Inland Empire Paper Company
NPDES Permit No. WA-000082-5
Permit Condition S4

Schedule of Compliance for CBOD5 and Total Phosphorus 2024 Annual Status Report

November 1, 2024

Table of Contents

Schedule of Compliance for CBOD5 and Total Phosphorus 2024 Annual Status Report

1.0 PURPOSE AND OUTLINE

Permit Condition S4, Schedule of Compliance for CBOD5 and Total Phosphorus (as P), of Inland Empire Paper Company's (IEP) National Pollutant Discharge Elimination System (NPDES) Permit No. WA-000082-5 includes a requirement to develop an Annual Status Report that delivers the following:

> *By the dates tabulated below, the Permittee must complete the following tasks and submit a report describing, at a minimum:*
>
> - *Whether it completed the task and, if not, the date on which it expects to complete the task.*
> - *The reasons for the delay and the steps it is taking to return the project to the established schedule.*
> - *The Annual Status Reports must contain a detailed description of the steps taken and plans to optimize the treatment system performance; and progress in meeting the Final Water Quality Based Effluent Limits.*

Item	Task	Due Date
1.	Annual Status Reports	November 1 of each year
2.	Meet Final Water Quality Based Effluent Limits for $CBOD_5$ and Total Phosphorus (as P)	November 1, 2024

IEP has committed significant capital and resources towards attaining the stringent DO TMDL water quality based effluent limits (WQBELs) that imposed reductions of 97% to CBOD and 93% to Total Phosphorus (TP) in IEP's final effluent from its pre-TMDL permit. These investments over the past 20 years, summarized in Section 6.0 *Past Tasks Implemented* have elevated IEP to one of the most advanced wastewater treatment facilities in the U.S. and the first in the pulp and paper industry to treat 100% of its effluent using ultra-filtration (UF) membrane tertiary treatment.

Even with all these state-of-the-art wastewater treatment system (WWTS) investments, IEP has been unable to consistently demonstrate performance below the WQBELs. IEP was provided a two-year compliance schedule extension to further evaluate and optimize operations of its WWTS, and evaluate the Delta Elimination tools towards compliance with the WQBELs. The compliance schedule extension granted by the WA State Department of Ecology (Ecology) assumed that no major additional modifications to IEP's WWTS were required. IEP and Ecology agreed that should the evaluation of IEP's WWTS under the compliance schedule determine that additional major modifications were necessary that an extension to the compliance schedule would be reconsidered.

The two-year compliance schedule extension expires on November 1, 2024, the same date of this Annual Status Report. As outlined in greater detail in Sections 3.0 *Current WQBEL Status* and 4.0 *Current Task Progress*, IEP has identified and committed to additional major capital investments needed to achieve the final WQBELs, and has therefore requested that the compliance deadline be extended to the end of the current permit cycle (July 31, 2027).. This extension will provide the time needed to complete construction, start-up, commissioning, and optimization of the required improvements to IEP's WWTS.

Section 5.0 *Delta Elimination Plans* presents various implementation tools allowable under the DO TMDL that IEP has successfully demonstrated for incorporation into its NPDES permit. With final compliance approaching, this section has a greater focus on tools already approved and those that IEP intends to finalize during the next permit renewal. A brief discussion of other potential implementation tools is included to emphasize that IEP reserves the right to reconsider any of these as needed.

Section 6.0 *Past Tasks Implemented* summarizes the historical achievements IEP has implemented to achieve this unprecedented level of treatment.

2.0 Cross-Functional Team for Annual Status Report Development

IEP's Engineering, Production and Management staff all play significant roles in the development and implementation of this Annual Status Report based on their respective disciplines, responsibilities, and departments. Key individuals contributing to this effort include:

Doug Krapas – Environmental Manager and Team Leader
Benjamin Carleton – Technical Superintendent
David Demers – Process Technician
Fletcher Austin – Mill Manager
Kevin Davis – Manager of Strategic Projects
Shawn Arman – Paper Machine Superintendent
Tanner Gerety – Pulp Mill Superintendent
Chris Robinson – President and General Manager

3.0 CURRENT WQBEL STATUS

3.1 *Summary*

The Annual Status Reports from the previous three years have documented in detail the extent to which IEP has encountered unusual and unexpected challenges to the WWTS that delayed compliance with the WQBELs for TP and CBOD. Being the only pulp and paper facility with this degree of wastewater treatment sophistication, and having a fundamentally different influent compared to municipal facilities, has left IEP at the forefront in developing technologies and handling unintended consequences as the complexity of the treatment system has increased.

The nutrient graphs dating back to 2008 (see images in Section 3.2 below) clearly show steady and sustained improvements in performance until about 2018 (for TP) and 2021 (for CBOD). In fact, at different times, both TP and CBOD were attaining effluent quality within the range of the final WQBELs. The loss of treatment performance that began in 2021 was initially thought to betransitory , but became apparent that the problems distressing the system would require more rigorous evaluation and remediation.

IEP has long relied upon experts in the industry to guide progress towards development of its state-of-the-art wastewater treatment system. Because IEP's WWTS is a unique and unprecedented system, IEP continues to utilize a wide range of subject matter experts (SMEs) that, in the aggregate, play a significant role in assisting IEP to evaluate and provide recommendations towards its goal of attaining the DO TMDL WQBELs. A partial list of the most recent SMEs include the following entities:

- Arcadis U.S., Inc. – WWTS design expertise
- Aster Bio, Inc – DNA & microbiological expertise & analysis
- Esvelt Environmental Engineering, LLC - WWTS design expertise
- Headworks International Inc.– Moving Bed biofilm Reactor (MBBR) expertise
- Leach Microbial Consulting – microbiological expertise and analysis
- LimnoTech – DO TMDL implementation tools modeling
- National Council of Air and Stream Improvement (NCASI) – Pulp & Paper WWT expertise
- Philip Pagoria, P.E., Ph.D, Consulting Environmental Engineer - Pulp & Paper WWT expertise
- Redmon Engineering Company - dissolved oxygen & activated sludge expertise & analysis
- Rubicon Environmental Services, LLC – dissolved oxygen & activated sludge expertise & analysis
- WesTech – Ultrafiltration Membrane expertise & analysis

This working group of experts has established several key areas that explain the source of the unexpected difficulties and the solutions developed towards resolving them.

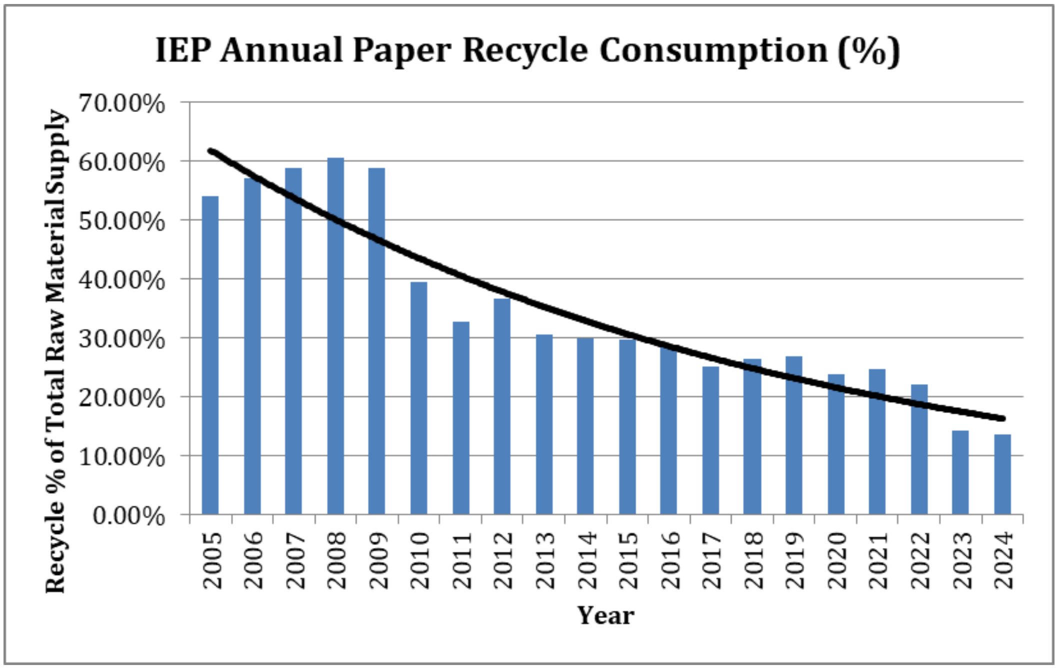
First, and most consequential, was the discovery of the recirculation and accumulation of problematic bacteria and their protective coating, known as extracellular polymeric substances (EPS). With the 2020 installation of the UF system as a “firewall” within IEP’s WWTS, there was no pathway out for the contaminants removed by the membrane filters, so they continued to accumulate in the rejects stream and were continually recirculated back to the WWTS. The working group was able to prove that this phenomenon was responsible for elevated turbidity and solids, andwhy the UF membranes were coated with a “slimy” substance. With this knowledge, IEP was able to engineer a pathway out for these contaminants via the Dissolved Air Flotation (DAF) system, resulting in immediate removal of these contaminants and improvement to the turbid water conditions. For a more detailed explanation, see Section 6.29.

With this issue of high turbidity and solids resolved, the working group was able to focus on a comprehensive assessment of the rest of the system that was previously being masked. Key factors included:

- Endogenous decay of biological matter in the secondary clarifier
- Elevated effluent temperatures
- Filamentous bacteria outbreaks due to low food-to-microorganism (F/M) ratio
- Low dissolved oxygen

All four of the above listed criteria, the group concluded, are a direct consequence of greater dependency on virgin wood fiber and associated higher BOD loads entering the WWTS. The increase in virgin wood fiber use is due in part to market changes initiated by the COVID-19 pandemic and an acceleration of a decline in the quality and reliability of recycled paper fiber.

