

Task 4: Protecting Water Quality and Reducing Water Use

Final Report – Water Reduction Opportunities and Recommendations



Prepared for: **Broward County Aviation Department**
Fort Lauderdale, Florida

September 2007



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Prepared for

Broward County Aviation Department

Ft. Lauderdale, Florida

Prepared by

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Final Report

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ACRONYMS

ASCE	–	Annual Comprehensive Site Evaluation
ASR	–	Aquifer Storage and Recovery
AWS	-	Alternative Water Supply
BCAD	–	Broward County Aviation Department
BCC	–	Broward County Board of County Commissioners
CAP	–	Clean Airport Partnership, Inc.
CUP	–	Consumptive Use Permit
FDEP	–	Florida Department of Environmental Protection
FLL	–	Ft. Lauderdale-Hollywood International Airport
GAI	-	Green Airport Initiative
Kg	–	Kilograms
MGD	–	Million Gallons per Day
MSGP	–	Multi-Sector Generic Permit
OES	–	Broward County Office of Environmental Services
PAC	–	Pre-Approved Advance Cleanup
POC	–	Point of Connection
REDI	-	Rural Economic Development Initiative
SFWMD	–	South Florida Water Management District
SIP	-	Savings Incentive Program
SPCC	–	Spill Prevention Control and Counter Measure
SRCO	-	Site Rehabilitation Completion Order
SWPPP	–	Storm Water Pollution Prevention Plan
WWTP	-	Waste Water Treatment Plant

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1. Executive Summary

The Green Airport Initiative (GAI) is designed to help the Ft. Lauderdale-Hollywood International Airport (FLL) improve environmental quality and operational efficiency, and become a community model for sustainable development. The first task under this contract was to prepare the environmental footprint for FLL operations. Potential direct and indirect sources of environmental impacts to the groundwater and storm water media at FLL were examined. In addition, potable and non-potable water conditions at FLL were examined to establish a baseline of current uses which, with the implementation of better management practices and water saving devices, could be reduced.

The Broward County Aviation Department (BCAD) requested several strategies be identified to improve the water use and water quality environmental footprint at the airport. Once several strategies were identified, the two (2) initiatives with the greatest potential to reduce the environmental footprint were further researched to evaluate costs of implementation versus benefits.

These two (2) initiatives which were further evaluated included the upgrade of bathroom facilities to reduce potable water consumption and the upgrade of the current irrigation systems to reduce the non-potable water consumption.

It was estimated that upgrading the bathroom facilities would reduce the current impact metric from 2.86 gallons per passenger to 1.01 gallons per passenger, saving nearly 43 million gallons per year. Based on the current water and sewer rates, this translates to nearly \$281,000 annually.

Implementation of this initiative is estimated to cost approximately \$234,000. The payback period to implement these upgrades is approximately 10 months, resulting in a return on investment of 114%.

Based on the preliminary irrigation audit findings, it appears that irrigation efficiency could be improved 40% to 70%, based on the level of recommendations that are followed. A detailed system analysis is needed to refine this efficiency estimate. However, assuming this estimate is accurate, the non-potable water use element of the footprint could be reduced by a minimum of 40%.

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2. Project Overview

2.1. **Introduction**

On November 9, 2004, the Broward County Board of County Commissioners (BCC) approved a contract with the Clean Airport Partnership, Inc. (CAP) and its team of subcontractors, to implement a GAI at the FLL. The GAI is designed to help FLL improve environmental quality and operational efficiency, and become a community model for sustainable development. The first task under this contract was to prepare the environmental footprint for FLL operations, which was submitted in September 2005.

Miller Legg, a CAP team member, was the lead contributor to the water portion of the environmental footprint development. Potential direct and indirect sources of environmental impacts to the groundwater and storm water media at FLL were examined. In addition, potable and non-potable water conditions at FLL were examined to establish a baseline of current uses which, with the implementation of better management practices and water saving devices, could be reduced.

2.2. **Purpose**

The purpose of this project is to provide the BCAD choices on how to lessen FLL's impact on natural resources, and to examine the potential effects of those choices compared to the economic requirements of their implementation.

In August 2005, Miller Legg submitted a baseline assessment to BCAD documenting the airport's environmental footprint with respect to water. Water use and stormwater and groundwater quality were evaluated. As the conditions at the airport are continually evolving and tenants changing, a proactive approach is necessary to handle future water use needs and to offset the ever decreasing availability of quality potable water.

2.3. **Scope**

Based on the baseline assessment, the following five (5) elements were completed during this Task:

1. Define FLL activities which have the potential to critically affect storm water receptors or may not efficiently manage water use on-site;

2. Review the current state of practice, research, and policy with BCAD and other FLL consultants;
3. Define a vision of future capabilities that would address the critical issues;
4. Identify specific research needs to help achieve FLL's vision of building a "Green Airport"; and
5. Recommend enhancement activities to be completed at FLL which will improve the quality of the natural environment and result in a net benefit to the community.

2.4. Report Organization

This report explores options to reduce FLL's water footprint on the environment. An evaluation of the current water usage and FLL's contribution to the underlying groundwater quality was performed.

This report focuses on three (3) areas of concern related to water:

- Groundwater
- Stormwater
- Water use (both potable and non-potable)

Current practices were evaluated to determine their effectiveness in conserving potable water, as well as the quality of the underlying groundwater. If current effectiveness could be reasonably improved, recommendations were made. This report provides a proactive approach to current FLL operations and tenants that can reduce usage of potable water, reduce the withdrawal of potentially potable water, and help prevent future contamination of the groundwater underlying the airport.

This report is organized into the following sections:

- **Section 1 Project Overview** provides a project introduction, purpose, scope of work and report organization.
- **Section 2 Impact Metric Evaluation Process** presents a broad view of the strategies and initiatives that were given a cursory review for groundwater, stormwater, and water use.

- **Section 3 Potable Water Use Recommendation** presents a strategy to conserve potable water, details a cost / benefit analysis to implement the strategy, and provides an opinion of the impact this strategy will have on FLL's environmental footprint.
- **Section 4 Non-Potable Water Use Recommendation** presents a strategy to conserve non-potable water, details a cost / benefit analysis to implement different levels of this strategy, and provides an opinion of the impact this strategy will have on FLL's environmental footprint.

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3. Impact Metric Evaluation Process

3.1. *Introduction*

The precursor report, Environmental Footprint for FLL Operations (September 2005) established a measuring tool to track the airport's environmental performance. For water quality and reducing water use, impact metrics were established for groundwater, surface water, and water use. The power of using these impact metrics is the ability to track performance over time to see where environmental initiatives are successful and where more effort may be required.

BCAD tasked the CAP team to identify several strategies to improve the water use and water quality environmental footprint at the airport. Once several strategies were identified, the two (2) initiatives with the greatest potential to reduce the environmental footprint were further researched to evaluate costs of implementation versus benefits.

