Sanford Attacks I/I to Protect Drinking Water Source

Migdalia Hernandez and James Peters

The city of Sanford, located in Seminole County, is one of the oldest cities in the state. During its early history, it was a strategic point for riverboat shipping from Jacksonville into Central Florida on the St. Johns River. The river and its unique environmental value have become the focus of surface water supply for drinking water purposes and recreational use. Nutrients loading could affect water quality for both purposes.

The city's North Water Reclamation Facility is located near Lake Monroe in Seminole County (Figure 1). The St. Johns River Water Management District has adopted a surface water improvement and management plan for the Middle St. Johns River Basin, and Lake Monroe is one of the watersheds listed within this basin.

During wet-weather conditions, Sanford discharges treated reuse water into the Middle Basin. Reuse (reclaimed) water is also land applied at the city's "Site 10," which is located on the northeastern shore of Lake Jessup.

I/I Becomes Evident During 2004 Hurricanes

Sanford's sewer system is very old, with a large portion of the system comprised of vitrified clay pipe and brick manholes. The problems with sewer deterioration became evident during the 2004 hurricanes (Charley, Frances, and Jeanne), when the system experienced very heavy stormwater infiltration and groundwater inflow (I/I). The sewer infrastructure remained overloaded for several months (see Figure 2).

I/I caused high sewer system flows and treatment challenges at the North Water Reclamation Facility, which is designed to treat 7.3 million gallons per day (MGD). During the hurricanes, plant flows were observed at the facility over 16 MGD (Figure 2). As a result, the city exceeded Middle Basin discharge limits in 2005.

To quickly create a plan of action, it was necessary to bring a consultant group (Brown and Caldwell) to assist with identifying sources and prioritizing correction of I/I.

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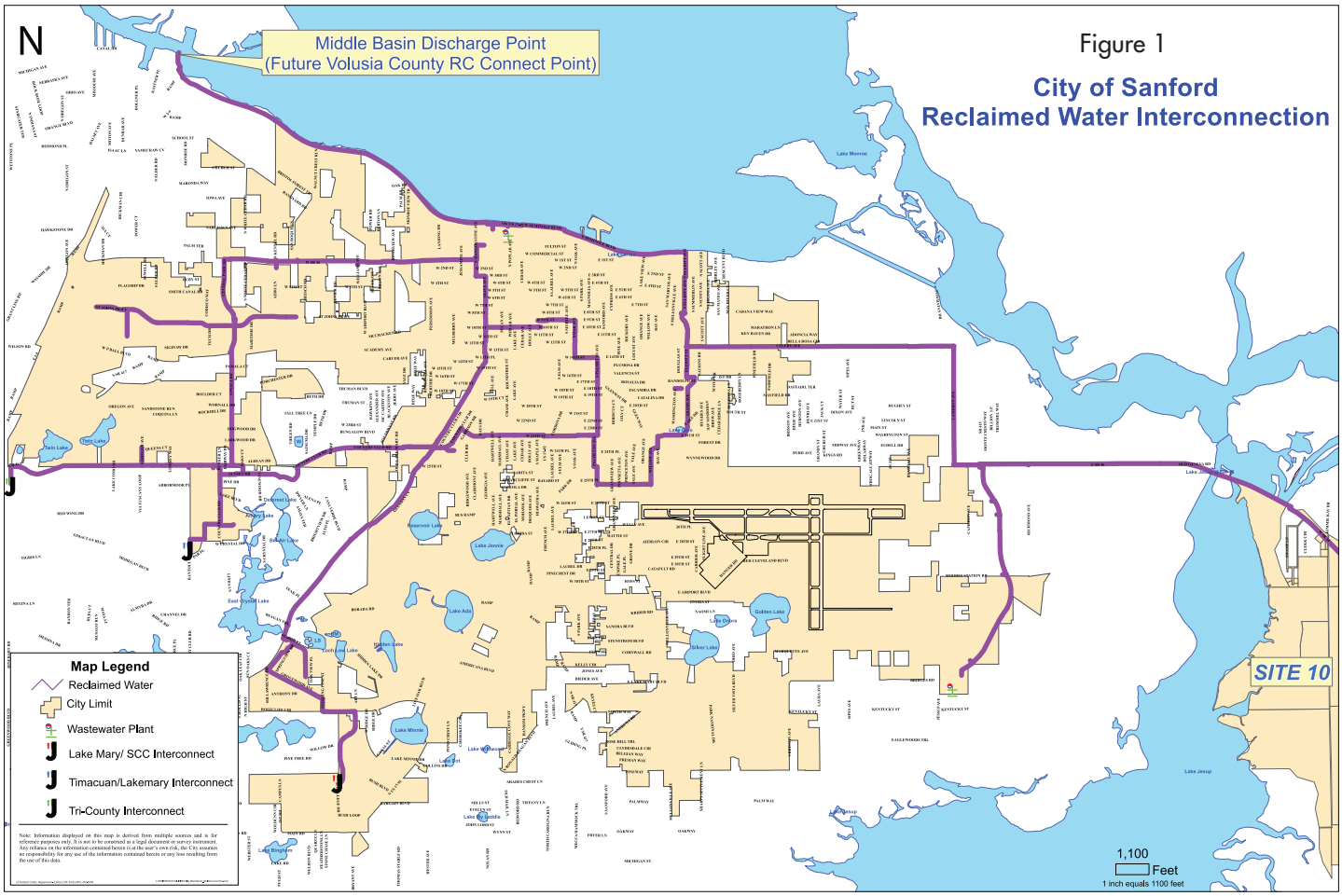