As documented at length in other IEP submittals, recycled paper fiber contains inks and pigments with concentrations of polychlorinated biphenyls (PCBs) billions of times higher than the water quality standards. Because this generation of PCBs is allowed under the Toxics Substance Control Act (TSCA), and because the Environmental Protection Agency (EPA) has refused to address this discrepancy, IEP has intentionally reduced its dependency on recycled paper fiber, contributing to an increase in CBOD load due to its replacement with virgin wood fiber.



The solutions towards permanently resolving these factors are detailed in Section 4.0 *Current Task Progress*. A summary of the most critical element, the upgrade to the activated sludge aeration capacity, is included briefly here.

As mentioned above, the primary issue is an overload of CBOD beyond the design capacity of the current WWTS, leading to stress conditions and sub-optimal treatment performance, resulting in the need for increased CBOD treatment capacity. A capital improvement project has been implemented to simultaneously address the following two concerns:

- Low dissolved oxygen (D.O.) concentration in IEP's activated sludge system, and
- The generation of poor floc-forming bacteria, such as filaments, that do not settle and adversely affect desired sludge retention times

The details of this project are outlined in Sections 4.1 and 4.2. First, the current aeration technology will replace surface mechanical aerators with fine bubble diffusers located on the basin floor, resolving the D.O. limitation and greatly increasing CBOD capacity. Second, the outermost activated sludge basin (and first sequentially) will be converted from a circulating well-mixed reactor to a plug-flow single-pass reactor. This modification creates a "selector" effect, well known in wastewater engineering principles, to select for good settling floc-forming bacteria and the ability to control solids retention time.

IEP has implemented an aggressive project schedule to implement this project:

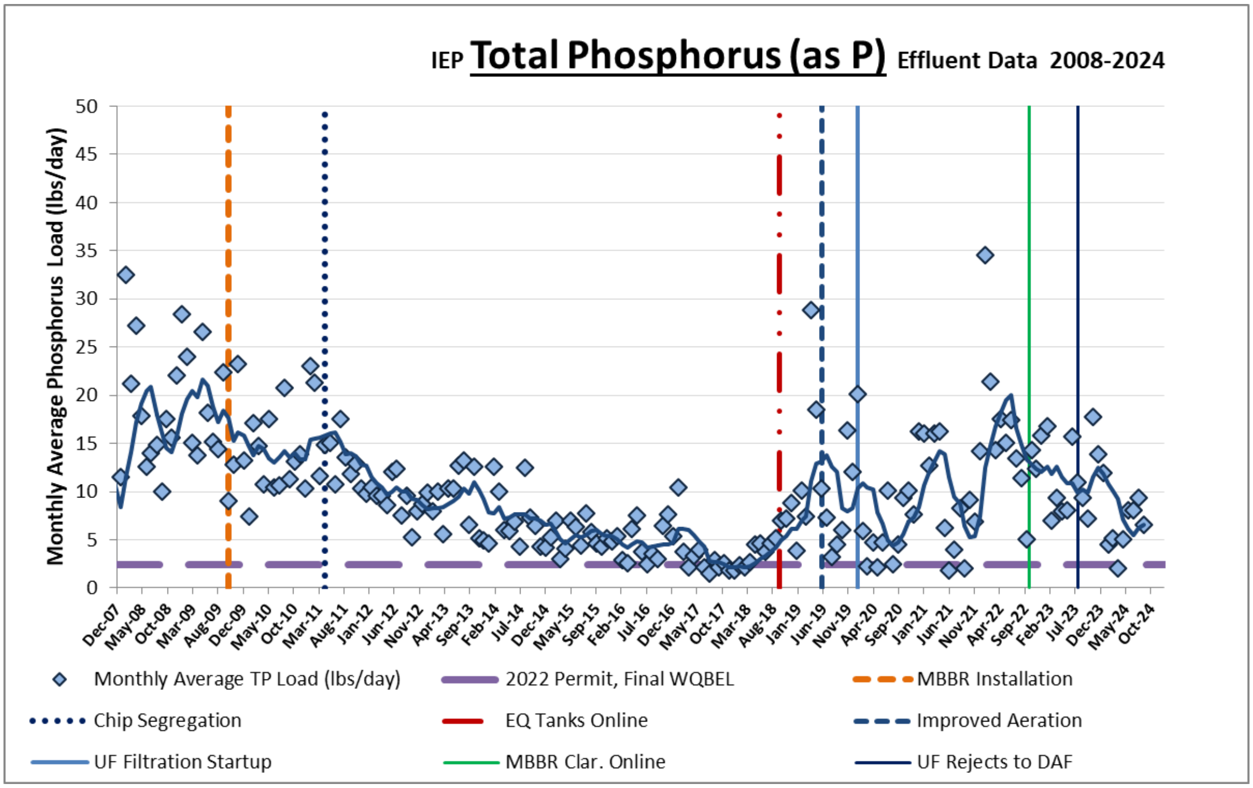
- Pilot testing – November 2023 (Complete)
- Project design – January 2024 (Complete)
- Funding – April 2024 (Complete)
- Initiation – May 2024 (Complete)
- Submittals due – July 2024 (Complete)

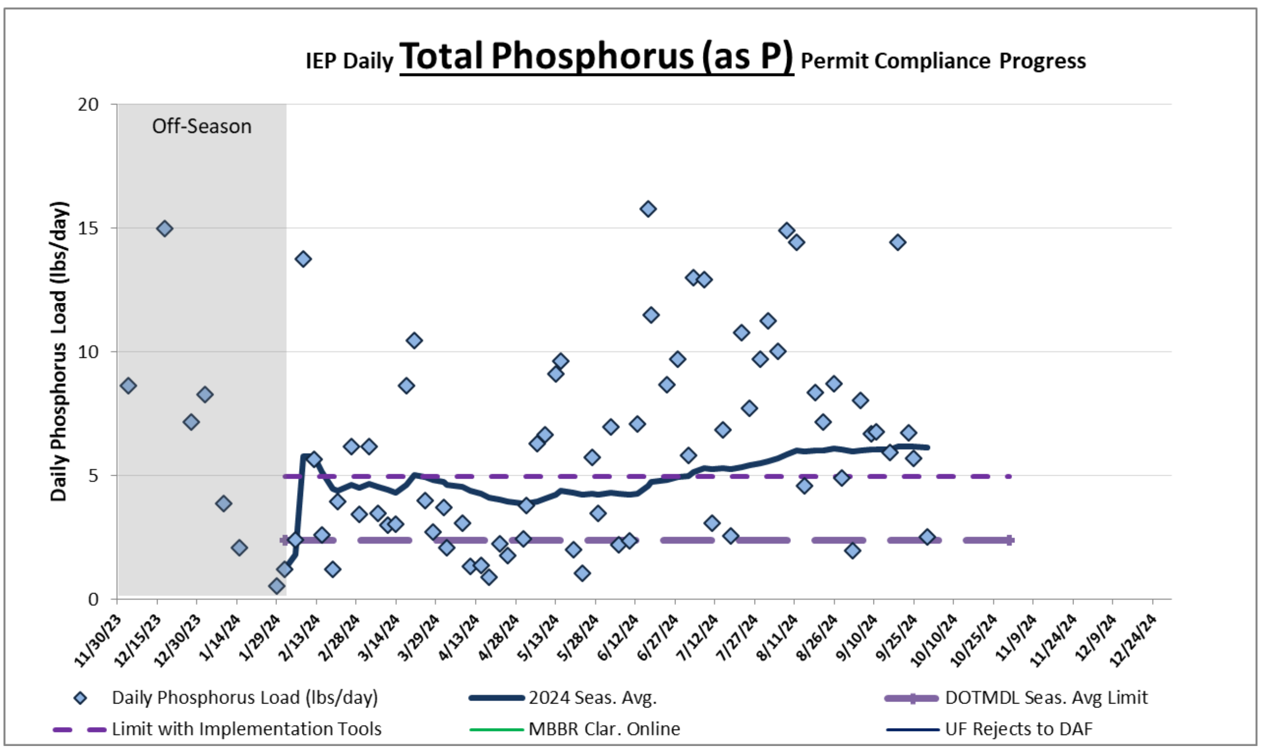
- Phased construction begin – September 2024 (Complete)
- Phased construction complete – January 2025 (Currently in progress)
- Start-up and commissioning – estimated between April thru June 2024
- Acclimation complete – estimated by June 2025
- Optimization – following the completion of the acclimation period
- Reevaluation of IEP’s WWTS to meet the WQBEL’s and the need for any additional improvements - through the end of this permit cycle, November 2027

