4.1 INTRODUCTION

In the *2002 Wastewater Facilities Plan*, Chapter 4 Demand Management presented a programmatic evaluation of water conservation and flow reduction measures. Much of the chapter focused on water conservation and its applicability to Spokane County, infiltration/inflow control, and industrial/commercial load reduction. Reference was made to the experience of the LOTT Alliance in western Washington

The *Foundational Concepts for the Spokane River TMDL Managed Implementation Plan* (*Foundational Concepts*) describes several "target pursuit actions" dischargers can make to help reduce phosphorus loading through other means than wastewater treatment technology alone. One of these target pursuit actions is conservation. *Foundational Concepts* targets 20 percent water conservation per household in older urban areas and 10 percent water conservation per household in newer (post-1992) urban areas. Ordinances and cost investment strategies adopted for water conservation should follow similar principles to those adopted and implemented by the LOTT Alliance in western Washington. The LOTT Alliance is a municipal wastewater agency consisting of four member organizations: City of Lacey, City of Olympia, City of Tumwater, and Thurston County.

Water conservation programs have the objective of reducing wastewater flows and/or loadings in the service area, thus reducing the required capacity of treatment and conveyance facilities. Through flow reduction and load minimization, these programs may reduce capital and operating costs, delay the need for facility expansions, improve regulatory compliance, or better ensure system costs are equitably distributed among wastewater generators. Most flow and load reduction alternatives are programmatic in nature, involving economic incentives, revisions to sewer ordinances, public education or operational practices. However, some alternatives involve significant capital expenditures to upgrade deteriorating infrastructure or retrofit homes or businesses with devices that reduce wastewater discharges.

4.1.1 Load Reduction versus Load Diversion Programs

Water conservation alternatives may be divided into two general categories as it pertains to a wastewater program: load reduction and load diversion.

Load reduction measures are aimed at: (1) minimizing wasteload generation at the source; or (2) preventing extraneous flows from entering the conveyance system en route to treatment facilities. A number of load reduction measures were identified during the alternatives brainstorming workshop in the original *2002 Wastewater Facilities Plan* (see Chapter 3). Most of these ideas survived the initial screening step and are evaluated in this chapter.

Load diversion alternatives involve rerouting all or part of the generated wasteload to another method of treatment or disposal. During the alternatives brainstorming workshop, a number of load diversion alternatives were identified, but were subsequently screened out as being undesirable or impractical (see Chapter 3 *2002 Wastewater Facilities Plan*). Examples are listed below:

- **Continue Partial Use of Septic Tanks.** A suggestion was made to sewer only densely populated areas, allowing low-density areas within the County's service area to remain on septic tanks. This idea was eliminated because it is inconsistent with the County's septic tank elimination program and Comprehensive Plan.
- **Implement Graywater Disposal Systems.** In this concept, houses would be retrofitted to divert flow from washing machines, showers, and lavatories to onsite or regional Graywater disposal systems. The idea was eliminated because it directs nutrient loadings to the aquifer, which is contrary to the objectives of the County's aquifer protection program.
- **Ban Garbage Disposals.** The idea to eliminate garbage disposals was considered impractical to implement. Also, treating this material at a wastewater plant can produce a reusable end product (biosolids). Diverting this material to the regional incinerator was viewed as a less beneficial outcome.
- **Promote Use of Composting Toilets.** While individuals may find this approach appropriate for their lifestyles, implementation of composting toilets on a wide scale was considered impractical.

4.1.2 Organization of the Chapter

This chapter begins with an overview of the LOTT water conservation efforts, since *Foundational Concepts* promotes "LOTT-style" indoor conservation efforts.

Following the LOTT overview, water conservation alternatives for Spokane County are discussed. Alternatives that survived the initial screening process are organized into the following groups: water conservation, infiltration/inflow control, and industrial/commercial load reduction. These sections describe alternatives within each group by presenting the basic concept, discussing the applicability of the concept to Spokane County, identifying key implementation requirements or issues, and projecting the anticipated results that would be achieved by implementing the idea.

Following the description of alternatives for Spokane County, a discussion is provided for water conservation through Leadership in Energy and Environmental Design (LEED) certification by the United States Green Building Council (USGBC). The water conservation measures recommended for implementation are described in Chapter 9, Recommended Plan.

4.2 LOTT EXPERIENCE

HDR met with Karla Fowler of the Lacey-Olympia-Tumwater-Thurston County Alliance (LOTT) Alliance in 2001 and again in 2006 to discuss applicability of water conservation approaches to Spokane County. The initial water conservation portions of the Spokane County facilities plan are based upon many of the LOTT concepts. Detailed information on the LOTT programs is available on their web site:
http://www.lottonline.org/water_conservation.aspx

4.2.1 Water Conservation

A significant reason for the success of LOTT in accomplishing water conservation is that LOTT has provided funds to support plumbing retrofits and other programs. Initially, the water utility for each of the LOTT-member cities was encouraged to establish their own approach to water conservation. However, the cities were continually learning from each others' programs and incorporating each others' concepts into their programs. In the end, the indoor water conservation program was fairly consistent among the three cities. There is a conservation committee, with membership from the three cities that now coordinates overall water conservation programming.

Physical Devices for Water Conservation

As the wastewater utility serving the state capital, LOTT has implemented a particularly effective fixture replacement program[1]. Their program focuses on toilet replacement, but also includes replacement showerheads and faucet aerators, as well as $100 rebates on front-loading washers. Through May 2001, LOTT had expended $2,018,000 on fixture replacement and reduced wastewater flow by an estimated value of 310,000 gallons per day. The cost has been $6.50 per gallon per day of wastewater reduction (2001 dollars), which is less than their estimated cost of constructing wastewater treatment plant capacity, which was $12.87 per gallon per day in 1998.

The LOTT Alliance program manager reports [2] that the program has been effective and well received by the public. There was initial skepticism that low-flow toilets would be acceptable. LOTT researched available units for their giveaway program and selected models with proven performance. They have retained a plumber to correct deficiencies as they occur. Ms. Fowler stated that the public satisfaction with the fixture replacement program is greater than 90 percent, and that for LOTT, economics justify conservation as a preferred approach over construction of new treatment plant capacity.

Impact of Water Conservation

Water conservation may impact collection and treatment system corrosion and wastewater strength. In Coeur d'Alene, Idaho, for example, the service population is growing rapidly, but the overall wastewater flow is not increasing at the same rate. Also, generally, the per-capita-flow in Europe is approximately half the value in the United States, but waste strength is twice the level in the United States. Although the conservation programs have been effective for LOTT, the new reduction in wastewater flow has not been sufficient to make a major impact on concentration or to have significant impacts on corrosion.

4.2.2 Infiltration and Inflow Control

In a personal conversation, the LOTT Alliance[3] program manager described a demonstration project in West Olympia and the repair of side sewers and main trunk lines. LOTT

[1] Flow Reduction Cost-Effectiveness Overall, Karla Fowler, LOTT Program Manager, May 21, 2001.
[2] Personal Communication with Karla Fowler, LOTT Program Manager, June 29, 2001.
[3] Personal Communication with Karla Fowler, LOTT Program Manager, September 8, 2006.

conducted flow monitoring and verified the overall program effectiveness, with an overall reduction in I/I. LOTT had concluded that the largest source of I/I is from the old, congested, downtown area of Olympia. Replacing combined sewers in this area would be a construction challenge, and the peat content of the soils would increase implementation complexity. Building drains are incorporated into overall building plumbing, so separation would be difficult. LOTT also believes that the stormwater contains significant levels of contaminants and that Budd Inlet water quality would improve if this flow were routed through the wastewater treatment plant. Therefore, justification to reduce I/I at LOTT is minimal.