The remainder of Section 2 discusses the general strategies to reduce the environmental footprint for groundwater, surface water, and potable and non-potable water. Section 3 and Section 4 are devoted to providing a more thorough analysis and recommendation to BCAD.

3.2. *Groundwater*

Groundwater flows in aquifers that underlay the airport. Throughout South Florida, groundwater is an important resource that has many uses, including as a supply to municipal potable water treatment facilities, residential wells, and agricultural irrigation. On-site groundwater is currently utilized for FLL irrigation. Groundwater also flows into canals and rivers and eventually outfalls into the Atlantic Ocean. Once contaminated, groundwater is difficult and expensive to clean up. Preventing pollution from occurring is the most cost effective strategy. That is why FLL and its tenants are an important community partner to protect groundwater resources and why programs like GAI are so important.

Groundwater contamination is generally not directly related to air travel demand, number of passengers, or other operational variables at FLL and therefore, difficult to evaluate in terms of benefits versus costs for all stakeholders, including the community. However, it is recognized that groundwater impacts should be addressed and prevented in the future.

Groundwater contamination can occur when chemical pollutants are spilled or dumped on the ground surface and then migrate into the groundwater, or are released from containment or transmission structures placed underground. There is also the potential for spillage of petroleum-based fuels during airplane refueling. If spillage occurs adjacent to unpaved areas, there is a significant risk of fuel causing soil and groundwater contamination. Further risks may be found with bulk storage facilities, particularly for fuel. This risk increases if the tanks are located underground, if underground fuel pipelines are used, and also with the aging of the tanks and pipelines.

Groundwater Impact Metric Evaluation

During the establishment of the environmental footprint, four (4) areas with groundwater impacts were being actively monitored. Mass was calculated from these sites to include 45.822 kilograms (kg) of contaminants. Of particular note, groundwater impacts are present on several airport properties which were not included in this calculation since, at the time, contaminant mass from those areas could not be quantified. The Impact Metric was normalized as follows:

$$\text{IM}_{\text{current year}} = (\text{Current year contamination}) / (\text{2004 contamination})$$

$$\text{IM}_{2004} = (45.806 \text{ kg}) / (45.806 \text{ kg}) = 1.0$$

There are many sites listed within FLL boundaries that are included on the list of Broward County contaminated sites. These sites have documented groundwater and/or soil contamination. Of the sites listed, two (2) sites have been issued a Conditional Site Rehabilitation Completion Order (SRCO) and 13 sites are in a state-funded petroleum cleanup program. The remaining sites are not funded. Groundwater contamination remains on the sites that have been issued a conditional SRCO, but the contaminant plume has been documented and is attenuating within the site boundaries. Currently the Florida Department of Environmental Protection (FDEP) and Broward County do not require these sites to conduct further remediation.

The funded sites are on a priority ranking list where funding will be distributed to sites with a higher (greater risk) score. A majority of these sites are low scoring and will not see funding for many years, since funds will be allocated in priority ranking order.

Currently, BCAD spends a great deal of resources assessing and cleaning up impacted areas on FLL properties. Several consultants are under contract and are managed by BCAD staff to reduce current impacts. Since this program is functioning effectively and active remediation and assessment is ongoing, Miller Legg determined that any additional recommendations focused on cleaning up groundwater impacts were not essential.

Furthermore, BCAD leases space to tenants that use, store, and/or handle hazardous and petroleum products. Tenants are required to actively remediate any documented contamination prior to the termination of their lease. BCAD has taken a very proactive approach to identify problems before a release happens by requiring tenants to follow best management practices and FLL's Storm Water Pollution Prevention Plan (SWPPP).

Groundwater Recommendation

Periodic inspections of the leased spaces should continue to be conducted to ensure compliance with applicable county, state and federal regulations pertaining to the storage, handling, and/or use of petroleum and hazardous products. These inspections identify any non-compliance issues and make recommendations and/or suggest solutions to achieve compliance. This reduces the potential for a release and the environmental liability of the tenant space.

Reducing the amount of groundwater utilized on FLL property is addressed under Section 2.4, Water Use.

3.3. Stormwater

Of course, like groundwater, inadvertent spills can also be point sources for stormwater impacts. FLL is a large air transport facility that is approximately 1,380 acres in size, which includes airport-related operations that potentially impact the water quality of stormwater runoff. These activities include commercial aircraft operations, private storage (airplanes and helicopters), and aircraft maintenance. In addition, FLL tenant operations include rental car facilities, air cargo, vehicle maintenance, aircraft maintenance and airfield support. Stormwater generally falls onto runways, ramp areas, and other impervious areas on the site and runs off through drainage ditches and culverts and into canals that ultimately outfall into the Atlantic Ocean. About 77% of the FLL property is impervious.

Stormwater Impact Metric Evaluation

Spills represent a potential source of releases to the environment. In order to generate an Impact Metric value for stormwater, total quantity of petroleum spills for the year 2004 was utilized. This approach allows BCAD to evaluate facility daily operations as well as personnel training and responsiveness to emergency situations. The Impact Metric was normalized as follows:

$$\text{IM}_{\text{current year}} = (\text{Current year release}) / (\text{2004 quantity release})$$

$$\text{IM}_{2004} = (217 \text{ gallons}) / (217 \text{ gallons}) = 1.0$$

FLL operates under a Multi-Sector Generic Permit for Stormwater Discharge Associated with Industrial Activity (MSGP) and currently has a SWPPP. FLL currently conducts SWPPP Annual Comprehensive Site Evaluations (ACSE) with regard to monitoring compliance of air transportation-related activities and operations being conducted in accordance with the requirements specified in the MSGP. The inspection evaluates permit compliance, condition of receiving water, and monitoring of storm water outfalls. The inspection also reports on best management practices that are currently conducted with respect to potential sources of storm water pollution. Items included in the inspection are:

- Fueling Stations/Areas
- Vehicle/Equipment Wash and Rinse Areas
- Vehicle/Equipment Storage Areas
- Outdoor Stockpile/Material Handling Areas
- Outdoor Manufacturing Areas
- Chemical/Waste/Sump Storage Containers
- Loading/unloading/Transfer Areas
- Illicit Connections to Stormwater System
- Trash and Debris Areas
- Painting and Stripping

Storm Water Recommendation

Periodic inspections of the leased spaces should be continued to ensure compliance with applicable county, state and federal regulations pertaining to

the storage, handling, and/or use of petroleum and hazardous products. BCAD's annual and random inspections should identify any non-compliance issues and make recommendations and/or solutions to achieve compliance. This will reduce the potential for a release and will reduce the environmental liability of the tenant space.

3.4. Water Use

FLL uses potable and non-potable water in many areas including irrigation, minimal aircraft washing, terminal building activities, fire training exercises, and chillers, as well as tenant and BCAD operations. Potable water is provided by Broward County's Office of Environmental Services (OES) and is withdrawn from the Biscayne Aquifer. FLL's impact on the potable water is in the form of consumption. In addition, inefficient usage can encumber valuable capacity in the County's consumptive use permit (CUP) and can put unnecessary strain on the water and waste water treatment plants that service the FLL.

