ROLE OF OTHERS

For the design focus of the project, key partners included:

- **Mortenson Construction, Contractor**
- **Jacobs, Contract Plant Operator**
- **Portland Engineering and Controls, I&C**

The City of The Dalles (City) is in north-central Oregon on the Columbia River, the nation's second largest river. The Dalles Wastewater Treatment Plant (WWTP) serves a population of 15,100 residents, and processes 7.7 mgd of daily peak wet weather wastewater flows. In 2013 existing and future needs at the plant were identified including: influent pumping capacity deficiencies; a lack of reliability in the headworks process; and a need for greater anaerobic digestion capacity.

Role of Entrant's Firm

To provide treatment facilities and equipment that are both sustainable and reliable, and to efficiently treat wastewater flows in full compliance of state and federal regulations for the City and surrounding areas, in 2015 The Dalles embarked on a Progressive Design-Build (PDB) project delivery method to plan, design and construct upgrades at the plant. This collaborative procurement approach brought together the City (Owner), the contractor (Mortenson Construction), and the design engineer (Kennedy/Jenks Consultants) from day one and is the first PDB project embarked on by a municipality for a major WWTP upgrade in the state of Oregon[1].

Specifically, Kennedy/Jenks provided the following services over the course of the project:

- Updated Facility Plan
- Completion of Funding Applications
- Pilot Testing of Primary Filtration
- Preliminary Design
- Permitting and Coordination with Regulatory Agencies
- Final Design
- Engineering Services During Construction
- Plant Startup and Commissioning Services

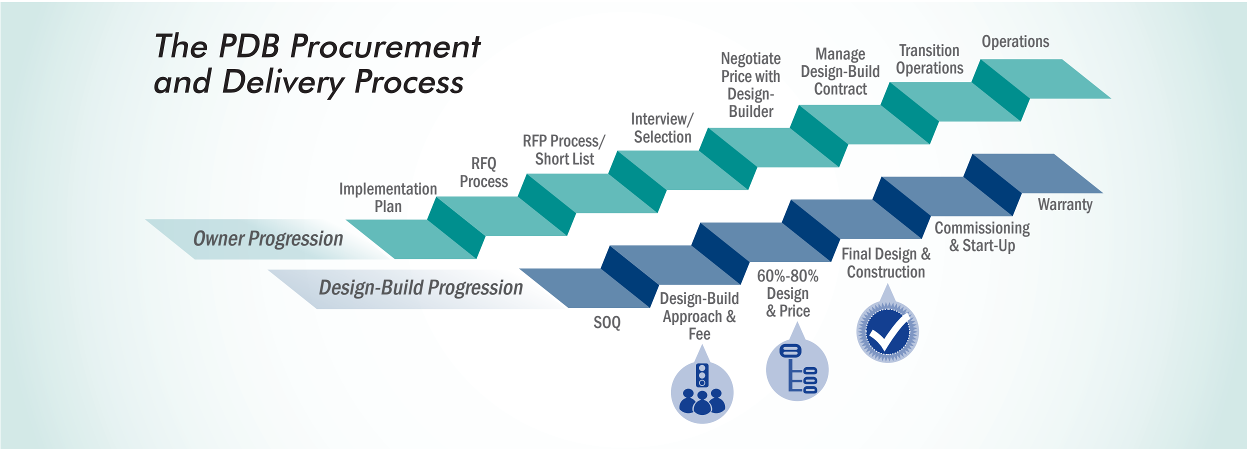
The Dalles Wastewater Treatment Plant is located within the downtown business district and occupies a congested footprint. As such, upgrades were designed with size, aesthetics, and odor control in mind.

[1]According to the Design-Build Institute of America.

UNIQUENESS AND/OR INNOVATIVE APPLICATION OF NEW OR EXISTING TECHNIQUES

PROGRESSIVE DESIGN-BUILD - A UNIQUE, COLLABORATIVE APPROACH RESULTS IN SCHEDULE ACCELERATION AND GUARANTEED MAXIMUM PRICE

In recognition of the value of working collaboratively with the designer and the contractor, the Design-Build (D/B) project procurement and delivery method has been used by Owners for decades. A relatively new and unique twist on D/B is PDB. As the state's first PDB project for a major WWTP upgrade, the Owner selected a D/B team from a pool of three prequalified applicants based on a list of project objectives and each team's qualifications. The selected D/B team of Mortenson Construction and Kennedy/Jenks collaborated with the Owner through a stepped, progressive process to complete the project. This included four early planning level workshops to design and select the improvements that would best meet project objectives and fit within a Guaranteed Maximum Price (GMP). By having an experienced builder on the team, Kennedy/Jenks was tasked with taking the final design to an 80 percent completion level, which served as final construction documents. Having Kennedy/Jenks more involved throughout construction allowed remaining details to be provided after the project was underway. By limiting the design effort, the team reduced upfront engineering to accelerate the project schedule. The 80 percent design set was also used to develop a final GMP and project schedule for City Council approval.



