The North Valleys Initiative: Advancing Solutions to Regional Water Issues

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INTRODUCTION

Regional water challenges facing our community include such complex issues as: ensuring sustainable water supplies to meet existing and future demands within the Truckee Meadows Services Area; maintaining the appropriate water quality discharge standards and treatment capacity requirements at several of our region's wastewater treatment plants; and addressing competing needs for the region's limited water resources to meet commitments to water supply, water quality, instream flows and the environment.

Many of these regional water issues are interrelated and their affects go beyond individual watershed boundaries. Solutions to one system, such as water, wastewater or flood control will likely affect the needs and costs of one or more of the other systems. In addition to being challenging, resolving many of these water issues will be expensive. Clearly, a Total Water Management (TWM)[1] approach that utilizes the region's common water resources and facilities to their optimum advantage has the potential to not only reduce potential costs, but also increase the level of service, enhance water quality and provide environmental benefits.

To help advance solutions to these regional water management issues, a process referred to as the North Valleys Initiative (NVI) was developed by the Northern Nevada Water Planning Commission and the Western Regional Water Commission. The NVI process is a collaborative effort among key staff from the City of Reno, the City of Sparks, Washoe County Department of Water Resources, Sun Valley General Improvement District and the Truckee Meadows Water Authority, designed to identify recommended solutions to many of the region's water issues. The first objective for the group was to evaluate the feasibility and merits of expanding reclaimed water use in the North Valleys, particularly in Stead, Lemmon Valley and Cold Springs. The North Valleys reclaimed water issue was selected as a representative example to work through a collaborative process to address a significant water issue of regional concern. The recommended solutions and lessons learned from this process will ultimately be applied to other regional water management issues within the community.

UNDERSTANDING THE PROBLEM: THE NORTH VALLEYS EXAMPLE

Currently, the Reno Stead Water Reclamation Facility (RSWRF) treats an annual average wastewater flow of about 1,680 acre-feet per year. Of this highly treated wastewater, or reclaimed water, a minimum of 490 acre-feet per year is directed into a natural drainage channel that flows to the nearby Swan Lake to sustain the existing wetlands and playa. In addition to Swan Lake, the RSWRF reuses about half of its total reclaimed water flow for irrigation and construction water from March through October. Recipients of the reclaimed irrigation water include the Sierra Sage Golf Course, the North Valleys Sports Complex and Mayors Park. A

[1] Total Water Management (TWM), as defined by the American Water Works Association Research Foundation, is the "exercise of stewardship of water resources for the greatest good of society and the environment." TWM balances competing water uses through efficient allocation, promotion of water conservation, reuse, source protection, and supply development. It enhances water quality and quantity; addresses social values, cost-effectiveness, and environmental benefits and costs; fosters public health, safety, and community goodwill; and requires the participation of utilities, businesses, government and the general public. The practice of TWM is intended for the greatest good of society and the environment.

truck fill stand is maintained at the treatment plant that is utilized heavily by local contractors for construction water and dust control. These current uses total approximately 674 acre-feet per year.

In addition to the reclaimed water generated from the Reno Stead facility, Washoe County owns and operates the Lemmon Valley Wastewater Treatment Plant. Presently water from this treatment plant is evaporated from on-site ponds that are adjacent to Swan Lake. These ponds also provide wildlife and wetland habitat.

The City of Reno and Washoe County recently completed their Truckee Meadows Service Area Water, Wastewater and Flood Management Facility Plan (TMSA Facility Plan). The TMSA Facility Plan estimates the future water supply needs, wastewater treatment improvements and related facilities necessary to accommodate the planned development for the region.

The North Valleys is one area within our region that is expected to see an increase in population in the near future. Large tracts of land within the North Valleys have already been master planned for commercial and residential development. This includes the Reno Tahoe Airport Authority property in Stead, which is one of the largest tracts of undeveloped commercial and industrial property in the region. The Airport Authority property will be instrumental in providing a new employment center as the area develops.

Much of the area's future water supply requirements will be satisfied by the recently completed Fish Springs water importation project and by expansion of the Truckee Meadows Water Authority (TMWA) Stead pumping system. These new water supplies augment the local groundwater resources, and both are currently available to serve the Stead and Lemmon Valley areas. With additional improvements, these facilities can also be extended to provide much needed water supplies to Cold Springs. Although these water supply sources are substantial, long-term development potential of the area may be limited as a result of ultimate water supply limitations.

Based on the long-term development potential, the TMSA Facility Plan also estimates that future wastewater flows from Stead and Lemmon Valley could eventually reach as much as 8,000 acre-feet per year. The Swan Lake wetlands and playa can benefit from receiving more water than it currently does, and an agreement has been reached with the Swan Lake Advisory Committee and the Nevada Division of Environmental Protection (NDEP) to allow as much as 2,240 acre-feet per year to be released to the playa in the future. Realistically, this is the maximum amount of water that the wetlands and playa can accommodate. Water released in excess of this amount could disrupt the natural wetland and playa processes and increase the potential 100-year flood hazards for the surrounding properties. Therefore, other means of reusing or disposing of the reclaimed water will need to be identified.

Cold Springs is in a very similar situation to Lemmon Valley and Stead. Currently, the reclaimed water from the Cold Springs Water Reclamation Facility percolates into the groundwater through a series of rapid infiltration basins. The amount of water the basins can infiltrate is limited to approximately 1.3 MGD, based on current information. Therefore, they may not be able to accommodate the amount of wastewater that is anticipated to be generated in the future. As is the case for Stead and Lemmon Valley, additional reuse and/or disposal strategies will have to be identified for Cold Springs. Because of their proximity and similarities concerning water supply and wastewater disposal, a coordinated regional water reclamation effort for the Stead, Lemmon Valley and Cold Springs areas is being pursued.

A number of alternatives for reusing and/or disposing of the reclaimed water have been evaluated. For instance, plans have been developed to expand the reclaimed water distribution system in the Stead area to include existing commercial irrigation demands, which are currently being served with potable water, as well as future commercial irrigation demands. The areas to be served would include the commercial properties generally along Lear Boulevard, Stead Boulevard and Lemmon Drive. Potentially, the North Valleys High School and landscape medians within planned Lemmon Valley developments could also be irrigated with reclaimed water. These future irrigation demands could reuse an additional 471 acre-feet of reclaimed water per year. Some additional reuse and disposal alternatives allowed under current NDEP regulations and policy include:

- Disposal to the White Lake playa to create beneficial year-round wetlands, similar to what has been developed as a park and wildlife viewing area at Swan Lake in Lemmon Valley;
- Disposal to Long Valley Creek in California, which could provide an outlet during periods when not all of the reclaimed water generated in the area can be placed to another beneficial use, particularly during the non-irrigation season. For this option, approval would have to be obtained from not only NDEP but the Lahontan Regional Water Quality Control Board and other California permitting authorities. The California water quality and permitting requirements for this alternative, although rigorous, are well defined.
- Export for disposal to other areas such as Bedell Flat or Warm Springs.

Discharge of treated effluent from the North Valleys to the Truckee River is not a preferred alternative at this time. The Truckee River has its own specific water quality requirements, and added discharge of treated effluent from the North Valleys could reduce available disposal capacity for the greater Truckee Meadows.

A NEW DIRECTION

Based on the TMSA projections, up to 8,000 acre-feet of reclaimed water could be available in the future from Stead, Lemmon Valley and Cold Springs to help provide other water resource benefits. In general, water resource benefits could include water supply reliability for both municipal and domestic wells, a new source of water to help meet water rights and water quality obligations, and more water left for the environment.

Research was conducted to see what other uses of reclaimed water resources are being implemented throughout the United States. Numerous states, including our neighbors in California, Arizona, Washington and Idaho, allow reclaimed water use for residential landscape irrigation. Most notably, the award-winning community of Serrano, an upscale development in El Dorado Hills, California, has been successfully using reclaimed water to irrigate both front and back yard landscaping throughout the development for 10 years. Local developers partnered with the El Dorado Irrigation District to oversee the long term monitoring, inspection and oversight of the system to ensure that the public health is protected. A dual water piping system was necessary, one for the potable uses within the residences, and a second, completely independent system to deliver the reclaimed water to the irrigation services.

Citizens locally are already familiar with the reclaimed water systems in widespread use today in the South Truckee Meadows area and in Sparks. These systems are used to supply irrigation water to schools, parks and landscape medians. The Serrano system takes it a step further, supplying reclaimed water to the individual homes. This use of reclaimed water was instrumental in extending El Dorado County's available water supplies and helping them meet their wastewater discharge permit requirements. In Nevada, current reclaimed water regulations do not provide for the same level of treatment and reliability as required in the other states that allow residential landscape irrigation. To allow reclaimed water use for residential irrigation, changes to the regulations (i.e. Nevada Revised Statutes, NRS, and/or Nevada Administrative Code, NAC) as well as improvements at the wastewater reclamation facilities to provide the necessary high quality water would be necessary. If these changes and improvements were accomplished, NDEP would have the ability to permit reclaimed water to be used for residential irrigation.

Another use of reclaimed water being employed by other states is groundwater recharge. California, Arizona, Texas and Florida are leading the way in advancing technologies and regulations to expand this practice. Groundwater recharge is being performed for a number of reasons: as a sea water intrusion barrier; to bolster declining groundwater levels due to over-pumping; and to augment potable water supplies, also referred to as Indirect Potable Reuse (IPR). The Orange County Groundwater Replenishment System is the best example of a large-scale reclaimed water groundwater recharge project implemented in the United States. The following excerpt is taken directly from the Overview section of their website (www.gwrsystem.com):

The Groundwater Replenishment System has evolved and changed over time as new goals, data, regulations and facts have been identified. However, the needs and benefits of the project have remained constant:

- *Orange County needs more reliable, high-quality water in the future to replenish the groundwater basin, to protect the groundwater basin from seawater intrusion, and for industrial uses*
- *The Groundwater Replenishment System reduces the amount of treated wastewater released into the ocean and delays the need for another ocean outfall*
- *The Groundwater Replenishment System decreases Orange County's reliance on imported water from northern California and the Colorado River*
- *The Groundwater Replenishment System's locally-controlled water helps drought-proof Orange County*
- *The Groundwater Replenishment System's new water will help meet statewide water objectives*

- *The Groundwater Replenishment System helps reduce mineral build up in Orange County's groundwater by providing a new source of ultra-pure water to blend with other sources, including imported water.*

Many of these same benefits, and others, could be realized locally with additional uses of the reclaimed water resource. Residential landscape irrigation could play a significant role in meeting future water supply requirements. Highly treated reclaimed water could be used as an economic development incentive to attract specialized water intensive industries to the Airport Authority property. Reclaimed water could be used to enhance existing wetlands, develop new ones, and help maintain important wildlife habitat. Groundwater replenishment could also be implemented with purified reclaimed water in a technically and environmentally sound manner that would enhance the sustainability of the region's water supplies. Reclaimed water is not one product, but multiple products where the water quality is tailored to the specific use.

These new uses of the reclaimed water resource would require regional coordination and cooperation between local governments, water and wastewater service providers, regulatory entities and other stakeholders. With appropriate treatment, regulatory oversight and buy-in from the general public, reclaimed water resources could be used to help provide watershed sustainability, where the region has enough high quality water for people, a healthy economy, and a healthy environment.

SUMMARY OF THE NVI INVESTIGATIONS

The NVI group has been meeting since May 2008. The group consists of the following members:

- City of Reno: Greg Dennis, Michael Drinkwater, Stan Shumaker and Terry Svetich;
- City of Sparks: Wayne Seidel, Joanne Meacham and Janelle Thomas;
- WCDWR: Rosemary Menard, John Buzzone, Jeanne Ruefer, Joe Stowell and Rick Warner;
- WRWC: Jim Smitherman;
- TMWA: Mark Foree, John Erwin and Ron Penrose;
- SVGID: Mike Ariztia;
- NDEP: Jennifer Carr and Jim Balderson (Dept of Safe Drinking Water), Cliff Lawson and Joe Maez (Dept of Water Pollution Control)
- WCDHD: Mary Anderson, Doug Coulter and Bob Sack;
- Utilities, Inc: Albert Van Dyke, Local Area Manager, Cold Springs
- Private Developer Representative: Bob Lissner
- ECO:LOGIC Engineering: John Enloe, Robert Emerick, Cindy Bertsch and Alissa Turner

A total of seventeen Group meetings, one field trip and four workshops have occurred for which ECO:LOGIC provided the necessary coordination, scheduling and preparation of technical information and meeting materials. Following is a summary of the Group's findings and accomplishments during this period.

Serrano Field Trip: At the end of May 2008, a field trip to the El Dorado Irrigation District (EID) and the Serrano residential development, both in El Dorado Hills, California, was coordinated to "kick off" the NVI process. Seeing firsthand what has successfully been accomplished at both EID and Serrano, as far as the implementation of reclaimed water use for residential landscape irrigation, assisted the Group in identifying what particular issues and questions needed to be addressed and analyzed early on to evaluate the feasibility of expanded reclaimed water use for residential landscape irrigation within our region.