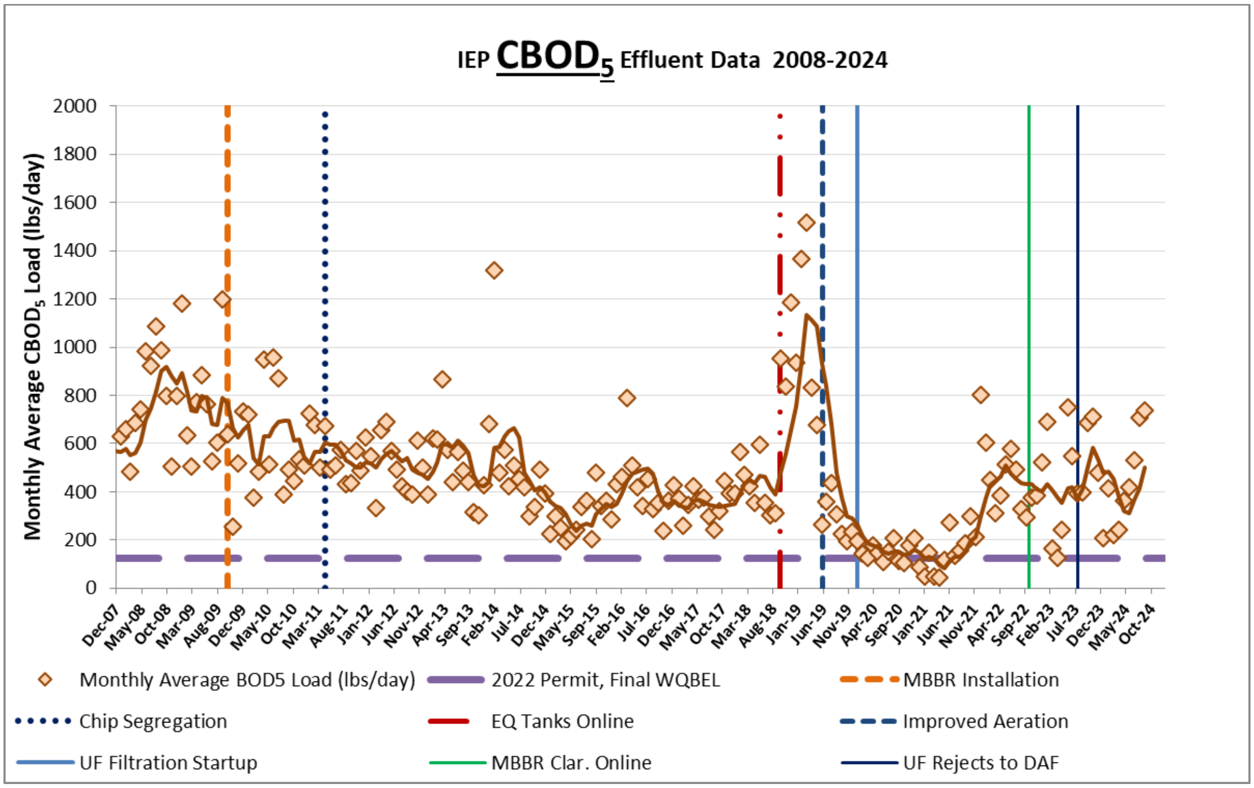
By resolving the D.O. limitation and maximizing CBOD treatment capacity, IEP is confident that the activated sludge system will be able to perform complete, or nearly complete degradation of CBOD while eliminating stress conditions that often result in elevated TP.

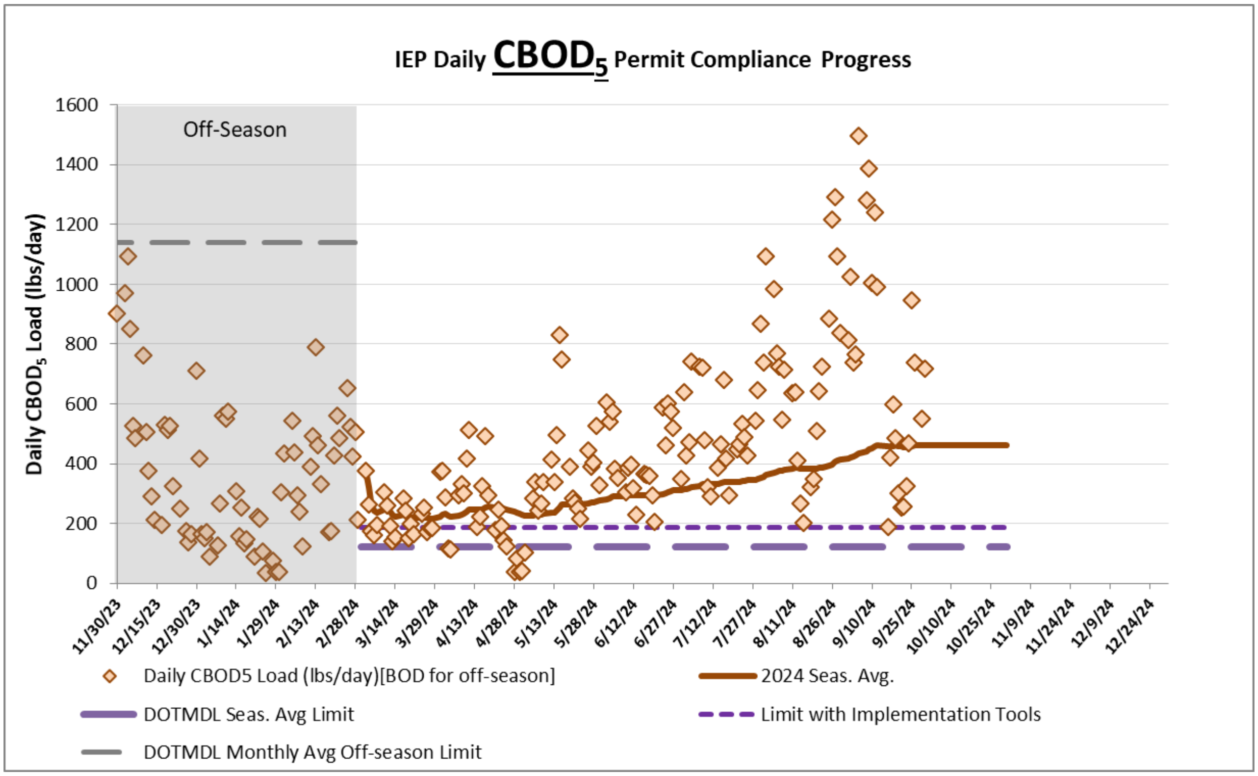
The regulatory flexibility afforded by the Delta Elimination tools are a critical element to IEP’s ability to meet the WQBELs. As demonstrated in the performance graphs below, IEP is approaching compliancewith the implementation tools incorporated.. Implementation of the WWTS improvement projects described in this status report combined with the regulatory implementation tools will produce the greatest likelihood of success of meeting these unprecedented D.O. TMDL water quality limits.

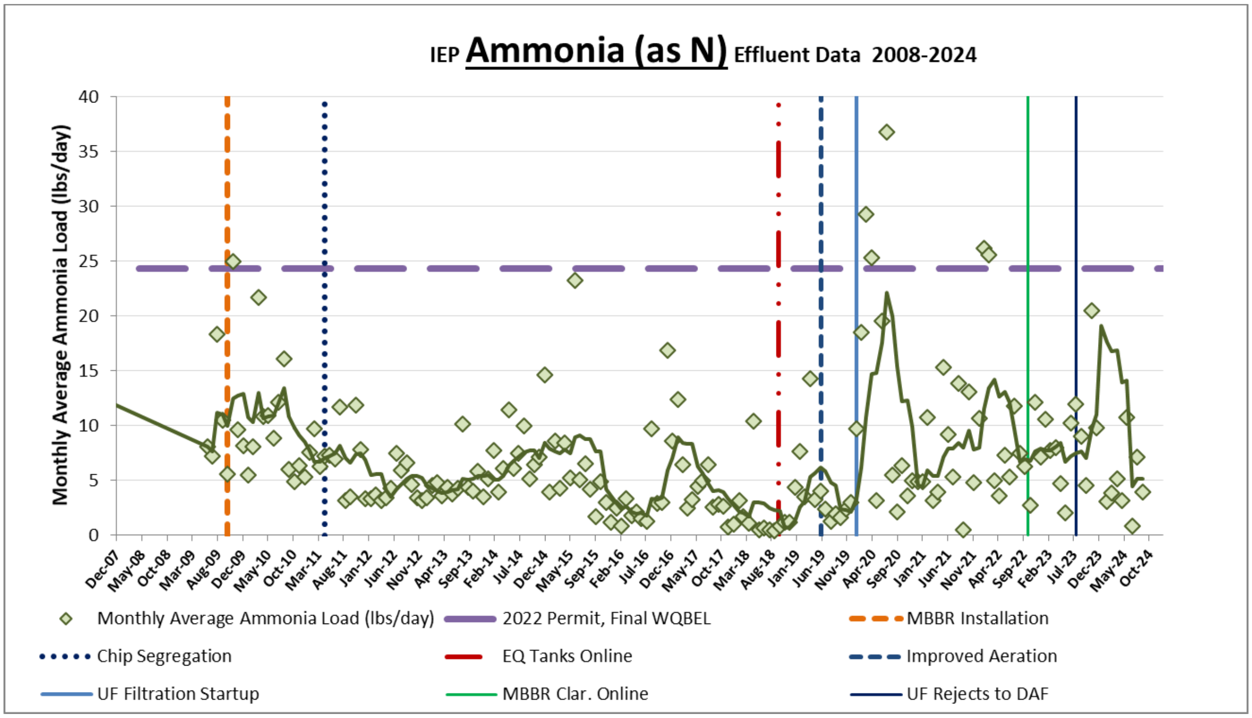
3.2 *Performance Graphs*






IEP CBOD5 Effluent Data 2008-2024
Monthly Average CBOD5 Load (lbs/day)
Monthly Average BOD5 Load (lbs/day)
2022 Permit, Final WQBEL
MBBR Installation
Chip Segregation
EQ Tanks Online
Improved Aeration
UF Filtration Startup
MBBR Clar. Online
UF Rejects to DAF


IEP Daily CBOD5 Permit Compliance Progress
Off-Season
Daily CBOD5 Load (lbs/day)
Daily CBOD5 Load (lbs/day)[BOD for off-season]
2024 Seas. Avg.
DOTMDL Seas. Avg Limit
Limit with Implementation Tools
DOTMDL Monthly Avg Off-season Limit