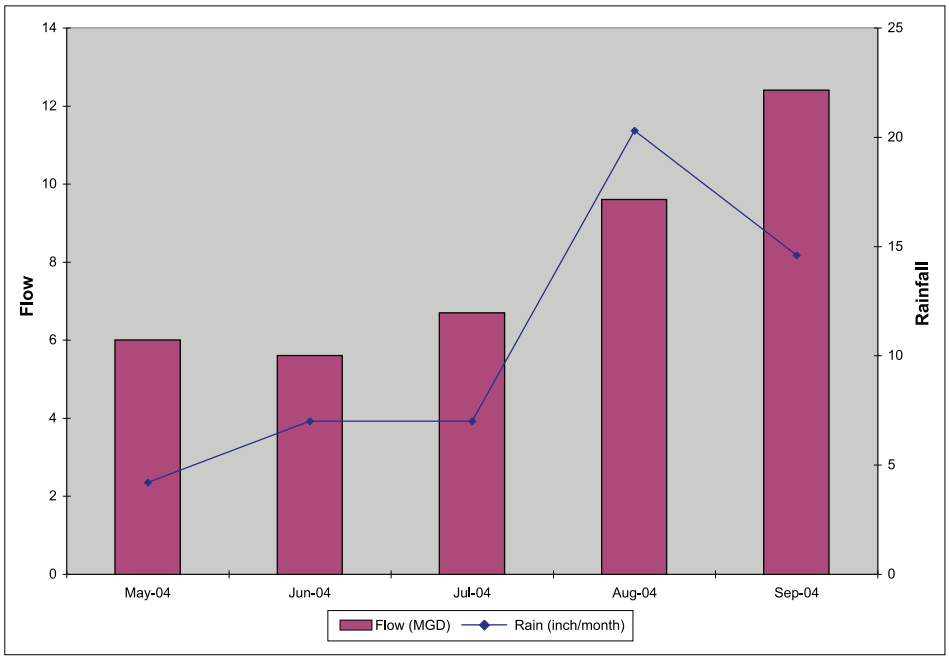

Figure 2

This initial "desk top" survey saved the city considerable time money by pointing to areas of most critical rehabilitation need.

The initial studies were followed by field evaluations. Results were used to determine rehabilitation methods, including "Quick Wins" by city crews to reduce stormwater inflow and pipe lining by contractors to reduce infiltration.

Desk Top Survey Establishes Initial Priorities

Brown and Caldwell's initial study revealed problems within the collection system that became evident during the prolonged wet weather in 2004. Some of the downtown area manholes are lower than street level, so inflow into them contributed to the system's failure. In 2005 the city installed 53 stainless steel "sewer shields" using grant funds from the Federal Emergency Management Agency. These have proven effective in minimizing inflow through manholes.