4.2.3 Wasteload Diversion

Composting Toilets

Composting toilets are oftentimes a topic of interest by the general public when discussing the reduction of wasteload. LOTT has an active rebate program for composting toilets. However, during the nearly 10 years of the program, no composting toilets have been installed. Most people recognize that this type of facility requires a significant amount of responsibility to operate and maintain. They do get two or three calls a year about this program, but most of the callers live outside the service area and are not eligible for the rebate.

Garbage Disposal Ban

LOTT has discussed banning garbage disposals, but have never taken action on this approach.

Graywater System

LOTT evaluated the feasibility of providing separate sewer systems for blackwater (toilet and kitchen sink wastes) and Graywater (baths, showers, clothes washers, and lavatories) in new construction. In a recent "Street of Dreams" pilot project, dual plumbing systems were connected to a house and the flow was measured to determine the relative proportions of each. The two separate systems were combined downstream and routed to the central wastewater collection system. LOTT has been trying to identify a developer to construct a new subdivision using this approach so that they could use the Graywater, but to date no one has opted to develop this approach. Graywater would need to be routed through a subsurface (drip) system to meet health code regulations to isolate wastewater from public contact. Since many people are confused by the difference between Graywater and reclaimed water, Class A reclaimed water may be a preferred approach over separate Graywater collection. Reclaimed water allows more options and less public contact restrictions

4.2.4 LEED Building Certification and Water Consumption Reduction

Over the next few years, LOTT is planning to focus on conservation through institutional, commercial, and industrial customers. The State of Washington has established a goal to achieve a silver LEED certification for new State-owned buildings. Many State-owned buildings are located in the LOTT service area, since Olympia is the capital of Washington. However, LOTT doesn't provide rebates for new construction that complies with current

plumbing and building codes – rebates are for retrofits only. However, LOTT is willing to offer rebates for extremely low flow or dual flush toilets, for waterless urinals, and for other approaches that use less water than the maximum allowed by the plumbing code. The Port of Olympia may use dual plumbing systems that allow reclaimed water to be used for toilet flushing in their new restroom facilities, and LOTT is interested in this approach.

4.2.5 Summary of the LOTT Experience

The LOTT program has been most successful in public education to raise awareness and in residential water conservation efforts. The LOTT program is being improved to target greater commercial water conservation. The Spokane County water conservation program will emulate many of the successful elements of the LOTT-type approach and support sustainable design concepts for institutional, commercial, and industrial development.

4.3 WATER CONSERVATION ALTERNATIVES

Typically, water conservation measures are driven by a desire to extend available water supplies in water-short areas. Conventional water conservation programs may address both external water uses (such as landscaping irrigation) and internal water uses (such as water consumption through plumbing fixtures or commercial and industrial processes). From a wastewater management perspective, reduction of internal uses is the principal objective.

Across the nation, communities have used a variety of approaches to water conservation, including the four methods examined in this section: public education, economic incentives, metering, and physical devices. Most successful programs employ a combination of measures to achieve effective conservation.

Cooperation with Water Purveyors

Successful implementation requires full coordination and participation of local water utilities. If there is little incentive for the water utility to embark on an aggressive water conservation program, then financial incentives would need to be funded by the beneficiary of such a program, specifically the wastewater agency. For the Spokane County wastewater service area, there are approximately 25 water purveyors. This large number complicates water conservation program coordination. Since some water purveyors are investor owned utilities, dependent on commodity sales, with what has been considered an extensive water supply (Spokane Valley Aquifer), some utilities may have little near-term incentive to embark on an aggressive water conservation program. In fact, some private utilities may actually promote increased water use, as it results in greater revenues.

The Spokane County Coordinated Water System Plan has general recommendations for water conservation programs, depending on utility size. However, these are general recommendations and not actual requirements. Adoption of a conservation plan is left to the discretion of the individual water purveyor.

4.3.1 Water Conservation – Public Education

Concept

The objective of a public education program for homeowners and businesses is to instill the conservation ethic among the customers. Communication approaches that have proven successful include newsletters, radio announcements, press releases, and school education programs. Most utilities have found that a continuous ongoing program is necessary to avoid reversion to pre-conservation habits.

Applicability to Spokane County

Public education approaches would be feasible in Spokane County. The County's long-term communication program to promote awareness for protection of the Spokane Valley Aquifer has been effective and demonstrates what can be accomplished with a well-conceived public communications approach.

Oftentimes, water conservation is associated with energy conservation. Higher water consumption requires increased energy for conveyance and also leads to increased hot water consumption. By reducing water use, energy is conserved. Also, drought conditions in recent years has led to water conservation in an effort to extend limited water resources.

Implementation

Preferably, the County and the water purveyors would jointly develop an education program. Since water conservation may be contrary to the desire of local investor-owned water purveyors to sell more water, there may not be support for a formal conservation program. Conservation could lead to decreased sales and reduced profits. The County could elect to implement an education program on its own, focusing on measures that reduce wastewater generation. However, this result is likely to be less effective than conservation programs developed by purveyors.

Anticipated Results

Historically, the greatest challenge in designing water conservation alternatives has been in estimating the relative success of water conservation programs. Many of the programs depend on voluntary efforts.

The most effective water conservation programs have been initiated in the arid regions of the western United States. During the extreme California drought of the late 1970s, voluntary conservation and high water rate charges resulted in significant reductions in wastewater flow during the course of the drought. This experience reveals that under some circumstances, public education, voluntary conservation, and economic factors can reduce wastewater flow.

Implementation of a public education conservation program in the Spokane area would be projected to have minimal impact on wastewater generation under normal conditions. However, a conservation program may be effective during drought conditions. Voluntary conservation is most likely to reduce consumptive uses, such as irrigation, that don't generate domestic wastewater.

Table 4-1. Reduction in Water Demand – Public Education

	Pre-1992 Urban Areas	Post-1992 Urban Areas
Anticipated Reduction in Wastewater Demand, %	4	2

4.3.2 Water Conservation – Economic Incentives

Concept

In this approach, utilities would discourage intensive water use by charging the customer a higher unit rate as their water consumption increases over a preset threshold. This is essentially a cost penalty for excessive consumption.

Applicability to Spokane County

Most water utilities in Spokane County do not charge on a sliding-rate basis. Currently, supplies from the Spokane Valley Aquifer are plentiful, providing little incentive to change the billing basis.

Implementation

Full implementation of this concept would require that all water purveyors convert to a sliding rate unit cost. The County currently has no direct control over water use charges. The County would need to request that water purveyors adopt this program.