PDB involves a collaborative, progressive (or stepped) process to arrive at a final project design, price, and delivery.

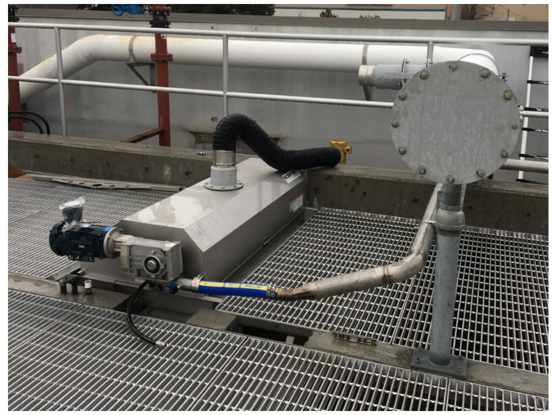
INNOVATIVE PRIMARY FILTRATION FACILITY PROVIDES MANY BENEFITS

To increase digestion capacity and facilitate increased gas production for cogeneration at the plant, an innovative primary filtration facility was designed that includes two rotating belt filters, and solids screw conveyors feeding a single solids pump. This is one of the first full-scale installations of its type in the USA. The filter basin includes flow control gates and a channel for both filters, a spare channel for future expansion and a bypass channel to split the flow. The following benefits to the plant are achieved with this primary filtration design:

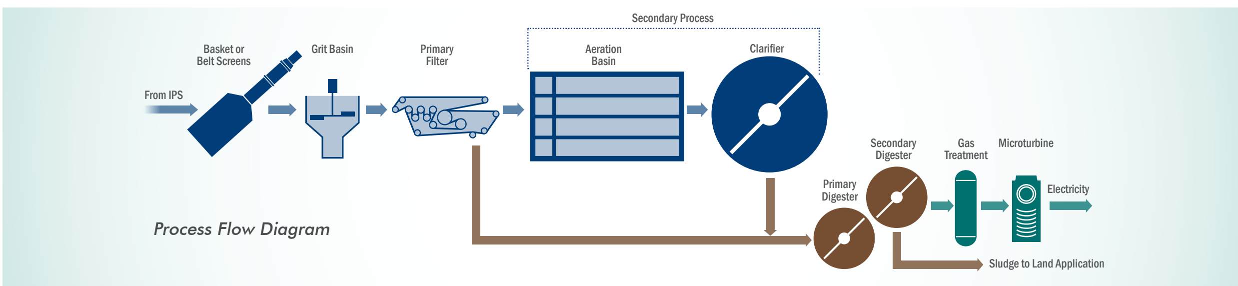
- Carbon diversion through primary filtration reduces loading on the aeration basins and delays need for a major capital expenditure to upgrade to the secondary process
- Reducing load on the secondary process minimizes the aeration requirement, saving power costs by maximizing blower turn down

- Concentrated primary sludge is sent directly to the digester complex, improving digestion performance and increasing gas production
- Reduced solids loading on the existing thickener lowers polymer consumption and reduces run times on the existing belt thickener.

Typically, a wastewater treatment plant uses a primary clarifier to remove solids ahead of the secondary process, but in this case the primary filtration process removes an equal or greater quantity of solids in a fraction of the footprint of a standard primary clarifier. Furthermore, the primary filter provides a means of thickening by concentrating solids on the belt, whereas the sludge removed from a standard primary clarifier would typically require thickening with a chemical polymer requiring additional equipment.



Primary filters are used to divert high strength solids directly to the anaerobic digesters to increase gas production.



The upgraded treatment process flow provides increased capacity, greater reliability, and several sustainability benefits.