The initial study also found that the downtown "Cypress Area" had especially high I/I. In fact, the Cypress Area pump station had monthly flows that were 40 times dry-weather flows (Figure 3). This area was selected as the first rehabilitation project.

During smoke testing of the Cypress Area, it was found that many cleanout caps had been removed and were therefore a source of inflow. Also, it was discovered that the roof drains from an apartment complex were directed into the Cypress sanitary sewer. The most significant single inflow source, however, was a 12-inch diameter storm sewer cross-connected with the sanitary sewer. It is suspected that this was a residual combined sewer that was not disconnected during the conversion to the vacuum system. City crews corrected the inflow sources in 2005.

A closed-circuit television inspection of the Cypress Area indicated the need to line about 11,000 feet of its vitrified clay pipe to correct main line defects, including cracked pipe, sources of roots, and offset joints. The lining was completed by a contractor in 2007 at a cost of about $400,000.

Subsequent Study Sets Additional Priorities

Following the initial survey, the city requested a study of its pump station areas to identify additional priorities for I/I reduction. Brown and Caldwell evaluated pump station run times and flows and compared this information to rainfall events. As a result, 10 areas were identified as heavily influenced by wet-weather events. One of these was a small but new subdivision, where it was found that the developer's contractor had not completed the installation of cleanout risers, a situation that allowed stormwater to inflow into the sanitary system.

A larger, older subdivision, the Sunland Area, was determined to be the next highest priority for rehabilitation. It is located outside the Sanford city limits in Seminole County but within the city's water and sewer service area. The Altair Environmental Group performed smoke testing and closed-circuit television surveys of the area, which revealed missing cleanout caps, leaking manhole lids, and numerous defects in vitrified clay pipe main lines.

The city installed equipment to record, by supervisory control and data acquisition, the impact of rainfall and groundwater on the Sunland Area sanitary sewer system. Rainfall is recorded over time with every 0.01 inch of rain so pump station flow can be correlated with rainfall events during the same time period. In a similar manner, a ground-

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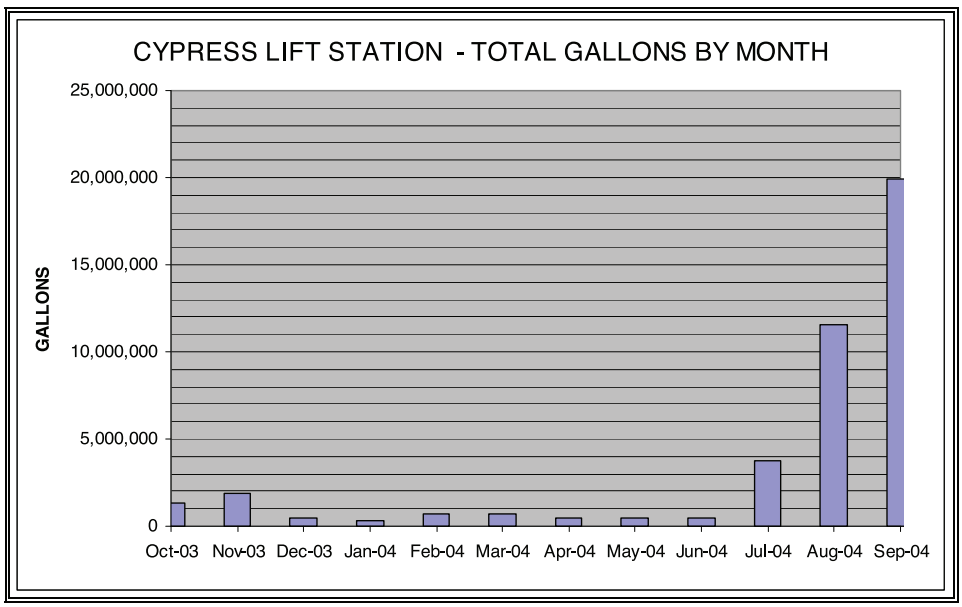