EID is the principal utility responsible for water, wastewater and reclaimed water service within El Dorado County. Having responsibility for all aspects of water and wastewater service allowed EID to take a holistic approach to their water resource management challenges. The use of reclaimed water for residential landscape irrigation helped EID meet its water supply commitments, improved their drought reliability, and allowed them to meet stringent waste discharge requirements on their treated effluent that otherwise was discharged into a nearby stream.

Preparation of Technical Information and Related Research: Through the course of the past year, technical information related to the NVI process was developed and provided to the Group, either at the regular meetings or through group distributed email. This information included the NVI Reclaimed Water Financial Considerations Memorandum, dated July 7, 2008; the NVI Proposed Reclaimed Water & Disposal Facilities Exhibit; the Cost Benefit Matrix for Implementing a Regional Reclaimed Water Distribution System in the North Valleys and associated itemized feedback table.

ECO:LOGIC researched information on existing reclaimed water uses, groundwater recharge, aquifer storage and recovery (ASR), and indirect potable reuse (IPR) that has occurred in various cities, states and countries around the world. Information has been shared with the Group and regulators, and has been included as topics of discussion at the regular meetings when appropriate.

ECO:LOGIC also compiled existing reclaimed water service ordinances, and design and construction standards from Washoe County and the City of Sparks, plus additional information obtained from entities such as EID. From this information, an initial draft of a regional reclaimed water ordinance and associated construction standards providing for residential irrigation was developed. If the region decides to move forward with potential implementation of a residential reuse program, one of the next steps would involve regulatory approval allowing for residential reclaimed water use. And as mentioned previously, before regulatory approval can happen, the appropriate revisions would have to be made to the current NRS/NAC. Considerable effort would be required to reach consensus on water quality and treatment requirements, and construction, monitoring, testing and inspection practices. As a prerequisite, NDEP and the WCDHD would require a local public entity to take full responsibility for monitoring and enforcement of any type of residential reuse system.

Reno's Advanced Treatment Pilot Test: In addition to the NVI process, an ongoing advanced treatment pilot study at the Reno Stead Water Reclamation Facility has been undertaken by the City of Reno and ECO:LOGIC. Consideration of groundwater replenishment and indirect potable reuse (IPR) of municipal wastewater must include demonstration of safe, reliable water quality, practicality, affordability and public acceptance. Coastal communities like Orange County, California utilize reverse osmosis (RO), high-energy UV and peroxide treatment as part of their Groundwater Replenishment System. Because RO brine disposal to the ocean is not readily available, this approach may be neither affordable nor appropriate for many inland areas like Reno. To address the feasibility of IPR without RO, the City of Reno developed an alternative treatment demonstration project for public review and regulatory evaluation using membrane filtration (MF), peroxide, ozonation (O3), and biologically activated carbon (BAC). Preliminary data from Reno's MF-Peroxide-O3-BAC pilot project has shown that the following process capabilities can be accomplished:

- Reduced EDCs and PPCPs to very low and non-detect concentrations;
- Avoidance of increasing the corrosivity of the product water, a serious concern for IPR in arsenic-rich aquifer formations;
- Significantly reduced biodegradable dissolved organic carbon (BDOC) concentrations to minimize bio-fouling of IPR aquifer injection wells;
- The removal of ozonation transformation byproducts; and
- The reduction of product water estrogen activity in human cell bioassays to background levels.

Compared to MF-RO-UV-Peroxide systems, Reno's MF-Peroxide-O3-BAC process has the benefits of multi-barrier treatment for all major categories of contaminants of concern, which provides additional reliability; lower capital costs; lower O/M costs and simpler O/M tasks, lower energy use; and eliminates treatment and disposal of process reject water.

Regulatory Collaboration: A number of specific activities and workshops were conducted for the benefit of NDEP and Washoe County District Health Department (WCDHD) in addition to the regularly scheduled Group meetings. John Gaston of CH2MHill was hired to meet independently with regulators from NDEP and WCDHD early on in the process to obtain feedback regarding the implementation of expanded reclaimed water use. John provided a brief summary document that included his take on the discussions that occurred in these meetings and recommendations regarding how to proceed with the regulators. Possible changes to the existing Nevada Administrative Code and/or Statutes, proposed public education and input programs, and additional studies relative to health impacts and reuse options were the primary take-home messages from his interviews. Additionally, John relayed that NDEP shared with him that they are more comfortable at this time with the idea of groundwater recharge versus the implementation of reclaimed water use for irrigation of single family residences. The reason for this is two-fold. First, groundwater recharge is already regulated under the current Codes/Statutes whereas irrigation of single family residences with reclaimed water is not. Second, the possibility of the public having unintended contact with the reclaimed water due to numerous individual points of connection is greater if applied to residential landscaping. This concern is reduced with groundwater recharge of reclaimed water since the water quality can be closely monitored and controlled at the treatment plant and recharge sites.

A second planned field trip to EID and the Serrano residential development to include staff from NDEP and the WCDHD could not occur due to conflicts in scheduling, internal re-organization and cut-backs at EID. Instead, Doug Venable from EID and Albert Hazbun, consulting engineer to EID, came to Reno to present their knowledge and experience in residential reclaimed water system development and operations at a workshop at the City of Reno on October 1, 2008. Specific concerns raised by NDEP and WCDHD included treatment requirements, monitoring and enforcement requirements, and public involvement and education.

Following this workshop, NDEP initiated discussions with the WCDHD concerning the use of treated effluent. Issues that are being discussed will be carried out through NDEP's permitting process of Waste Water Treatment Facilities (WWTF) and include appropriate effluent limitations, treatment reliability standards, as well as compliance points and assurances. Additionally, NDEP would seek a change to NAC 445A to account for higher water quality standards and treatment requirements. At best, a permanent regulation modification would be complete in 2010. Once those agreements and regulations are completed, the WWTF would need to request a modification of its permit. NDEP does not regulate, nor have the authority to regulate a residential re-use program. Therefore, an agency such as the WCDHD would have to be the primary agency in the regulation of a residential re-use program. All of these issues will need to be resolved prior to any future decision on residential re-use. If a project comes forward in the meantime, NDEP is not in a position to approve the request.

In response to questions raised on treatment requirements, on December 15, 2008 a Reclaimed Water Workshop was held at WCDWR with Bob Emerick of ECO:LOGIC as the presenter. Jeffrey Stone, Director of the Recycled Water Unit for the California Department of Public Health's Drinking Water Program, also participated in the workshop by phone. This workshop presentation included an overview of tertiary treatment in California, including tertiary disinfection and Title 22 Effluent Water Quality Standards, recycled water backflow prevention and cross-connection control, and current dilemmas with reclamation, including incidental runoff, groundwater degradation, effluent mists from spray irrigation, and effluent salinity issues. The presentation also included a brief review of California's Groundwater Recharge Reuse Project (GRRP) regulations.

Cost of Service Evaluation: A planning level evaluation of the various costs of three disposal or reuse scenarios was conducted. The evaluation considered the cost implications of both water supply and wastewater disposal for three scenarios. Each scenario considered the next 2-MGD expansion for wastewater treatment and disposal. Scenario 1 is representative of the current water management approach; import water to the North Valleys, use it once, treat it and dispose of it. Discharge of the treated wastewater to Long Valley Creek was selected as a representative disposal alternative to evaluate this scenario.

Scenario 2 represents expansion of existing reclaimed water uses by incorporating front and back yard residential irrigation for new construction. Factors such as increased or decreased costs for wastewater treatment, dual water systems, potable water rights dedication requirements, changes to potable water distribution pipe sizing, and connection fees were taken into consideration. In coordination with ECO:LOGIC and the NVI Group, the City of Sparks also contracted for an outside evaluation by Optimatics, Inc. to evaluate the capacity and cost differences between a conventional water distribution system, and a dual water system where residential irrigation demands were provided by reclaimed water. The results from this evaluation generally concluded that a dual water system costs about twice as much as a conventional system. This result is due to the reclaimed water system requirement for a 10 hour, night-time irrigation period, and continuation of the practice of providing fire flows with the potable system.

Scenario 3 represents one potential indirect potable reuse scenario, whereby treated wastewater is purified through an advanced treatment process, and recharged to replenish the local aquifer. For cost estimating purposes, Reno's MF-Peroxide-O3-BAC pilot treatment process was utilized, and it was assumed that the water would be recharged on Washoe County property north of the Airport in Stead, which is an area generally isolated from municipal and domestic wells.

As shown in the following Tables 1 and 2, the estimated water and wastewater capital costs for each of the three scenarios are approximately equal, based on the available information. After reaching this conclusion, the general consensus from the Group was if the region is going to spend the same amount of money in water and wastewater infrastructure regardless of which disposal or reuse scenario is implemented, we as a region should manage the investment to maximize the benefits provided by the available water resources.

From an operating cost perspective, Scenario 2 (residential reuse) is the most expensive, followed by Scenario 3, then Scenario 1. Operation of a dual water system that would provide residential irrigation, plus the additional monitoring and inspection requirements, make this alternative labor intensive compared to the other alternatives.

From a qualitative perspective, Scenario 1 would be relatively straightforward to implement, since the regulatory requirements for the status quo treatment and disposal practice are known. However, there would be a lost opportunity for Nevada to reuse the water if it were disposed of to California. Scenario 2 would provide a good use of water resources; it could defer capital costs for water system expansion and expenditures on future water importation projects, and would provide a drought proof, reliable irrigation water supply. However, this scenario would require a significant investment in pipes for the dual water system, it would be difficult to regulate, with high operations, maintenance and inspection costs, and it still requires a winter disposal solution. Scenario 3 appears to provide the most efficient use of water resources; it defers expenditures on future water importation projects, provides a drought proof, reliable water supply and a potential solution to groundwater basin over-drafting. Scenario 3 represents an investment in water quality rather than pipes. Potential long term accumulation of salts, public perception and a lack of regulatory guidance in Nevada are some of the challenges that would need to be overcome.

Table 1 – Scenario Detail

	Potential Cost Item	Scenario 1: Single Use of Water - Discharge to Long Valley Creek	Scenario 2: Residential Reclaimed Water Use	Scenario 3: Indirect Reuse
1	Cost to develop and manage a Public Outreach campaign/process ($/campaign)		2,500,000	2,500,000
2	Annual customer fees for potable water use ($/year)	3,680,000	2,350,000	3,680,000
3	Connection fees for potable water ($)	68,070,000	28,830,000	68,070,000
4	Potable water rights dedication requirements ($)	66,740,000	40,360,000	40,360,000
5	Operating costs to service potable water ($/year)	1,040,000	530,000	1,040,000
6	Customer fees for reclaimed water use ($/year)		1,590,000	
7	New reclaimed water connection/resource fee ($)	16,100,000	54,000,000	27,600,000
8	Costs associated with second system to operate and maintain (including monitoring, annual tests, inspections, treatment plant O&M) ($/year)	475,000	1,730,000	430,000
9	Costs for upgrading WWTP facilities to Category A+ water ($/project) (a)	40,100,000	39,100,000	
10	Costs for upgrading WWTP facilities to indirect potable reclaimed water quality ($/project) (a)			47,400,000
11	Cost of reclaimed distribution systems ($) (a)	16,000,000	52,100,000	17,800,000
12	Cost of developing the program and going through the required political, regulatory and public processes ($)		300,000	300,000
13	Cost of ongoing regulatory oversight ($/year)		200,000	200,000
14	Existing wastewater connection fee ($)	48,180,000	48,180,000	48,180,000
	One Time Cost	$255,190,000	$265,370,000	$252,210,000
	Annual Cost	$5,195,000	$6,400,000	$5,350,000

(a) Only pipeline capacity for 2 mgd has been included to Long Valley Creek (Scenario 1), to the reservoir (Scenario 2), and to and from the recharge area (Scenario 3). The pipe would not be built in phases; therefore, there is more initial cost than shown in the table.

Table 2 – Reclaimed Water Scenarios Cost Summary

One Time Costs			
Cost Item	**Scenario 1**	**Scenario 2**	**Scenario 3**
Wastewater treatment plant expansion (#9 or #10), and disposal pipe (Scenario 1, #11 (a))	56,100,000	39,100,000	47,400,000
Wastewater connection fee (#14)	48,180,000	48,180,000	48,180,000
Potable water right fees (#4)	66,740,000	40,360,000	40,360,000
Potable water connection fees (#3)	68,070,000	28,830,000	68,070,000
Reclaimed Water - Includes public outreach (#1), reclaimed water distribution system (#11) (a) and cost to develop reclaimed water program (#12)	0	54,900,000	20,600,000
Reclaimed water connection/resource fee (#7)	16,100,000	54,000,000	27,600,000
Total	$255,190,000	$265,370,000	$252,210,000

Table 2, Con't – Reclaimed Water Scenario Cost Summary

Annual Costs			
Cost Item	**Scenario 1**	**Scenario 2**	**Scenario 3**
Wastewater treatment plant O&M costs and pumping costs (Scenario 1) and/or reclaimed water O&M costs (#8)	475,000	1,730,000	430,000
Potable water operational costs (#5)	1,040,000	530,000	1,040,000
Potable water customer fees (#2)	3,680,000	2,350,000	3,680,000
Regulatory oversight (#13)	0	200,000	200,000
Reclaimed water customer fees (#6)	0	1,590,000	0
Total	$5,195,000	$6,400,000	$5,350,000

(a) Only pipeline capacity for 2 mgd has been included to Long Valley Creek (Scenario 1), to the reservoir (Scenario 2), and to and from the recharge area (Scenario 3). The pipe would not be built in phases; therefore, there is more initial cost than shown in the tables.