Anticipated Results

With respect to wastewater reduction, experience at other locations has shown that the portion of water demand reduced by this approach is typically lawn watering and car washing, uses which do not return wastewater to the sanitary sewers. Summer water use in the Spokane area is as much as ten times greater than winter consumption, reflecting these non-wastewater return uses. Also, the impact of economic approach is usually slow to be realized. Most area utilities invoice no more frequently than bimonthly. Therefore, most customers don't realize the financial impact of their water consumption until several months after the water has been consumed, often after the peak seasonal demand has passed.

The benefits to the wastewater utility of a sliding scale water commodity charge are anticipated to be minimal

Table 4-2. Reduction in Water Demand – Economic Incentives

	Pre-1992 Urban Areas	Post-1992 Urban Areas
Anticipated Reduction in Wastewater Demand, %	< 1	< 1

4.3.3 Water Conservation – Metering

Concept

In this approach, all water customers would have meters installed, with billing based on actual water consumption.

Applicability to Spokane County

In the Spokane County service area, most business and residences already have water meters, and the consumer can therefore monitor water use.

Implementation

If water meters are not available in specific areas, the County could encourage water purveyors to install them, but would have no significant control unless it was willing to fund the meter program.

Anticipated Results

Like economic incentives, installation of water meters has the most impact on high-volume external water uses such as landscape irrigation or car washing. Some small level of wastewater reduction would likely occur, but it would be insufficient to warrant the cost of meter installation.

Table 4-3. Reduction in Water Demand – Metering

	Pre-1992 Urban Areas	Post-1992 Urban Areas
Anticipated Reduction in Wastewater Demand, %	< 1	< 1

4.3.4 Water Conservation – Physical Devices

Concept

Water conservation can be implemented by installing plumbing devices that use minimal water quantities. These devices include ultra-low use toilets, front-loading washing machines, and flow-restricting faucets and showers.

Current state law requires that low-flow plumbing fixtures be installed in all new construction and all remodeling involving replacement of plumbing fixtures in all residential, hotel, motel, school, industrial, commercial use, or other occupancies which use significant quantities of water. State-mandated low-flow fixture consumption requirements are shown in Table 4-4 (Low-Flow Fixture Requirements).

Toilets consume a significant portion of the domestic water supply. Until 1990, toilets used 5 to 7 gallons per flush. From 1990 to 1993, units were designed to use 3.5 gallons per flush. In 1993, ultra-low flush units using 1.6 gallons per cycle were introduced.

Conventional, vertical axis washing machines use significant quantities of water, making clothes washing a major household water consumer. Horizontal axis machines, which are popular in Europe, use considerably less water. Through a demonstration project conducted

in Bern, Kansas in 1997 it was found that vertical axis machines used 42 gallons per water per load, while horizontal axis machines used only 26 gallons per load, a savings of 38 percent. Secondary benefits of the horizontal axis machine is that energy use is also reduced, due to reduced hot water consumption, higher efficiency motors and reduced moisture of the washed load. The last item translates to lower drying costs. Horizontal washers cost more than conventional units, and range upwards from $600 to more than $1,000. Horizontal washers require the use of special, low-suds detergent.

Table 4-4. Low-Flow Fixture Requirements

Fixture	Water Consumption
Tank-type toilets	1.6 gallons per flush
Flushometer-tank toilets	1.6 gallons per flush
Electromechanical hydraulic toilets	1.6 gallons per flush
Urinals	1.0 gallons per flush
Shower heads	2.5 gallons per minute
Bathroom faucets	2.5 gallons per minute
Lavatory faucets	2.5 gallons per minute
Kitchen faucets	2.5 gallons per minute
Replacement aerators	2.5 gallons per minute

Flow requirements per RCW 19.27.170 and WAC 51-46-0402.
Requirements effective as of July 1, 1993.

Another means to reducing wastewater generation is to install low-flow showerheads and flow restricting faucets. Older showerheads used about 4.5 gallons per minute, while new fixtures use 2.5 gpm. Flow restrictors may also be mounted in faucets to reduce water consumption.

The most common approach to fixture replacement is to select a desired flow reduction and replace fixtures over a period of several years to meet the objective. This approach has been adopted in other water conservation programs associated with wastewater facilities planning efforts.

Flow Reduction

Fixture replacement measures could result in reduction in the average daily sanitary wastewater quantity of 5 to 20 percent, depending on the measures implemented, i.e., whether a low, moderate, or aggressive program is adopted.

- A low-level approach would be based solely on enforcement of plumbing codes for new construction and major remodeling projects. Existing system retrofits would be by voluntary compliance for a low-level scenario. Low-level conservation measures are estimated to result in existing system retrofits of 0.5 to 1.5 percent annually (based on enforcement of existing plumbing codes), which corresponds to a minimum 5 percent reduction of wastewater flows over 10 years.

- Moderately aggressive conservation measures would result in retrofits of 3 to 5 percent of the existing households each year over 10 years, with a corresponding 9 percent total wastewater flow reduction.
- An aggressive program could result in fixture retrofits of 10 percent per year and a corresponding wastewater flow reduction of 20 percent or more.

Table 4-5. Reduction in Water Demand – Physical Devices

	Pre-1992 Urban Areas	Post-1992 Urban Areas
Anticipated Reduction in Water Demand, %	10 to 20	5 to 10

Applicability to Spokane County

Plumbing fixture replacement would be applicable to Spokane County. For new construction and major remodels, these measures would be implemented through the plumbing code. Outdated fixtures would be replaced with low-use units as remodeling occurs.

Implementation

For existing homes and businesses, either voluntary or mandatory retrofit programs could be implemented. Many utilities implementing a replacement program have recognized the potential public resistance to a mandatory fixture replacement program, and have adopted voluntary programs for fixture replacement. A voluntary program could be supplemented by utility rebates. Typically the water purveyor has initiated most of the successful water conservation programs. However, a joint County/water purveyor program may be appropriate.

Total cost to completely upgrade toilets, washers, showerheads, and faucets in an average residence is estimated at $1,150, based on the following assumptions:

- Toilet replacement cost of $500 per residence, based on a new unit cost of $150 each, with two toilets per residence, installation, old fixture disposal, and administration.
- A median cost of $600 for purchase of a front-loading washer. Cost for a front-loading washer can be as much as $1,000.
- Total estimated cost per home for showerhead and faucet restrictors is $50, with a showerhead replacement cost of $20 and flow restrictor cost of $10 each for two bathrooms and one kitchen.

Anticipated Results

The effectiveness of conservation programs may be estimated by examining potential water consumption reductions, as shown in Table 4-6 (Flow Reduction and Costs of Plumbing Fixture Replacement).

