

2020 ECR Plan Status Update Report
Quarterly Report – Update #13
January 30, 2024

Executive Summary:

General

This report covers LG&E and KU’s (“Companies”) progress on the 2020 Environmental Cost Recovery (“ECR”) Plan through the fourth quarter of 2023. The Companies filed applications requesting approval of their 2020 ECR Plan on March 31, 2020¹ and received approval on September 29, 2020.

The 2020 ECR Plan safety performance through the fourth quarter of 2023 remains excellent with a Year-to-Date OSHA Recordable Incident Rate of 0.0 and an Inception-to-Date OSHA Recordable Incident Rate of 0.0, compared to the industry average of 3.2.

Work to date continues to focus on construction activities at all three stations: Trimble County (“TC”), Ghent (“GH”), and Mill Creek (“MC”). At all three sites, work has included installation of above ground piping and electrical conduit/cable; loop checks for the control wiring have started and will continue into next quarter along with start-up activities for Bottom Ash at Ghent.

Compared to the total 2020 ECR Plan projected cost of \$405.2 million (net)², as provided in Case Nos. 2020-00060 (KU) and 2020-00061 (LG&E), the projected spend, as of the fourth quarter of 2023, remains at the \$272.6 million (net)² reported last quarter. This projected spend continues to represent a \$132.6 million (net) reduction from the original filing. The total spend to date increased to \$231.4 million (net)² through December 31, 2023.

Background

The Environmental Protection Agency’s (“EPA”) 2015 ELG Rule and amendments precipitated the need to construct Effluent Limitation Guidelines (“ELG”) water treatment systems at TC, MC and GH, as well as a Bottom Ash Transport Water (“BATW”) recirculation system at GH. The EPA’s proposed amendments to the 2015 ELG Rule were finalized in the Fall of 2020. The current ELG Rule includes daily maximum and monthly average limits for the concentration of mercury, nitrates/nitrites, selenium and arsenic allowed in Flue-Gas Desulfurization (“FGD”) wastewater effluent.

To meet the revised limits for these constituents, the Companies are required to install ELG water treatment systems to treat the effluent from the physical/chemical FGD process water treatment systems recently placed into service as described in the 2016 ECR Plan quarterly reports. Without the proposed 2020 ECR Plan projects at TC, MC, and GH stations, the Companies would not be able to continue steam generating operations at these generating stations and simultaneously comply with the ELG Rule, as enforced by Kentucky Pollutant Discharge Elimination System (“KPDES”) permits at each generating station. This

¹ Case No. 2020-00060 and Case No. 2020-00061

² Co-Owners of the Trimble County plant: Illinois Municipal Electric Agency (IMEA) and Indiana Municipal Power Agency (IMPA) are responsible for 25%. IMEA owns 12.12% and IMPA owns 12.88%. Co-owner shares are not included in the costs provided in this report.

would significantly impair the Companies’ ability to fulfill their mandate to provide adequate, efficient, and reasonable service to their ratepayers, as these generating stations are the three largest generating stations within the Companies’ generating fleet. The ELG Rule requires compliance for the FGD wastewater as soon as possible on or after November 1, 2020, but no later than December 31, 2025³.

The final ELG Rule also includes up to 10 percent volumetric discharge limit (on a 30-day rolling average) for BATW, which also must be complied with “as soon as possible” but in no event later than December 31, 2025. This proposed discharge limit requires KU to construct a BATW recirculation system on the existing bottom ash transport system at GH. The recirculation system will collect the transport water currently discharged from the remote bottom ash dewatering facility and reroute it through tanks and piping systems back to the four generating units for reuse. TC and MC do not require a BATW recirculation system due to their bottom ash transport systems being previously converted to a dry transport instead of a wet sluicing system like GH’s.

In March 2023, the EPA released a proposed revision to the ELG Rule requiring membrane filtration followed by solidification, or thermal evaporation for zero discharge of FGD Wastewater; zero discharge of Bottom Ash Transport Water; new discharge standards for combustion residual leachate waters, and best professional judgement for regulation of legacy combustion waters. The proposal stipulates compliance as soon as possible, but no later than December 31, 2029. A final rule is anticipated in 2024.

Schedules

FGD Process Water Treatment Facilities and Diffusers

<u>Project</u>	<u>Project #</u>	<u>Awarded Contractor</u>	<u>Status</u> ⁴	<u>Planned / Actual In-Service Date</u> ⁵
Trimble County Effluent Limitations Guidelines Water Treatment System ⁶	KU Project 44 LG&E Project 32	OKEP	Awarded March 15, 2021	September 2024
Mill Creek Effluent Limitations Guidelines Water Treatment System ⁶	LG&E Project 31	OKEP	Awarded March 15, 2021	June 2024
Mill Creek Outfall 025 Diffuser	LG&E Project 31	Tetra Tech	Awarded May 12, 2021	Placed in service December 2021
Ghent Effluent Limitations Guidelines Water Treatment System ⁶	KU Project 43	OKEP	Awarded March 15, 2021	December 2024
Ghent Bottom Ash Transport Water Recirculation System ⁷	KU Project 43	OKEP	Awarded March 15, 2021	April 2024
Ghent Outfall 001 Diffuser	KU Project 43	MAC Construction & Excavating	Awarded March 22, 2021	Placed in service December 2021

³ 84 Fed. Reg. 64664.

⁴ Project Engineering Department or Engineering, Procurement, and Construction (“EPC”) Contract work status.

⁵ The Planned In-Service Dates are per the 2020 ECR Plan filing (Straight Testimony, page 4-5) or the current, active construction schedule. Actual in-service dates are signified with red font.

⁶ ELG Equipment OEM: Frontier

⁷ BATW Equipment OEM: United Conveyor Corporation

Quarterly Status Update:

General

The engineering, procurement, and construction, (“EPC”) contracts for TC, MC, and GH were awarded on March 15, 2021 to Old Kentucky Energy Partners (“OKEP”), which is a joint venture between Bowen Engineering (a local company) and United E&C. At TC, GH and MC, work has included continued installation of above ground piping and electrical conduit/cable; installation of process equipment and electrical gear; installation of fiberglass tanks; heat tracing; and initiation of commissioning activities. Electrical work completed consisted of setting of switchgears, motor control center’s, installing cable tray, and conduit. All coatings for chemical containment areas, sump, battery room, and electric rooms is complete.