FUTURE VALUE TO THE ENGINEERING PROFESSION AND PERCEPTION BY THE PUBLIC

The PDB delivery approach facilitated the collaborative exploration and development of project enhancements. The resulting Recommended Plan maximized the City's existing assets, using the remaining service life in the Influent Pump Station building, the existing grit and screening areas and the secondary process basin. This Plan provides the City with the ability to continue meeting NPDES permit requirements and treatment reliability standards as the service area grows, while also addressing previously known and newly identified plant deficiencies. Improvements also address shortcomings in the solids storage system by constructing a digester to allow the City to accommodate outside waste streams and maximize renewable energy with a newly constructed cogeneration facility.

As part of the design, digester feed piping was added near the existing truck loading facility for a future hauled waste receiving facility. As a direct benefit to the community, the plant could accept high-strength waste, such as grease trap waste or food and beverage processing waste to increase the amount of renewable energy. Provisions were made to add a second microturbine, which required a sizeable upfront investment by the City, but will allow the plant to generate more renewable energy. In addition to piping, the new primary digester was designed with excess capacity and the digester gas treatment train was built to be expandable for a higher gas flow. The potential benefit to local businesses is immense as disposal costs for high strength wastes can greatly impact the profitability of a small business. Community perception is that the plant is helping small businesses, while generating renewable energy to directly offset sewer rates.

Additionally, the increased digester capacity gave the City a means to enhance and continue their environmentally-responsible biosolids land application program and laid the groundwork for a community-based hauled waste program.

SOCIAL, ECONOMIC AND SUSTAINABLE DESIGN CONSIDERATIONS

SUSTAINABILITY AND IMPROVED ECONOMICS THROUGH LOWER OPERATING COSTS AS A RESULT OF PRIMARY FILTRATION

The primary digester was oversized to accept additional feed stock and increase methane production.

Reducing operating costs in a move toward more sustainable operations should be the goal of every treatment plant. The City's WWTP is the first plant in Oregon to install a primary filtration facility to divert solids directly for conversion to renewable power. Making improvements for lower operating costs often promotes sustainability by minimizing resource consumption. Adding carbon diversion through primary filtration takes the energy that would have been spent on aeration to stabilize the biological oxygen demand (BOD) or carbon in the waste, and sends concentrated BOD directly to the digester to increase methane production. With this project, the plant has taken a major step toward energy independence with the generation of renewable energy from excess methane.

Primary Filtration is responsible for a reduction in energy used for aeration. In addition, using the microturbine generated electricity to offset the plant's power demand and also reduces the energy required to fire the plant's boiler by recovering waste heat from the microturbine's exhaust system. A heat exchanger mounted on the system was used to heat water returned to the boiler, thus offsetting natural gas consumption. The plant is currently in the process of confirming the results in Table 1 as the basis for energy rebates or incentives offered through the Bonneville Power Administration (BPA), the regional power provider. Energy Smart Industrial (ESI) is an energy services company working with BPA, tasked with verifying the power savings. Table 1 shows the energy savings for reduced aeration and cogeneration (also known as combined heat and power).

As part of this project, the biosolids process was expanded by providing additional storage so the City can continue to land apply the solids in an environmentally responsible manner. Without the additional winter storage, some biosolids would have ultimately been landfilled to avoid exceeding the plant's internal storage capacity, when weather does not permit land application. Solids from the digester are stabilized for 60 days in a process to reduce pathogens and produce a Class

TABLE 1: ESTIMATED PROJECT ENERGY SAVINGS

Area	kW-Hr / year	Savings/Offset[(a)]	Saved kW Incentive[(b)]
Aeration Savings	111,360	$4,728	$27,840
Cogeneration	259,320	$9,366	---
Total	370,680	$14,094	$27,840

Notes
[(a)]Annual, Year One Present Value
[(b)]One-Time Incentive from BPA-ESI

B biosolids. Once laboratory testing confirms the solids have been stabilized, the City hauls the waste sludge to local farms for use as fertilizer. Reuse of the solids provides a beneficial use for local farmers and the community.

COMPLEXITY

DETAILED PLANNING OF CONSTRUCTION PHASE TO PROTECT ENVIRONMENT, COMMUNITY AND OWNER

It is often difficult to maintain water quality in treatment plants during major upgrades; this project was no different. The influent pump station was bypassed using multiple diesel pumps from a deep common manhole. A temporary above-ground force main and coarse screen were constructed to divert flow directly to the aeration basin so that the pump station retrofit and headworks/primary filtration facilities could be constructed without interrupting plant operations. The contractor monitored the temporary pumps 24/7 for a period of three weeks during the pump station construction, startup and commissioning. The team was also responsible for manually cleaning the temporary screen so coarse solids were removed ahead of the aeration basin. This sequencing took careful planning and coordination between the PDB team and City operations staff.