Table 4-6. Flow Reduction and Costs of Plumbing Fixture Replacement

Residential Water Use	Wastewater Flow Attributed to Water Use (percent) [a]	Current Wastewater Flow (gallons per person per day)[b]	Wastewater Flow Eliminated (gallons per person per day)	Wastewater Flow Eliminated (gallons per ERU per day) [c]	Cost (dollars)	Cost (dollars per gallon per day removed)
With Washers at Full Cost:						
Toilets	28.5%	22.8	16.4 [d]	41.0	$500 [e]	$12.20
Washing machine	21.3%	17.0	6.5 [f]	16.2	$600	$36.97
Showers	21.1%	16.9	7.5 [g]	18.8	$20	$1.07
Faucets	11.6%	9.3	4.1	10.3	$30	$2.91
Baths	9.1%	7.3	0.0	0.0	$0	N/A
Toilet leakage	5.3%	4.2	0.0	0.0	$0	N/A
Dishwashers	3.1%	2.5	0.0	0.0	$0	N/A
Total	100%	80	35	86	$1,150	$13.33
With Washers at $100 Rebate:						
Toilets	28.5%	22.8	16.4	41.0	$500	$12.20
Washing machine	21.3%	17.0	6.5	16.2	$100	$6.16
Showers	21.1%	16.9	7.5	18.8	$20	$1.07
Faucets	11.6%	9.3	4.1	10.3	$30	$2.91
Baths	9.1%	7.3	0.0	0.0	$0	N/A
Toilet leakage	5.3%	4.2	0.0	0.0	$0	N/A
Dishwashers	3.1%	2.5	0.0	0.0	$0	N/A
Total	**100%**	**80**	**35**	**86**	**$650**	**$7.53**

a Percentage from Gambrell Urban, 1987 .

b 80 gallons per capita from current information (Basis of Planning Report).

c ERU = Equivalent Residential Unit. 2.5 capita per ERU.

d Existing toilets assumed to use 5.7 gallons per flush, as compared to 1.6 gallons per flush after 1993.

e Assumes cost of new toilets are $150 each, with two toilets per residence, installation, old fixture disposal, and administration, for a total cost of $500 per residence.

f Existing washers assumed to use 42 gallons per load, compared with 26 gallons per load for horizontal washers.

g Existing showers assumed to use 4.5 gallons per minute compared to 2.5 gallons per minute after 1993.

Table 4-7 (Project Water Conservation Effectiveness) shows that the estimated cost of wastewater reduction is $13.33 per gallon per day, when the full cost of washers is considered, or $7.53, when only the cost of a $100 rebate is considered in the analysis. The LOTT Alliance has adopted the second scenario, and has not considered the bulk of the cost to the individual customer for the washing machine. The estimated cost of $7.53 per gallon per day of wastewater eliminated compares favorably with LOTT's estimate of $6.50 per gallon per day.

Table 4-7. Project Water Conservation Effectiveness

Item	Best Achievable Performance [1]	Ten Percent Flow Reduction [2]
No. of ERUs Affected	23,327	7,532
Flow Reduction	2.01 mgd	0.65mgd
Flow Reduction	31%	10%
Estimated Cost	$26,800,000	$8,700,000
Cost (per gallon per day)	$13.31	$13.38

[1] Scenario where washers are paid by Spokane County at $600/each.
[2] Scenario where Spokane County provides rebates for washers at $100/each.

The estimated cost of $13 per gallon per day is not strictly comparable with wastewater treatment costs, as the conservation approach affects only wastewater quantity and not organic and solids loadings. Approximately half of treatment plant costs can be allocated to flow quantity and nearly all of sewer construction. Water conservation will be considered in the overall wastewater management program economics presented in Chapter 9. Elements of the overall program associated only with wastewater flow could be reduced in cost by lowering the volume of wastewater generated. Potential overall program impacts of water conservation are shown in Table 4-7 (Project Water Conservation Effectiveness).

The largest flow reduction may be estimated by assuming that all current customers do not have low fixtures.[4] As of April 2000, there were 23,327 equivalent residential units served by the Spokane County sewer system. The cost for replacing these fixtures is estimated to be $26.8 million. Best achievable flow reduction would be 35 gallons per person per day. Overall, the cost is $13 per gallon per day of flow reduction, with a maximum reduction of 2 mgd from the average existing flow of 6.5 mgd, equal to a 31 percent reduction. This approach assumes mandatory replacement of all existing plumbing fixtures. A ten-percent flow reduction goal is estimated to cost $8,700,000.

A low-effort program, relying on plumbing code enforcement, may be most appropriate for the Spokane County service area. This approach is estimated to reduce wastewater flow by 10 percent over the 20-year planning horizon. Continued monitoring of the numbers of connections and wastewater flow should be practiced to determine the effectiveness of the fixture replacement program.

No literature reference information on water conservation impacts on peak wastewater flow has been identified. Likely, there would be minimal changes from current peak flow patterns.

[4] This approach likely overstates the potential flow reduction because some homes and businesses currently connected to the sewer system were built under the new code and use low-volume fixtures. Also, a prior energy conservation program conducted by Avista promoted the installation of low-flow showerheads and faucet adapters. It is not known how successful this program was in terms of the number of plumbing fixtures converted.

4.3.5 Impact of Water Conservation on Wastewater Management

Water conservation may have a few negative impacts on wastewater management. Conservation will decrease the wastewater quantity, but not the mass of solids and organics. As a consequence, wastewater biochemical oxygen demand and total suspended solids concentrations may increase. Conveyance transport time may be increased. The higher strength and extended transport time may work to increase the potential for odor and corrosion in the collection system.

4.4 INFILTRATION AND INFLOW CONTROL

Infiltration is the unintentional entry of ground water into the wastewater collection system from surrounding soil. Infiltration is indicated when high wastewater flow is sustained for extended periods. Common points of entry typically include broken pipe and defective joints, as well as cracked manholes. For infiltration to occur, the ground water level must generally be situated above the collection system, so that water is forced into the sewer. This condition does not occur in most of Spokane County's collection system.

Inflow primarily consists of rainwater or snowmelt, which enters the collection system through roof drains, foundation and basement drains, catch-basin connections, and manholes cover holes in flooded streets. Inflow may also include cooling water discharges. Storm inflow is distinguished from infiltration by the pace with which inflow begins and ends after a period of rainfall.

Infiltration and inflow (I/I) are concerns because they consume useable capacity in the conveyance system and treatment facilities. Excessive levels may also dilute wastewater and cause treatment plant performance to deteriorate. Some communities have found that by reducing the quantity of I/I, sewer system and wastewater treatment hydraulic capacity can be extended.

However, Chapter 2 reveals that the County collection system has undetectable infiltration and minimal inflow. The programs described below would have marginal impact on current conditions, but may be appropriate to avoid future difficulties.

4.4.1 Sewer Rehabilitation

Concept

This approach involves rehabilitation to repair leaky sewers and service laterals to reduce current and future levels of I/I.

Applicability to Spokane County

As described in Chapter 2, no detectable amounts of infiltration have been identified in the existing Spokane County collection system. A minor amount of inflow has been detected. The source is thought to be basement sump pumps in a few limited areas (see next alternative). Minor amounts of infiltration may develop in the sewer system as the piping network reaches an age of 20 years.

Implementation

Rehabilitation measures, if needed, would be implemented by the County, either through its own forces or through construction contracts.

Anticipated Results

Since I/I quantities are quite low, there is little incentive to implement pipeline rehabilitation measures in the near future. The return on investment in this area would be low. Infiltration is estimated to increase to 10 gallons per day per person as piping materials age. This remains quite low compared to national and regional experience.

Table 4-8. Reduction in Water Demand – Sewer Rehabilitation

	Pre-1992 Urban Areas	Post-1992 Urban Areas
Anticipated Reduction in Wastewater Demand, %	< 1	< 1

4.4.2 Disconnect Sumps

Concept

There are anecdotal reports that discharges from basement sump pumps may be generating the modest inflow quantity observed in the collection system. With this approach, sump pump discharge would be routed to new or existing storm drainage facilities.

