Water Management in Buildings – A Strategic Approach for Facility Managers

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Building performance is defined by a number of important parameters. Energy use, water consumption, waste generation and removal, and environmental quality in the workplace are the broad categories of building performance that a facility manager is most concerned with. Water is generally considered an undervalued resource and does not always get as much attention as energy and waste. The categories that get the most attention are usually the ones that are most costly. Water is viewed as an important environmental topic for buildings, but it has not yet reached a level of critical thinking. Scarcity and the cost of water are likely to change that view and force us to think more strategically about how we use water in buildings.

The standard approach to water savings in buildings is to adopt the "fixtures approach". That is; water efficiency in buildings is measured by the efficiency of its fixtures. While this approach may capture the bulk of water use in buildings, it ignores a number of other important water conservation measures such as rainwater capture, gray water use, water used in cooling systems, and leakage. Facility managers are encouraged to think strategically. Thinking strategically about building water use will force us to go beyond the "low hanging fruit" of fixture use and force us look at our buildings more holistically. Strategies such as the Global Water Consumption Approach and Water Management Plan Approach (WMP) may offer better answers to conserving water in buildings.

Facility management is a profession that combines strategic thinking with operational processes that align with the organization's mission. Water use and conservation is a tactically driven subject and the conversation around the subject of water usually focuses on very tactical answers. Most of what we read and are taught about water is that it is very likely to become more scarce and expensive to use (if it hasn't already). The facility management world is filled with technological answers; most are centered on water reducing fixtures that balance the minimization of water use with the satisfaction of the user. This is a very good approach for the building industry since much of our water use is associated with toilets, lavatories and showers. However, there is much more for the facility manager to consider. Irrigation, leakage, and evaporation can account for significant water uses (and losses). Capture and reuse strategies can also contribute significantly to conservation. What is often missing in water management processes is systems thinking. That is the one area that the facility manager can use strategic thinking to think ahead, plan, and anticipate future needs. Now is the time to think about water use strategically.

Systems thinking leads us to consider water use in buildings in terms of inputs, uses, and outputs. Water inputs include either a municipal source, or an on-site source. Other inputs may include purchased water, particularly for domestic drinking water use.

Water use in buildings falls into three categories:

- Domestic water
- Process water
- Irrigation

Domestic water includes that which we use for washing, bathing, cleaning, waste removal, and in food service functions. Domestic water use is controlled by the fixtures in the building. Process water includes water that we use in heating and cooling. Irrigation water is used in landscaping.

Water outputs in a building include wastewater, evaporation, and leaks. Evaporation can account for a significant water loss in building systems that rely on open-loop cooling systems. Leaks can also account for a significant quantity of water use if they are not detected and corrected in a timely manner. In taking a strategic approach to improving water performance, all inputs, uses, and outputs should be considered. Figure 1 shows the typical inputs, processes and outputs for water use in buildings.

