In about 1990 or so the two mostly northerly pilot cells were vacated and use for the building across from the pump station, compost operations, et; leaving ten cells. In 2009 the ten remaining cells were configured into 7 serpentine cells with 3 cell (Influent –southerly area made into an inlet zone feeding the seven serpentine cells. The influent flows by gravity directly to the Pump station across the road.

The graphs on the next pages shows the Oxidation pond and treatment wetland BOD and TSS levels for the last two years. TM5 and 6 went through a difficult period getting the plants in place and growing. We were total inundated with coots who consume our plantings. We went through several cycles of replanting along with trying different hazing techniques. By spring of 2014 we to control of the coots and focused on planting the openwater which one of the coot attractants. By Spring of 2015 the system was in place and you see the resultant effects. Late spring and summer TM 5 and 6 are receiving over 80% of the flow, close to 500,000 gal/day. It was our expectations that it would take at least one year to become functional.

These graphs show how the pond BOD and TSS vary over the year somewhat out of sequence with influent flow to the treatment wetlands. This load variations works in favor of the way these systems work as progressive clarifiers.




BOD Comparison
180
160
140
120
100
80
60
40
20
0
BOD [mg/L]
Chart Area
7/3/14
8/3/14
9/3/14
10/3/14
11/3/14
12/3/14
1/3/15
2/3/15
3/3/15
4/3/15
5/3/15
6/3/15
Date
Pond 2
TM 2
TM 5
TM 6

Recommendations for Enhancement Marsh Upgrades

The sketch below shows a concept for insuring Hauser effluent meeting NPDES 30/30 permit requirement during higher flow and higher TSS periods. The concept is to minimize short circuiting in these two wetlands. (understanding that they were never design to treat natural system effluent-poor island siting and configuration, poor siting of inlets and outlets,etc). We have a calibrated model that has been used to assist in the development of this alternative. The table below estimates the increase in the flow period with this baffled serpentine configuration. Allen marsh's flow period with increase by about 100 % (1200 ft to 2400 Ft) and Gearheart marsh will increase about 300%. The discharge from Gearheart marsh will be at the gate on the southeast corner (the gate install at original upgrade and will discharge into the Northeast corner of Hauser. The release of Gearheart into Hauser will utilize a larger section of Hauser that has been a dead zone for the most part. The table also gives the approximate amount of baffle curtain required.

Baffle or Flow Path	Distance from Google Earth [Ft.]
1	142
2	213
3	97
4	342
5	60
6	238
7	107
8	124
9	206
10	110
11	108
Allen short circuit path	1200
Gearheart short circuit	702
Allen flow path	2341
Gearheart flow path	1990

Doug Wing

From: Bob Gearheart <bobgearheart@gmail.com>
Sent: Thursday, July 30, 2015 11:05 AM
To: Doug Wing; Erik Lust; Rachel Hernandez; Charles Swanson; Brad Finney; Eileen Cashman

Subject: BOD model sensitivity analysis Enhancement wetland
Attachments: EWPredictedBOD_VariousConditions (2).docx

All

Lauren has been working with and upgrading Heidi's EW BOD model the last couple of weeks (see attachment). I have asked her to develop a range of monthly flow and BOD levels to test the capacity of the EW under the existing conditions of flow (dye studies). The objective of this analysis is to determine the time and extent of Hauser effluent not meeting a 20 mg/l level (a target for a 30 mg/l permit requirement). There are months in the winter and early spring where the monthly predictions are above 20 mg/l. The upgrade suggestions of siting baffle curtains strategically in Allen and Gearheart will increase HRT's and hopefully will decrease the effluent levels for these months below 20 mg/l (this analysis is in process).

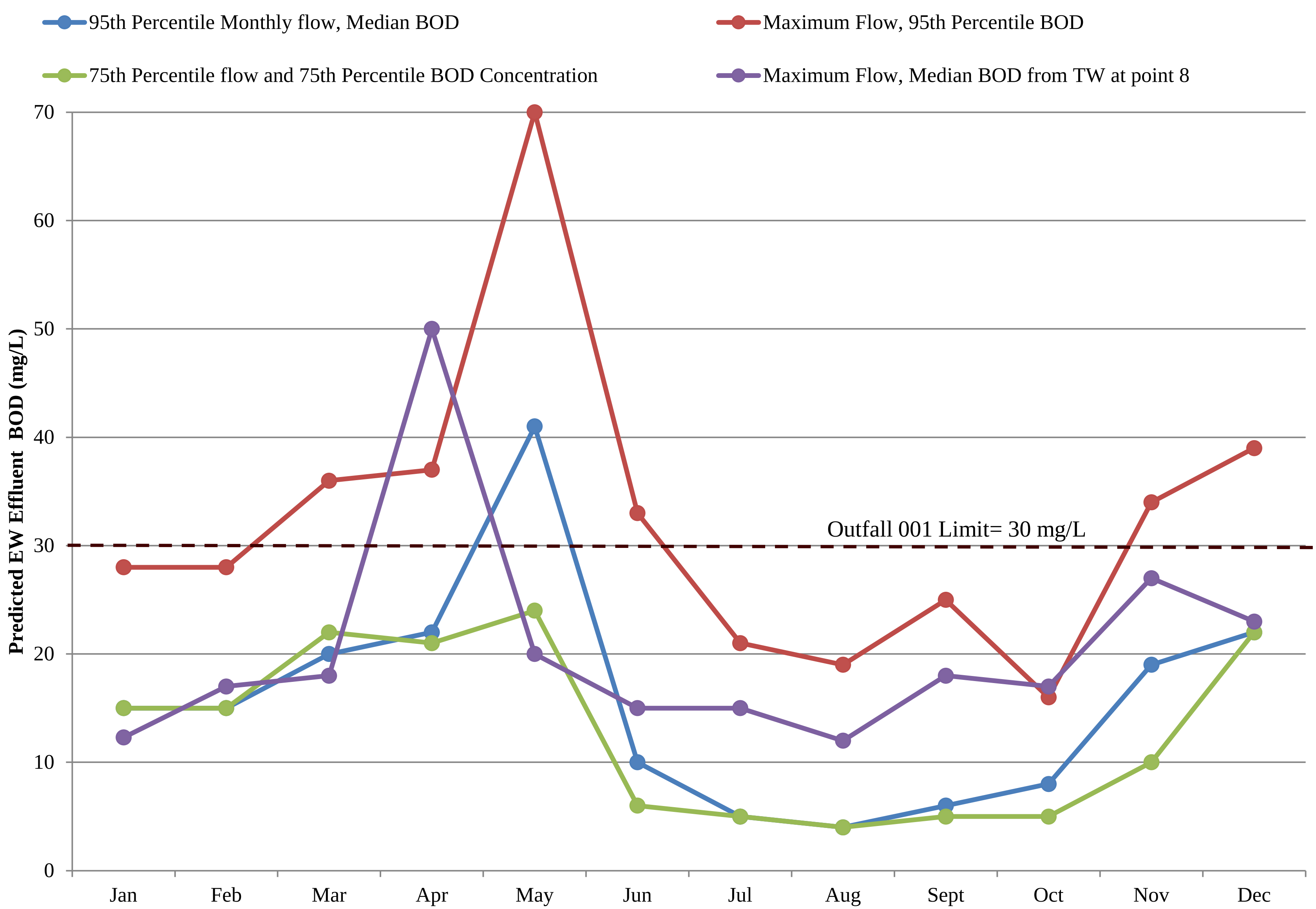
i would appreciate any comments you might have on our approach.

Bob

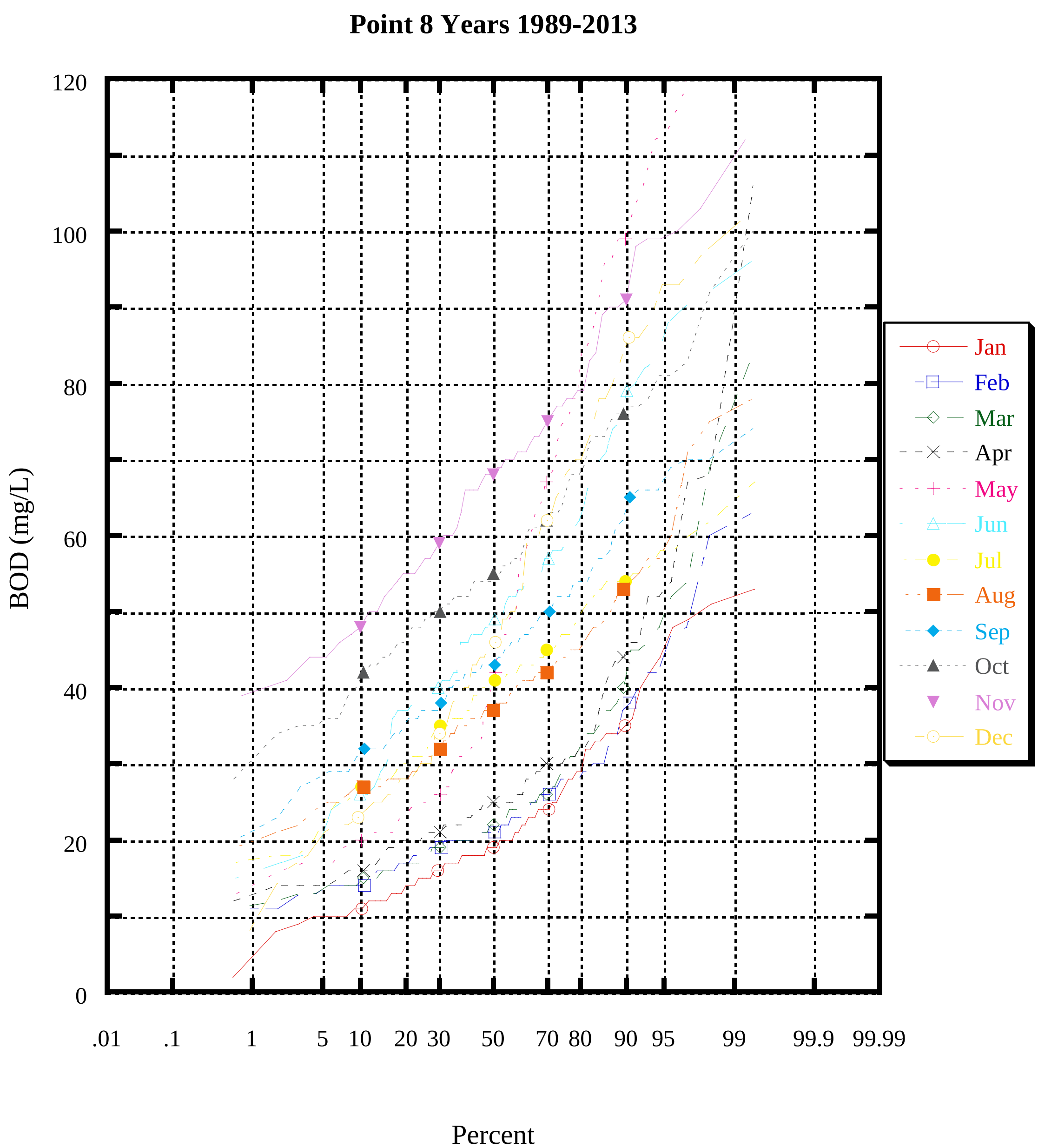
Predicted Enhancement Wetland BOD by Various Months and Conditions (Calculated using EW BOD Model (Halverson,2013)).

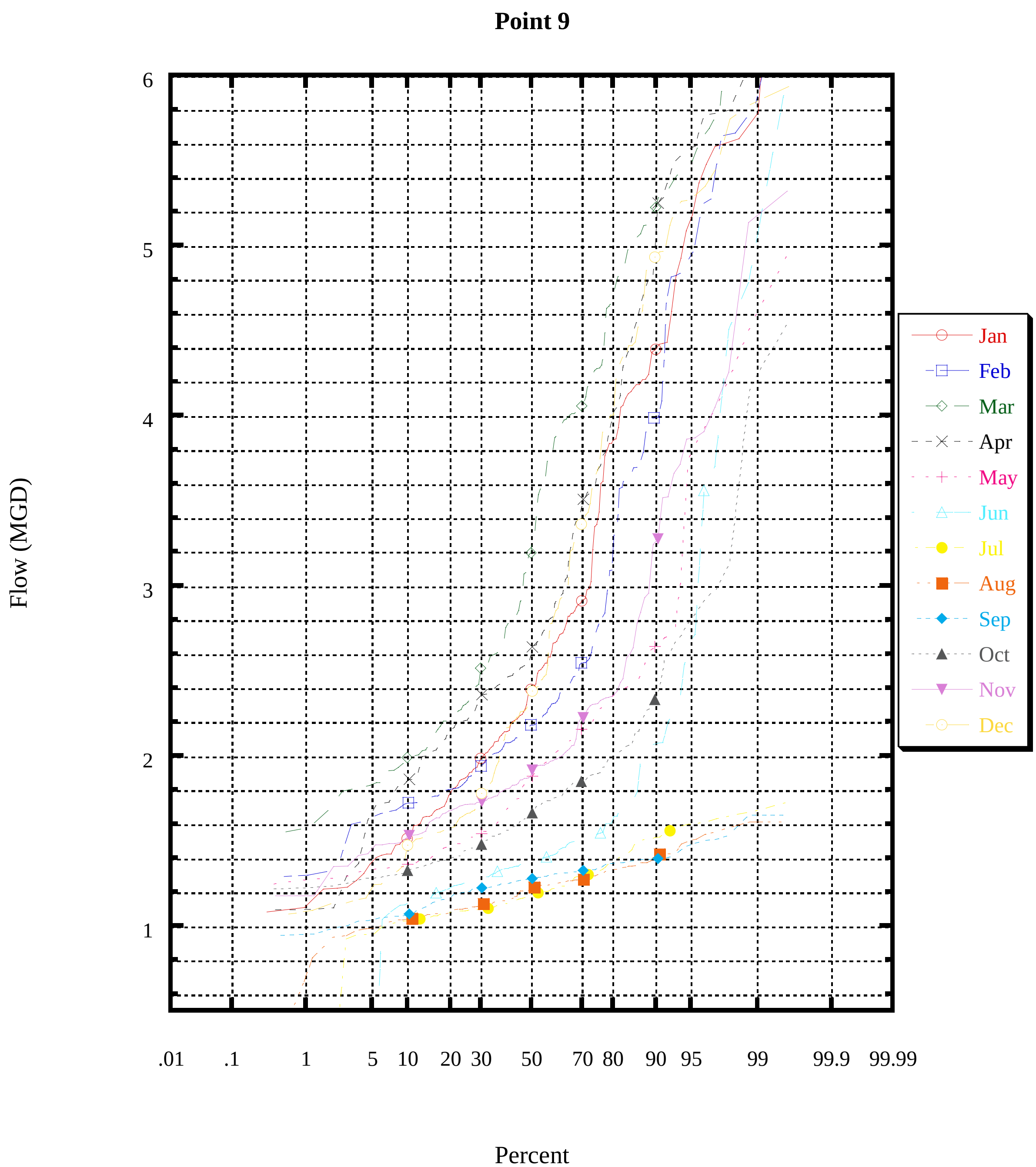
Month	Flow Rate (MGD)	Influent BOD (mg/L)	Total HRT	Predicted Effluent (mg/L)	Conditions
	5.9	45	2.19	28	BOD=95th Percentile of Month
	5.9	18	2.19	12.3	Median BOD from TW at point 8
	5.2	18	2.41	15	95th Percentile Monthly flow, Median BOD
Jan/Feb	3.2	28	3.78	15	75th Percentile flow and 75th Percentile BOD Concentration
	5.9	50	2.19	36	BOD=95th Percentile of Month
	5.9	22	2.19	17	Median BOD from TW at point 8
	5.8	22	2.19	20	95th Percentile Monthly flow, Median BOD
Mar	4.3	28	2.89	22	75th Percentile flow and 75th Percentile BOD Concentration
	5.9	53	2.19	37	BOD=95th Percentile of Month
	5.9	25	2.19	18	Median BOD
	5.5	25	2.19	22	95th Percentile Monthly flow, Median BOD
Apr	3.7	30	3.36	21	75th Percentile flow and 75th Percentile BOD Concentration
	5.9	112	2.19	70	BOD=95th Percentile of Month
	5.9	80	2.19	50	Median BOD
	3.8	80	3.19	41	95th Percentile Monthly flow, Median BOD
May	2.3	75	5.49	24	75th Percentile flow and 75th Percentile BOD Concentration
	5.9	87	2.19	33	BOD=95th Percentile of Month
	5.9	50	2.19	20	Median BOD
	2.6	50	4.66	10	95th Percentile Monthly flow, Median BOD
Jun	1.55	55	8.06	6	75th Percentile flow and 75th Percentile BOD Concentration
	5.9	58	2.19	21	BOD=95th Percentile of Month
	5.9	40	2.19	15	Median BOD
	1.6	40	7.56	5	95th Percentile Monthly flow, Median BOD
Jul	1.3	48	7.94	5	75th Percentile flow and 75th Percentile BOD Concentration
	5.9	58	2.19	19	BOD=95th Percentile of Month
	5.9	35	2.19	12	Median BOD
	1.5	35	8.06	4	95th Percentile Monthly flow, Median BOD
Aug	1.3	45	9.3	4	75th Percentile flow and 75th Percentile BOD Concentration
	5.9	65	2.19	25	BOD=95th Percentile of Month
	5.9	45	2.19	18	Median BOD
	1.5	45	8.06	6	95th Percentile Monthly flow, Median BOD
Sep	1.35	52	9.3	5	75th Percentile flow and 75th Percentile BOD Concentration

	5.9	80	2.19	16	BOD=95th Percentile of Month
	5.9	55	2.19	17	Median BOD
	2.8	55	4.33	8	95th Percentile Monthly flow, Median BOD
Oct	1.9	65	6.37	5	75th Percentile flow and 75th Percentile BOD Concentration
	5.9	99	2.19	34	BOD=95th Percentile of Month
	5.9	70	2.19	27	Median BOD
	3.9	70	3.19	19	95th Percentile Monthly flow, Median BOD
Nov	2.3	75	5.49	10	75th Percentile flow and 75th Percentile BOD Concentration
	5.9	93	2.19	39	BOD=95th Percentile of Month
	5.9	50	2.19	23	Median BOD
	5.25	50	2.41	22	95th Percentile Monthly flow, Median BOD
Dec	3.6	68	3.36	22	75th Percentile flow and 75th Percentile BOD Concentration

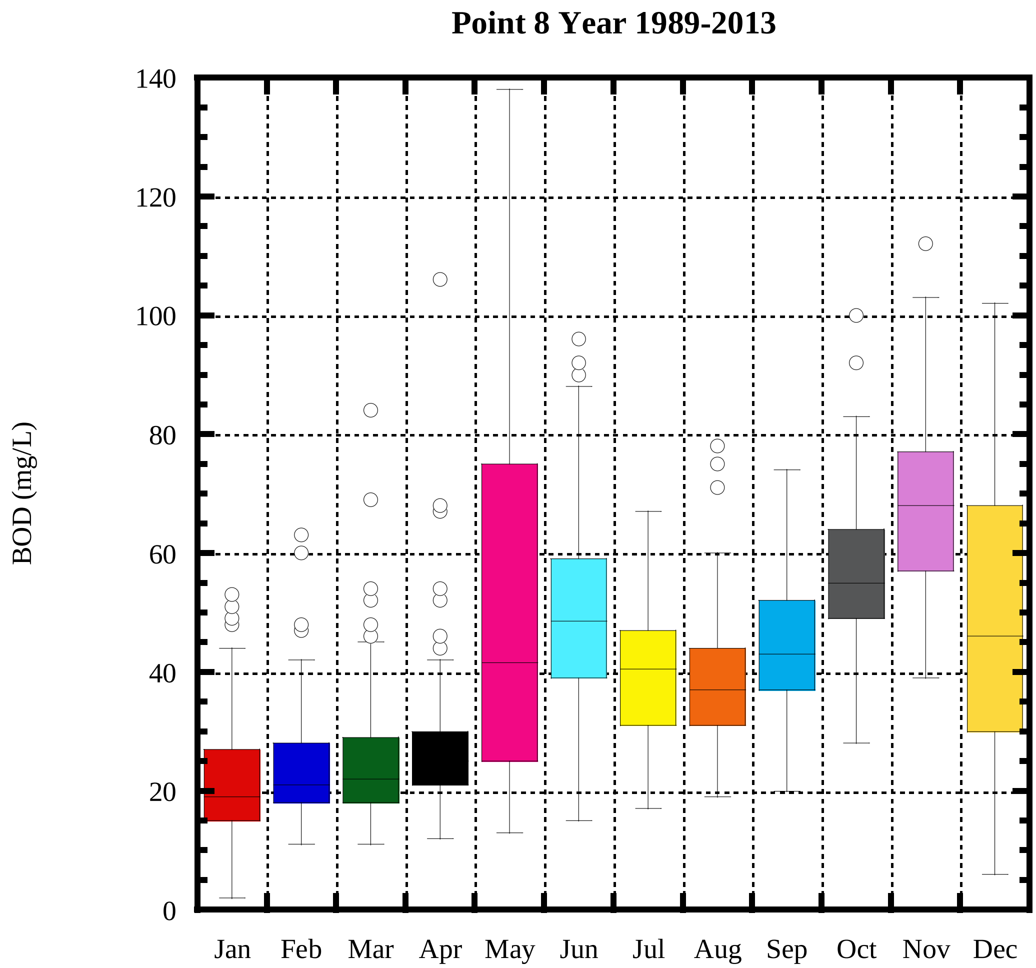


95th Percentile Monthly flow, Median BOD
Maximum Flow, 95th Percentile BOD
75th Percentile flow and 75th Percentile BOD Concentration
Maximum Flow, Median BOD from TW at point 8
Predicted EW Effluent BOD (mg/L)
70
60
50
40
30
20
10
0
Outfall 001 Limit= 30 mg/L
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
Oct
Nov
Dec


Point 8 Years 1989-2013
BOD (mg/L)
Percent
0
20
40
60
80
100
120
.01
.1
1
5
10
20
30
50
70
80
90
95
99
99.9
99.99
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec



Point 9
Flow (MGD)
6
5
4
3
2
1
.01
.1
1
5
10
20
30
50
70
80
90
95
99
99.9
99.99
Percent
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Point 8 Year 1989-2013
BOD (mg/L)
0
20
40
60
80
100
120
140
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

APPENDIX K – CIP ALTERNATIVE PROJECT DESIGN CRITERIA

		Alternative 1 Existing System rehabilitation	Alternative 2 Existing System with Side-stream Treatment	Alternative 3 Existing System with Parallel Treatment
Primary Treatment				
Primary Clarifiers				
Number		2	2	1
Capacity, each	MGD	3.0	3.0	2.0
Size, Diameter	FT	50	50	50
Secondary Treatment				
Oxidation Ponds				
Number		2	2	2
Acres		46	46	46
Pond 2 Aerators				
Number		8	8	NA
Treatment Wetlands				
Number		7	7	6
Size	acres	12	12	
Oxidation Ditch				
Number		0	1	2
Total Volume	MG	NA	2	4
Volume per Basin	MG	NA	2	2
Secondary Clarifiers				
Number		0	1	2
Capacity		0	2.0	4.0
Diameter, ea	ft	NA	55	55
Enhancement Wetlands				
Number		3	3	3
Overall area	acres	33	33	33
Vegitated area	acres	8	8	8
Disinfection				
UV Disinfection				
New Firm Capacity	MGD	5.9	5.9	5.9
Design UVT	%	**35**	**35**	**55**
Design Dose	mJ/cm2	35	35	35
Proposed lamps	Number	528	528	336
Wet Weather		Storage	Storage	Storage
Volume	MG	24	24	24
Rainfall	MG	2 to 6 MG	2 to 6 MG	2 to 6 MG

APPENDIX L – SUMMARY OF CHLORINE AND SULFUR DIOXIDE CHEMICAL USE

Month/Year	Monthly Ave Flow (MGD)	Average SO_2 Use (lbs/day)	Average SO_2 Dose (mg/L)	SO_2 Peak Daily Use (lbs)	Average CL_2 Use (lbs/day)	Average CL_2 Dose (mg/L)	CL_2 Peak Daily Use (lbs)
Jun-10	2.17	186	10.28	370	220	12.16	520
Jul-10	1.32	143	12.99	210	176	15.99	270
Aug-10	1.28	160	14.99	220	230	21.55	360
Sep-10	1.37	145	12.69	200	341	29.84	530
Oct-10	1.48	221	17.90	400	347	28.11	470
Nov-10	2.47	233	11.31	390	263	12.77	470
Dec-10	3.52	270	9.20	420	275	9.37	500
AVERAGE		194		316	265		446
Jan-11	2.75	205	8.94	350	197	8.59	340
Feb-11	2.51	203	9.70	320	189	9.03	300
Mar-11	3.26	307	11.29	510	373	13.72	560
Apr-11	2.54	220	10.39	420	227	10.72	420
May-11	1.70	139	9.80	170	202	14.25	340
Jun-11	1.48	118	9.56	180	178	14.42	250
Jul-11	1.18	92	9.35	140	190	19.31	380
Aug-11	1.25	132	12.66	180	412	39.52	286
Sep-11	1.33	143	12.89	180	347	31.28	540
Oct-11	2.00	217	13.01	300	362	21.70	560
Nov-11	1.59	201	15.16	290	234	17.65	320
Dec-11	1.42	145	12.24	200	218	18.41	380
AVERAGE	.	177		270	261		390
Jan-12	2.79	213	9.15	315	271	11.65	360
Feb-12	2.03	187	11.05	290	252	14.88	380
Mar-12	2.74	241	10.55	340	256	11.20	420
Apr-12	3.16	231	8.77	400	317	12.03	580
May-12	1.67	151	10.84	220	237	17.02	320
Jun-12	1.38	132	11.47	180	163	14.16	380
Jul-12	1.19	145	14.61	200	137	13.80	200
Aug-12	1.21	134	13.28	190	225	22.30	310
Sep-12	1.31	145	13.27	190	232	21.23	320
Oct-12	1.37	154	13.48	200	199	17.42	270
Nov-12	1.72	198	13.80	310	198	13.80	420
Dec-12	3.28	238	8.70	510	282	10.31	830
AVERAGE		181		279	231		399

Month/Year	Monthly Ave Flow (MGD)	Average SO_2 Use (lbs/day)	Average SO_2 Dose (mg/L)	SO_2 Peak Daily Use (lbs)	Average CL_2 Use (lbs/day)	Average CL_2 Dose (mg/L)	CL_2 Peak Daily Use (lbs)
Jan-13	2.00	179	10.73	230	166	9.95	240
Feb-13	1.86	212	13.67	270	217	13.99	290
Mar-13	2.40	175	8.74	230	181	9.04	290
Apr-13	1.72	150	10.46	210	195	13.59	290
May-13	1.40	139	11.90	210	153	13.10	240
Jun-13	1.24	166	16.05	210	235	22.72	390
Jul-13	1.10	149	16.24	200	287	31.28	440
Aug-13	1.19	105	10.58	280	236	23.78	380
Sep-13	1.32	96	8.72	260	198	17.99	670
Oct-13	1.37	156	13.65	250	237	20.74	440
Nov-13	1.30	142	13.10	210	347	32.01	530
Dec-13	1.19	120	12.09	160	174	17.53	320
AVERAGE		149		227	219		377
Jan-14	1.32	129	11.72	180	170	15.44	240
Feb-14	2.16	213	11.82	360	266	14.77	490
Mar-14	2.28	213	11.20	380	266	13.99	520
Apr-14	1.73	194	13.45	260	167	11.57	240
May-14	1.41	156	13.27	200	170	14.46	220
Jun-14	1.16	136	14.06	190	227	23.46	500
Jul-14	1.07	75	8.40	180	187	20.96	470
Aug-14	1.18	59	6.00	90	158	16.05	200
Sep-14	1.85	94	6.09	160	190	12.31	480
Oct-14	1.57	142	10.84	300	263	20.09	770
Nov-14	1.67	211.3	15.17	240	318.3	22.85	460
Dec-14	3.19	284	10.67	420	302	11.35	460
AVERAGE		159		247	224		421
Jan-15	1.55	180	13.92	320	193	14.93	360
Feb-15	1.93	203	12.61	320	233	14.48	410
Mar-15	1.77	194	13.14	260	191	12.94	320
Apr-15	1.84	211	13.75	280	202	13.16	260
May-15	1.29	90	8.37	180	87	8.09	240
AVERAGE		176		272	181		318

APPENDIX M – UVT DATA AND EVALUATION

PROJECT MEMORANDUM

Project Name:	WWTP Improvements Project	**Date:**	June 4, 2015
Client:	City of Arcata (LACO)	**Project Number:**	9913A10
Prepared By:	Andrew Salveson		
Reviewed By:	Doug Wing		
Subject:	Technical Brief - UVT Data Summary and Implications		
Distribution:	LACO, City, File		

This technical brief reviews several UV transmittance (UVT) data sets, provides a graphical comparison of those data sets, and evaluates the potential implications. Recommendations for additional sampling are also provided.

1.0 UVT DATA

The Carollo team was provided with several UVT data sets:

- Sample Dates: 2008, 2011, and 2015 (current).
- Sample Locations: 8, 8-3, 9, and 15.

The sample locations are shown in Figure 1. Point 15 is the Hauser effluent, whereas Points 8, 8-3, and 9, as we interpret the locations, all represent essentially the same location in the treatment process, which is after the treatment wetlands but before the enhancement marshes. The UVT data is presented in Figures 2 to 5.

2.0 DATA ANALYSIS

Our review of this data set results in both questions and answers, and more data is needed. We propose the following items for discussion with the City:

- Points 8, 8-3, and 9 have consistently had a low UVT in the ~20% range (Figure 2 and Figure 3). The higher UVT using one UVT meter in 2011 may be the result of a calibration issue.

- Point 15 has had a UVT of ~40% to ~55%, with consistent data in 2011, but a concerning downward trend in 2015. Something has changed within the process treatment train which is driving the UVT down as part of the latest testing. It may be that flows to the enhancement marshes were chlorinated, which may have reduced increased UVT by oxidizing soluble organic matter. We are in need of feedback from the City.

- The UV system is currently considered for implementation after Point 15, and thus the UVT data from Point 15 is most relevant. If the current downward UVT trend at Point 15 continues, then the new UV system will be quite expensive to implement. Further, the UVT at Point 15 is currently well below the UVT value in the new permit.

- The increase in UVT from Points 8, 8-3, and 9 to Point 15 is substantial and must be better understood. Is the UVT increase purely a function of biological activity and filtration through the Hauser Marsh? Was there (or is there) any other type of treatment that occurs after Points 8, 8-3, and 9 but before the end of the enhancement marshes?

3.0 RECOMMENDATIONS

It is recommended that the UVT sampling at location 15 be expanded to include testing after the treatment wetlands, at either points 8 or 9, prior to the chlorine contact basin. Further, we suggest testing of UVT as it enters the Hauser Marsh.

Figure III- 2. Locations and labels for sampling points through the AWTF.

Figure 1 – Sample Locations

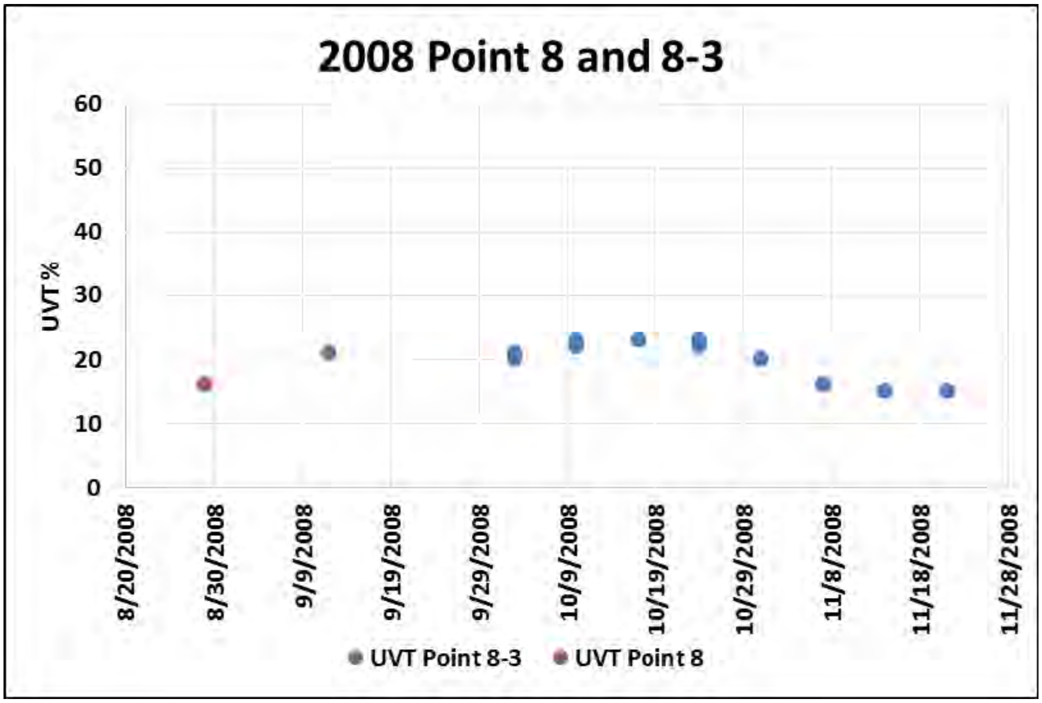


Figure 2 – 2008 Data, Points 8 and 8-3

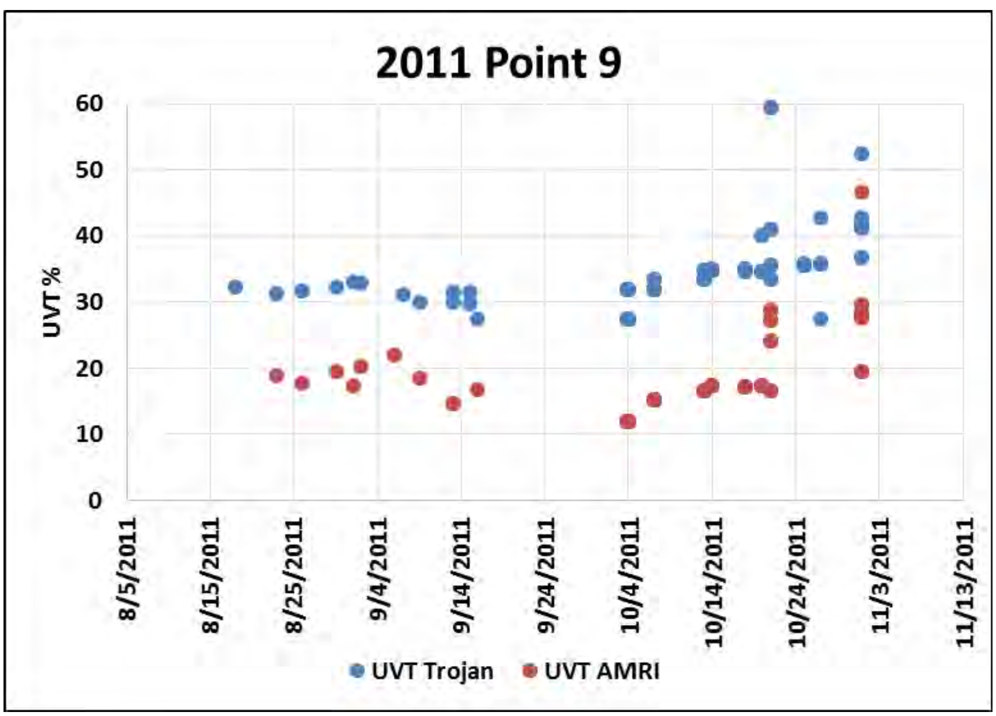


Figure 3 – 2011 Data, Point 9

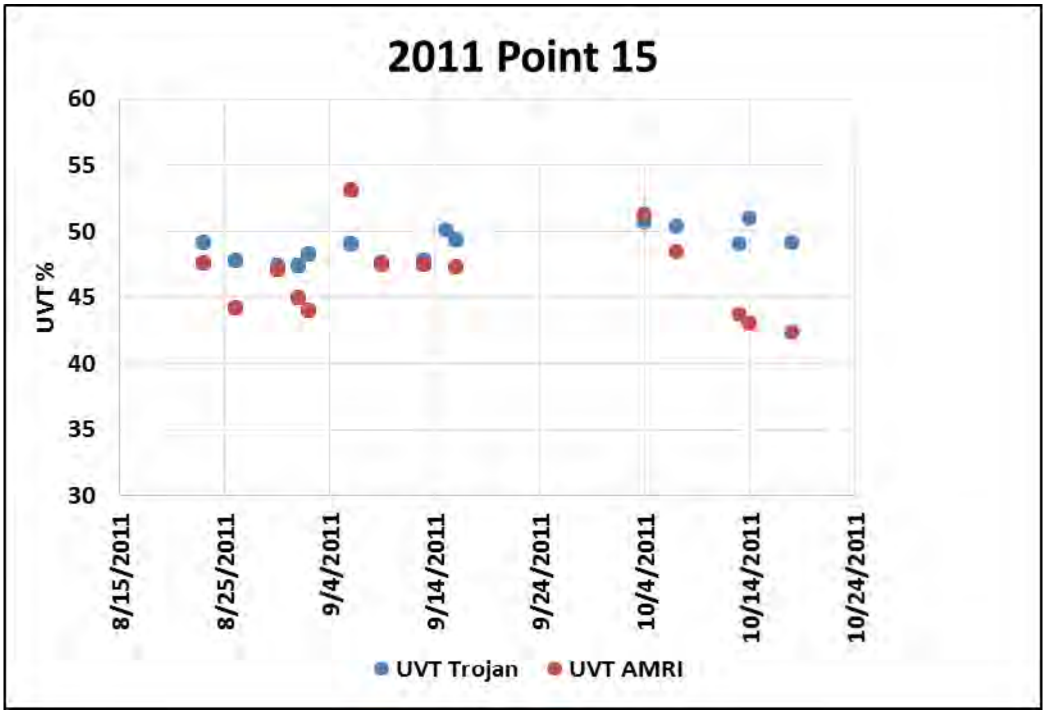


Figure 4 – 2011, Point 15

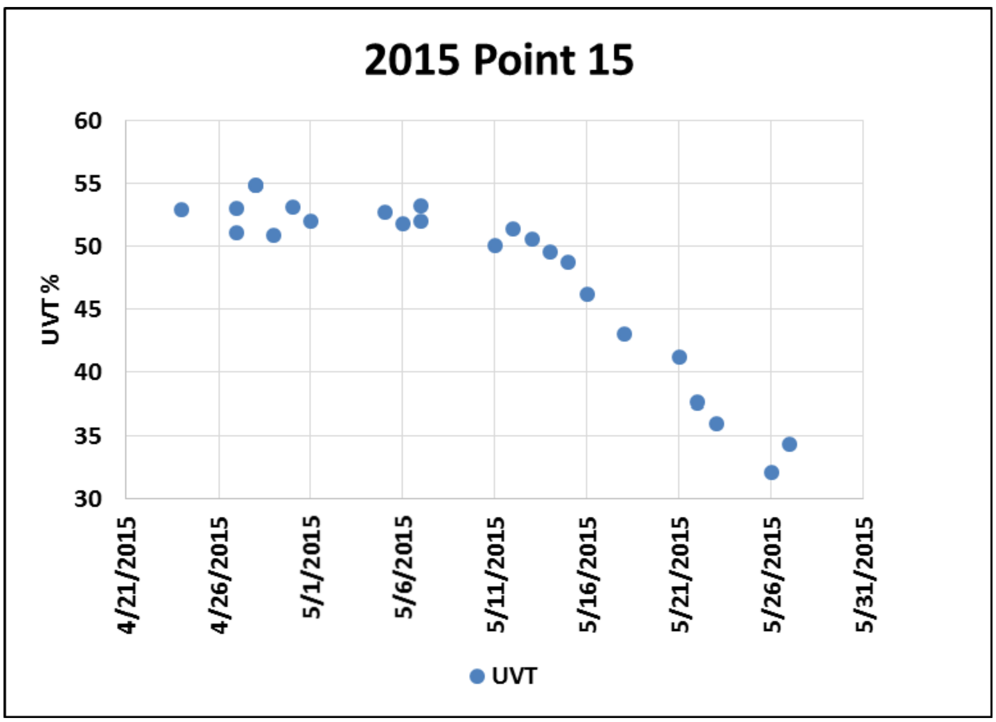


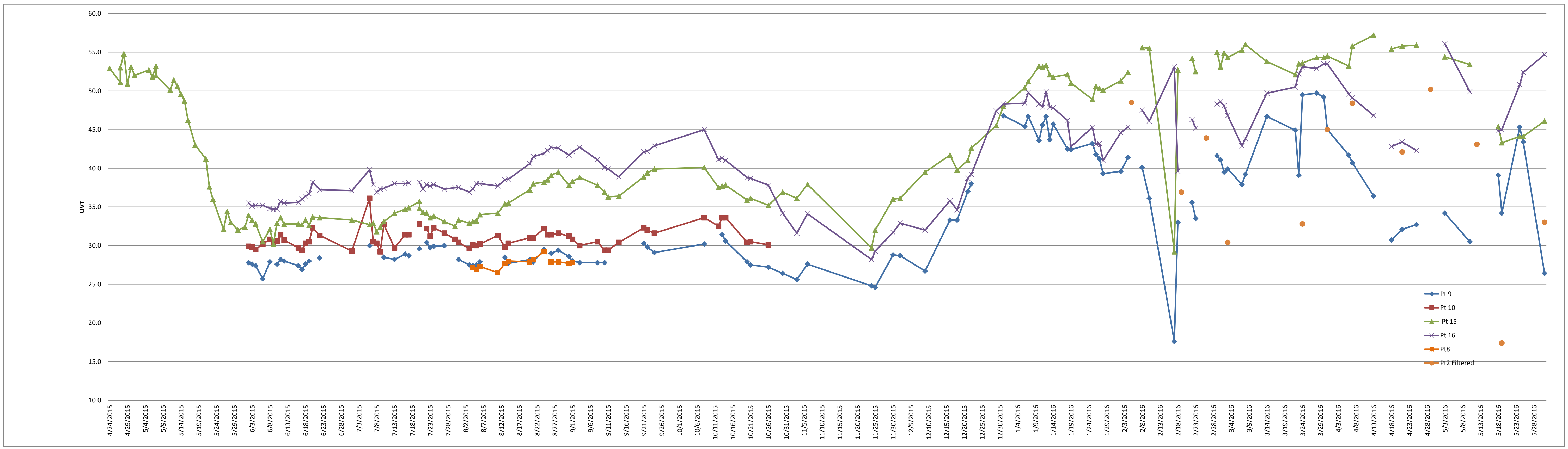
Figure 5 – 2015, Point 15

Prepared By:

Andrew Salveson

This is where the engineer digital seal will be placed.

Appendix M, UVT Data
City of Arcata
Wastewater Treatment Facility Improvements Project



c:\pw_working\projectwise\esimmons\d0388776\Arcata_UVT_Hauser Effluent_updated 6.1.2016.xlsxArcata_UVT_Hauser Effluent_updated 6.1.2016.xlsxSheet1

APPENDIX N – 2011 PILOT UV DISINFECTION TEST REPORT

MEMO

From: Arcata Marsh Research Institute

Date: November 2, 2011

UV Disinfection of the City of Arcata's treated wastewater

Purpose

Presently, UV disinfection is being considered to replace chlorine disinfection. Alternative sites for UV disinfection are being considered depending upon permitting requirements. The purpose of studying UV disinfection at multiple locations is to provide information that can be used to prove effectiveness and to design a full-system UV disinfection process. Continuing to disinfect with a chlorine-based system will produce disinfection byproducts that are not removed in the dechlorination process and are known human and ecological toxins. These disinfection byproducts have been identified in Arcata's effluent. The following list states the multipurpose goals of this UV pilot system.

