Council Business Meeting

November 5, 2019

Agenda Item	Comprehensive Sanitary Sewer Master Plan and Wastewater Treatment Plant Facilities Plan Amendment and Update to the Capital Improvements Program for the 2019-21 Biennium	
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SUMMARY

Before the Council is a request to:

1) accept the recent Wastewater Treatment Plant (WWTP) Facilities Assessment and Major Process Component Improvements Report (Jacobs August 2019);
2) amend the 2012 Comprehensive Sanitary Sewer Master Plan and the 2014 WWTP Facilities Plan; and
3) update the Capital Improvements Program (CIP) costs for the current 2019-21 biennium (BN).

POLICIES, PLANS & GOALS SUPPORTED

City Council Goals (supported by this project):

- Maintain Essential Services - wastewater
- Continue to leverage resources to develop and/or enhance Value Services

Climate Energy Action Plan (CEAP) Goals:

Natural Systems: Air, water, and ecosystem health, including opportunities to prepare for climate change through improved resource conservation and ecosystem management.

- Strategy NS-2: Manage and conserve community water resources

Department Goals:

- Maintain existing infrastructure to meet regulatory requirements and minimize life-cycle costs
- Deliver timely life cycle capital improvement projects
- Maintain and improve infrastructure that enhances the economic vitality of the community
- Evaluate all city infrastructure regarding planning management and financial resources

PREVIOUS COUNCIL ACTION

On February 5, 2019, Council approved award of a professional services contract to Jacobs Engineering Group, Inc., in the amount of $120,460 to complete a Wastewater Treatment Plant Facilities Assessment and Major Process Component Improvements Report.

Prior to that on April 17, 2012, Council approved the Comprehensive Sanitary Sewer Master Plan (Keller Associates). That approval lead to the completion of a Wastewater Facilities Plan completed by Keller Associates in May 2014 and approved by the Department of Environmental Quality (DEQ) on June 17, 2014.

BACKGROUND AND ADDITIONAL INFORMATION

The City operates a wastewater treatment plant at 1195 Oak Street. The original plant was built in 1936 with a primary clarifier, trickling filter, a secondary clarifier and sludge drying beds. The clarifiers were replaced in 1961 and an additional trickling filter was added. In 1974 the plant was converted to an activated sludge process adding a new larger clarifier, chlorine contact basin and digester.

The plant experienced a major overhaul between 1999 and 2002 converting to an oxidation ditch facility, adding grit removal and a third clarifier, converting from chlorine to ultraviolet disinfection, and finally adding tertiary treatment through membranes to achieve stringent phosphorous removal requirements. The digester and sludge drying beds were removed and replaced by two centrifuge dewatering units. All original membrane cassettes were replaced with increased capacity between 2009-2013. The membranes are in use between April and November. Other than maintenance, the wastewater treatment plant processes have not been improved. The headworks was not upgraded during the 1999 improvement.

The 2012 Master Plan identified $14.5 million in WWTP and collection system projects scheduled to be completed between 2012 and 2020. This total included $5 million for temperature improvements and a new oxidation ditch for $6.15 million. In addition to the priority improvements, there is an additional series of projects totaling $14.4 million scheduled for 2020-2030 completion. Not all projects were included in the 2019-38 CIP as staff awaited results of this Facilities Assessment and the future Collections Master Plan. Staff will release a qualifications-based request for proposals later this month for a wastewater collection system master plan.

The goal of the current facilities assessment was to recommend prioritized system improvements to optimize the wastewater treatment process, ensure simplicity, reduce energy consumption, potentially reduce solids production and improve reliability. The evaluation included an assessment of the wastewater treatment process and major process component elements. The initial assessment was based upon current and projected future flows, waste characteristics, system capacity and redundancy requirements.

This assessment did not make specific recommendations to the wastewater collection system as such but flows and loads were analyzed for impacts to the treatment process. Although the average amount of sewage generated by the Ashland community is 2.2 million gallons per day, the instantaneous hourly flows have been as high as 10 million gallons. This is typically a result of storm flows entering the sewage collection system through open ports, manholes or cracked pipes, and can be a result of inappropriate connections of storm water piping in general being connected to the sewer collection lines. Finding and correcting these sources of inflow and infiltration (I/I) will alleviate the need for significant capital improvements to the wastewater plant and to the prior recommendations to upsize collections system pipes.