A total of five diesel self-priming pumps were used to handle peak flow events and prevent a sewage spill during the influent pump station retrofit.

CREATIVE PLANNING BALANCED PROCESS TO MAINTAIN EFFICIENT FILTRATION

Critical flow split at the primary filters promotes secondary process stability.

Kennedy/Jenks had the insight to provide a means for bypassing the filters for maintenance, but more importantly to provide a flow balance between primary filtration and the secondary process. The flow balance was modeled extensively during design to provide necessary BOD to the secondary process to sustain the microorganisms. A process upset could have occurred if the primary filters removed too much of the food that microorganisms in the secondary process need to survive. A bypass channel was designed into the primary filtration facility to accomplish a flow split so the secondary process sustained enough microorganisms to provide good BOD removal and achieve effluent quality necessary to meet permit requirements. The startup sequence included a plan that would slowly step the amount of flow diverted to the primary filters. The result of continued monitoring was that the filters allow enough soluble BOD to bypass filtration without having to split the flow. The bypass channel only diverts flow when the hydraulic capacity of the filters is exceeded during high flow events.

SUCCESSFUL FULFILLMENT OF CLIENT/OWNER NEEDS

The plant is operational, and startup and commissioning was completed in July 2018. The Phase 2 Upgrade improvements completed by the Kennedy/Jenks-Mortenson Construction team successfully met the Owner’s strategic objectives of:

- **Increased Capacity.** The City of The Dalles WWTP now has projected capacity to the year 2037 given the improvements constructed using the PDB method of project delivery. The plant capacity increased from a peak flow rating of 7.7 mgd to 13.2 mgd.
- **Improved Quality.** Treatment facilities and equipment were designed and constructed to be reliable and efficient, treating peak wastewater flow rates in full compliance with federal and state regulations and contractual standards. Plant operators were trained on the new equipment during a startup phase led by the PDB team so changes in operation would result in maintained effluent quality during and following equipment turnover.
- **Sustainability.** The project gave the City a means to enhance and continue their environmentally-responsible biosolids land application program. The primary filtration facility lowered overall plant operating costs and the cogeneration facility created a source of green power by converting digester gas to electricity.
- **Budget.** Life-cycle cost was minimized through the PDB project delivery method. Ultimately the project savings allowed the City to make additional improvements outside of the scope of work and the project was constructed for less than the GMP of $10.9 million.
- **Schedule.** The project team took advantage of the PDB project delivery method to reduce the schedule by eliminating the need to provide complete design documents. Kennedy/Jenks was heavily involved during construction to add the final design details, which allowed for 80 percent completion on construction drawings. PDB also allowed the contractor to start four months ahead of schedule with an early permitting and civil earthwork design package prepared by Kennedy/Jenks. The submittal review process was also expedited, as equipment was selected during the preliminary design phase and was purchased directly by the contractor, greatly reducing normal equipment lead times. A brief 3-month schedule extension was only necessary to construct additional improvements (beyond the initial scope of work) due to the budget surplus.

The project has been considered a great success in meeting these objectives and will provide reliable service for many years to come. Due to the project's success, and also to meet the demands of rapid industrial growth, the City has awarded design and construction of a new secondary clarifier to the Kennedy/Jenks–Mortenson Construction team using the PDB project delivery model.

Summary

As a result of this project, the plant capacity increased from a peak flow rating of 7.7 mgd to 13.2 mgd (the projected capacity for the year 2037). Treatment facilities and equipment were designed and constructed to treat peak wastewater flow rates while promoting sustainability by lowering blower operating costs and generating clean energy. The project gave the City a means to enhance and continue their environmentally-responsible biosolids land application program and laid the groundwork for a community-based hauled waste program. Construction of a new primary filtration facility increased methane production in the new digester. A microturbine-based cogeneration facility was added to convert the additional digester gas to electricity. Life cycle costs were minimized through the PDB project delivery method by recommending alternatives that maximized the City's return on investment. The project was constructed for less than the initial project budget under a compressed schedule due to the PDB delivery model. Ultimately the project savings allowed the City to make additional improvements outside of the original scope of work.