- City of Arcata treats their wastewater with the lowest impact possible to meet all existing permit requirements (for disinfection permit limits see Table 1).

- Eliminating the chlorination disinfection system eliminates toxic byproducts and human hazards associated with chlorine usage.

- Options for disinfection are Point 9, a mixture of Point 9 and Point 15, and Point 15.

- Installation of UV disinfection at Point 001 is redundant when disinfection has been achieved at Point 002. Therefore, disinfection should be focused at Point 002. Additional water quality limits (BOD, TSS, Ammonia, metals etc) should be argued for and implemented at a final discharge point (Pt 001, or Pt 003 – to McDaniels Slough).

- Installation of UV disinfection at Point 001 while chlorinating at Point 002 does not eliminate the delivery of toxic byproducts to the Tertiary Constructed Wetlands (TCW). If the TCW are decided to be Waters of the State then fresh water toxicity limits from chlorination will be a difficult permit limit to meet.

Table 1: City of Arcata coliform permit limits at Outfall 001 and 002.

Permit location	Permit limit	Units	Monthly Average	Daily Maximum
Outfall 001	Fecal Coliform	MPN/100mL	14	43
Outfall 002	Total Coliform	MPN/100mL	23	230

Water Quality Objectives
The North Coast Water Quality Control Board defines water quality objectives for (1) shellfish growing areas and (2) watersheds in the ***North Coast Basin Plan*** (Plan)**.** Objectives for shellfish growing waters (applied within the Bay waters) state "*the geometric mean for fecal coliform shall not exceed 14 MPN per 100 ml and that the 90th percentile value for fecal coliform shall not exceed 43 MPN per 100 ml*." This Study applied the 90th percentile value of 43 MPN in the interpretation analyses of bay water samples.

Ultraviolet Disinfection – Background Information

The use of ultraviolet disinfection is an environmentally responsible, convenient, safe, and cost-effective way to disinfect municipal wastewater discharge. UV disinfection performance is equal to chlorine. The effluent easily meets NPDES permit requirements and is a more effective viralcide than chlorine. As a result, adequate disinfection is provided, permit requirements are met, and local aquatic life is protected. By reducing reliance on chlorine, the potential for accidental worker and/or citizen exposure is reduced.

Advantages

Safety: UV disinfection is safer than wastewater treatment systems that rely on chlorine gas. By eliminating transport and handling of large quantities of a hazardous chemical, the UV system reduces potential liability for worker/community exposure. Studies also suggest that UV disinfection controls viruses and many disease-causing bacteria better than chlorination/dechlorination.

Simplified Compliance: UV disinfection can help ease compliance with NPDES permit requirements and Fire Code regulations. Continued use of chlorine would require Arcata to build a new disinfection area incorporating secondary containment and a scrubbing/neutralization system.

Reduced Effluent Toxicity: Even at low concentrations, chlorine is toxic to aquatic organisms. Dechlorination only removes chlorine in the free residual form leaving combined forms. Aqueous chlorination practices also generate halogenated organic compounds, which may also be toxic. UV disinfection protects the aquatic habitat of the receiving waters. (Literature citation)

Operation, Maintenance and Cleaning: The operation and maintenance of UV disinfection systems is simpler than chlorination/dechlorination systems. UV process monitoring and controls relies on instrumentation that maintains optimum irradiation levels for disinfection. Automatic shutoff values exist to stop flow when conditions for target disinfections are compromised. (Literature citation)

Chemical of concern: UV has been demonstrated to reduce and remove a wide range of personal products and pharmaceutical found in domestic wastewater. There is a large body of literature showing the effectiveness of UV light on complex organic compounds in wastewater including endocrine disrupters. UV disinfection system can serve as an effective process to deal with the next group of potential NPDES parameters. (Literature citation)

Energy Consumption: The total energy requirement for UV is less than chlorination mostly due to the transportation and handling energy cost. UV has the potential to use the electricity generated from anaerobic digesters on-site. Presently Arcata does not use biogas for electrical power production.

UV Disinfection Studies

Currently, an open channel Trojan UV3000 system is being used to test disinfection of the City of Arcata's reclaimed wastewater. Previous studies (Wilson 1996, Ly 2008, Finney et al. 2009, and Garrison 2010) indicate UV disinfection is successful at both current chlorine disinfection locations (Pt 9 and Pt 15). The UV3000 model open-channel configuration believed to be the best model yet tested to handle the typical water quality seen at Pt 9 and Pt 15. Typical design range for industry norms is 20-140 mJ/cm^2.

Past UV Studies

The City of Arcata has invested in 2 previous pilot scale studies (Finney et al. 2009, and Garrison 2010), and 2 bench scale studies (Wilson 1996, and Ly 2008) to determine the efficacy of UV disinfection as a replacement for the use of chlorine.

Table 2: Summary of previous UV studies at the Arcata Marsh.

Study	**UV system (Q)**	**Study period; [# of runs]**	**Point of disinfection; Water quality**
Wilson (1996)	Lifeguard Aquatics, QL-40 (40 Watt bulb); closed vessel, (.96-5 GPM)	Oct. 1994 – Apr. 1995	Hauser effluent: Turbidity (0.9-6.1 NTU), TSS (0.3-8.2 mg/L), Transmittance (43-58%)
UV effectively disinfected all samples at all ranges below permit requirements. Dose ranged 48.4-283.63 mJ/cm^2. Note 19% of untreated samples complied with permit requirements.			
Ly (2007)	Bench-scale Double Helix UV sterilizer, closed vessel; (10 gallon samples)	Aug. – Dec. 2007 [n=15]	TM 4: TSS (17-35 mg/l), Transmittance (44.8 – 54.7%)
Influent FC ranged from 600-11,200 CFU/100ml all UV radiated samples achieved total FC kill and resulted in clean plates. UV dose is estimated to have ranged from 96-153 mW/cm^2.			

<table>
<tr><td rowspan="3">Finney et al. (2009)</td><td rowspan="3">Aquionics Inline 40+, closed vessel

(5-75 gal/min)</td><td>Aug. 2010

[n=5]</td><td>Pt 8: Turbidity (38-41 NTU), TSS (27-31 mg/l), Transmittance (16%). Water quality considered too low to achieve disinfection.</td></tr>
<tr><td>Sept. – Nov. 2010

[n=45]</td><td>TM 3: Turbidity (20-40 NTU), TSS (9-35 mg/l), Transmittance (25%).</td></tr>
<tr><td>Dec. 2010
[n=9]</td><td>Hauser: Turbidity (6 NTU), TSS (3 mg/l), Transmittance (49%).</td></tr>
<tr><td colspan="4">Increased TSS correlated with higher turbidity and lower transmittance. FC fairly easy to inactivate, TC harder, TM 3 effluent needed a dose over 200 mJ/cm^2. Hauser effluent achieved disinfection at a dose of 100 mJ/cm^2.</td></tr>
<tr><td>Garrison (2010)</td><td>Trojan Fit, model 18AL40 closed vessel

(0.11 – 1 MGD)</td><td>Sept. 2010 – Jan. 2011

[n = 107]</td><td>Pt 8: TSS (15-76 mg/L), Turbidity (10-75NTU), Transmittance @254 nm (22.5-56.3%)</td></tr>
<tr><td colspan="4">The study shows disinfection is achieved at all tested levels of TSS and UVT with varying dosages. Consistent and sufficient disinfection was achieved at 100 mJ/cm^2. There was no clear relationship between TSS and effectiveness nor between UVT and effectiveness although both TSS and UVT are considered the main parameters that affect effectiveness. Trojan was unable to provide the dosage equation that may better describe these relationships.</td></tr>
</table>

Findings:

Garrison (2010) found effective disinfection even though the closed-chamber Trojan Fit met unpredicted issues with solids build-up and flow regulation.

- Accumulated algal solids, unexpected cattail fragments, frogs, snails, and sticks.
- The UV lamps accumulated an opaque film that was described as excessive by the Trojan representative.
- The flow rate used to achieve UV disinfection was often below the designed operating parameters for the unit resulting in laminar flow rather than turbulent flow.

Recommendations

- Routine maintenance and screening at the influent pump station would reduce the amount of detrital solids entering the disinfection systems.
- Find appropriate cleaning solution for opaque film if it occurs again.
- Closed chamber UV disinfection is not appropriate

The 2011 UV Project – Testing Point 15 (Hauser) and Point 9 effluent

Pilot Study Design

A Trojan UV3000 pilot-scale UV unit for ultra-violet disinfection is being tested for effectiveness on Arcata Marsh secondary treated effluent. UV disinfection effectiveness is being determined by both the ease of operations and the ability to disinfect total and fecal coliform (TC & FC). The disinfection efficacy at different doses and ease of operations are used as design criteria and in developing operational strategies. The UV unit is located on the berm next to the chlorine contact basin to allow for multiple influent sources (Figure 1).

In order to test the disinfection effectiveness, the UV dose can be altered by changing the flow rate and therefore the residence time. The second way to change the UV dose is to alter the level of power delivered to the water.

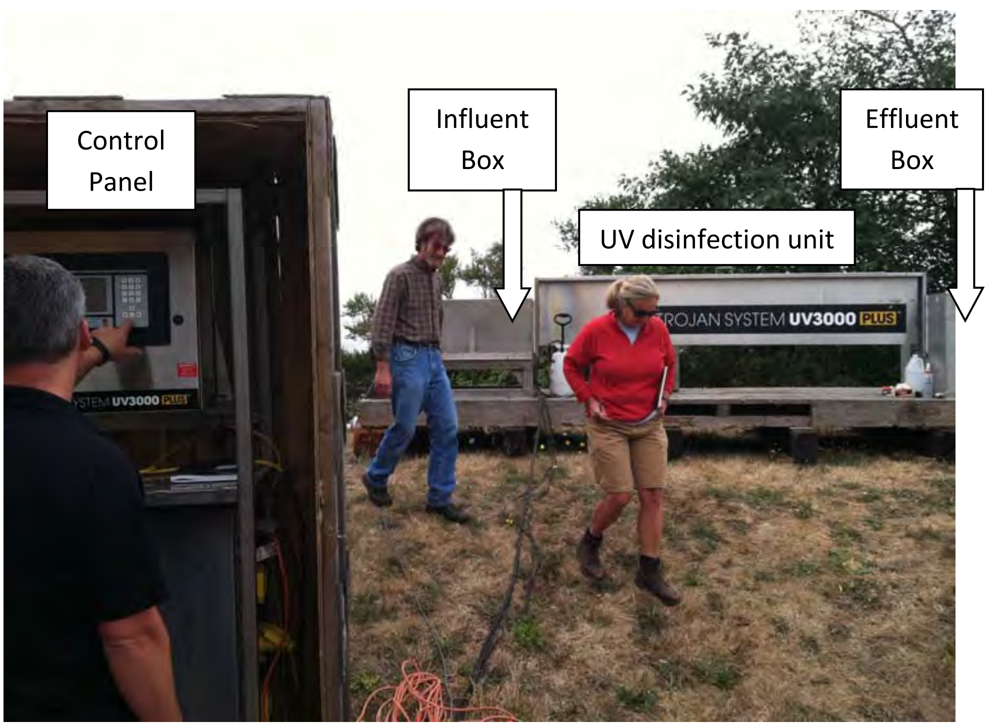


Figure 1: Trojan UV3000 control panel and disinfection unit.

The first source of water to be tested is from Hauser Wetland (Point 15). Additional sources of water to be tested are from Point 9 and a mixture from Point 9 and Hauser Wetland. The City of Arcata discharge permit has fecal coliform (FC) and total coliform (TC) limits for Outfall 001/Point 15 and Outfall 002/Point 9 (Table 3).

Table 3: City of Arcata discharge permit limits for total and fecal coliform.

Permit location	Permit limit	Units	Monthly Average	Daily Maximum
Outfall 001	Fecal Coliform	MPN/100mL	14	43
Outfall 002	Total Coliform	MPN/100mL	23	230

The different sources of water have different constituents that affect the ultra-violet transmittance (UVT). UVT is a measure of how well UV wavelengths can penetrate the source water and is effected by the turbidity, suspended and dissolved solids of the sample water. The assessment of each sampling location includes measuring UVT, turbidity, and TSS (Table 4). The Hauser Wetland effluent is typically described with a high UVT, low turbidity and TSS. Point 9 effluent is described with a lower UVT, and greater turbidity and TSS. The testing season, late summer, represents “worst-case” conditions for UVT due to high algal TSS, high turbidity, and increased humic acids (dissolved solids) from plant decomposition. Effective UV disinfection at this time of year provides design parameters that would cover poor water quality conditions.

Table 4: Water quality parameters for the influent sources to the UV system.

Source of UV influent	Dates of operation	UVT range	TSS (mg/L)	Turbidity (NTU)
Point 9	Aug 23 – Sept 16	27.5 – 34.9	54 – 77*	40 - 59
Mixture of Pt 9 and Hauser Wetland				
Hauser Wetland	Oct 4 - 13 & Oct 25 - 28	47.4 – 49.4	3 - 6	4 - 18

On October 7^{th} – 10^{th} or something – there were three days in a row of heavy rainfall. The high value for TSS reflects a spike in solids during this rainfall event.

Methods

Ease of operations is a function of how much time and effort is required by the treatment plant operators to maintain the UV unit as well as how much pre-treatment is necessary to deliver a quality of water that can be effectively disinfected.

Disinfection of coliform is being determined by the effect of UV dose on colony formation (reported in CFU/100mL) in accordance with Standard Methods for the Examination of Water and Wastewater. An alternative method for measuring coliform is the Most Probable Number (MPN) test that yields results in brackets of probable coliform abundance. The MPN test is the reporting standard for the discharge requirement.

The dose of UV light delivered to the water is described by a proprietary equation using flow rate and ultra-violet transmittance (UVT) (Figure 2). At this time of year, the effluent from Hauser Wetland is consistently about 50% UVT and Point 9 is about 30% UVT.

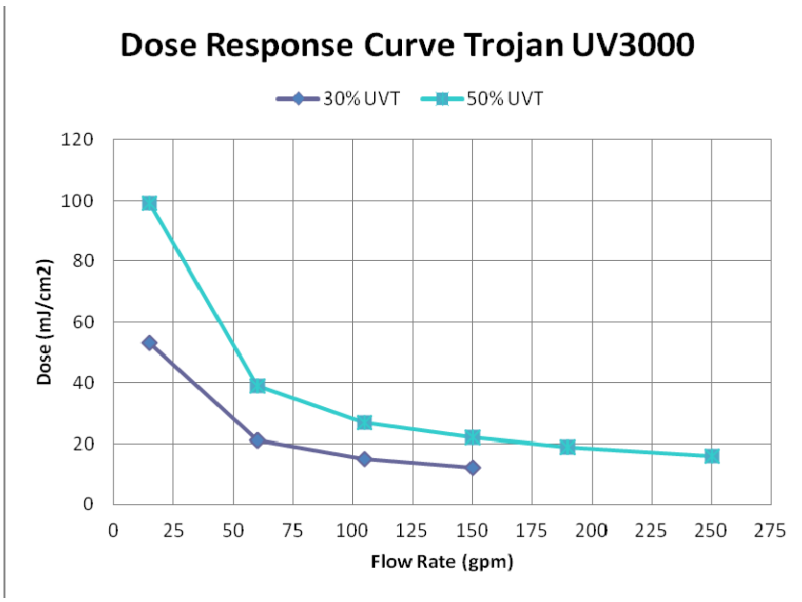


Figure 2: Dose response curve for Trojan UV3000.

Results and Discussion

Maintenance

Weekly visual inspections conducted by AMRI staff and City of Arcata wastewater treatment operators have demonstrated clean bulbs and some accumulation of solids. The clean bulbs were contrasted with the areas of grayish build-up on the bulbs that do not function as a part of the disinfection process and are not reached by the automatic cleaning mechanism (Figure 3). The accumulated solids were comprised of stringy material that may originate in the pipe between Hauser and the UV unit or may originate in Hauser Wetland itself (Figure 4). Once the influent source changed to Point 9, the influent settling basin showed pebbles and debris collecting. A simple screen was placed in front of the UV chamber to reduce the amount of large particles moving through the disinfection process. Throughout the study, the bulbs remained clean and clear of any noticeable film or build-up.

Operators have indicated that the maintenance time requirements of the UV unit are acceptable. Daily tasks are checking the UV control panel for alarms, checking the flow rate and the level of water in the unit. Additionally, when the unit is being run with Hauser influent, the operators turn off the unit and travel to the Hauser pump station to clean the effluent screen. If the screen is not cleaned daily, or if it accumulates a lot of solids there is a corresponding drop in the flow rate to the UV unit. The weekly visual inspections are demonstrating success and providing confidence in the ability of the UV unit to continue operations without a lot of maintenance.

The accumulation of stringy solids and large solids is potentially problematic, as solids can provide shielding for coliform as they move through the system. The result would be viable coliform on the effluent end of the UV unit. The solution would be a mechanical self-cleaning screen on the influent to the UV disinfection system.

Figure 3: Visual inspection demonstrating build-up of greyish coating on area of bulbs where the wiper does not reach.

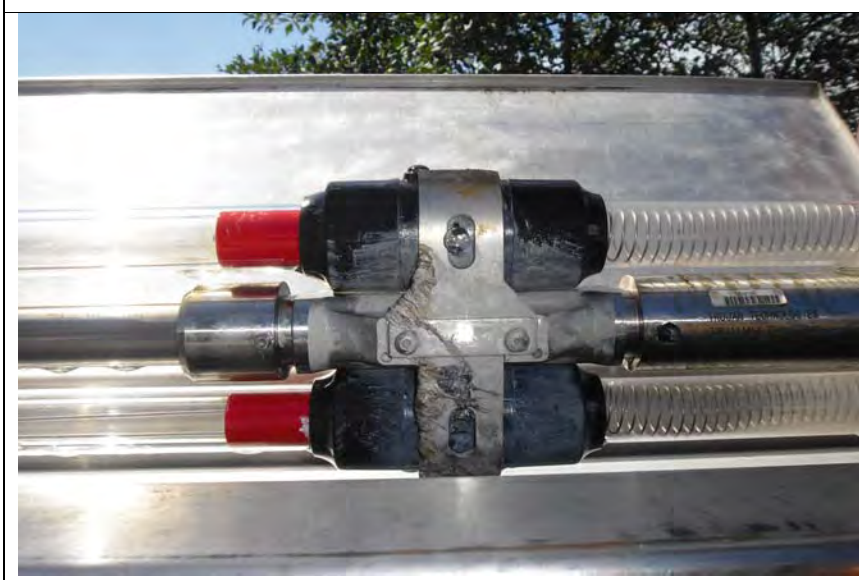


Figure 4: Visual inspection demonstrating the accumulation of stringy solids on bulb apparatus and very clean bulbs.

UV Disinfection Effectiveness receiving Hauser Effluent

Doses were tested ranging from 11-44 mJ/cm^2, at flows from 48.8 to 192 gpm, and with UVT of 47-50%. Doses were reported from Trojan after supplying the conditions for flow rate and UVT. Ten sampling events were run from August 23 – September 16, 2011 to assess the disinfection of Hauser Wetland effluent. Samples were not taken at flows lower than about 50 gpm due to difficulties in setting the effluent weir in the UV unit. Each dose was analyzed for Total and Fecal Coliform (TC and FC respectively), TSS, turbidity, temperature, and UVT.

The results for TC were determined to be unreliable because of competition with muccoid colonies causing interference with the growth of TC colonies and a lack of agreement with North Coast Laboratory samples run using the MPN test. The results for FC have been verified by North Coast Laboratory samples run using the MPN test (Figure 5).

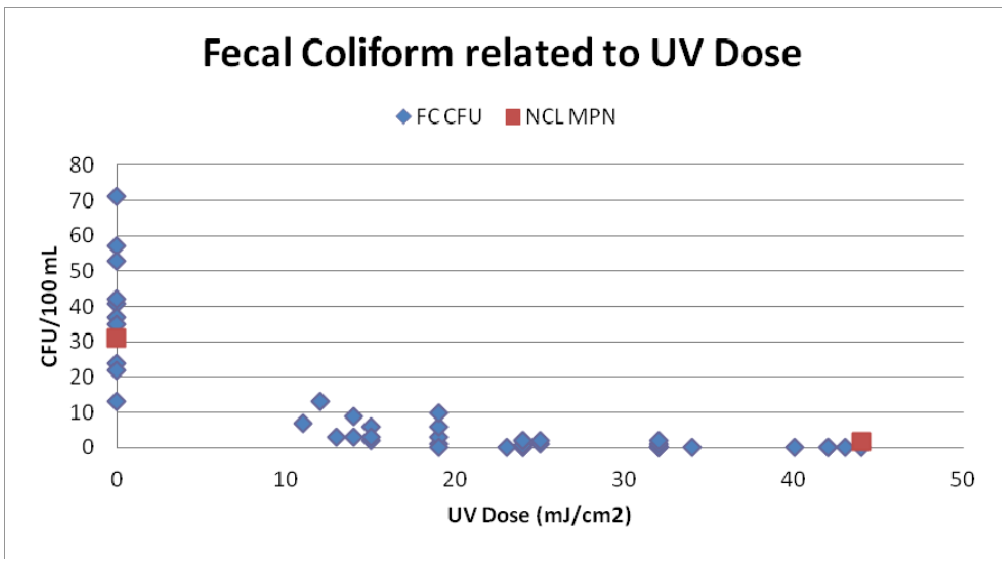


Figure 5: Fecal coliform colonies in CFU/100mL as related to applying different doses.

The lowest dose necessary to achieve permit levels for a daily maximum of 43 MPN/100mL was often achieved before disinfection, and was demonstrated by the coliform results at a dose of 0 mJ/cm^2 (Figure 5). All FC results were below 20 CFU/100mL. Results below 10 CFU/100mL were seen at doses greater than 20 mJ/cm^2.

The Trojan proprietary equation describing UV dose uses UVT and flow rate data. UVT is likely influenced by turbidity, TSS, and dissolved organics. The relationship between UVT, Turbidity, and TSS during the pilot study on Point 9 water is seen in **Error! Reference source not found.**. The distribution of turbidity data across the spectrum of UVT in Figure 6 shows a stronger correlation than that of TSS. As the turbidity of the water decreases the UVT increases.

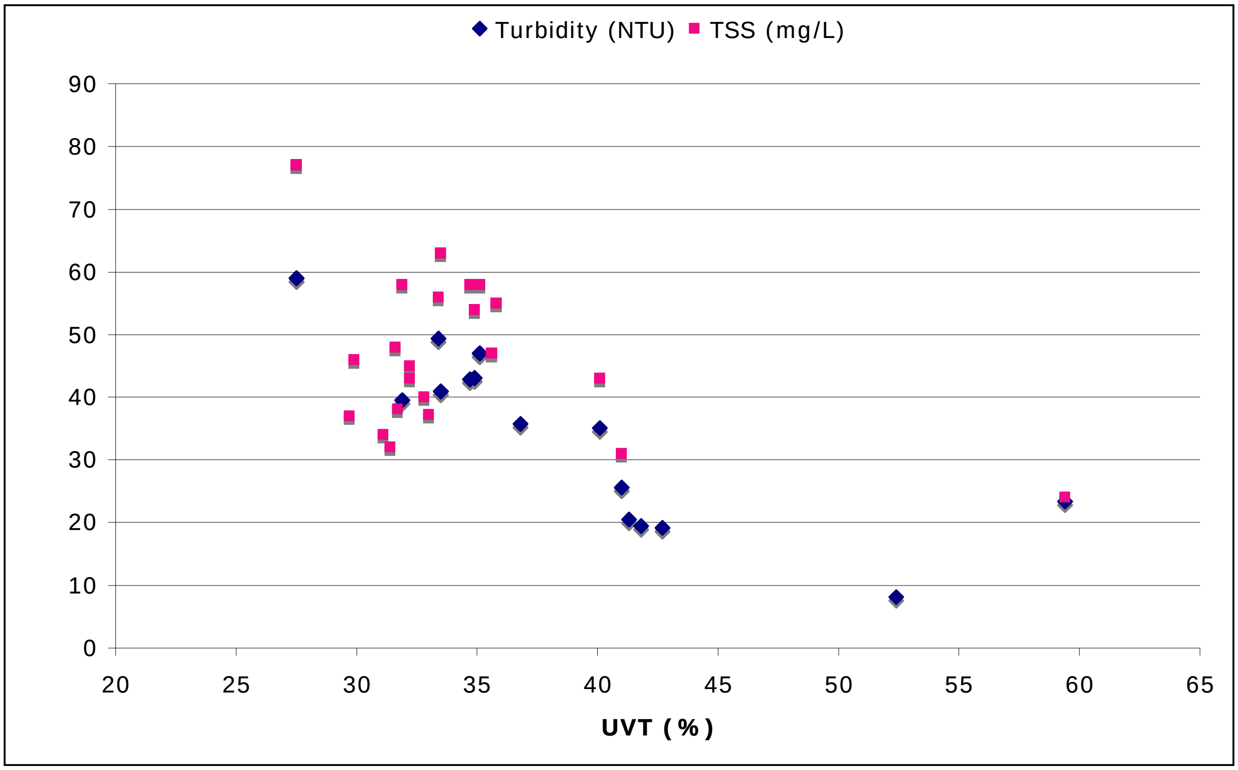


Figure 6: Ultra-violet transmittance as it relates to TSS and turbidity using Point 9 influent.

UV Disinfection Effectiveness receiving Point 9 Effluent

Doses were tested ranging from 20-42.6 mJ/cm^2, at flows from 21-132 gpm, and with UVT 27.5-59%. Doses were reported from Trojan after supplying the conditions for flow rate and UVT. Ten sampling events were run from October 4 – November 1, 2011 to assess the disinfection of Point 9 effluent. Samples were not taken at flows lower than 20.8 gpm as this is the low flow rate limit for the machine. Each dose was analyzed for Total and Fecal Coliform (TC and FC respectively), TSS, turbidity, and UVT.

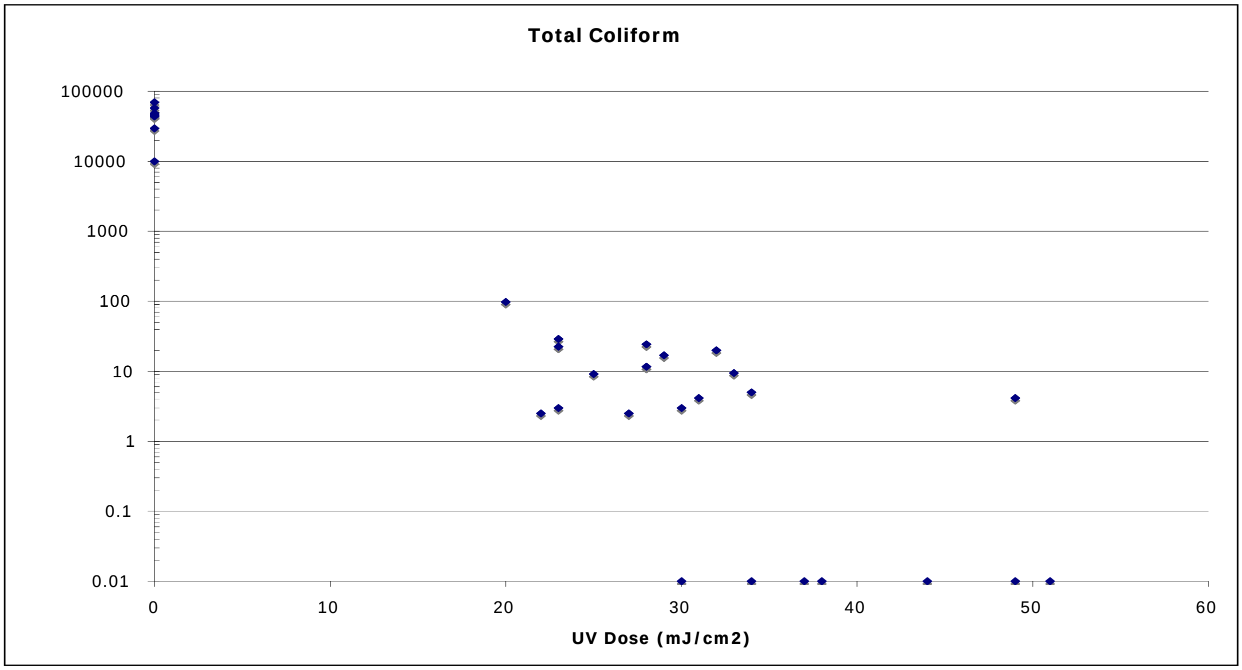


Figure 7: Total coliform in response to increasing UV dose applied to Point 9 influent. Value of 0.01 coliform is substituted for 0 coliform to use a logarithmic scale.

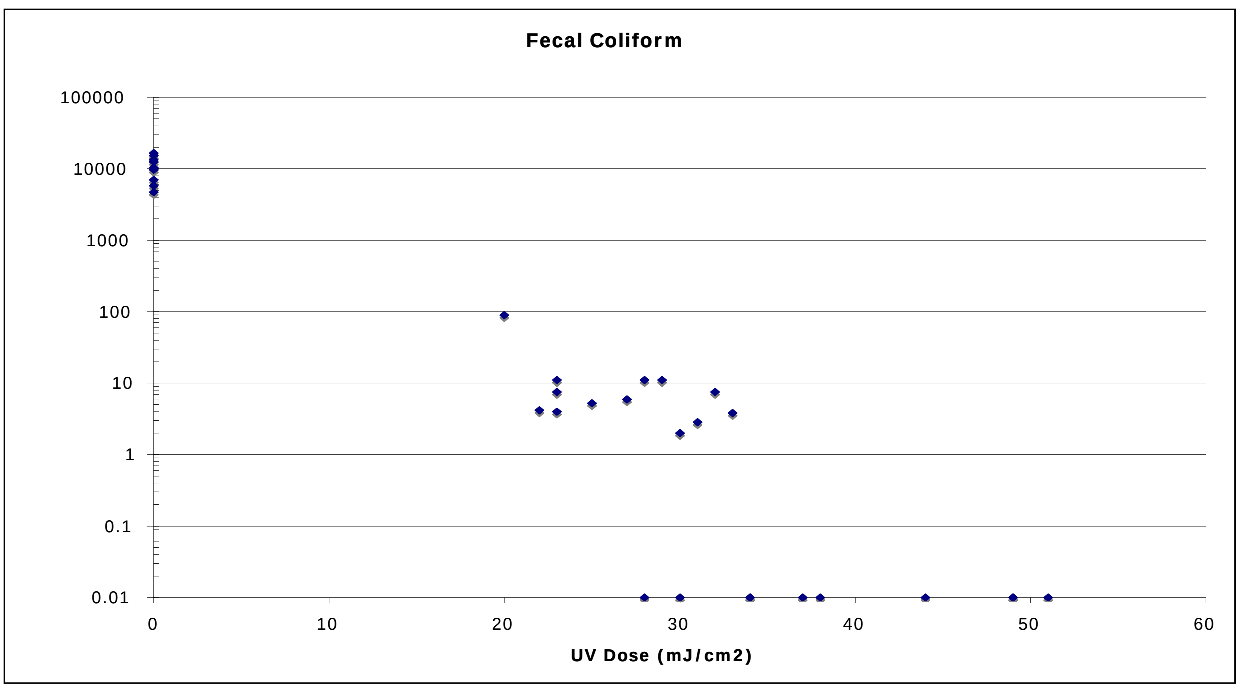


Figure 8: Fecal coliform in response to increasing UV dose applied to Point 9 influent. Value of 0.01 coliform is substituted for 0 coliform to use a logarithmic scale.

Total and fecal coliform colonies are reduced to less than 10 CFU/100mL at doses above 35 mJ/cm^2. All but one value for CFUs above 35 mJ/cm^2 are zero and are reported on the logarithmic scale as 0.01 CFU/100mL.

Conclusions

The open-channel Trojan UV3000 unit was shown to function well given the water quality and conditions of Hauser Wetland effluent (Point 15) and Treatment Marsh effluent (Point 9). Weekly visual inspections demonstrated the functionality of the wiper mechanism in keeping the bulbs clean of any build-up that could obscure the UV bulb.

The observation of stringy solids from Hauser Wetland on the UV bulb apparatus, large suspended solids from Point 9, and noticeable attached growth on the influent box for the UV unit indicates a potential problem for UV disinfection. If such large solids are allowed to pass through the unit, they may shield coliform from UV radiation and therefore not achieve disinfection. The recommendation for solving this issue is to install a mechanical self-cleaning screen to reduce influent solids and adopt a strict cleaning routine to eliminate attached growth.

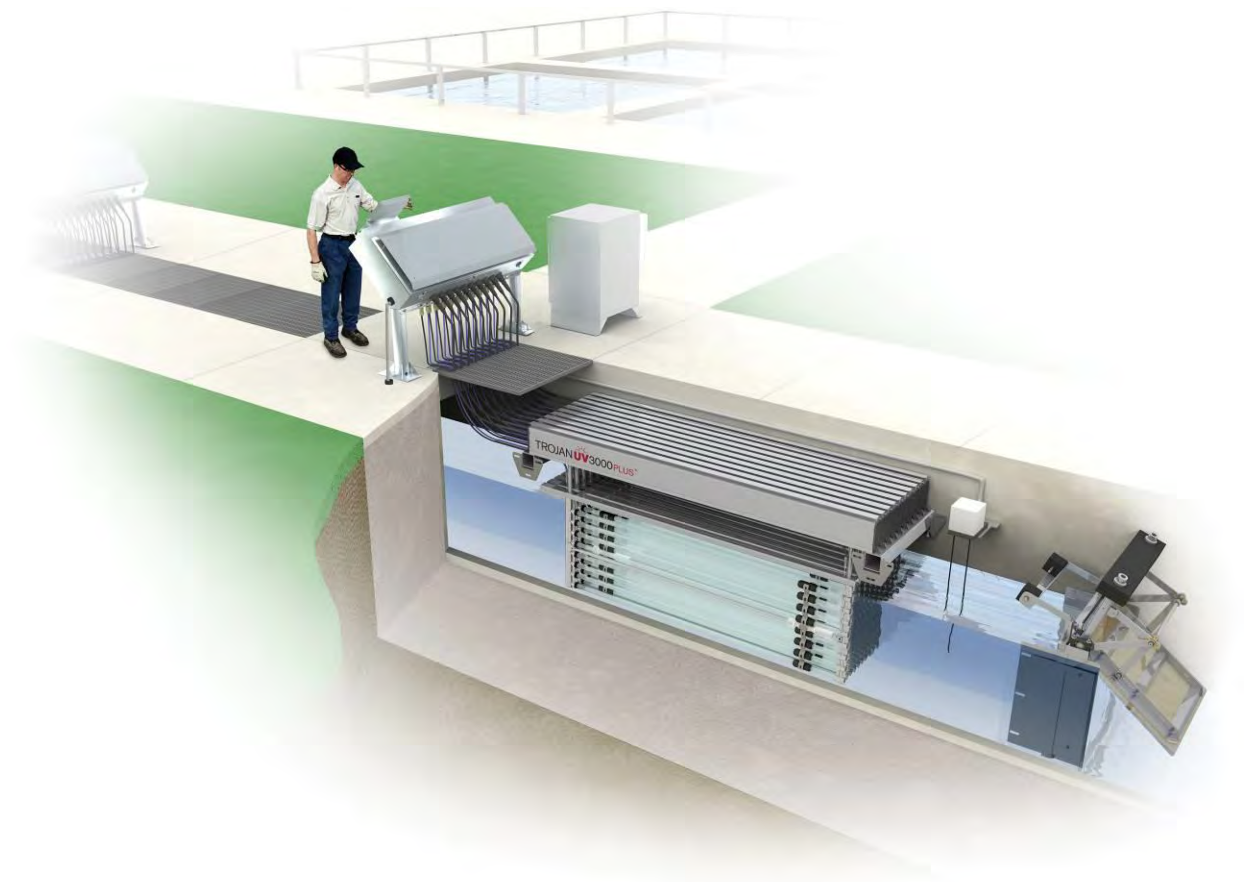
Fecal coliform levels in Hauser Wetland effluent often meet permit limits without disinfection. UV disinfection of Hauser Wetland effluent at current conditions described by UVT at ~50%, TSS at 3-6 mg/L, and turbidity at 3-4 NTUs, achieves levels below 10 CFU/100mL at doses above 20 mJ/cm^2. This low dose is considered the low end of the industry standard for UV disinfection and indicates the effectiveness of UV disinfection of Hauser Wetland effluent.

Total and fecal coliform levels in Point 9 effluent are numerous, around 10^4. UV disinfection of Point 9 effluent at current conditions described by UVT at ~34%, TSS at ~57 mg/L, and turbidity at 44 NTUs, achieves levels below 10 CFU/100mL at doses above 35 mJ/cm^2. This dose is at the low end of the industry standard for UV disinfection and indicates the effectiveness of UV disinfection of Point 9 effluent.

APPENDIX O – UV DISINFECTION EQUIPMENT PROPOSALS

TROJANUV3000PLUS™

PROPOSAL FOR THE CITY OF ARCATA, CA
QUOTE: LJKR1061E
6/16/2015



The TrojanUV3000Plus™ is operating in **over 1300** municipal wastewater plants around the world. Disinfecting **over 17 billion** gallons a day, the TrojanUV3000Plus™ has become the reference standard in the industry.

TROJANUV3000PLUS™

June 16, 2015

In response to your request, we are pleased to provide the following TrojanUV3000Plus™ proposal for the **Arcata** project.

The TrojanUV3000Plus™ has been shown in over 1300 installations to provide dependable performance, simplified maintenance, and superior electrical efficiency. As explained in this proposal, the system incorporates innovative features to reduce O&M costs, including variable output electronic ballasts to provide dimming capability and Trojan's revolutionary ActiClean-WW™ system – the industry's only online chemical and mechanical quartz sleeve cleaning system. All Trojan installations are supported by a global network of certified Service Representatives providing local service and support.

Please do not hesitate to call us if you have any questions regarding this proposal. Thank you for the opportunity to quote the TrojanUV3000Plus™ and we look forward to working with you on this project.

With best regards,

Jordan Fournier
3020 Gore Road
London, Ontario N5V 4T7
Canada
(519) 457 – 3400 ext. 2193
jfournier@trojanuv.com

Local Representative:
David Frost
The Coombs-Hopkins Company
2855 Mitchell Drive
Suite 215, Walnut Creek, CA 94598-1609
USA
(925) 947-6733

DESIGN CRITERIA

ARCATA

Peak Design Flow:	**5.9 MGD**
UV Transmittance:	**35%** (minimum)
Total Suspended Solids:	**50 mg/l** (30 Day Average, grab sample)
Disinfection Limit:	**43 fecal coliform per 100 ml**, based on a 1 day Maximum (90%ile) of consecutive daily grab samples
Design Dose:	**35,000 μWs/cm^2**, bioassay validated
Validation Factors:	**0.90** end of lamp life factor (Low-Pressure Amalgam Lamps) **0.95** fouling factor (ActiClean-WW™ Chemical / Mechanical Cleaning System)

DESIGN SUMMARY

QUOTE: LJKR1061E

Based on the above design criteria, the TrojanUV3000Plus™ proposed consists of:

CHANNEL (Please reference Trojan layout drawings for details.)	
Number of Channels:	**1**
Approximate Channel Length Required:	**30 ft**
Channel Width Based on Number of UV Modules:	**66 in**
Channel Depth Recommended for UV Module Access:	**54 in**
UV MODULES	
Total Number of Banks:	**2**
Number of Modules per Bank:	**22**
Number of Lamps per Module:	**8**
Total Number of UV Lamps:	**352**
Maximum Power Draw:	**88 kW**
UV PANELS	
Power Distribution Center Quantity:	**2**
System Control Center Quantity:	**1**
MISCELLANEOUS EQUIPMENT	
Level Controller Quantity:	**1**
Type of Level Controller:	**Weighted Gate (ALC)**
Automatic Chemical / Mechanical Cleaning:	**Trojan ActiClean-WW™**
UV Module Lifting Device:	**Davit Crane**
On-line UVT Monitor:	**Hach UVAS sc Sensor**
Standard Spare Parts / Safety Equipment:	**Included**
Other Equipment:	

ELECTRICAL REQUIREMENTS

1. Each Power Distribution Center requires an electrical supply of one (1) 480 Volts, 3 phase, 4 wire (plus ground), 44.9 kVA.
2. The Hydraulic System Center requires an electrical supply of one (1) 480 Volts, 3 phase, 3 wire (plus ground), 2 kVA.
3. The System Control Center requires an electrical supply of one (1) 120 Volts, 1 phase, 2 wire (plus ground), 15 Amps.
4. The Online UVT Monitor requires an electrical supply of one (1) 120 Volts, 1 phase, 2 wire (plus ground), 1 Amp.
5. Electrical disconnects required per local code are not included in this proposal.

COMMERCIAL INFORMATION

Total Capital Cost: $750,000 (US$)

This price excludes any taxes that may be applicable and is valid for 90 days from the date of this letter.

OPERATING COST ESTIMATE

Operating Conditions

Average Flow:	**2.0 MGD**
Yearly Usage:	**8760 hours**
UV Transmittance:	**35%**

Power Requirements		Lamp Replacement	
Average Power Draw:	**44 kW**	Number lamps per year:	**129**
Cost per kW hour:	**$0.10**	Price per lamp:	**$250**
Annual Power Cost:	**$38,544**	**Annual Lamp Replacement Cost:**	**$32,250**
Total Annual O&M Cost: $70,794			

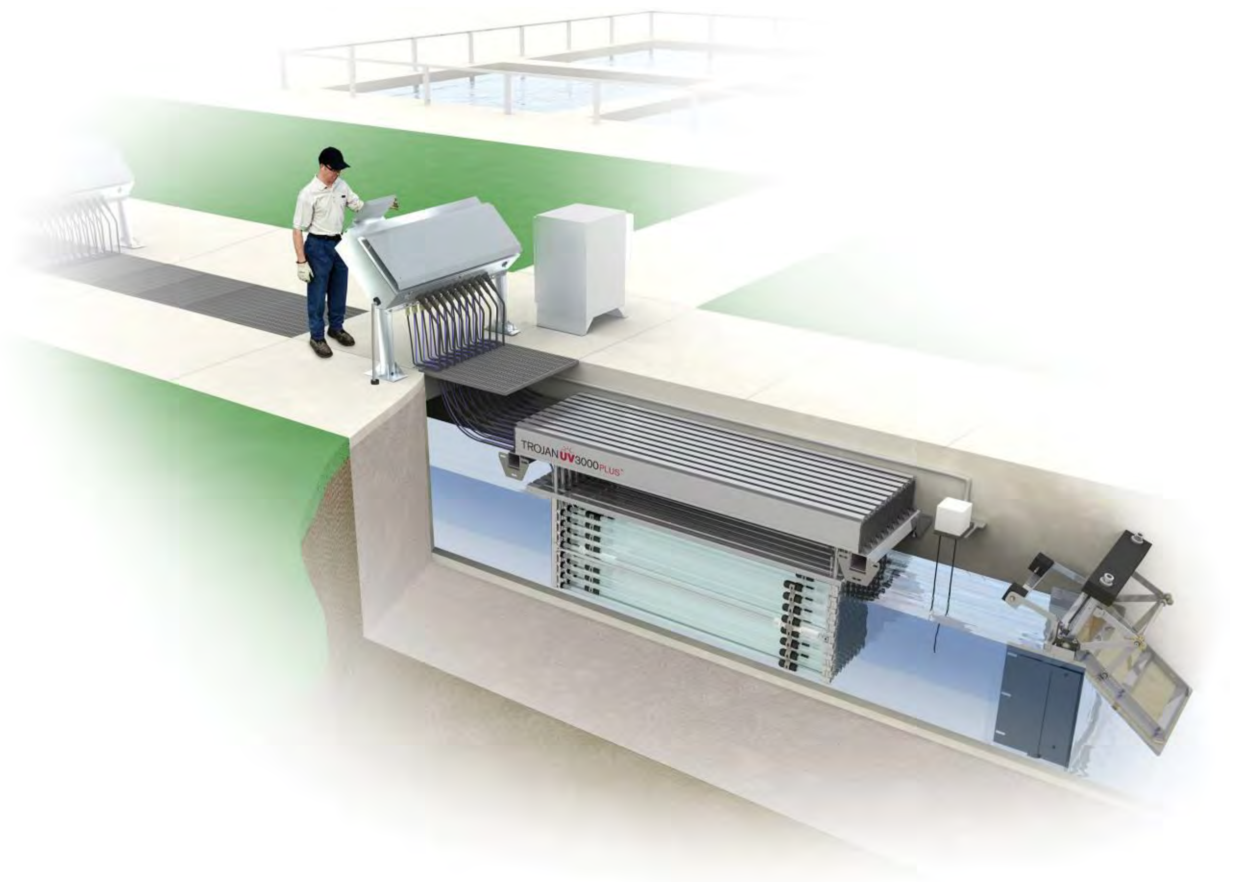
This cost estimate is based on the average flow and UV transmittance listed above. Actual operating costs may be lower due to the TrojanUV3000Plus™ automatic dose pacing control system. As UV demand decreases, by a change in operating conditions, the power level of the lamps decreases accordingly. The dose pacing system minimizes equipment power levels while the target UV dose is maintained to ensure disinfection at all times.