Figure 3

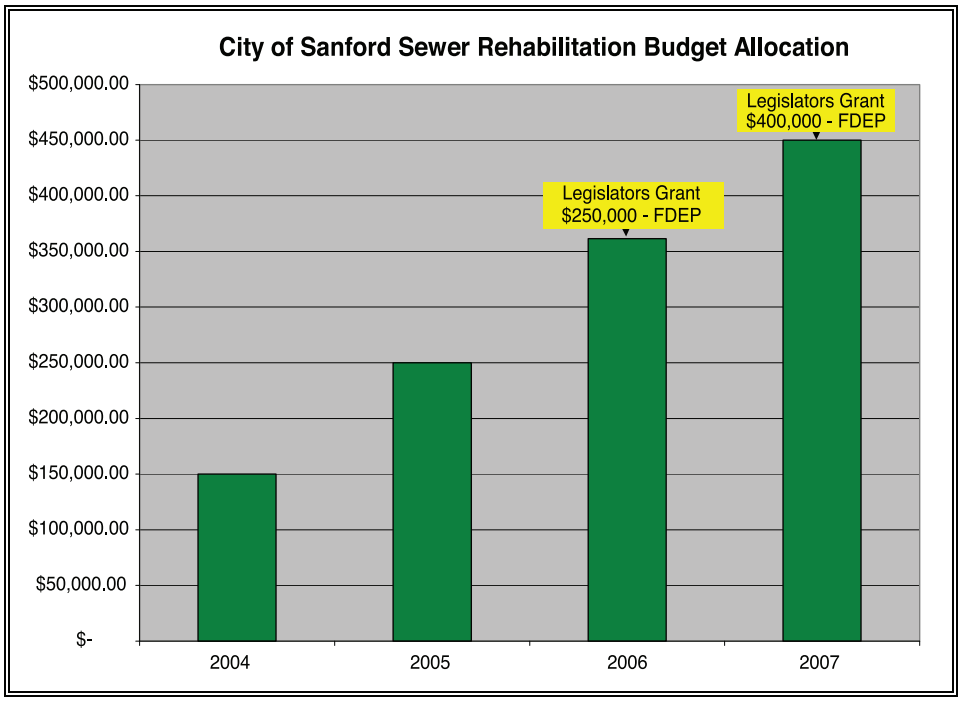

Figure 4

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water level monitor was installed to provide correlation of pump station flow with groundwater level.

It is estimated that during rain events, 6,200 gallons per hour of stormwater enter the sanitary system. Sanford has employed a contractor to commence repairs in 2008 and complete them by 2009. About 22,000 feet is involved.

Other priority areas are expected to be rehabilitated in the future, including the Sanford Airport Area. Sewers were installed there during World War II when housing was erected for the Army Air Corps training facility. There was an obvious need to conserve metal, because the manhole lids are made of concrete, rather than cast iron, and do not prevent inflow.

Finding the Money

One of the city's biggest challenges after the hurricanes and the consultant's desk top survey was finding repair funds. Before the hurricanes in 2004, sewer rehabilitation in Sanford was handled on an "as-needed" basis. In 2005 an increased budget allocation was necessary to repair sewer defects found by consultants during the initial desktop evaluation.

The goal of Sanford's new project, named "Lake Monroe Surface Water Quality Improvements," was to put together a plan to protect one of the most valuable resources in Central Florida: the St. Johns River. Knowing the importance of reducing river discharges to protect this water source, in 2006 city officials requested state legislative funds for sewer infrastructure rehabilitation.

In 2006 the city received a $250,000 (50 percent) matching funds grant from legislators to continue this project. The grant money was increased to $400,000 for the 2007-2008 Florida Department of Environmental Protection (FDEP) fiscal year budget, as shown in Figure 4.

The first agenda under this plan was to reduce flow coming into the North Water Reclamation Facility. Reducing flows into this facility will improve treatment processes hydraulics, leading to better treatment and better water quality.

As a result of this new commitment, Sanford added a new Critical Infrastructure Protection budget line item called *I/I Sewer Rehabilitation*, which is expected to continue until all sewer defects are repaired. Rehabilitation of sanitary sewer defects to prevent stormwater inflow and groundwater infiltration will be done over a number of years to reduce plant flows during wet weather. Reducing I/I will also increase wastewater treatment capacity to accommodate future development.