IEP Ammonia (as N) Effluent Data 2008-2024
Monthly Average Ammonia Load (lbs/day)
Monthly Average Ammonia Load (lbs/day)
2022 Permit, Final WQBEL
MBBR Installation
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UF Filtration Startup
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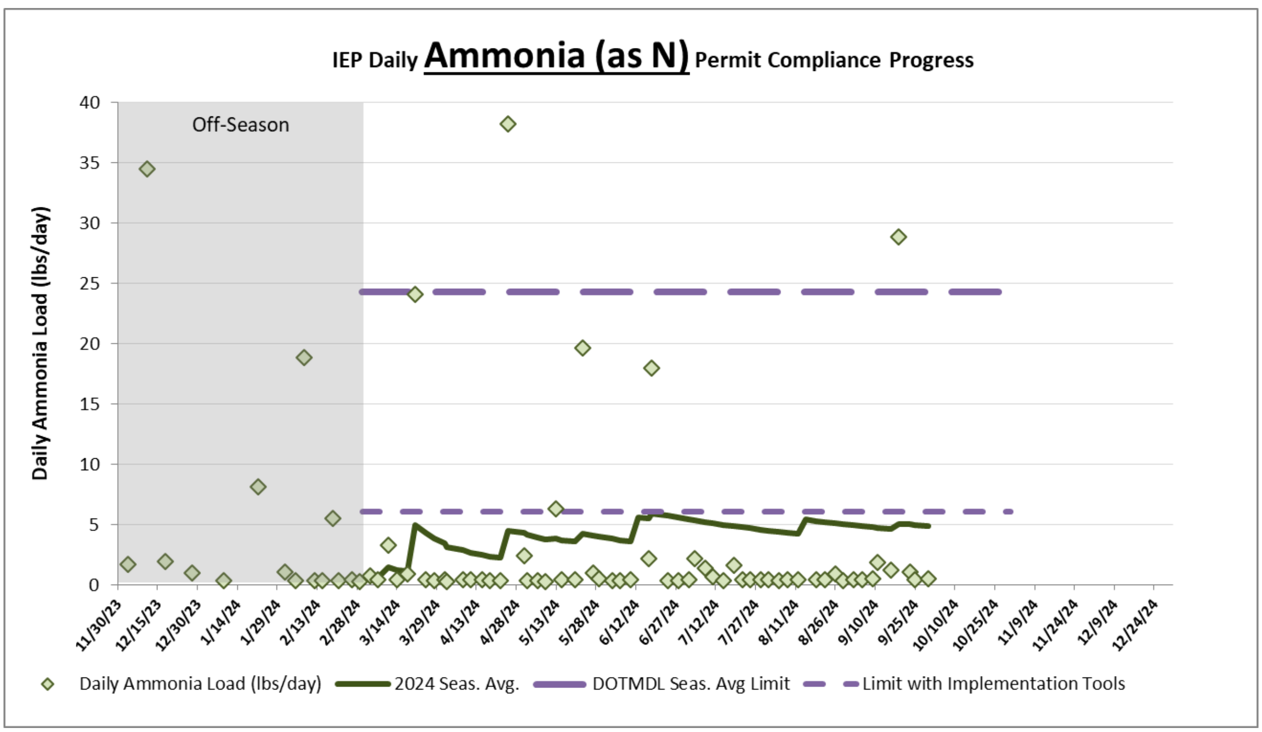

IEP Daily Ammonia (as N) Permit Compliance Progress
Off-Season
Daily Ammonia Load (lbs/day)
Daily Ammonia Load (lbs/day)
2024 Seas. Avg.
DOTMDL Seas. Avg Limit
Limit with Implementation Tools

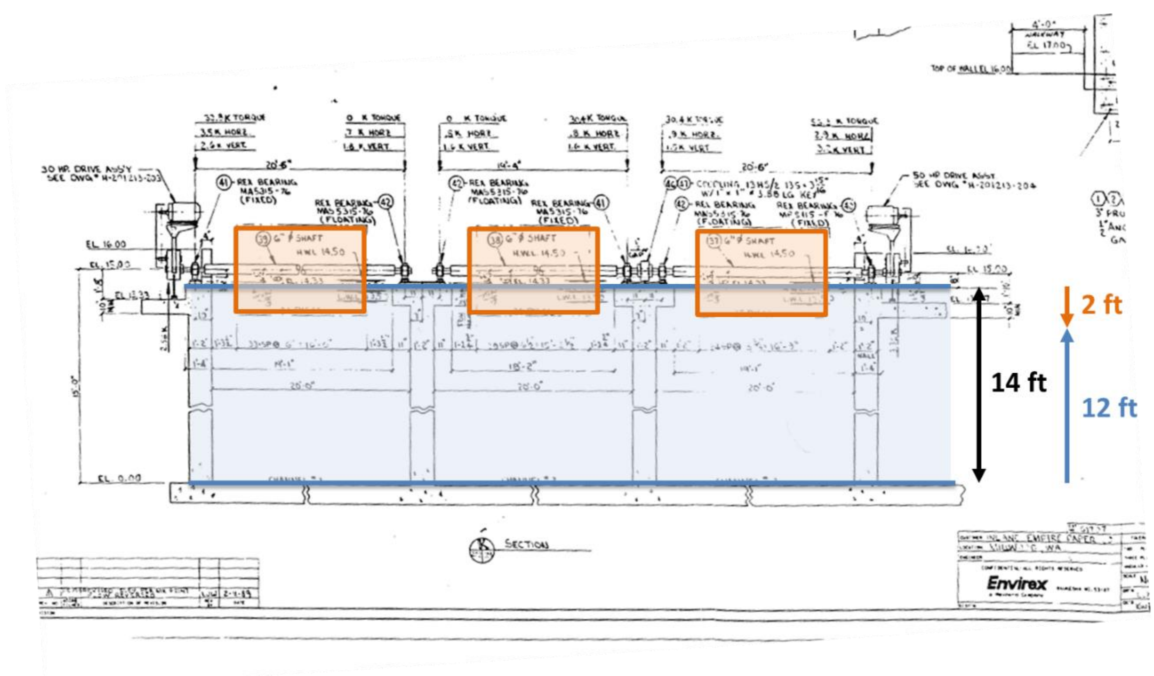
4.0 CURRENT TASK PROGRESS

The following list provides active tasks that are expected to have a significant impact towards IEP's goal of complying with the WQBELs.

4.1 *Fine Bubble Aeration (2023-Present)*

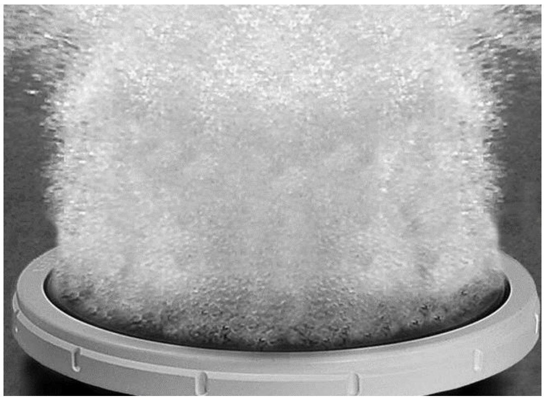
IEP's working group of SMEs (see Section 3.1) identified low dissolved oxygen in the activated sludge as one major inhibition factor preventing complete degradation of CBOD in the WWTS. In response, IEP has committed to a multi-million dollar upgrade of the aeration technology to improve D.O. conditions. The schedule for completion is aggressive. Pilot testing began in November 2023 and final project start-up is expected in the spring of 2025. A period of acclimation and optimization of operating parameters will begin immediately following start-up. IEP will then evaluate the effectiveness of its overall WWTS throughout the balance of the permit cycle to determine its capability to attain the WQBELs, and implement further improvements if needed.

The activated sludge portion of IEP's WWTS is often referred to as the Orbal, which is the brand name for a particular configuration of tanks trademarked and sold under the Evoqua brand. The initial installation of the Orbal was in 1989 and utilized the then-optimal method of aeration using surface discs and mechanical agitation. As technology matured in the ensuing decades, surface aeration was replaced with fine bubble diffusion as the standard technology for improved oxygen transfer. The difference between the technologies can be seen in the images below. Surface aeration only impacts the top two feet for a basin that is 14 feet deep. This configuration leads inevitably to anoxic or anaerobic conditions near the bottom of the basin.



Reference: Original cross-section drawing of IEP's Orbal tank system, superimposed to show area of effect of surface disc aerators.

In contrast, fine bubble diffusion utilizes aeration discs with small perforations to allow fine-sized bubbles of forced air to diffuse into the water column. Because these are installed at the bottom of the basin, the entire water column is aerated, with more efficient oxygen transfer and more efficient vertical mixing.

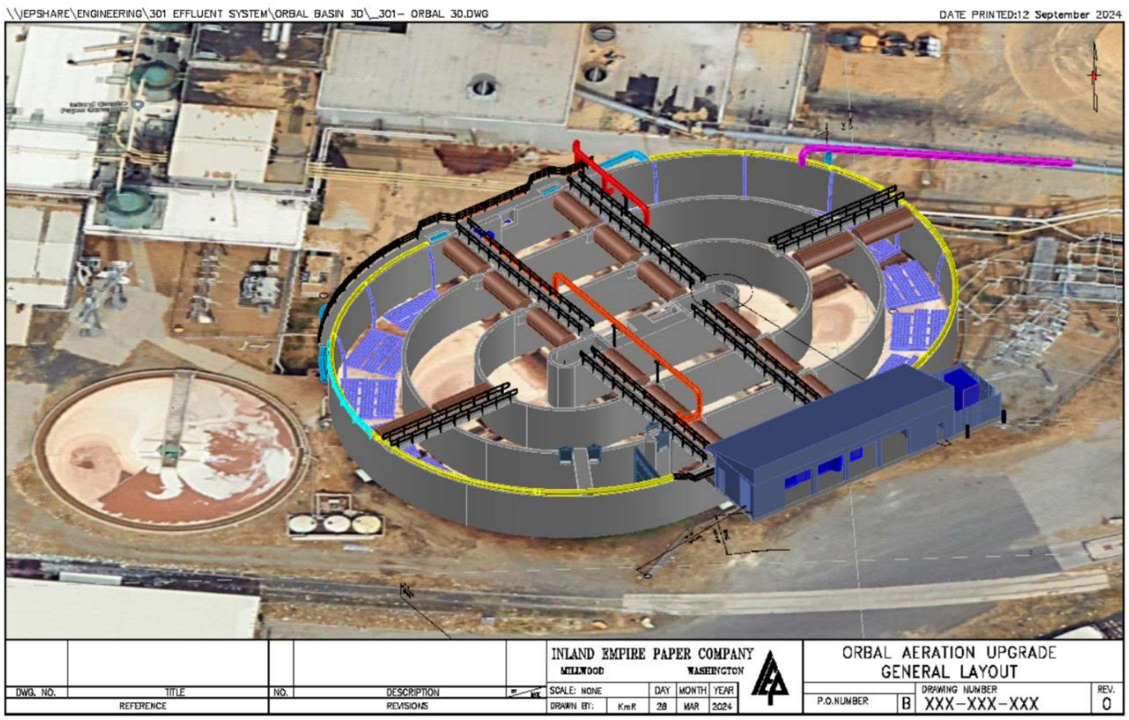


Reference: SSI Aeration; stock photos to show example, not images of IEP's actual system.