Applicability to Spokane County

Currently, no information is available that would allow the number of drainage sumps to be identified. However, based on the low magnitude of the observed inflow quantity, this issue is a relatively minor concern. Stormwater management program policies should be reviewed to ensure that basement drainage may be routed to storm drainage facilities.

Implementation

It may be most appropriate to address this issue as a component of the County's stormwater management planning. The public could be informed through the County's information newsletter. The homeowner would most likely be responsible for paying costs associated with sump pump modifications. A County ordinance bans the connection of sump pumps to the sanitary sewer system

Anticipated Results

The maximum effectiveness would be complete elimination of sewer system inflow. However, existing inflow is likely caused by a mixture of illegal connections, and not just sumps.

Table 4-9. Reduction in Water Demand – Disconnect Sumps

	Pre-1992 Urban Areas	Post-1992 Urban Areas
Anticipated Reduction in Wastewater Demand, %	< 1	< 1

4.4.3 Review Codes, Inspection and Enforcement

Concept

This concept involves benchmarking the County's current codes and practices for sewer and lateral construction against best management practices developed by other utilities. The County's current prevention methods are focused on sewer construction quality control measures such as: (1) design in accordance with industry standards; (2) testing and inspection of new sewer mains; and (3) testing and inspection of side sewers.

Applicability to Spokane County

The County has established rigid standards for sewer design and construction, which minimize the potential for infiltration and inflow. These standards are generally thought to be consistent with industry-wide practices used by other municipalities.

Implementation

This approach would involve a limited-scale study comparing the County's codes, construction requirements, inspection practices and enforcement with those used by other well-operated utilities.

Anticipated Results

Analysis of the County's current wastewater characteristics reveals that current infiltration quantities are nonexistent and inflow amounts are minimal, confirming that the current sewer construction practices are effective. The main benefits of a benchmark review are preventative and would minimize future infiltration and inflow.

Table 4-10. Reduction in Water Demand – Review Codes, Inspection, and Enforcement

	Pre-1992 Urban Areas	Post-1992 Urban Areas
Anticipated Reduction in Wastewater Demand, %	< 1	< 1

4.5 INDUSTRIAL AND COMMERCIAL LOAD REDUCTION

Many industries generate wastewater that has a high strength (in terms of conventional pollutants such as biochemical oxygen demand (BOD), total suspended solids (TSS), nitrogen, and/or phosphorus) or potentially toxic pollutants incompatible with municipal wastewater treatment. Another wasteload reduction method is to minimize the quantity and strength of wastewater generated by industrial and commercial customers.

There are three feasible industrial/commercial load reduction approaches. The first is pretreatment requirements, which are mandatory limits imposed by ordinance or federal law. The goal of pretreatment requirements is to ensure effluent quality, protect beneficial biosolids use, and avoid process upsets.

The second approach is high strength surcharge fees. This concept targets industries that discharge wastewater with high levels of organic, solids, and nutrients. These materials are amenable to conventional treatment, but increases wastewater management costs. The goal is to recover costs from the contributors.

The third approach is industrial recycling and waste minimization. Some industries are finding it economical to minimize water reuse by recycling and to recover valuable chemicals previously discarded as waste.

In addition to the three approaches to industrial and commercial load reduction described above, the draft NPDES Permit prepared by the Washington State Department of Ecology is expected to require additional source control of mercury by Spokane County. The potential draft NPDES permit language is as follows:

> *"The Permittee shall develop and submit to the Department a Mercury abatement and control plan beginning with a Dental plan. The plan shall be expanded as the Department of Ecology develops and releases further guidance. The Mercury Control Plan shall be submitted to the Department of Ecology by December 1, 2008. Mercury Plan development guidance can be found at the following locations:*
>
> *Ecology mercury website http://www.ecy.wa.gov/programs/eap/pbt/mercuryplan.html*
> *For Dental Plan guidance http://www.ecy.wa.gov/dentalbmps/index.html*
> *Reduction Plan guidance http://www.ecy.wa.gov/biblio/0303001.html"*

4.5.1 Pretreatment Requirements

Concept

This alternative would establish pretreatment limits for industrial and commercial discharges. Typically, these "local limits" apply to pollutants that are incompatible with the treatment system and may result in: (1) treatment process upsets; (2) effluent quality violations due to inadequate removal across the treatment process; or (3) unacceptable biosolids quality for the intended end use. Pretreatment targets toxic materials and very high strength wastes.

Through a sewer use ordinance, toxic materials are limited to an established standard. Most utilities have also established pretreatment limits for compatible pollutants in order to better define and control the wastewater strength that must be treated at the municipal plant.

Applicability to Spokane County

The regional treatment plant uses biological processes to treat wastewater and solids. Biosolids generated from the facility are beneficially used on agricultural lands. The Spokane River has elevated metal concentrations and total maximum daily loadings (TMDLs) have been established for cadmium, lead, and zinc. Wastewater dischargers are required to maintain discharges of these three metals at, or below, current levels. The existing regional plant, or any other biological treatment facility located in the basin, will therefore need to have industrial pretreatment limits for influent wastewater.

The County has adopted a sewer use ordinance that limits industrial and commercial wastewater strength and toxics. Industries are required to pretreat the wastewater if it exceeds the limits. To date, no industries are permitted to discharge significant high-strength wastewater into the County sewer system. There are a few metal and electronics fabricators that require attention to ensure low levels of metals in County wastewater.

Implementation

The County's industrial wastewater treatment program is already in place and there is a designated coordinator for supervising compliance. This program will need to be maintained. Local limits could be established in the pretreatment program for phosphorus concentrations that exceed residential and commercial strength and are detrimental to the treatment process, effluent quality and biosolids quality.

Anticipated Results

Since a pretreatment program is already in place, no revisions are anticipated.

4.5.2 High Strength Surcharges

Concept

The surcharge approach places a fee on dischargers that contribute wastewater with pollutant strength that is considerably higher than typical domestic sewerage. Typically a "cost per pound" of excess loading is applied in addition to the basic user charge. The surcharge program would apply to pollutants that are compatible with the wastewater treatment process, but which cost money to remove. This program is oriented towards industries with intermediate strength wastewater. The industry may either elect to pay the high strength surcharge or may construct pretreatment facilities to reduce wastewater strength prior to discharge to the municipal sewer system.

Applicability to Spokane County

Although the ordinance has provisions for a high strength surcharge fee, this element is not included in the current regulations. The County occasionally monitors wastewater quality of significant industrial and commercial dischargers.

Implementation

The County has authority to implement this program through its rate structure. Typically, a cost of service analysis is performed to determine an equitable system of charges.

To implement a high strength surcharge would require that the cost for treating the high strength be allocated to the wastewater components such as flow, BOD, and TSS. This formal allocation is usually performed in a rate study. The cost for each treatment or conveyance element is allocated to the applicable wastewater component. For example, sewer construction and operational costs are dictated by flow, whereas biological treatment costs are allocated to BOD. This type of cost analysis is not included in the rate study currently being prepared by the County.