Many of the airport tenants use potable and non-potable water for irrigation, building activities and vehicle/equipment washing. Considering ways to reduce the volume of water consumed by airport tenants can enhance the airport's commitment to water conservation.

Potable Water Use Impact Metric Evaluation

The environmental footprint for FLL operations, which was submitted in September 2005, determined that FLL water consumption and Impact Metric was 14.1 gallons per passenger, based on billing data for 2004. Reducing potable water use is a key action item under this program.

The following water conservation techniques were evaluated to determine the current strategy in place at the FLL. Areas of evaluation included:

- Reducing the use of municipal water supply to those activities requiring potable water.
- Installation of flow restrictors for plumbing fixtures.
- Installation of faucets with water conserving aerators.
- Installation of water conserving low-flow toilets.
- Installation of no-flow urinals

- Using energy efficient appliances to heat water for showers, dishwashing, and miscellaneous cleaning.

The CAP team's investigation into FLL operations revealed that potable water is used for terminal operations involving sinks, toilets, water fountains, dish washing, etc., and for vehicle and equipment washing. Although potable water is required for terminal operations, vehicle and equipment washing do not require potable water.

Airport tenants utilize significant volumes of potable water for vehicle/equipment washing and building operations. With the installation of water conserving fixtures, tenants would also see utility cost savings.

RECLAIMED WATER

The first strategy evaluated was the potential use of reclaimed water in areas where potable water is not required. Reclaimed water is the reuse of domesticated wastewater which has been treated and disinfected and is widely used in Florida for applications such as irrigation, car wash stations, toilet flushing, fire protection, commercial laundry, aesthetic uses (ponds, fountains, etc.), dust control for construction sites, and hose beds for washing vehicles and equipment. Using reclaimed water for these activities can significantly reduce FLL's potable water demand. Reclaimed water can also be discharged into on-site ponds for later use or recharge of the underlying aquifer, also known as Aquifer Storage and Recovery (ASR).

FLL is serviced by the City of Hollywood Waste Water Treatment Plant (WWTP) which currently provides reclaimed water. The WWTP is currently permitted to treat 48.75 million gallons per day (MGD) of waste water of which 4 MGD of effluent is treated for reclaimed water. The reclaimed water is pumped to multiple golf courses and road medians for irrigation. The remainder of the effluent is discharged by ocean outfall and deep injection wells. However, the municipalities that could provide reclaimed water to the airport do not have sufficient permitted capacity to service the airport. In addition, significant capital costs including upgrades to the reclaimed water plants, installation of transmission piping to the airport boundary and installation of the appropriate infrastructure to transmit reclaimed water to the appropriate facilities would be required.

Conversations with the South Florida Water Management District (SFWMD) reported that installing a network of reclaimed water transmission lines throughout Broward and Miami-Dade County is essential for the conservation of potable water and the future of readily available potable water.

Reclaimed Water Recommendation

At this time, a reclaimed water system is not feasible due to the capital costs to implement it and the absence of a current network in the area. It is recommended that FLL take a proactive approach and plan to tap into the reclaimed water network once it is available in the area.

GRAYWATER SYSTEM

Current potable water systems distribute drinking-quality water to all water use points within on-site buildings, regardless of how that water is to be used. At the same time, building roof drains, and stormwater collection systems gather water from the roof and all on-site paved surfaces and direct it away from the facility. Graywater is considered the reuse of this type of water and can dramatically reduce the use of water in restrooms.

Graywater systems filter water to remove dirt and debris and store it in tanks. Instead of piping fresh, domestic water to toilets and urinals, the system uses this graywater, reducing the requirement for fresh domestic water. The systems can even save additional water by using graywater for irrigation systems.

Graywater systems require the installation of two (2) distribution piping systems, one for domestic water and one for the graywater. They are best suited for new construction and major renovation projects, because it is difficult and expensive to install the graywater piping system in existing facilities. A graywater system for current airport facilities is not feasible due to the implementation cost, and therefore, was not researched further at this time.

BATHROOM FIXTURES

The airport is currently utilizing low-flow toilets and urinals, as well as water conserving faucets. The CAP team researched additional opportunities to enhance the current system. Although there would be required capital costs,

a reduction in water use and maintenance cost would allow the airport to recover capital costs.

Even with water-conserving low-flow fixtures, the majority of water use in the terminal building is associated with the use of the aforementioned facilities. New technologies are available that further conserve potable water.

At present, FLL is equipped with automatic shut-off faucets within restrooms. These faucets generally produce 1.0 gallons of water per minute. Water-conserving aerators could be added to existing faucets to produce approximately 0.3 gallons per minute, a decrease to one-third the original volume.

FLL currently uses low-flow toilets that put out approximately 1.6 gallons per flush. Newer toilets have been designed that use 0.8 gallons per flush, half the current volume.

FLL also currently uses low-flow urinals. A new technology has been developed that allows functional urinals that operate with no water. These water-free urinals use a filter system and are relatively low maintenance as there is no flushing mechanism. The filter cartridge is engineered to receive waste through drain holes. Waste passes through a layer of sealant, continues through a siphon trap system, and flows out through a baffle to prevent the loss of sealant. A discharge tube in the housing directs the flow of waste into the building drain system. The cartridge is designed as a replaceable component when its function has been exhausted. A retrofit would require minimal disruption of current operations and could be done in phases. This technology is currently being utilized by the Colorado Springs Airport.

The CAP team invited Ecotech Water, LLC to conduct a more thorough examination of the costs / benefits of implementing these changes. The findings are discussed in Section 3.

Non-Potable Water Use Impact Metric Evaluation

A review of the existing SFWMD CUP for FLL revealed the existence of a CUP (Permit Number 06-004310W) dated August 12, 1982 for the use of groundwater from the Biscayne Aquifer for landscape irrigation, serving 54.4 acres with a monthly withdrawal of 14 million gallons. The permit was modified in November 2004 and in October 2006 to irrigate 52.47 acres with an annual allocation of 63.21 million gallons.

At the time of the 2004 Impact Metric baseline, groundwater withdrawal meters were not installed and groundwater usage for the year could not be measured. Since that time, meters have been installed and are monitored monthly. According to the October 2006 Quarterly Withdrawal Report, approximately 9 million gallons of non-potable water is utilized per year.

Based on this information, the Non-Potable Impact Metric was established by calculating the following equation:

$$\text{IM}_{\text{current year}} = (\text{Current year total}) / (\text{2006 year total})$$

$$\text{IM}_{2006} = (9 \text{ million}) / (9 \text{ million}) = 1.0$$

Miller Legg conducted a preliminary audit of the irrigation system to examine how upgrades to the system could improve efficiency and reduce the impact metric. The findings are discussed in Section 4.