COORDINATION WITH REGIONAL WASTEWATER PLANNING / NEXT STEPS

The NVI Group presented the findings from this work to the management and director level staff of Reno, Sparks, Washoe County, TMWA and SVGID. Based on the knowledge gained throughout this year long investigation, it was decided to bring in an expert, John Ruetten of Resource Trends, Inc, to discuss the feasibility and public perception issues associated with implementation of a groundwater recharge option. Establishing feasibility is important because the ability to implement groundwater recharge using reclaimed water, or not, impacts the implementation of other forms of reuse. Resource Trends is a strategic marketing firm committed to increasing investment in water and the environment. Mr. Ruetten's work at Resource Trends includes developing marketing strategies for private-sector water companies and helping public utilities build strong brands, enhance public perceptions, and increase investment. Mr. Ruetten was the lead investigator on the WateReuse Foundation project investigating public perceptions of indirect potable reuse and has been a member of American Water Works Association Research Foundation project teams researching ocean desalination, utility communications, and the value of water.

Mr. Ruetten conducted two workshops at Washoe County DWR. The first workshop established a context for subsequent discussions about uses for reclaimed water in the Washoe County region. The presentation covered the following topics:

- Branding principles and how they relate to the value and acceptance of reclaimed water;
- The best way to lead a dialogue with the community about investing in reclaimed water; and
- The specific benefits of groundwater replenishment using reclaimed water.

The second workshop presented a series of collaborative processes designed to produce an executive summary for a groundwater recharge project using reclaimed water. Mr. Ruetten recommended a collaborative approach so that the insight and knowledge of many water industry stakeholders can be brought together in one location and consensus on several important issues can hopefully be more easily accomplished. These processes would also include the development of a community based public outreach program. In general, the desired outcome of the processes would be:

- Consensus among water industry stakeholders on the feasibility of implementing groundwater recharge;
- A clear definition of the overall water resource benefits to the region;
- A plan and agreements for addressing public health, water quality, and regulatory issues;
- A selection of the sponsoring agency for the initial project or projects; and
- An executive summary for the initial project or projects.

It is important to note that the executive summary for a groundwater recharge project using reclaimed water is intended to be a proposal designed to stimulate dialogue with community leaders. Once the community dialogue begins, the proposal can be refined based on feedback from the stakeholders. It is also important to be clear about the significance of establishing the feasibility of groundwater recharge. As stated previously, establishing the feasibility is important because the ability to implement it, or not, impacts other disposal or reuse options. In researching what has been done in other communities across the country, it has been discovered that groundwater recharge oftentimes provides the most efficient and productive use of reclaimed water resources. It can also result in higher overall water quality for the affected region. However, experience has shown that using reclaimed water to replenish potable water supplies can meet resistance due to the public's concerns about water quality. Thus, feasibility is primarily a public acceptance issue.

The primary purpose for conducting the North Valleys Initiative has been satisfied. Many of the technical, regulatory, political and financial issues associated with implementation of expanded uses of reclaimed water have been identified and evaluated at a planning level. Much has been learned regarding the use of reclaimed water for residential irrigation and groundwater recharge, and what will be necessary to move forward with implementation of one or both programs. Many questions remain, depending on what direction the region wants to take in using reclaimed water to help develop and implement solutions to provide a sustainable watershed. Groundwater recharge does not diminish the benefits of other forms of reuse, such as the current practice of non-potable irrigation reuse in specific areas and applications. However, if groundwater recharge is not accepted in Washoe County, future reclaimed water programs will be limited to non-potable applications, regardless of the compelling benefits that groundwater recharge could provide.

The North Valleys Initiative process has resulted in a broad realization that reclaimed water is not limited to one product or one type of use. Reclaimed water is a resource that can satisfy multiple purposes where the water quality is tailored to the specific use, and it can provide high quality water for people, a healthy economy, and a healthy environment.

APPENDIX A - EID/Serrano Field Trip, May 30, 2008

- Agenda & attendee list for Recycled Water Coordination Meeting at EID
- EID Recycled Water Information, including following publicly available handouts from EID:
  - Recycled Water Irrigation System Installation Overview
  - Recycled Water Orientation
  - Recycled Water and You
  - EID Recycled Water Program and Your Home
  - This Community Uses Recycled Water for Landscape Irrigation
- Serrano - Recycled Water and Your New Home
- Serrano Earns Award for Best Community Maintenance
- Serrano El Dorado Owner's Association - Top Ten Reasons Recycled Water "Plans" are Rejected
- Serrano El Dorado Owner's Association - Top Reasons Projects Fail the "Pipe" Inspection
- Serrano El Dorado Owner's Association - Top Reasons Projects Fail the "Final" Inspection
- Serrano El Dorado Owner's Association - 2008 Operating Budget, Cost Center 6 - Recycled Water
- List of additional items from EID and the Serrano El Dorado development that are available but not included in this appendix

El Dorado Irrigation District

AGENDA

Recycled Water Coordination Meeting
El Dorado Irrigation District

EID Board Room, 2890 Mosquito Road, Placerville, CA 95667
Friday, May 30, 2008 9:30 a.m. – 11:00 a.m.

El Dorado Irrigation District		**Visitors**
TOM GALLIER General Manager		**ALBERT HAZBUN** Consulting Engineer
STEVE SETOODEH Facilities Management Department Head		**BILL HETLAND** General Manager, El Dorado County Water Agency
TOM CUMPSTON General Counsel		~~**MARK FOREE**~~ Brent Smith ~~Director of Operations, Truckee Meadows Water Authority~~
TOM MCKINNEY Facilities Management Assistant Department Head		**JANELLE THOMAS** Civil Engineer, City of Sparks
ELIZABETH WELLS Wastewater/Recycled Water Co-Division Manager-Engineering		**JOANN MEACHAM** Utility Manager, City of Sparks
VICKIE CAULFIELD Wastewater/Recycled Water Co-Division Manager-Operations		**TRISH KUEHL** Senior Administrative Analyst, City of Sparks
SHANE JIANG Environmental Compliance Division Manager		**STAN SHUMAKER** Senior Civil Engineer, City of Reno
MARTY JOHNSON Environmental Compliance Division, Senior Environmental Compliance Officer		**TERRI SVETICH** Senior Civil Engineer, City of Reno
DOUG VENABLE Environmental Compliance Division, Recycled Water Coordinator II.		**MICHAEL DRINKWATER** Associate Civil Engineer, City of Reno
		JOE HOWARD Senior Licensed Engineer, Washoe County
		JOHN BUZZONE Licensed Engineer, Washoe County
		JOHN ENLOE Principal, ECO:LOGIC Engineering
		ALISSA TURNER Senior Engineer, ECO:LOGIC Engineering
		CINDY BERTSCH Associate Engineer ECO:LOGIC Engineering

El Dorado Irrigation District

AGENDA
Recycled Water Coordination Meeting

Time	Subject	Presenter
9:30-9:40am	**Introduction / Welcome**	Tom Gallier
19:40-10:10am	**Overview / Recycled Water Program Part I**	Steve Setoodeh
10:10-10:40am	**Recycled Water Program Part II**	Shane Jiang Doug Venable
10:40-11:00am	**Questions / Answers**	All
11:00am	**Adjourn**	
	NOTES	
	▪	
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El Dorado Irrigation District

El Dorado Irrigation District Recycled Water Information

May 2008

Recycled Water Irrigation System Installation Overview

The irrigation plan must be drawn in accordance with the District's Design and Construction Standards.

↓

Two sets of plans are submitted to the District; the designer should retain a copy for the homeowner.

← New Plans Submitted

Irrigation plans are revised and corrected by the designer.

↓

The District reviews plans; allow up to 15 working days for processing.

Plans NOT Approved →

If discrepancies are found, the irrigation plans are returned to the designer. The District will notify the homeowner of the plan return.

☑ **Plans APPROVED** ↓

When irrigation plans are approved, the District will mail notification to the designer and homeowner.

↓

Construction may begin by a contractor from the District's Approved Contractor List.

↓

Open trench inspection will be scheduled when irrigation pipe construction is ready; please call (530) 642-4194 and allow 48 hours for inspection.

↓

Final Inspection will be scheduled after the approval of the open trench inspection, the landscape construction is completed, and irrigation timers are set; please call (530) 642-4194 and allow 48 hours for inspection—homeowner or contractor are required to be present.

Congratulations!

YOU ARE INVITED TO ATTEND
EL DORADO IRRIGATION DISTRICT'S
RECYCLED WATER ORIENTATION

Please email or call to *<u>reserve a seat and packet</u>* for one of the scheduled Recycled Water Orientations.
Marie Gennette at mgennette@eid.org or (916) 933-6922

Dates: Wednesday- April 16, 2008
Wednesday- May 14, 2008
Wednesday- June 18, 2008
Wednesday- July 16, 2008
Wednesday- August 13, 2008
Wednesday- September 17, 2008

Time: 12:00 p.m. – 1:30 p.m.

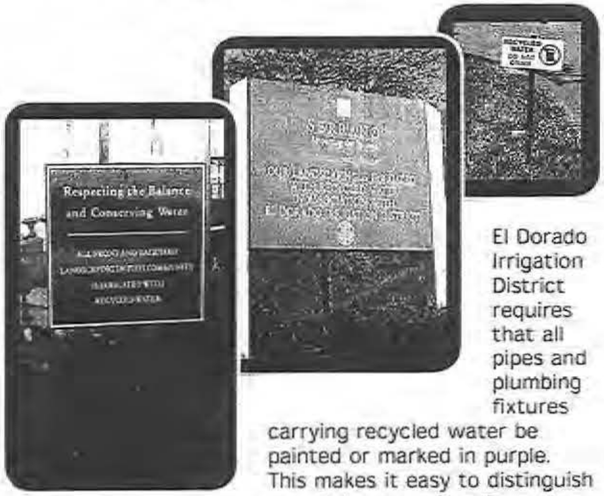
Place: The Lodge @ Four Seasons
3186 Four Seasons Drive
El Dorado Hills, CA 95762

(Latrobe Road, west on White Rock Rd, left at Four Seasons Drive)

The orientation will explain the District's recycled water guidelines and requirements. There will be a review of the plan approval and inspection process to help prevent costly mistakes in the design, bidding and installation of backyard landscaping.

All homeowners, designers, and contractors working in dual-plumbed communities are required to attend an El Dorado Irrigation District workshop explaining the uses and regulations of recycled water before any design or installation begins. All designers and contractors are required to attend this orientation every 18 months. Homeowners need attend one-time only.

Look for recycled water signs in your community



El Dorado Irrigation District requires that all pipes and plumbing fixtures carrying recycled water be painted or marked in purple. This makes it easy to distinguish recycled water pipes from those for drinking water.

And EID requires every development that uses recycled water to display signs about recycled water. The signs serve several purposes. First, they convey a sense of community pride. All customers who use recycled water for irrigation can be proud of their wise use of California's scarce water resources. Second, they indicate that strict water quality regulations are being followed for producing EID's recycled water.

Third, the signs remind people that while recycled water is excellent for irrigation, it is not for drinking. It is also not for use in swimming pools, spas or other backyard water features.

El Dorado Irrigation District
2890 Mosquito Road
Placerville, CA 95667

El Dorado Irrigation District

Recycled Water and You

What EID recycled water customers need to know and do

Serrano community uses recycled water to irrigate landscapes, including residential yards.

In EID's service area, recycled water irrigates:

- residential front and back yards
- golf courses
- decorative ponds
- street medians
- parks
- school landscapes
- dust at construction sites

About recycled water

- It's used around the world — in California, starting in 1929 with the City of Pomona's treatment of wastewater for irrigation.
- San Francisco, in 1932 — the first California city to build a plant just to produce recycled water.
- Irvine Ranch Water District in Orange County, in the water recycling business for nearly 30 years. Even supplies recycled water to toilets and urinals in high-rise office buildings.
- California now has more than 300 water recycling plants in operation.
- EID is the first utility in California authorized for back-yard irrigation with recycled water.