IEP has designed and is executing a project to convert the outermost basin in the Orbal (first tank in series of three concentric oval tanks) from exclusively surface aeration to exclusively fine bubble diffusion. Elements of the design include the following:

- Increase the CBOD treatment capacity to match IEP's historical maximum daily load
- Install 16 removable grids, each with 242 fine bubble disc diffusers, ballasted to the floor of the aeration basin
- Construct a new blower building with three (3) in-line blowers
- Allows for future upgrade to the middle and inner aeration basin channels, if deemed necessary
- Convert the outer aeration basin from a well-mixed reactor to a plug-flow reactor to create a "selector" effect and eliminate environmental pressure of low food-to-microorganism ratio on the biomass (see Section 4.2 for more information)

By resolving the D.O. limitation and maximizing CBOD treatment capacity, IEP is confident that the activated sludge system will be able to perform complete, or nearly complete degradation of CBOD while eliminating stress conditions.



Reference: Three-dimensional model of IEP's aeration upgrade.

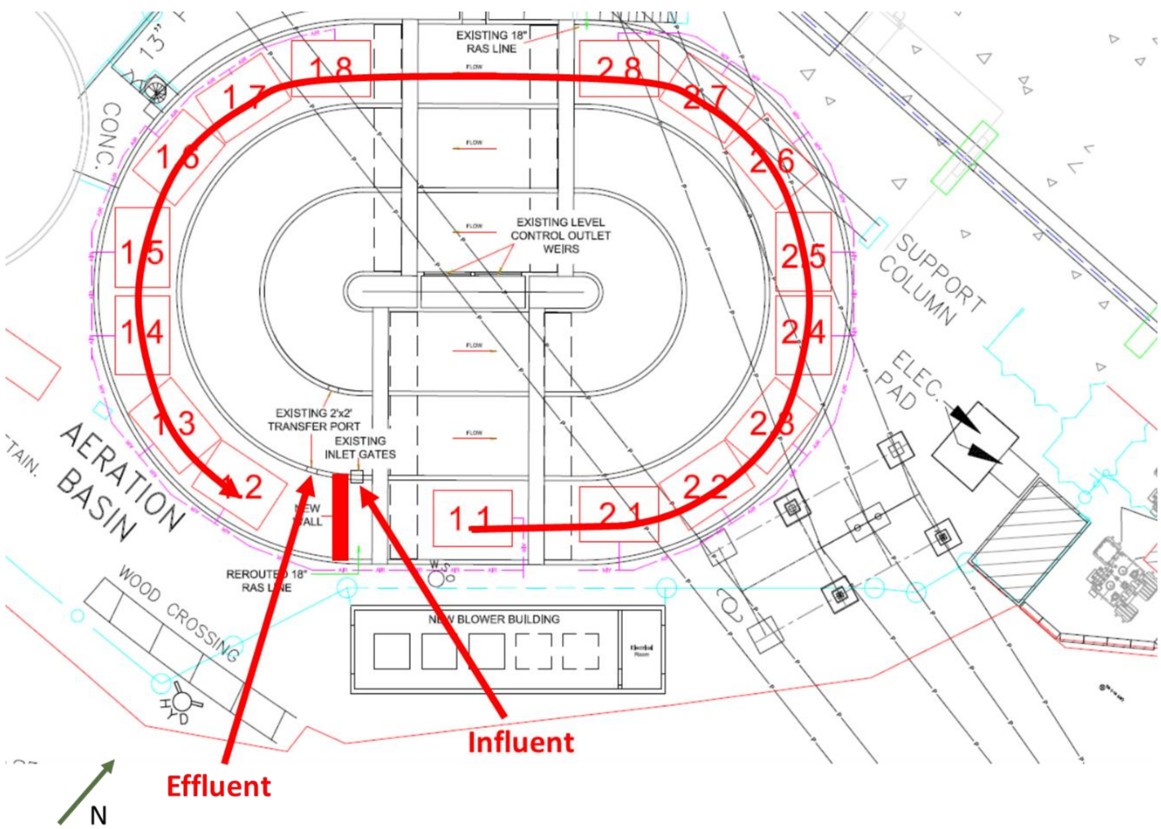
4.2 *Food-to-Microorganism Optimization and Reconfiguration (2023-Present)*

Conventional activated sludge relies on the generation of a healthy, stable biomass to break down organic material. An imbalance in the biochemistry may lead to poor treatment performance or generation of an undesirable biomass. As can be seen throughout this report, IEP has addressed many problems in the past related to nutrients (see Sections 4.5, 6.13, 6.14, 6.21, 6.23, 6.24, 6.25, and 6.28), dissolved oxygen (see Sections 1.1, 6.15, and 6.22), temperature (see Sections 4.4, 6.6, and 6.17) and load stabilization (see Sections 4.3, 6.8, 6.19, and 6.27). Despite these improvements spanning decades, IEP's activated sludge continues to perform suboptimally with a difficult settling biomass, indicative of stress or imbalance. This problematic biomass often leads to poor treatment, such as release of nutrients (phosphorus, ammonia, and CBOD) during secondary clarification, or elevated TSS feeding the downstream ultrafiltration membranes.

IEP's working group of SMEs (see Section 3.1) concluded that the primary cause of this poor settling is due to filamentous bacteria that thrive in an environment with a low food-to-microorganism ratio (F:M) and when there is insufficient CBOD to properly feed the total amount of biomass. This creates a food deficiency where filamentous bacteria have a competitive advantage and grow rapidly. In addition to the release of nutrients in the clarifier due to poor settled sludge compaction, it is theorized that the deficiency of CBOD contributes to a high death rate (i.e., endogenous decay) that also releases nutrients to the water from the aeration basin itself.

To resolve the issue of low F:M in the activated sludge, IEP has incorporated a "selector" into the design of the Orbal aeration system upgrade (see Section 4.1 for details). A selector, as the name implies, selects for microbial populations with desirable properties, in this case, good compaction and settling. An aerobic selector accomplishes this goal by increasing the CBOD concentration at the front end of the activated sludge process, and allows that concentration and therefore the F:M, to start high and then decline over distance and time. This concentration gradient is what allows floc-forming bacteria to gain a competitive advantage during the highest growth stage.

Aerobic selectors are often designed to be a series of small tanks, in which the CBOD concentration is highest in the first tank. However, the same effect can be accomplished by a single aeration tank running as a plug-flow configuration, versus a well-mixed configuration. IEP's outer aeration basin currently operates as a well-mixed tank, which causes excess dilution of the CBOD and leads to low F:M conditions, but because it is narrow and long, it can be converted to a plug-flow by putting an isolation wall dividing the influent chamber from the effluent chamber (to the middle basin). The drawing below shows a schematic of how this will be accomplished. In doing so, the CBOD concentration will be highest at the front end of the activated sludge process, right at its initial interaction with the biomass that will perform the degradation, and eliminate low F:M conditions to the greatest extent possible.



Reference: Two-dimensional drawing of IEP's aeration upgrade, superimposed to show conversion from multi-pass well-mixed bioreactor to single-pass plug-flow bioreactor in the outer basin.

4.3 *Mill Production Countercurrent Process Flow (2023-Present)*

IEP's business markets have changed substantially over the past five years, especially in the wake of the COVID-19 pandemic. Raw materials, such as recycled paper tend to be of lower quality, and historical virgin "white-wood" fiber are not readily available. IEP is also selling to a larger diversity of clients, placing greater strain on the production line to switch back and forth between grades with the least amount of transition possible. The net effect has been a considerable increase in organics from virgin wood fiber which directly contribute to higher BOD and COD loads to the WWTS.

A project is underway to make the internal mill process water management a fully countercurrent system. This means that, as fiber flows from the pulp mill to the paper machine, water flows in reverse from the paper machine to the pulp mill. IEP has always been partially countercurrent, which has been sufficient until recently, and the substantial changes necessary to convert to fully countercurrent has not been justifiable until now. It is expected that, once complete, bleaching demand (and therefore BOD and COD generation) will be lower and more efficient.

IEP has partially completed this conversion in 2024, but the final stage, which must include heat recovery from the purge point (see Section 4.4) is still under development.

4.4 *Wastewater Influent Temperature Control (2023-Present)*

IEP first installed wastewater influent temperature control in 2010 as an addition to the then-recently installed TMP processing line (Section 6.7) because it generates significantly more heat than the prior atmospheric refiners. The heat exchangers were sufficient until 2017 (Section 6.17) when upgrades were required due to increasing reliance on TMP pulp (high heat generation) and decreasing reliance on deink pulp (low heat generation). Following a flurry of market changes in the wake of the pandemic, IEP is again in need of improvements to temperature control as TMP pulp has increased to its largest share of production volume and deink has decreased to its lowest.