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4. Potable Water Use Recommendation

This section details the most cost-effective and efficient method of reducing potable water use at FLL.

4.1. **Basis of Analysis**

By choosing to use water-conserving products, not only is water saved; but, the burden is also decreased on the sewer infrastructure and the sewage treatment plant in Hollywood, Florida. As previously discussed in Section 2.4, FLL's impact on potable water is in the form of consumption. The CAP team conducted a more thorough examination of the costs / benefits of upgrading the bathroom facilities to reduce potable water consumption. The following section summarizes the analysis and the complete report is provided as **Appendix A**.

Consumption

According to information received from Broward County Utilities, it is shown that FLL was billed for over 65 million gallons of water from October 2005 through September 2006. An additional 142 million gallons of water was billed to 141 sub-meter airport related users during that same period of time. It appears that the sub-metered users are a combination of food service establishments (there are 27 such tenants in the airport as of October 2006), rental car companies, airlines, BCAD, Federal Aviation Administration, Broward County Animal Control, Fort Lauderdale Small Boat Club and others. The conservation analysis does not specifically address the sub-metered users. Substantial opportunities for water conservation may be available if a similar program is adopted for these facilities.

Traffic Counts

In 2005, 22,752,181 people traveled through FLL as airline passengers. For this analysis, it was assumed that 60% of this traffic was male. Additionally, the airport has between 28,500 and 31,500 employees and ancillary personnel.

Fixtures

The following table summarizes the proposed upgrade to FLL's bathroom facilities.

Table 4-1
Summary of the Proposed Facilities Upgrade Efficiency

Current Facilities	Current Rate	Proposed Rate	Efficiency Gain
106 urinals	1.0 gallons per flush	0 gallons per flush	100%
486 toilets	1.6 gallons per flush	0.8 gallons per flush	50%
359 hand sinks	1.0 gallons per minute	0.33 gallons per minute	67%

As shown on the table, the proposed upgrade would significantly upgrade the water efficiency for the bathroom facilities located in the airport terminals and common areas. Based on the analysis provided in **Appendix A**, this translates into a water reduction of nearly 43 million gallons per year.

4.2. Cost / Benefit Analysis

Based on the current water and sewer rates, the conservation of 43 million gallons per year would save FLL nearly \$281,000 annually. Implementation of this initiative is estimated to cost the airport \$234,000. The payback period for these proposed products is approximately 10 months, resulting in a return on investment of 114%.

Another 142 million gallons of water is consumed from other airport related entities not covered in this report. Based on the above study, substantial opportunities for water conservation may be available if a similar program is adopted for these facilities.

4.3. Alternative Funding Option

The County could utilize the Utility Trust Water Conservation Funding Program which provides an optional method of providing capital for water conservation retrofit projects. By using this Program, water conservation projects can often be implemented immediately without having to delay projects to wait for budget funds or alternate sources of capital.

Utility Trust is a business trust that is not focused on profit. Its sole mission is to provide capital and related services for conserving natural resources, reducing emissions, and lowering burdens on the sanitary sewer infrastructure and related treatment facilities.

This Program is unique and does not operate like typical finance, lease or energy service performance programs. Utility Trust does not share in the savings and there is no fixed payment or fixed term for the payback of the retrofit funds. The only payment obligation is to pay the actual amount saved in sewer and water charges as a result of implementing a water conservation program until the cost of the retrofit is paid for.

This Program, compared to other funding options, is very simple, straightforward and without risk to facility owners who utilize it. The only obligation for participating facilities during the retrofit payback period, starting the first month after the retrofit is complete, is to pay each month the same amount as they did in the same month of the previous year for water and sewer charges. Utility Trust applies the difference between the facility's previous year's same month water and sewer charge and the new monthly water and sewer charge, until the retrofit cost is paid. Any savings realized from reduced water heating cost and maintenance savings as a result of implementing the water conservation retrofit, does not have to be applied to the retrofit payback and are an immediate benefit to the owner of the facility.

4.4. Potential Environmental Footprint Reduction

Based on updated information provided during this investigation, the impact metric for FLL must be altered to reflect known passenger rates and water usage that is metered and paid for by FLL and not by FLL tenants. This revision changes the impact metric to 2.86 gallons per passenger, based on approximately 65 million gallons of water consumed and 22.7 million passengers traveling through FLL in 2005. If the proposed facility upgrades are implemented, it would result in an impact metric of 1.01 gallons per passenger and would reduce the environmental footprint for potable water from 1.0 to .35, a substantial improvement.

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5. Non-Potable Water Use Recommendation

The role of irrigation is to provide water when needed and in the amount needed to keep a plant healthy and thriving. Any water applied past this required amount is considered waste; any less causes stress to the landscape. Excess watering not only wastes water but can also cause other problems. Examples of some of these problems are nutrient leaching (resulting in groundwater contamination), erosion, extra costs in the form of unwarranted energy consumption and premature failure of system, plant disease and its associated need for additional chemicals to combat the disease, and, the most important problem of using up one of our most precious resources, water.

Florida receives, on average, over 50 inches of rain per year. It is not unusual to see irrigation operators supplement this with over 50 additional inches of irrigation water. Water management districts are changing their thinking on water allocations for irrigation. Just a few years ago in Broward County, it was common to see over 40 inches of water per acre being authorized for a CUP. Today, this number is less than half that amount, and ongoing research indicates this will go even lower.

Consistency with non-potable water best management practices requires an appropriate irrigation design, proper installation to match the design intent, quality landscape maintenance and careful management of the irrigation system to ensure maximum efficiency. To further maximize water conservation, the following should be considered:

- In addition to being consistent with FLL's Master Landscape Plan, proper plant selection should be based on the local climate and environment, as well as site characteristics of exposure, light intensity, soil pH, soil aeration, soil mineral analysis, site drainage, and irrigation water quality. Xeriscape planting should be considered to reduce the landscape water requirements. High maintenance and water sensitive tropical plants, if desired, should only be used in the most visual areas (i.e., entranceways).
- Quality landscape maintenance should include adequate fertilization, pest control, and thatch control.
- Periodic maintenance of the irrigation system is crucial to sustaining efficiency. Examples of the tasks associated with maintenance include:
 - Establish a documented maintenance schedule.
 - Inspect the mechanical components as well as the irrigation lines.
 - Monitor the pump and power unit. This can be done by keeping records of performance and maintenance. Flow rate and pressure

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delivered by the pump as well as the energy consumption of the power unit should be recorded frequently. Records should be maintained monthly.

Additional concepts that could be initiated property wide to improve water management and water quality include:

- Monitor and control water flow to individual tenant meters via a central control monitoring system.
- Remove all hose bibs currently connected to the pump station discharge headers. Replace the bibs with quick couplers on the irrigation mainline while making sure the station can handle the low flows. Modify the pump station as needed.
- Install small nutrient berms (about 6" high) at canal and lake edges to prevent fertilizer and other chemical runoff from entering the water body.
- Institute property wide best management practices for pond management, irrigation system maintenance and operation, and landscape management practices.
- Provide on-site training classes for maintenance and operational personnel.

