The winter season brings with it a number of headaches for airport managers and operators: poor visibility, snow-covered runways, delayed flights and icy planes and equipment, among other problems. Added to that list is another increasingly challenging problem — the need to responsibly and effectively treat the chemical runoff that results from deicing.

The U.S. Environmental Protection Agency (EPA) has been investigating this issue for years, taking samples from a number of airport treatment systems and formulating draft regulations, some of which are due later this year. Once the new rules are issued, all airports will need to comply with national standards for pollutant and treatment levels, meaning many will need to upgrade or install all new treatment systems.

A new technology has emerged that can help airports control this issue. Engineered wetlands combine the passive treatment of a natural wetland with a controllable, active system using specially designed processes to drive chemical treatment reactions within a wetland environment. In other words, these systems allow airports actively to manage stormwater runoff and its treatment as needed — with greater intensity during deicing, for instance, or entirely passively during drier, warmer conditions. What’s more, these wetlands are entirely underground, allowing treatment to continue during the coldest winter months.

**Gravel Layer**

The system works by directing runoff under the surface through a layer of gravel covered with an impermeable liner. This gravel layer, which facilitates most of the pollutant treatment, also often is equipped with an aeration blower system to ensure that the bacteria that form on the gravel receive enough air and oxygen to induce aerobic respiration. In cold climates, the gravel then is covered with a layer of mulch, which insulates the wetland during the winter to allow it to continue operating.

New York’s Buffalo Niagara International Airport already is taking advantage of this technology. The airport recently installed an engineered wetland system capable of treating large pollutant loads and adapting to the fluctuating levels of glycol and other chemicals. The new system, which is up and running now as the airport prepares for the 2010 winter season, was installed to replace a series of underground tanks that stored and gradually discharged the airport’s runoff. When New York state imposed a new stormwater management permit that set the biochemical oxygen demand (BOD) limit at 30 milligrams per liter, the airport needed to change its system, considering the average deicing treatment can produce more than 10,000 milligrams of BOD per liter.

Given the airport’s harsh winters and seasonally fluctuating pollutant levels, an underground engineered wetland proved the best solution for meeting the new permitting standards. Not only does the subsurface structure mean it can function effectively throughout the winter, but it also means birds and other...
wildlife — dangerous hazards on airfields — are not drawn to it as they would be to a traditional wetland. The system also means avoiding the operation and maintenance costs of an entirely automated system since most of the engineered wetland operates naturally. In effect, the airport traded land for mechanical complexity, a cost-effective solution for those airports with land to spare.

Because Buffalo’s airport is a land-abundant facility, the engineering team was able to design the wetland in an open area near the main runway. Approximately 4.6 acres in size, the wetland was constructed to accommodate both large and small flows with varying concentrations and appears on the surface as a typical grassy area. The underlying gravel bed uses fairly large gravel that better accumulates the bacterial biofilm needed to treat the more intense chemical loads during deicing. While that process is relatively passive, monitoring systems using electromagnetic flow meters and online analysis tools gauge the amount of glycol in the runoff, allowing operators to actively adjust the air and nutrients being delivered through the wetland’s patented aeration system.

Stormwater Management

During the summer when pollutant loads aren’t quite as high but the overall runoff volume can be, the wetland continues to function in a stormwater management role. The “slime” that accumulates on the gravel during the winter decomposes in the warmer weather and is food for seasonal insects and bacteria, helping to manage the potential for sludge build-up. During a particularly rainy stretch, operators can ramp up the aeration system as needed, depending on the demand and contaminants. In many cases, passive treatment works so effectively in the summer that the aeration system can be turned off entirely.

More airports are considering the engineered wetland option, as it easily can be added to or converted from an existing stormwater management system. Edmonton International Airport in Alberta, Canada, for instance, is in the midst of a large expansion project, including upgrading its stormwater management capacity. The airport installed a constructed wetland — an entirely passive system — nearly 10 years ago, but now is considering converting it to an engineered wetland as the new system optimizes treatment with aeration within nearly the exact same footprint. For cold-climate areas like Edmonton and Buffalo, this higher treatment capacity is essential as deicing continues each winter.

Not every airport, of course, is well suited for an engineered wetland. Those with tight space restrictions may not have the available land and instead must focus any upgrades on mechanical treatment systems. However, as EPA prepares to impose new regulations on the aviation industry later this year, those airports able to take advantage of the land surrounding their airfields now have a cost-effective, low-maintenance option that allows them to be environmentally responsible without sacrificing the safety of the people and planes that use the airport throughout the year.

The wetland cells at Buffalo Niagara International Airport were constructed on approximately 4.6 acres and will appear as grassy areas when complete.

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