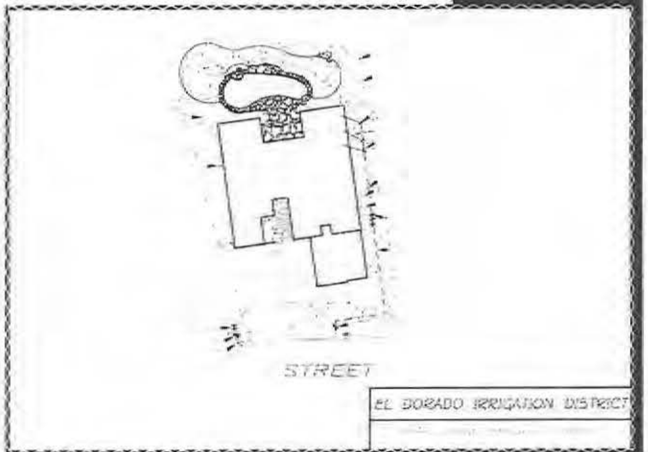
If you choose to design and install your own system, you must first attend the recycled water orientation. Your design and installation must meet recycled water on-site design and construction standards for residential sites.

If you choose not to design and install your own system, EID has a list of designers and contractors authorized to work with landscapes irrigated by recycled water. If you choose people or firms not on the list, they must attend the recycled water orientation.

Required documents

Visit EID's website at www.eid.org and refer to the Public Information Document Library page to download documents containing information about the recycled water process and use. Or call us so we can send you the documents.

Read the Recycled Water On-Site Design and Construction Standards for Residential Sites and the Recycled Water Use Guidelines for Residential Use. Make sure you have a copy of the Standard Details for On-Site Recycled Water Notes, shown below.



Important

In homes plumbed for both drinking and recycled water, EID must perform a test to ensure that there are no cross-connections between the two systems.

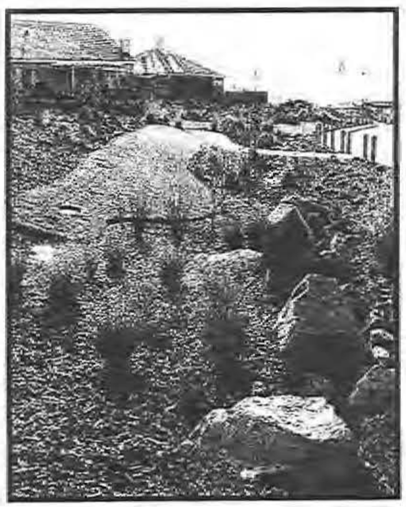
Contact Marie Gennette at 530-642-4038 or mgennette@eid.org to schedule an appointment for this test when you first move into a dual-plumbed home.

Also, ask Marie about upcoming, mandatory recycled water orientations. Remember: home-owners, renters, designers and installers in homes and other buildings served by recycled water must attend an orientation.

Backyard in Serrano irrigated with EID's recycled water.

Why use recycled water?

- Using recycled water for irrigation saves drinking water supplies for our area's growing population.
- You can save money and keep your landscape looking great. Recycled water costs 20% less than drinking water and provides nutrients for your lawn and plants.
- Recycling wastewater that would otherwise be released into local streams and creeks helps stimulate natural flows.



THINK GREEN GO PURPLE

El Dorado Irrigation District

2890 Mosquito Road
Placerville, CA 95667
Main: (530) 622-4513

Find us online at www.eid.org

for more information contact:

Doug Venable
Recycled Water Coordinator
Phone: (530) 642-4081
dvenable@eid.org

Marie Gennette
Recycled Water Coordinator
Phone: (530) 642-4038
mgennette@eid.org

El Dorado Irrigation District

Recycled Water Program

and your home

K. Hovnanian Homes

El Dorado Irrigation District's Recycled Water Program

▲ Construction ready to begin

Your backyard irrigation plan

Do-it-yourself... If you choose to design your backyard landscaping, you need to submit a plan following the *Design and Construction Standards* to EID for approval after first attending an EID workshop.

Hiring a contractor... EID requires that your contractor be on the District's authorized contractor list. Your HOA has a copy, or you can visit www.eid.org and click on recycled water. All contractors on the list have attended the recycled water orientation.

Remember... no construction should begin on your landscape until EID approves your irrigation plans.

Recycled Water Orientation

EID's professional recycled water staff will answer questions about your dual-plumbed home. The orientation covers the plan submittal and inspection process. This workshop is offered each month and is a requirement for residents, designers, and contractors to attend. Please refer to your HOA or EID's website for the next scheduled workshop.

What is recycled water?

Recycled water comes from wastewater collected from the El Dorado Hills area that is treated, purified, and disinfected. This level of treatment is called *tertiary,* and it meets state requirements for irrigation. The water is delivered to your home in a completely separate system of purple pipes.

▲ Recycled water irrigation

Is recycled water safe?

Recycled water is carefully monitored to protect public health and safety, and it is strictly regulated by the state Department of Health Services and the Regional Water Quality Control Board. It is safely used for irrigation of home landscapes, vegetable gardens, parks, schoolyards, golf courses, and agriculture throughout California. However, recycled water is not for human consumption.

Check your progress...

Attend a recycled water workshop.

Read the EID Design and Construction Standards.

Hire a contractor from the authorized list or design the irrigation plan yourself.

Submit the plan to EID for approval.

Construction begins by an authorized contractor. Or do it yourself.

EID approves installation.

Landscaping is completed.

EID checks system...you're done!

What is recycled water?

Recycled water is wastewater that has been highly treated and disinfected to produce water of suitable quality for many appropriate purposes. These purposes include irrigation of front and back yards, parks, school grounds and golf courses, restoration of habitat, and various industrial uses.

Water recycling reduces the amount of freshwater required for non-potable uses. This helps to ensure that the best and purest sources of water will be reserved for the highest use — drinking water.

El Dorado Irrigation District
2890 Mosquito Road
Placerville, CA 95667

El Dorado Irrigation District

This Community Uses Recycled Water for Landscape Irrigation

El Dorado Irrigation District

Why it's safe

EID's recycled water undergoes three careful levels of treatment to meet some of the most stringent standards in the world. The final treatment includes filtration and the addition of disinfectants such as chlorine to destroy bacteria, viruses and other pathogens. The combined treatment processes mimic nature's own purifying actions. The result? High-quality water that is odorless, colorless and pure enough for human contact, but not for human consumption.

Recycled water facilities are kept completely separate from drinking water. other hardware for recycled water are clearly distinguishable from potable water fixtures to avoid mixing the two supplies. They are colored purple and labeled "Recycled Water, Do Not Drink".

Did you know?

In 15 years, California's population will stand at 49 million. As the state's population grows, adequate and reliable water supplies will become critical. The California legislature has declared recycled water a key component of those supplies.

Recycling water is important

For many communities, an investment in recycled water solves many problems at once. Recycled water helps conserve drinking water and provides a drought-resistant water supply.

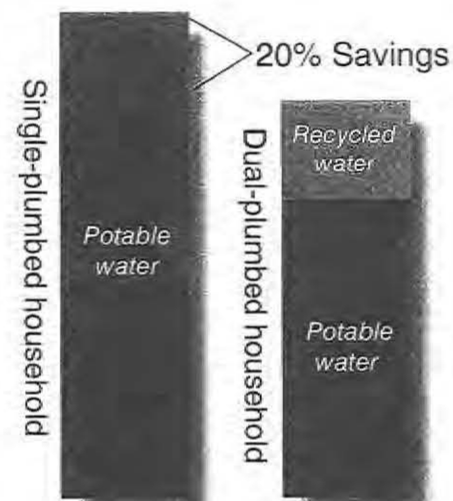
As a reliable supply of water for landscaping, recycled water helps keep yards, parks, street medians and other areas healthy. This enhances the quality of life in our communities.

Use of recycled water also helps the environment It reduces the need to discharge treated wastewater into creeks and streams.

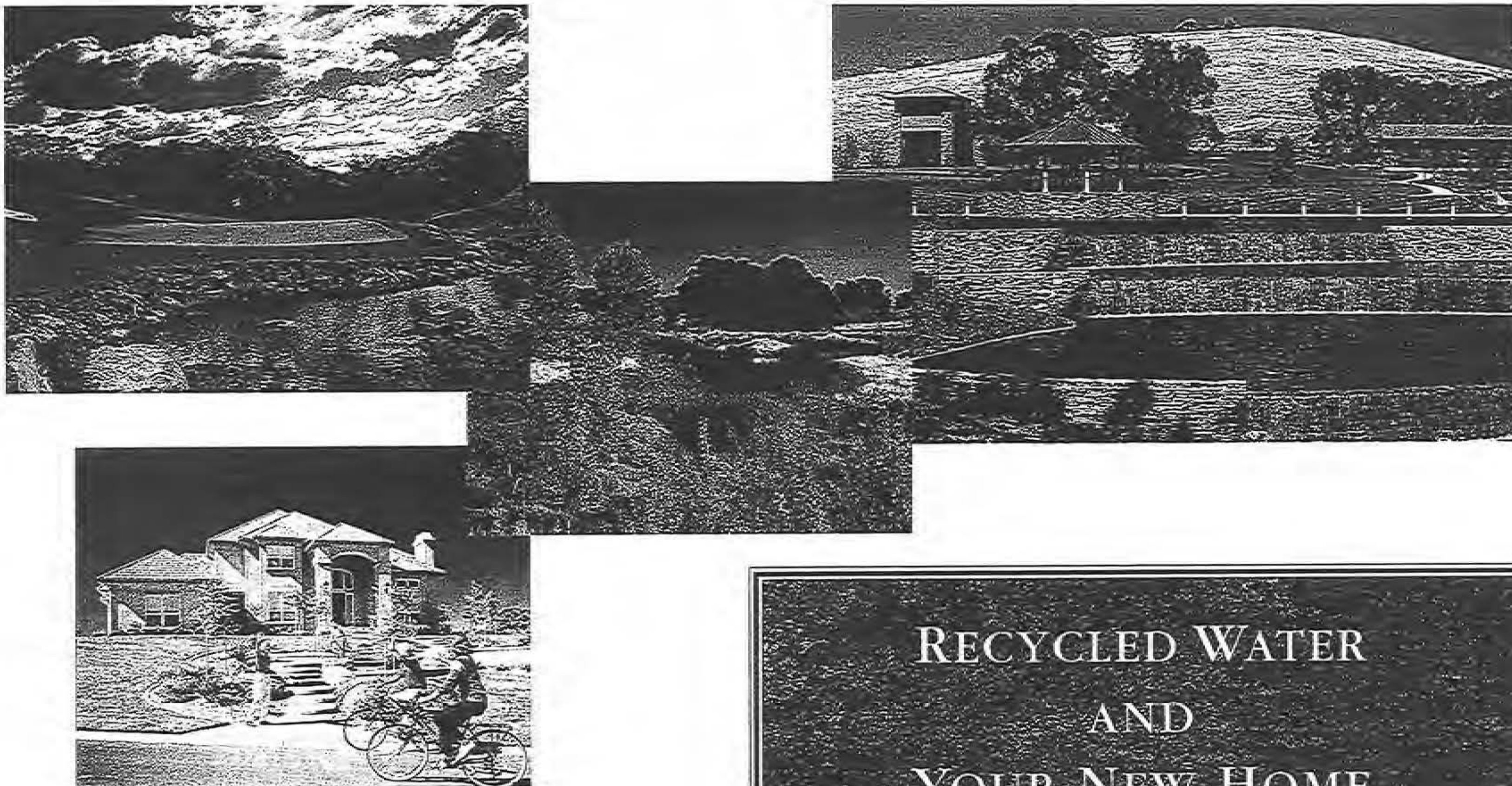
The benefits to you

Recycled water customers can feel good about being active participants in the efficient use of water and in knowing that they are helping to protect our valuable water resource. Customers will also realize cost savings! The use of recycled water frees up drinking water that would otherwise be used for irrigation. This means savings on drinking water infrastructure projects — savings that all water customers enjoy.

Annual Water Costs for the Average EID Residence



For more information about the recycled water program at this community, contact El Dorado Irrigation District at (530) 642-4038.



RECYCLED WATER AND YOUR NEW HOME

ANSWERS TO SOME IMPORTANT QUESTIONS

SERRANO

Named "Project of the Year" by the WaterReuse Association of California

RESPECTING THE BALANCE BY CONSERVING OUR MOST VITAL RESOURCE

Serrano was named "1998 Project of the Year" by the WaterReuse Association of California for its continuing expansion of a water recycling program which helps eliminate wasting limited drinking water supplies on landscape irrigation.

This commitment to water conservation reflects Serrano's reputation as a dynamic planned community and an exceptional place to live.

Serrano's developers built the backbone of its water recycling system in 1993 and have spent more than $9 million on the treatment, storage and distribution system.

Serrano's recycled water system now includes the irrigation of landscaping in many of the new homes. Homeowners within many of Serrano's new home villages are part of a growing effort to conserve one of the planet's most vital resources.

What is recycled water?

Recycled water comes from waste-water that is treated and purified to remove sediments and impurities. The level of treatment is called *tertiary*. It meets state and federal requirements that are close to drinking water standards; however, as an extra precaution, recycled water may not be used for human consumption.

Where does Serrano's recycled water come from?