Reducing groundwater infiltration is very expensive to do because it involves mainline, manhole, and sewer lateral rehabilitation. For this reason, Sanford is working to reduce stormwater inflow first by performing smoke testing in selected priority areas of the city.

Watershed Protection Plan

Reducing nutrients and other pollutants is part of the new mandated Total Maximum Daily Load Rule. Sanford's estimated nutrient loading records from 2005 showed that 3 MGD of reclaimed water removed from river discharges could reduce nutrient loading by 251 pounds of nitrogen per day and 40 pounds of phosphorus per day.

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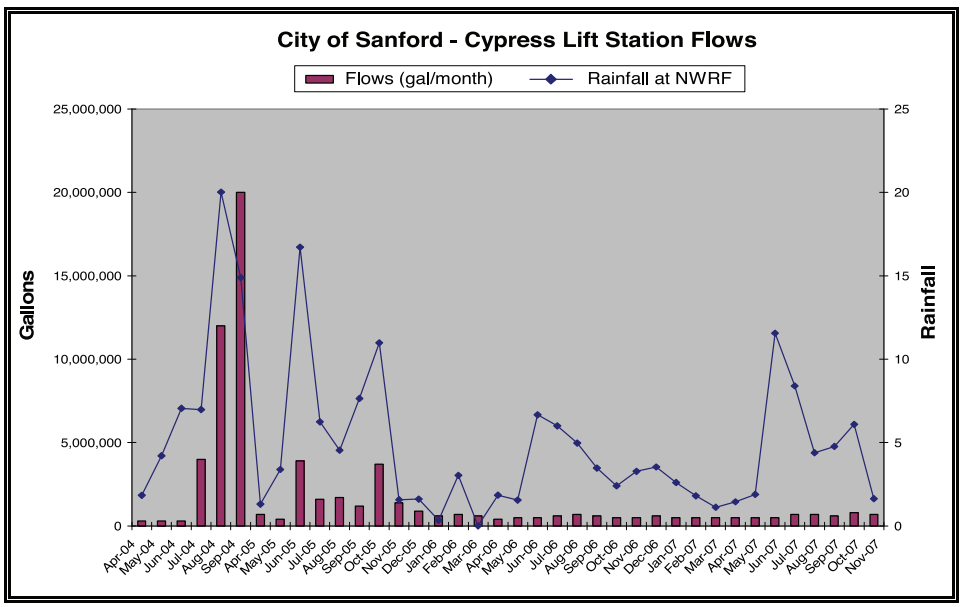

Figure 5

Table 1

Nutrient Reductions and Cost Expected from Plant Surface Water Discharge Elimination			
I/I Flow	Nitrogen Reduction (lb-day)	Phosphorus Reduction (lb/day)	Cost ($)
0.26 MGD	21	3.3	$960,000

Table 2

Nutrient Reductions Expected after Plant Surface Water Discharge Elimination		
I/I Flow	Nitrogen Reduction (lbs-day)	Phosphorus Reduction (lbs-day)
5 MGD	420	65
4 MGD	335	53
3 MGD	251	40
2 MGD	167	6.5
1 MGD	84	13

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Water quality improvement of reclaimed water will also enable this product to be used for irrigation and aquifer recharge at sensitive areas, such as the Wekiva Primary Protection Zones. Lowering the pollutant loading into the Middle St. Johns River Basin will minimize algal bloom and related toxins throughout the basin. Controlling algal bloom will also improve downstream water quality.

The city's plan to reduce nutrients contains three major initiatives:

- I/I Reductions
- ACTIFLO Treatment
- Reuse Interconnections.

Inflow/Infiltration Reductions

As discussed previously, the city's North Water Reclamation Facility discharges to the St. Johns River during wet-weather conditions. One of the sewer infrastructure areas identified with high sewer inflow and infiltration was the Cypress Area downtown. This site work was completed in August 2007 using FDEP grant funds.