The countercurrent project (see Section 4.3) described above simultaneously incorporates both water recovery and heat recovery. Water and heat that are valuable to mill production, but detrimental to wastewater treatment, will be captured internally and utilized completely before being discarded. Besides the benefits of decreased effluent temperature, this will also make the mill more energy and process efficient.

4.5 *Activated Sludge Nutrient Dosing Control (2021-Present)*

Nutrients (P and N) are added to the influent of the activated sludge system, independent of the nutrient feed to the MBBRs (Section 3.3). IEP installed online nutrient analyzers for phosphorus and nitrogen feed to the Orbal in 2020-2021 (see Section 6.23) to assist with activated sludge nutrient control. In its current configuration, the nutrient analyzers measure at both the beginning and end of the activated sludge basin. This configuration is effective in determining if nutrient dose levels are too high, but it has been less useful to determine if the dose is too low, potentially leading to non-ideal activated sludge health. To ensure nutrient sufficiency, IEP intends to reproduce the success of MBBR nutrient control by linking the nutrient dose to online CBOD monitoring of the feed to the activated sludge process (Section 6.28). This modification is made more practical with the removal of MBBR solids using the 75' Clarifier (Section 6.27). In its final form, IEP will be able to ensure, in real time, that nutrients are simultaneously added at high enough dosages to promote healthy biomass growth while assuring residual concentrations are low enough to comply with final WQBELs.

The completion of this project is dependent on the completion of the fine bubble aeration project (Section 4.1) to eliminate volatility in biomass behavior and eliminate the influent on nutrient upcycling.

4.6 *Chemically Enhanced Primary Treatment (CEPT) (2022-2024)*

IEP last modified the CEPT process in 2018 for the primary clarifier (see Section 6.18). Following the COVID-19 pandemic, IEP experienced many changes to raw materials and internal processes that have rendered the existing application less effective. A complete reevaluation of all chemical applications will include the dissolved air flotation (DAF), the MBBR Clarifier (Section 6.27), Secondary Clarifier, and Tertiary Membranes. These latter two locations are limited to inorganic coagulants (rather than polymers) due to the potential for irreversible fouling of the ultrafiltration membranes.

Resource limitations have made this project a lower priority compared to others in this section. However, it still has high potential and is remaining on the list of active pursuits.

4.7 *Tertiary Membrane Ultrafiltration (2020-2024)*

IEP selected WesTech/Toray's ultrafiltration membrane system (UF system) as its tertiary treatment solution after sixteen years of extensive experimentation with over two dozen combinations of state-of-the-art tertiary treatment technologies. IEP commissioned the UF system in January 2020. Water quality data shows that the UF system effectively removes all Total Suspended Solids (TSS) including particulate forms of CBOD, TP, and Nitrogen.

IEP is the first and only pulp and paper mill in the industry to treat 100% of its wastewater with UF system technology. As a result, IEP is learning to manage the day-to-day fluctuations of industrial treatment with very little outside assistance and experience. In just three years of operation, IEP has already made several modifications and improvements to the frequency and type of chemical cleans necessary for full capacity treatment. Routine biofouling is the most common cause of lost flux capacity, but microbiological analysis has also found fungus, while destructive membrane testing has found high degrees of scaling. The conventional chemistries selected during design are not always effective, or may only be effective for a short period. As the membranes have aged, IEP has found it difficult to keep pace with the rate of cleaning and chemical consumption necessary for performance.

The ultimate lifespan of the membrane modules is unknown and presents a significant economic risk. IEP is also considering increasing existing treatment capacity by adding additional membrane modules that may partially mitigate short-term process fluctuations and extend membrane life, but may ultimately prove uneconomical. Continued evaluation of the UF system to determine its efficacy and longevity will continue through the remainder of the existing compliance schedule.

The completion of this project is dependent on the completion of the fine bubble aeration project (Section 1.1) to eliminate volatility in biomass behavior that has a tendency to foul the membranes and the pre-filtration equipment.

4.8 *Internal Process Improvements (Ongoing)*

IEP is continually seeking new ways to improve internal mill efficiencies that provide a net positive benefit to wastewater treatment. A partial list is given below and all of these process improvements will continue throughout this permit cycle:

4.8.1 *Fresh Water Flow Tracking*

IEP’s wastewater treatment benefits from low flow conditions by providing longer retention times for abatement of CBOD. To control wastewater flow, IEP must control freshwater flow into the mill. However, the production process is complex and tracking process uses of freshwater that could potentially be eliminated is difficult. IEP is installing freshwater flow meters in strategic locations to assist with water audits now and into the future.

4.8.2 *Internal Water Recycling*

Over the past twenty years (see Section 6.0), IEP has reduced flow to the Outfall from an average of 4.5 to 2.5 million gallons per day (MGD) by closing mill water loops and implementing internal water reuse programs. IEP is continually seeking additional opportunities to reuse more water. However, new reuse applications must account for inevitable buildup of salts and other contaminants that could cause operational problems.

5.0 DELTA ELIMINATION PLANS

The DO TMDL provides for “Delta Elimination” and “Target Pursuit Actions” in recognition that the implementation of additional treatment technologies alone at a point source may not be able to reduce permitted discharges to the levels derived from the WLAs established in the TMDL. The delta elimination plan, in combination with the pollutant reduction from technology, shall provide reasonable assurance of meeting the Permittee’s final WQBELs. IEP has successfully demonstrated the need and Ecology has approved of various Delta Elimination tools for use by IEP as described in Sections 5.1 to 5.3 below. Tools pending approval are described in Section 5.4. IEP may elect to pursue other tools as described in Section 5.5.

The combined effect of all the approved or pending Delta tools are incorporated into the performance graphs in Section 3.2. As can be seen from those graphs, the implementation of these tools are a critical element of IEP’s pathway to WQBEL compliance.

5.1 *NCCW Credit for TP (APPROVED)*

Special Condition S1.A.d of IEP’s NPDES Permit allows for a TP credit in non-contact cooling water towards meeting the final WQBEL’s:

The Permittee may calculate discharge quantities of total phosphorus using an allowance (credit) for the fraction of river water phosphorus loads in Outfall 004 (non-contact cooling water). The allowance shall be the lesser of the observed non-contact water loads and 0.182 pounds per day of total phosphorus (as P).

5.2 *Nutrient Bubble with Kaiser Aluminum (APPROVED)*

Special Condition S1. Discharge limits of IEP’s NPDES Permit allows for the use of a bubble limit towards meeting the final WQBELs:

Carbonaceous Biochemical Oxygen Demand (5-day) (CBOD5)

a. *The March 1 through October 31: seasonal average individual limit for CBOD5 is 123.2 lbs/day.*

b. *The March 1 through October 31: seasonal average bubble (aggregate) limit for CBOD5 is:*

   i. *123.2 lbs/day, when the CBOD5 seasonal average individual load from Kaiser Aluminum Washington (NPDES Permit No. WA0000892) during February 1 to October 31 is equal to or greater than 462.7 lbs/day.*

   ii. *123.2 + [462.7 – CBOD5 seasonal average individual load from Kaiser Aluminum Washington during March 1 to October 31 (lbs/day)] ÷ 4.247 lbs/day, when the CBOD5 seasonal average individual load from Kaiser Aluminum Washington (NPDES Permit No. WA0000892) during March 1 to October 31 is less than 462.7 lbs/day.*

c. *The Permittee will not be considered in violation of the seasonal average individual limit for CBOD5 listed in b.i, above, unless the seasonal average* *bubble (aggregate) limit listed in b.ii, above, is also exceeded for the same reporting period.*

Total Phosphorus (as P)

a. The February 1 through October 31 seasonal average individual limit for total phosphorus (as P) is 2.39 lbs/day.

b. The February 1 through October 31 seasonal average bubble (aggregate) limit for total phosphorus (as P) is:

i. 2.39 lbs/day, when the total phosphorus (as P) seasonal average individual load from Kaiser Aluminum Washington (NPDES Permit No. WA0000892) during March 1 to October 31 is equal to or greater than 3.21 lbs/day.

ii. 2.39 + [3.21 – total phosphorus (as P) seasonal average individual load from Kaiser Aluminum Washington during March 1 to October 31 (lbs/day)] ÷ 3.4 lbs/day, when the total phosphorus (as P) seasonal average individual load from Kaiser Aluminum Washington (NPDES Permit No. WA0000892) during March 1 to October 31 is less than 3.21 lbs/day.

c. The Permittee will not be considered in violation of the seasonal average individual limit for total phosphorus (as P) listed in b.i, above, unless the seasonal average bubble (aggregate) limit listed in b.ii, above, combined with d. below, is also exceeded for the same reporting period.

5.3 <u>*Alternate or Extended Season Limits (APPROVED)*</u>

Section S5 of IEP's NPDES Permit issued in 2011 allowed for the use of alternate or extended seasonal limits towards meeting the final WQBEL's:

> *The Department may adjust the final water quality based effluent limitations on the basis of new information following a revision to the Spokane River DO TMDL. This new information may include: …alternate modeled water quality based effluent limits extended into February or January.*

IEP utilized this seasonal equivalency for TP by extending the season of treatment from March through October to February through October. This equivalency was also included in Section S5 of IEP's NPDES permit issued in 2011:

The final WQBEL for total phosphorus of 2.39 lbs/day seasonal average from February to October (0.070 mg/L at 4.1 mgd) is equivalent to the wastewater allocation for total phosphorus.

This equivalency is included in Special Condition S1. Discharge limits in IEP's current NPDES permit:

Total Phosphorus (as P)

a. The February 1 through October 31 seasonal average individual limit for total phosphorus (as P) is 2.39 lbs/day.