EQUIPMENT WARRANTEES

1. Trojan Technologies warrants all components of the system (excluding UV lamps) against faulty workmanship and materials for a period of 12 months from date of start-up or 18 months after shipment, which ever comes first.
2. UV lamps purchased are warranted for 12,000 hours of operation or 3 years from shipment, whichever comes first. The warranty is pro-rated after 9,000 hours of operation. This means that if a lamp fails prior to 9,000 hours of use, a new lamp is provided at no charge.
3. Electronic ballasts are warranted for 5 years, pro-rated after 1 year.

TROJANUV3000PLUS™

PROPOSAL FOR THE CITY OF ARCATA, CA
QUOTE: LJKR1061G
6/16/2015



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June 16, 2015

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DESIGN CRITERIA

ARCATA

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Total Suspended Solids:	**50 mg/l** (30 Day Average, grab sample)
Disinfection Limit:	**43 fecal coliform per 100 ml**, based on a 1 day Maximum (90%ile) of consecutive daily grab samples
Design Dose:	**35,000 μWs/cm^2**, bioassay validated
Validation Factors:	**0.90** end of lamp life factor (Low-Pressure Amalgam Lamps) **0.95** fouling factor (ActiClean-WW™ Chemical / Mechanical Cleaning System)
Redundancy:	**50%**

DESIGN SUMMARY

QUOTE: LJKR1061G

Based on the above design criteria, the TrojanUV3000Plus™ proposed consists of:

CHANNEL (Please reference Trojan layout drawings for details.)	
Number of Channels:	**1**
Approximate Channel Length Required:	**42 ft**
Channel Width Based on Number of UV Modules:	**66 in**
Channel Depth Recommended for UV Module Access:	**54 in**
UV MODULES	
Total Number of Banks:	**3 (2 duty, 1 redundant)**
Number of Modules per Bank:	**22**
Number of Lamps per Module:	**8**
Total Number of UV Lamps:	**528**
Maximum Power Draw:	**132 kW**
UV PANELS	
Power Distribution Center Quantity:	**3**
System Control Center Quantity:	**1**
MISCELLANEOUS EQUIPMENT	
Level Controller Quantity:	**1**
Type of Level Controller:	**Weighted Gate (ALC)**
Automatic Chemical / Mechanical Cleaning:	**Trojan ActiClean-WW™**
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On-line UVT Monitor:	**Hach UVAS sc Sensor**
Standard Spare Parts / Safety Equipment:	**Included**
Other Equipment:	

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4. The Online UVT Monitor requires an electrical supply of one (1) 120 Volts, 1 phase, 2 wire (plus ground), 1 Amp.
5. Electrical disconnects required per local code are not included in this proposal.

COMMERCIAL INFORMATION

Total Capital Cost: $1,090,000 (US$)

This price excludes any taxes that may be applicable and is valid for 90 days from the date of this letter.

OPERATING COST ESTIMATE

Operating Conditions

Average Flow:	**2 MGD**
Yearly Usage:	**8760 hours**
UV Transmittance:	**35%**

Power Requirements		Lamp Replacement	
Average Power Draw:	**44 kW**	Number lamps per year:	**129**
Cost per kW hour:	**$0.10**	Price per lamp:	**$250**
Annual Power Cost:	**$38,544**	**Annual Lamp Replacement Cost:**	**$32,250**
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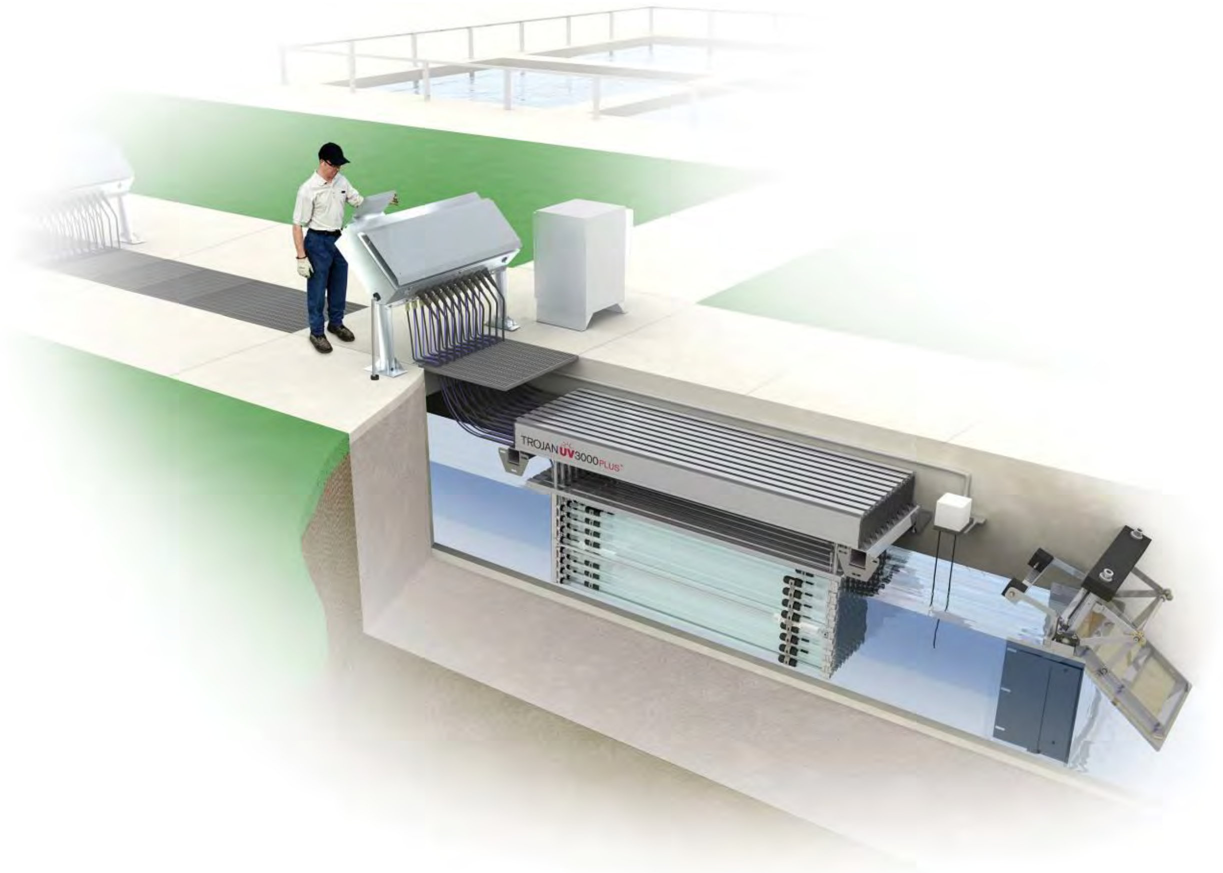
3. Electronic ballasts are warranted for 5 years, pro-rated after 1 year.

TROJANUV3000PLUS™

PROPOSAL FOR THE CITY OF ARCATA, CA
QUOTE: LJKR1061D
6/16/2015



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DESIGN CRITERIA
ARCATA

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UV Transmittance:	**35%** (minimum)
Total Suspended Solids:	**50 mg/l** (30 Day Average, grab sample)
Disinfection Limit:	**43 fecal coliform per 100 ml**, based on a 1 day Maximum (90%ile) of consecutive daily grab samples
Design Dose:	**50,000 μWs/cm²**, bioassay validated
Validation Factors:	**0.90** end of lamp life factor (Low-Pressure Amalgam Lamps) **0.95** fouling factor (ActiClean-WW™ Chemical / Mechanical Cleaning System)

DESIGN SUMMARY

QUOTE: LJKR1061D

Based on the above design criteria, the TrojanUV3000Plus™ proposed consists of:

CHANNEL (Please reference Trojan layout drawings for details.)	
Number of Channels:	**1**
Approximate Channel Length Required:	**42 ft**
Channel Width Based on Number of UV Modules:	**60 in**
Channel Depth Recommended for UV Module Access:	**54 in**
UV MODULES	
Total Number of Banks:	**3**
Number of Modules per Bank:	**20**
Number of Lamps per Module:	**8**
Total Number of UV Lamps:	**480**
Maximum Power Draw:	**120 kW**
UV PANELS	
Power Distribution Center Quantity:	**3**
System Control Center Quantity:	**1**
MISCELLANEOUS EQUIPMENT	
Level Controller Quantity:	**1**
Type of Level Controller:	**Weighted Gate (ALC)**
Automatic Chemical / Mechanical Cleaning:	**Trojan ActiClean-WW™**
UV Module Lifting Device:	**Davit Crane**
On-line UVT Monitor:	**Hach UVAS sc Sensor**
Standard Spare Parts / Safety Equipment:	**Included**
Other Equipment:	

ELECTRICAL REQUIREMENTS

1. Each Power Distribution Center requires an electrical supply of one (1) 480 Volts, 3 phase, 4 wire (plus ground), 40.8 kVA.
2. The Hydraulic System Center requires an electrical power supply that is powered from the Power Distribution Center.
3. The System Control Center requires an electrical supply of one (1) 120 Volts, 1 phase, 2 wire (plus ground), 15 Amps.
4. The Online UVT Monitor requires an electrical supply of one (1) 120 Volts, 1 phase, 2 wire (plus ground), 1 Amp.
5. Electrical disconnects required per local code are not included in this proposal.

COMMERCIAL INFORMATION

Total Capital Cost: $999,000 (US$)

This price excludes any taxes that may be applicable and is valid for 90 days from the date of this letter.

OPERATING COST ESTIMATE

Operating Conditions

Average Flow: **2 MGD**
Yearly Usage: **8760 hours**
UV Transmittance: **35%**

Power Requirements		Lamp Replacement	
Average Power Draw:	**60.8 kW**	Number lamps per year:	**234**
Cost per kW hour:	**$0.10**	Price per lamp:	**$250**
Annual Power Cost:	**$53,261**	**Annual Lamp Replacement Cost:**	**$58,500**
Total Annual O&M Cost: $111,761			

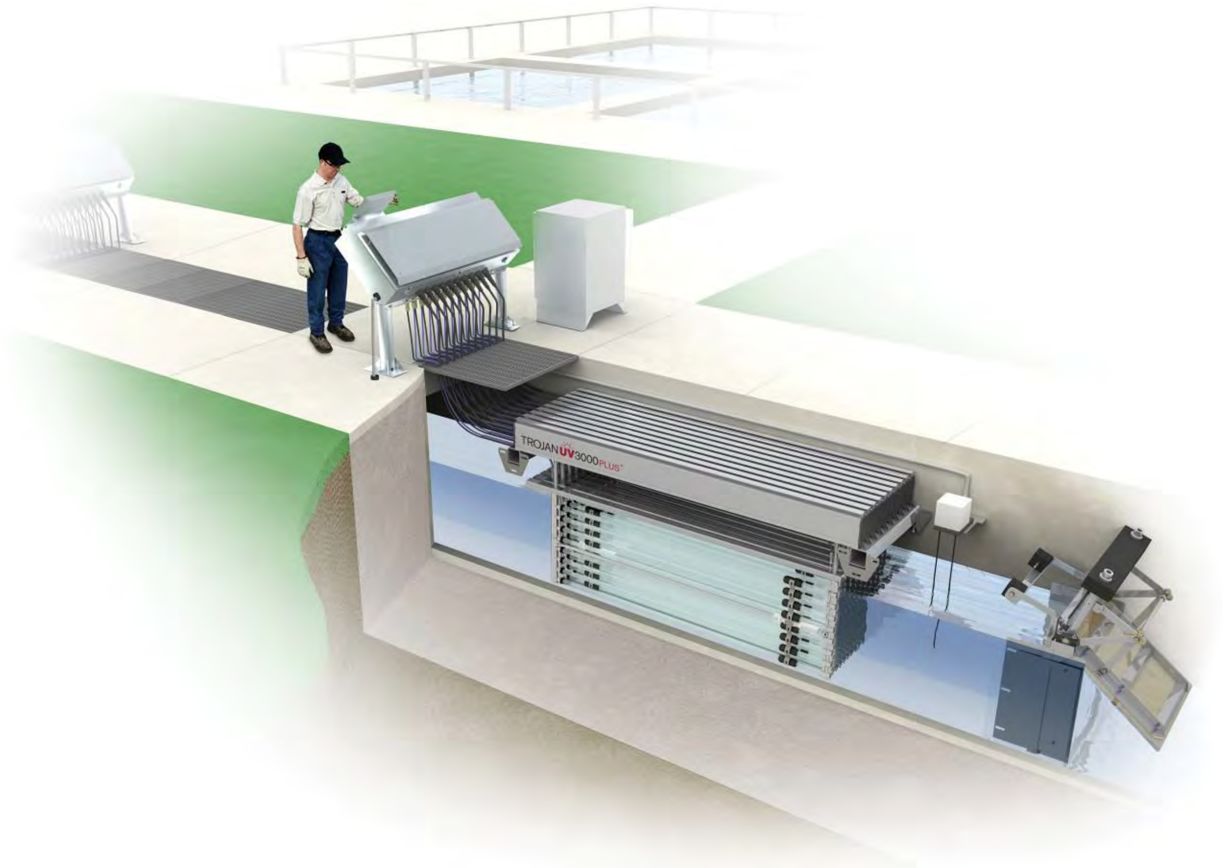
This cost estimate is based on the average flow and UV transmittance listed above. Actual operating costs may be lower due to the TrojanUV3000Plus™ automatic dose pacing control system. As UV demand decreases, by a change in operating conditions, the power level of the lamps decreases accordingly. The dose pacing system minimizes equipment power levels while the target UV dose is maintained to ensure disinfection at all times.

EQUIPMENT WARRANTEES

1. Trojan Technologies warrants all components of the system (excluding UV lamps) against faulty workmanship and materials for a period of 12 months from date of start-up or 18 months after shipment, which ever comes first.
2. UV lamps purchased are warranted for 12,000 hours of operation or 3 years from shipment, whichever comes first. The warranty is pro-rated after 9,000 hours of operation. This means that if a lamp fails prior to 9,000 hours of use, a new lamp is provided at no charge.
3. Electronic ballasts are warranted for 5 years, pro-rated after 1 year.

TROJANUV3000PLUS™

PROPOSAL FOR THE CITY OF ARCATA, CA
QUOTE: LJKR1061F
6/16/2015



The TrojanUV3000Plus™ is operating in **over 1300** municipal wastewater plants around the world.
Disinfecting **over 17 billion** gallons a day, the TrojanUV3000Plus™ has become
the reference standard in the industry.

TROJAN UV3000 PLUS™

June 16, 2015

In response to your request, we are pleased to provide the following TrojanUV3000Plus™ proposal for the **Arcata** project.

The TrojanUV3000Plus™ has been shown in over 1300 installations to provide dependable performance, simplified maintenance, and superior electrical efficiency. As explained in this proposal, the system incorporates innovative features to reduce O&M costs, including variable output electronic ballasts to provide dimming capability and Trojan's revolutionary ActiClean-WW™ system – the industry's only online chemical and mechanical quartz sleeve cleaning system. All Trojan installations are supported by a global network of certified Service Representatives providing local service and support.

Please do not hesitate to call us if you have any questions regarding this proposal. Thank you for the opportunity to quote the TrojanUV3000Plus™ and we look forward to working with you on this project.

With best regards,

Jordan Fournier
3020 Gore Road
London, Ontario N5V 4T7
Canada
(519) 457 – 3400 ext. 2193
jfournier@trojanuv.com

Local Representative:
David Frost
The Coombs-Hopkins Company
2855 Mitchell Drive
Suite 215, Walnut Creek, CA 94598-1609
USA
(925) 947-6733

DESIGN CRITERIA

ARCATA

Peak Design Flow:	**5.9 MGD**
UV Transmittance:	**35%** (minimum)
Total Suspended Solids:	**50 mg/l** (30 Day Average, grab sample)
Disinfection Limit:	**43 fecal coliform per 100 ml**, based on a 1 day Maximum (90%ile) of consecutive daily grab samples
Design Dose:	**50,000 μWs/cm^2**, bioassay validated
Validation Factors:	**0.90** end of lamp life factor (Low-Pressure Amalgam Lamps) **0.95** fouling factor (ActiClean-WW™ Chemical / Mechanical Cleaning System)
Redundancy:	**33%**

DESIGN SUMMARY

QUOTE: LJKR1061F

Based on the above design criteria, the TrojanUV3000Plus™ proposed consists of:

CHANNEL (Please reference Trojan layout drawings for details.)	
Number of Channels:	**1**
Approximate Channel Length Required:	**54 ft**
Channel Width Based on Number of UV Modules:	**60 in**
Channel Depth Recommended for UV Module Access:	**54 in**
UV MODULES	
Total Number of Banks:	**4 (3 duty, 1 redundant)**
Number of Modules per Bank:	**20**
Number of Lamps per Module:	**8**
Total Number of UV Lamps:	**640**
Maximum Power Draw:	**160 kW**
UV PANELS	
Power Distribution Center Quantity:	**4**
System Control Center Quantity:	**1**
MISCELLANEOUS EQUIPMENT	
Level Controller Quantity:	**1**
Type of Level Controller:	**Weighted Gate (ALC)**
Automatic Chemical / Mechanical Cleaning:	**Trojan ActiClean-WW™**
UV Module Lifting Device:	**Davit Crane**
On-line UVT Monitor:	**Hach UVAS sc Sensor**
Standard Spare Parts / Safety Equipment:	**Included**
Other Equipment:	

ELECTRICAL REQUIREMENTS

1. Each Power Distribution Center requires an electrical supply of one (1) 480 Volts, 3 phase, 4 wire (plus ground), 40.8 kVA.
2. The Hydraulic System Center requires an electrical supply of one (1) 480 Volts, 3 phase, 3 wire (plus ground), 2 kVA.
3. The System Control Center requires an electrical supply of one (1) 120 Volts, 1 phase, 2 wire (plus ground), 15 Amps.
4. The Online UVT Monitor requires an electrical supply of one (1) 120 Volts, 1 phase, 2 wire (plus ground), 1 Amp.
5. Electrical disconnects required per local code are not included in this proposal.

COMMERCIAL INFORMATION

Total Capital Cost: $1,310,000 (US$)

This price excludes any taxes that may be applicable and is valid for 90 days from the date of this letter.

OPERATING COST ESTIMATE

Operating Conditions

Average Flow: **2.0 MGD**
Yearly Usage: **8760 hours**
UV Transmittance: **35%**

Power Requirements		Lamp Replacement	
Average Power Draw:	**60.8 kW**	Number lamps per year:	**234**
Cost per kW hour:	**$0.10**	Price per lamp:	**$250**
Annual Power Cost:	**$53,261**	**Annual Lamp Replacement Cost:**	**$58,500**
Total Annual O&M Cost: $111,761			

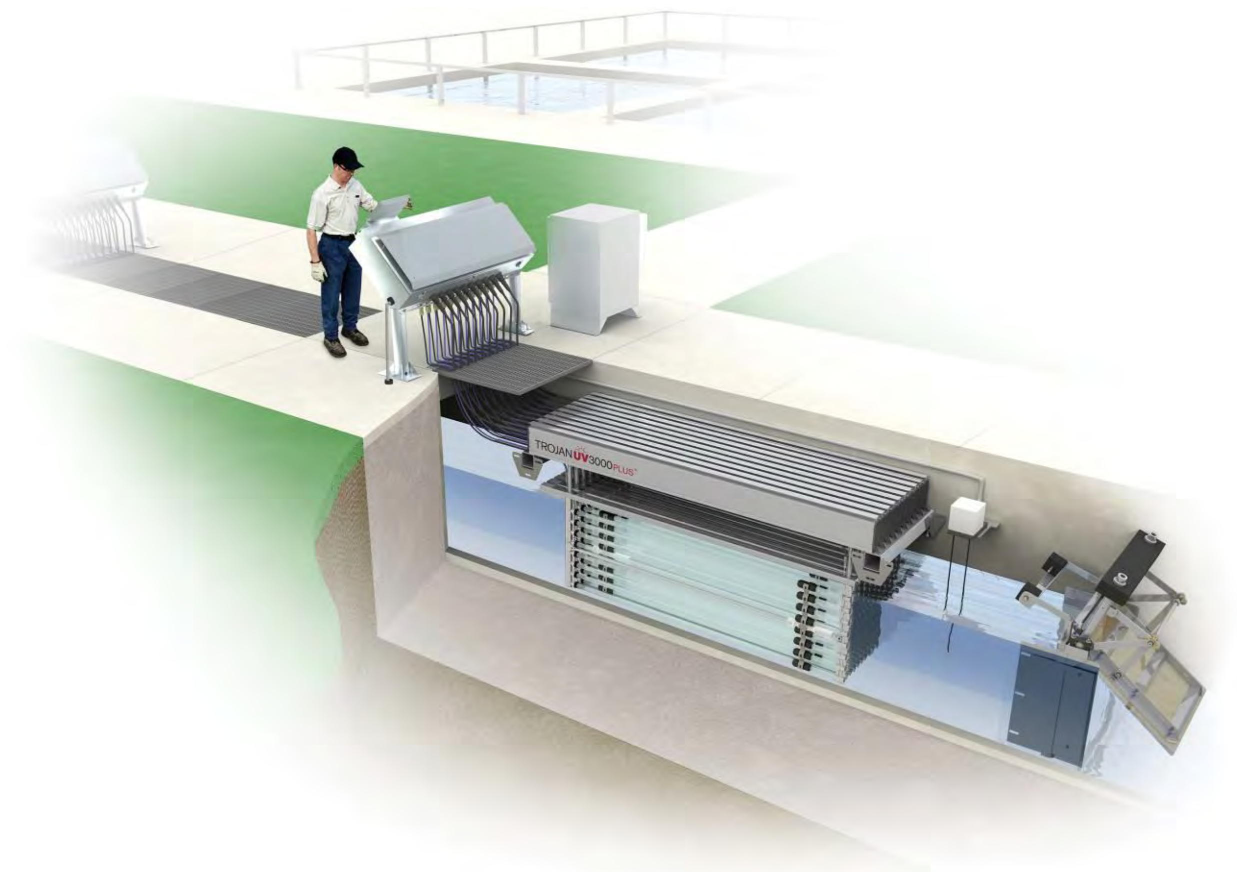
This cost estimate is based on the average flow and UV transmittance listed above. Actual operating costs may be lower due to the TrojanUV3000Plus™ automatic dose pacing control system. As UV demand decreases, by a change in operating conditions, the power level of the lamps decreases accordingly. The dose pacing system minimizes equipment power levels while the target UV dose is maintained to ensure disinfection at all times.

EQUIPMENT WARRANTEES

1. Trojan Technologies warrants all components of the system (excluding UV lamps) against faulty workmanship and materials for a period of 12 months from date of start-up or 18 months after shipment, which ever comes first.
2. UV lamps purchased are warranted for 12,000 hours of operation or 3 years from shipment, whichever comes first. The warranty is pro-rated after 9,000 hours of operation. This means that if a lamp fails prior to 9,000 hours of use, a new lamp is provided at no charge.
3. Electronic ballasts are warranted for 5 years, pro-rated after 1 year.

TROJANUV3000PLUS™

PROPOSAL FOR THE CITY OF ARCATA, CA
QUOTE: LJKR1061H
6/19/2015



The TrojanUV3000Plus™ is operating in **over 1300** municipal wastewater plants around the world. Disinfecting **over 17 billion** gallons a day, the TrojanUV3000Plus™ has become the reference standard in the industry.

June 19, 2015

In response to your request, we are pleased to provide the following TrojanUV3000Plus™ proposal for the **Arcata** project.

The TrojanUV3000Plus™ has been shown in over 1300 installations to provide dependable performance, simplified maintenance, and superior electrical efficiency. As explained in this proposal, the system incorporates innovative features to reduce O&M costs, including variable output electronic ballasts to provide dimming capability and Trojan's revolutionary ActiClean-WW™ system – the industry's only online chemical and mechanical quartz sleeve cleaning system. All Trojan installations are supported by a global network of certified Service Representatives providing local service and support.

Please do not hesitate to call us if you have any questions regarding this proposal. Thank you for the opportunity to quote the TrojanUV3000Plus™ and we look forward to working with you on this project.

With best regards,

Jordan Fournier
3020 Gore Road
London, Ontario N5V 4T7
Canada
(519) 457 – 3400 ext. 2193
jfournier@trojanuv.com

Local Representative:
David Frost
The Coombs-Hopkins Company
2855 Mitchell Drive
Suite 215, Walnut Creek, CA 94598-1609
USA
(925) 947-6733

DESIGN CRITERIA

ARCATA

Peak Design Flow:	**5.9 MGD**
UV Transmittance:	**35%** (minimum)
Total Suspended Solids:	**50 mg/l** (30 Day Average, grab sample)
Disinfection Limit:	**43 fecal coliform per 100 ml**, based on a 1 day Maximum (90%ile) of consecutive daily grab samples
Design Dose:	**100,000 μWs/cm^2**, bioassay validated
Validation Factors:	**0.90** end of lamp life factor (Low-Pressure Amalgam Lamps) **0.95** fouling factor (ActiClean-WW™ Chemical / Mechanical Cleaning System)

DESIGN SUMMARY

QUOTE: LJKR1061H

Based on the above design criteria, the TrojanUV3000Plus™ proposed consists of:

CHANNEL (Please reference Trojan layout drawings for details.)	
Number of Channels:	**2**
Approximate Channel Length Required:	**54 ft**
Channel Width Based on Number of UV Modules:	**78 in**
Channel Depth Recommended for UV Module Access:	**54 in**
UV MODULES	
Total Number of Banks:	**8**
Number of Modules per Bank:	**26**
Number of Lamps per Module:	**8**
Total Number of UV Lamps:	**1664**
Maximum Power Draw:	**416 kW**
UV PANELS	
Power Distribution Center Quantity:	**8**
System Control Center Quantity:	**1**
MISCELLANEOUS EQUIPMENT	
Level Controller Quantity:	**2**
Type of Level Controller:	**Weighted Gate (ALC)**
Automatic Chemical / Mechanical Cleaning:	**Trojan ActiClean-WW™**
UV Module Lifting Device:	**Davit Crane**
On-line UVT Monitor:	**Hach UVAS sc Sensor**
Standard Spare Parts / Safety Equipment:	**Included**
Other Equipment:	
ELECTRICAL REQUIREMENTS	

1. Each Power Distribution Center requires an electrical supply of one (1) 480 Volts, 3 phase, 4 wire (plus ground), 53.1 kVA.
2. The Hydraulic System Center requires an electrical power supply that is powered from the Power Distribution Center.
3. The System Control Center requires an electrical supply of one (1) 120 Volts, 1 phase, 2 wire (plus ground), 15 Amps.
4. The Online UVT Monitor requires an electrical supply of one (1) 120 Volts, 1 phase, 2 wire (plus ground), 1 Amp.
5. Electrical disconnects required per local code are not included in this proposal.

COMMERCIAL INFORMATION

Total Capital Cost: $3,240,000 (US$)

This price excludes any taxes that may be applicable and is valid for 90 days from the date of this letter.

OPERATING COST ESTIMATE

Operating Conditions

Average Flow: **2 MGD**
Yearly Usage: **8760 hours**
UV Transmittance: **35%**

Power Requirements		**Lamp Replacement**	
Average Power Draw:	**125 kW**	Number lamps per year:	**456**
Cost per kW hour:	**$0.10**	Price per lamp:	**$250**
Annual Power Cost:	**$109,500**	**Annual Lamp Replacement Cost:**	**$114,000**
Total Annual O&M Cost: $223,500			

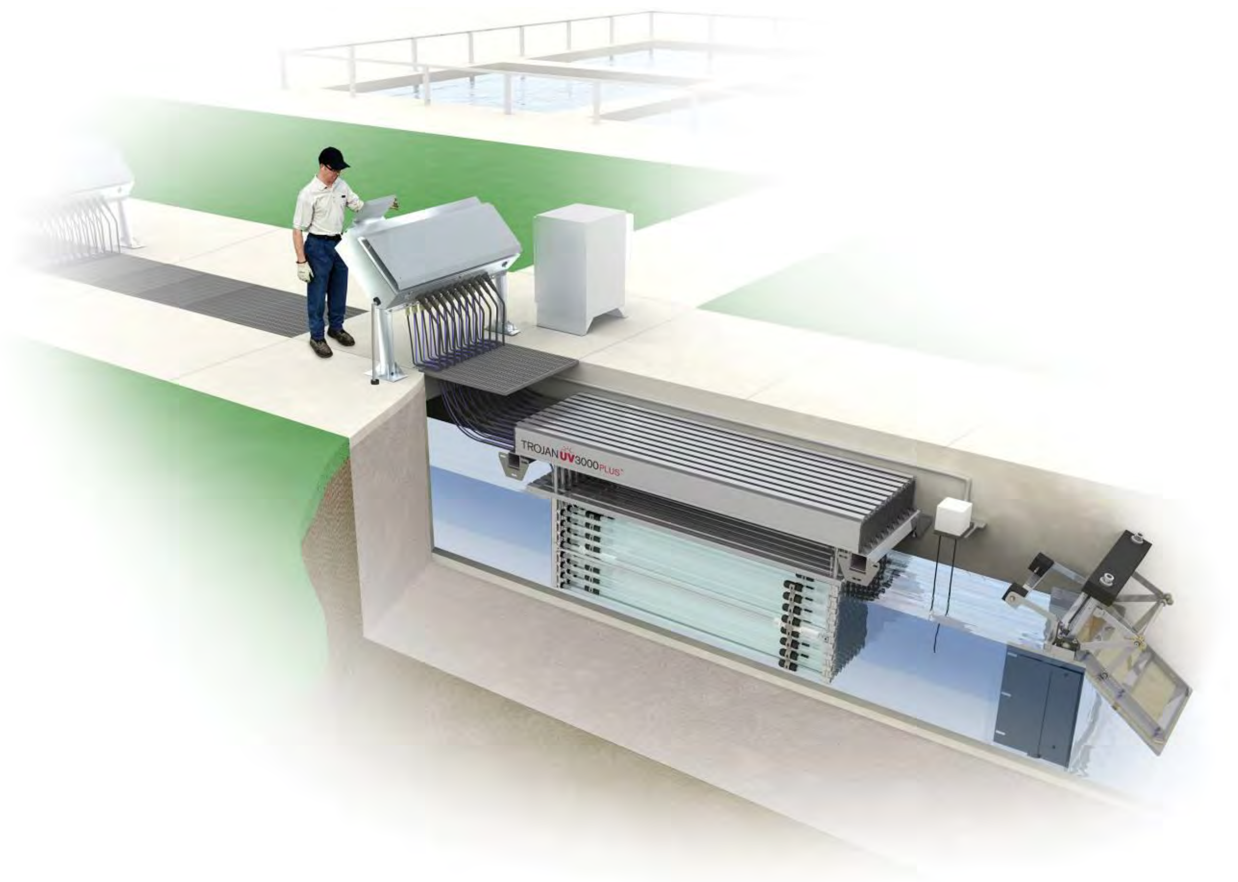
This cost estimate is based on the average flow and UV transmittance listed above. Actual operating costs may be lower due to the TrojanUV3000Plus™ automatic dose pacing control system. As UV demand decreases, by a change in operating conditions, the power level of the lamps decreases accordingly. The dose pacing system minimizes equipment power levels while the target UV dose is maintained to ensure disinfection at all times.

EQUIPMENT WARRANTEES

1. Trojan Technologies warrants all components of the system (excluding UV lamps) against faulty workmanship and materials for a period of 12 months from date of start-up or 18 months after shipment, which ever comes first.
2. UV lamps purchased are warranted for 12,000 hours of operation or 3 years from shipment, whichever comes first. The warranty is pro-rated after 9,000 hours of operation. This means that if a lamp fails prior to 9,000 hours of use, a new lamp is provided at no charge.
3. Electronic ballasts are warranted for 5 years, pro-rated after 1 year.

TROJAN UV3000PLUS™

PROPOSAL FOR THE CITY OF ARCATA, CA
QUOTE: LJKR1061I
2/23/2016



The TrojanUV3000Plus™ is operating in **over 1300** municipal wastewater plants around the world.
Disinfecting **over 17 billion** gallons a day, the TrojanUV3000Plus™ has become
the reference standard in the industry.

February 24, 2016

Attention:

In response to your request, we are pleased to provide the following TrojanUV3000Plus™ proposal for the **Arcata** project.

The TrojanUV3000Plus™ has been shown in over 1300 installations to provide dependable performance, simplified maintenance, and superior electrical efficiency. As explained in this proposal, the system incorporates innovative features to reduce O&M costs, including variable output electronic ballasts to provide dimming capability and Trojan's revolutionary ActiClean-WW™ system – the industry's only online chemical and mechanical quartz sleeve cleaning system. All Trojan installations are supported by a global network of certified Service Representatives providing local service and support.

Please do not hesitate to call us if you have any questions regarding this proposal. Thank you for the opportunity to quote the TrojanUV3000Plus™ and we look forward to working with you on this project.

Best Regards,

John Houghton
Municipal Applications
TROJANUV / SALSNES FILTER

3020 Gore Road, London, Canada N5V 4T7
(519) 457-3400 *office*
(519) 902-1892 *mobile*
trojanuv.com

Local Representative:
David Frost
The Coombs-Hopkins Company
2855 Mitchell Drive
Suite 215, Walnut Creek, CA 94598-1609
(925) 947-6733

DESIGN CRITERIA
ARCATA

Peak Design Flow:	**5.9 MGD**
UV Transmittance:	**55%** (minimum)
Total Suspended Solids:	**50 mg/l** (30 Day Average, grab sample)
Design Dose:	**35 mJ/cm²**, bioassay validated per NWRI 2012 protocol, CR 1.0
Validation Factors:	**0.9** end of lamp life factor CA DHS approved (LP Amalgam Lamps) **0.95** fouling factor CA DHS approved (ActiClean-WW™ Chemical / Mechanical Cleaning System)
Redundancy:	**50%**

DESIGN SUMMARY

QUOTE: LJKR1061I

Based on the above design criteria, the TrojanUV3000Plus™ proposed consists of:

CHANNEL (Please reference Trojan layout drawings for details.)	
Number of Channels:	**2**
Approximate Channel Length Required:	**42 ft**
Channel Width Based on Number of UV Modules:	**28 in**
Channel Depth Recommended for UV Module Access:	**62 in**
UV MODULES	
Total Number of Banks:	**6 (4 Duty, 2 Redundant)**
Number of Modules per Bank:	**7**
Number of Lamps per Module:	**8**
Total Number of UV Lamps:	**336 (Including Redundancy)**
Maximum Power Draw:	**84 kW (Including Redundancy)**
UV PANELS	
Power Distribution Center Quantity:	**6**
System Control Center Quantity:	**1**
MISCELLANEOUS EQUIPMENT	
Level Controller Quantity:	**2**
Type of Level Controller:	**Fixed Weir**
Automatic Chemical / Mechanical Cleaning:	**Trojan ActiClean-WW™**
UV Module Lifting Device:	**Davit Crane**
On-line UVT Monitor:	**Hach UVAS sc Sensor**
Standard Spare Parts / Safety Equipment:	**Included**
ELECTRICAL REQUIREMENTS	

1. Each Power Distribution Center requires an electrical supply of one (1) 480 Volts, 3 phase, 4 wire (plus ground), 14.3 kVA.
2. The Hydraulic System Center requires an electrical supply of one (1) 480 Volts, 3 phase, 3 wire (plus ground), 2 kVA.
3. The System Control Center requires an electrical supply of one (1) 120 Volts, 1 phase, 2 wire (plus ground), 15 Amps.
4. The Online UVT Monitor requires an electrical supply of one (1) 120 Volts, 1 phase, 2 wire (plus ground), 1 Amp.
5. Electrical disconnects required per local code are not included in this proposal.

COMMERCIAL INFORMATION

Total Capital Cost: $785,500
Deduct for NO redundancy (remove 2 banks): $234,198

This price excludes any taxes that may be applicable and is valid for 90 days from the date of this letter.

OPERATING COST ESTIMATE

Operating Conditions

Average Flow: **2.0 MGD**
Yearly Usage: **8760 hours**
UV Transmittance: **55%**
Number of Banks Operating at Average Flow: **2 in 1 Channel**

Power Requirements		Lamp Replacement	
Average Power Draw:	**21.3 kW**	Number lamps per year:	**82**
Cost per kW hour:	**$0.1**	Price per lamp:	**$250**
Annual Power Cost:	**$18,658**	**Annual Lamp Replacement Cost:**	**$20,500**
Total Annual O&M Cost: $39,158			

This cost estimate is based on the average flow and UV transmittance listed above. Actual operating costs may be lower due to the TrojanUV3000Plus™ automatic dose pacing control system. As UV demand decreases, by a change in operating conditions, the power level of the lamps decreases accordingly. The dose pacing system minimizes equipment power levels while the target UV dose is maintained to ensure disinfection at all times.

EQUIPMENT WARRANTEES

1. Trojan Technologies warrants all components of the system (excluding UV lamps) against faulty workmanship and materials for a period of 12 months from date of start-up or 18 months after shipment, which ever comes first.
2. UV lamps purchased are warranted for 12,000 hours of operation or 3 years from shipment, whichever comes first. The warranty is pro-rated after 9,000 hours of operation. This means that if a lamp fails prior to 9,000 hours of use, a new lamp is provided at no charge. .
3. Electronic ballasts are warranted for 5 years, pro-rated after 1 year.

APPENDIX P – BASIS OF COSTS

Appendix P
Basis of Cost

1.0 PURPOSE

As part of the Arcata Wastewater Treatment Facility Improvements Project, several types of cost estimates were developed. This appendix provides procedures and guidelines for estimating capital and repair and replacement (R&R) costs.

2.0 INTRODUCTION

Cost estimates are often prepared at various stages during project planning and design. The cost estimate is one of the most sensitive products prepared for a project. The level of accuracy that can be expected is directly proportional to the level of engineering effort completed. Each cost estimate must be carefully prepared from the conceptual level to the facilities plan level, through the preliminary design and the final engineer's estimate.

2.1 SCOPE AND LEVEL OF ACCURACY

The Association for the Advancement of Cost Engineering International (AACE International, formerly known as the American Association of Cost Engineers) has suggested levels of accuracy for five estimate classes. These five estimate classes are presented in the AACE International Recommended Practice No. 18R-97 (Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries). Table P1 presents a summary of these five estimate classes and their characteristics, including expected accuracy ranges.

The quantity and quality of the information required to prepare an estimate depends on the end use for that estimate. Typically, as a project progresses from the conceptual phase to the study phase, preliminary design and final design, the quantity and quality of information increases, thereby providing data for development of a progressively more accurate cost estimate. A contingency is often used to compensate for lack of detailed engineering data, oversights, anticipated changes, and imperfection in the estimating methods used. As the quantity and quality of data becomes better, smaller contingency allowances are typically utilized. For the projects developed as a part of the Facility Plan, cost estimates are developed following the AACE International Recommended Practice No. 18R-97 estimate class 5.

Table P1	Classes of Cost Estimates[1] ATWF Improvements Project City of Arcata				
Estimate Class	**Primary Characteristic**	**Secondary Characteristic**			
	Level of Project Definition Expressed as % of complete definition	**End Usage** Typical purpose of estimate	**Methodology** Typical estimating method	**Expected Accuracy Range** Typical variation in low and high ranges[1a]	**Preparation Effort** Typical degree of effort relative to least cost index of 1[1b]
Class 5	0% to 2%	Concept Screening	Capacity Factored, Parametric Models, Judgment, or Analogy	L: -20% to -50% H: +30% to +100%	1
Class 4	1% to 15%	Study or Feasibility	Equipment Factored or Parametric Models	L: - 15% to -30% H: +20% to +50%	2 to 4
Class 3	10% to 40%	Budget, Authorization, or Control	Semi-Detailed Unit Costs with Assembly Level Line Items	L: - 10% to -20% H: +10% to +30%	3 to 10
Class 2	30% to 70%	Control or Bid/Tender	Detailed Unit Cost with Forced Detailed Take-Off	L: - 5% to -15% H: +5% to +20%	4 to 20
Class 1	50% to 100%	Check Estimate or Bid/Tender	Detailed Unit Cost with Detailed Take-Off	L: - 3% to -10% H: +3% to +15%	5 to 100

Note:

(1) Table 1 comes from the AACE International Recommended Practices, No. 18R-97:

(a) The state of process technology and availability of applicable reference cost data affect the range markedly. The +/- value represents typical percentage variation of actual costs from the cost estimate after application of contingency (typically at a 50% level of confidence) for a given scope.

(b) If the range index value of "1" represents 0.005% of project costs, then an index value of 100 represents 0.5%. Estimate preparation effort is highly dependent upon the size of the project and the quality of estimating data and tools.

Class 4 and 5 estimates are prepared for any number of strategic business planning purposes, including, but not limited to: project screening, evaluation of resource needs and budgeting, and long-range capital planning. Very limited information is available at the time when a Class 5 estimate is developed. Therefore, Class 5 estimates virtually always use stochastic estimating methods such as cost to capacity curves and various scaling factors. Subsequently, estimated costs have wide accuracy ranges. Typical accuracy ranges for Class 5 estimates are -20 percent to –50 percent on the low side, and +30 percent to

+100 percent on the high side, depending on the technological complexity of the project, availability and accuracy of appropriate reference information, and the inclusion of an appropriate contingency determination. Capital costs for the Facility Plan improvements are prepared based on Class 4 and 5 estimates, depending on the available information.

3.0 BASIS OF COST EVALUATIONS

The costs presented in the Facility Plan are based on equipment useful life and existing conditions, increased capacity, preliminary layouts, preliminary unit process sizes, and conceptual alternative configurations. Construction costs are estimated for new capital, replacement and repair and rehabilitation projects. Construction costs for new capital and replacement projects are estimated from unit costs developed from past Bay Area construction contracts, estimating guides, unit prices, and construction costs of similar facilities and configurations at other locations. Construction costs for repair and rehabilitation are based on structural and equipment estimates. Equipment costs were developed from reference projects and RS means data.

A summary of the economic criteria to be used for estimating costs is presented in Table P2.