In addition to the delivery system part of the water conservation and water quality equation, the management of the irrigation system itself is crucial. Rain sensors and soil moisture sensors prevent irrigation when sufficient rainfall has occurred. Irrigation schedules based on environmental conditions versus a set time save on average of 30% on total consumption.

In order to determine the best course of action for FLL to undertake, a complete and thorough site audit should be conducted for each system. This audit will provide the information necessary to determine what efficiency the current system operates at, what efficiencies are obtainable and at what cost, and what the proper irrigation schedules should be. Some examples of how an audit can help are:

- POC operational test will verify that the system is operating at designed pressure and flow. A system operating at the incorrect pressure will decrease system efficiency dramatically.
- Review of backflow prevention devices. An improperly operating backflow prevention device is not only a violation of state law but can result in backward contamination of drinking water supplies.
- Installing proper nozzles and fixing broken heads can raise efficiency by 20 % or more.

- Rain sensors should be operational and properly set. One week of no unnecessary irrigation results in over 2.5 million gallons of water saved.
- Irrigation schedule should be customized. All zones do not require the same run time.

The intent of the non-potable recommendation is to identify existing irrigation system conditions and utilize the information to create an outline for future planning. Future planning will include the development of a long term plan for improving water conservation and water quality at the FLL.

5.1. Basis of Analysis

It takes approximately 1 inch of water per week to maintain a healthy landscape. It takes 27,154 gallons of water to put 1 inch of water on 1 acre of landscape. If the landscape needs all this water to survive, the delivery system would need to be 100% efficient; but none are. In general, irrigation systems in South Florida deliver their water with a measured efficiency of between 30-50%. Therefore, on average, a 40% efficiency system will need to apply 67,885 gallons of water to every irrigated acre to ensure the landscape receives its required 27,154 gallons. Systems can be designed, installed, and maintained with efficiencies of 75%.

Miller Legg conducted general site and irrigation system evaluations for each of the following non-potable water use systems:

- | | |
|--------------------------|------------------------|
| • South Economy Area | • Median |
| • Palm Parking Garage | • Administration |
| • Cypress Parking Garage | • Maintenance Building |
| • Flight 19 | |

The information gathered during these site evaluations was utilized to create the following information. Each site was looked at for current operational conditions and site-specific challenges that can affect water conservation and/or water quality.

State of Current Conditions

The current conditions for each site were observed and noted during the site inspection. The ratings used were as follows:

- Poor – needs considerable repairs to operate to general industry standards
- Average - needs minor repairs to operate to general industry standards
- Good – does not need repairs - currently operates to general industry standards.
- Excellent – the system is in very good operational condition and is already set up to provide exceptional water conservation and water quality.

The current conditions of the irrigation systems are as follows:

- South Economy Area - Average
- Palm Parking Garage - Poor
- Cypress Parking Garage - Good
- Flight 19 - Poor
- Median - Poor
- Administration - Poor
- Maintenance Building - Poor

Recommendations

The following recommendations were made for the 7 irrigation systems which are currently operational and utilize non-potable groundwater.

Immediate Recommendations

These recommendations should be implemented as soon as possible, as they are intended to provide current baseline data and/or allow for low cost, and relatively immediate, results.

1. Conduct an airport-wide, detailed system analysis to determine the overall course of action and refine a cost estimate to implement the irrigation upgrades and improvements (Recommendations 2 through 11)

Cost: \$20,000

Benefit: Implementation of this recommendation should realize a reduction in non-potable water use of 10 percent or more

2. Point of Connection (POC) operational performance test
Cost: \$3,000
Benefit: Implementation of this recommendation should realize a reduction in non-potable water use of 5 percent or less
3. Evaluate backflow and obtain certification
Cost: \$1,000
Benefit: Implementation of this recommendation should realize a reduction in non-potable water use of 5 percent or less
4. Conduct a water audit of each site, including catch can tests on a representative sample (approximately 15% of existing zones)
Cost: \$3,000
Benefit: Implementation of this recommendation should realize a reduction in non-potable water use of 5 percent or less
5. Initiate monthly irrigation system maintenance program (This includes the setup of the program and assumes BCAD staff would implement internally.)
Cost: \$7,000
Benefit: Implementation of this recommendation should realize a reduction in non-potable water use between 5 and 10 percent
6. Initiate an annual backflow certification procedure (This includes the setup of the program and assumes BCAD staff would implement internally.)
Cost: \$7,000
Benefit: Implementation of this recommendation should realize a reduction in non-potable water use of 5 percent or less
7. Test rain sensor, ensure that it is operational and set appropriately (if none are installed, install one as required by Florida State Law)
Cost: \$5,000
Benefit: Implementation of this recommendation should realize a reduction in non-potable water use between 5 and 10 percent
8. Initiate a scientifically generated, zone-by-zone irrigation schedule per controller
Cost: \$10,000
Benefit: Implementation of this recommendation should realize a reduction in non-potable water use between 5 and 10 percent

9. Create a zone-by-zone color coded map to allow easier zone location and maintenance

Cost: \$10,000

Benefit: Implementation of this recommendation should realize a reduction in non-potable water use of 5 percent or less

10. Install soil moisture sensors at each controller

Cost: \$5,000

Benefit: Implementation of this recommendation should realize a reduction in non-potable water use between 5 and 10 percent

11. Install flow meters at each POC and make central control compatible for future possibilities

Cost: \$5,000

Benefit: Implementation of this recommendation should realize a reduction in non-potable water use of 5 percent or less

Long Term Potential Suggestions

These suggestions are concepts that are more global in nature and offer the most long term benefit. These tasks are often the most costly and require the most planning.

- Upgrade the control system to be part of an airport-wide central control system to include flow watch (leak detection), flow management, evapotranspiration (ET)-based irrigation schedules, and remote management capabilities;
- Convert to a lower quality water source, if available. For example, treated, reclaimed water and stormwater are excellent options for lower quality irrigation water sources (see also the discussion of the Alternative Water Supply program in Section 5.3).

5.2. Cost / Benefit Analysis

Since system upgrades and costs will be refined during the implementation of the first recommendation, a 25% contingency factor has been included for budgetary reasons. The immediate recommendations provided are estimated to cost approximately \$95,000 to implement. Once implemented, these enhancements could improve irrigation efficiency by as much as 70%. There are no direct costs associated with non-potable water use, except for minor electrical charges associated with operating the pumps. Even though a typical

cost/benefit analysis and pay back period could not be completed, the reduction of a valuable natural resource is an immense benefit.

5.3. Alternative Funding Option

Several funding programs are available to assist with efforts to conserve potable water and utilize alternate water sources.