It comes from the El Dorado Irrigation District's wastewater treatment plants. After undergoing a stringent filtration and purification process, it is conveyed through a series of irrigation lines that are completely separate from drinking water pipelines.

Step One
Wastewater from homes and businesses enters the treatment plant.

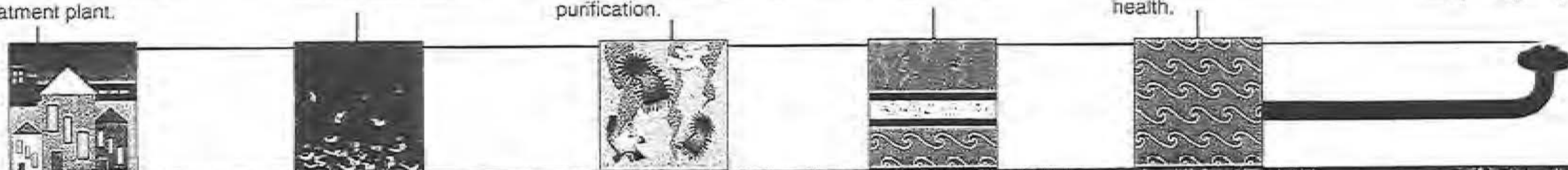
Step Two
Solid matter is settled out of wastewater.

Step Three
Bacteria digest more solid material, promoting water purification.

Step Four
Water is processed through filters.

Step Five
Water is disinfected to protect the public's health.

Step Six
Recycled water is pumped from the treatment plant through a system of pipes used exclusively for transporting recycled water.



Where will recycled water be used within Serrano?

In 1999, Serrano expanded its use of recycled water from golf course, greenbelt, parks and play field applications to irrigation of front and back yards in all new subdivisions where the infrastructure is available. Serrano will continue to use recycled water for golf courses, greenbelts, parks and playing fields in areas which can be physically served by the system.

Why did Serrano decide to use recycled water?

Using recycled water is an element of Serrano's philosophy that emphasizes preservation of the environment. As California's water supplies are stretched, using recycled water for irrigation preserves drinking water supplies and water for creeks, rivers and wetlands. Recycled water is an integral component of California's water supply plan, and Serrano's use of recycled water puts it at the forefront of a trend toward environmentally sensitive development.

How does recycled water get to the community and new homes?

Recycled water is delivered through a series of purple-colored pipelines that are separate from drinking water pipelines. Each home will have two completely separate water meters, one for drinking and domestic purposes, and the other for irrigation.

Is recycled water safe to use?

Yes. Recycled water must meet stringent regulatory requirements monitored by the State Department of Health and the Regional Water Quality Control Board, so that there is a high level of safety for homeowners and workers. In 40 years of use, there has never been a documented case of anyone becoming ill from recycled water use used in strict accordance with the regulations of the California Department of Health Services.

Is there any chance of mixing up the two water systems?

Connected correctly, there is no chance of the two water systems intermingling. A "backflow prevention device" that is required for the drinking water pipeline system will be installed when a home is constructed. In the case of a cross-connection between the two systems, this device will prevent the contamination of the drinking water system. This device will be inspected annually.

Are there any restrictions or precautions?

Homeowners receive a manual that describes how the recycled water system must be constructed. Assuring that the recycled water lines are kept separate from drinking water lines is the primary objective. Although recycled water quality is close to drinking water standards, drinking it is prohibited. Once the homeowner's back yard recycled water system is installed, an inspector will check to make sure that it has been constructed according to specifications.

Will recycled water affect landscaping?

There will be no differences for landscaping with the recycled water. The important elements of successful landscaping - soil management, fertilizers and irrigation — are the same as with domestic water.

What about swimming pools?

Swimming pools will receive potable water. Water lines made of copper will be required to avoid any inadvertent cross connection with the purple plastic recycled water lines running in the yard.

How will using recycled water benefit homeowners?

During California's normal drought cycles, many communities are prohibited or limited from receiving water for the irrigation of lawns, golf courses and parks. However, Serrano's recycled water system enables homeowners on the system to continue to irrigate with very minor water reductions. Therefore, Serrano is more likely to stay lush and green throughout droughts.

How much will recycled water cost homeowners?

Recycled water rates for homeowners are less than drinking or domestic water, and the recycled water will be measured with a separate meter. Both domestic and irrigation uses will appear on the same water bill.

How can I obtain more information about how to landscape and maintain my backyard?

New homeowners under this program will receive information that will detail the specifications for installing a recycled water irrigation system. Recycled water pipes are colored purple, which distinguish them from drinking water lines. Designated home improvement stores carry the purple pipeline and supplies that homeowners will need to install their new systems. If you have any questions about installing your irrigation system, please call the Serrano Owners Association at (916) 939-1728.

How do I find a landscape contractor who is knowledgable about installing a recycled water irrigation system?

All landscape contractors who are hired to install a recycled water irrigation system must be authorized by the Serrano Owners Assocation. The Association maintains a list of authorized contractors who have attended a Recycled Water Workshop, required for any contractor who intends to design, install or modify irrigation on a dual plumbed lot. The 90-minute workshops are offered every quarter and are also open to homeowners. For a list of authorized contractors or for a workshop schedule, please contact the Association.

SERRANO

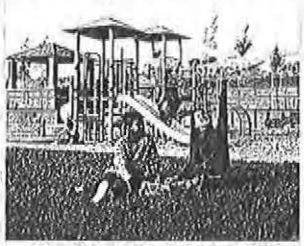
For additional facts and documentation on recycled water, stop by or call the Serrano Visitors Center located at:

4525 Serrano Parkway, El Dorado Hills, California 95762

916/939-1728 Owners Association 916/939-3333 Visitors Center

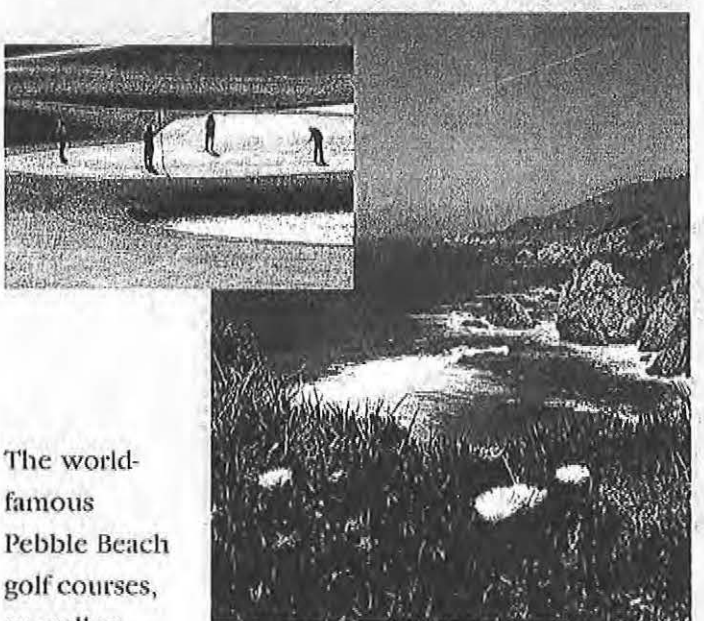
www.serranoeldorado.com

Other Places Using Recycled Water Today

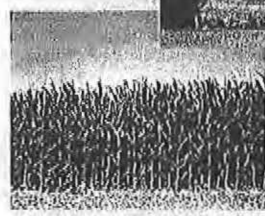


Recycled water has been used successfully throughout California, Florida, South Carolina and Texas for the past 40 years.

The City of Irvine, for example, has been using recycled water for homes, greenbelts and common areas, parks, schools, and agriculture for the past 27 years. Irvine's luxury home communities in Wishbone Estates and Pelican Hill use recycled water for front and rear yard irrigation.

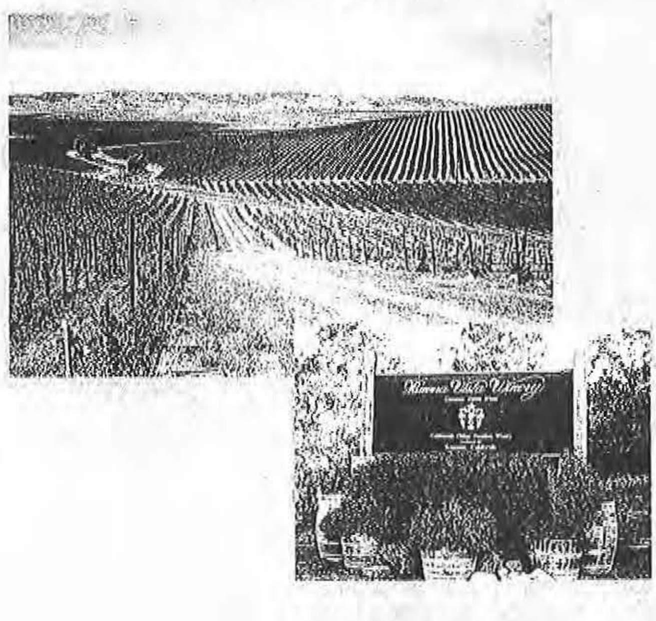


The world-famous Pebble Beach golf courses, as well as other recreational and open space areas in Carmel are irrigated with tertiary-treated wastewater. The system reduces the outflow of secondary-treated wastewater to Carmel Bay.



The City of San Jose has constructed a 60-mile pipeline system that is delivering recycled water to golf courses, parks, schools, agriculture and industry. It is projected that California will be using 1 million acre-feet* of recycled water by the year 2010. This amount of recycled water conserves drinking water for 1.5 million homes.

Many Northern California wineries use recycled water to irrigate their vineyards, including Wente, Korbel, Gallo and Buena Vista wineries.



SERRANO

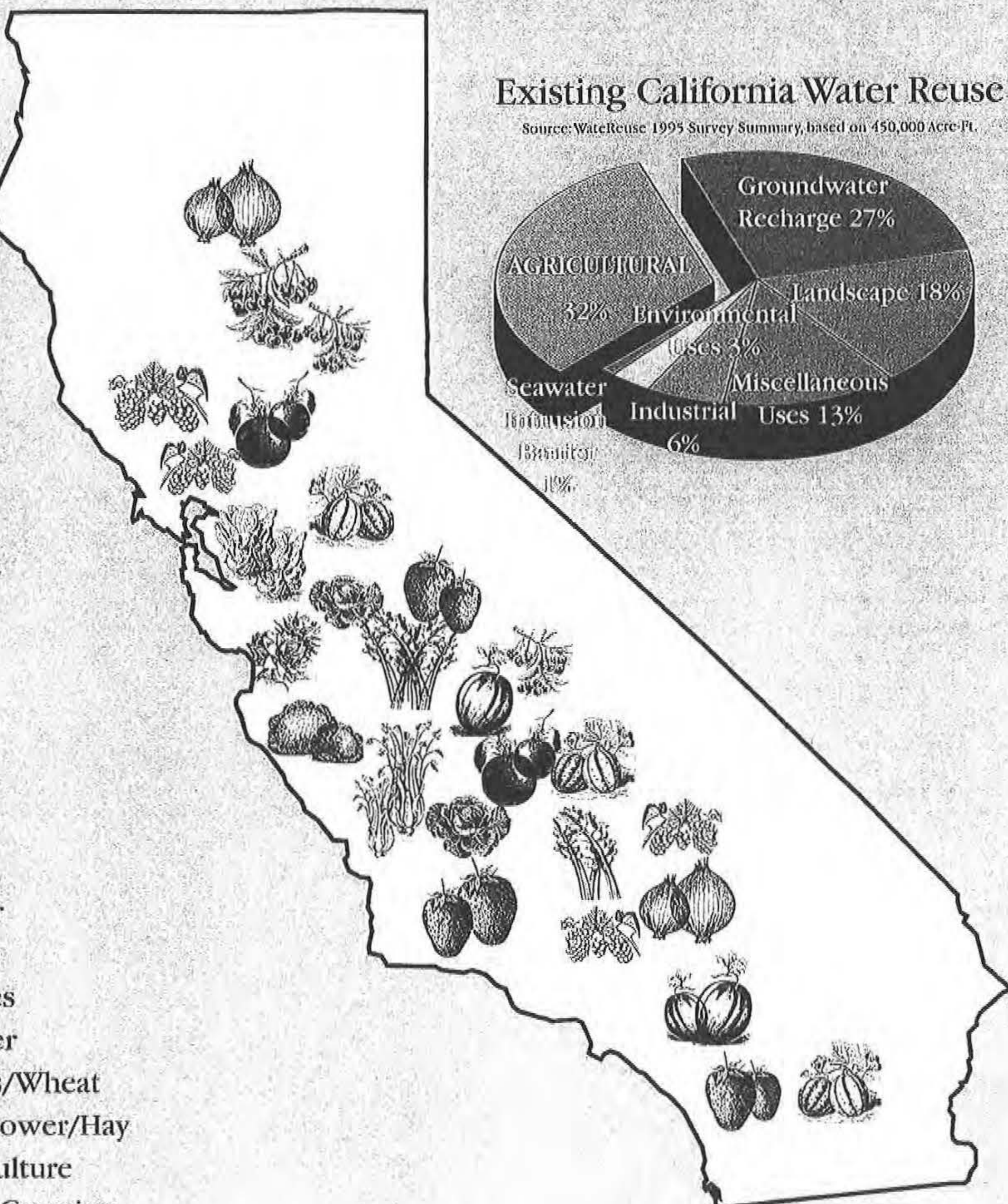
For additional facts and documentation about recycled water, contact the Serrano Visitors Center at (800) 866-8786 or (916) 939-3333.
E-mail: marketing@serranoeldorado.com