Table P2 Economic Criteria
ATWF Improvements Project
City of Arcata

Item	Assumption
Costs in Time and Place[(1)]	Costs are based on June 2015 costs in Arcata, California
Inflation Rate	Annual inflation rate is assumed to be 4 percent
Interest Rate	6 percent for amortization purpose
Amortization Period	20 years

Note:
(1) San Francisco ENR CCI of 11,155 was used to update costs to June 2015. The 2014 R.S. Means location factor for the City of Eureka of 108.5 was used.

4.0 CAPITAL COSTS

While the estimated construction costs represent the average bidding conditions for many projects, variations in bidding climate at the time the facilities are constructed can affect actual construction costs. Further, the size of the facilities may be refined during preliminary design based on the most current operational information available. For these reasons, the actual construction costs may be lower or higher than originally estimated.

Construction costs have historically escalated with time. This trend is expected to continue in the future. To record these trends in rising costs, several indices have been established for various fields of construction. The standard indicator of changes in heavy construction prices is the ENR CCI. Construction costs in June 2015 are based on the San Francisco ENR CCI of 11,155. To account for the project location, the corresponding R.S. Means Location Factor of 108.5 was used, which is the location factor for Eureka, California.

The construction costs presented typically include contractor's overhead and profit, and construction contingencies. Costs to the owner, such as engineering, legal, administrative, project contingencies, and construction management costs are added to the construction costs. The basis for estimating capital costs for new capital and replacement projects is presented in Table P3.

The replacement cost estimates for individual assets are estimates of the total project cost to purchase and install similar assets in today's dollars. Replacement values comprise both direct and indirect costs. Direct costs are the actual cost of the replacement equipment and structures. The indirect construction costs include the other factors that are included in rehabilitation such as demolition, installation labor, contractor overhead, and profit, and other factors. Descriptions of each project cost factor are presented in Table P3. Unless otherwise noted, direct costs were estimated for in-kind replacement of each asset based on a variety of sources and are the costs directly attributed to the physical make-up of the assets (e.g., site development, materials, site dewatering, facilities, equipment, piping, electrical/ instrumentation/controls, installation and labor, etc.). A factor is then applied for installation, which ranges from 15 to 50 percent. Because the asset inventory is comprised only of the important and/or high cost assets, remaining components are accounted for in a factor termed "ancillary support." This factor encompasses items such as sump pumps, seal water pumps, small valves, service-air piping, hoses, etc. The lumped value of these assets is adjusted according to best professional judgment and usually ranges from 25 to 45 percent of the sum of the itemized asset costs; therefore, an 80 to 140 percent construction cost factor is applied to each asset. Indirect construction costs are then applied, including general conditions, contractor overhead and profit and sales tax. The resulting total construction cost factor ranges from 2.75 to 4.3 for simple and complex rehabilitation items. In addition, cost factors to complete the overall project, including engineering / legal / administration, and construction management are added to estimate the overall project cost.

As noted, these factors are adjusted to two levels of project complexity: 1) conducted by external contractors at a simple level, or 2) conducted by external contractors with complexity requiring design services and/or contractor staging. The overall cost factor applied to direct costs then ranges from 2.75 to 4.5 (rounded from 4.3) depending on the level of complexity.

Table P3	**Project Cost Factors ATWF Improvements Project City of Arcata**		
Factor	**Description**	**External Project**	
		Simple	**Complex**
Demolition	Destruction and removal of existing asset.	5%	10%
Installation		15%	50%
Ancillary Support	Lumped cost of mechanical piping, electrical cable, conduit and other costs.	25%	45%
Construction and Estimating Contingency	Unforeseen or unanticipated project costs involved in the design details and installation of the new asset.	35%	35%
	Subtotal	**80%**	**140%**
General Conditions	All items contained within Division 01 of most project specifications including: mobilization and demobilization, contractor temporary facilities, contractor's field supervision, and bonds and insurance.	10%	10%
Contractor Overhead and Profit Margin	This value includes general contractor home office overheads and profit.	**10%**	**25%**
Sales Tax Factor	Sales tax factor applied to approximately half of direct cost.	5%	5%
	Subtotal	**25%**	**40%**
Total Construction Cost Factor		**2.2 (1)**	**3.2(1)**
Engineering, Legal, Administrative, and Project Contingencies	Engineering (design and services during construction), legal, and administrative costs reflect assistance with permitting and financing.	25%	35%
Total Project Cost Factor		**1.25**	**1.35**
Total Construction and Project Multipliers (Compounded)		**2.75(1)**	**4.3(1)**

Note:

(1) Factor is compounded from both subtotal values.

4.1 Treatment Plant Cost Estimating Approach

The treatment plant unit process construction cost estimates are developed using past City and other Carollo Engineers project costs and the cost curve approach for estimating. The "cost curve approach" is the use of historical project cost data to estimate planning level costs for capital improvement projects. In this approach, historical project cost data are used to develop plots of total cost versus process capacity, or "cost curves," for a given unit process. In the development of the cost curves, the project locations and dates of costs are accounted for with the application of "location factors" (R.S. Means Location Factors), and ENR CCI values. The location factors are based upon the R.S. Means national average construction costs.

City-to-City location adjustment factors may be accurately derived by dividing the published factor for one location by the factor for another. By accounting for location factors and ENR CCI values, the cost curves are plots of "location-less" costs and in today's dollars. Given a known required capacity for a capital improvement project, the estimated cost is extrapolated from the cost curve.

APPENDIX Q - CIP ALTERNATIVE CAPITAL COST INFORMATION

ALTERNATIVE 1: EXISTING SYSTEM REHABILITATION
AWTF CIP CASH FLOW 2016-2026
CITY OF ARCATA

PROJECT DESCRIPTION					COST ESTIMATES		
CITY PROJECT ID [(1)]	PROJECT TYPE	PROJECT TITLE	ORIGINAL PROJECT DESCRIPTION (BY CITY)	RECOMMENDED PROJECT DESCRIPTION (BY CAROLLO)	SOFT COSTS (CEQA, DESIGN, LEGAL, ADMIN, CM)	ESTIMATED CONSTRUCTION COST	ESTIMATED PROJECT COST
1	Regulatory - Permit	UV Disinfection System	Replace current chlorine disinfection system with a new UV disinfection system	New UV disinfection system for Outfall 003 sized for 5.9 mgd (UVT 35%). Existing chlorine disinfection system remains for wet weather discharge to Outfall 001.	$ 1,308,000	$ 4,360,000	$ 5,670,000
3	Capacity	Treatment Marsh #7	Reconfigure current aquaculture ponds into another treatment wetland	Reconfigure current aquaculture ponds into another treatment wetland (2.3 acres). Includes additional environmental permitting costs.	$ 269,000	$ 230,000	$ 500,000
4	Regulatory - Permit	AWTF Reconfiguration/ New Outfall 003	a. Re-route the wastewater treatment flow from a two-pass configuration to a single-pass configuration (permit) b. Construct Outfall 003 (permit) c. Replace the pumps at the Enhancement Wetlands (Hauser) PS (Moved to Project #22)	a. Reroute flow (piping) from the two pass configuration to single pass configuration. b. Construct Outfall 003 and effluent piping (from UV to Outfall 003).	$ 543,000	$ 1,810,000	$ 2,350,000
8	Modernization	30 kW PV System	New Photovoltaic system to offset power for UV disinfection.	Determine whether or not the project economics are still viable without current grants (during pre-design). If yes, package with UV Disinfection System.	$ 81,000	$ 270,000	$ 350,000
10, 11, 12	Rehabilitation & Repair (R&R)	Headworks: Influent Screw Pump, Bar Screen, Flume and Grit Chamber Replacement	Replacement of headworks equipment	Replace structural and mechanical headworks assets due to age and condition. Upsize headworks to handle PWWF of 5.9 mgd.	$ 1,980,000	$ 6,600,000	$ 8,580,000
13	R&R	Primary Clarifier Replacement	Replacement and upsizing of existing primary clarifiers with 2 identical 5.9-mgd clarifiers for complete redundancy	Replacement of existing primary clarifiers with two new 3.0 mgd clarifier (1 standby). Package with sludge pump replacement project	$ 1,386,000	$ 4,620,000	$ 6,010,000

ALTERNATIVE 1: EXISTING SYSTEM REHABILITATION
AWTF CIP CASH FLOW 2016-2026
CITY OF ARCATA

PROJECT DESCRIPTION					COST ESTIMATES		
CITY PROJECT ID [1]	PROJECT TYPE	PROJECT TITLE	ORIGINAL PROJECT DESCRIPTION (BY CITY)	RECOMMENDED PROJECT DESCRIPTION (BY CAROLLO)	SOFT COSTS (CEQA, DESIGN, LEGAL, ADMIN, CM)	ESTIMATED CONSTRUCTION COST	ESTIMATED PROJECT COST
14	R&R	Primary Clarifier: Sludge and Scum Pump Replacement	Replacement of primary sludge and scum pumps (with redundancy) for new 5.9 mgd primary clarifiers.	Package with primary clarifier project.	$ 69,000	$ 230,000	$ 300,000
15A	Regulatory - Capacity	Digester R&R Project - Phase 1	Replace and reconfigure sludge digestion system to improve performance.	Upgrade and reconfigure sludge digestion system to accommodate additional primary sludge. Elements to be determined during preliminary design but may include digester cover rehabilitation and digester tank modifications.	$ 225,000	$ 750,000	$ 980,000
16	R&R	Treatment Wetlands 4 Influent Pump Replacement	Replacement of Treatment Wetlands 4 Influent Pumps	Evaluate whether project still required during preliminary design. Package with treatment wetlands or oxidation ponds project.	$ 36,000	$ 120,000	$ 160,000
17	R&R	Treatment Wetlands: Pump Station 1 R&R Project	Replacement of Pump Station 1 pumps	Replace pumps with 2.3 mgd firm capacity (3 mgd with standby running) and rehabilitate wet well. Package with PPS project.	$ 54,000	$ 180,000	$ 230,000
18	R&R	Treatment Wetlands: Pump Station 2 R&R Project	Replacement of Pump Station 2 pumps	Evaluate whether project still required during preliminary design or if pump station can be demolished with rehabilitation of PPS/PS1 wet well. Package with PPS/PS1 project.	$ 18,000	$ 60,000	$ 80,000
19	R&R	Oxidation Ponds: Pond Pump Station R&R Project	Plan and implement performance improvements for Oxidation Pond 2 Reconfigure inlet/outlet structures	Replace pumps with 3.6 mgd capacity (with standby running) and rehabilitate wet well. Package with PS1 project.	$ 54,000	$ 180,000	$ 230,000
20	R&R	Oxidation Ponds: Transfer Structure Reconfiguration	Reconfigure Pond 1 to 2 effluent structures	Allows for better flow distribution and potential storage. Package with oxidation pond work.	$ 82,500	$ 275,000	$ 360,000
21	R&R	Disinfection: Chlorine/SO2 Project	Project is undefined	Upgrade existing chlorine gas disinfection system or conversion to hypochlorite liquid chlorine system for plant water chlorination.	$ 45,000	$ 150,000	$ 200,000

ALTERNATIVE 1: EXISTING SYSTEM REHABILITATION
AWTF CIP CASH FLOW 2016-2026
CITY OF ARCATA

PROJECT DESCRIPTION					COST ESTIMATES		
CITY PROJECT ID [1]	PROJECT TYPE	PROJECT TITLE	ORIGINAL PROJECT DESCRIPTION (BY CITY)	RECOMMENDED PROJECT DESCRIPTION (BY CAROLLO)	SOFT COSTS (CEQA, DESIGN, LEGAL, ADMIN, CM)	ESTIMATED CONSTRUCTION COST	ESTIMATED PROJECT COST
22	R&R	Enhancement Wetlands: Pump Station Project	Replacement of enhancement wetland effluent pump station (Hauser PS)	Replace pumps at the EWPS with 2.3 mgd firm capacity. Add a mechanical bar screen on PS inlet and a strainer on the discharge line.	$ 258,000	$ 860,000	$ 1,120,000
24	R&R	Oxidation Ponds: Aerator Replacement	Aerator replacement / upgrades	Addition of aerators in Pond 2 for aeration capacity and flow diversion. Includes electrical improvements.	$ 255,000	$ 850,000	$ 1,110,000
26	R&R	Treatment Wetlands Re-Vegetation Project	Dikes and vegetation maintenance	Regrading (deep and shallow zones) and replanting in TW 1-4 only.	$ 174,000	$ 580,000	$ 750,000
27	R&R	Enhancement Wetlands Re-Vegetation Project	Dikes and vegetation maintenance	Vegetation maintenance, new inlet/outlet structures with piping, new baffles for short circuiting. Includes additional environmental permitting costs and EW influent pipe sliplining.	$ 822,000	$ 1,740,000	$ 2,560,000
29	R&R	Oxidation Ponds: Emergency Pond Pump Replacement Project	Develop and implement a disinfection system for Pond 2 storm pumps under the new flow configuration	Provide bypass piping to allow Oxidation Pond 1 effluent to be pumped to Oxidation Pond 2. Package with PPS/PS1 or oxidation pond work.	$ 60,000	$ 200,000	$ 260,000
35N	R&R	Oxidation Ponds: Sludge Removal R&R Project	New Project	Allows for improved treatment and hydraulic capacity in Oxidation Ponds 1 & 2. Assumes 1' sludge dredging, dewatering and disposal.	$ 765,000	$ 2,550,000	$ 3,320,000
37N	Regulatory - Capacity	Additional Secondary Treatment Capacity: New Treatment Wetlands	New Project	N/A in Alternative #1	$ -		$ -
38N	Regulatory - Capacity	New Secondary Sludge Thickening Project	New Project	N/A in Alternative #1	$ -		$ -
39N	R&R	Corporation Yard Modifications & Building Replacement	New Project	Allows for corporation yard and building modification costs associated with new and improved facilities.	$ 6,000	$ 20,000	$ 30,000
TOTAL 10 YR CIP						**$ 26,640,000**	**$ 35,150,000**

Notes:
1. Project ID number as identifed in City of Arcata Capital Improvements Program (CIP)
2. Project priority generally defined as follows: 1 = Permit and Capacity; 2 = R&R; 3 = Modernization; 4 = Sea Level Rise.

ALTERNATIVE 2: EXISTING SYSTEM WITH SIDESTREAM TREATMENT
AWTF CIP CASH FLOW 2016-2026
CITY OF ARCATA

PROJECT DESCRIPTION					COST ESTIMATES		
CITY PROJECT ID (1)	PROJECT TYPE	PROJECT TITLE	ORIGINAL PROJECT DESCRIPTION (BY CITY)	RECOMMENDED PROJECT DESCRIPTION (BY CAROLLO)	SOFT COSTS (CEQA, DESIGN, LEGAL, ADMIN, CM)	ESTIMATED CONSTRUCTION COST	ESTIMATED PROJECT COST
1	Regulatory - Permit	UV Disinfection System	Replace current chlorine disinfection system with a new UV disinfection system	New UV disinfection system for Outfall 003 sized for 5.9 mgd (UVT 35%). Existing chlorine disinfection system remains for wet weather discharge to Outfall 001.	$ 1,308,000	$ 4,360,000	$ 5,670,000
3	Capacity	Treatment Marsh #7	Reconfigure current aquaculture ponds into another treatment wetland	Reconfigure current aquaculture ponds into another treatment wetland (2.3 acres). Includes additional environmental permitting costs.	$ 269,000	$ 230,000	$ 500,000
4	Regulatory - Permit	AWTF Reconfiguration/ New Outfall 003	a. Re-route the wastewater treatment flow from a two-pass configuration to a single-pass configuration (permit) b. Construct Outfall 003 (permit) c. Replace the pumps at the Enhancement Wetlands (Hauser) PS (capacity)	a. Reroute flow (piping) from the two pass configuration to single pass configuration. b. Construct Outfall 003 and effluent piping (from UV to Outfall 003).	$ 543,000	$ 1,810,000	$ 2,350,000
8	Modernization	30 kW PV System	New Photovoltaic system to offset power for UV disinfection.	Determine whether or not the project economics are still viable without current grants (during pre-design). If yes, package with UV Disinfection System.	$ 81,000	$ 270,000	$ 350,000
10, 11, 12	Rehabilitation & Repair (R&R)	Headworks: Influent Screw Pump, Bar Screen, Flume and Grit Chamber Replacement	Replacement of headworks equipment	Replace structural and mechanical headworks assets due to age and condition. Upsize headworks to handle PWWF of 5.9 mgd.	$ 1,980,000	$ 6,600,000	$ 8,580,000
13	R&R	Primary Clarifier Replacement	Replacement and upsizing of existing primary clarifiers with 2 identical 5.9-mgd clarifiers for complete redundancy	Replacement of existing primary clarifiers with two new 3.0 mgd clarifier (1 standby). Package with sludge pump replacement project	$ 1,386,000	$ 4,620,000	$ 6,010,000

ALTERNATIVE 2: EXISTING SYSTEM WITH SIDESTREAM TREATMENT
AWTF CIP CASH FLOW 2016-2026
CITY OF ARCATA

PROJECT DESCRIPTION					COST ESTIMATES		
CITY PROJECT ID [1]	PROJECT TYPE	PROJECT TITLE	ORIGINAL PROJECT DESCRIPTION (BY CITY)	RECOMMENDED PROJECT DESCRIPTION (BY CAROLLO)	SOFT COSTS (CEQA, DESIGN, LEGAL, ADMIN, CM)	ESTIMATED CONSTRUCTION COST	ESTIMATED PROJECT COST
14	R&R	Primary Clarifier: Sludge Pump Replacement	'Replacement of primary sludge and scum pumps (With redundancy)	Package with primary clarifier project.	$ 69,000	$ 230,000	$ 300,000
15A	Regulatory - Capacity	Digester R&R Project - Phase 1	Replace and reconfigure sludge digestion system to improve performance.	Upgrade and reconfigure sludge digestion system to accommodate additional sludge from new secondary treatment project. Elements to be determined during preliminary design but may include digester cover rehabilitation, digester tank modifications, and heater/boiler upgrade.	$ 300,000	$ 1,000,000	$ 1,300,000
16	R&R	Treatment Wetlands 4 Influent Pump Replacement	Replacement of Treatment Wetlands 4 Influent Pumps	Evaluate whether project still required during preliminary design. Package with treatment wetlands or oxidation ponds project.	$ 36,000	$ 120,000	$ 160,000
17	R&R	Treatment Wetlands: Pump Station 1 R&R Project	Replacement of Pump Station 1 pumps	Replace pumps with 2.3 mgd firm capacity (3 mgd with standby running) and rehabilitate wet well. Package with PPS project.	$ 54,000	$ 180,000	$ 230,000
18	R&R	Treatment Wetlands: Pump Station 2 R&R Project	Replacement of Pump Station 2 pumps	Evaluate whether project still required during preliminary design or if pump station can be demolished with rehabilitation of PPS/PS1 wet well. Package with PPS/PS1 project.	$ 18,000	$ 60,000	$ 80,000
19	R&R	Oxidation Ponds: Pond Pump Station R&R Project	Plan and implement performance improvements for Oxidation Pond 2 Reconfigure inlet/outlet structures	Replace pumps with 3.6 mgd capacity (with standby running) and rehabilitate wet well. Package with PS1 project.	$ 54,000	$ 180,000	$ 230,000
20	R&R	Oxidation Ponds: Transfer Structure Reconfiguration	Reconfigure Pond 1 to 2 effluent structures	Allows for better flow distribution and potential storage. Package with oxidation pond work.	$ 82,500	$ 275,000	$ 360,000

ALTERNATIVE 2: EXISTING SYSTEM WITH SIDESTREAM TREATMENT
AWTF CIP CASH FLOW 2016-2026
CITY OF ARCATA

PROJECT DESCRIPTION					COST ESTIMATES		
CITY PROJECT ID (1)	PROJECT TYPE	PROJECT TITLE	ORIGINAL PROJECT DESCRIPTION (BY CITY)	RECOMMENDED PROJECT DESCRIPTION (BY CAROLLO)	SOFT COSTS (CEQA, DESIGN, LEGAL, ADMIN, CM)	ESTIMATED CONSTRUCTION COST	ESTIMATED PROJECT COST
21	R&R	Disinfection: Chlorine/SO2 Project	Project is undefined	Upgrade existing chlorine gas disinfection system or conversion to hypochlorite liquid chlorine system for plant water chlorination.	$ 45,000	$ 150,000	$ 200,000
22	R&R	Enhancement Wetlands: Pump Station Project	Replacement of enhancement wetland effluent pump station (Hauser PS)	Replace pumps at the EWPS with 2.3 mgd firm capacity. Add a mechanical bar screen on PS inlet and a strainer on the discharge line.	$ 258,000	$ 860,000	$ 1,120,000
24	R&R	Oxidation Ponds: Aerator Replacement	Aerator replacement / upgrades	Addition of aerators in Pond 2 for aeration capacity and flow diversion. Includes electrical improvements.	$ 255,000	$ 850,000	$ 1,110,000
26	R&R	Treatment Wetlands Re-Vegetation Project	Dikes and vegetation maintenance	Regrading (deep and shallow zones) and replanting in TW 1-4 only.	$ 174,000	$ 580,000	$ 750,000
27	R&R	Enhancement Wetlands Re-Vegetation Project	Dikes and vegetation maintenance	Vegetation maintenance, new inlet/outlet structures with piping, new baffles for short circuiting. Includes additional environmental permitting costs and EW influent pipe sliplining.	$ 822,000	$ 1,740,000	$ 2,560,000
29	R&R	Oxidation Ponds: Emergency Pond Pump Replacement Project	Develop and implement a disinfection system for Pond 2 storm pumps under the new flow configuration	Provide bypass piping to allow Oxidation Pond 1 effluent to be pumped to Oxidation Pond 2. Package with PPS/PS1 or oxidation pond work.	$ 60,000	$ 200,000	$ 260,000
35N	R&R	Oxidation Ponds: Sludge Removal R&R Project	New Project	Allows for improved treatment and hydraulic capacity in Oxidation Ponds 1 & 2. Assumes 1' sludge dredging, dewatering and disposal.	$ 765,000	$ 2,550,000	$ 3,320,000
37N	Regulatory - Capacity	New Secondary Treatment Project: Oxidation Ditch and Secondary Clarifier Project	New Project	One new oxidation ditch and secondary clarifier sized for 2 mgd capacity.	$ 1,510,500	$ 5,035,000	$ 6,550,000
38N	Regulatory - Capacity	New Secondary Sludge Thickening Project	New Project	New secondary sludge thickening equipment sized for secondary sludge from one oxidation ditch and secondary clarifier.	$ 588,000	$ 1,960,000	$ 2,550,000

ALTERNATIVE 2: EXISTING SYSTEM WITH SIDESTREAM TREATMENT
AWTF CIP CASH FLOW 2016-2026
CITY OF ARCATA

PROJECT DESCRIPTION					COST ESTIMATES		
CITY PROJECT ID [1]	PROJECT TYPE	PROJECT TITLE	ORIGINAL PROJECT DESCRIPTION (BY CITY)	RECOMMENDED PROJECT DESCRIPTION (BY CAROLLO)	SOFT COSTS (CEQA, DESIGN, LEGAL, ADMIN, CM)	ESTIMATED CONSTRUCTION COST	ESTIMATED PROJECT COST
39N	R&R	Corporation Yard Modifications & Building Replacement	New Project	Allows for corporation yard and building modification costs associated with new and improved facilities.	$ 30,000	$ 100,000	$ 130,000
TOTAL 10 YR CIP						**$ 33,960,000**	**$ 44,670,000**

Notes: 1. Project ID number as identifed in City of Arcata Capital Improvements Program (CIP)
2. Project priority generally defined as follows: 1 = Permit and Capacity; 2 = R&R; 3 = Modernization; 4 = Sea Level Rise.

ALTERNATIVE 3: EXISTING SYSTEM WITH PARALLEL TREATMENT
AWTF CASH FLOW 2016-2026
CITY OF ARCATA

PROJECT DESCRIPTION					COST ESTIMATES		
CITY PROJECT ID [(1)]	PROJECT TYPE	PROJECT TITLE	ORIGINAL PROJECT DESCRIPTION (BY CITY)	RECOMMENDED PROJECT DESCRIPTION (BY CAROLLO)	SOFT COSTS (CEQA, DESIGN, LEGAL, ADMIN, CM)	ESTIMATED CONSTRUCTION COST	ESTIMATED PROJECT COST
1	Regulatory - Permit	UV Disinfection System	Replace current chlorine disinfection system with a new UV disinfection system	New UV disinfection system for Outfall 003 sized for 5.9 mgd (UVT 55%). Existing chlorine disinfection system remains for Outfall 001.	$ 942,600	$ 3,142,000	$ 4,080,000
3	Capacity	Treatment Marsh #7	Reconfigure current aquaculture ponds into another treatment wetland	N/A in Alternative #3 within 10-yr CIP (deferred to later phase).	$ -		$ -
4	Regulatory - Permit	AWTF Reconfiguration/ New Outfall 003	a. Re-route the wastewater treatment flow from a two-pass configuration to a single-pass configuration (permit) b. Construct Outfall 003 (permit) c. Replace the pumps at the Enhancement Wetlands (Hauser) PS (capacity)	a. Reroute flow (piping) from the two pass configuration to single pass configuration. b. Construct Outfall 003 and effluent piping (from UV to Outfall 003). c. Package with new secondary treatment project.	$ 543,000	$ 1,810,000	$ 2,350,000
8	Modernization	30 kW PV System	New Photovoltaic system to offset power for UV disinfection.	Determine whether or not the project economics are still viable without current grants (during pre-design). If yes, package with UV Disinfection System.	$ 81,000	$ 270,000	$ 350,000
10, 11, 12	Rehabilitation & Repair (R&R)	Headworks: Influent Screw Pump, Bar Screen, Flume and Grit Chamber Replacement	Replacement of headworks equipment	Replace structural and mechanical headworks assets due to age and condition. Upsize headworks to handle PWWF of 5.9 mgd.	$ 1,980,000	$ 6,600,000	$ 8,580,000
13	R&R	Primary Clarifier Replacement	Replacement and upsizing of existing primary clarifiers with 2 identical 5.9-mgd clarifiers for complete redundancy	Replacement of existing primary clarifiers with one new 1.8 mgd clarifier. Package with sludge pump replacement project	$ 468,000	$ 1,560,000	$ 2,030,000

ALTERNATIVE 3: EXISTING SYSTEM WITH PARALLEL TREATMENT
AWTF CASH FLOW 2016-2026
CITY OF ARCATA

PROJECT DESCRIPTION					COST ESTIMATES		
CITY PROJECT ID [(1)]	PROJECT TYPE	PROJECT TITLE	ORIGINAL PROJECT DESCRIPTION (BY CITY)	RECOMMENDED PROJECT DESCRIPTION (BY CAROLLO)	SOFT COSTS (CEQA, DESIGN, LEGAL, ADMIN, CM)	ESTIMATED CONSTRUCTION COST	ESTIMATED PROJECT COST
14	R&R	Primary Clarifier: Sludge Pump Replacement	Replacement of primary sludge and scum pumps for one 1.8 mgd clarifier.	Package with primary clarifier project.	$ 42,000	$ 140,000	$ 180,000
15A	Regulatory - Capacity	Digester R&R Project - Phase 1	Replace and reconfigure sludge digestion system to improve performance.	Upgrade and reconfigure sludge digestion system to accommodate additional sludge from new secondary treatment project. Elements to be determined during preliminary design but may include digester cover rehabilitation, digester tank modifications, and heater/boiler upgrade.	$ 300,000	$ 1,000,000	$ 1,300,000
16	R&R	Treatment Wetlands 4 Influent Pump Replacement	Replacement of Treatment Wetlands 4 Influent Pumps	Evaluate whether project still required during preliminary design. Package with treatment wetlands or oxidation ponds project.	$ 36,000	$ 120,000	$ 160,000
17	R&R	Treatment Wetlands: Pump Station 1 R&R Project	Replacement of Pump Station 1 pumps	Replace pumps with 1.3 mgd firm capacity (1.8 mgd with standby running) and rehabilitate wet well. Package with PPS project.	$ 36,000	$ 120,000	$ 160,000
18	R&R	Treatment Wetlands: Pump Station 2 R&R Project	Replacement of Pump Station 2 pumps	Evaluate whether project still required during preliminary design or if pump station can be demolished with rehabilitation of PPS/PS1 wet well. Package with PPS/PS1 project.	$ 18,000	$ 60,000	$ 80,000
19	R&R	Oxidation Ponds: Pond Pump Station R&R Project	Plan and implement performance improvements for Oxidation Pond 2 Reconfigure inlet/outlet structures	Replace pumps with 2.3 mgd firm capacity and rehabilitate wet well. Package with PS1 project.	$ 45,000	$ 150,000	$ 200,000
20	R&R	Oxidation Ponds: Transfer Structure Reconfiguration	Reconfigure Pond 1 to 2 effluent structures	Allows for better flow distribution and potential storage. Package with oxidation pond work.	$ 82,500	$ 275,000	$ 360,000

ALTERNATIVE 3: EXISTING SYSTEM WITH PARALLEL TREATMENT
AWTF CASH FLOW 2016-2026
CITY OF ARCATA

PROJECT DESCRIPTION					COST ESTIMATES		
CITY PROJECT ID (1)	**PROJECT TYPE**	**PROJECT TITLE**	**ORIGINAL PROJECT DESCRIPTION (BY CITY)**	**RECOMMENDED PROJECT DESCRIPTION (BY CAROLLO)**	**SOFT COSTS (CEQA, DESIGN, LEGAL, ADMIN, CM)**	**ESTIMATED CONSTRUCTION COST**	**ESTIMATED PROJECT COST**
21	R&R	Disinfection: Chlorine/SO2 Project	Project is undefined	Upgrade existing chlorine gas disinfection system or conversion to hypochlorite liquid chlorine system for plant water chlorination.	$ 45,000	$ 150,000	$ 200,000
22	R&R	Enhancement Wetlands: Pump Station Project	Replacement of enhancement wetland effluent pump station (Hauser PS)	Replace pumps at the EWPS with 1.8 mgd firm capacity. Add a mechanical bar screen on PS inlet and a strainer on the discharge line.	$ 249,000	$ 830,000	$ 1,080,000
24	R&R	Oxidation Ponds: Aerator Replacement	Aerator replacement / upgrades	N/A in Alternative #3.	$ -		$ -
26	R&R	Treatment Wetlands Re-Vegetation Project	Dikes and vegetation maintenance	Regrading (deep and shallow zones) and replanting in TW 1-4 only.	$ 174,000	$ 580,000	$ 750,000
27	R&R	Enhancement Wetlands Re-Vegetation Project	Dikes and vegetation maintenance	Vegetation maintenance, new inlet/outlet structures with piping, new baffles for short circuiting. Includes additional environmental permitting costs and EW influent pipe sliplining.	$ 822,000	$ 1,740,000	$ 2,560,000
29	R&R	Oxidation Ponds: Emergency Pond Pump Replacement Project	Develop and implement a disinfection system for Pond 2 storm pumps under the new flow configuration	Provide bypass piping to allow Oxidation Pond 1 effluent to be pumped to Oxidation Pond 2. Package with PPS/PS1 or oxidation pond work.	$ 60,000	$ 200,000	$ 260,000
35N	R&R	Oxidation Ponds: Sludge Removal R&R Project	New Project	Allows for improved treatment and hydraulic capacity in Oxidation Ponds 1 & 2. Assumes 1' sludge dredging, dewatering and disposal.	$ 765,000	$ 2,550,000	$ 3,320,000
37N	Regulatory - Capacity	New Secondary Treatment Project: Oxidation Ditches and Secondary Clarifiers Project	New Project	New oxidation ditches and secondary clarifiers sized for 4.1 mgd capacity.	$ 3,021,000	$ 10,070,000	$ 13,090,000
38N	Regulatory - Capacity	New Secondary Sludge Thickening Project	New Project	New secondary sludge thickening equipment sized for secondary sludge from oxidation ditches and secondary clarifiers.	$ 588,000	$ 1,960,000	$ 2,550,000

ALTERNATIVE 3: EXISTING SYSTEM WITH PARALLEL TREATMENT
AWTF CASH FLOW 2016-2026
CITY OF ARCATA

PROJECT DESCRIPTION					COST ESTIMATES		
CITY PROJECT ID [1]	PROJECT TYPE	PROJECT TITLE	ORIGINAL PROJECT DESCRIPTION (BY CITY)	RECOMMENDED PROJECT DESCRIPTION (BY CAROLLO)	SOFT COSTS (CEQA, DESIGN, LEGAL, ADMIN, CM)	ESTIMATED CONSTRUCTION COST	ESTIMATED PROJECT COST
39N	R&R	Corporation Yard Modifications & Building Replacement	New Project	Allows for corporation yard and building modification costs associated with new and improved facilities.	$ 30,000	$ 100,000	$ 130,000
TOTAL CIP						**$ 33,430,000**	**$ 43,770,000**

Notes: 1. Project ID number as identifed in City of Arcata Capital Improvements Program (CIP)
2. Project priority for early phase (A) and late phase (B) generally defined as follows: 1 = Permit and Capacity; 2 = R&R; 3 = Modernization; 4 = Sea Level Rise.

APPENDIX R – CIP ALTERNATIVE OPERATION AND MAINTENANCE COST INFORMATION

Alternative 1: Existing System Rehabilitation

	PROCESS					POWER					PARTS REPLACEMENT			CHEMICAL	Vegetation Management	Added Labor	TOTAL
Process Area	Average Flow (mgd)	No. of Operating Units	TDH (ft)	Power Required (hp)	Connected Motor Power (hp)	Total Operating Motor Power (hp)	Annual Use (%)	Total (hp)	Power input (KW)	Power Cost ($/year)	Material ($/year)	Labor ($/year)	Total ($/year)	Chemical Cost ($/year)	$/year	**Added Labor $/year**	**O&M Cost ($/year)**
Primary Clarifiers (2 @3.0 mgd)	2.3																
Clarifier Mechanism		1			2	2	100%	2	1	$1,830	$1,000		$1,000				
Primary Sludge Pumps	0.3	1	50	3	3.4	3	100%	3	3	$3,085	$1,000		$1,000				
Primary Scum Pumps	0.1	1	50	1	1.7	2	100%	2	1	$1,542							
										$6,500			**$2,000**	**$0**			**$8,500**
Oxidation Ponds	2.3																
Aerators		8			15.0	120	100%	120	90	$109,827	$1,000		$1,000				
Pumping																	
PS1	2.3	1	20	8	10.8	11	100%	11	8	$9,854	$1,000		$1,000				
EPPS	0	1	10	0	0.0	0	10%	0	0	$0							
PPS	0	1	20	0	0.0	0	25%	0	0	$0							
EWPS	2.3	1	30	12	15.0	15	100%	15	11	$13,728	$1,000		$1,000				
										$133,400			**$3,000**	**$0**			**$136,400**
Ultraviolet Disinfection (UVT @ 35%)	2.3																
Lamps									55	**$67,771**	$112,000		$112,000			**$30,000**	**$209,771**
Chlorine Disinfection																	
Hypochlorite (3W)																	
Metering Pumps	0.1	1	30	1	1.0	1	100%	1	1	$915			$5,000	$5,000		$2,500	**$13,415**
Wetland Vegetation Management																	
Treatment wetlands 12 acres @ $5,000 per acre															$60,000	$10,000	**$70,000**
Enhancement wetlands 33 acres @ $2,500 per acre															$82,500	$10,000	**$92,500**
Pond Sludge Removal (Cost per year, for removal every 5 years)																	**$10,000**
Permit Violations (Does not include any Nutrient Criteria violations)																	**$125,000**
										$208,586			**$122,000**	**$5,000**	**$142,500**	**$52,500**	**$666,000**

Unit Prices		
Elec:	$0.14	$/kwh
Pond Dredging Cost	$50,000	$/ac-ft
Treatment Wetlands Rehab:	$100,000	$/ac
Violations:	$3,000	$/violation

Appendix R-2 CIP Alternative O Cost Information
City of Arcata
Wastewater Treatment Facility Improvements Project

Alternative 2: Existing System Rehabilitation with Side stream Treatment

	PROCESS					POWER						PARTS REPLACEMENT			CHEMICAL	Vegetation Manageme	Added Labor	TOTAL
Process Area	Flow (mgd)	No. of Operating Units	TDH (ft)	Power Required (hp)	Connected Motor Power (hp)	Req'd Pump (bhp)	Total Operating Motor Power (hp)	Annual Use (%)	Total (hp)	Power input (KW)	Power Cost ($/year)	Material ($/year)	Labor ($/year)	Total ($/year)	Chemical Cost ($/year)	$/year	**Added Labor $/year**	**O&M Cost ($/year)**
Primary Clarifiers (2 @ 3.0 mgd)	2.3																	
Clarifier Mechanism		1			2	--	2	100%	2	1	$1,830	$1,000		$1,000				
Primary Sludge Pumps	0.3	1	50	3	3.4	--	3	100%	3	3	$3,085	$1,000		$1,000				
Primary Scum Pumps	0.1	1	50	1	1.7		2	100%	2	1	$1,542							
											$6,500			**$2,000**	**$0**			**$8,500**
Oxidation Ponds	1.5																	
Aerators		8			15.0	--	120	100%	120	90	$109,827	$1,000		$1,000				
Pumping																		
PS1	2.3	1	20	8	10.8		11	100%	11	8	$9,854	$1,000		$1,000				
EPPS	0	1	10	0	0.0		0	10%	0	0	$0							
PPS	0	1	20	0	0.0		0	25%	0	0	$0							
EWPS	2.3	1	30	12	15.0		15	100%	15	11	$13,728	$1,000		$1,000				
											$133,400			**$3,000**	**$0**			**$136,400**
Oxidation Ditches	0.8																	
Aerators		1			100.0	--	100	100%	100	75	$91,522	$5,000		$5,000			$12,500	
Secondary Clarifiers																		
Clarifier Mechanism		1			2		2	100%	2	1	$1,830	$1,000		$1,000				
RAS Pumping	0.8	1	25	4	4.7		5	100%	5	3	$4,284	$1,000		$1,000				
WAS Pumping	0.1	1	25	0	0.4		0	100%	0	0	$386	$500		$500				
Scum Pumping	0.1	1	40	1	0.7		1	100%	1	1	$617	$250		$250				
											$98,600			**$7,800**	**$0**		**$12,500**	**$118,900**
Ultraviolet Disinfection (UVT @ 35%)	5.9																	
Lamps										55	$67,771	$111,749		$111,749			**$30,000**	**$209,520**
Chlorine Disinfection																		
Hypochlorite (3W)																		
Metering Pumps	0.1	1	30	1	1.0		1	100%	1	1	$915			$5,000	$5,000		$2,500	**$13,415**
Thickening																		
Gravity Belt Thickener		1			5		5	50%	3	2	$2,288	$ 2,000		$ 2,000			$12,500	
TWAS Pumping		1			7.5		8	50%	4	3	$3,432	$ 500		$ 500				
Polymer System		1			1		1	50%	1	0	$458	$ 500		$ 500	$5,000			
											$6,178			$ 3,000	$5,000		$12,500	**$26,678**
Wetland Vegetation Management																		
Treatment wetlands 12 acres																$60,000	$10,000	$70,000
Enhancement wetlands 33 acres																$165,000	$10,000	$175,000
											$313,364			**$132,549**	**$10,000**	**$225,000**	**$77,500**	**$758,000**
																		$758,413

Unit Prices

Elec:	$0.14	$/kwh
Pond Dredging Cost	$50,000	$/ac-ft
Treatment Wetlands Rehab:	$100,000	$/ac
Violations:	$3,000	$/violation

Alternative 3: Existing System Rehabilitation with Parallel Treatment

	PROCESS					POWER						PARTS REPLACEMENT			CHEMICAL	Mangement	Labor	TOTAL
Process Area	Flow (mgd)	No. of Operating Units	TDH (ft)	Power Required (hp)	Connected Motor Power (hp)	Req'd Pump (bhp)	Total Operating Motor Power (hp)	Annual Use (%)	Total (hp)	Power input (KW)	Power Cost ($/year)	Material ($/year)	Labor ($/year)	Total ($/year)	Chemical Cost ($/year)	$/year	**Added Labor $/year**	**O&M Cost ($/year)**
Primary Clarifiers (1 @ 3.0 mgd)	2.3																	
Clarifier Mechanism		1			2	--	2	100%	2	1	$1,830	$1,000		$1,000				
Primary Sludge Pumps	0.3	1	50	3	3.4	--	3	100%	3	3	$3,085	$1,000		$1,000				
Primary Scum Pumps	0.1	1	50	1	1.7		2	100%	2	1	$1,542							
											$6,500			**$2,000**	**$0**			**$8,500**
Oxidation Ponds	1																	
Aerators		0			15.0	--	0	25%	0	0	$0							
Pumping																		
EPPS	0	1	10	0	0.0		0	10%	0	0	$0							
PPS/PS1	1	1	20	4	4.7		5	100%	5	3	$4,284	$1,000		$1,000				
EWPS	1	1	30	5	15.0		15	100%	15	11	$13,728							
												$1,000		$1,000				
											$18,000			**$2,000**	**$0**			**$20,000**
Oxidation Ditches	1.3																	
Aerators		1			100.0	--	100	100%	100	75	$91,522	$5,000		$5,000			$12,500	
Secondary Clarifiers																		
Clarifier Mechanism		1			2		2	100%	2	1	$1,830	$1,000		$1,000				
RAS Pumping	1.3	1	25	6	7.6		8	100%	8	6	$6,962	$1,000		$1,000				
WAS Pumping	0.1	1	25	0	0.4		0	100%	0	0	$386	$500		$500				
Scum Pumping	0.1	1	40	1	0.7		1	100%	1	1	$617	$250		$250				
											$101,300			**$7,800**	**$0**		**$12,500**	**$121,600**
Ultraviolet Disinfection (UVT @ 35%)	5.9																	
Lamps										55	$43,127	$40,000		$40,000			**$25,000**	**$108,127**
Chlorine Disinfection																		
Hypochlorite (3W)																		
Metering Pumps	0.1	1	30	1	1.0		1	100%	1	1	$915			$5,000	$5,000		$2,500	**$13,415**
Thickening																		
Gravity Belt Thickener		1			5		5	50%	3	2	$2,288	$ 2,000		$ 2,000			$12,500	
TWAS Pumping		1			7.5		8	50%	4	3	$3,432	$ 500		$ 500				
Polymer System		1			1		1	50%	1	0	$458	$ 500		$ 500	$5,000			
											$6,178			$ 3,000	$5,000		$12,500	**$26,678**
Wetland Vegitation Management																		
Treatment wetlands 12 acres																$30,000	$10,000	$40,000
Enhancement wetlands 33 acres																$82,500	$10,000	$92,500
											$176,020			**$59,800**	**$10,000**	**$112,500**	**$72,500**	**$431,000**
																		$430,820

Unit Prices

Elec:	$0.14	$/kwh
Pond Dredging Cost	$50,000	$/ac-ft
Treatment Wetlands Rehab:	$100,000	$/ac
Violations:	$3,000	$/violation

APPENDIX S - PRESENTATIONS TO CITY COUNCIL

Wastewater Treatment Facility Improvements Project

City Council – Facility Plan Update

June 6, 2016

LACO carollo

Engineers...Working Wonders With Water

What we heard at April Council Meeting

- Need to closely revisit capacity shortfall
- Look at opportunities to rehabilitate existing facilities
  - Pond solids removal
  - Wetlands revegetation
- Expand Alternatives discussion
- Confirmed plan to move away from chlorine disinfection and use UV disinfection instead

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Agenda

- Background
- Treatment/Permit Overview
- Existing Facilities Review
  - Capacity Shortfall
- Expanded Alternatives
- Alternatives Comparison
- Next Steps

Wastewater Treatment Facility Improvement Project Goals

- Provide reliable service to the community now and in the future
- Meet permit/regulatory requirements that protect public health and the environment
- Meet City's goals for sustainability, as much as possible

Philosophy of Sustainability – What does that mean for this project?