Anticipated Results

Implementation of this measure would encourage industries to examine the cost of continued discharge versus the cost of pretreatment. This may lead to reduced pollutant loadings to the County system, although there is no guarantee that high-strength dischargers will take this course. Consequently, this alternative should be viewed as a cost recovery mechanism more than a pollutant reduction program.

Currently, there is inadequate data available to ascertain whether a high strength surcharge would generate additional revenue, or encourage industries to reduce loadings. The loading impact from new customers should be considered prior to completing a new sewer connection.

4.5.3 Water Recycling and Waste Minimization

Concept

The recycling approach would encourage industrial discharges to implement aggressive internal reuse and waste minimization programs. This would decrease both the quantity of flow and mass of pollutants discharged to the sewer system. Economic incentives or other enticements may be needed to implement this approach. Many high technology industries, such as pharmaceuticals, oil/gas, and electronics, are finding that valuable materials have been discharged to a sanitary sewer. These materials can often be economically recovered.

Applicability to Spokane County

The ten most significant industrial sources connected to the Spokane County sewer system are shown in Table 4-11 (Significant Industrial Sources). Most of the industries use modest water quantities. The exception is Honeywell (formerly Johnson Mathey), an electronics manufacturer, which uses 400,000 gallons per day (gpd). This industry and the metal fabricators are potential candidates for recycling.

Table 4-11. Significant Industrial Sources

Industry Name	Address	Type	Total Water Consumption (gpd)
Alloy Trailers	3808 N. Sullivan Rd.	Truck trailer manufacturer	Not identified
American Electronic Sign	3808 N. Sullivan Rd.	Electronic component manufacturer	Not identified
Ecolite Manufacturing	E. 9919 Montgomery	Louver manufacturer	Not identified
Honeywell	E. 15128 Euclid	Forming and fabrication of metal components	400,000
Mica Landfill	Hidden Hollow Rd.	Leachate from closed landfill	8,300
Novation	2616 N. Locust Rd.	Anodizing, electroplating, painting, powder coating	24,000
Pathology Associates Medical Laboratories	11604 E. Indiana	Clinical laboratory	15,000
Precision Machine and Supply	3808 N. Sullivan Rd.	Metal products machining	Not identified
Smiley's Cleaners	121 S. Sullivan Rd.	Laundromat	100
Wagstaff	3910 N. Flora Rd.	Machining, direct-chill casting for research and development	14,000

NOTE: List was compiled in the Spring of 2001.

Implementation

The implementation approach would rely on each industry taking the initiative to recycle water. However, the County could consider establishing incentives, potentially financial, to encourage water recycling. An industry adopting water recycling would likely need to make a capital investment in new facilities. This approach is probably most effective with a new industrial facility.

Anticipated Results

Water recycling and waste minimization would be most effective with new industries locating to the service area. With a new industry, the process can be designed to incorporate recycling approaches. The County may consider working with any new industrial customer to determine whether water recycling has potential benefits.

4.6 LEADERSHIP IN ENVIRONMENTAL AND ENERGY DESIGN (LEED)

LEED is the acronym for Leadership in Energy and Environmental Design, a performance-based green building rating system developed by the U.S. Green Building Council (USGBC).

The system is based on points earned by achieving specific sustainable design criteria. LEED is a self-assessing system (i.e., the applicant decides which credits are most appropriate to

pursue for a project). When sufficient points are verified by the USGBC, a building is awarded the title "LEED Certified Building". LEED was developed through consensus of USGBC members, and is administered by the USGBC.

The USGBC is a non-profit organization dedicated to promoting high-performance building and development that protects both the environment and building occupant health. The USGBC is comprised of interests that span the entire building industry, including manufacturers, design and construction professionals, educators, environmentalists, and government agencies. Founded in 1993 the USGBC focuses on forming win-win solutions through collaboration and research. Membership is open to all who seek to construct and maintain high performance buildings.

LEED Versions

LEED is available in various versions to accommodate different project types. LEED – NC is the parent system from which all other versions are adapted. Despite their differences, all LEED versions are organized in the same basic structure as LEED - NC.

- **LEED-NC (New Construction and Renovation) –** LEED-NC Version is the most recent release from the USGBC. LEED-NC is tailored for new building construction or substantial renovation projects. Recognizing that sustainable design decisions are more effective and economical when implemented in the preliminary design stage, LEED-NC places emphasis on sustainable design strategies that promote whole building performance through collaborative design decision-making, construction coordination, and post-occupancy building operation and maintenance.
- **LEED-EB (Existing Buildings) –** LEED-EB was created to allow building owners to be recognized for sustainable design efforts in existing buildings. Unlike LEED-NC, LEED-EB addresses operations and maintenance processes and performance.
- **LEED-CI (Commercial Interiors) –** Tenant improvements represent a large percentage of all construction in the United States. LEED-CI was created for commercial tenant improvement projects. This allows tenants, who may be limited in what options of a building design they can influence, to obtain a LEED rating for only those spaces they occupy.
- **LEED-CS (Core and Shell) –**LEED Core and Shell promotes sustainable design focused on those portions of a building likely to have the greatest effect – the envelope and distribution systems.

LEED is a dynamic system subject to continuous review and refinement. The USGBC uses information gleaned from LEED projects to track market transformation and trends. This information helps the USGBC refine future versions of LEED as well as suggest other LEED versions that are needed. For example, LEED-R is being developed for residential applications and LEED-ND is currently being offered as a Pilot Program for neighborhood developments.

Some cities have found that a supplement or slightly altered version of LEED works best for them. While the USGBC does not develop these, they may support them. For example, the

USGBC has approved a city-specific version of LEED for Portland, called Portland-LEED. The City of Seattle has been approved by the USGBC to include supplements to LEED specific to Seattle conditions.

Eligibility

Commercial buildings as defined by standard building codes are eligible for certification under LEED-NC. Commercial occupancies include, but are not limited to, offices, retail and service establishments, institutional buildings (e.g., libraries, schools, museums, churches, etc.), hotels, and residential buildings of four or more habitable stories.

LEED Certification Process

- **Registration -**The first step toward earning LEED certification is project registration. Registering the project demonstrates that the owner is intent on earning LEED certification. Registering during the early phases of project design will ensure maximum potential for achieving certification. Registration is an important step that establishes contact with the USGBC and provides access to essential information, software tools and communications. The registration process creates a central shared folder where team members can submit documentation throughout the project to support proof of compliance during the certification review process. Fees are charged for LEED registration and are assessed on the size of the project in gross square feet of the building.
- **Documentation -** Once a project is registered, the project design team begins to prepare documentation and calculations to satisfy the prerequisite and credit submittal requirements. It is helpful to have a LEED accredited professional as the project contact and team member responsible for shepherding the certification process. To streamline the application process, required documentation should be gathered throughout the design and construction process. Credit and prerequisite documentation is converted to PDF format electronic files which are transferred to the LEED project team.
- **Certification –** Once all credit and prerequisite documentation has been uploaded to the USGBC project folder, and the certification fees have been paid, the LEED certification review process may commence. The process normally takes 30 days to receive an initial audit review. The audit review will list those credits and prerequisites that have been accepted, those that are denied and approximately 30-40 percent which are being audited. Credits and prerequisites that are audited must be supported in an electronic re-submittal with supplemental information. After a review of this supplemental information a final rating (certified, silver, gold or platinum) is granted. However, should the project team feel that a denied ruling in the final rating is unjustified, they can appeal this decision. There is a fee for each credit and prerequisite that is appealed.