5.4 *Static Pollutant Equivalency (PENDING)*

Static pollutant equivalency allows IEP to internally trade away a portion of a nutrient's waste load allocation for an increase in the allocation for another nutrient. IEP is intending to trade 75% of its ammonia limit for an increase in TP, considering the difficulty in attaining such a stringent limit that also jeopardizes the health and effectiveness of IEP's WWTS. This complete analysis includes CE-QUAL-W2 modeling performed by LimnoTech in accordance with the guidelines established by EPA and Ecology on October 27, 2010. The request has been submitted to Ecology where it is currently pending and awaiting independent verification. According to the model results, this static equivalency would increase IEP's TP allowance from 70 ug/L to 140 ug/L.

5.5 *Other Delta Elimination Opportunities*

Other allowable DO TMDL implementation tools that may be of future interest to IEP include the following:

5.5.1 *Static Pollutant Equivalency*

On October 30, 2015, IEP submitted to Ecology with its Delta Elimination Plan, a complete analysis for alternate limits for the ammonia and CBOD5 wasteload allocations established under the DO TMDL. This complete analysis includes CE-QUAL-W2 modeling performed by LimnoTech in accordance with the guidelines established by EPA and Ecology on October 27, 2010. IEP has, for now, declined to incorporate this trade into the NPDES permit pending further review of wastewater treatment performance. IEP may ask to apply this tool in the future.

5.5.2 *Dynamic Pollutant Equivalency*

Section S5 of IEP's 2011 NPDES Permit allows for the use of pollutant equivalency towards meeting the final WQBEL's:

An analysis, subject to Ecology approval and public review and comment, that provides a pollutant loading equivalency relating phosphorus, CBOD5 and ammonia.

5.5.3 *Nutrient Trading*

Section S5 of IEP's 2011 NPDES Permit allows for the use of nutrient trading towards meeting the final WQBELs:

Any approved trades between Permittees and/or nonpoint sources to reduce nutrients (total phosphorus, CBOD, and ammonia) to the Spokane River and Lake Spokane consistent with the Water Quality Trading Framework developed by Ecology and the DO TMDL Implementation Advisory Committee.

5.5.4 *Bioavailable Phosphorus Studies*

IEP's 2011 NPDES permit and the Spokane TMDL Dispute Resolution Panel supported a delta elimination opportunity for revising the WQBELs based upon a consideration that a fraction of IEP's final effluent is not bio-available. IEP has since shifted selection of its treatment technologies to UF membrane filtration as described in Section 4.7 of this report. IEP will reserve its right to reevaluate the implications of this technology selection on bioavailable phosphorus in its final effluent for potential use at some later date if necessary to comply with the WQBELs.

5.5.5 *Ortho-Phosphorus to Total Phosphorus Ratio*

IEP is afforded the opportunity under its previous NPDES permit to evaluate and potentially modify the ortho-phosphorus (ortho-P) to total phosphorus (total-P) ratio that was used in the DO TMDL to determine IEP's waste load allocations. Section S5, Page 17 of IEP's prior NPDES Permit states:

> *The Department may adjust the final water quality based effluent limitations on the basis of new information on the ratio of ortho phosphorus to total phosphorus in the effluent. An adjustment to the effluent limitations based on a new ratio of ortho phosphorus to total phosphorus will be consistent with the assumptions and wasteload allocations in the Spokane River DO TMDL and, as such, does not require a modification to the DO TMDL.*

IEP has since shifted selection of its treatment technologies to UF membrane filtration as described in Section 4.7 of this report. IEP will reserve its right to reevaluate the implications of this technology selection on the ortho-phosphorus (ortho-P) to total phosphorus (TP) ratio for potential use at some later date if necessary to comply with the WQBELs.

5.5.6 *New Information*

The Spokane River and Lake Spokane Dissolved Oxygen Total Maximum Daily Load Water Quality Improvement Report (DO TMDL) allows for the evaluation of new information to change wasteload allocations. The DO TMDL states:

> *"...final wasteload allocations will be re-evaluated and possibly changed in subsequent permits based on new monitoring and modeling information collected for the biennial and ten year assessments. Any changed wasteload allocations will be protective of water quality."*

> *"New actions could include modification of NPDES permits and reconsideration of the water quality standards applied to the Spokane River and Lake Spokane. As described earlier, the Dischargers are required to be in compliance with the then-current TMDL wasteload allocations by the end of ten years, unless Ecology makes adjustments to the TMDL and applicable permits based on new information."*

IEP intends to monitor the progress of water quality improvements to determine if any changes to its wasteload allocations are warranted.

6.0 PAST TASKS IMPLEMENTED

Since 2001, Inland Empire Paper Company (IEP) has embarked on a modernization program that has resulted in improvements to nearly every process within its facility using state-of-the art equipment. This significant investment into the phased modernization effort has raised IEP's status to one of the most modern specialty paper product facilities in the world. The following provides a summary of IEP's specific achievements that have resulted in improvements to the efficiency of its wastewater treatment system, reduced nutrient levels in its discharge, and overall volume reduction of final effluent:

6.1 *Paper Machine #5 (2001)*

IEP installed a modern energy efficient paper machine that remains the newest of its kind in North America. The machine utilizes heat recovery and water reuse to minimize energy and water consumption.

6.2 *Conustrenner (2004)*

The Conustrenner is a compact highly efficient self-cleaning fractionation filter. Approximately 1 MGD of primary treated water is diverted to the Conustrenner for reclamation and reuse in the pulp mill processes, greatly reducing freshwater needs and volumetric loading to the wastewater treatment system.

6.3 *Pump Seals (2005-2007)*

Flow limiting devices were installed on mechanical seal water lines for numerous pumps around the mill. These devices greatly reduced freshwater consumption to the process streams resulting in a substantial decrease in the volumetric loading to the wastewater treatment system.

6.4 *MBBR #1 (2006)*

IEP installed a Moving Bed Biofilm Reactor (MBBR) for enhanced CBOD removal. As of 2021, this system treats 1-1.5 MGD and is currently achieving in excess of 45% CBOD removal and has improved the efficiency of the overall wastewater treatment system.

6.5 *MBBR's #2 and #3 (2009)*

IEP further improved the efficiency of its secondary wastewater treatment system with the installation of two additional MBBR systems, providing IEP with the maximum amount of effective secondary treatment.

6.6 *Surge Control (2009)*

IEP converted its existing 75-foot diameter clarifier to a surge control system to equalize hydraulic flow and CBOD loadings to its secondary treatment system. This allows more uniform loading conditions to the wastewater treatment system thereby reducing variability in the final effluent and providing process stability.

6.7 *#5 Thermo-Mechanical Pulping (TMP) Refiner Effluent Treatment (2010)*

Plant effluent from the #5 TMP system is pretreated with a coagulant and a polymer before treatment through a Dissolved Air Floatation (DAF) system. The average TSS reduction across the DAF is over 90% and the average CBOD reduction is approximately 45%.

6.8 *Chip Segregation (2011)*

IEP receives waste wood chips for local sawmills as a raw material supply for its paper making process. Chip species are separated and used only on grades where they are most effective, resulting in improved energy efficiency and bleaching. Reducing the bleaching needs of any specific paper type results in decreased CBOD and TP loading to the water system.

6.9 *Retention Aid Carrier Water (2012)*

IEP switched from using freshwater to reclaimed process water for its retention aid carrier water. This modification reduced treated effluent flow by approximately 100 gallons/minute.

6.10 *Stock Blending (2013)*

Pulp mill modifications were implemented to allow for pulp specific blending. Targeting specific pulps has improved the bleaching efficiency and reduced the amount of dissolved material (CBOD, TP) created during the reaction.

6.11 *Disk Filter Shower Water (2014)*

IEP's #1 Disk Filter showers were changed from freshwater to reclaimed process water. This modification reduced treated effluent flow by approximately 200 gallons/minute.

6.12 *PM5 Vacuum Roll Seal (2015)*

IEP installed a new style of lubrication seal strip on the paper machine vacuum roll that reduced freshwater consumption and discharge by 10 million gallons/year.

6.13 *Phosphorus Nutrient Source – Phosphoric Acid (2016)*

IEP's secondary treatment system is deficient in nutrients, including phosphorus, and therefore must add nutrients for the health of the secondary biological system for efficient and effective removal of CBOD that is another regulated parameter under the DO TMDL. In 2016, IEP changed its form of phosphorus feed from agricultural grade Ammonium Ortho-polyphosphate to phosphoric acid (P acid). P acid provides complete and readily available phosphorus as a nutrient to the secondary treatment system for more efficient use and enhanced control of residual phosphorus. Ammonium Ortho-polyphosphate contains phosphorus forms that are not bioavailable which contribute to elevated levels of total phosphorus in the effluent that are difficult to remove.

6.14 *Nitrogen Nutrient Source – Urea (2016-2018)*

IEP conducted an investigation to replace aqua ammonia as the primary nitrogen source for biological treatment. Aqua ammonia was costly and presented several logistical and safety hazards for effective dosing. Urea ammonium nitrate (UAN-32) was first selected as the replacement in 2016. Later, in 2018, urea was found to be more economically feasible and replaced UAN-32.

6.15 *Speece Cone In-line Superoxygenation System (2016)*
A Speece cone system was installed immediately downstream of IEP's effluent pumps to oxygenate 100% of the wastewater that leaves the effluent pump house, including all flows to the primary clarifier, reclaimed effluent wastewater, and all water directed to surge tanks used on-site for surge control. The cone super oxygenates the water that passes through by creating an intense bubble swarm at the inlet of the cone. The geometry of the cone and the buoyant force of the bubbles do not allow any the bubbles to exit, thereby ensuring complete dissolution. An onsite oxygen generator that utilizes molecular sieve technology provides a nearly pure oxygen source from ambient air. Water conservation efforts described herein have resulted in lower effluent flows to the primary clarifier, so increased oxygenation of the wastewater offsets septic conditions and enhances CBOD removal in the primary clarifier.