Triple bottom line framework

Arcata's system is recognized around the world - sustainable treatment with community and environmental benefits




Drivers to do anything different

- Permit violations
- Aging infrastructure
- Capacity limitations
- Deferred maintenance

Process for this Improvement Project

Task Description	2015	2016	2017	2018	2019	2020
Facility Plan						
RWQCB Meetings						
Predesign						
Final design						
Construction						
Start up						

Break for Questions/ Comments

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Wastewater Treatment/ Permit Overview

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Discharge permit requirements are governed by California and EPA

- Effluent standards for treatment wetlands prior to AMWS
- Effluent standards for discharge to Humboldt Bay:
  - Current location
  - New discharge point at brackish marsh
- Water Quality Criteria established to be protective of human health and aquatic organisms


Water Boards

North Coast Regional Water Quality Control Board

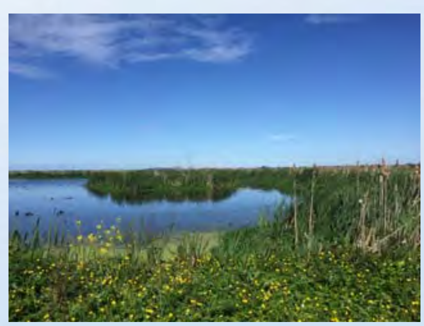
ORDER NO. R1-2012-0031
NPDES NO. CA0022713
WDID NO. 1B82114OHUM

WASTE DISCHARGE REQUIREMENTS
FOR THE
CITY OF ARCATA
MUNICIPAL WASTEWATER TREATMENT FACILITY

Only allowed to discharge to Humboldt Bay because of enhancement wetlands

Discharges to enclosed bays and estuaries are prohibited by state law

- Resolution No. 83-9 by RWQCB acknowledged that discharge of treated waste water through the AMWS met definition of “enhancement” as established by State.
- Permit ensures that water quality is enhanced by treatment through AMWS to the fullest extent possible prior to discharge to Humboldt Bay



"How It Works"

Arcata's sustainable system combines conventional and land based treatment elements:

- Headworks and primary clarifier
- Oxidation ponds, treatment wetlands, and enhancement wetlands: Allen, Gearheart, and Hauser.
- Chemical treatment/disinfection
- Digesters, and sludge drying beds
- Discharge to bay

from FOAM website

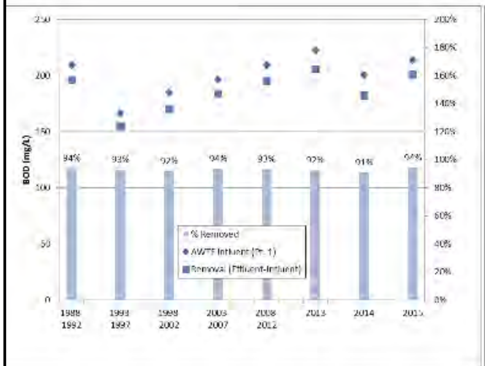
History of treatment in Arcata

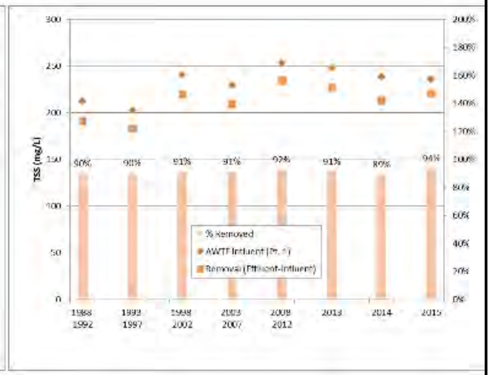
Early primary treatment, circa 1954

Ponds and wetlands, around 1989

- Mandatory minimum penalties implemented by State Board in 1999, enforced in 2006
- Regulatory climate is increasingly stringent

Looking at annual averages…. existing system has performed well over the years





However…. Permit compliance is not measured on annual averages

Compliance review found ongoing treatment issues (violations)

- NPDES permit notes violations/penalties (2008-2012)
- 2013: 12 noncompliance treatment incidents
- 2014: 23 noncompliance treatment incidents
- 2015: 27 noncompliance treatment incidents

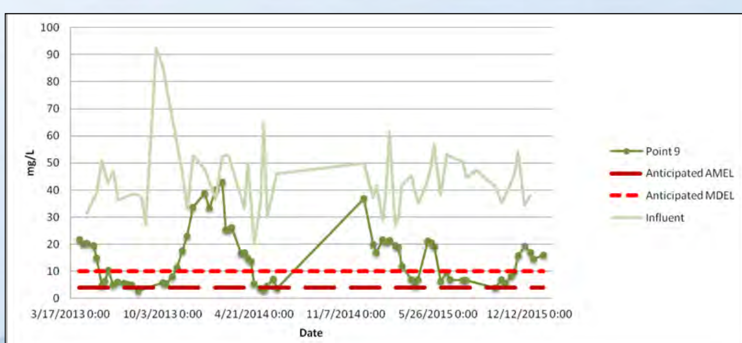
May be subject to mandatory penalties (34 of 62 incidents)

Issues related to:
- Secondary Treatment
- Disinfection (by products)
- Ammonia Toxicity

2012 Permit requires UV disinfection and Flow reconfiguration - new discharge

Potential future regulatory issues

- Virus disinfection to provide shellfish protection
- Ammonia/Nutrient limits expected in the next permit in 2018 (to protect aquatic health/toxicity)
- Pharmaceuticals and other contaminants in future permits



Break for Questions/ Comments

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Existing Facility Review

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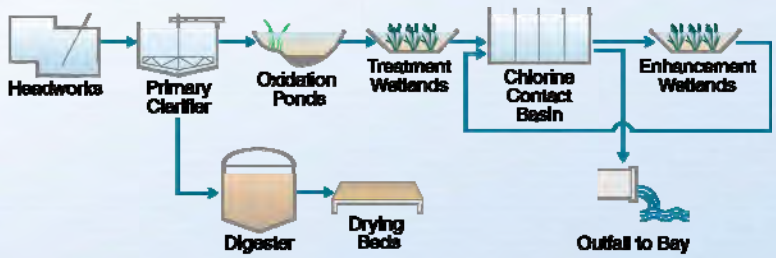
Existing Facility Schematic



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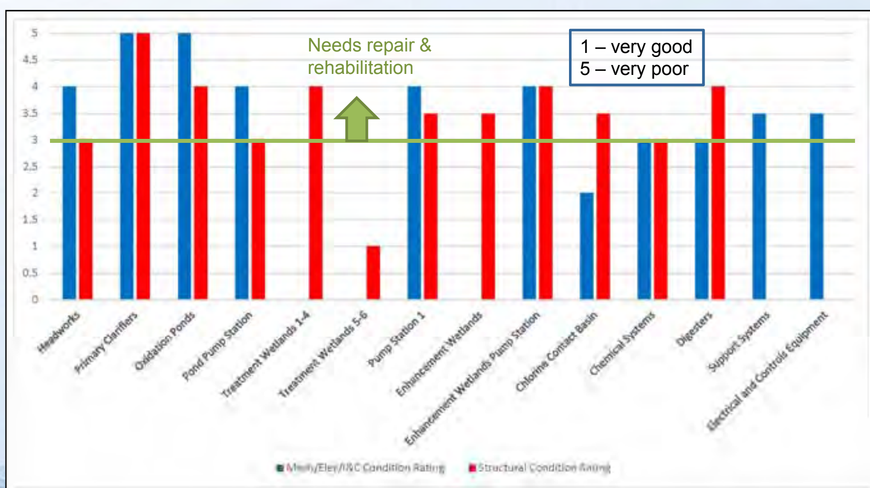
Condition Rankings: 30 year old facilities are well maintained but in need of rehabilitation and repairs



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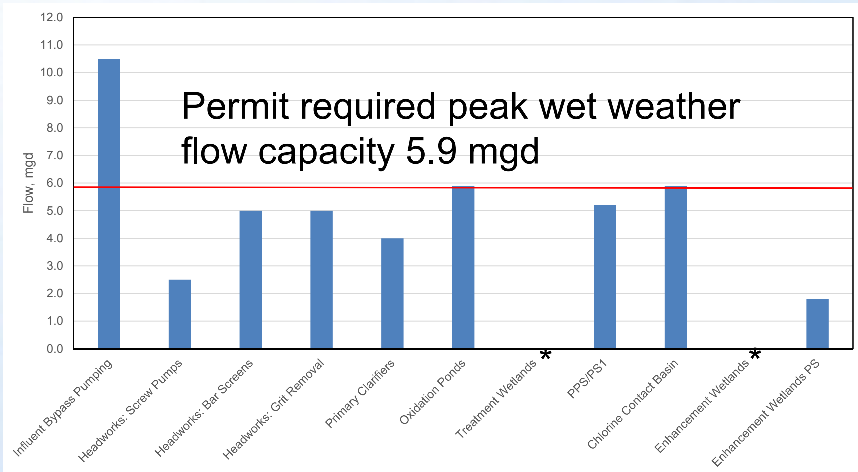
Hydraulic Capacity - Shortfalls



* Wetland hydraulic capacity based on pump stations

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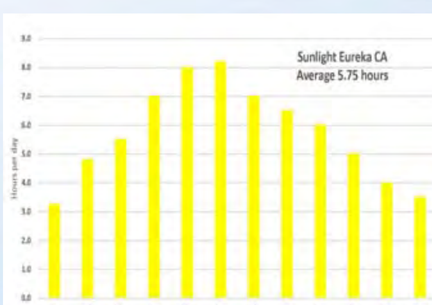
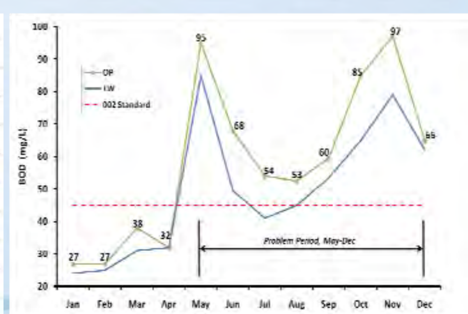
Pond and wetland treatment capacity

- Land based system has performed well over past 30 years, with help of chlorination system (oxidizing)
- Treatment capacity has deteriorated due to deferred vegetation maintenance and solids accumulation
- System has variable performance due to climate which make it difficult to comply with increasingly restrictive limits





From Arcata Marsh Research Institute (AMRI)

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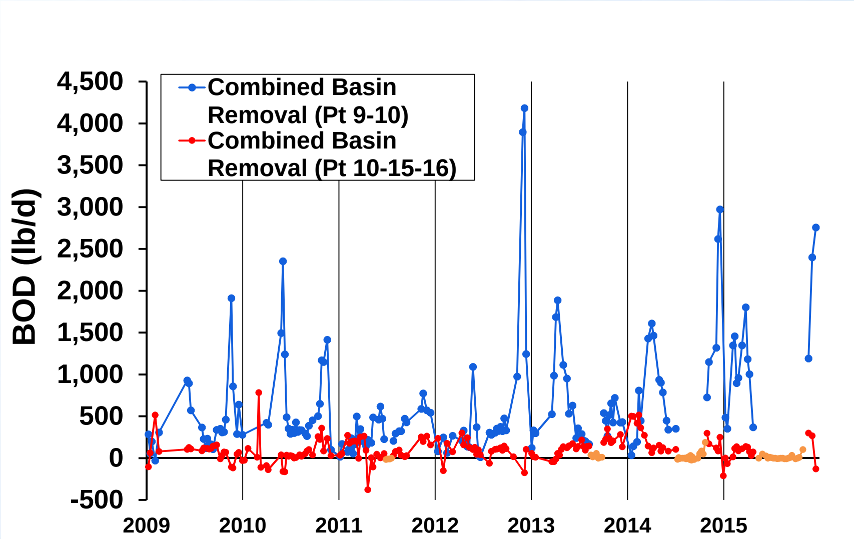
Chlorination impact on BOD removal capacity



Process Capacity shortfall identified

Process	BOD load removed, ppd	BOD load remaining, ppd
Influent		4,400
Primary Clarifiers	1,320	3,080
Ponds	1,150	1,930
Treatment Wetlands	340	1,590
Enhancement Wetlands	120	1,470
Disinfection	none if UV	
Discharge Goal at 10 mg/l	190	1,280
BOD Capacity Shortfall		1,280

- Influent load to meet General Plan = 4400 ppd BOD
- Existing facilities capacity (without Cl) < 3200 ppd
- BOD removal capacity shortfall = 1280 ppd

Summary of Future Needs

Capacity

- Projected 10% increase in load
  - 4000 ppd BOD Design going to 4400 ppd
- Consistent with General Plan projections
- Dry weather flow is not an issue

Future regulatory requirements

- Ammonia
- Nutrients (Total Nitrogen and Phosphorus)
- Toxicity
- Contaminants of Emerging Concern

Break for Questions/ Comments

Expanded Alternatives

Review of philosophy in developing alternatives and CIP

- 100% permit compliance
- Reliable capacity to meet all flows/loads and general plan growth
- Maximize existing natural system
- Address deferred maintenance
- Address aging infrastructure through repair and rehabilitation

Common CIP project elements identified for near term

Process	Action	Driver
Flow configuration	New outfall in brackish marsh	• ***Permit*** condition
Disinfection	New UV disinfection	• Prevent ***permit*** violations • Eliminates chlorine use
Headworks	Replace and provide new equipment	• Increase reliable ***capacity*** • ***Replacement*** of aging infrastructure
Primary Treatment	Replace	• Increase reliable ***capacity*** • ***Replacement*** of aging inf.
Plant Pumping Systems	Replace	• Increase reliable ***capacity*** • ***Replacement*** of aging inf.
Digesters	Rehabilitate	• Maintain reliable ***capacity*** • ***Replacement*** of aging inf.

Common Elements – Address Deferred Maintenance

- Oxidation Ponds
  - Solids removal
  - Flow routing
  - Attenuation of wet weather flows
- Treatment Wetlands
  - Removal of vegetative mats and solids
  - Regrading
  - Revegetation
- Enhancement Wetlands
  - Vegetation Management
  - Flow short circuiting

Initial screening evaluated treatment type compared to constituents removed

Process	Ability to Remove		
	Organics (BOD)(1)	Ammonia(2)	Total Nitrogen(2)
Suspended Growth			
Activated Sludge (conventional or oxidation ditch)	X	X	X
Attached Growth			
Trickling Filters	X		
Nitrifying Trickling Filters		X	
Denitrification Filters			X
Land Based Systems			
Ponds (Aerated or not)	X	Summer only	
Vegetated Wetlands	X	minor	If nitrified before
Open Water Wetlands	X	moderate	If nitrified before

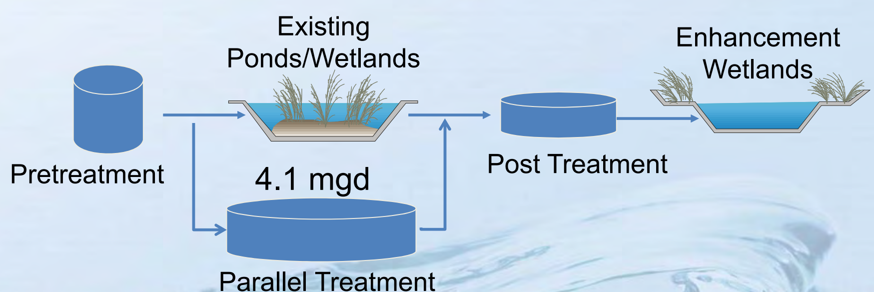
Notes:

(1) Current permit discharge requirement.

(2) Anticipated future permit discharge requirement.

Second screening considered sequence of treatment relative to existing system

- Considered:
  - Pretreatment - reduce BOD load before/in ponds
  - Parallel - provide BOD treatment for part of flow
  - Post treatment – provide BOD removal after TWs



Pretreatment options considered:

	Treatment Option	Adds BOD capacity ?	Removes ammonia ?	Improves final UVT?	Reliable?	Move forward ?
Pretreatment	Chemically Enhanced Primary	< 400 ppd	No	No	Yes	No
	Aeration in Ponds	yes	limited	No	Yes	Yes
	Trickling Filter	Yes	only if 2-stage	No	Yes	No
	Activated Sludge/Ox Ditch	Yes	Yes	No	Yes	No

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Parallel Treatment options considered:

	Treatment Option	Adds BOD capacity ?	Removes ammonia ?	Improves final UVT?	Reliable?	Move forward ?
Parallel	Additional Ponds/Wetlands	Yes	Summer only	No	Maybe	TW#7
	Rehabilitate Ponds/Wetlands	Yes - not enough	Summer only	No	Maybe	Yes
	Trickling Filter	Yes	only if 2-stage	No	Yes	Yes
	Activated Sludge/Ox Ditch	Yes	Yes	Yes	Yes	Yes

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Post treatment options considered

	Treatment Option	Adds BOD capacity ?	Removes ammonia ?	Improves final UVT?	Reliable?	Move forward?
Post Treatment	Trickling Filter/Nitrifying TF	Yes	2-stage	No	No	No
	Submerged Biofilter	Yes	Yes	? Likely No	Unknown	No - Need to pilot
	Ozone/Biological Active Filtration	Yes	Maybe - must pilot	Not needed	Maybe - must pilot	No - Need to pilot
	Filtration	< 400 ppd	No	Maybe	Yes	No - Need to pilot

Summary of screening (carried forward)

In addition to rehabilitation of the land based system is included in all alternatives

- Pretreatment Options
  - Aeration in ponds
- Parallel treatment Options
  - Rehab existing system (ponds/wetlands)/add TW#7
  - Conventional Activated Sludge (Aeration Basins, Blowers, Diffusers)
  - Extended Aeration Activated Sludge (Oxidation Ditch)
  - Trickling Filters (Plastic Media)

Evaluation of Parallel treatment options — Noneconomic factors

Alternative	Meets Permit	Ease of O&M	Constructability	Reliability	Ammonia Removal
Conventional Activated Sludge	3	1	3	3	2
Extended Aeration – Oxidation Ditch	3	3	2	3	3
Trickling Filters	1	2	2	1	1

Criteria: 1 = least favorable to 3 = most favorable

Evaluation of Parallel treatment options — Economic factors

Alternative	Construction Cost	Footprint	Operator Attention	Power Cost	Sludge Production	Maintenance Requirement
Conventional Activated Sludge	3	3	1	1	1	1
Extended Aeration – Oxidation Ditch	2	1	2	2	2	3
Trickling Filters	1	2	3	3	3	2

Criteria: 1 = least favorable to 3 = most favorable

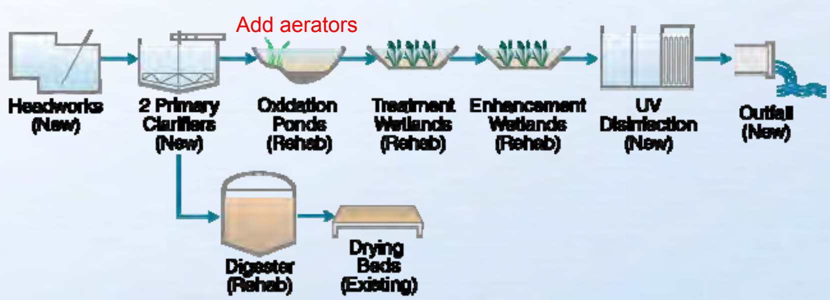
Alternatives developed to provide adequate capacity

- Alternative 1 – Existing System Rehabilitation with Aerators
- Alternative 2 – Existing System Rehabilitation with Sidestream Treatment
- Alternative 3 – Existing System Rehabilitation with Parallel Treatment
- New Process assumptions:

UV Disinfection

Ox Ditch Supplemental Capacity

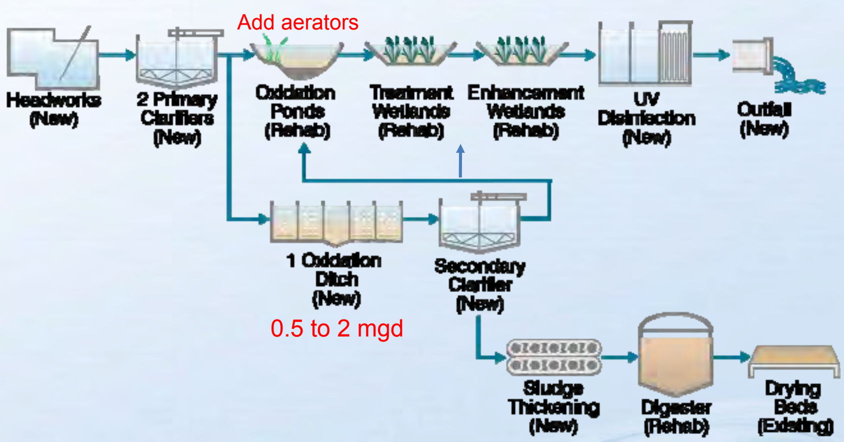
Alternative 1 – Existing System Rehab with Aerators



Alternative 1 – Process Elements

- New headworks with 5.9 mgd firm capacity
- Two new primary clarifiers for a total of 5.9 mgd
- Remove pond solids, rehab pond structures and put in new aerators in Pond 2
- Rehab treatment wetlands and add TW #7 (limit flow to 2.3 mgd)
- PS upgrades to (PS1) and from (Hauser PS) enhancement wetlands for a firm capacity of 2.3 mgd
- New UV disinfection (35% transmittance)
- Flow reconfiguration and new outfall
- Digester rehab (mechanical)

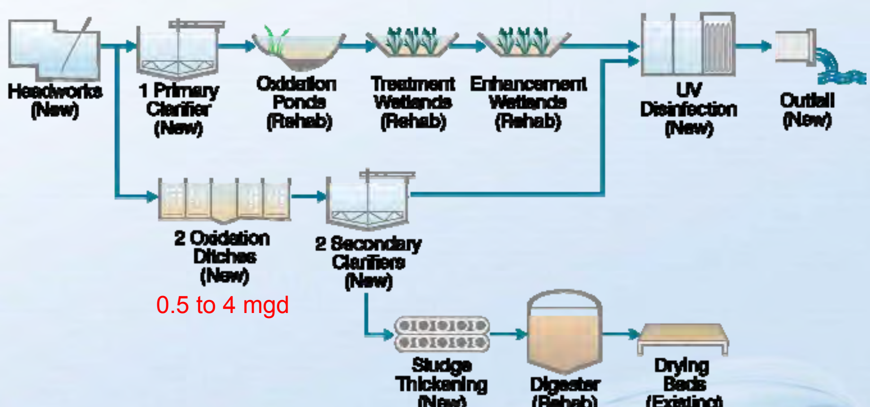
Alternative 2 – Existing System Rehab with Side-Stream Treatment



Alternative 2 – Process Elements

- New headworks with 5.9 mgd firm capacity
- Two new primary clarifiers for a total of 5.9 mgd
- Remove pond solids, rehab pond structures and put new aerators in Pond 2
- Rehab treatment wetlands and add TW #7 (limit flow to 2.3 mgd)
- New ox ditch (1) and new secondary clarifier (1)
- PS upgrades to (PS1) and from (Hauser PS) enhancement wetlands for a firm capacity of 2.3 mgd
- New UV disinfection (35% transmittance)
- Flow reconfiguration and new outfall
- Digester rehab and new sludge thickening

Alternative 3 – Existing System Rehab with Parallel Treatment



Alternative 3 – Process Elements

- New headworks with 5.9 mgd firm capacity
- One new primary clarifier (1.8 mgd) for ponds
- Remove pond solids and rehab ponds structures
- Rehab treatment wetlands and add TW #7 (limit flow to 1.8 mgd)
- New ox ditch (2) and new secondary clarifier (2)
- PS upgrades to (PS1) and from (Hauser PS) enhancement wetlands for a firm capacity of 2.3 mgd
- New UV at 55% transmittance
- Flow reconfiguration and new outfall
- Digester rehab and new sludge thickening

Proposed facilities site plan

Break for Questions/ Comments

Alternatives Comparison

Summary of Alternative Comparison for Non-Economic Factors

Alternative	Meets Permit	Ease of O&M	Construct-ability	Reli-ability	Ammonia Removal
1. Existing System Rehabilitation with Aerators	1	3	1	1	1
2. Existing System Rehab with Side-stream Treatment	2	1	2	2	2
3. Existing System Rehab with Parallel Treatment	3	2	3	3	3

Criteria: 1 = least favorable to 3 = most favorable

Summary of Alternative Comparison for Economic Factors

Alternative	Construction Cost (1)	Annual O&M Cost (2)
1. Existing System Rehabilitation with aerators	26.6	0.67
2. Existing System Rehab with Side-stream Treatment	33.9	0.75
3. Existing System Rehab with Parallel Treatment	33.4	0.43

Notes:

1) Costs are in today's dollars (May 2016), in millions.

2) Annual O&M costs, in millions, include only differential costs and do not include costs of common elements.

Summary of Alternative Life Cycle Comparison

Alternative	Project Cost (1)	Annual O&M Cost (2)	Present Worth O&M (3)	Life-cycle Cost (3)
1. Existing System Rehabilitation	35.1	0.67	5.7	40.9
2. Existing System with Side-stream Treatment	44.7	0.75	6.5	51.1
3. Existing System with Parallel Treatment	43.8	0.43	3.7	47.5

Notes:

*1) Costs are in today's dollars (May 2016), in millions. Project Cost = Construction Cost *1.3*

2) Annual O&M costs include only differential costs and do not include costs of common elements.

3) Lifecycle cost is project cost plus present worth O&M cost. Annual O&M costs were converted to present worth value based on 3 percent inflation rate, 6 percent discount rate, and 10-year analysis period.

Consultant Recommendation

- Retain and rehab existing land based system
- Consultant team recommends Alternative 3 based on the following factors:
  - Ability to reliably meet permit year-round
  - Flexibility to provide ammonia removal
  - Ability to keep plant operating during construction and wetland rehabilitation

Break for Questions/ Comments

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Next steps

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Immediate next steps for implementation

- Finalize Facility Plan and Capital Improvements Program
- Meet with Regional Board – June 27th
- Financial Plan/Rate Study
- Update application for state grants and revolving loan fund (interest rate currently 1.7%) and meet with SRF
- Start CEQA and natural resource agency review
- Predesign and final design of proposed improvements

Implementation Schedule

Task Description	2015	2016	2017	2018	2019	2020
Facility Plan						
RWQCB Meetings						
Predesign						
Final design						
Construction						
Start up						

Questions

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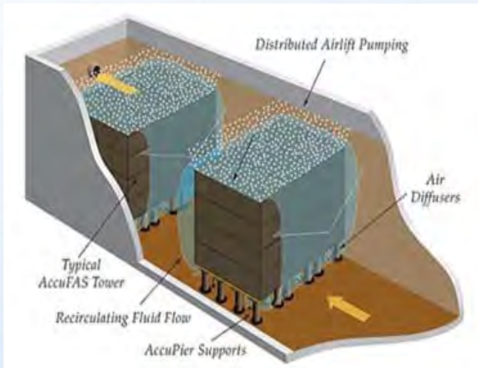
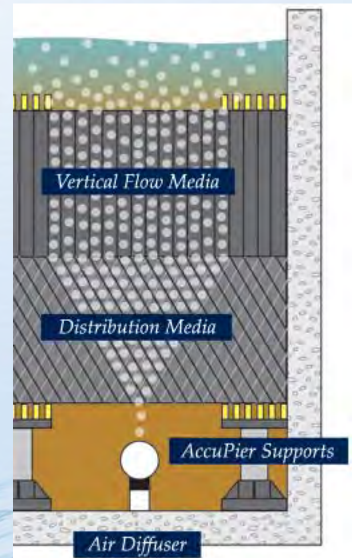
Submerged Fixed Film Technology (AccuFAS)





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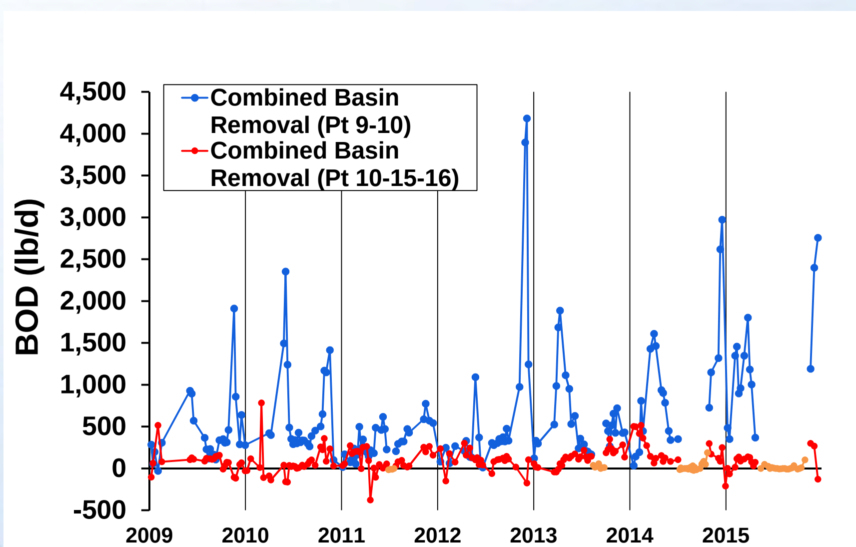
BOD Removal Due to Chlorination



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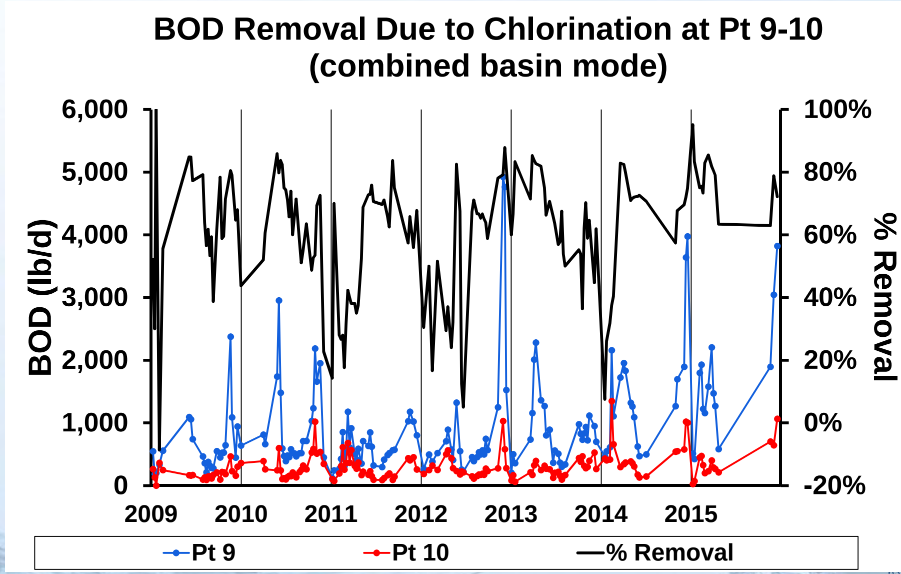
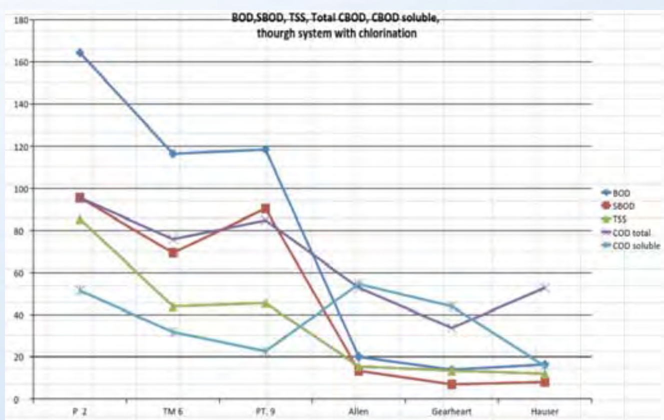
Chlorination impact on capacity



Chlorination has provided treatment capacity



- Average BOD Removal = 730 ppd
- 80th percentile BOD removal = 1080 ppd
- Max BOD removal = 4000 ppd

APPENDIX T – REPORT OF WASTE DISCHARGE (BY CITY) JANUARY 2017

CITY OF ARCATA

Supplemental Information for Report of Waste Discharge

NPDES Permit No. CA0022713 Renewal Application

January 2017

Table of Contents

Introduction

Operating in its current configuration since 1985, Arcata's natural land-based treatment system achieves many beneficial uses including improved water quality, wildlife habitat, and recreation. The dynamic and sustainable system promotes the community pride and involvement, educational opportunities, including local and international research, and sustainability. Driving factors for the future of the Arcata Wastewater Treatment Plant (AWTP) include environmental, economic and social responsibilities.

In 2012, the AWTP began operating under a new NPDES permit (Order No. R1-2012-0031) that specifically addresses several long-term issues regarding disinfection, treatment units and discharge locations. Due to past compliance issues, the permit required changes to be made to improve wastewater treatment, protect beneficial uses, increase energy efficiency and reduce chemical usage. Permit required changes included installation and start-up of a new ultraviolet light (UV) disinfection treatment unit, elimination of chlorine disinfection except for discharges greater than 5.9 MGD, and construction and start-up of new discharge location Outfall-003. In response to the permit required changes, the City initiated a Facility Plan and wastewater treatment plant improvement project to address several issues including ongoing NPDES permit violations and regulatory compliance, repair and rehabilitation of aging infrastructure, deferred maintenance of the natural treatment units, and capacity and treatment for dry and wet weather flows now and in the future.

Due to the growing complexity of the wastewater treatment plant improvement project, the City did not achieve compliance with the required start-up date of December 1, 2016 for the UV disinfection system or discharge from Outfall-003. This Report of Waste Discharge (ROWD) proposes compliance schedules for implementation of UV disinfection and discharge at Outfall-003 within the next five-year permit period. The Facility Plan and wastewater treatment plant improvement project identified several other issues which need to be addressed for the AWTP to consistently achieve compliance with its NPDES permit and meet community expectations and goals. The City is proposing changes and additional treatment to the current wastewater treatment system that will occur within the next permit cycle in an effort to improve system efficiency and overall water quality.

In addition to proposed compliance schedules and changes and additions to the treatment system, the City is proposing several changes to the NPDES permit including requests to modify specific permit limits and requirements.

A more thorough discussion of many of the topics in this document is found in the City of Arcata Facility Plan (June 2016).

CA0022713/Order No. R1-2012-0031 Compliance Requirements

The NPDES permit issued to the City in 2012 includes several regulatory requirements that affect the design and operation of the AWTP. The permit requires a new flow configuration, discharge point and a new disinfection treatment system. The permit requires all flows less than 5.9 MGD to be directed from the treatment wetlands directly to the enhancement marshes, eliminating chlorine disinfection prior to discharge to the enhancement marshes via Outfall-002 and increasing the percentage of flow receiving enhanced treatment in the enhancement marshes (Arcata Marsh and Wildlife Sanctuary (AMWS)). Outfall-003 is slated to be constructed in the brackish marsh at the north end of the Arcata Bay section of Humboldt Bay. The permit compliance date for flow reconfiguration, UV disinfection, and discharge to Outfall-003 was originally required by December 1, 2016.

The Facility Plan, which originated, in part, to address these compliance projects was initiated in early 2015 and an Administrative Draft Facility Plan was presented to City staff and the Arcata Marsh Research Institute in September 2015. During the course of evaluating the current treatment plant, compliance history and requirements, city council goals and community expectations, the City and consultant team identified several treatment and capacity concerns in direct relation to the required compliance projects, future capacity, on-going treatment and compliance issues, and aging infrastructure and deferred maintenance. A summary of the issues that arose from this initial workshop/presentation are provided below:

- Flow Reconfiguration and Wet Weather Flows

  The permit requires a new flow configuration and discharge point. With the new configuration, effluent flows will no longer discharge directly from the chlorine contact basin to Humboldt Bay through Outfall-001. Instead, disinfected enhancement marsh effluent will discharge through the future Outfall-003, which will serve as the new point of compliance. The permit requires all flows less than 5.9 MGD to flow through the enhancement marshes and disinfection system. Analysis of available modeling indicates that at flows as high as 5.9 MGD treatment capacity and resultant water quality may significantly decrease through the enhancement marshes. Further evaluation is necessary to determine the maximum continuous flow that can be treated through the enhancement marshes while still maintaining enhanced treatment.

  The permit Fact Sheet cites that the required treatment plant upgrades "will result in overall improvements to effluent quality discharged to Humboldt Bay because effluent will no longer be commingled; therefore all effluent of at least up to 5.9 MGD will receive enhanced treatment through the AMWS." Further, in Prohibition III.I "the discharge of treated effluent at Outfall 001 is prohibited, other than that portion of the flow exceeding peak flows of 5.9 MGD." This prohibition is effective upon activation of the UV disinfection system and discharge at Outfall-003. Flows greater than 5.9 MGD will either need to be attenuated in the oxidations ponds or discharged on an emergency basis through Outfall-001. Further, Regional Water Quality Control Board (RWQCB) staff has indicated that bypasses of wet weather flow around the treatment wetlands are an on-going issue that should be addressed in the wastewater treatment plant improvement project.

- UV Disinfection and Elimination of Chlorine Disinfection

  Since 2013 there have been approximately 21 permit violations for disinfection related incidents including disinfection by-products, chlorine residual, or adequate bacteria removal. The permit includes approval for construction of a new UV disinfection system, in place of the existing chlorine disinfection system. Implementation of UV disinfection will eliminate the compliance violations arising from disinfection byproducts; however, the existing natural treatment system has a very low UV transmittance (UVT), which impacts the sizing of the UV system needed to meet disinfection requirements.

  Additionally, during the course of investigating existing treatment performance and capacity, it was determined that the existing use of chlorine provides chemical treatment of BOD_5 and seasonal hydrogen sulfide. Eliminating the use of chlorine will result in a shortfall of BOD_5 removal capacity by between 600 to 1000 pounds per day.

- Secondary Treatment

  Ongoing permit violations of plant effluent limits for BOD_5 and TSS indicate the need for additional secondary treatment capacity. This compliance history, paired with the anticipated treatment capacity shortfall after removing chlorine disinfection and the potential need for additional treatment for flows which cannot be routed through the treatment wetlands and enhancement marshes supports the need for treatment beyond the capacity of the existing land-based natural system.

The Facility Plan proposes three options to address secondary treatment concerns. The recommended option is a parallel oxidation ditch treatment system to address treatment shortfalls and improve UVT. A second option includes rehabilitation of treatment wetlands and oxidation ponds to deal with legacy sludge loading, and improvements to these units to maximize secondary treatment in the existing land-based system. A third option is a hybrid of a smaller parallel oxidation ditch and existing land-based system improvements and rehabilitation. These first three options included limiting flow through the enhancement marshes to 2.3 MGD to prevent a degradation of water quality. During follow-up discussions with the RWQCB in June 2016 regarding flow routing, Board staff indicated that the permit required all flows less than 5.9 MGD to receive enhanced treatment through the enhancement marshes, or AMWS. In September 2016, the consultant team proposed a fourth treatment option which includes parallel treatment via an oxidation ditch, natural treatment system rehabilitation and UV disinfection upstream of the treatment marshes, with flow up to 5.9 MGD flowing through the treatment wetlands and enhancement marshes. A draft schematic of Option 4 is included in this application package for reference. Options 1-3 have been previously submitted to the Regional Board in the Facility Plan.

- Nutrients and Pollutants of Emerging Concern
  Ammonia, phosphorus and nitrate have been identified as constituents that the Regional Board will evaluate for inclusion in the next permit cycle. The natural treatment system provides good ammonia treatment during certain times of the year and adds ammonia to the system during other times of the year. The City recognizes that it needs to implement a consistent treatment solution for future limits for nitrogen compounds which are likely to be issued in the next permit.

  Constituents of emerging concern, including pharmaceuticals and personal care products are widely recognized in the wastewater industry as pollutants which will likely be evaluated for permit inclusion in the future, as technology for treatment and standardized test methods for these constituents in wastewater are developed. While monitoring requirements and limits for pollutants of emerging concern are not currently required, the City recognizes that maintaining treatment units and selecting new treatment units which may provide treatment of pollutants of emerging concern will benefit the community well into the future.

These concerns significantly widened the scope of the Facility Plan and wastewater treatment plant improvement project since it became apparent that significant permit non-compliance would occur if the permit-required changes were implemented absent corresponding secondary treatment and hydraulic capacity improvements. In April 2016, a public workshop was held to present the findings and recommendations of the Draft Facility Plan, followed by a public city council meeting on April 20th. The Draft Facility Plan was also presented on June 6th and 13th at public city council workshops. At these meetings, significant discussion took place regarding the use of the existing land-based natural treatment system and investing to improve it. The Facility Plan incorporates additional alternative evaluations and developments to address many of the comments received during these public meetings.

In fall 2016, an oxidation pond expert was retained to evaluate the feasibility of improving and rehabilitating the oxidation ponds to achieve consistent permit compliance with current and future effluent limits and discharge standards. Initial findings indicate that the existing pond system does not have sufficient capacity to meet permits limits. Additional baffling and aeration is suggested to improve treatment of dry season flows. However, the pond performance is anticipated to deteriorate significantly during wet season flows even with these recommended improvements. Final completion of the oxidation pond evaluation is pending.

On October 11, 2016 the City submitted a request for extension of the compliance date for activation of the UV disinfection system and implementation of discharges at Outfall-003. Upon discussion with the Regional Board it was indicated that an extension would not be issued. On January 1, 2016 the City submitted to the Regional Board N*otification of Violating or Threatening to Violate Permit Conditions Required by December 1, 2016* for failing to activate the new UV disinfection system, reconfigure flow to eliminate circular chlorination blending, and relocate primary discharge to Outfall-003 by the compliance date. The City anticipates that the Regional Board will issue a Time Schedule Order, either prior to or concurrent with issuance of the next NPDES permit.

Permit Compliance and Violations

The AWTP provides preliminary, primary and secondary treatment followed by disinfection. Preliminary and primary treatment facilities include influent pumping, mechanical bar screens, grit removal and primary clarifiers. Primary solids are sent to anaerobic digesters, sludge drying beds and sludge composting. Secondary treatment is accomplished through two oxidation ponds in series, followed by six treatment wetlands operating in parallel. Currently, secondary effluent is disinfected with chlorine gas and dechlorinated with sulfur dioxide gas prior to discharge. Under the existing flow configuration, for about 9 months every year, a portion of the treated effluent is sent to the enhancement marshes for enhanced treatment while the remainder is discharged to Humboldt Bay via Outfall-001. Effluent out of the enhancement marshes is returned to the chlorine contact basin for a second step of disinfection and dechlorination. The result is disinfected secondary effluent that does not receive all the enhancement benefits of the enhancement marshes and is chlorinated multiple times, increasing the opportunity for formation of disinfection byproducts above water quality objectives.

The NPDES Permit (No.CA0022713) and Waste Discharge Requirements Order (No. R1-2012-0031) were issued by the North Coast Regional Water Quality Control Board (RWQCB), and became effective on August 1, 2012. The permit was subsequently modified in 2015. The new permit enabled changes to be made to improve wastewater treatment, protect beneficial uses, increase energy efficiency, reduce chemical usage, and reduce the potential for permit violations.

The permit approves a new flow configuration and discharge point. Effluent flows will no longer discharge directly to Humboldt Bay (Outfall-001), but will be discharged after enhanced treatment in the AMWS. The new point of compliance and outfall (Outfall-003) will be to the brackish marsh adjacent to the AMWS, which discharges into a slough at the north end of the Arcata Bay portion of Humboldt Bay. The permit also includes approval of a new disinfection process using UV disinfection facilities prior to Outfall-003. Until the improvements are complete, the AWTP is operating under interim effluent limits for discharge to Outfall-001, which are essentially the same as the final compliance requirements for Outfall-003. Discharge requirements for the intermediate discharge point to the AMWS (Outfall-002) are also noted in the permit.