4.6.1 Water Conservation and LEED

Commercial building standards throughout the United States do not, in general, adequately address water conservation and its role in phosphorus loading in receiving water bodies. Water conservation in buildings is enforced throughout the United States by the Federal Energy Policy Act of 1992 which limits plumbing fixture flow and flush volumes. Other elective strategies pertinent to commercial buildings include lavatory motion sensors, timers and aerators. For sewage conveyance, dual flush toilets offer users the opportunity to flush waste with either a 0.8 gallon flush (sufficient for urine) or a 1.6 gallon flush to remove solids.

LEED has raised awareness of water conservation and phosphorus reduction, and how buildings can easily integrate features and operations policies to achieve both. LEED water efficiency credit points can help projects reduce potable water consumption and phosphorus loading as follows:

- ***Water Efficiency Credits 1.1 & 1.2, Water Efficient Irrigation*** – Encourages reducing potable water demand by the use of water-conserving sprinkler system and by using reclaimed non-potable water for irrigation. It also rewards projects for using native, indigenous vegetation which needs no irrigation once these plants' root systems are sufficiently established.
- ***Water Efficiency Credit 2, Innovative Wastewater Technologies*** – Promotes fixtures with reduced flush volumes, such as waterless urinals or even composting toilets. It also rewards using reclaimed non-potable water for sewage conveyance.
- ***Water Efficiency Credits 3.1&3.2 - Water Use Reduction –*** For this credit point water efficiency gains are determined by comparing a code-compliant "Base" building compared with a water-conserving "Design" building. Credit points are awarded for the amount of water use reduction. Water consuming fixtures – faucets, toilets & urinals, and other domestic fixtures are included in these water calculations. Process loads and water for mechanical cooling are not considered.

Several water conserving strategies can easily reduce water consumption, which in turn will reduce volume of wastewater to the municipal system:

- **Low-flow lavatory faucets –** By specifying low-flow faucets, commercial buildings can reduce water used for hand washing by 75 percent. Currently, most lavatory faucets flow at a rate of one gallon per minute (gpm). Faucets with flow rates which use only 0.5 gpm are readily available. If these faucets are controlled by motion sensors (which regulate the water to flow only when needed) and/or with timers (which shorten the time of flow) the amount of water used for hand washing can be reduced another 50 percent.
- **Hand sanitizers –** Installing hand sanitizing dispensers in restrooms is another water conservation strategy that is gaining popularity. Not only does this reduce the water used for hand washing by 100 percent (per use), it also reduces any phosphates found in the soap used for hand washing.

- **Low-flush urinals -** Most urinals installed today consume 1.0 gallons per flush (gpf). However, most plumbing fixture manufacturers are now offering flush valves which only use 0.5 gpf.
- **Waterless urinals –** Waterless urinals are gaining popularity, especially in buildings which have frequent urinal use such as stadiums or schools. Also, waterless urinals have no flush valves, which are often the target of vandalism or are prone to leaking, they are simple to maintain. Waterless urinals use a cartridge filled with a buoyant liquid to create an air seal in the trap. This liquid allows urine to flow into the trap past this liquid and thus any odors associated with it are blocked. Waterless urinals do require special cleaning solutions, and the cartridges must be kept filled with the buoyant liquid and periodically replaced. Waterless urinals are currently more expensive than conventional urinals, however, because of water demand is eliminated, they are generally considered to be cost neutral.
- **Low-flush water closets –** Water closets (toilets) sold today can use no more than 1.6 gpf. However, there are models available which use only 1.2 gpf.
- **Dual-Flush Toilets** Dual flush toilet systems have been in use in Australia for several years. The basic purpose of a dual flush system is to provide both a full-flush and a reduced flush. The concept is that less flow is required to flush liquid waste than solids. The full-flush is selected to convey wastewater with solids and reduced flush is selected to convey liquid wastewater.
- **Other toilet technologies –** There are several other technologies available such as composting toilets or incinerating toilets. Most of these are better suited for remote areas not served by a sewage utility. In general, they cost more than conventional water closets and may require more maintenance. While composting toilets reduce water consumption for sewage conveyance dramatically, they are most likely not an appropriate strategy for commercial building use.

Table 4-12 describes conventional water consumption versus several water consumption-reducing strategies in a conventional commercial office building.

Table 4-12. Estimated Water Reduction Using Water Conservation Technologies

Water Consumption Description	Average Water Use, gpd	Total Annual Water Use, gal [1]	Percent Decrease in Wastewater Flow
Sewage Conveyance			
Conventional water closets (1.6 gpf) and urinals (1.0 gpf)	550	145,200	
Dual flush water closets	400	105,600	27.3%
Low-flow water closets; low-flow urinals	350	92,400	36.4%
Low-flow water closet, waterless urinals	275	72,600	50%
Hand Washing			
Conventional Lavatory (1.0 gpm)	100	26,400	
Low-flow Lavatory (0.5 gpm)	50	13,200	50%

Water Consumption Description	Average Water Use, gpd	Total Annual Water Use, gal [1]	Percent Decrease in Wastewater Flow
Low-flow Lavatory with motion sensors and timers (0.25 gpm)	25	6,600	75%
Hand Sanitizer Dispenser (if used each time by every occupant = 0.0 gpm)	0	0	100%
Other Miscellaneous Water Consumption			
Miscellaneous Water Use in Conventional or Water Conserving Buildings	350	91,000	

[1] Scenarios assume 50 female and 50 male occupants. Each urinates 3 times each day and defecates once each day.

[2] Each washes their hands for 15 seconds each time they use a water closet or urinal.

[3] Accounts for additional water use on a per person basis for typical employment.

A practical scenario for implementation of water conservation fixtures in future commercial buildings is to require the installation of low-flow water closets, low-flow urinals, and low-flow lavatory with motion sensors and timers. If these water conservation measures are installed, water consumption will be reduced by approximately 28 percent.

Impact to the Development Community

The impact to developers to implement these types of water conserving strategies in commercial buildings is relatively small. The installation of low-flow and low-flush fixtures is the same as conventional fixture with one exception: waterless urinals do not require supply water piping. In terms of cost, this is also expected to be normally cost neutral. Some manufacturers charge slightly more for fixtures with higher efficiency (generally 10-15 percent), but the reduced water consumption should pay back this added cost within 2 to 5 years, depending on frequency of use.

Impact to County Review Process

No impact to the County review process is anticipated. With the exception of the waterless urinals and composting toilets, the fixtures described above are proven and accepted throughout the United States by code officials. Waterless urinals are not as widely accepted, but popularity is increasing. To encourage installation of these water conservation fixtures, the County may wish to implement an accelerated review time for building projects that are LEED Registered and which are implementing these water conservation strategies. One strategy is for developers to provide a fixture schedule with a total reduction savings listed above a specific threshold.