The facilities assessment recommended several prioritized improvements to the treatment plant processes, many of which have been anticipated in the CIP. Staff compiled the list based on the prioritization of the consultant but has modified timing to include current operational conditions and the consultant's overall system condition rating.

Please note that the temperature improvements that are currently planned or started were not assessed and will continue as planned. All of the temperature recommendations have been fully vetted and will await the new National Pollution Discharge Elimination System (NPDES) permit from DEQ. Staff had hoped to have the permit in 2019, but it looks like it will slip to 2020 due to other scheduling priorities with DEQ.

PROCESS	DESCRIPTION	COST	TIMING
Headworks	replace headworks screening	$560,000	FY21/22
Headworks	new grit removal facility and flow split to the oxidation ditches	$3.2 M	FY22/23 (further evaluation)
Disinfection	replace obsolete existing medium pressure high output ultraviolet (UV) disinfection system	$900,000	FY20/21 (permitting priority)
Electrical upgrades	Assess/improve harmonic distortion; add surge protection	$50,000	FY20 (in-house solution)
Biosolids Treatment Improvements	Increase storage and redundancy; replace failed values	$250,000	FY23/24
Secondary Clarifier Improvements	Replace mechanism; re-level peripheral weir; repair/recoat launder surface	$795,000	FY20/21 weir FY22/23 launder
Replace Aerators Oxidation Ditch	Existing aerators are 20 years old; replace with more effective/energy efficient aerators	$300,000	FY21/22
Overall plant maintenance needs	Pumps are the primary concern as many are at the end of their useful life	$150,000 /year	Spread out

Proposed adjustments to the CIP are shown below. The green rows are for the temperature improvements and were not changed.

Wastewater Treatment Plant	FY20	FY21	FY22	FY23	FY24	FY25	Project Totals
UV System Upgrades	$ 300,000	$ 600,000					$ 900,000
WWTP Riparian Restoration/Shading - Water Quality Temperature Trading	$ 465,000	$ 600,000	$ 660,000	$ 380,000	$ 420,000	$ 200,000	$ 2,925,000
Outfall Relocation / Fish Screen	$ 500,000	$ 500,000	$ 200,000				$ 1,823,324
WWTP Process Improvements (Headworks)		$ 60,000	$ 500,000	$ 300,000	$ 1,500,000	$ 1,500,000	$ 3,860,000
WWTP Process Improvements (Harmonics)	$ 50,000						$ 50,000
WWTP Process Improvements (Secondary Clarifier)	$ 50,000	$ 250,000	$ 250,000	$ 250,000			$ 800,000
WWTP Process Improvements (Ox Ditch Aerators)	$ 150,000	$ 150,000					$ 300,000
WWTP Process Improvements (Miscellaneous)	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 150,000	$ 150,000	$ 500,000
Membrane Replacement (two trains)					$ 600,000	$ 600,000	$ 1,200,000
Subtotal Treatment Plant	$ 1,565,000	$ 2,210,000	$ 1,660,000	$ 980,000	$ 2,670,000	$ 2,450,000	$ 12,358,324

FISCAL IMPACTS

The Wastewater Treatment Plant Facilities Assessment and Major Process Component Improvements Plan was awarded to Jacobs Engineering Group, Inc. in the amount of $120,460. To date the consultant has spent $112,513 and is complete; under budget by nearly $7,950. The remaining budget will be reserved for any additions or modifications to the Assessment required by DEQ upon their review and approval.

The 20-Year Capital Improvements Program (CIP) was approved by Council on April 2, 2019. In the currently approved FY20-21 budget the totals in the WWTP are $1,585,000 for FY20 and $1,950,000 in FY21 (totaling $3,535,000). With the proposed reduction in the harmonics and miscellaneous improvements and increases in the UV, adding the secondary clarifier weir leveling and replacing the oxidation ditch aerators, the FY20 total is proposed at $1,565,000 and FY21 $2,210,000 (total $3,775,000); representing an overall increase of $240,000 over the biennium. Staff is committed to holding cost increases to an absolute minimum and feels confident that the UV costs may not be as high as initially anticipated. Staff is asking for approval for changes to the 2019-21 biennium CIP.

With the increase to the cost of the grit removal and splitter box ($3.2M) and the secondary clarifier improvements, there is an overall proposed increase to the 6-year CIP of $3,738,033. Staff will evaluate the timing of the grit removal and splitter box improvements and come back to council prior to the end of this BN for future changes to the CIP.