Burns & McDonnell (“B&McD”) is the ELG Owner’s Engineer and is assisting the Companies with reviewing engineering, design and construction support related to submittals and fieldwork from the EPC (OKEP) and ELG technology providers (Frontier – ELG) or United Conveyor Corporation (Ghent BATW).

KU Project 44 and LG&E Project 32 – Trimble County (TC) Station Effluent Limitations Guidelines (ELG) Water Treatment System

General

Project 44 (KU) and Project 32 (LG&E) are for construction of an ELG water treatment system at the TC generating station. The current forecasted capital cost to implement these facilities remains \$51.6 million (net)⁸, being allocated between KU and LG&E, with Mechanical Completion achieved in October 2023 and planned in-service by September 2024. The planned in-service date has been adjusted to address impacts associated with late delivery of critical electrical components and failure of the initial performance test due to biomass shed as further described below. As the vendor finalizes their analysis of the performance test failure as well as their recommendation for necessary mitigation, the planned in-service date may shift further out based on mitigation lead time and optimization time required.

To streamline the review process and to take advantage of multiple internal resources, the TC project team continues to include the MC and GH project teams during all major reviews. This collaborative effort was implemented to minimize issues associated with the TC project, all while accelerating the review process on the subsequent projects.

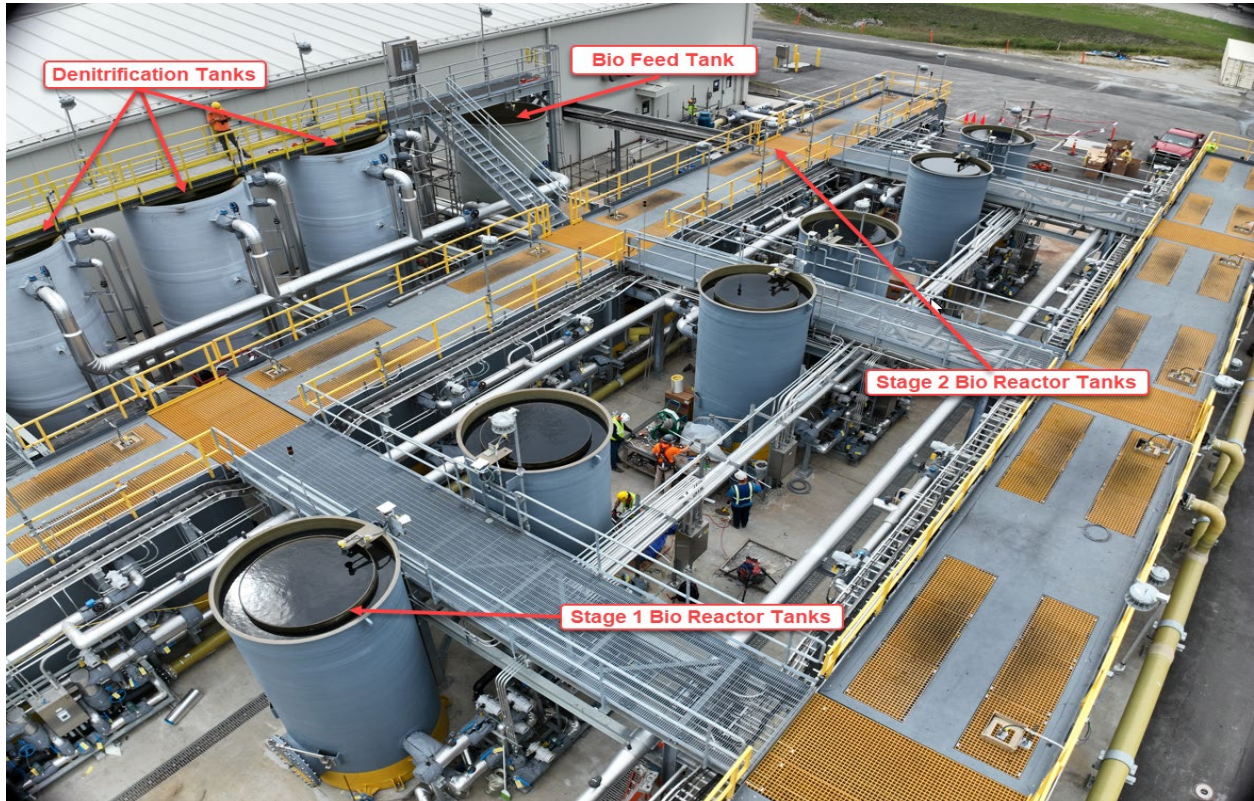
⁸ KU’s 48 percent ownership allocation equals \$24.8 million (Project 44) and LG&E’s 52 percent ownership allocation equals \$26.8 million (Project 32) – both costs are net.