4.6.2 Example LEED Commercial Buildings

The Banner Bank Building in Boise, Idaho is an excellent example of comprehensive water conservation in a commercial office building. The Banner Bank Building has reduced its potable water consumption by 72 percent over conventional office buildings of equivalent size by using reclaimed stormwater and gray water to flush each toilet and urinal within this 11-story, 185,000 square foot building. Separate drain lines to capture all lavatory water (gray water) were installed to convey gray water to storage. Stormwater is also collected

from a 7.3 acre area and is conveyed to the office building for storage. The water reclamation system includes an oil/water separator; hydrodynamic separator; perlite media filter; 20,000 gallon storage tank with aeration; 0.35 micron filter; and ultraviolet disinfection. Figure 4-1 is a process schematic of the stormwater/Graywater reclamation system of the Banner Bank Building. Also, low-flow water closets, low-flow urinals, and low-flow lavatories with timers and motion sensors were installed to reduce the volume of water consumed.

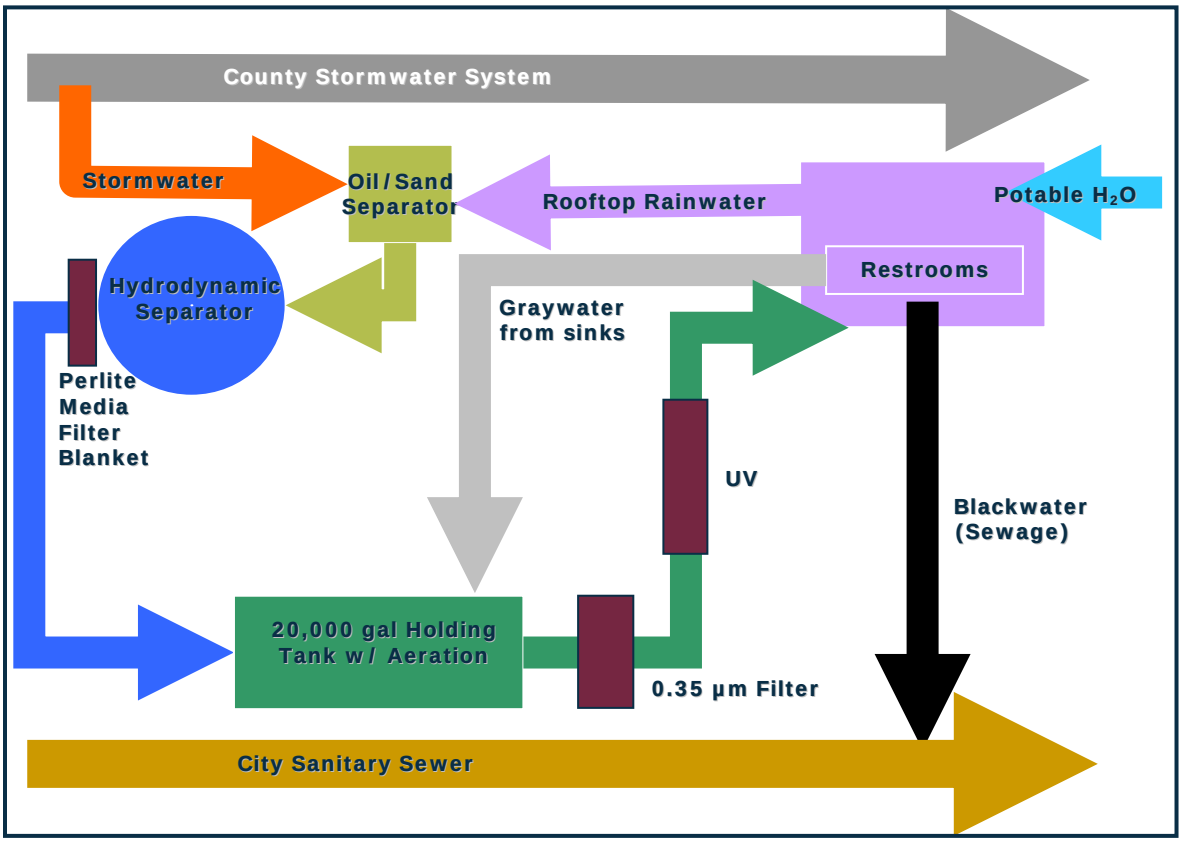

Figure 4-1. Banner Bank Building (Boise, Idaho) Stormwater and Graywater Reclamation System

The McKinney Office Building in McKinney Texas is another example of water conservation strategies successfully integrated in a commercial office building. This project features waterless urinals and low-flow water closets to reduce potable demand for sewage conveyance by over 50 percent. In addition low-flow faucets, aerator heads reduce potable water demand by over 30 percent.

4.6.3 Phosphorus Load Reduction Potential from LEED

The mass of phosphorus which enters the system is mostly independent of flow consumed and conveyed to the collection system. However, if water conservation efforts are successful, the flow at the wastewater treatment plant would be reduced and the phosphorus load in the discharge from the wastewater treatment facility would then, therefore, be reduced. This assumes constant effluent phosphorus concentrations, independent of flow.

The potential phosphorus load reduction through LEED building can vary widely depending on how aggressively the County pursues LEED in future public and private development.

Table 4-13 presents the existing (2005) and projected future (2030) employment population for several future land uses. Based on these employment forecasts, the wastewater flow rate to the collection system has been estimated for conventional building construction and compared with sustainable building construction. Assuming that the concentration of phosphorus remains the same, an assumption which may not be valid, the potential reduction in phosphorus loading to the river is estimated based on the differences in wastewater flow rates. Given that effluent phosphorus concentrations from the Spokane County Regional Water Reclamation Facility will be very low (seasonal average less than 50 µg/L), the potential for phosphorus load reduction from water conservation in sustainable design appears limited.

Table 4-13. Employment Population and Phosphorus Loading in the Spokane County Wastewater Service Area

Land Use Type	2005 Employment Population	2030 Employment Population	Increase in Flow Rate to Municipal Wastewater System (2005 to 2030) from Employment Population, gpd		Potential Phosphorus Reduction, lbs/day
			Conventional Building Construction[1]	Sustainable Building Construction[2]	
Hotels	584	2,879	22,950	17,213	0.002
Industrial	14,898	26,062	111,640	83,730	0.012
Non-Central Business District	17,766	33,312	155,460	116,595	0.016
Office	10,275	10,457	1,820	1,365	0.000
Fire Stations	3,683	8,651	49,680	37,260	0.005
Medical[5]	6,576	6,491	0	0	0.000
Schools[5]	5,048	4,798	0	0	0.000
TOTAL	58,830	92,650	341,550	256,163	0.036

Notes:

[1] Existing (2005) and future (2050) employment population is based upon Spokane County traffic analysis zones from the Spokane Regional Transportation Council (SRTC).

[2] Flow rate to the municipal wastewater collection system from conventional building construction is estimated based on 10 gpcd.

[3] Flow rate to the municipal wastewater collection system from sustainable building construction is estimated based on 7.2 gpcd (28 percent reduction).

[4] The pounds of phosphorus that is no longer discharged to the Spokane River if water conservation is implemented based upon effluent phosphorus concentration of 50 µg/L.

[5] Medical and School land uses show a decrease in population from year 2005 to year 2030.

As a part of phosphorus reduction through water conservation, a LEED program could be considered by the City of Spokane Valley and Board of County Commissioners for new buildings, and appropriate regulations developed to implement the program.