STAFF RECOMMENDATION

Staff recommends option 1: accept the recent Wastewater Treatment Plant Facilities Assessment and Major Component Improvements Report, amend both the 2012 Comprehensive Sanitary Sewer Master Plan and the 2014 WWTP Facilities Plan and update the Capital Improvements Program (CIP) costs for the current 2019-21 biennium (BN).

ACTIONS, OPTIONS & POTENTIAL MOTIONS

1. I move to approve staff's recommendation to
    a. accept the 2019 Wastewater Treatment Plant Facilities Assessment,
    b. amend both the 2012 Comprehensive Sanitary Sewer Master Plan and the 2014 Wastewater Treatment Plant Facilities Plan, and
    c. update the Capital Improvements Program (CIP) costs for the current 2019-21 biennium (BN).
2. I move to approve staff's recommendation to
    a. accept the Wastewater Treatment Plant Facilities Assessment,
    b. amend both the 2012 Comprehensive Sanitary Sewer Master Plan and the 2014 Wastewater Treatment Plant Facilities Plan,
    c. however request additional information prior to accepting changes to the current 2019-21 biennium (BN) capital costs.
3. I move to request staff to reevaluate the Wastewater Treatment Plant Facilities Assessment and bring back revised costs and CIP adjustments.
4. I recommend staff not make any changes to the current wastewater treatment plant processes or CIP.

ATTACHMENTS

1. WWTP Facilities Assessment and Major Process Component Improvements, Final Project Summary Report; Jacobs August 2019 (Executive Summary only without Appendices –full report available here)

WWTP Facilities Assessment and Major Process Component Improvements

City of Ashland

Project Summary Report

August 2019

Contents

Final Summary Report

Background

In late 2018, the City of Ashland contracted with Jacobs Engineering Group to perform work for the Wastewater Treatment Plant (WWTP) Facilities Assessment and Major Process Components Improvements Project. This project includes an assessment of the wastewater treatment process and major process component elements. The assessment is based upon current and projected future flows and loads, capacity and redundancy requirements, anticipated regulatory changes, and waste characteristics.

This Final Summary Report summarizes the results of the four technical memorandum (Tasks 1 – 4) developed for this study. This summary report includes prioritized recommendations for the wastewater treatment plant process improvements.

Prioritized Improvements

In order of prioritization the following improvements are recommended:

Table 1 Prioritized Improvements

Improvement	Description	Construction Cost Estimate
Headworks Improvements	Construct new grit removal and oxidation ditch flow splitting downstream of existing screening facility. Replace existing headworks screen, washer compactor and accessories	$3,196,000 Grit Removal $560,000 Screenings system replacement
Disinfection Improvements	Replace the existing Medium Pressure High Output Ultraviolet (MPHO UV) disinfection system with a new MPHO UV system.	$800,000
Electrical System Modifications	Surge protection and Uninterruptable Power Supply Installation	$47,200 material cost Option A $58,700 material cost Option B
Biosolids Treatment Improvements	Replace failed valves to increase storage capacity/redundancy ahead of centrifuge dewatering	$250,000
Secondary Clarifier 2 Improvements	Replace Secondary Clarifier 2 mechanism, relevel effluent launder weir	$795,000
Plant wide major maintenance	The condition assessment identified maintenance improvements needs plantwide. Elements of these maintenance improvements may be	Cost depending on extent of elements of major maintenance to be included.

Improvement	Description	Construction Cost Estimate
	candidates for inclusion in a capital improvements package.	

Task 1 Load Analysis, Regulatory Analysis, Whole Plant Process Modeling and Hydraulic Model

This task updated the plant flow and load analysis using plant data from the past 5 years, evaluated the potential and anticipated regulatory changes affecting effluent quality and treatment requirements, developed a whole plant process model, and evaluated current operating water surface elevations at various points in the plant to confirm the existing hydraulic grade line through the unit processes is correct.

Regulatory Analysis

The WWTP is operating under the 2004 National Pollutant Discharge Elimination System (NPDES) Waste Discharge Permit 101609.

The NPDES permit includes interim limits for ammonia and stated that revised limits would automatically be applied upon DEQ adoption of the EPA 1999 ammonia criteria without a permit modification. DEQ has adopted new ammonia criteria, but the limits for the WWTP were not updated.