The SFWMD offers two (2) funding programs with awards for water conservation. The first program is the Water Savings Incentive Program (SIP). This annual funding program provides matching funds up to \$50,000 to water providers for installing water-saving technology such as low-flow plumbing fixtures, rain sensors, fire hydrant flushing devices, and other hardware that saves water. The Water SIP program is funded annually, with approval from the SFWMD Governing Board. The applicant must be a public water provider, user or homeowners association and public private partnerships are encouraged. Entities seeking funding must be able to match at least 50% of the total costs for the project, either with matching funds or in-kind services unless the entity is a Rural Economic Development Initiative (REDI) community (defined in section 288.0656, Florida Statutes).

Applicants submit proposals in response to a grant solicitation posted on the District website at www.sfwmd.gov. Eligible projects are ranked based on selection criteria that include:

- Conservation efficiency (estimated number of gallons saved per year)
- Consistency with regional water supply plans and/or Governing Board initiatives
- Innovation
- Cost effectiveness
- Project in REDI

The second program offered by the SFWMD is the Alternative Water Supply (AWS) program. During the 2005 State Legislative Session a bill creating the Water Protection and Sustainability Program, or SB444, was enacted, providing significant state funding for AWS Projects that are identified in the Water Management Districts' Regional Water Supply Plans. The regional water supply plans are updated every 5 years. Three (3) of the SFWMD's four (4) plans are currently being updated: the Kissimmee Basin; the Lower East

Coast; and the Lower West Coast. In order to implement this program immediately as directed by the legislation, an interim process has been developed by the SFWMD to allow entities with projects that may be eligible for this funding to submit information for possible future funding.

Alternative Water Supply Projects are defined as:

- saltwater & brackish water
- surface water captured predominantly during wet-weather flows
- sources made available through the addition of new storage capacity
- reclaimed water
- stormwater (for use by a consumptive use permittee)
- any other source designated as nontraditional in a regional water supply plan

Information on the SFWMD funding resources can be found at the following website: <http://www.sfwmd.gov/org/wsd/wsconservation/whoweare.htm>

5.4. Potential Environmental Footprint Reduction

At the time of the 2004 Impact Metric baseline, groundwater withdrawal meters were not installed and groundwater usage for the year could not be measured. Since that time, meters have been installed and are monitored monthly. According to the October 2006 Quarterly Withdrawal Report, approximately 9 million gallons of non-potable water is utilized per year.

Based on the preliminary irrigation audit findings, it appears that irrigation efficiency could be improved 40% to 70%, based on the level of recommendations that are followed. This estimate is a professional opinion and a detailed system analysis is needed to refine this efficiency estimate. However, assuming this estimate is accurate, the non-potable water use element of the footprint could be reduced by a minimum of 40%.

Appendix A – Water Conservation Study

WATER CONSERVATION STUDY

Presented to:

FORT LAUDERDALE-HOLLYWOOD

INTERNATIONAL AIRPORT



By:

Mr. David Fowler and Mr. Terry E. Janssen

Ecotech Water, LLC.

252 Hermosita Drive

St. Pete Beach, FL 33706



EXECUTIVE SUMMARY

- Report entitled FLL International-Building A Green Airport environmental footprint includes four major areas to be address. One of these areas is potable water consumption.
- Retrofitting the Terminal Buildings rest rooms with new generation waterless urinals, 0.8 gallon per flush toilets and 0.33 gallon per minute faucet aerators would result in lowering water consumption by approximately 42.0 million gallons per year based on current traffic levels. Additional savings could be achieved with new generation 1.0 gallon per minute Showers and 0.5 gallon per minute Pre-rinse Spray Valves. A significant reduction in water heating cost could also be achieved.
- Estimated cost savings in water, sewer and maintenance is \$310,000 per year based on current traffic levels and utility cost.
- Forecasts indicate that traffic will increase by 15% and water and sewer utility cost will increase by 10% by the year 2010.
- Based on general observations during the compilation of this report the Fort Lauderdale-Hollywood International Airport related entities consumed an additional one hundred forty two million (142,000,000) gallons of water per year over and above the meters covered by this report.
- It is estimated that approximately an additional 85.0 million gallons and \$555,000 annually could be saved by retrofitting other airport related facilities with new generation fixtures and giving consideration to other water conservation measures such as Rain Water Harvesting, Condensate Water Capture, 0.5 gallon per minute Pre-rinse Spray Valves, 1.0 gallon per minute Showers and the use of Water Brooms.
- Pay back time period for the products proposed in this report is approximately ten (10) months resulting in an ROI of approximately one hundred fourteen percent (114%). Savings in water heating cost and electric pumping cost have not been considered in the payback or ROI projections.

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INTRODUCTION

Our goal at Ecotech Water, LLC. is to generate awareness of the issues surrounding one of our most valuable assets today; Potable Water. With the continued climate change and construction showing no signs of slowing anytime soon, the burden we place on those resources are already beginning to show and it is increasingly critical we make changes now. Ecotech also places a great deal of emphasis on other environmental matters with a replacement parts recycle program, biodegradable and recyclable packaging and research on recycling used toilet fixtures by grinding them into powder to make tile and/or man made reefs.

Ecotech Water, LLC. is a leading manufacturer of fixtures that dramatically lower the water consumption flow rates compared to traditional low flush / low flow products such as Toilets, Urinals, Showers, Faucet Aerators and Kitchen Pre-Wash Spray Valves to name a few. Terry Janssen and the Ecotech Team has worked in the field of construction, engineering, manufacturing conservation and environmental enhancement research for over 50 combined years and bring considerable expertise from many directions on conservation and the environment as a result.

OBJECTIVE

- Conserve water (a valuable natural resource).
- Reduce the burden on the sanitary sewer system and treatment process.
- Reduce emissions by reducing water pumping, sewage treatment and pumping and water heating.
- Reap the economic benefits from reduced water, sewer, water heating and maintenance costs.
- Reduce personnel maintenance burdens by increasing fixture performance.
- Reduce impact of future utility rate increases.
- Improve restroom esthetics and quality of fixtures.
- Enhance Environmental conditions with replacement parts recycle program, biodegradable and recyclable packaging and non-changeable parts programs and systems.
- Achieve favorable press and recognition for improving your social responsibility image and enhancing “LEED” rating by gaining “LEED” points.

WHY ECOTECH WATER?

The old school of thinking would have you believe that low flow fixtures do just exactly that, which then implies poor performance and complaints, which is unacceptable for any business. Well to some degree that interpretation is probably accurate, because there are a great many low flow products on the market today that just don't perform well. At Ecotech we only manufacture fixtures that will match or better the performance of its traditional non low-flow counterpart and all our products come with a full 10 year warranty. The key to effective water conservation is the lowering of the flow without sacrificing performance and while many products on the market today claim to be low flow the quality of the product and the lack of performance wouldn't justify making the change.

