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Saving money and the environment: How one airport manages stormwater and industrial wastewater

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The lessons the Port of Seattle has learned about managing stormwater and industrial wastewater become more relevant to airports around the world as environmental regulations become more stringent and the demand for air travel increases.

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The Port of Seattle's Mission Statement says: *The Port of Seattle's primary mission is to be a leader in providing services and facilities to accommodate the transportation of cargo and passengers by air, water and land…and to foster regional economic vitality and a quality life for King County citizens.* King County, located in Western Washington and including the City of Seattle, is known for its high quality of life, greatly due to its pristine environment and bounty of beautiful natural resources.

To help preserve this environment, the Port of Seattle developed an extensive program to protect waters near its facilities, including Sea-Tac Airport. A major component of environmental management for the Port is the 37 inches of annual rainfall the region averages. The lessons the Port has learned about managing stormwater and industrial wastewater become more relevant to airports around the world as environmental regulations become more stringent and the demand for air travel increases.

Why separate stormwater and industrial wastewater? (top)
The future in airport industrial wastewater treatment could very well mirror the system that has been in place at the Seattle-Tacoma International Airport since the late 1960s. The Port separates stormwater from industrial wastewater, and is one of the few airports worldwide that treats its industrial wastewater on site.

The stormwater drainage system collects surface water from areas that are less likely to contain industrial pollutants, such as runways. The Industrial Waste System (IWS) gathers water from surface areas that likely to contain contaminants, such as de-icing fluid (glycol), fuel and oil. These areas include terminals and maintenance yards. Although most airports currently have some type of oil and water separation function in their stormwater system, they soon may be looking at separation of their stormwater and industrial wastewater systems as an option to meet more stringent environmental regulations regarding disposal of gas, oil and especially glycol.

The old slogan "dilution is not a solution" holds true in this situation. If all stormwater and industrial wastewater flow to the same drain, the contaminants become diluted and consequently more difficult—and expensive—to treat. When areas that may contain contaminants drain separately from those that do not, there is much less water to treat for contaminant removal, and the concentrated contaminated water is less expensive to treat, resulting in a cost savings.

Glycol treatment can be managed on site or sent to a biological treatment plant. If the glycol is collected on site it may actually be recycled and sold as antifreeze, although re-using the glycol to de-ice planes is against FAA regulations. The Port tentatively plans to send treated industrial wastewater that contains glycol to a King County-owned biological treatment plant. Because the airport separates its industrial wastewater from its stormwater, it will have much

less water to send to the County treatment facility. This will save money on treatment costs, and also will reduce impacts to the County treatment plant, a public resource.

The industrial waste system at the Sea-Tac Airport has provided the Port with these cost and environmental protection advantages for almost 40 years. The Port is currently upgrading the system to meet all local, state and federal airport and environmental standards.

How does the IWS work? (top)
The IWS handles run-off from 365 acres of impervious surface. The system is composed of 22 miles of drains that flow to one of three lagoons which hold the water until it can be treated at the adjacent wastewater treatment plant. Lagoons One and Two (and soon Lagoon Three) are lined with 100-millimeter thick high-density polyethylene liners.

Once in the plant, the water is screened for large debris, including everything from luggage tags and food containers to the orange wands used by ground crews to guide planes. The water is then treated through a dissolved air flotation (DAF) process. The DAF process goes one step beyond typical oil and water separation (which only removes free product) by actually breaking the emulsion of the oil, resulting in a float of oil and solids. This float is removed and placed in tanks on site for further settling.

The treated wastewater gravity-flows through a pipe to a deepwater outfall in Puget Sound. After the waste in the storage tanks has settled, the tanks are dewatered and the remaining waste is disposed of by a specialized private waste contractor.

Ten employees maintain the wastewater treatment plant in shifts, which operate around-the-clock during the rainy season, and in two shifts during the dry season. All plant employees have been certified as State of Washington Operators-in-Training for Wastewater Treatment Plants.

Current Upgrades to the IWS (top)
The Port has completed approximately $12 million in capital improvements to the IWS in the past four years. The current phase includes a $19 million expansion of the third industrial wastewater storage lagoon.

Based on runoff projections for the next 20 years, in combination with anticipated development, engineers have estimated lagoon should be expanded from its existing 26 million gallon capacity to at least 47 million gallons. However, the Port of Seattle has decided to go beyond this minimum requirement and is upgrading the lagoon to a capacity of 72 million gallons. This expansion ensures enough storage for unforeseen extreme weather events and future airport development.

Engineering and environmental challenges of lagoon expansion (top)
Expanding the lagoon presents several interesting challenges, both in terms of engineering and environmental protection. The lagoon is situated to the south of the treatment plant on a site that is approximately 22 acres. At its expanded size the lagoon will measure 950 feet by 350 feet, or about the size of 7 football fields. The area has historically been used by the Port as a multi-purpose storage area, for everything from light posts to fill from other construction sites. The engineering firm hired to design the expansion, Kennedy/Jenks, has assessed the soils in the area to determine what materials may be present. The engineers are challenged with moving a large amount of dirt during construction on a site constrained by size and wetlands, as well as deciding the best placement for the dirt, depending on its contents. In the best case scenario the dirt removed will be suitable for use in the construction of the third runway, or for the on-site construction of berms around the lagoon.

Industrial Waste System is composed of 22 miles of drains that flow to one of three lagoons which hold the water until it can be treated at the adjacent wastewater treatment plant. Lagoons One and Two are lined with 100-millimeter thick high-density polyethylene liners, as seen here.

Another challenge the engineers face is the presence of several freshwater springs located directly in the area where the lagoon will be expanded, as rising spring water could cause the liner of the lagoon to float. To address this possibility the engineers designed a ground water collection system that will be installed beneath the lagoon liner. The system will empty into the Port's stormwater system without treatment, as the water in this drainage system will not be in contact with the water in the lagoon.

Wetlands and wildlife present environmental safety issues (top)
With the presence of freshwater springs on the site, it was not a surprise to find wetlands there as well. But the fact that the lagoon is surrounded on virtually all sides by Class I wetlands has presented some environmental safety issues, especially since these wetlands are directly connected to fish-bearing streams. To address these issues the engineers have carefully designed the lagoon to protect the surrounding wetlands.

Wetlands and open water attract wildlife, including birds, which are not welcomed at airports due to the threat bird strikes pose to aircraft. The plan for bird deterrence at Sea-Tac Airport includes covering Lagoons One and Two and the placement of surface water agitators in Lagoon Three.

Overall Benefits (top)
The Port of Seattle has realized many benefits resulting from its efforts to manage industrial wastewater. Through its IWS program the Port meets all local, state, and FAA regulations and saves money by treating only industrial wastewater. Perhaps most importantly, the IWS and lagoon design offer important environmental protection measures enabling the Port to fulfill its mission to foster a high-quality of life for people living in, and visiting, the Puget Sound area.

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