The City is relocating the plant discharge from Ashland Creek to Bear Creek to increase dilutions and improve fish habitat uses. Key drivers were compliance with ammonia and copper discharge criteria. The City is implementing Oregon Department of Environmental Quality (DEQ) required effluent and creek sampling to provide inputs to the Copper Biotic Ligand model/ This will be used to calculate site-specific (and seasonal) copper criteria for discharge compliance in Bear Creek.

Flow and Load Analysis

This evaluation updates 20-year flow and load projections based on the previous 5-years of plant data from the Ashland Wastewater Treatment Plant (WWTP), previous projections from the May 2014 City of Ashland, Oregon Wastewater Facilities Plan (Facilities Plan), and Oregon Department of Environmental Quality (DEQ) Facility Planning Guidelines.

Portland State University Population Research Center Population projections for the Ashland Urban Growth Boundary were reduced from previous facilities plans. The projected populations are included in Table 2.

Table 2: Population Projections

Year	Ashland Urban Growth Boundary Population
2018	21,501
2020	21,788
2025	22,539
2030	23,196
2035	23,544

Year	Ashland Urban Growth Boundary Population
2040	23,630
2045	23,617
2050	23,710
2055	23,595
2060	23,767

Future design wastewater loads were calculated by assuming that loads will increase proportional to population growth. The updated 2040 loads, summarized in Table 3, are lower than the Facilities Plan 2030 loads due to updates to the population projections and recent plant loads being lower than projected previously.

Table 3: Projected 2040 Influent Loads

	BOD5 lbs/day	TSS lbs/day	TKN ppd	Ammonia ppd	Phosphorus lbs/day
2018 - Population 21,501					
Wet Weather Average	4,044	3,981	670	402	88
Dry Weather Average	4,898	4,643	771	454	94
Wet Weather Maximum Month	5,050	5,044	830	483	115
Dry Weather Maximum Month	5,541	5,356	897	516	106
2040 - Projected Population 23,630					
Wet Weather Average	4,444	4,375	736	441	97
Dry Weather Average	5,383	5,103	847	498	103
Wet Weather Maximum Month	5,551	5,544	913	531	126
Dry Weather Maximum Month	6,090	5,886	986	567	116

Design flows were generally determined using the Oregon Department of Environmental Quality's *Guidelines for Making Wet-Weather and Peak Flow Projections for Sewage Treatment in Western Oregon: MMDWF, MMWWF, PDAF, and PIF*. Future flows were projected using the same methodology as the May 2014 City of Ashland, Oregon Wastewater Facilities Plan (Facilities Plan). Projected flows are summarized in Table 4.

Table 4: Updated 2040 Flow Projections

	2014-2018 Avg	Design 2018	Projected Unit Flow	2040
Population	-	21,501	-	23,630
Units	MGD	MGD	gpcd	MGD
Average Day Dry-Weather (ADWF)	2.38	2.4	111	2.6
Max Month Dry-Weather ($MMDWF_{10}$)	2.60	3.0	141	3.3
Annual Average Day (AADF)	2.34	2.3	109	2.6

Average Day Wet-Weather (AWWF)	2.30	2.3	107	2.5
Max Month Wet-Weather ($MMWWF_5$)	2.94	3.4	158	3.7
Peak Week (PWkF)	3.81	5.3	200	5.7
Peak Day ($PDAF_5$)	8.29	7.8	250	8.3
Peak Instantaneous (Hour) (PIF_5)	-	10.7	350	11.4

Whole Plant Process Modeling

Flows and loads were used to create and calibrate a whole plant process model using Jacobs' Pro2D™ process model for the specific unit processes at the Ashland WWTP. The model was used to achieve the following objectives:

- identify which unit process(es) become limiting as projected flows and loads increase over time
- evaluate the potential for and specific operating parameters associated with single oxidation operation to accommodate removing one oxidation ditch from service to facilitate cleaning and maintenance
- evaluate potential for and specific operating parameters associated with Secondary Clarifier #2 out of service to accommodate replacement of the mechanism

The scenarios listed in Table 5 were investigated to evaluate secondary treatment capacity based on solids loading, air requirements, and nutrient removal requirements.