In addition to our conservation work, we are conscious that our environment and landfills need the same dedication and we are continually exploring new ideas and opportunities to become as green an organization as possible. Almost two years ago we developed a cartridge for use in waterless urinals that never needs to be replaced and in doing so will help bring an end to the stock pile of replaceable cartridges that currently enter our landfills in huge quantities.

HIGHLIGHTS

- Ecotech fixtures have few or no working parts and any parts are replaced without charge for ten years.
- All future rate increases are based on the new water consumption level not on the old higher consumption levels.
- Restroom appearance is improved via new more vandal proof fixtures.

Ecotech Water has access to a funding program which would allow for the savings to pay for this retrofit described in this study. The Utility Trust Funding Program is unique and does not operate like typical finance, lease or energy service performance (ESCO's) programs. Utility Trust does not share in the savings and there is no fixed payment or fixed term for the payback of the retrofit funds. The only payment obligation is to pay the actual amount saved in sewer and water charges as a result of implementing a Water Conservation Program until the cost of the retrofit is paid for.

CONSUMPTION NOTES

According to information received from the Broward County Utilities it is shown that the Fort Lauderdale-Hollywood Airport (FLL) was billed for 65.0 + million gallons of water from October 2005 thru September 2006. An additional 142 + million gallons of water was billed to 141 sub-meter airport related users during that same period of time.

It appears that the sub-metered users are a combination of food service establishments (there are 27 such tenants in the airport as of 10/16/06), rental car companies, airlines, animal control, FAA, Broward County animal control, Fort Lauderdale Small Boat Club and others.

The conservation analysis does not specifically address the sub-metered users. Suffice to say that many of them would incur substantial water savings by installing pre-wash valves (0.5gpm), low flow sink aerators (0.33 gpm), low flow restroom fixtures, using water brooms for wash downs, re-cycling water from airplane and/ or car washdowns and choosing other conservation measures such as eliminating the use of water using trap primers.

By choosing to use water conserving products not only is water saved; but, the burden is also being lowered on the sewer infrastructure and the sewage treatment plant in Hollywood, FL

The current airport budget forecasts for FY 2007 are as follows:

Maintenance: \$36,430,600 an 11.5% increase over FY 06

Operations: \$78,148,100 an 12.2% increase over FY 06

TRAFFIC COUNTS

Passengers: 20,805,000 annual estimate
22,752,181 FY05 actual
22,500,000 FY06 forecast
23,171,266 FY07 forecast

Employees: 7,500-10,500

Ancillary Personnel: 21,000

If current passenger count of 22,752,181 (FY05 actual) is divided into 60% male and 40% female the projected scenario would be as follows:

13,651,308 male passengers
9,100,873 female passengers

FIXTURE COUNTS

Urinals: 106 @ 1.0 Gallons per flush currently

Toilets: 486 @ 1.6 gallons per flush currently

Hand sinks: 359 @ 1 gallon per minute currently

WATER AND SEWER RATES (as of 10/01/06 ***

Water: \$4.00 per 1,000 gallons Over 110% of base average

Sewer: \$2.56 per 1,000 gallons

***Note: There have been rate increases in 2004, 2005, 2006



www.utilitytrust.org

FUNDING & GRANTS AVAILABLE FOR WATER CONSERVATION RETROFITS

**FOR INFORMATION:
CONTACT UTILITY TRUST info@utilitytrust.org**

727-501-2202

The Utility Trust Water Conservation Funding Program provides an optional method of providing capital for Water Conservation retrofit projects. By using the Utility Trust Funding Program many times Water Conservation projects can be implemented immediately without having to delay projects to wait for budget funds or alternate sources of capital.

Utility Trust is a Business Trust that is not focused on profit. Its sole mission is to provide capital and related services for conserving natural resources, reducing emissions, and lowering burdens on the sanitary sewer infrastructure and related treatment facilities.

The Utility Trust Funding Program is unique and does not operate like typical finance, lease or energy service performance (ESCO's) programs. Utility Trust does not share in the savings and there is no fixed payment or fixed term for the payback of the retrofit funds. The only payment obligation is to pay the actual amount saved in sewer and water charges as a result of implementing a Water Conservation Program until the cost of the retrofit is paid for.

The Utility Trust Funding Program, compared to other funding options, is very simple, straight forward and without risk to facility owners who utilize the program. The only obligation for participating facilities during the retrofit payback period, starting the first month after the retrofit is complete, is to pay each month the same amount as they did in the same month of the previous year for water and sewer charges. Utility Trust applies the difference between the facilities previous years same month water and sewer charge and the new monthly water and sewer charge until the retrofit cost is paid. Any savings realized from reduced water heating cost and maintenance savings as a result of implementing the Water Conservation retrofit does not have to be applied to the retrofit payback and are an immediate benefit to the owner of the facility.

Utility Trust also does research on each project that it funds for Water Utility Rebates and/or Grants that might be available to pay part of the Water Conservation retrofit cost which funds if available do not have to be repaid.

To implement the Utility Trust Funding Program and the Rebate / Grant funds search it is required that a Certified Water Conservation Study be completed by a Representative of a participating Manufacturer of Water Conservation Products.

Utility Trust Board Of Trustees

Ecotech Water: Water Savings Analysis Detail for

All Terminal Buildings

Estimated Water Usage by Fixture Type							Per Day Total Flushes	Per Year Total Flushes
	Persons	%	Uses per Person/Day	Days				
Urinals -106								
Male Staff	14,250	100%	3	365			42,750	15,603,750
Male Visitor / Travelers	37,400	40%	1	365			14,960	5,460,400
Total Urinal Flushes							61,450	21,064,150
Number of Gallons per Use								1
Total Gallons Used Urinals								21,064,150
Toilets - 486								
Male Staff	14,250	33%	1	365			4,702	17,162
Male Visitor / Travelers	37,400	15%	1	365			5,610	2,047,650
Female Staff	14,250	100%	3	365			42,750	15,603,750
Female Visitor / Travelers	24,933	40%	1	365			9,973	3,640,145
Total Toilet Flushes							65,528	21,308,707
Number of Gallons per Use								1.6
Total Gallons Used Toilets								34,093,931
Aerators - 359								
	Uses / Yr	% Use	GPM	Days	Minutes	MPY		Gallons per Year
	42,372,857	50%		1.0	365	0.33	7,062,142	7,062,142
Pre-rinse Spray Valves	No information						N/A	N/A
Showers	"	"					N/A	N/A
Total Gallons Used Faucets								7,062,142
Misc Dishwashing, Ice Making, Leakage etc. Information Not Available							2,931,777	141 Sub Meter Use 142,848,000
Total Number of Gallons per Year with Current Fixtures								208,000,000
Operating Costs with Current Fixtures								
Water Charges/1000							\$4.00	\$2.56
Sewer Charges/1000								\$832,000
Maintenance								\$532,480
Water Heating Cost							\$50.00	
Showers								\$29,600
Water Heating Cost Pre-rinse Spray Valves							\$0.01 5	
							\$0.015	N/A N/A
Total Annual Operating Costs								\$1,394,080