ELG

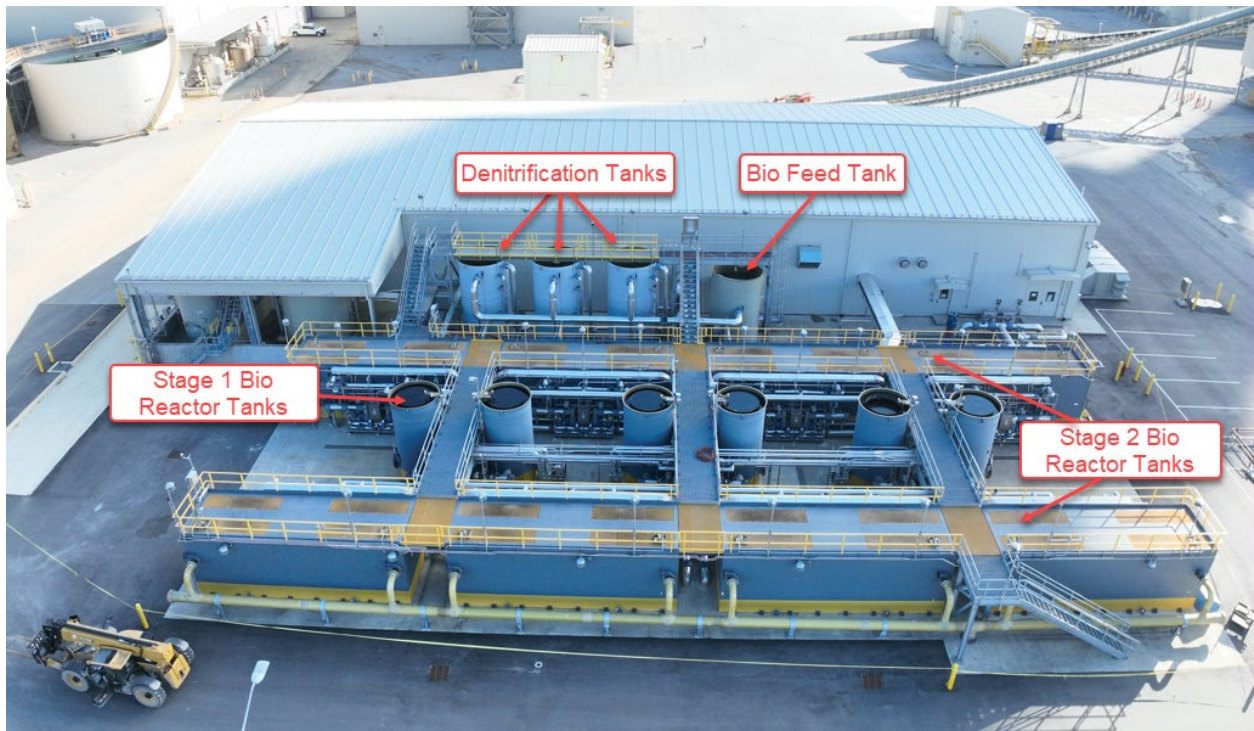
The ELG system is being constructed in close proximity to the recently completed process water treatment system (“PWS”). All facilities are being installed on land currently owned by KU and LG&E at the generating station. The system is designed to handle water flow capacity up to 750 gallons per minute.

Engineering was substantially completed in the fourth quarter of 2023, with remaining focus on as-built drawings, O&M manual verification, and turnover book completion. Commercial and minor procurement activities continued. Field work completed includes hot commissioning of the process equipment, continued piping and electrical installation associated with the Maintenance Tank and pump house, and initiation of the ELG system Performance Testing.

The first Performance Test did not pass due to the noted biomass shed from the bioreactors. In line with how this stage of the project often identifies process issues requiring tuning and optimization, OKEP and the OEM, Frontier, began to evaluate the conditions of the failed test and to facilitate modifications prior to the second performance test. As Frontier has limited experience with the specific water chemistry constituents created by the mix of 1) the fuel burned on TC1 and 2) the generation of flue gas desulfurization used on TC1, this issue likely requires tuning, and potentially installation of minor additional equipment to ensure an appropriately reliable process. It is anticipated that the second performance test will commence late first quarter 2024.



Trimble County – ELG Water Treatment Location – October 2023



Trimble County – ELG Water Treatment Location – December 2023

LG&E Project 31 – Mill Creek (MC) Station Effluent Limitations Guidelines (ELG) Water Treatment System and Diffuser

General

Project 31 is for construction of an ELG water treatment system and wastewater diffuser at the MC generating station. The current forecasted capital costs to implement this project remains \$72.0 million. The MC project team has engaged the TC and GH project teams during all major reviews to apply lessons learned from the other projects. This collaborative effort was implemented to ensure lessons learned are applied across all the projects to promote a common fleet approach to the ELG program.

ELG

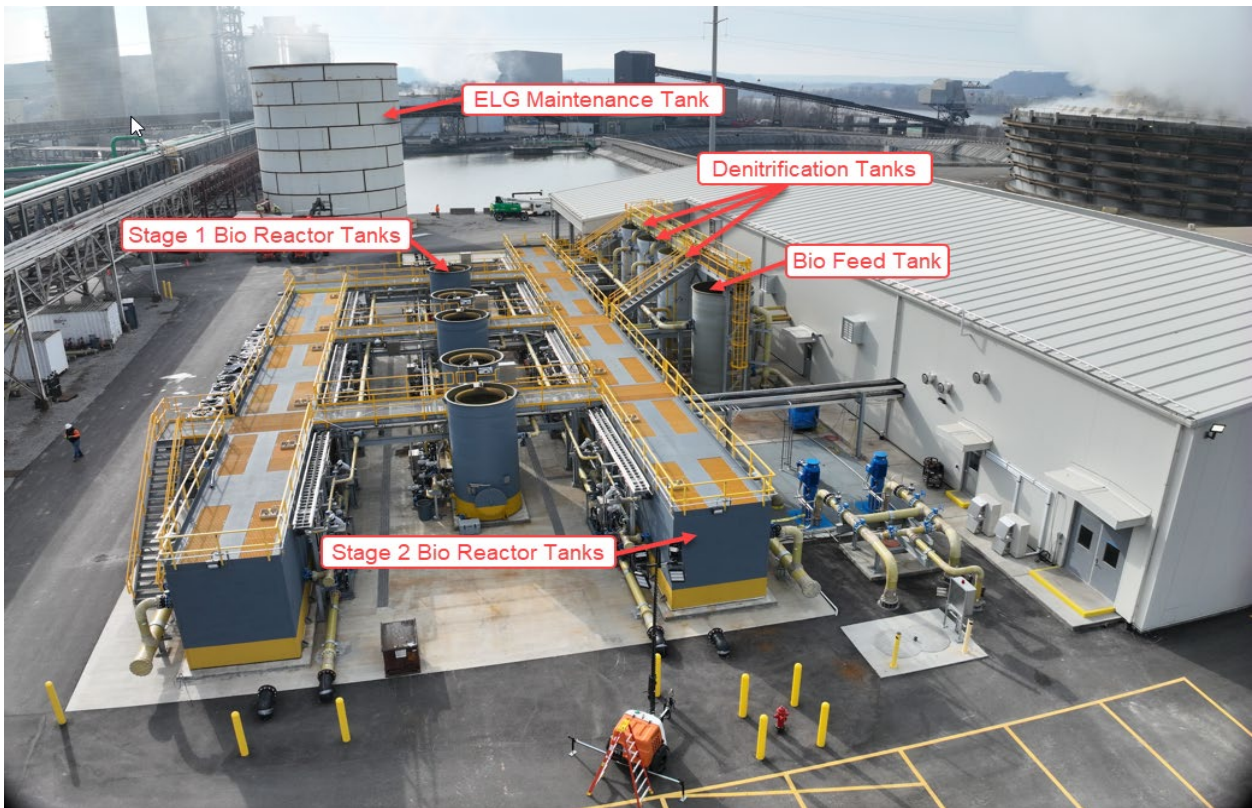
Work completed during the fourth quarter of 2023 includes continued participation in project technical, engineering, and construction meetings with OKEP; review of submittals and various project documents; commercial activities; and construction progress and schedule reviews. During the fourth quarter of 2023, OKEP completed erection of the maintenance tank, established a construction punch list, completed training, and began initial startup activities. OKEP has focused on the underflow drains pump upgrade, addressing mechanical and civil punch list items, and painting around the site. Electrical work completed includes pulling the second half of the 5KV cable from the PWS to the ELG, pulling and terminating cable for skids, and installation of the distributed control system cabinets. Termination of the DCS wiring has begun and is roughly 40% complete.

Diffuser

The diffuser was installed and placed into service in 2021.



Mill Creek – ELG Water Treatment – October 2023



Mill Creek – ELG Water Treatment – December 2023

KU Project 43 – Ghent (GH) Station Effluent Limitations Guidelines (ELG) Water Treatment System, Bottom Ash Transport Water (BATW) Recirculation System, and Diffuser

General

Project 43 is for construction of an ELG water treatment system, a BATW recirculation system, and a wastewater outfall diffuser at the GH generating station. These facilities are designed to process and lawfully discharge wastewater from GH in accordance with the EPA’s existing and proposed amendments to the ELG Rule and the existing Kentucky Pollutant Discharge Elimination System (“KPDES”) Permit for GH. The current forecasted capital costs to implement these facilities remains \$149.8M, with construction completion anticipated for April 2024 for the BATW recirculation system and December 2024 for the ELG water treatment system.

The ELG Rule requires that BATW be recirculated, instead of used once, to transport bottom ash and then discharged. The BATW recirculation system at GH consists of transfer tanks, low pressure pumps, high pressure pumps, piping, foundations, controls, and related equipment. This system will collect the bottom ash sluice water, after being dewatered from the bottom ash solids in the remote bottom ash dewatering facility and pump the water to collection tanks where the water will then be pumped back to the bottom ash removal systems underneath the four generating unit boilers to be used again for sluicing bottom ash to the remote dewatering facility. The water will be recirculated as necessary, with fresh water being added to replace evaporated water. A purge system, up to 10 percent of the volumetric discharge limit (on a 30-day rolling average) for BATW per the ELG Rule, will be included to control pH and other constituent buildup in the recirculation system.

The GH project team has engaged the TC and MC project teams during all major reviews, to apply lessons learned from the other projects. This collaborative effort was implemented to ensure lessons learned are applied across all the projects to promote a common fleet approach to the ELG program.

ELG

In the fourth quarter of 2023, activities included attending technical, engineering, and construction meetings with OKEP; reviewing project documents; engaging in commercial activities; and monitoring construction progress and schedule. Onsite construction activities included the ongoing installation of electrical conduits, cable trays, and equipment skids in the ELG Building and Tank Farm Area, including testing for 480V ELG cable and equipment power cable terminations. Work continued on the fire detection and instrument air systems, alongside the installation of fiberglass reinforced process piping and supports. Hydrostatic testing for the ELG influent process piping up to the heat exchangers and the Ultrafiltration supply header was completed. Concrete foundations for supports, bollards, and the ELG service water and chemical piping systems were successfully integrated and hydrotested. The ELG Lab's construction continued with the installation of cabinetry, countertops, and sinks, in tandem with progress in the ELG well water pump motor and instruments along with the ELG Fire Detection system alarm installation. Preparatory work for the Service Water system tie-in at PWS for hydrostatic testing was completed. Additionally, the completion of finish grade work and asphalt around the ELG Building and perimeter road were completed.

Bottom Ash Transport Water (“BATW”)

During the fourth quarter of 2023, OKEP continued finalizing the turnover packages for each of the subsystems and focused on addressing punch list items throughout the system. OKEP achieved Mechanical Completion of the Common and Unit 4 Ash Subprojects with Unit 3 still in progress. Additionally, OKEP successfully completed Performance Testing and Commercial Operation of the Unit 1, Unit 2, and Common Ash Subprojects. Installation work continued for the Submerged Flight Conveyor (“SFC”) sump, bypass pump, and associated systems within the BATW and SFC Buildings. Key electrical and safety installations, such as lighting and fire detection, advanced in the BATW Pump House and across the Unit 3 and 4 areas. Civil work, including asphalt and concrete for various infrastructure components, were completed, contributing to the site's civil/structural progress. Throughout the period, OKEP and Project Engineering consistently monitored and reviewed all developments to ensure adherence to project specifications and prepared for the upcoming turnover of the Unit 3, Unit 4, and Common Ash Subprojects.

Diffuser

The diffuser was installed and placed into service in 2021.



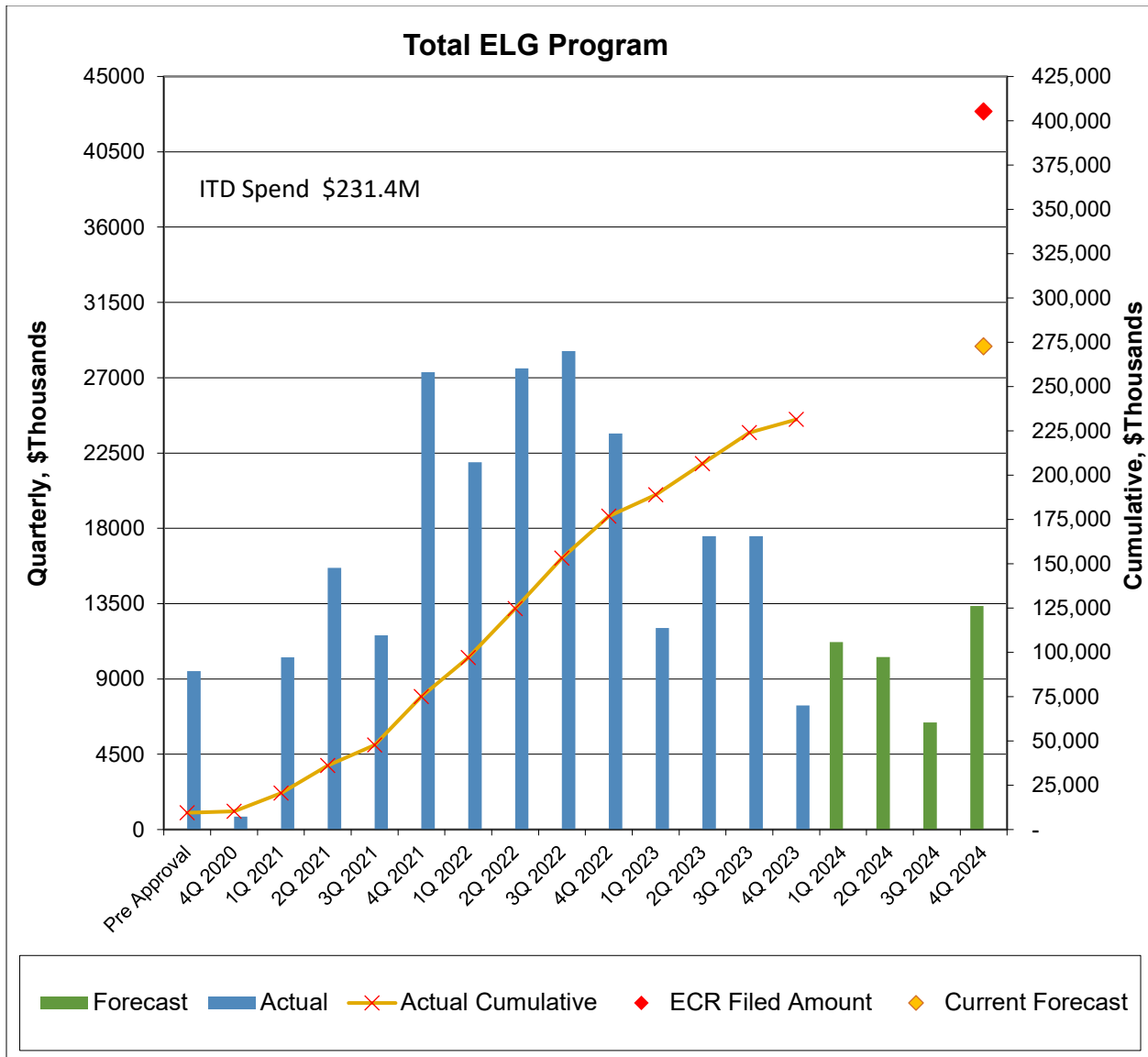
Ghent – ELG Water Treatment – October 2023



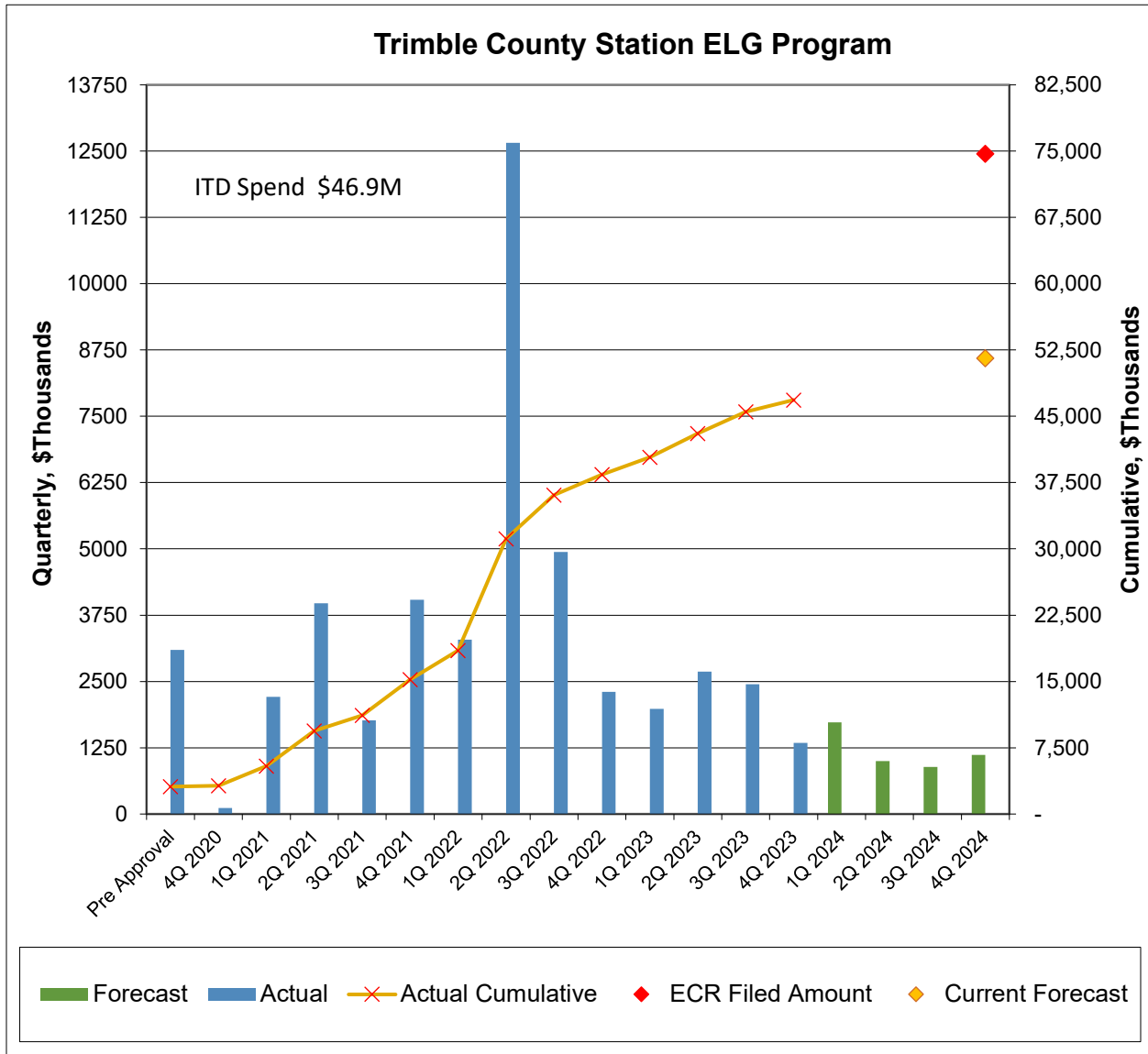
Ghent – ELG Water Treatment – December 2023

Financials:

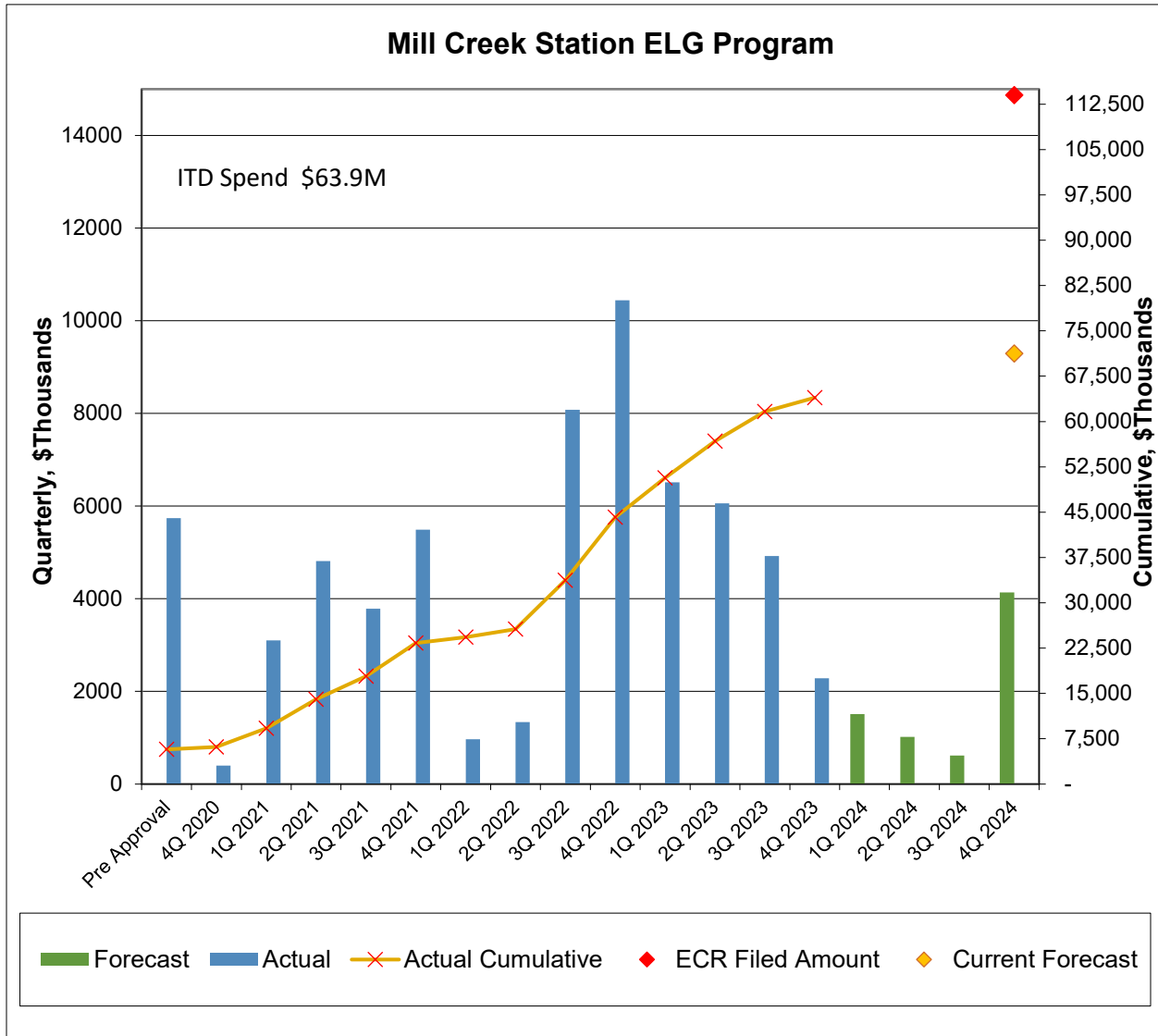
As previously reported, the total 2020 ELG Program forecasted cost was reduced from \$405.2 million (net), as filed, to \$272.6 million (net). The projected spend, as of the fourth quarter of 2023, remains \$272.6 million (net). Total spend increased to \$231.4 million (net)² through December 31, 2023. The graph below includes: 1) a symbol (◆) to show the current forecast to completion and 2) inception-to-date (“ITD”) Spend in the upper left of the chart.



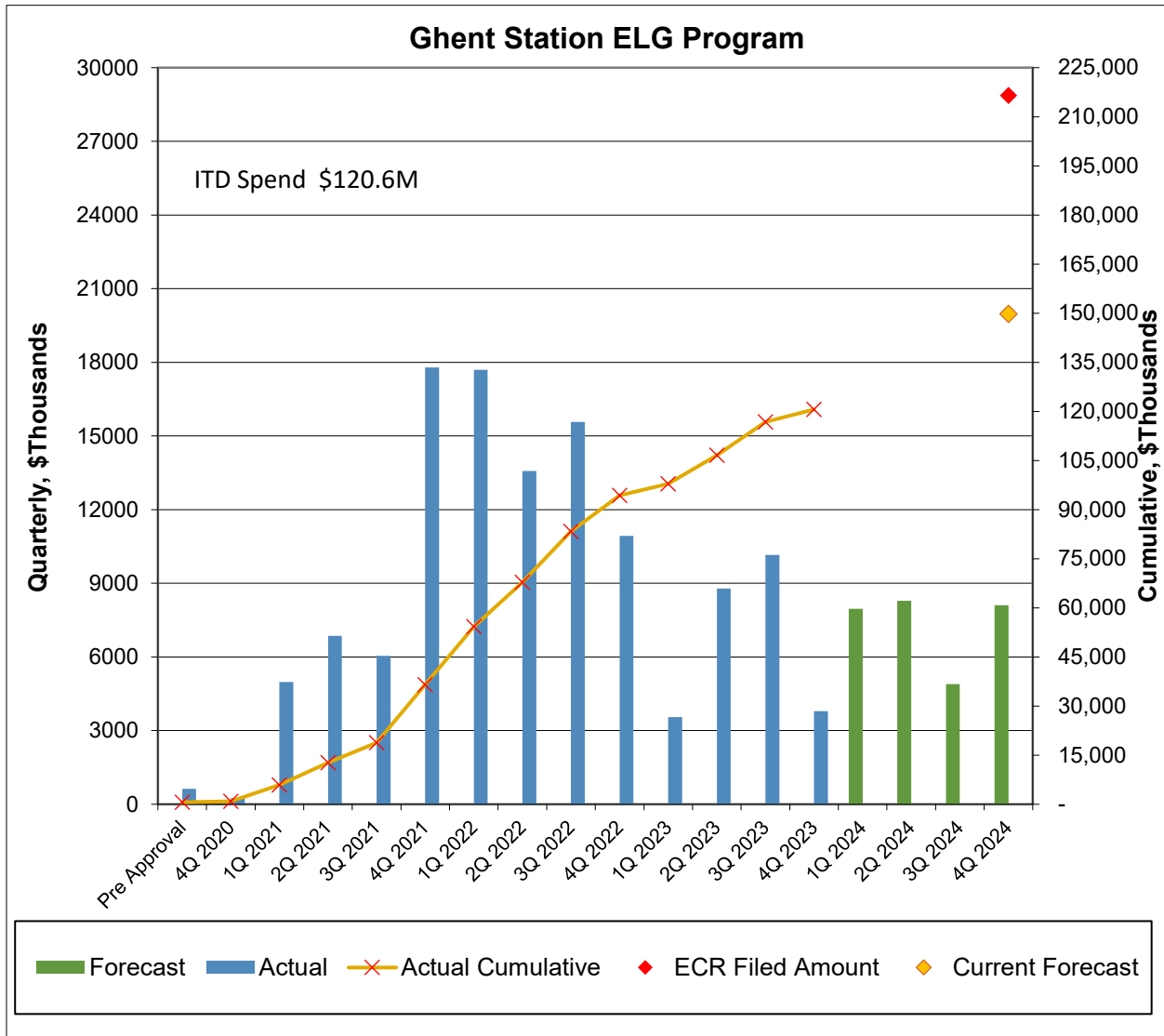
The total Trimble County Station ELG Program forecasted cost remains \$51.6 million (net)². Total spend increased to \$46.9 million (net)² through December 31, 2023. The graph below includes: 1) a symbol (◆) to show the current forecast to completion and 2) inception-to-date (“ITD”) Spend in the upper left of the chart.



The total Mill Creek Station ELG Program and Diffuser forecasted cost remains \$72.0 million. Total spend increased to \$63.9 million through December 31, 2023. The graph below includes: 1) a symbol (◆) to show the current forecast to completion and 2) inception-to-date (“ITD”) Spend in the upper left of the chart.



The total Ghent Station ELG Program, BATW, and Diffuser forecasted remains \$149.8 million. Total spend increased to \$120.6 million through December 31, 2023. The graph below includes: 1) a symbol (◆) to show the current forecast to completion and 2) inception-to-date (“ITD”) Spend in the upper left of the chart.



Planned Activities for Next Quarter:

KU Project 44 and LG&E Project 32 – Trimble County (TC) Station Effluent Limitations Guidelines (ELG) Water Treatment System

ELG – The ELG OEM, Frontier, will assist OKEP in root-cause analysis of the first Performance Test failure. Areas of focus are to reseed the bioreactors, make modifications to the ELG system and/or recommend modifications to the upstream effluent. It is anticipated that the second Performance Test will occur late first quarter 2024. OKEP will work toward finalization of record drawings, O&M manuals, and turnover books.

LG&E Project 31 – Mill Creek (MC) Station Effluent Limitations Guidelines (ELG) Water Treatment System and Diffuser

ELG – In the first quarter of 2024, OKEP will focus on completing electrical construction and begin commissioning and startup activities. Remaining electrical construction consists of completing electrical cable pulls, testing, and cable termination. As construction wraps up, testing and cold commissioning will continue to ramp up. Additionally, OKEP plans to coat the maintenance tank, and install piping between the PWS and maintenance tank in the first quarter of 2024.

Diffuser – No further work expected.

KU Project 43 – Ghent (GH) Station Effluent Limitations Guidelines (ELG) Water Treatment System, Bottom Ash Transport Water (BATW) Recirculation System, and Diffuser

ELG – KU will maintain regular meetings with OKEP to assess the progress of the construction project. This will involve reviewing project submittals, RFIs, and schedules, as well as receiving the remaining components. Onsite construction activities will continue, including the installation of process equipment, above-ground chemical, and process piping, as well as piping heat trace and insulation. Additionally, OKEP will proceed with the installation of electrical conduits and cable trays in both the ELG building and Biological Area.

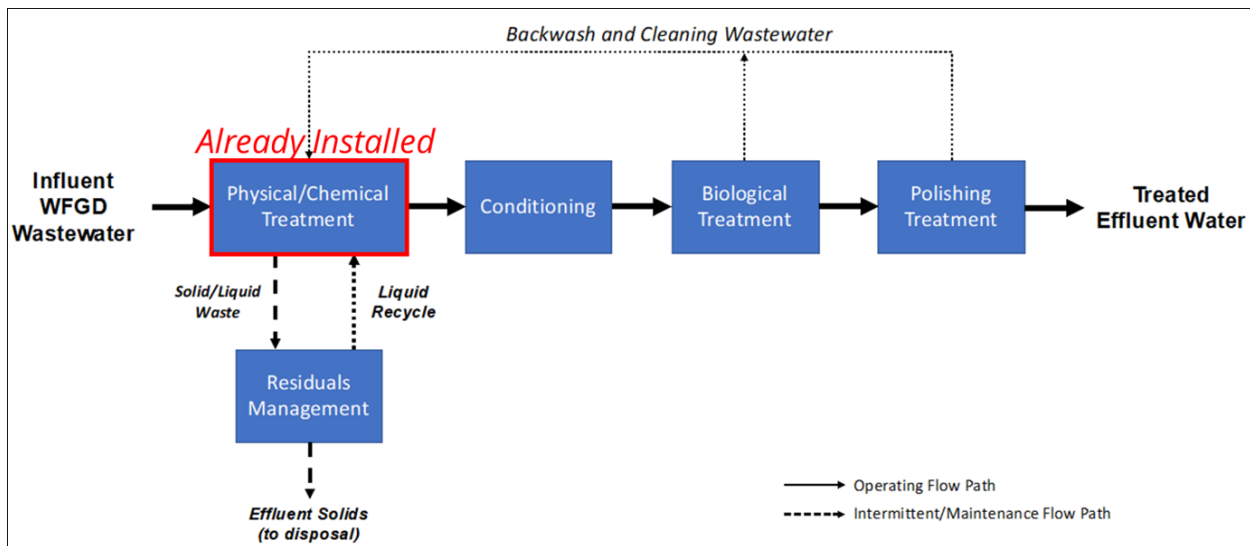
BATW – OKEP will conduct safety reviews, commercial activities, and schedule reviews while continuing electrical and instrumentation installation throughout the quarter. The BATW sump pumps, Unit 3 and 4 high-pressure pumps will be completed, and system commissioning will continue. OKEP is expected to complete the installation of electrical conduits and cable trays in the BATW building and around the units. OKEP is expected to achieve Mechanical Completion for the Unit 3 Ash Subproject during this upcoming quarter and begin performance testing and commissioning activities for Unit 3 and Unit 4 Ash Subprojects.

APPENDIX

ELG Water Treatment System Description – TC, MC, and GH

The ELG Rule requires the Companies to use the Best Available Technology Economically Achievable (“BAT”)⁹ to control particulate, metals, arsenic, mercury, selenium, and nitrates/nitrites. Current BAT technology is physical/chemical treatment plus biological treatment. The process water systems are physical/chemical systems designed to capture particulate and most metals; however, they are not designed to capture nitrates/nitrites and selenium. The levels of nitrate/nitrite and selenium capture required by the ELG Rule requires biological treatment of the process water treatment system’s effluent.

The first step in the biological treatment process is denitrification, which is the reduction in concentration of nitrates/nitrites through a biological process utilizing denitrification equipment. Effluent from the denitrification equipment is discharged to the first stage reactor, which is comprised of fiberglass vessels and internal reactor surfaces. The reactor contains living microorganisms, which are fed nutrients and convert the nitrates/nitrites and selenium molecules in an aerobic atmosphere, to an elemental form. Effluent from the first stage reactor flows into a second stage reactor, where additional biological processes reduce remaining selenium. The elemental form of selenium is transferred, via a backwash phase of the process, to the equalization tanks at the beginning of the process water treatment system for particulate removal. The second stage reactor feeds to an ultrafiltration (“UF”) system where remaining particulate metals are filtered out. The UF tank is then discharged to a series of clean water tanks, which can be used to backwash the biological and UF systems or be discharged. A “typical” flow diagram is shown below.



The majority of the mechanical and electrical systems will be constructed in a building for weather protection, whereas most of the biological process tanks will be located outside. The building houses the denitrification equipment, UF systems, effluent tanks, various pumps and support subsystems. The system also requires cleaning and chemical feed equipment, pumps, piping, valves, and electrical equipment.

⁹ 84 Fed. Reg. 64624.

Separate rooms must be constructed inside the treatment building to house battery systems and electrical equipment. A control room is also required, along with restrooms. The reactor area, including the vessels housing the microorganisms, will be constructed outside the building under a weather canopy. All of the tanks and reactors in the system must be large enough to handle the immense volume of water flowing through the effluent treatment process. In other words, the system must be sized commensurate with the process water treatment systems recently commissioned to enable treatment of the effluent of flow from the process water treatment systems.

Diffusers Description – GH and MC

The diffusers planned to be installed at GH and MC are large multi-port pipes that connect to the stations’ wastewater outfall pipe and are placed into the bottom of the Ohio River with the discharge ports above the riverbed and facing downstream. The pictures shown below provide a general concept of the GH diffuser, which will be similar to the proposed MC diffuser. As this graphic representatively shows, the diffuser is a single large discharge pipe that is installed in the riverbed. The diffuser ports face downstream to disperse the water out of multiple discharge ports instead of a single, larger point of discharge.

Ghent Outfall 001 Diffuser Concept