** An acre foot equals approximately 326,000 gallons*

WATEREUSE ASSOCIATION

Current Crops Grown With Recycled Water

Corn
Beans
Cotton
Celery
Herbs
Grapes
Broccoli
Lettuce
Onions
Squash
Orchards
Cabbage
Artichokes
Cucumbers
Avocados
Walnuts
Oranges
Peppers
Tomatoes
Pumpkins
Grapefruits
Cauliflower
Sugar Beets
Strawberries
Feed/Fodder
Barley/Oats/Wheat
Alfalfa/Safflower/Hay
Sod/Horticulture
...And Still Growing



SERRANO EARNS AWARD FOR BEST COMMUNITY MAINTENANCE

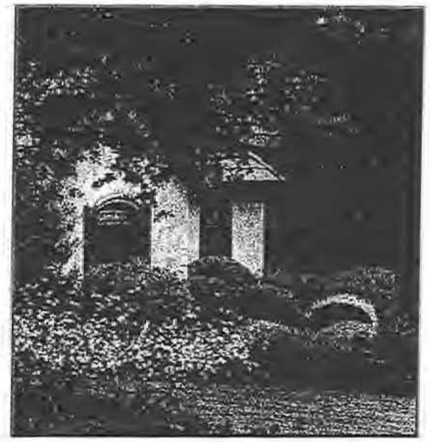
Serrano's homeowner association has been named "Best-Maintained Association" in 2006 by the California North Chapter of the Community Associations Institute (CAI). The award recognizes Serrano's excellence in landscaping and maintenance services.

The award is also reflective of Serrano's enduring value to its residents. Families choose Serrano for their home in part because of the beauty of the community, established by the quality of the land improvements. As members of the association, homeowners can be secure in knowing that their surroundings will be maintained in accord with the high quality that they experienced upon purchase.

As the working arm of the community's developer, the Serrano El Dorado Owners' Association is the key provider of Serrano's pristine beauty. The Association's maintenance and landscaping team maintains the common areas and residential villages within Serrano's 3,500 acres. Day-to-day operations include the upkeep of neighborhood parks, gated village entries, landscaped roadways and common areas.

Perhaps more telling to the large scope of the association's award-winning efforts is the additional maintenance of 2,800 front yards. Serrano's homeowners enjoy having their front yards kept up on a frequent basis, including grass, trees and plants.**

** Not applicable for custom homes



SERRANO

El Dorado

Owners' Association

Top Ten Reasons Recycled Water "Plans" are Rejected

1) The copper fill line for a existing or proposed pool is not shown on the irrigation plan.

2) A fountain, spa or other potable water use feature is shown on the plan but there is no-fill line shown or no note saying "No-Fill Line".

3) The irrigation plan does not clearly show the entire irrigation system, from point of connection to sprinkler.

4) The plan is not scaled, the scale is not indicated, or the scale is not standard (use 1"= 4', 1"= 8' or 1"= 10').

5) There is no irrigation legend incorporated on the plan, or the legend does not demonstrate compliance with recycled guidelines (i.e. in-line valves, purple pipe, recycled water I.D. tags on valves and recycled water label on controller, etc.).

6) Sprinkler heads are not properly spaced per manufactures specifications (uneven spacing, not enough coverage, over-spray).

7) The irrigation plan does not indicate the <u>actual Gallons Per Minute</u> for each valve. (There is a max. of 15 GPM.)

8) Shrubs are irrigated with overhead spray, not drip irrigation.

9) The designer does not list their company name on the plans or the designer is not on our "authorized" list.

10) The plan has no indication that the lot uses recycled water, and the "Serrano Typical Recycled Water Notes and Details" are not attached and referenced on the plan.

SERRANO

El Dorado

Owners' Association

Top Reasons Projects Fail the "Pipe" Inspection

The Association requires "pipe" or "open trench" inspections after your water lines are in the ground, but before they are covered. Below are common reasons this inspection is failed.

1) Contractors call for the inspection before the plans are approved.
2) There is no compliance deposit on file for this project.
3) The depth of the purple pipe does not meet the minimum requirement (12" deep).
4) The contractor installed "anti-siphon" valves instead of "in-line valves".
5) The water lines are covered up or partially covered at the time of the inspection.
6) Copper water lines are closer than 10 feet to a recycled main line.
7) The installation does not match the approved plans.

SERRANO

El Dorado
Owners' Association

Top Reasons Projects Fail the "Final" Inspection

Once your project is complete and your access route is fully restored, call the Association for a Final Inspection and return of your compliance deposit. Generally, the inspectors are looking to see if your project is installed consistent with your approved plan, or if any variances from your plan are in violation of the guidelines. Below are common reasons that projects fail the Final Inspection.

1) Trees are planted closer to a fence than 5 (five) feet.
2) There are no recycled water I.D. tags on the valves or the recycled I.D. label is not on the controller.
3) The air-conditioner unit or pool equipment is not properly screened.
4) The grade has been raised within 2 (two) feet of a fence.
5) The concrete is not per plan and is too close to the fence.
6) There are drain inlets installed in the lawn area.
7) The drain outlet discharges onto open space, or runoff from irrigation is draining onto open space.
8) The project is incomplete, with trees or significant plants missing, or bark mulch not installed.
9) The access route is not fully restored with the fence and fence hardware painted and two drip emitters to each shrub.

Serrano El Dorado Owners' Association
2008 Operating Budget
Cost Center 6 - Recycled Water

	Budget 2008
OPERATING COSTS	
Backflow Testing / Inspections	$ 216,000
Supplies	9,600
Administrative Supplies	4,800
Education & Affiliations	3,000
Minor Repairs	3,200
Sub Total	**236,600**
RESERVE CONTRIBUTION	
Per Reserve Report	61,285
OTHER EXPENSE	
Contingency	-
TOTAL ALL EXPENSES	**$ 297,885**
INCOME	
Member Assessments	$298,900
Prior Year Carry-over	-
TOTAL ALL INCOME	**$ 298,900**
EXCESS REVENUE (EXPENSE)	**$ 1,015**

NVI Wrap-Up Report

List of additional items from EID and the Serrano El Dorado development that are available but that are not included in the appendix:

From EID/Serrano tour on Friday, May 30, 2008:

1. Recycled Water On-Site Design and Construction Standards for Nonresidential Sites
2. Recycled Water Use Guidelines for Nonresidential Sites
3. Recycled Water On-Site Design and Construction Standards for Residential Dual Plumbed Homes
4. Recycled Water Use Guidelines for Residential Dual Plumbed Homes
5. El Dorado Irrigation District Recycled Water Standard Details
6. El Dorado Irrigation District Board Policy
7. *Recycled Water User's Manual for Dual Plumbed Homes in Serrano*, prepared by the Serrano El Dorado Owners Association, 4525 Serrano Parkway, El Dorado Hills, California 95762-4231, Revised August 2001
8. *Serrano El Dorado Standard Lots: Residential Landscape Design Guidelines - Backyard*, Revised April 2008
9. Example Work Orders for inspections of residential water line installations within Serrano

From Presentation to NDEP by Albert Hazbun and Doug Venable, EID Recycled Water Coord. II, at the City of Reno Council Chambers on Wednesday, October 1, 2008:

10. Bound package of background documents that led to the approval for the use of recycled water in a dual-plumbed system at the residential community of Serrano El Dorado in El Dorado Hills, El Dorado County, California, which includes:
    - California Department of Health Services documents pertaining to the use of recycled water
    - Correspondence leading to the approval of the Serrano project
    - Serrano El Dorado Owner's Association Recycled Water Manual
    - Correspondence regarding project approval
    - Correspondence with the California Department of Health Services regarding the operation of the project during the first year of operation

APPENDIX B - Preparation of Technical Information and Related Research

- Draft (Regional) Reclaimed Water Ordinance (V3.0)
- Draft Reclaimed Water Distribution System Design and Construction Standards (V3.0)
- Draft Non-Residential On-Site Reclaimed Water Design and Construction Standards (V2.0)
- Draft Residential On-Site Reclaimed Water Design and Construction Standards (V2.0)

REGIONAL RECLAIMED WATER ORDINANCE AND STANDARDS

BACKGROUND

Washoe County, Sparks, and Reno, all have different reclaimed water regulations. Below is a summary of each entity's regulations.

Washoe County: Uses a reclaimed water ordinance that describes policy, fees and technical standards (Washoe County Ordinance number 1299, adopted May 23, 2006).

Sparks: Sparks modified Washoe County's ordinance into an ordinance, (Municipal Code Chapter 13.85 Effluent Service), and reclaimed water treated effluent design and performance standards, (City of Sparks Reclaimed Water Treated Effluent Design and Performance Standards, updated April 27, 2007).

Reno: Reno modified the performance standards from Sparks by changing the City name from Sparks to Reno (City of Reno Chapter IX Reclaimed Water Treated Effluent Design and Performance Standards, updated May 4, 2007). Reno does not have an ordinance that discusses policy or fees.

REGIONAL ORDINANCE AND STANDARDS

Draft regional reclaimed water ordinance, and standards were developed through meetings with NDEP, Washoe County District Health, TMWA, Reno, Sparks, Washoe County, and Sun Valley GID. The ordinance and standards are composed of the following components.

- Ordinance
- Distribution System Standard
- On-Site Nonresidential Standard
- On-Site Residential Standard
- Standard Drawings

A schematic of how the standards relate to each other is shown on Figure _. The ordinance was constructed to allow for a regional reclaimed water purveyor, or for each entity to adopt the ordinance. The ordinance refers to a "Purveyor" that could be replaced by each entity, such as Washoe County, Reno, Sparks, or represent a new regional entity.

Residential irrigation is currently not allowed. The on-site residential irrigation standard was developed in case the regulations change. The residential irrigation standard is stand-alone and may be removed in the future. One sentence in the ordinance referring to residential irrigation would need to be removed, if residential irrigation is no longer an option.

Ordinance and Standards Status

The ordinance and standards have been through several revisions based on comments from each entity. In general, sections that need more explanation are written in blue text. All of these documents still need legal review by the legal department of each entity. The detailed status of each component is described in the following paragraphs.

Ordinance: A few details need to be finished such as including more description on water quality requirements, connection requirements for parcels X distance from existing pipes, and for parcels with X flow. The rates and fees also need to be added.

Distribution System Standard: The distribution system standard is well developed.

On-Site Nonresidential Standard: The on-site nonresidential standard is well developed.

On-Site Residential Standard: The type of backflow prevention that will be required for each house is ~~still to be~~ not determined.

Standard Drawings: The standard drawings that are part of Sparks' regulations will be used as a starting point. These standard drawings have not been developed.

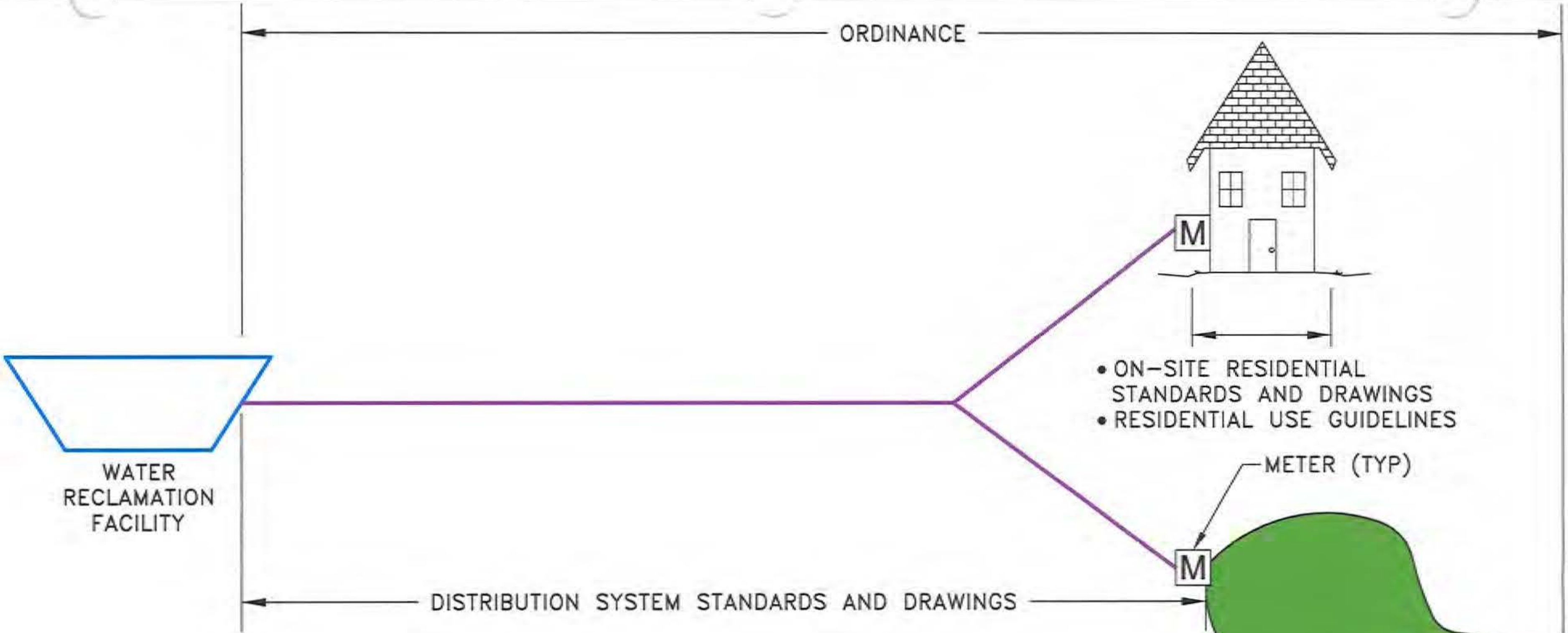
Permitting Responsibility

Each reclaimed water use area may require different permits. For each of the permitting components, the end user, or the purveyor may be responsible. A draft description of the responsible party for each type of user is listed in Table_.