With Current Fixtures

SAVINGS WITH ECOTECH

Number of Gallons used by Ecotech Urinal	0	
Water Savings with Ecotech	21,064,150	
\$ Savings @ current \$6.56 Water & Sewer Rate	\$138,179	Savings Per Yr

Number of Gallons used by Ecotech Toilet	0.8	
Water Savings with Ecotech	17,046,965	
\$ Savings @ current \$6.56 Water & Sewer Rate	\$111,821	Savings Per Yr

Number of Gallons used by Ecotech Sink Aerator	0.33	
Water Savings with Ecotech	4,708,094	
\$ Savings @ current \$6.56 Water & Sewer Rate	\$30,884	Savings Per Yr

Number of Gallons used by Ecotech Shower	1.0	
Water Savings with Ecotech	N/A	
\$ Savings @ current \$6.56 Water & Sewer Rate	N/A	Savings Per Yr

Number of Gallons used by Ecotech Pre-rinse Valve	0.5	
Water Savings with Ecotech	N/A	
\$ Savings @ current \$6.56 Water & Sewer Rate	N/A	Savings Per Yr
Water Heating Cost Savings	N/A	Savings Per Yr
Maintenance Savings	\$29,600	Savings Per Yr

Total Water Saved	42,819,209 Gallons Per Yr	
Total Dollars Saved	\$310,484 Savings Per Yr	
Total Dollars Saved (Water/Sewer only)	\$280,884 Savings Per Yr	



PRODUCT DESCRIPTION:

Ecotech Water LLC manufactures a unique line of “Water Conservation Products”. By choosing to use a combination of air and water instead of just more water Ecotech's state of the art product technology has demonstrated that plumbing fixture performance can be substantially enhanced.

For example, Ecotech’s Ecocloset toilet performs better using 0.8 gallon per flush water and air combined than other 1.6 gallon(s) per flush toilets that use all water and no air. The same high level performance is true for the 1.0 GPM “Air-induced” Shower; the 0.33 GPM “Air-induced” Sink Faucet Aerator; the 0.5 GPM “Air-induced” Pre-rinse Spray Valve which meets all Health Department requirements and the Water Broom manufactured using “Air-induced” nozzles. By using “Air-induction Technology” scaling will not occur when using these products. All Ecotech Products achieve their high level performance with less complex mechanical functions and have fewer working parts. ALL ECOTECH PRODUCTS COME WITH A WARRANTY THAT STATES "ANY REPLACEMENT PARTS YOU MAY NEED ARE FURNISHED WITHOUT CHARGE FOR 10 YEARS".

Ecotech also manufactures the Eco Urinal a “Self Cleaning Waterless Urinal” that comes with a EcoUrinal Cartridge (WARRANTY HAS BEEN UPGRADED TO FOR THE LIFE OF THE URINAL). Ecotech's EcoUrinal Cartridge does not contain sealant or odor blocking liquid and does not have to be changed or taken out and be cleaned. As stated there is no sealant liquid to get flushed down the drain and fowl sewer systems, cause harm to fresh water sources or Marine Life and Environments (a concern expressed by parties at the Department of Oregon Parks and Recreation). An additional benefit is that there is no old replacement cartridge to discard thus lightening the burden on landfills.



THE LEADERS IN LEED

MANUFACTURERS OF STATE OF THE ART WATER CONSERVATION PRODUCTS

“ECO URINAL” SELF CLEANING TOUCHFREE WATERLESS SANITARY URINALS

“ECOCLOSET” PRESSURE ASSIST LOW FLUSH COMMERCIAL TOILETS

PRESSURE ASSIST LOW FLOW COMMERCIAL SHOWERS <> PRESSURE ASSIST LOW FLOW COMMERCIAL SINK AERATORS
PRESSURE ASSIST PRE-RINSE SPRAY VALVES <> RAIN WATER HARVESTING SYSTEMS <> WATER RECLAMATION SYSTEMS



LEADERS IN LEED CONSERVATION

LOW FLOW TOILET

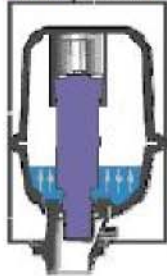
Ecocloset = 0.8 gpf
Standard = 1.6 gpf



www.ecocloset.com

FEATURES:

- Pressure assist, no double flushing
- Few working parts, less maintenance
- No flapper, no leaks
- Stainless steel tank retrofits flush valve toilets, can be powder coated, also comes in porcelain



- Largest trapway reduces clogging and maintenance
- Water velocity peaks in first second of flush cycle
- Drainline carry exceeds ANSI standards by 50%
- 10 year warrantee on parts



NO-WATER URINALS

Eco-urinal = 0 gpf
Standard = 1.6 gpf

FEATURES:

- High quality porcelain
- Lip height standard for both new construction and retrofit
- Available with self-cleaning misting attachment
- In new construction, reduces some piping costs



LIFETIME CARTRIDGE FOR URINAL

www.lifetimecartridge.com



FEATURES:

- Eliminate the expense, maintenance, and mess of replacing cartridges
- Flexible memory rubber tube lets liquid through and seals out sewer odor (Space Program spin-off!)
- Highly chemical resistant, not sensitive to cleaners
- Warranted for life of the urinal



LOW FLOW SHOWERHEAD

Ecotech = 1.0 gpm
Standard = 2.6 gpm

FEATURES:

- Patented "Turbulizer" chamber increases water pressure and velocity
- Feels like a 2-3 gpm showerhead
- Greater pressure prevents mineral buildup and clogging, reducing maintenance and replacement
- Reduces hot water use and water heating costs

PRE-RINSE SPRAY VALVE

Ecotech = 0.5 gpm
Standard = 6 - 9 gpm



FEATURES:

- "Turbulizer" technology meets Department of Health Paste Removal requirements at 0.5 gpm
- Reducing the amount of 140°F water needed provides excellent savings on water heating charges.

LOW FLOW FAUCET AERATOR

Ecotech = 0.3 gpm
Standard = 2-2.5 gpm



FEATURES:

- Same "Turbulizer" chamber as showerhead gives a strong feel to the flow
- No more mineral buildup and clogging
- 10-year warrantee

WATERLESS TRAP PRIMER

Ecotech = 0 gpd
Standard = 30 gpd

FEATURES:

- Prevents sewer gas release from floor drains but uses no water
- Prevents raw sewage backup
- In new construction, eliminates piping costs



CUSTOM DESIGNED

RAIN WATER HARVESTING AND WATER RECYCLE SYSTEM AVAILABLE

PARTIAL CUSTOMER LIST



FEDERAL GOVERNMENT PARTIAL CUSTOMER LIST



STATE & LOCAL GOVERNMENTS PARTIAL CUSTOMER LIST



HIGHER EDUCATION PARTIAL CUSTOMER LIST



HOTELS AND RESORTS PARTIAL CUSTOMER LIST