Table 5: Scenarios

Scenario	Design Year	Flow Condition	Oxidation Ditches in-service	Clarifiers in-service	Tertiary Filters in-service
1 – Oxidation Ditch, N-1	2018	ADWF	1	3 & 2	Yes
2 – Clarifier, N-1	2018	MMDWF10	2	3 & 2	Yes
3 – Clarifier, N-1	2018	MMWWF5	2	3 & 2	No
4 – Limiting Unit Process	2040	MMDWF10	2	3 & 2	Yes
5 – Limiting Unit Process	2040	MMWWF5	2	3 & 2	No

The modeling results led to the following conclusions:

- An oxidation ditch should come offline for maintenance only in the summer to avoid peak flows. This should only occur when there is a good SVI. A 20-day SRT should be maintained when an oxidation ditch is offline to maintain effluent ammonia requirements. The RAS rate will need to increase to at least 75% due to the higher MLSS.
- The surface aerators in one oxidation ditch may be insufficient for the target effluent ammonia. Additional temporary aeration is recommended when an oxidation ditch is offline.
- There is sufficient clarifier capacity to have one clarifier offline for an extended period with current flows and loads. Increased RAS rate may be required at peak flows.

- Under 2040 average flows and loads there is sufficient secondary treatment capacity with all units in-service.
- Under 2040 peak flows and loads the clarifiers and firm RAS pumping capacity will be at their limit.

Hydraulic Model Confirmation

On August 6, 2019 at a flow of 2.13 mgd, water surface elevation measurements were taken from known concrete top of wall elevations at five locations throughout the plant to compare with values shown in the hydraulic profile included in the record drawings. The values were consistently below the values shown in the hydraulic profile for the 3.3 mgd average day maximum month flow. This is consistent with the hydraulic profile and serves to confirm that the design hydraulic profile is likely accurate.

Task 2 Condition Assessment

The Project includes a condition assessment of the major process component elements and systems. This assessment report is intended to be used to facilitate decision making. The system condition information can also be used to facilitate future repair and refurbishment projects.

Condition assessment activities occurred in late February 2019 and included document review, staff interviews and facility inspection. Routine maintenance, electrical and repair work is performed by City staff. Specialty craft work including SCADA, instrumentation and equipment rebuilds is performed by contractors.

Systems and components were rated using the rating scale described in Table 6. This rating system is published by the Association of Metropolitan Sewerage Agencies (AMSA) in Managing Public Infrastructure Assets to Minimize Cost and Maximize Performance, 2002.

Table 6

Asset Condition Assessment Rating Scale

GRADE	CONDITION	DESCRIPTION
0	Abandoned	Asset abandoned, no longer in use, or no longer exists
1	Very Good	Sound physical condition. Meets current needs. Operable and well-maintained. Asset expected to perform adequately with routine maintenance for 10 yr or more. No work required.
2	Good	Acceptable physical condition. Shows minor wear that has minimal impact on performance. Minimal short-term failure risk. Potential for deterioration or impaired performance over next 5-10 years. Minor work (if any) required.
3	Fair	Functionally sound but showing wear and diminished performance. Moderate short-term failure risk. Potential for further deterioration and diminished performance within next 5 years. Renewal or major component replacement expected within next 5 years. Minor work required but asset is serviceable.
4	Poor	Asset functions but requires a high level of maintenance to remain operable. High Risk of short-term failure. Likely to have significant deterioration in performance within next 2 years. Renewal or replacement expected within next 2 years. Substantial work required, asset barely serviceable.
5	Very Poor	Asset failed or failure is imminent. Excessive maintenance required. No further service life expectancy. Significant health and safety hazard. Major work or replacement is urgent.

Source: Association of Metropolitan Sewerage Authorities, "Managing Public Infrastructure Assets", 2002

The WWTP is well maintained with numerous refurbishments or replacements recently completed. The overall average condition rating for the WWTP is Good. Seventy-three percent of the system components rated Very Good or Good, followed by twenty-three percent rating as Fair.

Of the 187 components assessed, eight components were rated Poor to Very Poor condition. The components at most risk of failure is identified in Section 4 Results.

Table 7 provides a summary of the WWTP System condition ratings. The Systems at most risk of component failure is listed first with improved ratings in descending order.