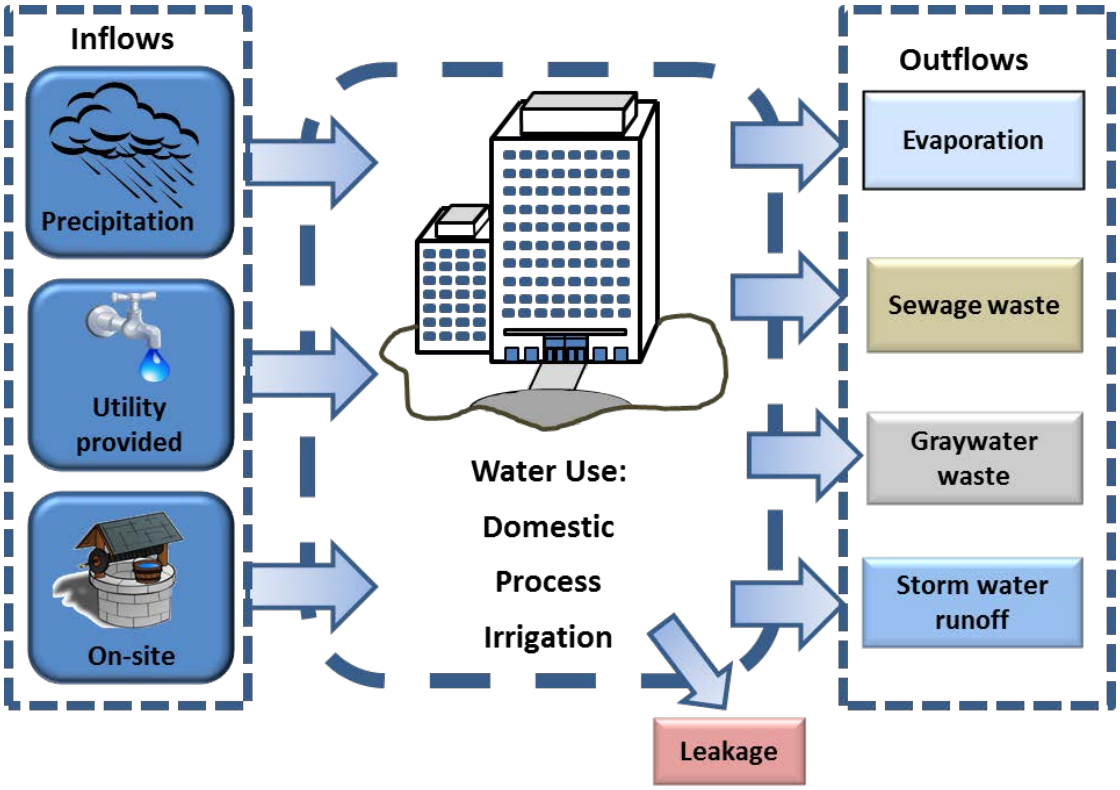

Figure 1 – Water use in buildings

Any water management strategy in buildings should also consider the capabilities of the building and site infrastructure to handle precipitation (storm water), waste removal, and storm water runoff. Each of these elements is an integral part of the facility manager's water management strategy. Water performance of buildings is often defined by how much we consume. However, a more comprehensive strategy that includes building and site infrastructure and water and waste handling capabilities are well worth considering. Current thinking on water management strategy involves three basic approaches:

Key Fixtures Approach – The key fixtures approach follows the logic that a building is water efficient if the fixtures within the building are efficient. Water efficient toilets, urinals, lavatories, showers, and food service equipment are selected and installed with the highest level of water savings that does not inconvenience the user. By setting water efficiency requirements at the fixture level, this strategy takes advantage of current water savings technologies. The advantage of this approach is that it is simple to implement. There are a number of labeling programs that guide us to the most efficient fixtures. A major disadvantage of the key fixtures approach is that it does not take other water conservation strategies into account. The systems thinking approach shown in Figure 1 is not employed. Another disadvantage of the key fixtures approach is that once we have upgraded our fixtures, there may not be any more incentive for improvement until the next round of technological improvements coincides with the next major building renovation.

Global Water Consumption Approach – This approach considers the overall water consumption of the building. It uses a net-water use metric. Using the overall consumption approach gives "credit" for water reduction strategies such as rainwater harvesting and gray water use. In this approach, the water consumption of a comparable standard building is determined as a reference value. A standard building would be one that uses standard or non-water-saving fixtures. The standard water metric for a typical building is expressed in a "per person" or "per area" metric. For example, according to the Watermark program in the UK, the standard benchmark for water use in an office building is 9.3 cubic meters (2456 gallons) of water per person per year. The Watermark program establishes the "best practice" level of water performance at 6.4 cubic meters (1690 gallons) per person per year.

To understand the overall water consumption of a building, it is necessary to measure and monitor water use. Baseline use is determined by conducting an inventory of fixtures and flow rates, and establishing a standard number of uses for each fixture per building occupant (usually derived from the plumbing codes). Reduction targets are determined and strategies such as fixture replacement, rainwater harvesting, gray water use, food service strategies, and irrigation strategies are put in place. Water use metrics are then monitored for improvement.

An advantage of the global water consumption approach is that allows the facility manager to benchmark water performance against others. A disadvantage is that the benchmark is often established against non-water saving buildings (i.e.: old plumbing codes). Once the market improves water performance of buildings and new codes are in place over the next few years, a new benchmark is required. This will require a fresh look at how to continue to improve water conservation.

Water Management Plan (WMP) Approach – this approach is more strategic in nature and views the water management process as a system. It incorporates the fixtures approach and the global water consumption approach in order to reduce consumption. The primary concept is to meter and target. As with energy, measurement and monitoring of water consumption is critical in establishing the baseline use that will allow the facility manager to establish reduction targets that make sense for the facility. Reduction strategies such as fixture replacement, gray water use, leak prevention and monitoring, and use of technologies to reduce cooling water loss in open loop cooling systems can be implemented once consumption is properly measured at the system level. The reduction targets are set by the facility manager based on actual consumption data.

Of all three of these approaches, the water management plan (WMP) approach offers the facility manager the greatest opportunity for continuous improvement. Consumption data is based on real data, not theoretical fixture and use rates, and it allows for the incorporation of the greatest number and variety of reduction strategies. The WMP approach also allows the facility manager to think beyond the uses of water and consider sources (rainwater) and the building and site infrastructure that move water and waste from source to disposal.

A common problem in many facilities is aging infrastructure that is not readily accessible and expensive to repair. A WMP approach can also consider aging underground piping for the risk of leaks and disruption of service, safety issues, and damage to the facility that can result from major leak events.

A comprehensive WMP approach should include all of the elements outlined below:

- Site and building infrastructure age and condition
- Risks associated with leak events
- Methodologies for handling storm water
- Methodologies for handling waste
- Domestic, process, and irrigation uses of water
- Conservation and reuse strategies
- Building fixture technologies

- Potential sources and mitigation of evaporation

Managing water use in buildings is not merely an issue of reducing consumption. Employing the systems thinking approach requires consideration of all water and wastewater-related issues. Above all, an effective strategy for water management in buildings requires the ability to measure, monitor and report water consumption and wastewater output. The ability to measure is dependent on an adequate and accurate metering plan. The ability to improve performance is dependent on how well the metering plan is sub-divided to account for water use at a system level. The greatest level of improvement will happen when the facility manager has adequate data on consumption, access to the technological improvements needed to reduce consumption at the fixture level, thoughtful strategies for process and irrigation water uses, and an eye toward reducing waste.

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