6.16 *Surge Control (2017)*
IEP installed enhanced valves and controls on the 75-foot clarifier that is used for hydraulic flow and BOD surge control in April, 2017. These improvements dampened significant flow variations to IEP's secondary treatment system, resulting in improved nutrient feed effectiveness and enhanced wastewater treatment system performance.

6.17 *Effluent Temperature Reduction (2017)*
Effluent flow reductions due to many of the above projects have resulted in ever increasing temperatures to the secondary treatment system. Higher effluent temperatures can adversely affect WWTS performance by lowering biological activity in the secondary treatment system. In August 2017, the valves in the Dissolved Air Flotation (DAF) heat exchanger were increased from 4" to 6" to allow for more non-contact cooling water flow, resulting in greater cooling capacity of the effluent to the wastewater treatment system (WWTS).

6.18 *Chemical Enhanced Primary Treatment (CEPT) (2018)*
Chemical trialing was conducted in the summer of 2018 to determine a suitable program for improved solids and BOD5 removal in IEP's primary clarifier. A new flocculation aid was selected that was a substantial improvement over the previous application.

6.19 *Equalization Tanks (2018-2021)*
Due to the many diverse grades of paper produced by IEP and the myriad of processes within the mill that can impact the WWTS, IEP installed two (2), one-million-gallon tanks to normalize flow and BOD loading through equalization. The system was commissioned in September 2018 with final modifications concluding in 2019. The tanks were initially configured pre-primary treatment, but unexpected side effects negatively impacted the downstream biological processes. Equalization is now configured post-primary treatment, completed in 2021.

6.20 *Sheet Ash Retention (2019)*

IEP tested a new chemistry to retain more fiber and ash in the paper sheet, thus reducing the amount of material and CBOD discharged to the WWTS.

6.21 *Effluent CBOD Analyzer (2016-2020)*

IEP first installed an online CBOD analyzer on final treated effluent in 2016. The instrument, from ZAPS Corp., correlated the CBOD concentration to the absorbance at multiple wavelengths in the ultraviolet and visible (UV/VIS) spectrums through multiple linear regression. Unfortunately, this instrument was plagued with operational problems and the company stopped all services in 2019. A replacement unit was purchased from RealTech, Inc. and installed in 2020. The new unit has a similar operating principle by which it calculates CBOD in real time using a multi-wavelength correlation. The new unit provides superior results and more relevant information by measuring both the feed and effluent from the tertiary ultrafiltration system. This unit, placed at the end of the process, provides a critical feedback signal to monitor real-time treatment performance.

6.22 *Improved Aeration (2019-2020)*

Multiple audits of the activated sludge process showed it was oxygen deficient under many process conditions. A total of five surface aerators were added over the course of two years to enhance oxygen availability and uptake. Effluent soluble CBOD was reduced to levels that exceeded the best performance of every other technology IEP had evaluated until that time. When coupled with conventional ultrafiltration (i.e. no chemical or biological pretreatment), IEP was able to achieve compliance with the WQBEL for CBOD during this period.

6.23 *Online Nutrient Analyzers (2020-2021)*

Online nutrient analyzers for both ammonia and phosphorus were installed in September 2020 to support nutrient dosing control. The system, from Hach Company, consists of an ammonia analyzer (0.05-20 mg/L), a phosphate analyzer, and two-channel monitoring. The original phosphate unit (0.05-15 mg/L) proved to be ineffective for IEP's wastewater due to color interferences and the inability to accurately measure down to the desired concentration range. It was replaced in April 2021 with another Hach Company unit that has superior resolution (0.005-1.0 mg/L) and a more reliable analytical method. The filtration equipment filters the outer and inner channels of the activated sludge basin and sends a continuous sample stream to both analyzers. These units provide both a feedforward signal to prevent nutrient deficiency and a feedback signal to ensure compliance with WQBELs (see Section 4.5).

6.24 *Influent CBOD Analyzer (2021)*

Following the success of the RealTech, Inc. effluent CBOD analyzer (Section 6.21), another similar unit was installed for influent CBOD monitoring in 2021. The signal is used to monitor the CBOD fluctuations as a function of paper machine grade production. It also provides a quantitative basis for nutrient dosing control to the MBBRs (Section 6.25). The instrument continually measures absorbance at four wavelengths in the UV/VIS spectrums and calculates the CBOD using multiple linear regression. Given the instantaneous flow rate and the real-time CBOD measurement, the flow rate of nutrient addition is precisely calculated to maintain a constant ratio of nutrient load to CBOD load.

6.25 *MBBR Nutrient Dosing Control (2019-2022)*

Nutrients (P and N) are added to the influent of the MBBRs to maximize CBOD removal through the first phase of biological treatment. Prior to 2019, the strategy was to apply a fixed flow of chemical nutrient feed to the MBBR influent. This strategy did not compensate for changes in flow or CBOD concentration, both of which can change rapidly depending on the wide variety of process changes associated with IEP's operations. With the installation of the influent CBOD analyzer in 2021 (see Section 6.24), nutrient dosages can now be controlled to the CBOD concentration with precision. This allows for enhanced CBOD removal through the MBBRs and reduces excessive residual nutrient carryover to the activated sludge system and potentially to the Outfall. Implementation was fully completed in 2022.

6.26 *Secondary Clarifier Seal Failure (2022)*

Another problem adversely impacting IEP's ability to achieve the DO TMDL WQBELs was the gradual failure of a seal within the secondary clarifier that created significant operational problems with IEP's activated sludge system. Degradation of this seal likely occurred over a long time frame spanning years that masked the cause, leading IEP on an extensive evaluation of all its processes and equipment searching for the source of these operational concerns. Imminent failure and immediate repair of the seal in September 2022 appears to have been the root cause to much of IEP's WWTS challenges with operations returning to much improved performance expected of this state-of-the-art WWTS. After repairing the seal, IEP was then able to continue optimization of WWTS operations, including tuning of the nutrient feed systems that is another essential step towards attaining the WQBELs.

6.27 *MBBR Clarifier (2022)*

IEP's original 75-foot diameter primary clarifier, which had previously served as a redundant surge tank alongside the equalization tanks, was repurposed to operate as a clarifier for solids removal from the Moving Bed Biofilm Reactors (MBBRs) prior to introduction into the activated sludge process ("Orbal"). Bacteria in the MBBRs grow and thrive while attached to media in the reactors and ultimately "slough off" of the media towards the end of their lifecycle. The biomass in the MBBR discharge stream does not meaningfully contribute to further wastewater treatment in the activated sludge with the shift from surface growth to free suspension conditions. Consequently, these solids increase the CBOD load to the Orbal, resulting in a higher oxygen demand, and may contribute to in-situ nitrogen and phosphorus release through cell lysis, further complicating nutrient control schemes in the Orbal. The intermediary addition of clarification with the 75' clarifier redirects a sizable percentage of these inactive solids to sludge handling, thus reducing the solids and CBOD load on the Orbal and simplifying nutrient control.

Preliminary experimentation in 2020 and 2021 has demonstrated a reduction of solids in the MBBR discharge stream by as much as 35 to 50% with measurable reductions of

CBOD ranging from 10 to 20%. The 75' clarifier was refurbished and re-commissioned as an MBBR clarifier in the fall of 2022.

6.28 *MBBR CBOD Analyzer (2023)*

IEP had already commissioned online CBOD analyzers at the influent and effluent of the biological treatment process (see Sections 6.21 and 6.24) as feedforward and feedback signals. In 2023, IEP added an intermediate CBOD analyzer situated between the MBBRs and the activated sludge process. With the commissioning of the MBBR Clarifier (Section 6.27), IEP can monitor MBBR performance in real-time and compensate for changes in behavior more rapidly. For example, see Section 4.5 on how this instrument can assist with enhanced nutrient addition and control.

6.29 *Side Stream Treatment of Ultrafiltration Rejects (2023)*

IEP installed ultrafiltration membrane technology in 2020 to process 100% of treated wastewater flow and eliminate all particulate matter from the discharge to Outfall 001 (see Section 4.7). The disadvantage to this approach, however, is that the material captured by the membranes, presumably after passing through all other upstream processes, have no efficient outlet once they are returned to the headworks. In other words, the captured particulates pose a high risk of long-term, chronic accumulation in the WWTS.

About one year after the installation of membranes, IEP's WWTS began to suffer from long-term, chronic degradation of effluent water quality in the form of high turbidity and high effluent TSS. This material was not easily isolated or identified, but was known to contain high quantities of CBOD and TP (see graphs in Section 3.0). IEP sought the assistance of a diverse team of wastewater and industry experts, and though a combination of repeated microbiological exams and DNA identification, the solids were finally determined to be unusually impervious microcolonies in the *Zoogloea* genera surrounded by Extra-Cellular Polymeric Substance (EPS). It was determined that the *Zoogloea* were being repeatedly filtered by the UF system and allowed to propagate in the aerobic processes through reintroduction into the WWTS and continual accumulation and growth. The EPS surrounding these colonies was likewise being generated at a high rate and passed through the activated sludge process, manifesting as turbidity, and severely fouling the UF membranes.

IEP evaluated several potential options for breaking the cycle of accumulation of the *Zoogloea* microcolonies and EPS. The best opportunity was determined to be the rejects waste stream from the UF System, because it was the point of highest concentration after aerobic treatment. The methods considered were thermal denaturation, chemical oxidation, and coagulation/clarification. IEP was able to achieve two out of three by pumping the UF rejects to the existing dissolved air flotation (DAF) system, typically used for pretreating mill waste prior to wastewater treatment. The DAF currently uses a combination of coagulation and flocculation to capture colloidal material and remove it to the solids handling system. In addition, the DAF feed temperature is typically 130-140°F, sufficient to cause thermal denaturation of bacterial cells.

The UF rejects to DAF project became operational on 8/4/2023, and within two weeks, the turbidity at the secondary clarifier decreased from nearly 40 to less than 5 NTU: