Surry’s complex interceptor force main beats tight deadline

Cost: $170 million
Location: Gilbert, Arizona
Year: 2021-12-21
Size: 14 mgd
Owner: Mesa, Arizona Gilbert, Arizona Queen Creek, Arizona
Designers: Carollo Engineers Inc. Brown and Caldwell HDA Architects EPS Group Speedie and Associates MakPro Services Corrosion ProbeCarollo Engineers Inc. Brown and Caldwell HDA Architects EPS Group Speedie and Associates MakPro Services Corrosion Probe
Contractor: McCarthy Building Co. AIMS Companies L&L Asphalt Matrix Services Progressive Roofing Sun Valley Masonry Prime Controls K&F Electric Sturgeon Electric

The Greenfield Water Reclamation Plant Phase III Expansion project is a significant upgrade to the existing facility located in Gilbert, Arizona. The facility serves the water reclamation needs for Mesa, Gilbert, and Queen Creek. This project was delivered using the construction manager-at-risk (CMAR) integrated project delivery method and represents a 14 mgd annual average day flow (AADF) expansion of liquids and solids treatment capacity.

The plant can now treat up to 30 mgd AADF of liquids and 38 mgd AADF equivalent of solids, capable of reliably producing Class A+ reclaimed water and Class B biosolids for beneficial reuse. The project was delivered at a total construction cost of approximately $170 million and represents one of the largest municipal wastewater capital improvement projects in the Southwest region over the past several years.

Conceptual planning for the plant expansion started in early 2015, led by Carollo Engineers with support from Brown and Caldwell, followed by detailed design efforts over an 18-month period. Procurement and construction activities commenced in November 2017, led by McCarthy Building Companies as the CMAR, and reached substantial completion in August 2020 and final completion in November 2020.

The project had many goals, but the most notable include optimizing short and long-term operational performance; collaborating for cost-effective delivery; and enriching the quality of life for the community.

The project focused on life-cycle cost savings and the inclusion of several strategies and technologies to maintain cost control and certainty. Several new or different technologies were implemented throughout the expanded facility which were specifically chosen to overcome and address specific operations and maintenance (O&M) challenges and needs of the plant staff.

Although construction encountered challenges to working conditions due to the COVID-19 pandemic, these challenges were mitigated. One of the primary difficulties to this expansion was overcoming a significant increase in the influent wastewater strength resulting from water conservation and commercial growth in the service area. This growth had increased significantly, roughly 20 to 30%, from the original facility design criteria. To accommodate this increased wastewater strength as well as the plant capacity expansion needs, a total of three new aeration basins and four new secondary clarifiers were required to match the existing basins.

As an alternative, a few strategies were implemented in the secondary treatment process to effectively accommodate the increased loadings with only two new aeration basins and three new secondary clarifiers. These strategies resulted in a rerating of the existing and new components of the overall secondary treatment system while still effectively meeting a Total Nitrogen limit of 10 mg/L.

Achieving this required converting the existing conventional Modified Ludzack-Ettinger (MLE) process to a 4-stage Bardenpho process; converting the existing coarse air bubble diffused aeration to fine bubble diffused aeration; increasing the mixed liquor recycle (MLR) pumping capacity; and incorporating side-stream recycle treatment using Centrate and a return activated sludge Reaeration Basin (CaRRB) process integrated within the aeration basin.

This approach resulted in the ability to defer one aeration basin, one secondary clarifier, and three process blowers, saving upwards of $25 million in construction cost from the baseline approach.

This plant is the primary means of treating wastewater in the service area, and several years prior to completion of construction, plant staff were challenged to operate the existing facilities for extended periods at or beyond the original design capacity of the plant. Carollo and plant staff collaborated to developed real-time operational strategies to squeeze capacity out of the existing infrastructure prior to new facilities and additional capacity being placed online.

One such strategy was implementing a solid retention time (SRT) control strategy for operating the aeration basins, which improved sludge settleability in the downstream secondary clarifiers and resulted in a more robust, consistent operating strategy to maintain operational compliance within the nutrient permit limits.

A continuous operations limitation was the replacement of aging infrastructure throughout the plant, including a full replacement of existing programmable logic controllers (PLCs) and variable frequency drives (VFDs), concurrent with the installation of new infrastructure required to support the expanded facility. Approximately 20 PLCs and 60 VFDs were replaced, reconfigured, rewired, and reprogrammed as part of this asset renewal effort, in addition to coordinating new PLCs and VFDs.

During the pre-construction phase, the CMAR and design engineers identified 130 key outages and critical tie-ins, or maintenance of plant operations (MOPOs). To address this, the CMAR led weekly MOPO planning meetings throughout the construction phase with as many as 25 key stakeholders contributing ideas.

The plant operations staff worked closely with the CMAR and designers to make sure all constraints of the operation were known and properly accounted so asto thoroughly vet and coordinate each plan prior to the outage. As a result, the overall team successfully completed the project without any unplanned outages.

The final phase of construction was concurrent with the COVID-19 pandemic, which came with its own headwinds. With a dedicated focus on the safety of workers and plant personnel, the team was forced to quickly pivot to develop and implement various novel project-specific safety guidelines.

On-site safety provisions were not the only impact of COVID-19. The team also worked through numerous one-off challenges, including schedule interruptions due to supply-chain impacts, resource limitations, and travel restrictions by subcontractors and vendors. These impacts forced the team to leverage additional local vendors and suppliers and increase self-performance crews. The threat of manpower shortages, factory delays, and various

traveling/shipping restrictions were effectively mitigated through quick actions and collaboration, allowing the team to finish the project within the contract milestone dates and under budget.

By closely monitoring the project risks and cost budgets throughout the multi-year project and consistently working to develop innovative cost-cutting measures, the team was able to deliver significant savings to the owners. As a result, additional funds were made available from the overall GMP, and approximately $1.7 million was reallocated toward additional plant repairs, including the removal and replacement of a failed coating system in the existing digester tanks.

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