Table_

Permitting Responsibility

	Governing Agency-NDEP			Governing Agency-Reclaimed Water Purveyor				
Type of User	**Effluent Management Plan (EMP)**	**Groundwater Discharge Permit**	**On-going Monitoring and Reporting**	**Applicable On-Site Standard**	**User Application**	**User Agreement**	**Site Specific Plan/ O&M Manual**	**Deed Restriction**
Non-residential (agriculture, commercial or multi-family common area landscaping, streetscaping, parks, schools, truck fill)	Covered under Purveyor's master EMP	Covered under Purveyor's master permit	Purveyor	Non-residential	User to prepare	Purveyor to prepare	Purveyor	None
Large commercial or industrial (golf course corporations, large commercial corporations)	User responsible	User responsible	User	Non-residential	User to prepare	Purveyor to prepare	Not required as there is an EMP specific to this user	None
Single-family residential development	Covered under Purveyor's master EMP	Covered under Purveyor's master permit	Purveyor	Residential	User to prepare	Purveyor to prepare	Purveyor	Purveyor



ORDINANCE

- AUTHORIZED AND MANDATED USE OF RECLAIMED WATER
- SUITABILITY OF RECLAIMED WATER SUPPLIES
  –REFERENCE TO TECHNICAL STANDARDS AND DRAWINGS
- DETERMINATION OF REQUIRED USE
- CONSTRUCTION AND INSPECTION OF FACILITIES
- PERIODIC TESTING AND INSPECTION
- DISCONTINUATION/INTERRUPTION OF SERVICE
- MISUSE OF RECLAIMED WATER
- FINES AND PENALTIES

ORDINANCE APPENDIX

- RATES
- MISCELLANEOUS FEES/CHARGES/DEPOSITS
- USER AGREEMENT/APPLICATION

ECO:LOGIC
ENGINEERS · CONSULTANTS
10381 Double R. Boulevard
Reno, Nevada 89521
Phone: (775) 827-2311
Fax: (775) 827-2316

TRUCKEE MEADOWS
RECLAIMED WATER
ORDINANCE AND STANDARDS

DESIGNED	CVB	DATE	JULY 2008	JOB #	RENO08-002
DRAWN	RJG	CHECKED	CVB	SCALE	NONE

Draft Reclaimed Water Ordinance

Notes To Reviewer

- **Text in red is dependent on multiagency acceptance, and probable state regulatory revisions. Text may be removed.**
- **Comments are in blue. These areas still need work.**
- **Purveyor will be defined in each ordinance (i.e. Reno, Washoe County, Sparks)**
- **Rates and fees will be specific to Reno, Washoe County, Sparks**

1.0 AUTHORIZED AND MANDATED USE OF RECLAIMED WATER

The use of reclaimed water is required, as defined herein, for non-domestic purposes when such water is of adequate quality and quantity, not detrimental to public health, and not injurious to waters of the state, plant life, fish, and wildlife. The types of use mandated by this Ordinance are consistent with the allowable uses of reclaimed water defined in Nevada Administrative Code Section 445A.2762. In general, property subject to mandatory reclaimed water use are defined in the most current version of the reclaimed water Purveyor's (Purveyor) Reclaimed Water Master Plan.

Furthermore, water users are encouraged to seek opportunities where non-domestic use of potable water can be converted to reclaimed water.

2.0 SUITABILITY OF RECLAIMED WATER SUPPLIES

Reclaimed water supplies shall meet all criteria for Category A treated effluent as described in the Nevada Administrative Code Section 445A.2762.

Note: we need to further discuss and present in this section more water quality conditions, such as agronomic, odor, color, TSS, etc. If we are going to allow exceptions to mandatory use based on water quality, we should define the water quality conditions. However, we want to avoid guaranteeing a certain water quality.

3.0 MASTER PLAN

Purveyor shall develop and implement a Reclaimed Water Master Plan to define the use of reclaimed water within its boundaries. The Master Plan shall be updated no less than every five years. The Master Plan shall include, but not be limited to, the following:

- Reclaimed Water Use. Reclaimed water uses may include, but are not limited to, the irrigation of residential or multi-family landscape areas, greenbelt and agricultural areas, cemeteries, golf courses, parks, road side landscapes and median strips, filling impoundments, construction water, processing water and other appropriate industrial and commercial uses.
- Reclaimed Water Service Areas. Definition of reclaimed water service area with estimation of current and future demands and available supply.
- Plants and Facilities. Evaluation of the location and size of present and future treatment facilities, distribution pipelines, pump stations, reservoirs, storage tanks, and other related facilities, including cost estimates and potential financing methods. Cost estimates shall include analysis of existing and future operating and maintenance costs, including staffing needs, and revenue sufficiency.

4.0 DETERMINATION OF REQUIRED USE

The criteria for determining whether reclaimed water is feasible for a particular property or non-domestic use include the following factors:

- The property is located within an area as defined in the most current version of the Purveyor's Reclaimed Water Master Plan.
- The property is located within XXXX feet of an existing conveyance facility. Alternatively, if the reasonable estimated reclaimed water demand associated with a property or project exceeds XXXX gallons per year, the Purveyor shall consider the projected cost of supplying, storing, and delivering the reclaimed water relative to the cost of providing potable water service for the same amount of water and make a determination on the requirement for using reclaimed water.
- Reclaimed water is of adequate quantity and quality for the intended use and does not require on-site treatment beyond that required for potable water.
- The use of reclaimed water is consistent with all applicable federal, state, and local laws and regulations.
- The use of reclaimed water will not be detrimental to the public health and will not adversely affect waters of the State, plant life, fish and wildlife.
- As determined by the Purveyor.

5.0 NEW CONSTRUCTION OR MODIFICATION OF FACILITIES

All plans for the construction of new, or modification of existing on-site and off-site reclaimed water facilities shall be submitted to the Purveyor for review and approval prior to construction. All construction plans shall be in conformance with the *Reclaimed Water System Design and Construction Standards*, as currently adopted by the Purveyor and the potable water purveyor's *Backflow Prevention and Cross Connection Control Policy and Construction Standards*.

Facilities constructed up to the meter, and not part of the on-site facilities shall be dedicated to the Purveyor and shall be maintained by the Purveyor.

The Purveyor maintains a list of "Approved Contractors" who have attended the Purveyor's orientation class on reclaimed water installation and use. If hiring a contractor to design, install, modify or repair a reclaimed water system, only "Approved Contractors" are authorized to work on the systems.

6.0 OPERATION AND MAINTENANCE, TESTING, AND INSPECTION

The Owner shall be responsible for maintaining the on-site (all facilities downstream of the flow meter) reclaimed water system in good working order and operating the system in accordance with the *Effluent Management Plan*, as adopted by the Purveyor. The Purveyor will conduct an annual inspection of the on-site reclaimed water system. The Owner shall make any repairs or modifications of the on-site reclaimed water facilities that are inconsistent with the *Reclaimed Water System Design and Construction Standards* or is of a nature that could cause a detriment to public health or will adversely affect waters of the State, plant life, fish, or wildlife.

6.1 EDUCATION PROGRAM

The Purveyor will provide the required training for on-site reclaimed water supervisors, homeowners' association representatives, management company representatives, contractors, and landscaping companies.

6.2 PROPERTY ACCESS

Owners of reclaimed water systems shall permit the Purveyor access to the site for periodic inspection of the reclaimed water facilities to ensure that the facilities are consistent with the approved design, are in conformance with the standards outlined in the *Reclaimed Water System Design and Construction Standards*, and that no unapproved modifications have been made.

The Purveyor will attempt to provide prior notice where possible, but failure to do so will not be cause to deny access to the representative.

6.3 CONSTRUCTION INSPECTION

During construction, the Owner shall make the reclaimed water facilities available for inspection by the Purveyor. No reclaimed water facilities trenches shall be backfilled prior to inspection by the Purveyor.

6.4 POST CONSTRUCTION SITE INSPECTION

Prior to activation of the reclaimed water service, after any modifications and at the change of ownership, the Purveyor will inspect both the exterior potable and reclaimed water irrigation systems on the site and annually thereafter. A cross connection/shutdown test shall be completed immediately following construction as described in Section_.

6.5 BACKFLOW DEVICES INSPECTION

Annual inspections and tests of backflow devices for the domestic and fire services will be required in accordance with the rules and policies of the potable water purveyor. Inspection and test reports shall be provided to the potable water purveyor. Backflow prevention assembly tests will be performed by a tester certified by CA/NV section of the American Water Works Association (AWWA). The tests will follow procedures as required by the CA/NV section of AWWA.

6.6 CROSS CONNECTION CONTROL INSPECTION (SHUTDOWN TESTS)

An annual cross connection control inspection including a shutdown test is required for the reclaimed water system prior to the start up of the irrigation system and annually thereafter. The shutdown test protocol is described in the *Reclaimed Water System Design and Construction Standards*.

Documentation showing the results of the shutdown test shall be submitted immediately following the inspection to the reclaimed water Purveyor and potable water purveyor. Documentation shall include a description of any and all repairs necessary to ensure a passing shutdown test. Appropriate agencies will be given 48 hours notice prior to commencing the annual cross connection control inspection. The annual cross connection control inspection must be performed by a backflow cross-connection control specialist as certified by the California-Nevada Section, American Water Works Association (AWWA). Cross-connection control inspections and shutdown tests shall be performed annually, after any modifications and at changes of ownership.

7.0 INTERRUPTION OF SERVICE

It is the goal of the Purveyor to provide continuous service and, in the event of a service disruption, to resume service in an expedited manner.

7.1 EMERGENCY INTERRUPTIONS

The Purveyor will make all reasonable efforts to prevent interruptions of service and when such interruptions occur, will endeavor to reestablish service without unreasonable delay. The Purveyor will not be liable for interruptions, shortages, insufficiency of supply or any loss or damage of any kind or character if caused by weather, fire, strike, riot, war, accident, breakdown, action by governmental agency, or other cause beyond the control of the Purveyor.

7.2 SCHEDULED INTERRUPTIONS

Whenever the Purveyor finds it necessary to schedule an interruption to its service, it will, within twenty-four (24) hours, where feasible, notify customers to be affected by the interruption, stating the approximate time and anticipated duration of the interruption. Scheduled interruptions will be made at such hours and days as to provide the least inconvenience to the customers, consistent with reasonable Purveyor operations.

8.0 MISUSE OF RECLAIMED WATER, SERVICE TERMINATION AND PENALTIES

8.1 ENFORCEMENT AUTHORITY

The Purveyor shall enforce the provisions and requirements herein prescribed. The chief of police shall deputize the environmental control officer for the purpose of enforcing the reclaimed water regulations, and, when so deputized the environmental control officer shall have the power and authority of a peace officer to prevent and abate all such violations.

8.2 ENFORCEMENT

When violation of any provisions of this ordinance has been determined, the Purveyor or environmental control officer may terminate service and direct those persons not complying with this ordinance to:

- Comply forthwith;
- Comply in accordance with a time schedule set forth by the Purveyor; or
- Take appropriate remedial or preventative action.

The Purveyor, environmental control officer, or employees bearing proper credentials, have the authority to issue an on-site citation.