Table 7 Summary of Overall System Condition Ratings

City of Ashland Wastewater Treatment Plant			Condition by Rating Value				
System Identification*	Unit Process Number	(1 = Very Good, 5 = Very Poor) Overall Condition Rating	1	2	3	4	5
Ultraviolet Disinfection	06	2.83	0	6	2	4	0
Secondary Clarifiers	03	2.80	0	2	2	1	0
Sludge Stabilization	20	2.73	0	4	6	1	0
Oxidation Ditches Process	02	2.50	0	8	8	0	0
Grit Removal and Screenings	01	2.41	0	11	5	1	0
WAS and Scum Pumping	05	2.36	1	7	2	0	1
3 Water	09	2.33	0	4	2	0	0
Effluent Re-Aeration and Effluent Pump Station	07-08	2.14	0	12	2	0	0
Sludge Feed and Dewatering	22	2.13	0	20	3	0	0
RAS Pumping	04	2.00	3	8	3	0	0
Auxiliary Systems	-	2.00	0	2	0	0	0
Membrane System	21	1.96	8	33	6	0	0
Ashland Creek Lift Station	19	1.92	3	8	2	0	0
Sodium Hydroxide System	11	0.00	0	0	0	0	0
	Overall Average	**2.15**					
** System identification as per system design documentation.*							
		Total Ratings	15	125	43	7	1
		Percentage	8%	65%	22%	4%	1%
			73%		27%		

The overall average condition rating of Good represents a well maintained and operated facility. The following systems have been identified as having the highest priority.

- The Ultraviolet Disinfection (UV) system is in the greatest need of refurbishment. The main control and power system are obsolete. Emergency spare parts are on hand however, replacement parts require custom fabrication. Custom parts cost four times the original cost and reliability of parts sources is not known. Adding new technology will improve reliability and reduce operating costs. Operators also report this system being a hydraulic bottleneck at high flows. The system is currently on line and meeting disinfection needs.

- The Secondary Clarifier 2 performance. The weir imbalance on clarifier 2 is causing hydraulic short circuiting. The clarifier 2 sludge removal mechanism is not performing as needed and requires frequent operator adjustment.
- The Sludge Stabilization System is serving as a holding tank for WAS. The holding tank is used for WAS storage so that dewatering operations can be completed during regular work hours. Inoperable valves need replacement to ensure the reliability of this system.
- The Oxidation Ditch system has large mixers and aerators that have been in service for over 20 years. Lubrication seepage is present on all units as seals are beginning to fail. Aerators and mixers are monitored by plant staff. Recommend developing a frequency for vibration analysis and motor condition monitoring.
- The Grit Removal and Screening System's mechanical bar screen is operating well with components in need of refurbishment. The screenings compactor trough has failed and is leaking wastewater onto the ground.
- The WAS and SCUM pumping system has a new WAS pump installed however, the WAS pumps that provide redundancy are not reliable. Having a reliable redundant WAS pump will help ensure process stability should the primary WAS pump fail.

Task 3 Specific Treatment Component Assessments

The Task 3 technical memorandum presents the evaluations of treatment areas specifically highlighted by the plant staff and recommends improvements for process optimization and/or needed improvements. This evaluation followed the condition assessment, flow/load projections, and whole plant modeling efforts so that recommended improvements can be informed by the potential for treatment capacity limitations and/or condition assessments that identify limitations that would need to be considered.

Each area listed below was evaluated for current operations deficiencies and recommendations for improvements. Conceptual level cost estimates for each recommendation are included in Table 1 above.

Headworks

A new grit removal facility is recommended downstream of the existing headworks to eliminate operational challenges related to ragging and due to the age of the existing grit system. A single Hydro International Headcell® unit with bypass channel is recommended because of space limitations and the efficiency of this equipment. The new grit facility would include flow splitting to three oxidation ditches, two existing, and one planned future ditch. In addition, based on the condition of the existing headworks screening system, we further recommend the replacement of the influent screen, washer compactor and associated equipment. Since we recommend installing a new grit removal system downstream of the existing screen, replacing the screen at this some time is a cost-effective approach. Additionally, the condition assessment identified several major screen components that needed repair/refurbishment, so a significant refurbishment investment would be required even if the entire screen were not replaced. We completed an estimate for a very similar headworks screen for another Oregon city late in 2018, and adjusting that estimate for Ashland's application, we estimate the construction cost to be $560,000.

Oxidation Ditch Flow Split

The new headworks grit removal system, recommended above, would include adjustable weir gates to split flow to existing and future oxidation ditches. This would alleviate the poor hydraulic split observed in the existing flow split box during peak flows.

If a new headworks is not constructed, minor improvements to the existing flow split box may be achieved by installing a horizontal baffle or replacing the fixed weirs with adjustable weir gates.