As shown in Figure 5, the high I/I was reduced with the sewer rehabilitation work. The Cypress Area lift station flow remains steady at 500,000 gallons per month, compared with 2004 during heavy rain events. A potential estimated load reduction of 84 pounds per day of nitrogen and 13 pounds per day of phosphorus will be achieved for each 1 MGD. I/I flow reductions into the Cypress lift station will minimize river discharges, because this reduced flow will not enter the treatment train at the reclamation facility.

The second area to be rehabilitated is the Sunland Subdivision. The calculated I/I entering the city's sewer system during rainy events is approximately 255,000 gallons per day. The Table 1 represents the cost involved to complete this project and the expected nutrient loading reduction.

ACTIFLO Treatment

This system will be installed in 2008 (Figure 6). Pilot testing showed metals, turbidity, organic, inorganic, parasite, nutrient, and other pollutant reductions.

Reuse Interconnections

Reuse water interconnects with other cities and counties. Sanford entered a tri-party Agreement with Lake Mary and Seminole County to use reclaimed water at areas with high water usages, such as golf courses and commercial and residential areas (Figure 1). The city is negotiating an agreement to interconnect reclaimed water to provide Volusia County with up to 1.5 MGD of this recycled product, helping the county with its need for alternative water supplies for existing and future irrigation demands. It is also negotiating possible reclaimed agreements with the cities of Winter Springs and Oviedo.

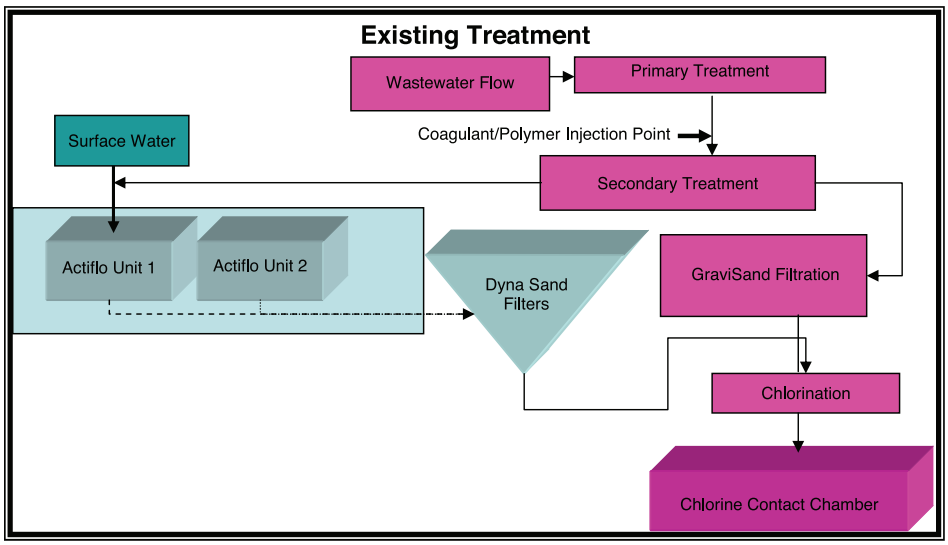

Figure 6

Plan Benefits

Treating surface water for potable use may be necessary in the near future to conserve our groundwater resources during the expected high population growth in Florida. Reducing stormwater inflow and groundwater infiltration will reduce wet-weather discharge into the St. Johns River, reducing nutrient loading into the water body and improving the Middle Basin water quality, thus protecting the body of water that's listed as a possible source of drinking water for Seminole County and its cities.

Also, reducing nutrients will reduce algal blooms alleged to be causing water quality issues downstream of the Middle Basin. Algal blooms—especially blue-green algae—are known for their dangerous toxins to other water-body species, such as fish; the odor they cause; and their link to carcinogenic compounds formed after disinfection treatment at drinking water treatment facilities.

Water quality improvement of reclaimed water will also enable this product to be used for irrigation and aquifer recharge at sensitive areas such as the Wekiva Primary Protection Zones. Expanding reuse and recharge in and around Seminole County will also reduce the need of a large drinking water treatment facility as future growth, new construction, and required landscapes can use an alternative product to keep a "green," beautiful lawn with alternative water supplies. Table 2 features good examples of surface water quality improvements that could be achieved thru successful infrastructure rehabilitation.