A review of available data for the current NPDES permit period (August 1, 2012 through November 30, 2016) was conducted to provide a summary of permit violations which have occurred under the current NPDES permit. The trend of permit compliance and violations are in line with those evaluated in the Facility Plan for the period of 2004 and 2011 indicating that long-term issues regarding disinfection and treatment units continue to be an issue for the aging AWTP.

Effluent limit violations at Outfall-001 are predominantly the result of exceedances of the effluent limit for dichlorobromomethane, a disinfection byproduct. Twenty-two permit violations for the disinfection byproduct were self-reported for the current NPDES permit period. Total Suspended Solids (TSS) are also an issue at Outfall-001. Twenty permit violations were self-reported for TSS during the permit period for violations of concentration-based, mass-loading based and percent reduction effluent limits. BOD_5 violations and chronic toxicity violations also occur at Outfall-001. During the current NPDES permit period seven effluent violations have been reported for both constituents. Additionally, permit violations have been reported for suspended solids, total residual chlorine, cyanide, fecal coliform, bis (2-ethylhexyl) phthalate, pH and 2,3,7,8-TCDD equivalents.

Violations of discharge standards at Outfall-002 also occur with some regularity. Seventeen permit violations were self-reported during the current NPDES permit period for exceedances of the discharge specifications for BOD_5 at Outfall-002. Additionally, one violation for suspended solids and four violations for total residual chlorine were self-reported for exceedances of the discharge specifications at Outfall-002.

Since August 2012 there have been at least 29 violations of effluent limits or discharge standards for disinfection byproducts, fecal coliform and total residual chlorine. Implementation of UV disinfection would eliminate the disinfection byproduct violations. Ongoing violations for BOD_5 and total suspended solids indicate the need for additional secondary treatment capacity beyond that of the existing natural system. A secondary treatment system that is capable of ammonia removal/nitrogen treatment may also be beneficial for meeting future permit limits for ammonia or nitrogen. Some violations may be reduced or eliminated with treatment plant improvement projects which will allow for flow attenuation, including total residual chlorine violations which may otherwise occur with the use of emergency discharges via Outfall-001 and settleable solids violations which occur when oxidation pond pumps and emergency storm pumps are used to maintain hydraulic capacity.

Capacity and Treatment Issues

Hydraulic capacity

Hydraulic capacity at the AWTP during wet weather periods is an on-going issue. Increased flows from inflow and infiltration (I&I) during wet weather periods contribute, on average, more than 1.47 MGD of extra flow to the treatment plant. Funding is currently being sought for $7 million of I&I work in targeted areas of the collection system, scheduled to begin in September 2017. Even with the scheduled I&I work hydraulic capacity in the oxidation ponds will continue to be an issue. In addition to I&I issues, rainfall on the natural treatment system can add significant flow to the system depending on the storm event. In calendar year 2016, for example, 44 inches of rain added an additional 95.8 MG of flow to the treatment plant in the form of rainfall catchment. During wet weather periods it is normal operation to use one to three oxidation pond pumps to move effluent directly from Oxidation Pond 2 to the chlorine contact basin (skipping the treatment wetlands). Occasionally, the AWTP utilizes the Oxidation Pond 2 Emergency Storm Pumps to direct an even greater volume from Oxidation Pond 2 directly to the contact basin. Regional Board staff have indicated the need to eliminate the use of oxidation pond pumps and emergency storm pumps for bypass of treatment wetlands except in the case of emergency when hydraulic capacity threatens to be insufficient to keep oxidation ponds from overflowing.

During a June 27, 2016 meeting, RWQCB staff indicated that the Basin Plan requires the entire treatment plant flow, up to 5.9 MGD, to receive treatment through the enhancement marshes as a condition of discharge to Humboldt Bay. However, as indicated at that meeting by City staff and consultants, the flow model available indicates that those treatment units do not have the capacity to treat flows as high as 5.9 MGD. Historically, a maximum of approximately 2.0 MGD flows through the enhancement marshes.

After start-up of the UV disinfection system and discharge to Outfall-003, flows exceeding 5.9 MGD will need to be attenuated or discharged, on an emergency basis, to Outfall-001. Using Outfall-001 for emergency discharge adds additional complications to the treatment process because although there is currently a chlorine and sulfur dioxide chemical dosing system in place for disinfection and dechlorination, it is a system that will be difficult to “mothball” until it is needed, and a new system will need to be engineered in order to provide a safe and reliable means of disinfection if flows cannot be attenuated.

During development of the Draft Facility Plan, anticipated community growth was a discussion item that needed additional evaluation. The City originally anticipated a 10 percent growth in the community based on the General Plan's redevelopment plans and planned growth at Humboldt State University. For the purposes of the Draft Facility Plan evaluation, a 10 percent growth was originally assumed. After further discussion with the City at the Council meeting on June 13, 2016, followed by input from the City's Community Development Director, the community growth is anticipated to be 20 percent from now through build out. Updates in the Facility Plan address this additional growth factor. Due to water conservation efforts seen in recent years, the growth is primarily anticipated to impact influent loading to the AWTP, and will not change the design flows.

Treatment Capacity

As noted earlier, the existing use of chlorine provides chemical treatment of BOD_5 and seasonal hydrogen sulfide. Eliminating the use of chlorine will result in a shortfall of BOD_5 removal capacity by between 600 to 1000 pounds per day. Meeting TSS effluent limits at Outfall-001 and BOD_5 discharge specifications at Outfall-002 has been increasingly difficult. Some evidence indicates that the legacy load, solids which have been accumulating in the natural treatment system over time, may be contributing to the BOD_5 effluent violations. Other evidence suggests that the drought and unusual weather patterns experienced in Arcata during the current NPDES permit cycle have been contributing to permit violations because the natural treatment system is sensitive to changes in weather. Regardless of the cause of permit violations, the on-going violations, in addition to the predicted BOD_5 treatment shortfall indicate the need for additional secondary treatment capacity.

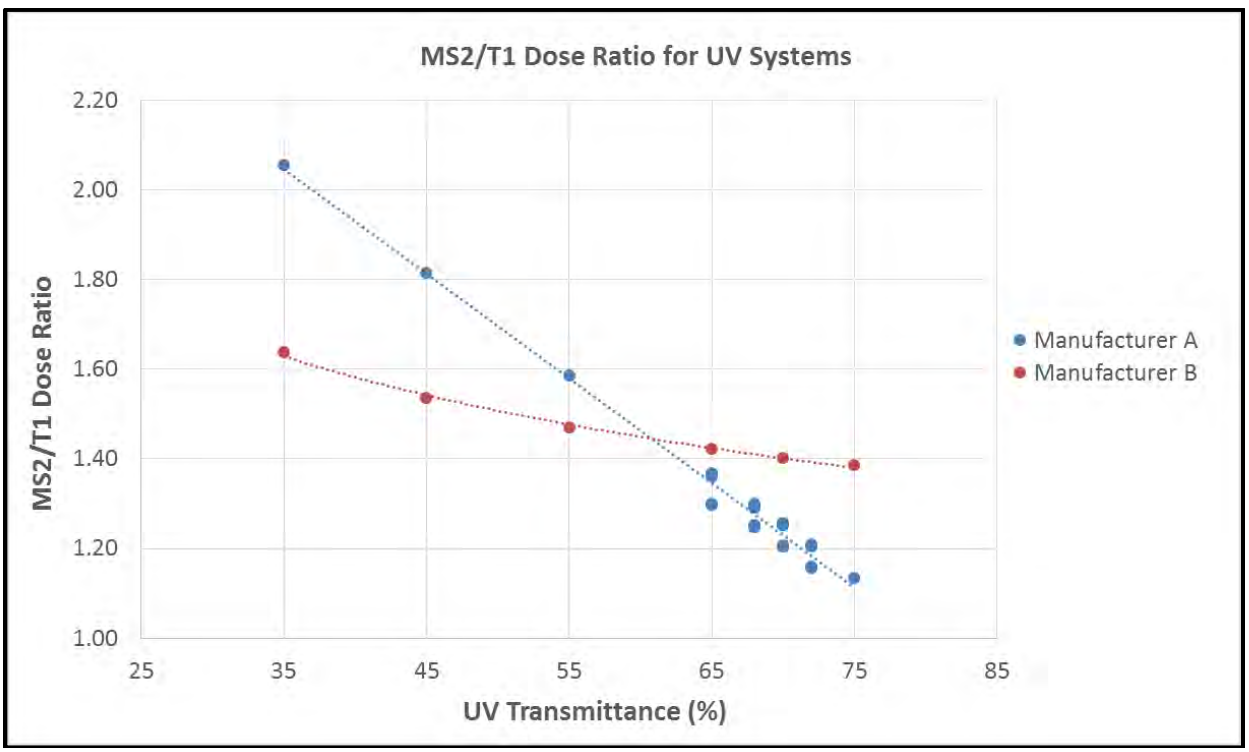
Nutrients such as nitrogen and phosphorus have been identified as potential issues. The North Coast RWQCB has recently implemented limits for these constituents for the City of Eureka and will probably be adding similar limits to other dischargers' permits. Arcata's current NPDES permit requires monitoring for ammonia and nitrate to determine the assimilative capacity of the receiving water for these nutrients and to generate background data for these constituents for a future Reasonable Potential Analysis. Board staff indicated that Arcata could expect an ammonia limit in their next permit (in 2017) similar to Eureka, based on the similar Humboldt Bay discharge. A Reasonable Potential Analysis will be conducted to develop the limit based on salinity, pH and other factors at the point of discharge. The current natural land-based treatment system does an excellent job of treating ammonia on a seasonal basis. Data shows that in the summer months virtually no ammonia is discharged from the treatment system. However, during the rest of the year ammonia levels are either stagnant or increasing from the internal load (plant die-off in the fall/winter). Inconsistent ammonia removal in the current system indicates that there is a need for reliable ammonia removal that is less dependent on weather and the natural land-based treatment process.

UV Disinfection Design Criteria

The first criterion for a design dose is that the discharge must provide bacteria reduction, specifically to meet the fecal coliform level required in the discharge permit. In an initial meeting with the RWQCB, City staff, and consultant staff on June 23, 2015, RWQCB staff indicated a specific concern about virus kill. The discussion focused on the disinfection of coliphage, but without any specific effluent target. In the second meeting with the RWQCB on June 27, 2016, there was discussion about a future virus reduction requirement. Virus reduction would require a higher design UV dose than for bacteria reduction alone. The City will need additional input from the State (RWQCB and Division of Drinking Water) on the design dose and disinfection objectives during preliminary design. The design dose discussion that follows is based on the current permit requirement for bacteria (fecal coliform) reduction.

To properly size a UV system, the dose must be determined for each target organism (bacteria and/or virus, in this case). Different organisms (e.g., bacteria, virus, and protozoa) have measurably different sensitivities to UV disinfection. For example, viruses tend to be more resistant to UV disinfection than bacteria. Much of the UV system validation work that has been completed to date has been for water reuse applications in California, where virus inactivation is the primary goal. For these applications, the ideal and recommended test organism is MS2 coliphage (MS2); however, using MS2 validation data for disinfection of bacteria results in potential under dosing since bacteria (coliforms) react differently to UV disinfection than MS2. Some manufacturers (Calgon Carbon, Ozonia, and Wedeco) have performed validation work using proven bacteria surrogates such as T1 coliphage (T1). For cases where manufacturers have not validated their system based on T1, MS2 validations can be allowed with some degree of conservatism. To account for the difference between the dose-response curves of the organisms, higher dose levels will be specified for systems validated with MS2. Based on systems that have been validated by Carollo using both MS2 and T1, the ratio between the two varies depending on the UVT and the reactor efficiency.

The figure below shows the MS2/T1 dose ratio for two different UV reactors that range between 1.63 and 2.06 at this project's design UVT of 35 percent. For the higher MS2/T1 ratio of 2.06, a T1 dose of 1.0 mJ/cm^2 is equivalent to an MS2 dose of 2.06 mJ/cm^2.



The first step is to address the permit limits. The permit requirement for the AWTP is a median fecal coliform concentration that should not exceed 14 MPN per 100 ml on a monthly basis and a daily limit that should not exceed more than 10 percent of samples exceeding 43 MPN per 100 mL. Previous UV studies of the enhancement marsh effluent have indicated the maximum marsh effluent fecal coliform concentration is in the 10,000 MPN per 100 mL range. Therefore, the UV system is required to provide a minimum 2.85 log reduction of fecal coliform to meet the permit limit of 14 to treat effluent from the natural system (Option 1 and 2). Typically, Carollo's recommended sizing approach is to design a UV system to disinfect fecal coliform to approximately one log below the permit limit; however, due to this project's already low permit limit, a half log will be added as a safety factor.

Using T1 as a surrogate for fecal coliform, and knowing that T1 has a similar UV sensitivity as fecal coliform, the proper dose for 2.85 log reduction of coliform can be determined. T1 has a UV sensitivity of 5 mJ/cm^2/log inactivation; a fecal coliform log inactivation of 3.35 (2.85 + 0.50 safety factor) thus represents a T1 dose of 16.75 mJ/cm^2. Converting this T1 dose to a MS2 dose using the MS2/T1 ratio of 2.06 from above, the validated MS2 dose will be 34.5 mJ/cm^2. Therefore, the specified MS2 dose for an equivalent log inactivation of fecal coliform is 35 mJ/cm^2.

For Option 3, a similar dose analysis is required for blended effluents from the natural system and the oxidation ditch/secondary clarifier treatment train. The fecal coliform concentration from the oxidation ditch/secondary clarifier effluent may be as high as 2,000,000 MPN per 100 mL range. Depending on the blending ratio, a typical fecal concentration from the blended effluents might be 1,000,000 MPN per 100 mL with a UVT of 50 to 55%. The dose analysis for this scenario results in a fecal coliform log inactivation of 5.35 (4.85 plus 0.50 safety factor) for a T1 design dose of 27.11 mJ/cm^2. However, T1 validation is generally limited to 5 log inactivation as anything above this is not reliable. Hence, for Alternative 3 an equivalent MS2 design dose of 50 mJ/cm^2 is specified.

The second step of the dose analysis is to address the RWQCB concerns regarding virus kill. As part of preliminary design, the dose necessary to reduce indigenous virus (measured as coliphage) in the UV effluent should be determined. This would be done with a collimated beam test on the enhancement marsh effluent, at dose values dependent on the desired test organism. There are two types of native coliphage in effluent, F-specific and somatic). F-specific (F+) coliphage has a similar UV sensitivity to MS2; therefore, recommended dose levels are 0, 5, 10, 15, 20, 30 and 40 mJ/cm^2. Somatic coliphage has a similar UV sensitivity to T1; therefore, recommended dose levels are 0, 2.5, 5, 7.5, 10, 15 and 20 mJ/cm^2. The current permit lists the required UV system dose as 50 mJ/cm^2, which may be based on protection of shellfish growing operations in Humboldt Bay. The Facility Plan proposes a dose of 35 or 50 mJ/cm^2, depending on which option is selected, based on site specific conditions.

The proposed location of the new UV facility is at the main WWTP site, near the existing chlorination facilities. This location allows for better safety and public access control but does add extensive piping requirements for the new Outfall-003 if disinfection is required for flows immediately preceding discharge. Alternatively, split compliance would allow complying with disinfection standards at the WWTP before conveying flows to the enhancement marshes and then discharge to Outfall-003. Once an alternative is selected, the City would appreciate discussions with the RWQCB regarding the feasibility of obtaining split compliance points in their NPDES permit for the new facilities.

Compliance and Construction Schedules

On August 1, 2012 the City began operating under a new NPDES permit which requires the City to complete several required modifications to the treatment plant no later than December 1, 2016. In general terms these conditions are activation of a new UV disinfection system, flow reconfiguration and relocation of primary wastewater treatment plant discharge to a new location, Outfall-003. Due to secondary treatment performance shortfalls and hydraulic capacity issues discussed previously, completion of the permit required projects must be completed in conjunction with a major secondary process wastewater treatment plant upgrade and reconfiguration for flow attenuation in order to achieve compliance with permit conditions and effluent limits.

On January 1, 2017 the City submitted to the Regional Board *Notification of Violation or Threatening to Violate the Permit Conditions Required by December 1, 2016*. The notification included updated project schedules for completion of a UV disinfection system and relocation of primary wastewater treatment plant discharge to Outfall-003. Upon further review and consultation with the Carollo engineering team the City is proposing changes to the project schedules for relocation of primary wastewater treatment plant discharge to Outfall-003 and construction of the UV disinfection system in this Report of Waste Discharge. Of the four treatment plant improvement project options identified in the Facility Plan at least one option has significantly different piping for Outfall-003 than the other options. Until a final decision has been made by the City, preliminary design and concurrent environmental review cannot begin. It has been determined that it is unrealistic to complete the Outfall-003 project in the fourth quarter of 2018, as proposed in the aforementioned notification, until a wastewater treatment plant improvement project option has been selected. The City is proposing that relocation of primary wastewater treatment plant discharge to Outfall-003 occur concurrently with activation of the new UV disinfection system. The proposed schedule is:

Predesign, and CEQA	6/30/2018
Design and Funding	6/30/2019
Begin Construction:	10/1/2019
End Construction:	10/1/2021
Begin Discharge:	1/15/2022
Attain Operational Level:	1/15/2022

A secondary treatment process capacity augmentation project is required to address the capacity shortfall of the existing processes, especially without the chemical treatment removal that occurs with chlorine disinfection, and ammonia treatment. As discussed previously, one alternative to secondary capacity augmentation is to upgrade the oxidation ponds with aeration or another technology to improve treatment capacity and realize ammonia treatment in the existing system. Alternatives to this include addition of an oxidation ditch for parallel treatment or a hybrid-system of a smaller oxidation ditch and improvements to oxidation pond treatment. To ensure compliance with effluent limits and discharge specification this project must be completed in conjunction with the UV disinfection system and relocation of the primary discharge point to Outfall-003. The proposed schedule for the secondary treatment capacity augmentation project is:

Predesign, and CEQA	6/30/2018
Design and Funding	6/30/2019
Begin Construction:	10/1/2019
End Construction:	10/1/2021
Begin Discharge:	1/15/2022
Attain Operational Level:	1/15//2022

Construction of Treatment Wetland 7 is also recommended in the Facility Plan. This project would convert an existing unused aquaculture pond into a new 2.3 acre treatment wetland, increasing the hydraulic capacity of the treatment wetlands from 1.8 MGD to 2.3 MGD. Roadblocks to the Treatment Wetland 7 project have included obtaining clarification from the U.S. Army Corp of Engineers on the status of the former aquaculture ponds as Waters of the U.S. or aquaculture ponds belonging to the wastewater treatment facility, and previous surveys which have found tide water goby in at least one of the aquaculture ponds.

Construction of Treatment Wetland 7 is anticipated in the near future. The City is in the process of obtaining a final decision by the Army Corp of Engineers. Additionally, an environmental DNA (eDNA) study conducted in 2016 found evidence tidewater goby is utilizing only spillway portions of the existing aquaculture ponds. The City is developing a plan to relocate tide water goby utilizing the former aquaculture ponds to the brackish water marsh, where identical eDNA was identified. Pending the final decision of the Army Corp of Engineers and permitting, the following schedule is proposed for this improvement project:

Begin Construction:	3/1/2018
End Construction:	10/31/2018
Begin Discharge:	11/1/2018
Attain Operational Level:	12/1/2020

Note a two year start up schedule will be required in order to allow adequate time for the wetland vegetation to become established and functional in providing treatment.

Solids accumulation in the oxidation ponds is affecting treatment and hydraulic capacity. Between one and two feet of solids in each pond is anticipated to need dredging or in-situ treatment. One wastewater treatment plant improvement option involves optimizing oxidation pond and treatment wetland performance to achieve better BOD_5 and TSS treatment and provide for ammonia removal in these treatment units. If this is deemed a feasible option and selected for construction, the oxidation ponds and treatment wetlands will be improved on a schedule similar to the schedule proposed for a secondary treatment process capacity augmentation project. If this option is not selected the City still plans on rehabilitating these treatment units to mitigate years of deferred maintenance and optimize performance. Rehabilitation will include reconfiguration of oxidation pond transfer structures, dredging or in-situ treatment of accumulated sludge in the oxidation ponds and treatment wetlands and vegetation removal in the treatment wetlands to improve flow distribution and storage capacity.

Solids accumulation and heavy vegetation growth in the enhancement marshes is also affecting treatment and hydraulic capacity in these treatment units. Vegetation maintenance, new baffles, and new inlet/outlet structures are anticipated in all three enhancement marshes in order to improve treatment and hydraulic efficiency and capacity. Improvement projects will be limited to those which do not significantly reduce water quality or habitat since the enhancement marshes are Waters of the State.

Rehabilitation of the natural land-based system will occur over the span of several years due in part to the number of treatment units that need rehabilitation and because only one unit can be taken offline for work at a time. Pilot projects and evaluation of rehabilitation options are currently underway. A rehabilitation and on-going maintenance plan will be continuously developed as this project proceeds. This improvement project is scheduled to begin in 2017 and continue through 2025.

2017 NPDES Permit

Enhanced Treatment through AMWS

Resolution No. 74-43, SWRCB Water Quality Control Policy for the Enclosed Bays and Estuaries of California, known as the Bays and Estuaries Policy, prohibits the discharge of municipal wastewater to enclosed bays and estuaries "unless the discharge enhances the quality of the receiving water above that which would occur in the absence of the discharge." In 1979, the State Water Board issued Order 79-20, in which it concluded that there was reasonable probability that the discharge of secondary, disinfected and dechlorinated effluent into Humboldt Bay, together with a treatment process which either created new beneficial uses or resulted in a fuller realization of existing beneficial uses, such as the marsh treatment process proposed by Arcata, could enhance the receiving water quality. The Order further concluded that enhancement required full secondary treatment, with disinfection and dechlorination of sewage discharge, compliance with any additional NPDES permit requirements issued by the Regional Board to protect beneficial uses, and the fuller realization of existing beneficial uses or the creation of new beneficial uses either by or in conjunction with a wastewater treatment project.

The current NPDES permit requires ongoing evaluation the enhancement marshes with the purpose of using the findings of the evaluations for "adaptive management to ensure the AMWS retains maximum treatment function while protecting beneficial uses". As previously discussed, currently available data indicates that the ability to provide enhanced treatment may significantly decrease at flows greater than what has historically been treated by these treatment units. Historically, the AWTP has provided enhanced treatment by treating less than 2.0 MGD through the enhancement marshes. This practice not only preserves treatment capacity but may also preserve habitat related beneficial uses of the water bodies.

It is the opinion of the City that a treatment plant improvement project which will produce effluent which meets full secondary treatment standards and provides for ammonia removal, along with the creation of additional beneficial uses through construction of the brackish water marsh may meet the definition of enhancement, as concluded by the State Water Board in Order 79-20. Based on this opinion, the City is requesting that the enhancement marshes be allowed to be operated at historical flow rates if further evaluation indicates that treatment capacity or beneficial uses of those water bodies would be negatively impacted by increasing flows through the treatment units.

Disinfection Process Requirements for UV Disinfection System

UV disinfection design criteria and operations and maintenance requirements cited in the current NPDES permit are based upon the National Water Research Institute validation testing from California Division of Drinking Water (formerly the Department of Public Health). As previously discussed, the Regional Board has expressed concern about virus inactivation because Humboldt Bay is an important oyster growing area for the state. However, design dose cited in the current permit is based on fecal coliform reduction. The City will need additional input from the State (RWQCB and Division of Drinking Water) on the design dose and disinfection objectives during preliminary design.

The City would like the Regional Board to consider a design dose of 35 mJ/cm^2 to 50 mJ/cm^2, depending on which treatment option is selected, as proposed in the Facility Plan and summarized above. The proposed design dose addresses conditions specific to the AWTP and concerns of both virus and bacteria inactivation.

Outfall-003 Receiving Waters Location

The City requests clarification to the receiving water at Outfall-003, the brackish marsh as defined in the current NPDES permit. For the purposes of Reasonable Potential Analyses which require salinity and other water quality inputs, clarification is sought on whether the receiving water is considered the point at which Outfall-003 discharges into the brackish marsh, the point at which the constructed brackish marsh drains into Humboldt Bay or another location.

Municipal Designation of Humboldt Bay

The Water Quality Control Plan for the North Coast Region (Basin Plan) designates a beneficial use of municipal and domestic supply (MUN) to Humboldt Bay. The Basin Plan implements State Water Resources Control Board Resolution No. 88-63, which establishes state policy that all waters, with certain exceptions, should be considered suitable or potentially suitable for MUN. It is noted that for the permit issued to the City of Eureka in 2016 (R1-2016-0001) an evaluation of the salinity of Humboldt Bay in the vicinity of the discharge point was found to exceed the threshold salinity of 5,000 µS/cm and therefore the MUN designation was not applied. The City requests evaluation of the exceptions to Resolution No. 88-63 as they pertain to Humboldt Bay in the vicinity of Outfall-001 and Outfall-003 and seeks to have the MUN designation removed from the listed beneficial uses for the receiving water in the next NPDES permit.

The City additionally requests that all language referencing the MUN designation be removed, or modified, should the Regional Board find that Humboldt Bay meets and exception in Resolution No. 88-63, including removal of monitoring requirements for pollutants for which the Division of Drinking Water has established Maximum Contaminant Levels at Title 22, Division 4, Chapter 15, sections 644431 and 64444 of California Code of Regulations.

Chronic Toxicity

On August 25, 2016 the City submitted to the RWQCB a letter requesting modification of the Monitoring and Reporting Program allowing for ammonia removal. In that request the City asked that specific language be added to Monitoring and Reporting Program Section V. Whole Effluent Toxicity Testing Requirements which provide provisions for allowing the City to demonstrate that effluent toxicity is caused by ammonia because of increasing test pH when conducting the toxicity test. The City is requesting that the Regional Board review the modification request and consider implementation of the request in the next permit cycle.

The City would like to retain the ability to choose between a variety of fresh water and salt water test species for Whole Effluent Toxicity monitoring.

Option for Split Compliance

The LACO/Carollo consultant engineering team presented the City with four treatment plant improvement project options. Draft option four proposes parallel secondary treatment utilizing the existing natural land-based treatment system and an oxidation ditch. Effluent for both processes would be blended prior to UV disinfection at Outfall-002. The entire disinfected flow would receive treatment through the enhancement marshes prior to discharge to the brackish marsh at Outfall-003.

Although further investigation is necessary before this option can presented alongside the other three options for final selection, the City would like the RWQCB to consider the option of “split” compliance if this treatment option proves feasible and is accepted by the city council for construction. Under “split” compliance some effluent limits which are scheduled to be monitored at Outfall-003 would be monitored at Outfall-002. At a minimum, the City would request permit limits for fecal coliform to be applied at Outfall-002.

Wet Weather Calculation of Mass Limits

Mass-based effluent limits are based on the dry weather design flow of 2.3 MGD and technology-based effluent limits for BOD_5 and TSS. The current permit allows for the actual daily average effluent flow rate to be used in lieu of the dry weather design flow rate during wet weather periods when influent flow exceeds dry weather design flow. However, when the actual daily average effluent flow rate exceeds the average wet weather design flow (5.0 MGD) the average wet weather design flow is the maximum flow rate that may be substituted for the dry average design flow for wet weather mass-based effluent limit calculations.

Due to the nature of the mass-based effluent limit formula when flow exceeds 5.0 MGD, the concentration of BOD_5 or TSS in the effluent must be lower than the technology-based effluent limit for the constituent. Mass-based effluent limits become increasingly harder to meet as effluent flow increases. The City is requesting that the permit language be modified to allow for actual daily effluent flow to be used in the wet weather calculation of mass limits. If this is not an acceptable request, the City would like the Regional Board to consider allowing flows up to the peak wet weather design flow of 5.9 MGD to be used in the formula during wet weather conditions.

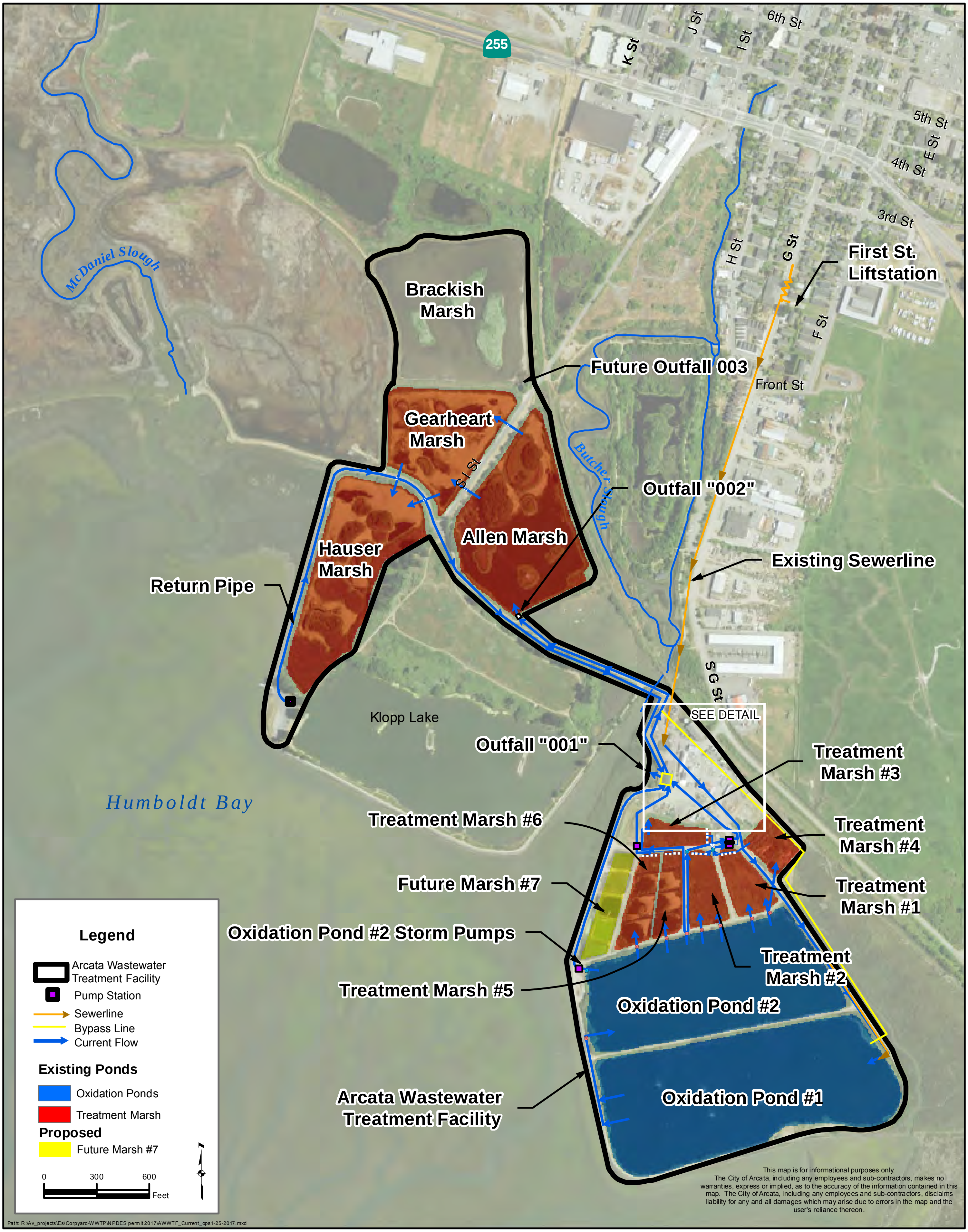
Percent Removal Limits

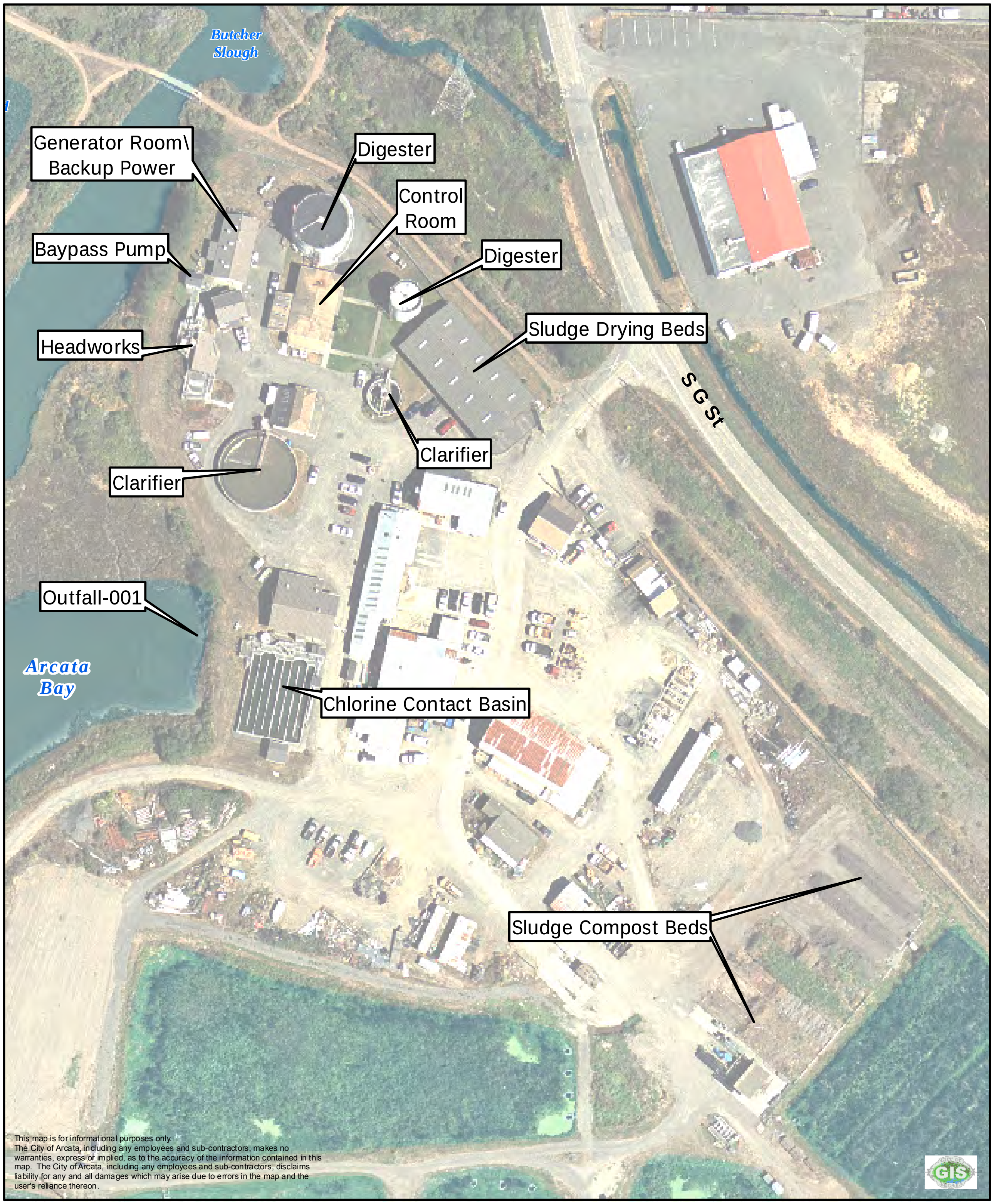
Secondary treatment standards set minimum standards of 85 percent removal for BOD_5 and TSS. Percent removal is based on the difference between weekly influent and effluent concentrations, averaged over each calendar month. The minimum percent removal for interim Outfall-001 and Outfall-003 is 85 percent for BOD_5 and TSS.

During wet weather periods influent flow at the AWTP can increase dramatically depending on ground saturation conditions and rainfall. Influent BOD_5 and TSS concentrations during these periods are often diluted to a concentration much lower than average, making it difficult to meet the 85 percent removal requirements for BOD_5 and TSS despite having effluent concentrations which are well below the technology-based effluent limits. This situation is aggravated by significant rainfall on the 80 acres of ponds and wetlands which can add several million gallons per day to the plant flow during high rainfall events. The Fact Sheet for the current permit cites that secondary standards can be achieved at interim Outfall-001 in association with enhanced treatment in the enhancement marshes, however, as previously discussed, flow to the enhancement marshes is currently limited by pump capacity and there is data that shows that wet weather volumes may actually reduce treatment capacity in the enhancement marshes.

The City is requesting that wet weather allowances be made for percent removal requirements during periods when the influent flow exceeds the dry weather design flow of 2.3 MGD. During periods when the influent flow exceeds 2.3 MGD the City proposes that a 65 percent removal apply at interim Outfall-001 and Outfall-003 based on equivalent to secondary treatment standards.

Current Operations
Arcata Wastewater Treatment Facility





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City of Arcata
Environmental Services

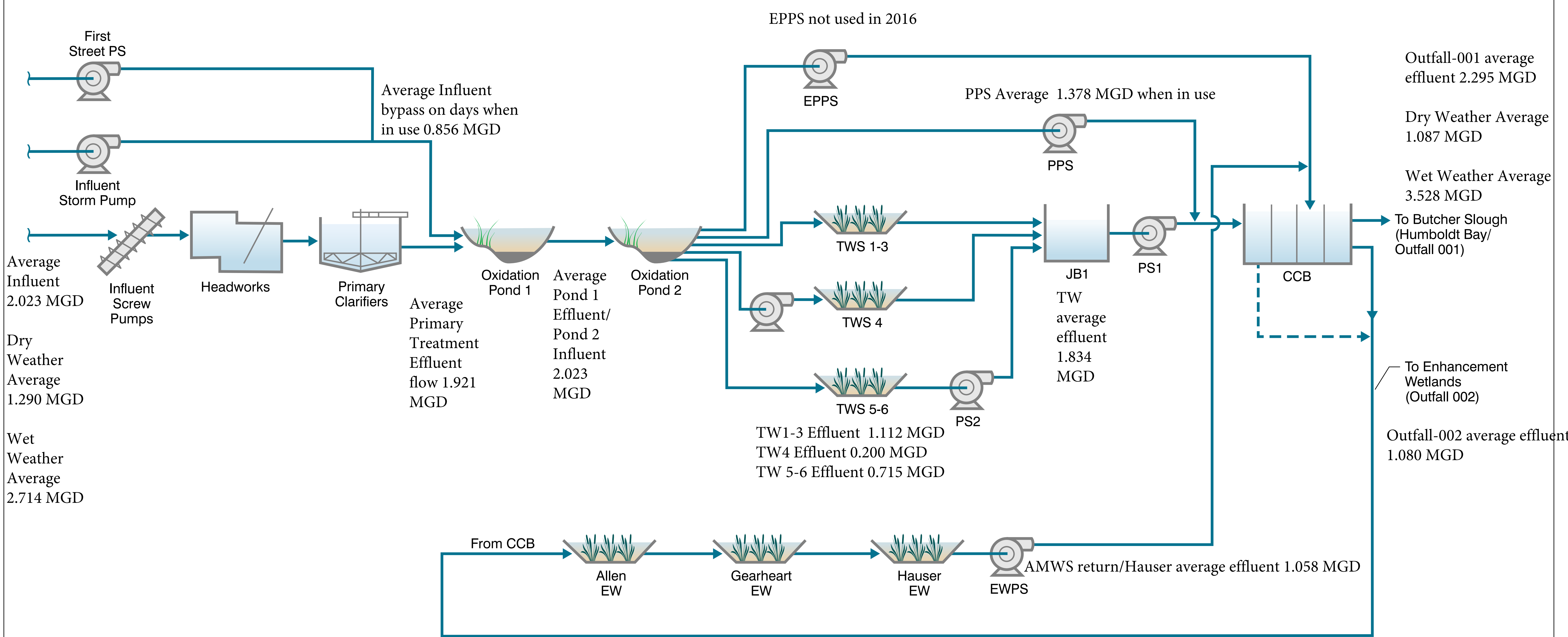
Arcata Wastewater Treatment Facility Detail

NORTH

0   40 Feet

Flow estimates based on 2016 calendar year data

2016 Total Plant Influent 738.395 MGD. Direct rainfall on AWTP 44.12 inches = 95.842 MG added rainfall = 0.527 MGD of added rainfall during wet weather season



EXISTING AWTF FLOW SCHEMATIC

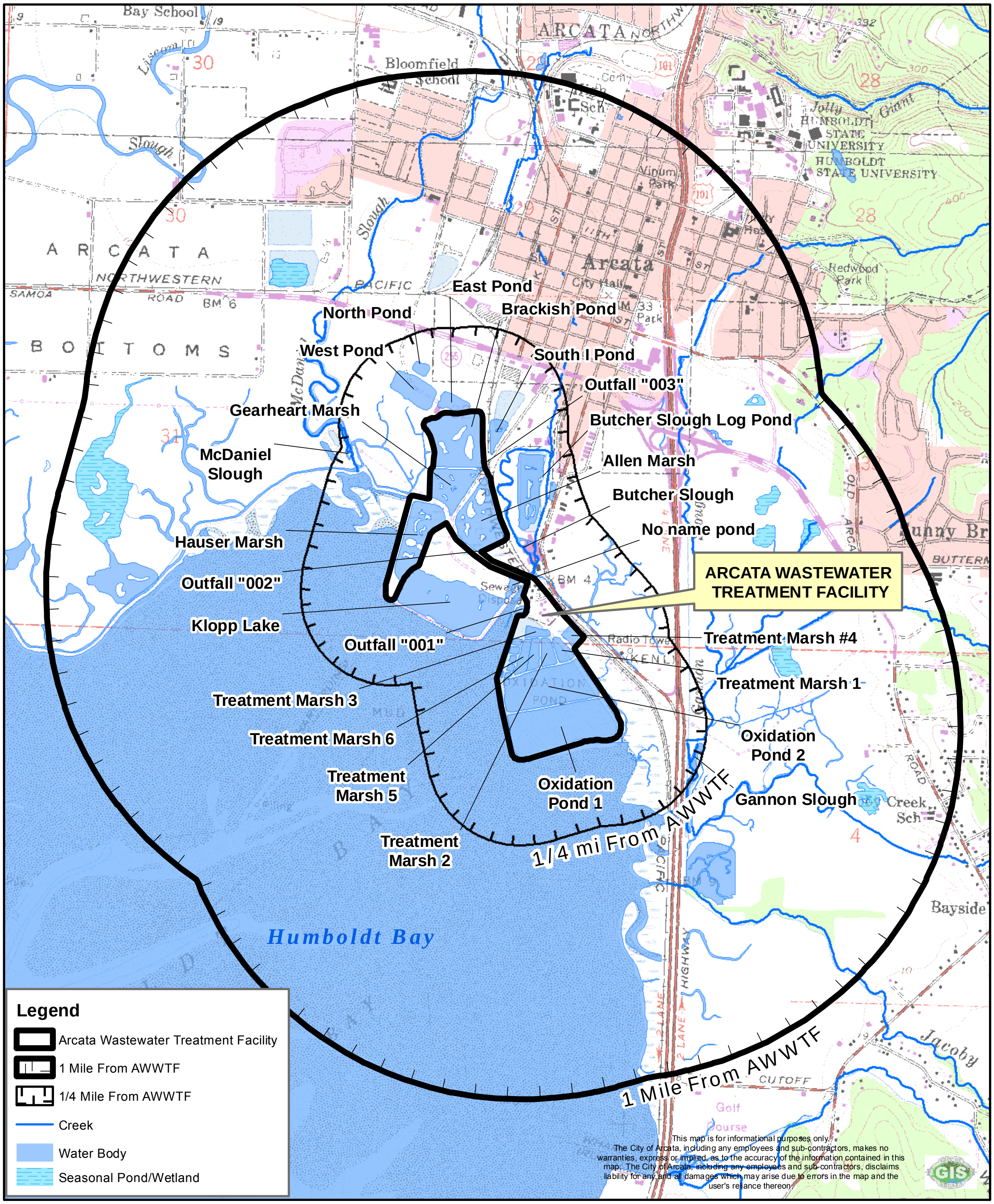
FIGURE 4.2

CITY OF ARCATA

WASTEWATER TREATMENT FACILITY IMPROVEMENTS PROJECT

arc0915f3-9913.ai

carollo



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City of Arcata

Environmental Services

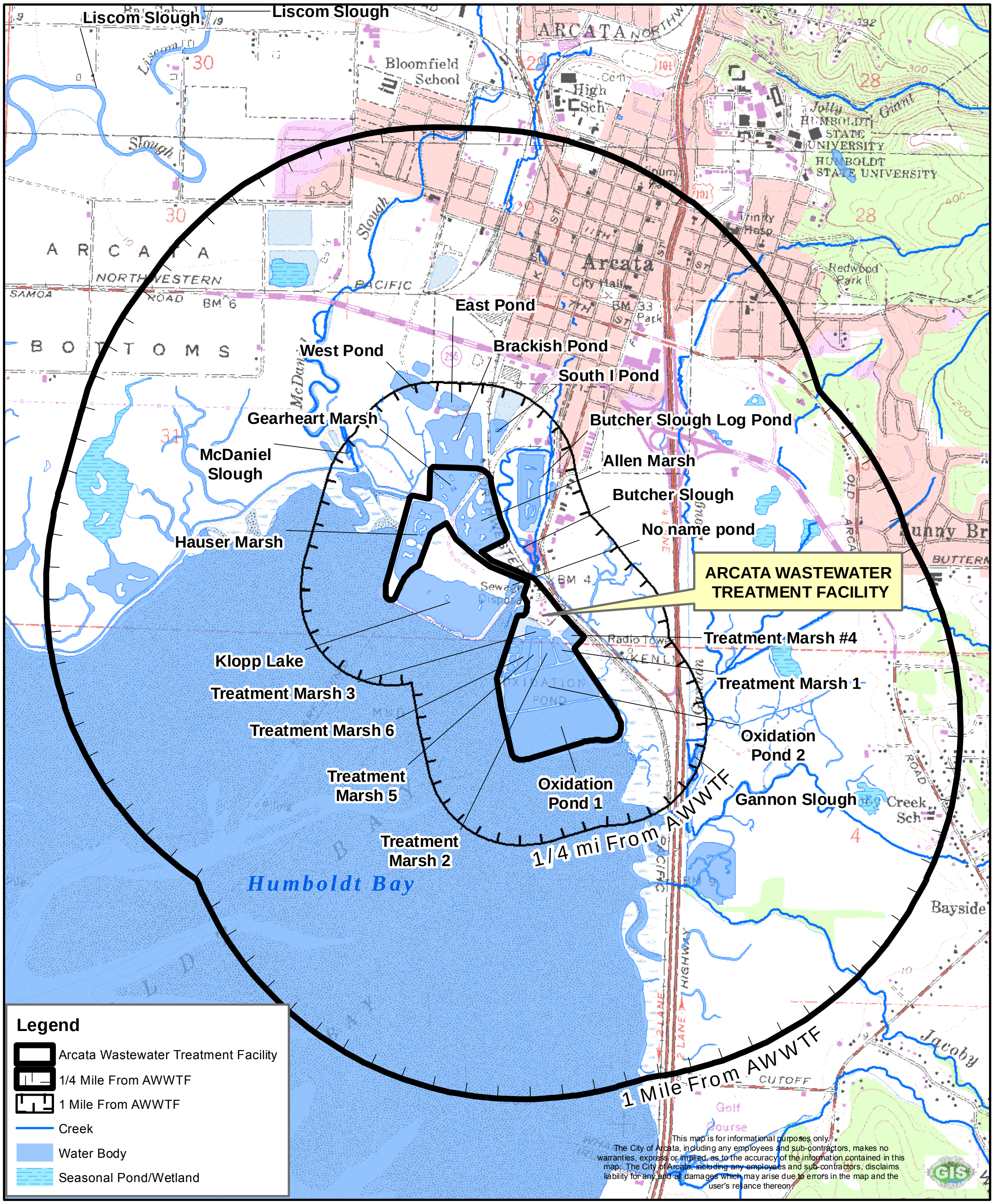
Arcata Wastewater Treatment Facility Topographical Map

U.S.G.S. 7.5 Minute Topographic Map: Arcata South Quadrangle

Section 32 of T.6.N., R.1.E. of H.B. & M.

NORTH

0 1,000 Feet



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City of Arcata

Environmental Services

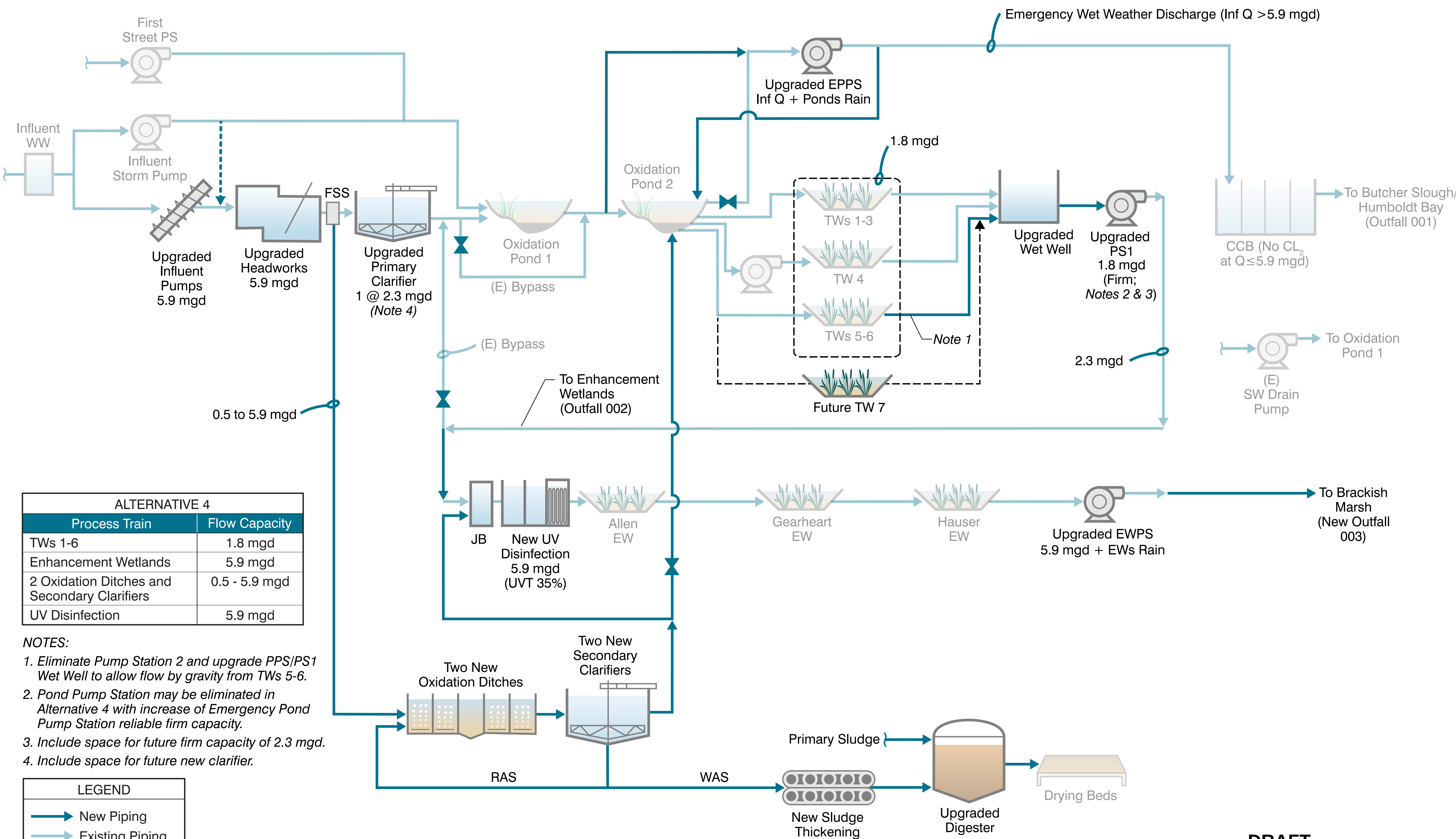
Arcata Wastewater Treatment Facility Topographical Map

U.S.G.S. 7.5 Minute Topographic Map: Arcata South Quadrangle

Section 32 of T.6.N., R.1.E. of H.B. & M.

NORTH

0 1,000 Feet



ALTERNATIVE 4	
Process Train	Flow Capacity
TWs 1-6	1.8 mgd
Enhancement Wetlands	5.9 mgd
2 Oxidation Ditches and Secondary Clarifiers	0.5 - 5.9 mgd
UV Disinfection	5.9 mgd

NOTES:

1. *Eliminate Pump Station 2 and upgrade PPS/PS1 Wet Well to allow flow by gravity from TWs 5-6.*
2. *Pond Pump Station may be eliminated in Alternative 4 with increase of Emergency Pond Pump Station reliable firm capacity.*
3. *Include space for future firm capacity of 2.3 mgd.*
4. *Include space for future new clarifier.*

LEGEND

- New Piping
- Existing Piping
- Normally Closed Valve

DRAFT
PROPOSED ALTERNATIVE 4
FLOW SCHEMATIC

CITY OF ARCATA
WASTEWATER TREATMENT FACILITY IMPROVEMENTS PROJECT

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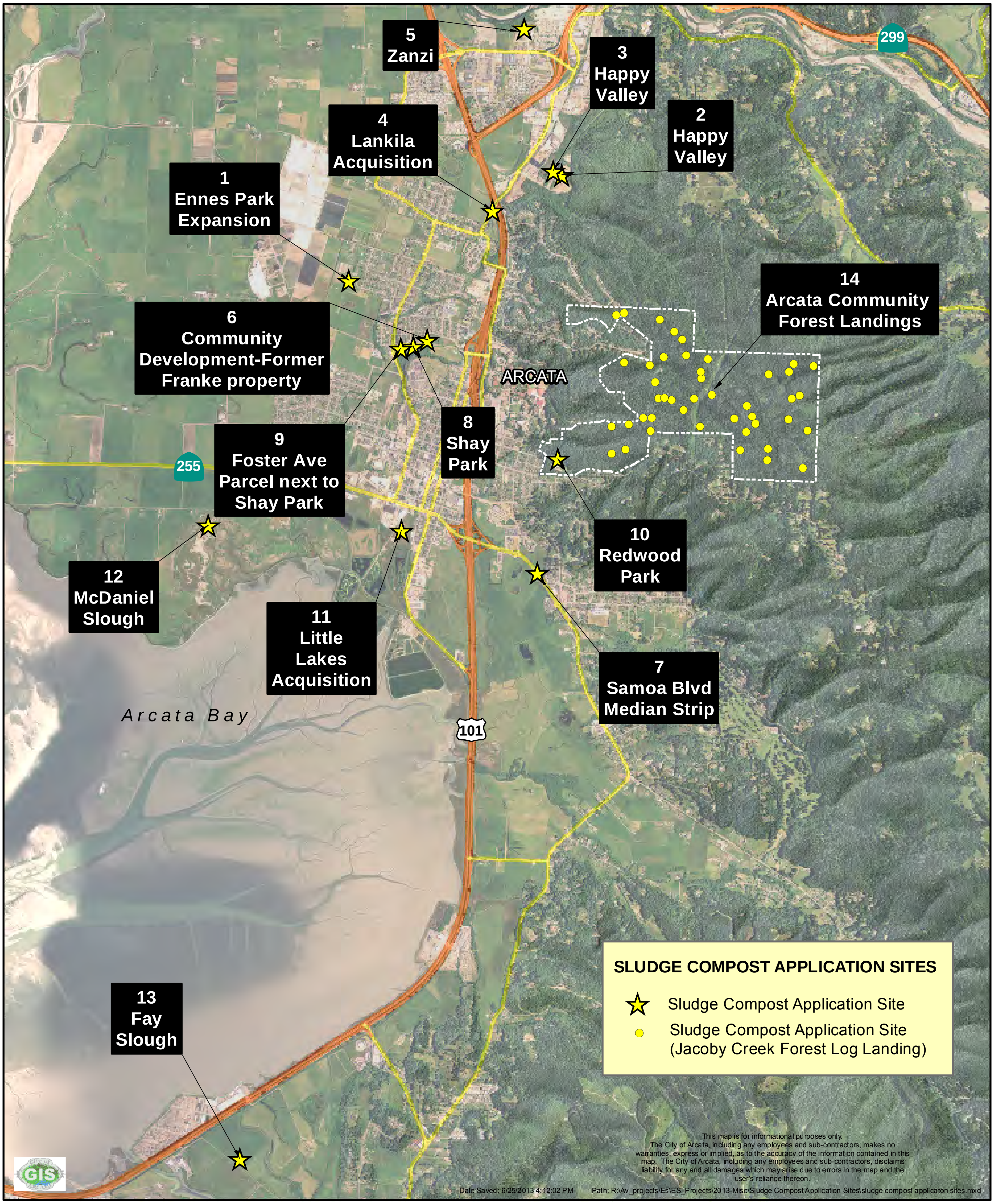
carollo



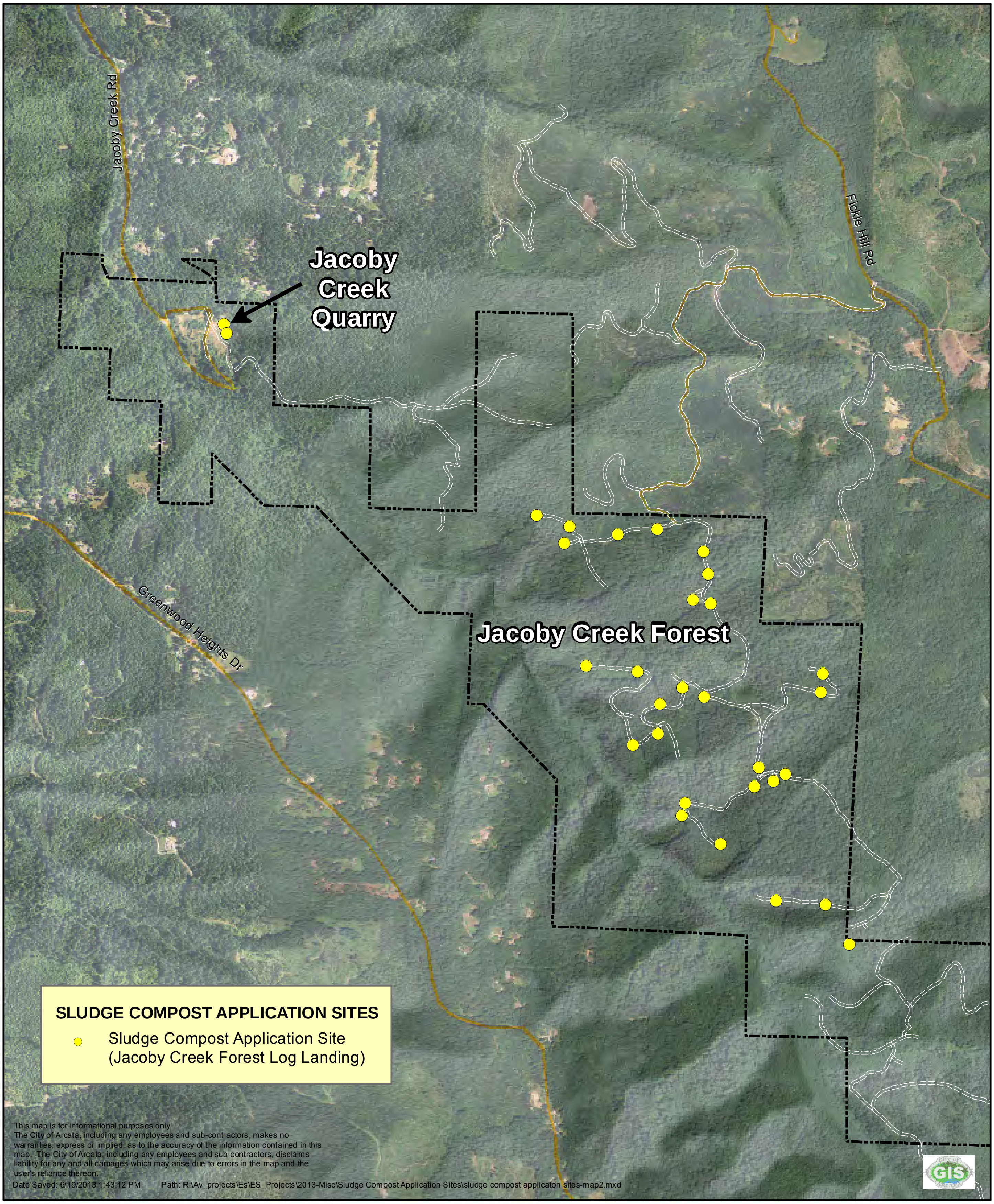
City of Arcata
Environmental Services

Sludge Compost Application Sites

Map 1 of 3

NORTH

0 0.25 0.5 1 Miles



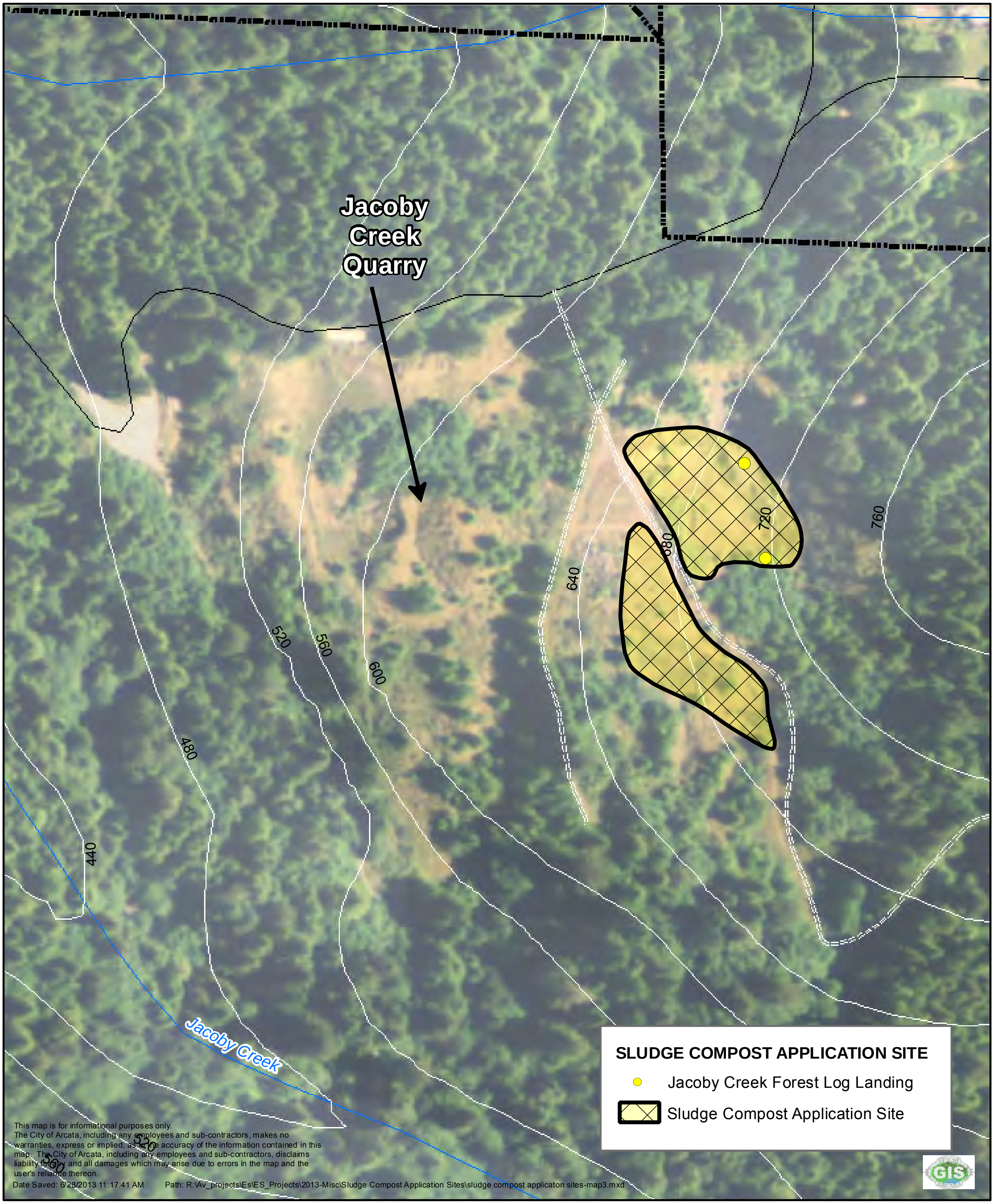
City of Arcata
Environmental Services

Jacoby Creek Forest
Sludge Compost Application Sites

Map 2 of 2

NORTH

0 1,000 2,000 Feet



City of Arcata
Environmental Services

Jacoby Creek Forest Quarry
Sludge Compost Application Site

NORTH

0 100 200 Feet

APPENDIX U – PERFORMANCE REVIEW – JOE MIDDLEBROOKS FEBRUARY 2017

Performance Expected and Operational Requirements for the Arcata, CA, Wastewater Treatment Facility

By

E. Joe Middlebrooks, PE, PhD, BCEE

After reviewing several possible modifications to the Pond system at Arcata, CA, it was decided that the most feasible and dynamic approach is to use Pond 1 as an equalization basin and divide Pond 2 into two cells designed as partial mix aerated ponds (Ponds 2A and 2B). With control of the I/I in Pond 1, coupling the ponds with the upgraded wetlands should provide an effluent quality that will meet the proposed regulatory requirements. The system could perform well for many years at the proposed average flow rate of 2.3 mgd after the I/I problems are controlled or solved.

Following are presentations discussing the proposed design and operational requirements to make the system successful. All results are based on information and data provided by the City of Arcata and information found in the report by Carollo Engineering.

Discussions of several performance situations are presented in the following sections. A summary of the most severe controlling situation at the average design flow of 2.3 mgd will be presented first.

Worst Case Scenario

It seemed best to start with the likely severe design load that will enter Pond 2A during average design flow. The expected performance for the worst case scenario for the design of Ponds 2A and 2B receiving a flow rate of 2.3 mgd is shown in Table 1. It is assumed that Pond 1 will serve as an equalization pond, and that the equalization pond will not remove any BOD or ammonia-N, transferring the entire load from the clarifier to Pond 2A.

The greatest stress on Ponds 2A and 2B will occur when the water temperature is 6 degrees Celsius and microorganism growth rate is at its lowest.   BOD removal in Pond 2A and Pond 2B should average approximately 70 and 27 mg/l, respectively. Ammonia-N conversion to NO_3-N likely will be minimal in Pond 2A, but it is expected that the effluent from Pond 2B will contain between 4 and 6 mg/L at the 2.3 mgd flow rate and an influent ammonia-N concentration of 55.2 mg/L. Theoretical calculations and experience with aerated ponds indicate that this level of ammonia conversion is feasible at 6 degrees Celsius (Gearheart, 2016).

Maximum power requirements as shown in Table 1 will be controlling in both cells during the warm months because of the lower solubility of oxygen at higher temperatures. The power requirements shown in Table 1 are produced by a design program that determines the controlling oxygen demand (Middlebrooks, 2005).   The requirements during the cold months will be less because of the increase in solubility of oxygen and the reduced BOD and ammonia-N removed. Automated equipment should be installed to reduce the operating time for aerators used during the cold months and when power requirements might be lower after dilution of the influent during the rainy season.

During the summer and fall seasons when the flow rate is approximately 1.6 mgd, the aeration power requirements will be much less; therefore, it is essential that the aeration system be designed for control of each aerator. This will not only reduce the power consumption, but also provide better control of system performance.   As pointed out above for Pond 1, the operators must be fully committed to good operation, be well informed and receive good training. There is no substitute for good operators.

As pointed out in Table 1, the power requirements are estimates that require refinement by equipment manufacturers; however the kg O_2/hr requirements must be provided by the equipment suppliers. The kg O_2/hr requirement is based on the environmental and microorganism requirements.

Based upon experience, it is best to install larger numbers of smaller aerators rather than fewer larger aerators. This approach provides better mixing, and when one or more are out of service, the power level is less affected.

Alkalinity Requirement

Because of the low concentration of alkalinity (approximately 60 mg/L) in the wastewater, to ensure good conversion of the ammonia-N to nitrate-N it will be necessary to add alkalinity to Ponds 2A or 2B. The calculation of the alkalinity needed is shown in Table 2. The adjustment to pH normally observed in facultative or lightly aerated ponds due to growth of algae will be much less prevalent than in facultative ponds and in partial-mix aerated ponds; therefore, there will be a need to supplement the limited supply of alkalinity in the wastewater. There will be a reduced concentration of algae in the aerated ponds that might help buffer the wastewater, but it is necessary to maintain the pH at 7 to maximize ammonia-N conversion.

During the summer and fall when the flow rate averages approximately 1.6 mgd, the needed alkalinity will be less, and the dosage will vary with the influent ammonia-N concentration and the influent flow rate. The influent alkalinity will vary significantly with the seasons; therefore, careful monitoring of the influent alkalinity will be needed to control costs for chemicals.

With an influent alkalinity of 60 to 100 mg/L there would be enough to convert approximately 8 to 14 mg NH_4/L to NO_3-N, respectively. Using all of the alkalinity would reduce the pH value below 7, the optimum for conversion.

Alkalinity also will be required with a carousel activated sludge process. If this was mentioned in the Corolla report I overlooked it.

Influence of I/I

As the flow increases during the rainy season, the performance in Ponds 2A and 2B will be significantly influenced by the control of the water transferred from Pond 1. Assuming good control of discharges from Pond 1, the pond system could produce a good quality effluent; however, the impact of solids washout into Pond 2A could be problematic with the first large surge of influent. Without diligent control of transfer of wastewater from Pond 1, the most dramatic effect on Ponds 2A and 2B will occur when a large rainfall occurs and washes the solids from Pond

1 into Pond 2A. Solids in Pond 1 are not similar or biologically active as those in Pond 2A and would dilute the active mass of organisms in Pond 2A. By controlling discharge from Pond 1 as diligently as possible, the system should function reasonably well throughout the year. It is imperative that washout of the active mass of solids be controlled constantly. It is essential that the operating staff be trained and educated about the urgency of flow control, and then monitor the system constantly.

With dilution of large inflow, the effects should not overwhelm the system provided the suspended solids in the pond ae not reduced to the point of biological inactivity. Also, the dramatic effect on the hydraulic retention time would significantly affect the efficiency of the system. Control of the depth of water in Pond 1 is critical if Ponds 2A and 2B are to function adequately during the rainy season. An automated depth control device is essential.

Storage Available

Normal operation of equalization ponds recommends that the depth of the pond not be drawn down below two feet to prevent odors. Following this advice, at a pond depth of 5.5 feet the volume in Pond 1 is approximately 45 MG, and at a depth of 2 feet the volume is approximately 16 MG. This leaves 29 MG for storage, which provides adequate room to control the discharge from Pond 1 if careful monitoring is exercised. Because the high rainfall occurs during the cool months, it is likely that odor control should not be a problem. Although redundant, it cannot be over emphasized that careful control of Pond 1 will determine how well Ponds 1, 2A and 2B perform; therefore, as stated above, automatic level control is highly recommended.

Impact of High Flow Rates

Flow Rate = 4.3 mgd

Assuming that the influent flow rate to Pond 2A is increased to 4.6 mgd and the BOD reduced by 50 percent, the effluent BOD would be less than that observed for the worst case scenario as shown in Table3. If the ammonia-N entering Pond

2B were also reduced to half of the influent to Pond 2A, the performance should also be equal to the worst case or less. These assumptions require a serious caveat: The accuracy of these projected effluent concentrations is dependent on to what degree the suspended solids in Ponds 2A and 2B are washed out. Doubling the flow to 4.6 with the diluted wastewater by very careful introduction of wastewater from Pond 1 that did not reduce the suspended solids concentration in the aerated pond, by more than 5 to 10 %, the performance predicted in Table 3 would likely produce an effluent quality similar to that shown. However, with aerated pond suspended solids reductions beyond the 5 to 10 %, the reduction in efficiency likely will be directly proportional to the percentage that the solids are diluted in Ponds 2A and 2B. As mentioned below, the success of the proposed system is directly related to the degree of success with controlling the discharge from Pond 1.

Flow Rate = 5.9 mgd

Assuming an influent flow rate of 5.9 mgd and dilution of the pond influent BOD and ammonia-N by a ratio of 2.565 (5.9 MGD/2.3 MGD), the design concentrations for BOD and ammonia are 71 and 21.5 mg/L, respectively. The results of this analysis are shown in Table 4. All of the concerns apply here that were expressed in the caveat in the 4.3 mgd section. Also, there are concerns about the significant increase in flow rate that would wash out an excess quantity of suspended solids in Pond 2A unless there is careful control of discharge from Pond 1.

Projected Performance

Diligently implementing the above suggestions, the total system could produce effluent concentrations as follows: BOD < 30 mg/L, TSS 30 to 40 mg/L, ammonia-N 4 to 6 mg/L, and a pH value 7.0. The system could provide an effluent that will meet the regulatory requirements for the 20% growth projected for Arcata.

Recommendations and Comments

1. **Use Pond 1 as an equalization basin and divide Pond 2 into two cells of equal volume and designed as partial mix aerated ponds as described in this report (Ponds 2A and 2B).**
2. **Practice diligent control and use the recommendations for the pond system, and the system coupled with the upgraded wetlands could satisfy the anticipated effluent standards for many years.**
3. **Correct the I/I problem and the entire treatment system will function well without the careful control of Pond 1, and will provide treatment for the projected 20% growth to an average flow rate of 2.3 mgd for many years.**
4. **Install control equipment that will provide flexibility in control of depth in Pond 1. This is essential to ensure good performance in Ponds 2A and 2B.**
5. **Install aeration equipment with controls that will provide flexibility in operation during all seasons of the year.**
6. **Install chemical feed equipment to add alkalinity to Pond 2A with controls that will provide flexibility in operation during all seasons.**
7. **Maintain a minimum pH value of 7.0 in Ponds 2A and 2B.**
8. **Provide excellent training for the operators. Careful operation is required for peak performance from the pond system and other components of the system.**

References

Gearheart, Robert and Swanson, Chuck. 2016. Facultative Oxidation Pond Aeration, Project Description, EIT, AMRI, January 15, 2016.

Middlebrooks, E. Joe. 2005. Program for Partial-Mix Aerated Wastewater Stabilization Pond Design, With Known Temperature and Hydraulic Detention Time.

Table 1. Expected treatment in Pond 2A and 2B at design flow rate of 2.3 mgd at various water temperatures when Pond 2 is divided into two equal cells.

Assuming Pond 1 Does Not Remove any BOD or NH3-N. (Worst Case Scenario). Design based on average design flow rate of 2.3 mgd , and assuming 30% BOD removal in primary tank influent of 260 mg/L.

Water Temperature Degrees Celsius	Pond 2A Effluent BOD Flow Rate = 2.3 mgd Inf. BOD = 182 mg/L mg/L	Pond 2A Dissolved Oxygen Requirement for BOD Without Correction for Equipment Efficiency[a] kg O_2/hr[b]	kW Required In Pond 2A for BOD at 2.3 mgd kW[b]
6	69.38	153.56	80.82
10	63.41	156.95	82.61
15	56.32	160.06	84.24
20	49.68	161.98	85.25
25	43.56	162.92	85.75
30	37.97	163.12	85.85
35	32.93	162.74	85.65

[a]Excludes correction for equipment efficiencies , but Includes environmental corrections and multiplying factor of 1.5 for BOD removal.

[b]Controlled by Summer Temperature.

[c]These power req. are approximate values and are used for the preliminary selection of equipment. These values are used in conjunction with equipment manufacturers catalogs to select the proper equipment.

Table 1 Cont. Expected treatment in Pond 2A and 2B at design flow rate of 2.3 mgd at various water temperatures when Pond 2 is divided into two equal cells.

Assuming Pond 1 Does Not Remove any BOD or NH3-N. (Worst Case Scenario). Design based on average design flow rate of 2.3 mgd , and assuming 30% BOD removal in primary tank influent of 260 mg/L.

Pond 2B Effluent BOD Flow Rate = 2.3 mgd Inf. BOD = Col. B mg/L	Pond 2B Dissolved Oxygen Requirement for BOD Without Correction for Equipment Efficiency[a] kg O_2/hr[b]	kW Required In Pond 2B for BOD at 2.3 mgd kW[b]	Pond 2B Dissolved Oxygen Requirement for NH_3-N Without Correction for Equipment Efficiency[a] kg O_2/hr[b]
26.45	51.55	27.13	132.39
22.10	48.03	25.28	135.32
17.45	43.34	22.81	138.00
13.56	38.54	20.28	139.66
10.42	33.84	17.81	140.46
7.92	29.39	15.47	140.64
5.96	25.30	13.32	140.31

[a]Excludes correction for equipment efficiencies , but Includes environmental corrections and multiplying factor of 1.5 for BOD removal.

[b]Controlled by Summer Temperature.

[c]These power req. are approximate values and are used for the preliminary selection of equipment. These values are used in conjunction with equipment manufacturers catalogs to select the proper equipment.

Table 1 Cont. Expected treatment in Pond 2A and 2B at design flow rate of 2.3 mgd at various water temperatures when Pond 2 is divided into two equal cells.

Assuming Pond 1 Does Not Remove any BOD or NH3-N. (Worst Case Scenario). Design based on average design flow rate of 2.3 mgd , and assuming 30% BOD removal in primary tank influent of 260 mg/L.

kW Required In Pond 2B for NH3-N at 2.3 mgd kWb	Total Oxygen Demand for Pond 2B Flow rate = 2.3 mgd kg O2/hrb	Total kW Required for Pond 2 Flow Rate = 2.3 mgd kWb	Total hp Required for Pond 2 Flow Rate = 2.3 mgd hpb
69.68	337.5	177.63	238.20
71.22	340.3	179.11	240.19
72.63	341.4	179.68	240.95
73.50	340.18	179.03	240.08
73.93	337.22	177.49	238.01
74.02	333.15	175.34	235.13
73.65	328.35	172.62	231.48

aExcludes correction for equipment efficiencies , but Includes environmental corrections and multiplying factor of 1.5 for BOD removal.

bControlled by Summer Temperature.

cThese power req. are approximate values and are used for the preliminary selection of equipment. These values are used in conjunction with equipment manufacturers catalogs to select the proper equipment.

Table 2. Alkalinity in the wastewater is consumed during the process; therefore, must calculate needed alkalinity for 2.3 mgd.

Flow rate =	**8706.5**	**m^3/d**
Influent Alkalinity	**60**	**mg/L**
Influent Total Nitrogen =	**55.2**	**mg/L**
Assumed conversion =	**0.96**	
NO_3 = TN - Ne	**53.0**	**mg/L**
Influent Alkalinity	**60**	**mg/L**
Alk. used for nitrif. = (7.14 g $CaCO_3$/gNH_4-N)(NO_x) =	**378**	**mg/L used as $CaCO_3$**
Alkalinity Residual needed to maintain pH at 7 =	**80**	**mg/L as $CaCO_3$**
Alk to maintain pH at approx. 7 = Alk Used + Residual Alk. to maintain pH 7 - Inf. Alk	**398.4**	**mg/L as $CaCO_3$**
Alkalinity Needed =	**3468**	**kg/d as $CaCO_3$**

Table 3. Expected treatment in Ponds 2A and 2B at Various Temperatures and 4.6 mgd.

Water Temperature Degrees Celsius	Pond 2A Effluent BOD Flow Rate =4.6 mgd Inf. BOD = 91 mg/L mg/L	Pond 2A kg O2/hr Required at 4.6 mgd	Pond 2B Effluent BOD Flow Rate = 4.6 mgd Inf. BOD = 2A Effluent mg/L	Pond 2B kg O2/hr Required at 4.6 mgd	Pond 2B Dissolved Oxygen Requirement for NH_3-N Influent = 27.6 mg/L kg O_2/hr
6	50.23	153.55	27.73	74.65	122.04
8	48.63	155.35	25.99	73.03	123.47
10	47.03	156.95	24.30	71.24	124.74
15	43.01	160.06	20.33	66.20	127.21
20	39.03	161.98	16.74	60.55	128.74
25	35.14	162.92	13.57	54.61	129.49
30	31.41	163.12	10.84	48.64	129.65
35	27.88	162.74	8.54	42.85	129.35

Table 4. Expected treatment in Ponds 2A and 2B at Various Temperatures and 5.9 mgd.

Water Temperature Degrees Celsius	Pond 2A Effluent BOD Flow Rate = 5.9 mgd Inf. BOD = 91 mg/L mg/L	Pond 2A kg O2/hr Required at 5.9 mgd	Pond 2B Effluent BOD Flow Rate = 5.9 mgd Inf. BOD = 2A Effluent mg/L	Pond 2B kg O2/hr Required at 5.9 mgd	Pond 2B Dissolved Oxygen Requirement for NH_3-N Influent = 27.6 mg/L kg O_2/hr
6	34.69	196.95	13.22	66.12	156.4
8	33.18	199.26	12.1	63.91	156.4
10	31.71	201.31	11.05	61.61	156.4
15	28.16	205.29	8.71	55.59	156.4
20	24.84	207.76	6.78	49.43	156.4
25	21.78	208.17	5.21	47.89	156.4
30	18.98	209.22	3.96	37.70	156.4
35	16.46	208.74	2.98	32.45	156.4

APPENDIX V – PUBLIC MEETING AND COUNCIL PRESENTATIONS = MARCH AND APRIL 2017

6. ADJOURNMENT

REGULAR MEETING
6:00 p.m.

I. FLAG SALUTE

II. ROLL CALL

III. CEREMONIAL MATTERS

A. Proclamation Celebrating *Water Week*, May 7–13, 2017.

B. Proclamation in Recognition of the *22nd Annual Godwit Days Spring Migration Bird Festival*, April 19–25, 2017.

C. Proclamation in Recognition of *Wetlands Month*, May 2017.

D. Proclamation Designating May 2017 as *National Historic Preservation Month in Arcata*.

E. Proclamation in Recognition of *Bike Month*, May 2017.

F. Swear-in Appointed City Council Member Brett Watson.

IV. REPORT BY COMMISSION/COMMITTEE

A. Annual Report of the Wetlands and Creeks Committee 2016.

V. EARLY ORAL COMMUNICATIONS

This 15-minute time period is provided for people to address the Council on matters not on the agenda. At the conclusion of all oral communications the Council may respond to statements. Any request that requires Council action will be set by the Council for a future agenda or referred to staff. Speakers addressing the Council at this time may be limited to two minutes. All other Oral and Written Communications will be heard at this meeting under Agenda Item XI.

VI. N/A

VII. CONSENT CALENDAR

All matters on the Consent Calendar are considered to be routine by the City Council and are enacted in one motion. There is no separate discussion of any of these items. If discussion is required, that item is removed from the Consent Calendar and considered separately. At the end of the reading of the Consent Calendar, Council members or members of the public can request that an item be removed for separate discussion.

A. **Approve Minutes of the City Council Meeting of April 5, 2017.**

B. **Bi-Weekly Report on General Warrants.**

C. **Reappoint Brad Freeman to the Open Space and Agriculture Committee for a New Three-Year Term Ending April 30, 2020; and Reappoint Zane Brotherton and Jayne McGuire to the Parks and Recreation Committee for New Three-Year Terms Ending April 30, 2020.**

D. **Accept an $800 Donation from Arcata Main Street's "Plaza Watershed Program" for Riparian Tree Planting in the Jolly Giant Creek Watershed.**

E. **Adopt Resolution No. 167-46 Authorizing a Grant Application to the California Natural Resources Agency (CNRA) Urban Greening Program for the Forsyth Property Acquisition (49 acres); and Authorize the City Manager to Execute Pertinent Grant Agreements.**

F. **Authorize Mayor to Sign On to the Climate Mayors' Letter to President Trump Opposing the Rollback of U.S. Climate Actions.**

G. **Authorize the Mayor to Sign a Letter in Support of Assembly Bill 1326, Theft: Aggregate Valuation.**

VIII. ITEMS REMOVED FROM CONSENT CALENDAR

Items removed from the Consent Calendar will be heard under this section.

IX. OLD BUSINESS

A. **Receive an Update on the Wastewater Treatment Plant Facility Plan and Upgrade Project; Authorize an Upgrade Alternative to Pursue for Development of Additional Detail; Authorize Staff to Seek State Revolving Loan/Grant Funding for Preliminary Design and Engineering; and Initiate CEQA Environmental Review.**

The Arcata Wastewater Treatment Plant (WWTP) Facility Plan/upgrades are designed to:

- provide reliable service to the community now and in the future;
- meet permit/regulatory requirements that protect public health and the environment; and
- meet the City's goals for sustainability, as much as possible.

The required capital improvements fall into three general categories:

1) Facilities beyond their useful life including the WWTP headworks, clarifier and internal and external pumping stations.
2) Facilities necessary to accomplish the permit requirements to be chlorine free and move our discharge point to be in compliance with our NPDES permit including pipes, pumps, and valves to re-route wastewater. This will allow the plant to utilize ultra-violet (UV) disinfection process and eliminate chlorine contact basin blending that is not compliant with current standards.

3) Identified performance issues to reduce WWTP discharge violations and resolve the narrow compliance safety margins, including the removal of chlorine from the WWTP treatment process which currently contributes significantly to the WWTP's biochemical oxygen demand (BOD) reduction; as well as other pollutants of concern including total and suspended solids removal and anticipated new effluent limits requirements for ammonia discharges to the bay.

Performance enhancements to assure WWTP performance include increased reliability, ease of operation, redundancy and flexibility to accommodate moderate growth and high volume wet weather flows.

Following City Council presentations and focused workshops on this topic, the City Council directed staff and the consultant team to further explore a few items including:

1) Meeting with Regional Water Quality Control Board staff to obtain clarity on the future permit requirements.
2) Provide detail on the WWTP flow rating and/rainfall inflow for sizing.
3) Consideration of oxidation pond improvements.
4) Determine if the underlying bay muds would allow for long term use of unlined ponds for treatment and also if the existing bay front levee was stable enough to raise elevation over time for sea level rise adaptation.
5) Provide detail on estimated population growth projections.
6) Return with revised alternatives for consideration.
7) Provide additional detail on costs.

RECOMMENDATION:
It is recommended that the Council:

1) Receive an update on the Wastewater Treatment Plant Facility Plan and upgrade project;
2) Authorize an alternative to pursue for development of additional detail;
3) Authorize staff to seek State Revolving Loan/Grant funds for preliminary design and engineering; and
4) Initiate CEQA Environmental Review.

B. Introduce Ordinance No. 1486, an Ordinance of the City Council of the City of Arcata Amending Arcata Municipal Code Title IX—Land Use Code, Section 9.12.020, Zoning Map and Zoning Districts, Affecting 21 Parcels, Waive Reading of the Text and Consent to Read by Title Only; and Adopt Resolutions Amending the Zoning and General Plan Designations for 21 Publicly Owned Properties and a Minor Adjustment to the Urban Services Boundary Affecting the Forsyth Property (Assessor's Parcel No. 020-201-005).

On March 1 and 15, 2017, the City Council received staff reports and public testimony, and deliberated on this item. The Council directed staff to separate the two aspects of the project by bringing the zoning map and land use amendments affecting 21 parcels back for adoption independent from the larger Urban Service Boundary and Sphere of Influence boundary adjustments, which will be considered at a later date.

The Forsyth Urban Services Boundary adjustment, however, is a minor adjustment to accommodate existing conditions on the site and will facilitate the acquisition of a 49-acre property by the City for inclusion into the Arcata Community Forest. This was included originally in the larger project and was reviewed by the Planning Commission which recommended approval of all the proposed amendments in its adoption of Resolution PC-17-02 on January 24, 2017.

This action will approve general plan and zoning amendments for the subject publicly owned parcels and a minor Urban Services Boundary adjustment to better align a segment of the boundary to existing conditions. Previous staff reports can be viewed on the City's Meeting Portal website.

RECOMMENDATION:
Staff recommends the Council:

1) Introduce Ordinance No. 1486, an Ordinance of the City Council of the City of Arcata Amending Arcata Municipal Code Title IX—Land Use Code, Section 9.12.020, Zoning Map and Zoning Districts, affecting 21 parcels, waive reading of the text and consent to read by title only;
2) Adopt Resolution No. 167-33, A Resolution of the City Council of the City of Arcata Adopting a General Plan Amendment Modifying the Land Use Designations of 21 Parcels Throughout the City;
3) Adopt Resolution No. 167-43, Accepting a General Plan Amendment Modifying the Urban Services Boundary Affecting the Forsyth property (Assessor's Parcel No. 020-201-005); and
4) Find that the project is covered by the General Rule, §15061(b)(3) of the California Environmental Quality Act Guidelines, for projects that will not have a significant effect on the environment.

C. Review Investment Policy and Adopt Resolution No. 167-44, Adopting the City of Arcata Investment Policy.

Section 53646(a) of the California Government Code states that the treasurer may annually provide the City Council with a statement of investment policy for consideration at a public meeting. The City's Investment Policy was last reviewed and adopted by the City Council on June 13, 2012.

RECOMMENDATION:
Adopt Resolution No. 167-44, Adopting the City of Arcata Investment Policy.

D. Adopt Resolution No. 167-47, A Resolution of the City Council of the City of Arcata Approving an Agreement Declaring Restrictive Covenants for the Transfer of Caltrans Property, Assessor's Parcel No. 507-141-050, to the City of Arcata and the Cooperative Agreement for Same Property.

The purpose of the Agreement Declaring Restrictive Covenants for the transfer of property and Cooperative Agreement for shared use of the property is to allow the City of Arcata to utilize the property as a park to provide the infrastructure to promote public access to the Mad River, promote conservation and stewardship, develop public appreciation for nature, and support outdoor recreation on the property.

RECOMMENDATION:
It is recommended that the Council adopt Resolution No. 167-47, A Resolution of the City Council of the City of Arcata Approving an Agreement Declaring Restrictive Covenants for the Transfer of Caltrans Property, Assessor's Parcel No. 507-141-050 to the City of Arcata and the Cooperative Agreement for Same Property.

X. NEW BUSINESS

A. Appoint Members for Three Vacancies on the Open Space and Agriculture Committee for Two Terms Expiring on April 30, 2020, and One Term Expiring on April 30, 2018.

XI. ORAL AND WRITTEN COMMUNICATIONS

This time is provided for people to address the Council or submit written communications on matters not on the agenda. At the conclusion of all oral and written communications, the Council may respond to statements. Any request that requires Council action will be set by the Council for a future agenda or referred to staff. Speakers addressing the Council may be limited to three minutes, with a maximum of five minutes, and a time limit on the overall length of oral communications may be imposed.

XII. COUNCIL AND STAFF REPORTS

All reports shall be specifically limited to City business and shall not request or lead to action by the Council at this meeting.

XIII. DATES OF FUTURE MEETINGS—None

XIV. CLOSED SESSION

XV. CLOSED SESSION REPORTS

XVI. ADJOURNMENT

Other than items continued or tabled to a date certain, the Council may, by majority vote, continue all matters not completed by 10:30 p.m. to the following Thursday at 6:00 p.m. in the Council Chamber. Should the Council vote to continue the meeting past 10:30 p.m., discussion on an item on the agenda that either requires or allows for public input may not begin without a unanimous vote of the City Council members present. (Closed Session items may begin later.) (Reference: Resolution No. 101-69)

STAFF REPORT – CITY COUNCIL MEETING

April 19, 2017

TO: Honorable Mayor and City Council Members

FROM: Mark Andre, Director of Environmental Services

PREPARER: Mark Andre, Director of Environmental Services

DATE: April 13, 2017

TITLE: **Receive an Update on the Wastewater Treatment Plant Facility Plan and Upgrade Project; Authorize an Upgrade Alternative to Pursue for Development of Additional Detail; Authorize Staff to Seek State Revolving Loan/Grant Funding for Preliminary Design and Engineering; and Initiate CEQA Environmental Review.**

RECOMMENDATION:

It is recommended that the Council:

1) Receive an update on the Wastewater Treatment Plant Facility Plan and upgrade project;
2) Authorize an alternative to pursue for development of additional detail;
3) Authorize staff to seek State Revolving Loan/Grant funds for preliminary design and engineering; and
4) Initiate CEQA Environmental Review.

INTRODUCTION:

The Arcata Wastewater Treatment Plant (WWTP) Facility Plan/upgrades are designed to:

- provide reliable service to the community now and in the future;
- meet permit/regulatory requirements that protect public health and the environment; and
- meet the City's goals for sustainability, as much as possible.

The required capital improvements fall into three general categories:

1) Facilities beyond their useful life including the WWTP headworks, clarifier and internal and external pumping stations.
2) Facilities necessary to accomplish the permit requirements to be chlorine free and move our discharge point to be in compliance with our NPDES permit including pipes, pumps, and valves to re-route wastewater. This will allow the plant to utilize ultra-violet (UV) disinfection process and eliminate chlorine contact basin blending that is not compliant with current standards.
3) Identified performance issues to reduce WWTP discharge violations and resolve the narrow compliance safety margins, including the removal of chlorine from the WWTP treatment process which currently contributes significantly to the WWTP's biochemical oxygen demand (BOD) reduction; as well as other pollutants of concern including total and suspended solids removal and anticipated new effluent limits requirements for ammonia discharges to the bay.

Performance enhancements to assure WWTP performance include increased reliability, ease of operation, redundancy and flexibility to accommodate moderate growth and high volume wet weather flows.
Following City Council presentations and focused workshops on this topic, the City Council directed staff and the consultant team to further explore a few items including:

1) Meeting with Regional Water Quality Control Board staff to obtain clarity on the future permit requirements.
2) Provide detail on the WWTP flow rating and/rainfall inflow for sizing.
3) Consideration of oxidation pond improvements.
4) Determine if the underlying bay muds would allow for long term use of unlined ponds for treatment and also if the existing bay front levee was stable enough to raise elevation over time for sea level rise adaptation.
5) Provide detail on estimated population growth projections.
6) Return with revised alternatives for consideration.
7) Provide additional detail on costs.

DISCUSSION:

1.) Permit discussions with Regional Water Quality Control Board (RWQCB):
Staff and the consultant team met with the RWQCB in Santa Rosa on June 27, 2016.
That meeting provided important feedback to inform the direction of the plant upgrades including:
All flow under 5.9 MGD are to pass through the AMWS enhancement wetlands, which affects hydraulic capacity needs of the total system.
Expect ammonia limits as low as 4 mg/l in permit renewal July 2017. On this matter City staff is requesting a seasonal limit and we are also collecting onsite data so that we can make a case for an appropriate limit rather than an arbitrary one for ammonia.
The RWQCB expects that the City will continually monitor inflow and infiltration (I/I) and work aggressively to reduce it as well as Sanitary Sewer Overflows or SSO's.

2.) Rainfall Influence and flow rating findings
The land based system receives significant additional flow due to rainfall that totals 2 MGD for every one inch of rain that falls directly on the oxidation ponds/wetland system. We decided to use a 3 inch per 24-hour storm event as our design condition. Continued improvements to the wastewater collection system to reduce I/I are ongoing and the City is estimating a reduction of up to 1.2MGD with the currently proposed project which we are currently seeking State Revolving Funds (SRF) to begin construction late this summer. Continued efforts to reduce I/I citywide and specifically working to reduce the I/I emanating from the private side of the system will require continued vigilance and collaborative efforts to successfully reduce it as much as possible. With improved I/I control in the future it may be possible to reduce the size of future long term WWTP capital improvements, improve treatment efficiency as well as significantly reducing sanitary sewer overflows and violations. This is one of the merits of using a phased approach to the facility plan implementation. Currently, storage of I&I in oxidation ponds helps reduce WWTP peak flows while we continue to make I/I reductions in the entire collection system.

3.) Oxidation Pond Improvements Findings
Considerable time and effort was spent on looking at potential upgrades and enhancements to both the treatment marshes and the oxidation ponds in order to determine what appropriate investments to those components would yield cost effective treatment gains. A focused study was prepared by an expert in field, Dr. Joe Middlebrooks, and he provided findings and recommendations including:

Use of oxidation pond 1 for wet weather equalization allowing planned wet weather storage and wastewater metering.
Adding baffles and inlet/outlet controls to prevent short circuiting and approximately 20 (15 HP) aerators to oxidation pond 2 for enhanced treatment of pollutants of concern and specifically ammonia conversion.
Improve removal efficiencies and our ability to meet permit limits likely in low flow months, compromised during wet weather, cold months
Predicted improved ammonia removal, but may not meet permit limit year round requiring other measures.
Remove existing legacy sludge from the 50 year-old ponds to increase depth, volume and reduce internal loading.

4.) Geotechnical Findings
The findings from the LACO Associates geotechnical report and Arcata Marsh Research Institute (AMRI) infiltrometer testing show that the underlying bay muds under the existing ponds and dikes constructed from and within the bay muds are extremely low permeability. The proposed new wetland treatment Marsh 7 to be constructed at the former aquaculture facility and adjacent to the AMRI lab will likely not require lining. The existing bay mud levee that protects and surrounds the oxidation ponds and WWTP were also found to be sound enough to raise the elevation by 2-3 feet over time up to approximately 15' which would be high enough to protect the oxidation ponds from the maximum credible storm surge waves of 14' estimated by FEMA in 2015. This is an important adaptive strategy as well which will allow the City to protect this critical facility as well as adjust to predicted credible storm events and sea level rise. Raising the levees higher will likely require moving material into the oxidation pond in order to allow elevation augmentation. These findings also are supportive of the Citys goal to protect the shoreline with living shorelines where possible.

5.) Population Growth Projection Findings
Based upon analysis of past growth rates, future growth rates and the General Plan build out estimates, Arcata's population can be expected to grow at approximately 1% over the next 20 year planning horizon. It is important to stress that the planned WWTP improvements are designed for the Arcata General Plan build-out and growth rate projections and it is not a project that will lead to growth inducing effect.

6.) Expanded Alternatives and staff recommended alternative.
Project alternatives and estimated costs are listed on Attachment (A.) A total of five alternatives were expanded and analyzed since June 2016. All project alternatives include common upgrades to the aging components of the WWTP and the UV disinfection system and re-route of discharge to McDaniel Slough. All alternatives except for Alternative #5 direct significant investments to the land based oxidation pond/treatment/ enhancement wetland systems. All alternatives listed are expected to meet compliance and flow requirements except for Alternative (4.) which is the pond/wetland improvements only alternative without additional secondary components.

Of the expanded alternatives, staff and our consultant team are recommending #4.1. This alternative is a hybrid of the land based wetlands plus the addition of one oxidation ditch and secondary with a design for the addition of another oxidation ditch that would be phased in at some point in the future if needed. This "hybrid" alternative strikes a balance with costs and allows for phasing in improvements. It allows for pond improvements to be made while still maintaining treatment; meets expected compliance objectives; allows an opportunity to obtain information from pond near-term improvements to inform potential additional treatment plant components and sizing needs; allows an opportunity to ascertain how much reduction the City can obtain from I&I work; provides a level of confidence for future planned growth in the City.

The hybrid system and phased approach as outlined in Alternative #4.1 utilizes an adaptive management strategy. Adaptive management (learning by doing) is a structured, iterative process of decision making in the face of uncertainty, with a goal for reducing uncertainty over time using system monitoring. Because adaptive management is based on information feedback, it improves outcomes in the long-run. For the City's WWTP, the challenge of the adaptive approach is in finding a solid balance between acquiring knowledge to improve operations in the future and achieving the best short-term outcomes based on current knowledge and information.

Other considerations:
Sea level rise will impact the levees at the WWTP and any anticipated new structures. All recommended plant upgrades will be viable for the next 30-40-year design life cycle. Future plant upgrades on a smaller footprint (corporation yard) will extend the viability of the core WWTP at least another 30-40 years. All project alternatives will incorporate sea level rise adaptive measures including:
Phased raising of the levee around the oxidation ponds, treatment marshes and WWTP/Corporation Yard.
Establishment of "living shorelines" on the outboard side of the levee to minimize wave energy; reduce armoring costs and to provide habitats.
Design of replacement facilities on a higher base elevation within the corporation yard and design of outfall pipes and pumps to be able to work under higher future sea levels.
Provide flexibility for flow paths.

*Note: the facility plan and alternatives do not detail costs for sea level rise adaptation measures at this time. These additional costs are not listed a near term but must be planned and programmed in the CIP. Staff will be looking at possible special funding opportunities for both sea level rise adaptation measures and energy upgrades. For long-term planning (beyond 30-40 years), protection of the core corporation yard (approx. nine acres) and WWTP involves approximately 3,700 linear feet of levee. An additional mile of levee protection would be required to if we were to try to protect the oxidation ponds and treatment marshes beyond the current planning horizon of 30-40 years.

All project alternatives have a substantial increase in energy consumption. Components such as UV, aerators, oxidation ditch aerators and pumps have an impact on energy consumption and costs. While the project includes a modest 60kW photovoltaic system to provide some energy offset, it is less than 10% of the total net energy increase. The 60 kW systems are near term placeholder for now for systems that can be accommodated on anticipated building roofs within the corp. yard. A much larger system may be able to site at the WWTP after a more detailed design is completed. Additionally, staff will recommend that in the near future a separate project to analyze the sludge digester and provide information on the potential to generate energy from biogas (methane). Additionally, staff is interesting in exploring the total lifecycle costs in terms of carbon footprint. From a literature review, it is apparent that the lifecycle aspects of UV compared to chlorine may be favorable. This will be further explored as well as the current carbon footprint of the City's current chemical disinfection system in order to provide net energy and carbon impact comparison.

Next Steps:
Move forward with improvements
(not all decisions on process need to be made yet)
Start CEQA and environmental review

Apply for Disadvantaged Community status state revolving loan/grant
Confirm design criteria based on tentative NPDES permit (June 2017)
Predesign to finalize proposed improvements

The City's existing National Pollution Discharge Elimination System (NPDES) Permit required work such as reconfiguring the plant and switching to UV disinfection be completed by December 2016. Preliminary design must begin as soon as possible due to an impending Time Schedule Order applied to resolve the missed December 2016 permit requirements. The missed permit conditions are to relocate the wastewater treatment plant outfall, switch to UV disinfection, and eliminate the circular blending pattern known as Combined Basin Mode.
Other critical work such as replacing old equipment should begin as soon as possible to reduce the danger of costly and dangerous equipment failure and to fulfill the permit requirement that equipment be maintained adequately. Due to widespread replacement needs covering most of the primary equipment preliminary design and engineering should begin as soon as possible. The project elements already identified as CIP priorities such as: influent pumps, bar screens, grit removal system, primary clarifiers, and pump stations within the plant will collectively require a substantial amount of planning/engineering dollars in the immediate future and are required regardless of approach used to resolve the performance deficiency.
There is a clear need to secure a substantial amount of funding for planning/engineering as soon as possible. Securing planning/engineering funding will allow portions of the total project to move forward.

BUDGET/FISCAL IMPACT:
The complete project costs for replacement and/or refurbishing WWTP components plus adding the permit required UV disinfection and piping to new outfall total $21.9 million (M), this is the minimum level of work required immediately to maintain the aged system and comply with the goal to be chlorine free.
The staff recommended project is Alternative 4.1 (see Attachment A.) which additionally includes the improvements to the existing oxidation ponds as described above, rehabilitation of existing wetlands and construction of an additional Marsh 7, ($8.0 M), construction of a 1.8 MGD oxidation ditch, digester improvements and sludge handling ($12.4M). This would result in an estimated total project cost of $42.3 million dollars.
Life cycle costs for the alternatives analyzed are included in Attachment B.
Staff will be developing additional detail on the necessary rate structure to support capital costs and debt services for the project once those costs are better determined. It is unknown at this time how much loan or grant funding may be available for this project.

ATTACHMENTS:

A. Alternatives and Cost Estimates (PDF)
B. Alternatives Lifecycle Costs and and Energy Usage (PDF)
C. Estimated Power Usage by process (PDF)

DRAFT

City of Arcata Wastewater Treatment Facility Improvements Project - Estimated Alternatives Project and Construction Costs

Prepared by LACO/Carollo. LACO Project No. 8226.00

Updated April 5, 2017

CIP ELEMENTS	DESCRIPTION / BASIS	Common Elements		ALTERNATIVE 4 PHASED SECONDARY TREATMENT								ALTERNATIVE 5	
		Plant Rehabilitation and Modernization plus UV Disinfection plus 60 kW Photovoltaic System		Alt 4 Common Elements plus Pond Improvements (Oxidation Ponds,Treatment Wetlands, and Enhancemnet Wetlands)		Alt 4-1 Common Elements plus Pond Improvements plus One Oxidation Ditch and Secondary Clarifier		Alt 4-2 Common Elements plus Pond Improvements plus Two Oxidation Ditches and Two Secondary Clarifiers		Alt 4-3 Common Elements plus Pond Improvements plus Three Oxidation Ditches and Three Secondary Clarifiers		Treatment Three Oxidation Ditches and Clarifiers Modified Common Elements No Pond Improvements No Phasing	
Headworks Capacity [1]		5.9 MGD		5.9 MGD		5.9 MGD		5.9 MGD		5.9 MGD		5.9 MGD	
Total Secondary Process Capacity [1]		None added		2.3 MGD		4.1 MGD		5.9 MGD		> 5.9 MGD		5.9 MGD	
UV/Outfall Capacity [1]		5.9 MGD		5.9 MGD		5.9 MGD		5.9 MGD		5.9 MGD		5.9 MGD	
		Construction Cost	Project Cost	Construction Cost	Project Cost	Construction Cost	Project Cost	Construction Cost	Project Cost	Construction Cost	Project Cost	Construction Cost	Project Cost
Flow Reconfiguration		**$ 3,200,000**	**$ 4,240,000**	**$ 3,200,000**	**$ 4,240,000**	**$ 3,200,000**	**$ 4,240,000**	**$ 3,200,000**	**$ 4,240,000**	**$ 3,200,000**	**$ 4,240,000**	**$ 2,910,000**	**$ 3,780,000**
AWTF Reconfiguration/New Outfall 003	4200 ft of 24-inch pipe and new outfall, takeoff	$ 1,810,000	$ 2,350,000	$ 1,810,000	$ 2,350,000	$ 1,810,000	$ 2,350,000	$ 1,810,000	$ 2,350,000	$ 1,810,000	$ 2,350,000	$ 1,810,000	$ 2,350,000
Treatment Wetlands 4 Influent Pump Replacement	Pump and structure	$ 60,000	$ 160,000	$ 60,000	$ 160,000	$ 60,000	$ 160,000	$ 60,000	$ 160,000	$ 60,000	$ 160,000	$ -	$ -
Treatment Wetlands: Pump Station 1 R&R Project	Three new pumps & VFDs	$ 170,000	$ 220,000	$ 170,000	$ 220,000	$ 170,000	$ 220,000	$ 170,000	$ 220,000	$ 170,000	$ 220,000	$ -	$ -
Treatment Wetlands: Pump Station 2 R&R Project	Two new pumps & VFDs (if needed)	$ 60,000	$ 80,000	$ 60,000	$ 80,000	$ 60,000	$ 80,000	$ 60,000	$ 80,000	$ 60,000	$ 80,000	$ -	$ -
Enhancement Wetlands: Pump Station Project	New 5.9 mgd pump station based on cost curve	$ 1,100,000	$ 1,430,000	$ 1,100,000	$ 1,430,000	$ 1,100,000	$ 1,430,000	$ 1,100,000	$ 1,430,000	$ 1,100,000	$ 1,430,000	$ 1,100,000	$ 1,430,000
Headworks/Primary		**$ 8,650,000**	**$ 11,240,000**	**$ 8,650,000**	**$ 11,240,000**	**$ 8,650,000**	**$ 11,240,000**	**$ 8,650,000**	**$ 11,240,000**	**$ 8,650,000**	**$ 11,240,000**	**$ 6,600,000**	**$ 8,580,000**
Headworks: Influent Screw Pump, Bar Screen, Flume and Grit Chamber Replacement	New 5.9 MGD headworks based on cost curve	$ 6,600,000	$ 8,580,000	$ 6,600,000	$ 8,580,000	$ 6,600,000	$ 8,580,000	$ 6,600,000	$ 8,580,000	$ 6,600,000	$ 8,580,000	$ 6,600,000	$ 8,580,000
Primary Clarifier Replacement	New 2.3 mgd Primary Clarifier based on cost curve	$ 1,910,000	$ 2,480,000	$ 1,910,000	$ 2,480,000	$ 1,910,000	$ 2,480,000	$ 1,910,000	$ 2,480,000	$ 1,910,000	$ 2,480,000	$ -	$ -
Primary Clarifier: Sludge Pump Replacement	Four sludge/scum pumps	$ 140,000	$ 180,000	$ 140,000	$ 180,000	$ 140,000	$ 180,000	$ 140,000	$ 180,000	$ 140,000	$ 180,000	$ -	$ -
Ponds/Wetlands				**$ 5,860,000**	**$ 7,980,000**	**$ 5,860,000**	**$ 7,980,000**	**$ 5,860,000**	**$ 7,980,000**	**$ 5,860,000**	**$ 7,980,000**	**$ 200,000**	**$ 260,000**
Treatment Marsh #7	2.3 acres @ $100,000 per acre			$ 230,000	$ 500,000	$ 230,000	$ 500,000	$ 230,000	$ 500,000	$ 230,000	$ 500,000	$ -	$ -
Oxidation Ponds: Pond Pump Station R&R Project	Three new pumps			$ 150,000	$ 200,000	$ 150,000	$ 200,000	$ 150,000	$ 200,000	$ 150,000	$ 200,000	$ -	$ -
Oxidation Ponds: Transfer Structure Reconfiguration	Placeholder from Erik Lust			$ 275,000	$ 360,000	$ 275,000	$ 360,000	$ 275,000	$ 360,000	$ 275,000	$ 360,000	$ -	$ -
Oxidation Ponds: Aerator Replacement	Aerator additions based on a ratio from Petaluma aerator addition 2005 bid (escalated)			$ 1,470,000	$ 1,910,000	$ 1,470,000	$ 1,910,000	$ 1,470,000	$ 1,910,000	$ 1,470,000	$ 1,910,000	$ -	$ -
Oxidation Ponds: Baffle Wall	Takeoff based on diagonal and SF cost for sheet pile, maybe a high unit cost			$ 810,000	$ 1,060,000	$ 810,000	$ 1,060,000	$ 810,000	$ 1,060,000	$ 810,000	$ 1,060,000	$ -	$ -
Treatment Wetlands Re-Vegetation Project	TW 1 to 4: total acres x $100,000			$ 580,000	$ 750,000	$ 580,000	$ 750,000	$ 580,000	$ 750,000	$ 580,000	$ 750,000	$ -	$ -
Enhancement Wetlands Re-Vegetation Project	EW (3) total acres x $50,000			$ 870,000	$ 1,280,000	$ 870,000	$ 1,280,000	$ 870,000	$ 1,280,000	$ 870,000	$ 1,280,000	$ -	$ -
Oxidation Ponds: Emergency Pond Pump Replacement Project	Added pump and piping			$ 200,000	$ 260,000	$ 200,000	$ 260,000	$ 200,000	$ 260,000	$ 200,000	$ 260,000	$ 200,000	$ 260,000
Oxidation Ponds: Sludge Removal R&R Project	Takeoff based on $600/ dry ton (Synagro) and compared to McKinleyville - Pond 2 Prioritized			$ 1,275,000	$ 1,660,000	$ 1,275,000	$ 1,660,000	$ 1,275,000	$ 1,660,000	$ 1,275,000	$ 1,660,000	$ -	$ -
New Parallel/Sidestream Treatment [2]						**$ 7,380,000**	**$ 9,600,000**	**$ 14,760,000**	**$ 19,200,000**	**$ 23,410,000**	**$ 30,460,000**	**$ 23,350,000**	**$ 30,370,000**
New Secondary Treatment Project: Oxidation Ditches and Secondary Clarifiers Project	Scaled from Modesto 2.3 MGD OD bid (2008?) and added secondary clarifier from cost curve					$ 7,380,000	$ 9,600,000	$ 14,760,000	$ 19,200,000	$ 23,410,000	$ 30,460,000	$ 23,350,000	$ 30,370,000
UV Disinfection/Other		**$ 4,510,000**	**$ 5,870,000**	**$ 4,510,000**	**$ 5,870,000**	**$ 4,510,000**	**$ 5,870,000**	**$ 4,510,000**	**$ 5,870,000**	**$ 4,510,000**	**$ 5,870,000**	**$ 3,292,000**	**$ 4,280,000**
UV Disinfection System	Based on facility plan const cost (based on Trojan budget proposal)	$ 4,360,000	$ 5,670,000	$ 4,360,000	$ 5,670,000	$ 4,360,000	$ 5,670,000	$ 4,360,000	$ 5,670,000	$ 4,360,000	$ 5,670,000	$ 3,142,000	$ 4,080,000
Disinfection: Chlorine/SO2 Project	Placeholder from Erik Lust	$ 150,000	$ 200,000	$ 150,000	$ 200,000	$ 150,000	$ 200,000	$ 150,000	$ 200,000	$ 150,000	$ 200,000	$ 150,000	$ 200,000
Digester [2]						**$ 1,200,000**	**$ 1,560,000**	**$ 1,200,000**	**$ 1,560,000**	**$ 1,200,000**	**$ 1,560,000**	**$ 1,200,000**	**$ 1,560,000**
Digester R&R Project - Phase 1	Based on placeholder for cover rehab from Erik Lust and replacement boiler (larger capacity)					$ 1,200,000	$ 1,560,000	$ 1,200,000	$ 1,560,000	$ 1,200,000	$ 1,560,000	$ 1,200,000	$ 1,560,000
Thickening [2]						**$ 940,000**	**$ 1,220,000**	**$ 1,410,000**	**$ 1,830,000**	**$ 1,970,000**	**$ 2,560,000**	**$ 1,910,000**	**$ 2,480,000**
New Secondary Sludge Thickening Project	Based on Rotary drum thickener, Marin SD#5 2012 bid					$ 940,000	$ 1,220,000	$ 1,410,000	$ 1,830,000	$ 1,970,000	$ 2,560,000	$ 1,910,000	$ 2,480,000
Relocation/Modernization		**$ 400,000**	**$ 520,000**	**$ 400,000**	**$ 520,000**	**$ 400,000**	**$ 520,000**	**$ 400,000**	**$ 520,000**	**$ 400,000**	**$ 520,000**	**$ 400,000**	**$ 520,000**
60 kW PV System	Based on budget quote	$ 300,000	$ 390,000	$ 300,000	$ 390,000	$ 300,000	$ 390,000	$ 300,000	$ 390,000	$ 300,000	$ 390,000	$ 300,000	$ 390,000
Corporation Yard Modifications & Building Replacement	Placeholder	$ 100,000	$ 130,000	$ 100,000	$ 130,000	$ 100,000	$ 130,000	$ 100,000	$ 130,000	$ 100,000	$ 130,000	$ 100,000	$ 130,000
TOTAL COSTS		**$ 16,760,000**	**$ 21,870,000**	**$ 22,620,000**	**$ 29,850,000**	**$ 32,140,000**	**$ 42,230,000**	**$ 39,990,000**	**$ 52,440,000**	**$ 49,200,000**	**$ 64,430,000**	**$ 39,862,000**	**$ 51,830,000**

Notes:
1. Based on influent flow.
2. Includes 20 % growth factor applied to secondary treatment and solids handling facilities.
3. Costs are in today's dollars.

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Table X **Estimated Lifecycle Cost and Energy Usage Comparison of Treatment Alternatives**
Wastewater Treatment Plant Improvement Project
City of Arcata, California
Updated April 5, 2017

Alternative	Description	Secondary Treatment Capacity (MGD)	Estimated Total Project Cost[1]	O&M Annual Power Usage (kWh)	O&M Annual Cost[2]	O&M Present Worth[3]	Lifecycle Cost[3]
4	Common Elements + Pond Improvements Only	2.3	$29,850,000	1,860,000	$474,000	$8,330,000	$38,180,000
4-1	Common Elements + Pond Improvements + 1 Ox Ditch	4.1	$42,230,000	2,650,000	$625,000	$10,990,000	$53,220,000
4-2	Common Elements + Pond Improvements + 2 Ox Ditches	5.9	$52,440,000	3,430,000	$776,000	$13,650,000	$66,090,000
4-3	Common Elements + Pond Improvements + 3 Ox Ditches (Ponds Offline)	5.9	$64,430,000	3,160,000	$747,000	$13,140,000	$77,570,000
5	Modified Common Elements + 3 Ox Ditches No Pond Improvements and No Phasing	5.9	$51,830,000	3,160,000	$747,000	$13,140,000	$64,970,000

Notes:

(1) Costs are in today's dollars.

(2) Annual O&M power usage and costs include only differential O&M costs, and does not include the cost of common O&M costs such as influent pumping which are common to all alternatives..

(3) Lifecycle cost is total project cost plus present worth value of annual O&M costs. Annual O&M costs were converted to present worth value based on 3 percent inflation rate, 6 percent discount rate, and 25-year analysis period.

Table Y **Estimated Power Usage by Process**
Wastewater Treatment Improvement Project
City of Arcata, California
Updated April 5, 2017

Alternative	Description	Estimated Annual Power Usage	
		kWh	Percent
4	**Pond Improvements**	**1,859,000**	
	Primary Clarifier	46,000	2.5%
	Oxidation Ponds	1,051,000	56.5%
	UV Disinfection	484,000	26.0%
	Chlorine Disinfection	7,000	0.4%
	Effluent Pumping	271,000	14.6%
4-1	**Pond Improvements + 1 Ox Ditch**	**2,645,000**	
	Primary Clarifier	46,000	1.7%
	Oxidation Ponds	1,051,000	39.7%
	Oxidation Ditch	654,000	24.7%
	Secondary Clarifier	89,000	3.4%
	Thickening	44,000	1.7%
	UV Disinfection	484,000	18.3%
	Chlorine Disinfection	7,000	0.3%
	Effluent Pumping	271,000	10.2%
4-2	**Pond Improvements + 2 Ox Ditches**	**3,432,000**	
	Primary Clarifier	46,000	1.3%
	Oxidation Ponds	1,051,000	30.6%
	Oxidation Ditch	1,307,000	38.1%
	Secondary Clarifier	178,000	5.2%
	Thickening	88,000	2.6%
	UV Disinfection	484,000	14.1%
	Chlorine Disinfection	7,000	0.2%
	Effluent Pumping	271,000	7.9%
4-3	**Pond Improvements + 3 Ox Ditches (Ponds Offline)**	**3,165,000**	
	Primary Clarifier	-	
	Oxidation Ponds	-	
	Oxidation Ditch	2,143,000	67.7%
	Secondary Clarifier	292,000	9.2%
	Thickening	145,000	4.6%
	UV Disinfection	308,000	9.7%
	Chlorine Disinfection	7,000	0.2%
	Effluent Pumping	271,000	8.6%
5	**Conventional Treatment 3 Ox Ditches**	**3,165,000**	
	Oxidation Ditch	2,143,000	67.7%
	Secondary Clarifier	292,000	9.2%
	Thickening	145,000	4.6%
	UV Disinfection	308,000	9.7%
	Chlorine Disinfection	7,000	0.2%
	Effluent Pumping	271,000	8.6%

Wastewater Treatment Facility Improvements Project

Facility Plan Update

March 30, 2017

LACO carollo
Engineers...Working Wonders With Water®

Agenda:

- Review of Facility Plan and where we left off
- Findings of Additional Study
- Expanded Alternatives
- Next Steps

Decisions needed to proceed:

- Agree that improvements are needed
  - Don't have to agree exactly on all elements, will clarify during predesign
- Apply for grants (Disadvantaged Community)
- Begin Environmental Assessment (CEQA)

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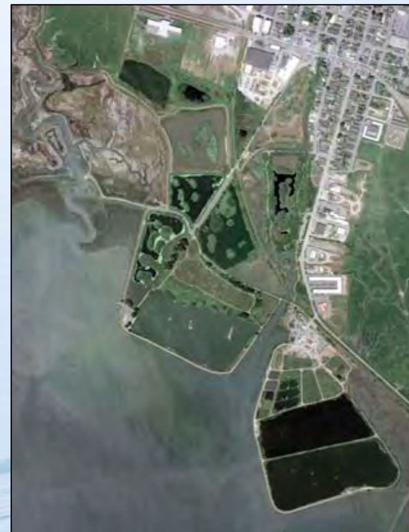
Where we last left Council

Where we left off last April and June… at last Council meetings

- Facility Plan was complete and found that improvements were needed to address:
  1. Hydraulic limitations
  2. Aging Infrastructure
  3. Treatment capacity shortfalls
  4. Future permit compliance

Where we left off last April and June… at last Council meetings

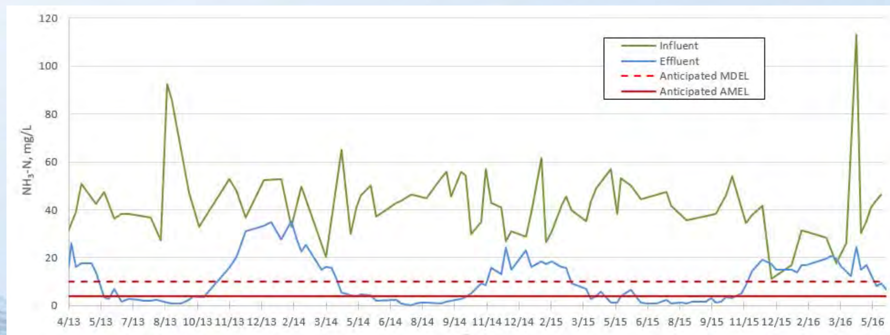
- Directed to further explore a few items:
  1. Future permit renewal with RWQCB
  2. Flow/rainfall for sizing
  3. Pond improvement considerations
  4. Revisit growth projections
  5. Come back with revised alternatives



Additional Studies

Results of additional study - Permit

- Permit discussions with Regional Water Board:
  - Want all flow under 5.9 MGD to go through enhancement wetlands, which affects hydraulic capacity needs
  - Expect ammonia limits as low as 4 mg/l in permit renewal July 2017.



Plant flow and rainfall

- Land based system receives significant additional flow due to rainfall
- Decided to use 3 inches over 24 hours as design condition
- Considered improvements to collection system to reduce inflow and infiltration
- Result:
  - Could downsize some facilities by 0.5 to 1mgd (City)
  - Keep hydraulic capacity at 5.9 mgd (permitted flow)
  - Storage in ponds helps reduce peak flows

Results of additional study - Ponds

- Geotechnical review to evaluate ponds
  - Recommendations: minimum levee (approx. 3 feet) raising (for sea level rise protection only); underlying bay muds are very impervious, TM including proposed Marsh 7 will not require lining;
  - Hired pond expert to consider improvements needed:
  - Use Pond 1 for wet weather equalization
  - Add baffles and aerators to Pond 2 for better treatment
  - Ability to meet permit limits likely in low flow months, compromised during wet weather, cold months
  - Predicted ammonia removal may not meet permit limit year round

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Expanded Alternatives

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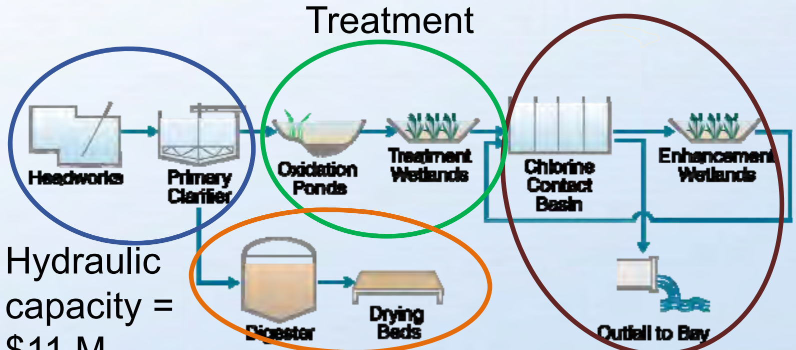
Original direction for developing alternatives and CIP

- 100% permit compliance
- Reliable capacity to meet all flows/loads and general plan growth
- Maximize existing natural system
- Address deferred maintenance
- Address aging infrastructure through repair and rehabilitation

Existing Facility Areas of Improvement ($ 25 M without biological treatment)

Biological Treatment



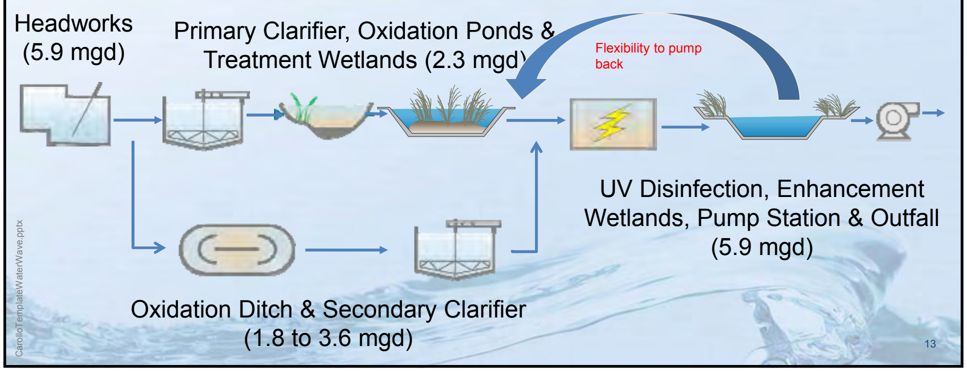
Hydraulic capacity = $11 M

Misc other improvements = $4 M

UV Disinfection /Discharge = $10 M

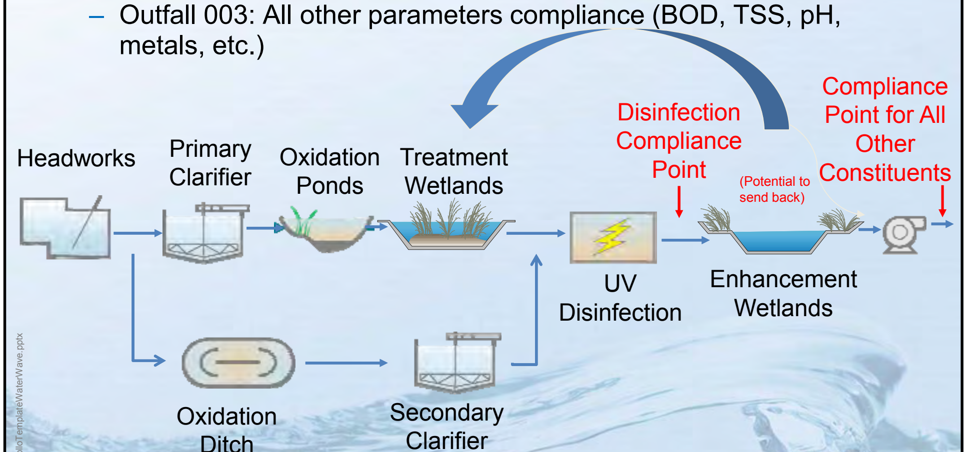
Alternatives focus around biological treatment relative to existing system

- New components:
  - Recommended pond & wetlands improvements = $8 M
  - Parallel treatment for high flows and ammonia reduction = $10 M (one Ox Ditch) or $20 M (two Ox Ditches)



Discharge Compliance Points

- Dual compliance point locations
  - UV Discharge to Enhancement Wetlands: Disinfection compliance (Fecal coliform)
  - Outfall 003: All other parameters compliance (BOD, TSS, pH, metals, etc.)



Comparison of Biological Treatment Options

	Project Costs	Pros/Cons
Make improvements to ponds and wetlands only (include aerators and baffle wall)	$8 million	Will not consistently meet permit requirements, provides 2.3 mgd of secondary treatment
Improve ponds + Build one Ox Ditch	$8 million + $10 million	Still risk of permit violation due to ammonia, and does not provide 5.9 mgd of secondary treatment
Improve ponds + Build two Ox Ditches	$8 million + $20 million	Provides 5.9 mgd of secondary treatment and will comply with permit 90% to 95% of time

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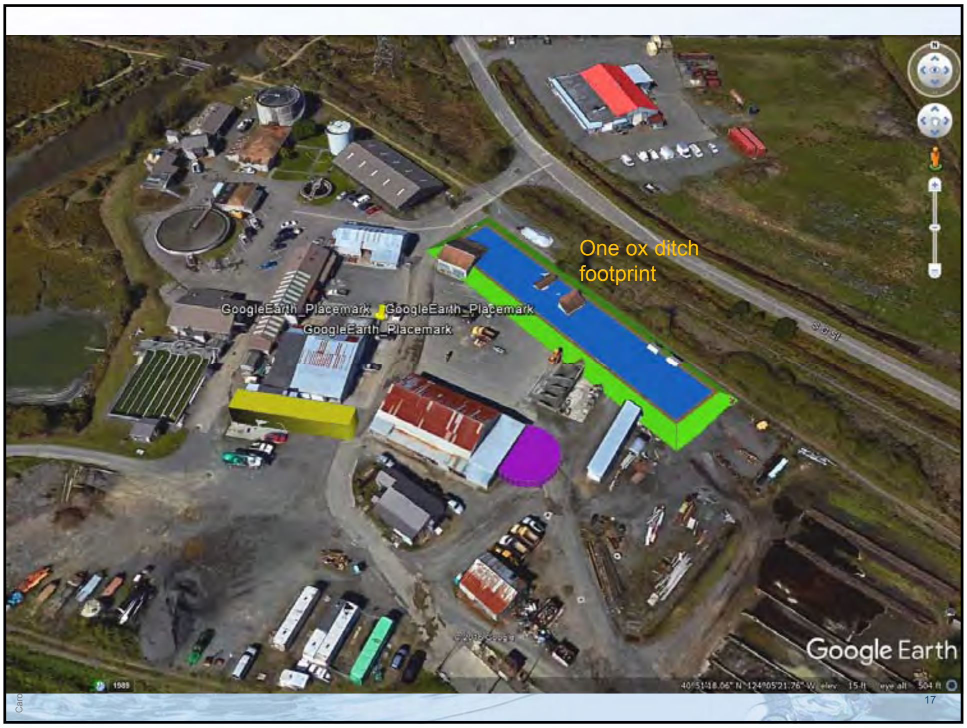

Schedule

- NPDES Permit October 2017
- Preliminary Design July 2017 –June 2018
- Final Design June 2018 – May 2019
- Bid/Award May 2019 – September 2019
- Construction October 2019 – December 2021
- Begin Discharge January 2022

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Next steps

Immediate next steps for implementation

- Decide to move forward with improvements (not all decisions on process need to be made yet)
- Apply for Disadvantaged Community SRF loan/grant
- Confirm design criteria based on tentative NPDES permit (June 2017)
- Start CEQA and environmental review
- Predesign to finalize proposed improvements

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