Oxidation Ditch

Though not identified as treatment element for evaluation, during the course of the whole plant modeling effort evaluating operation on a single oxidation ditch, results indicated such operation may require supplemental aeration under some future conditions (See the Technical Memorandum Task 1: Load Analysis and Process Modeling) In addition, during the project, the oxidation ditch manufacturer shared a proposal for replacing the existing aerators, perhaps when they have reached their useful life, with upgraded mixer/aerators that provide additional aeration at the same horsepower and with greater efficiency. We recommend the plant execute this upgrade at the point the existing equipment needs replacement. The equipment quote provided by the vendor was $150,000 per aerator/mixer.

Secondary Clarification

Secondary clarifiers experience daphnia blooms in the summer caused by algae growth. Launder covers can be installed to reduce algae growth and avoid the daphnia blooms, but the nearly $400,000 cost coupled with the fact that the Daphnia blooms have not created a compliance issue suggest that the benefit is not worth the cost, and we do not recommend covering the lauders.

The secondary scum pump should be replaced with one that has sufficient capacity to deliver scum to biosolids dewatering.

Secondary Clarifier 2

Recommendations for Secondary Clarifiers 2 include the following:

- Remove and replace Clarifier 2 mechanism
- Re-level Clarifier 2 peripheral weir
- Repair and coat Clarifier 2 launder surface

We recommend replacing Clarifier 2 suction pipe type mechanism with a spiral scraper type mechanism similar to Clarifiers 1 and 3. Benefits include more similar clarifier performance (consistent sludge movement, eliminated draft tube plugging, etc.), and Operations will no longer need to adjust the suction pipe valves to balance the sludge removal

The condition of Clarifier 2 weirs was good, so reuse of the weirs is expected. Re-leveling the weirs might be made using the existing weir plates if oversized holes or slots in the plate exist.

Clarifier 2 launder coating is recommended. Not only does the coating protect the concrete from further erosion, but it can also make a surface that is more easily cleaned preventing algae buildup.

For all these tasks, Clarifier 2 will be required to be taken out of service for approximately 3 months. Coordination of this shutdown with seasonal conditions will be required to minimize impacts to operation.

UV Disinfection

The UV disinfection system alternatives evaluation included the evaluation of low pressure, high output (LPHO) in an open channel configuration and medium pressure, high output (MPHO) closed conduit UV systems in the current location. In addition, two potential locations for in-channel LPHO UV disinfection were considered, and the potential energy savings associated with replacing the existing 20-year-old MPHO UV system was evaluated.

The UV system alternatives are sized for disinfecting secondary effluent to receiving stream disinfection requirements. From the existing plant design summary, the original system was sized for UV doses that would be associated with Class A recycled water disinfection, but conversations with both Oregon DEQ and plant staff confirmed recycled water was never produced, nor is needed at this time.

Three UV system upgrade alternatives were evaluated:

- Replacement of in-conduit MPHO UV in current location. This alternative includes the elimination of the size reduction in existing pipe configuration to relieve the hydraulic bottleneck.
- In-channel LPHO UV in existing post-aeration channel upstream of the point where tertiary and secondary effluents are combined.
- In-channel LPHO UV downstream of tertiary filtration, where tertiary and secondary effluents are combined. This would result in disinfection of secondary effluent when tertiary treatment is offline, and disinfection of tertiary effluent when tertiary treatment is online.

Table 8 summarizes the construction cost estimates for the three alternatives evaluated.

Table 8 UV Alternatives Construction Cost Estimates

Alternative	Cost
Alternative A – Existing In-Conduit MPHO UV Replacement	$0.8 M
Alternative B – New In-Channel LPHO UV in Re-Aeration	$1.2 M
Alternative C – New UV Facility, downstream of tertiary treatment	$2.9 M

The existing plant water (3W) pump station is in the channel between the existing MPHO UV system and the re-aeration channels, and would not require relocation under Alternative A. Alternatives B and C would require relocation of the 3W pump station downstream of disinfection, or an alternate disinfection system for just the 3W system. The cost estimates do not reflect this additional cost that would only drive up the costs of Alternatives B and C relative to Alternative A. The configuration of the existing UV system allows for phased replacement and continued disinfection during construction of Alternative A.

LPHO UV disinfection is less energy consumptive than MPHO UV disinfection. For the anticipated dose/flows treated, the annual energy consumption difference (cost of electricity based on $0.06/kWh) is:

Trojan LPHO channel: $8,415 based on an average power draw of 16 kW

Aquionics MPHO vessel: $26,508 based on an average power draw of 50.4 kW

The LPHO UV system uses less energy than the MPHO UV system but has a higher capital cost. It would take 22 to 25 years operating the LPHO UV system before the system would make up the capital difference depending on the actual capital cost of the UV equipment, and the cost to relocate the plant water pumps and piping system.

For the following reasons we recommend Alternative A for UV disinfection upgrade:

- The alternative addresses the hydraulic and obsolescence deficiencies with the current system
- The alternative does not require the relocation of the 3W pump station
- Implementation of the alternative is the least disruptive to plant operations
- Plant staff report no issues with MPHO UV regarding disinfection reliability, operations and maintenance outside of the obsolesce of elements of the system.
- While the MPHO energy consumption is greater than LPHO UV, MPHO systems have less lamps, sleeves, ballasts and the cost of replacing those items is less than for the LPHO systems.
- The alternative would have the lowest design and construction cost.

RAS Pump Station

Replacement of the Secondary Clarifier 2 sludge removal mechanism is expected to improve issues regarding RAS removal. No improvements are recommended for the RAS Pump Station.

Biosolids Dewatering

We recommend that the corroded plug valves and telescoping valves in the Stabilization Holding Tank be replaced for continued use and increased redundancy of this structure to store WAS.

Task 4 Electric System Harmonic Analysis

The Ashland WWTP has experienced problems associated with their SCADA communications systems that may be related to electrical “noise” and/or harmonic issues within the plant electrical system. The City has noted that the active harmonic filters on the system do not currently function and are therefore not providing harmonic mitigation.

There are several issues that high harmonic distortion may cause:

1. High harmonic distortion may create voltage spikes at the windings of the upstream transformer, reducing overall transformer life. At this facility, this could cause a slight reduction in the overall life of the Utility transformer if there was enough overall harmonic distortion.
2. High harmonic distortion can change the power factor at the facility.
3. High harmonic distortion can cause problems with sensitive electronic equipment.

Issues 1 and 2 above mostly affect the connecting Utility. We have noted in most cases that the serving electric Utility is not concerned with the harmonic content affecting the transformer and rarely charges the customer for bad power factor. Issue 3 is of most concern to the City.

In looking specifically at the SCADA system, we note that it is powered from 120/208V panelboards. The majority of the non-linear loads, such as the VFDs and the UV system, are powered from the 480V bus. The 480-120/208V transformer's leakage inductance and capacitance will provide some harmonic mitigation to the 120/208V bus but aren't specifically designed to mitigate harmonics unless special harmonic mitigating transformers are used. The plant SCADA system is shown to be powered from a 4.3kVA UPS. This UPS should be checked to make sure it's providing clean, uninterrupted power to the SCADA panel and that it's in good working order. Assuming the UPS is working properly, other noise contributors could be the various instruments and devices connected to the SCADA system that are powered from non-UPS power sources.

The following modification options are available to mitigate harmonics on the Ashland WWTP electrical system:

1. Review all new and existing VFDs to ensure 3% (min.) reactors on the line side of the drive are installed.
2. Replace the existing full plant active harmonic filters with new active harmonic filters.
3. Provide on-line type uninterruptible power supplies at the incoming power feeds to SCADA RIO panels and instruments.
4. Replacing the step down 480-120/208-volt transformer with harmonic mitigating transformers.

Our review of the electrical system also noted that surge protection devices were not shown on the record drawings which could keep voltage surges/spikes from causing undo harm to electrical equipment.

To improve the overall power quality at the facility the following changes are recommended:

1. Add a 480V surge protection device at Main Switchgear "A" to limit voltage surges from adversely affecting the systems electrical equipment.
2. Review new and existing VFDs to ensure they have 3% (min) line reactors installed.
3. Analyze the UPS feeding the plant SCADA system to make sure it's an online type providing clean uninterruptible power to the plant SCADA panel.
4. Add 120/208V surge protection devices at the following lighting panelboards. These panelboards are directly fed from a transformer and could have the possibility of adverse voltage surges from the secondary side of the transformer.
    a. LP-1
    b. LP-2
    c. LP-3
    d. LP-4
    e. LP-7
    f. LP-8
    g. LP-9

To mitigate harmonic content on the SCADA and instrumentation system, the following changes are recommended:

A. Option A: Provide panelboard type Uninterruptible Power Supply (UPS) systems for panelboards LP-2, LP-7, and LP-9.

B. Option B: In lieu of or in addition to the UPS recommendations in Option A, replace the existing transformers for LP-2, LP-7, and LP-9 with harmonic mitigating transformers.