Penalties and fines shall be imposed for any violations of this ordinance, and the customer will be required to take corrective action as prescribed by the Purveyor. Violations include, but are not limited to, the following:

- Modification or relocation of the meter, which results in nonconformance with Purveyor requirements.
- Intentional non-permitted discharges; for example, discharge to surface water or pond overflow.
- Intentional cross connection; for example, connection of the reclaimed water system to the potable water system.
- Non-approved system installations or modifications; for example, irrigation system modifications that have not been reviewed, approved, and/or inspected by the Purveyor, excluding drip systems and sprinkler heads.
- Theft of reclaimed water; for example, unmetered use of water or meter tampering.
- Non-compliant use of reclaimed water; for example, use that is not in compliance with the Effluent Management Plan, Operation and Maintenance Plan, and/or the provisions of Nevada Administrative Code 445A.
- Refusal of reasonable access to the user's premises for the purpose of inspection or monitoring.

8.3 TERMINATION

The Purveyor will terminate reclaimed water service to a customer's premise immediately if the hazard to the potable water supply system cannot be immediately abated.

For all other conditions, when misuse has been determined and penalties and fines are not paid or corrective action is not taken within the prescribed time frames, service may be temporarily or permanently terminated until penalties and fines are paid and corrections have been made. Prior to termination of service, the Purveyor shall notify the owner in writing of such property that service is intended to be so terminated. Such notice shall be mailed to the owner as his name and address are shown on the real property assessment rolls on which general taxes are collected, and a copy shall be delivered to the tenant or posted conspicuously on the property. The notice shall state the date of proposed termination of service and the reasons therefore.

8.4 RECONSIDERATION

Any user affected by any decision, action, or determination, interpreting or implementing the provisions of this Ordinance, may file with the Purveyor a written request for reconsideration within ten days of such decision, action or determination, setting forth in detail the facts supporting the user's request for reconsideration and requesting reconsideration of the decision, action, or determination by the Purveyor.

8.5 Civil Liabilities and Penalties

Any person who violates or aids or abets the violation of any provisions of this Ordinance, shall be liable civilly to liabilities imposed on the Purveyor.

8.6 Criminal Penalties

Any person who is in violation of this Ordinance shall be guilty of a misdemeanor; and upon conviction thereof, may be punished.

8.7 Falsifying of Information

Any person who knowingly makes any false statements, representation, record, report, plan or other document filed with the Purveyor is hereby declared to be in violation of this Ordinance, and subject to the civil liabilities imposed under Section __, or subject to prosecution and punishment under Section __.

8.8 Remedies are Cumulative

The remedies and sanctions provided herein are cumulative and the institution of any proceeding or action seeking any one of such remedies or sanctions does not bar any simultaneous action or proceeding seeking any other of such remedies or sanctions.

8.9 Specific Remedies Do Not Impair Other Rights

No remedy or sanction provided herein impairs any right which the Purveyor or any person has under any statute or common law.

8.10 Penalties

To enforce the provisions of this Ordinance, the Purveyor may correct any violation hereof. The costs of such correction may be added to any reclaimed water service charge payable by the person violating this Ordinance or the owner or tenant of the property upon which the violation occurred, and the Purveyor shall have such remedies for the collection of such costs as it has for the collection of reclaimed water service charges. The Purveyor may also petition the appropriate court for the issuance of a preliminary or permanent injunction, or both, as may be appropriate, restraining any person from the continued violation of this Ordinance.

Penalties are listed in the following table.

Violation	First Occurrence	Second Occurrence	Third Occurrence
Non-approved system modifications or installations	Written warning and submittal of modifications within 10 days	$100 fine Submittal of modifications within 10 days	$100 fine 50% rate surcharge for 1 year $100 bimonthly compliance

Violation	First Occurrence	Second Occurrence	Third Occurrence
			inspection fee for 1 year
Non-compliant use of reclaimed water/ Operational non-compliance	Written warning Immediate termination Of non-compliant use	$100 fine Immediate termination of non-compliant use	$100 fine 50% rate surcharge for 1 year $100 bimonthly compliance inspection fee for 1 year
Intentional Cross Connection	$500 fine Reimbursement of staff time Temporary termination of service until cross connection remediation	$3000 fine Reimbursement of staff time Temporary termination of service until cross connection remediation	Termination of service
Theft of reclaimed water	$1000 fine Commodity charge for water used Reimbursement of staff time Termination of service		
Non-permitted discharge	Regulatory fine assessed to Purveyor Reimbursement of staff time	Regulatory fine assessed to Purveyor Reimbursement of staff time	Regulatory fine assessed to Purveyor Reimbursement of staff time 50% rate surcharge for 1 year
Intentional Non-permitted discharge	$3000 minimum fine or regulatory fine assessed to Purveyor, whichever is greater Reimbursement of staff time	$5000 minimum fine or regulatory fine assessed to Purveyor, whichever is greater Reimbursement of staff time	Termination of service

Violation	First Occurrence	Second Occurrence	Third Occurrence
Applicant Agreement, Effluent Management Plan, or Operation and Maintenance Plan Non-Compliance	$2,500 minimum fine or regulatory fine assessed to Purveyor, whichever is greater Reimbursement of staff time	$5,000 minimum fine or regulatory fine assessed to Purveyor, whichever is greater Reimbursement of staff time	$10,000 minimum fine or regulatory fine assessed to Purveyor, whichever is greater Reimbursement of staff time

9.0 WATER RIGHTS

Potable water rights will be reduced in an amount equal to the approved reclaimed water demand.

For existing development, the displaced potable water rights will be the property of the Owner.

There will be no reclaimed water right created.

10.0 RATES AND FEES

To be filled in by Reno, Washoe County, Sparks.

Draft Reclaimed Water Distribution System Design And Construction Standards

1.0 INTRODUCTION

1.1 APPLICABLE CODES AND POLICIES

The following documents have been referenced in the preparation of the Reclaimed Water Design & Performance Standards herein:

a) NDEP WTS-1A: General Design Criteria for Reclaimed Water Irrigation Use
b) NDEP WTS-1B: General Criteria for Preparing an Effluent Management Plan
c) NDEP WTS-37: Guidance Document for Design of Wastewater Detention Basins
d) NDEP WTS-4: Guidance Document for Design of Groundwater Monitoring Wells
e) NDEP Discharge Permit application forms, DMR form, and Permit fees
f) NAC 445A.275 – 445A.280, Use of Effluent (Reuse Regulations)
g) NAC 445A.6715 – 445A.67215, Water/Sewer System Separation Regulations
h) AWWA Standards
i) Standard Specifications for Public Works Construction, Latest Edition
j) Uniform Plumbing Code, Latest Edition

1.2 DEFINITIONS

NDEP	Nevada Division of Environmental Protection Bureau of Water Pollution Control
NRS	Nevada Revised Statutes
NAC	Nevada Administrative Code
WTS	Water Technical Sheet
AWWA	American Water Works Association
PWC	Public Works Construction
APWA	American Public Works Association
DIP	Ductile Iron Pipe
PVC	Polyvinyl Chloride
RJ-DIP	Restrained Joint Ductile Iron Pipe
PRV	Pressure Reducing Valve
AWG	American Wire Gage
DMR	Discharge Monitoring Report
SSPWC	Standard Specifications for Public Works Construction
HOA	Homeowner's Association
Customer	Person who receives reclaimed water service from the Purveyor within the service area or who owns the parcel to which reclaimed water is served.
Design Engineer	Registered Professional Engineer in the State of Nevada hired by the Customer to provide design services

2.0 DESIGN AND CONSTRUCTION REQUIREMENTS

2.1 DESIGN STANDARDS

a) All reclaimed water systems shall be designed and constructed in accordance with all applicable federal, state and local laws and requirements including, but not limited to:

i) State of Nevada

ii) Nevada Division of Environmental Protection

iii) Purveyor

b) All reclaimed water reuse systems must be included in a Reclaimed Water Discharge Permit issued by NDEP.

2.2 HYDRAULIC ANALYSIS

a) A hydraulic analysis shall be provided for all proposed reclaimed water distribution systems within public right-of-way to ensure adequate flow and pressures at points of service. Two (2) copies of the hydraulic analysis report shall be submitted to the Purveyor for review and approval. The final report will also be provided electronically in a file format compatible with EPANET. At a minimum, the report submittal shall include the following:

i) Complete application for reclaimed water

ii) Project description.

iii) Name and version of hydraulic modeling software.

iv) Site plan.

v) Assessor's parcel number and address.

vi) Hydraulic model input data.

vii) Hydraulic node map.

viii) Hydraulic model output data.

b) All pump systems require coordination and approval from the Purveyor. If you are designing a system with pumps, tanks, etc., contact the Purveyor during the planning phase of the project.

2.3 DESIGN PRESSURE

a) Service point(s). As determined by the Design Engineer to accommodate irrigation system requirements.

b) Mainline termination point(s). As required by the Purveyor.

c) Design pressure shall be at least five psi under the parallel potable water system pressure during peak hour conditions. Coordinate with potable water purveyor.

2.4 PIPE MATERIAL TYPE

a) PVC - PVC pipe shall be purple (Pantone color #512) in color. Joints shall be bell and spigot type with gaskets designed for potable water service.

b) Ductile Iron Pipe and Restrained Joint Ductile Iron Pipe (DIP and RJ-DIP) may be used with prior approval of the Purveyor in consideration of soil corrosion issues.

c) Pipe material shall meet or exceed AWWA standards.

d) Or as approved by the Purveyor.

2.5 BURIED WARNING AND IDENTIFICATION TAPE

Buried warning and identification tape shall be polyethylene plastic, metallic core detectable warning tape. AWWA, APWA, acid and alkali resistant, permanent marking, unaffected by moisture or soil, minimum five (5) mils thick by 3-inches wide. Warning tape shall be manufactured specifically for locating, warning, and identification of buried utility lines. APWA color coded PURPLE for reclaimed water with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read "CAUTION: BURIED RECLAIMED WATER LINE BELOW" or similar.

2.6 TRACER WIRE AND TEST STATIONS

Tracer wire shall be provided for all distribution reclaimed water lines and service laterals and shall be placed on top of pipe and attached with duct tape at 6 feet maximum intervals. At 500 feet intervals, tracer wire shall be extended into separate test stations consisting of risers and valve boxes (ref. Purveyor Reclaimed Water Detail SR-3). Test lead wire shall be long enough to extend four (4) feet above ground level and shall terminate in test station box. Tracer wire shall be attached to service laterals with duct tape at 3 feet maximum intervals, and shall be long enough to extend four (4) feet above ground and shall terminate in meter box.

Wire shall be #12 AWG, insulated, copper, THHN 600V. Prior to acceptance of the reclaimed waterline(s) by the Purveyor, the contractor shall perform a continuity test after backfilling the trench to the satisfaction of the Purveyor Inspector and/or Engineer.

2.7 THRUST RESTRAINTS

a) Mechanical joint fittings/pipe with wedge style mechanical joint restraint.
b) Concrete Thrust Blocking per Detail SR-13.
c) Restrained Joint Ductile Iron pipe (RJ-DIP).
d) Ductile Iron pipe push-on joint with restrained joint gasket.
e) PVC Pipe Bell Restraint Harness.
f) For vertical deflections, thrust blocks are not allowed for thrust restraint.

2.8 DEPTH OF COVER

a) Design depth of cover
    i) Adjacent to existing water and gas, as required providing minimum separation requirements.
    ii) Per NAC 445A.67145. Minimum depth of cover = 3 feet.
c) Restrained Joint Ductile Iron Pipe (RJ-DIP) shall be used for all crossings under ditches, seasonal ditches, streams, intermittent streams, existing pipelines, reinforced concrete boxes, and any other structure that will impede access for maintenance purposes.
d) Provide a minimum of five feet of cover and concrete encasement or sleeves for pipeline at waterbody (ditches, seasonal ditches, streams, intermittent streams) crossings.

2.9 PIPE DEFLECTION/BENDING

a) PVC Pipe – per AWWA C605.
b) DIP – per AWWA C600.
c) Per pipe manufacturer's recommendation.
d) Shall be parallel to street centerline where possible.

2.10 TRENCH BACKFILL

Reference Detail SR-4.

2.11 Buoyancy

As determined by the Design Engineer and approved by the Purveyor. Buoyancy parameters and concerns shall be discussed by the Design Engineer with Purveyor Engineering staff during the design phase of the project and shall be mitigated on a case by case basis.

2.12 Surge Protection

As determined by the Design Engineer and approved by the Purveyor. Surge protection parameters and concerns shall be discussed by the Design Engineer with Purveyor staff during the design phase of the project and shall be mitigated on a case by case basis.

2.13 Isolation Valves

a) Gate Valve, 3 to 12 inch, AWWA C500.
b) Butterfly Valve, 14 to 30 inch, AWWA C504.
c) As required for isolation and operation and maintenance of the system including a valve for two branches of a tee and three branches for a cross.
d) As approved by the Purveyor.
  i) In residential/ commercial developed areas, 500 ft. maximum.
  ii) Other areas, 1200 ft., maximum.

2.14 Combination Air Vacuum and Air Release Valve Assemblies

Located at high points in the reclaimed water mainline. As determined by the Design Engineer and approved by the Purveyor.

2.15 Flush Valve Assembly

a) Provide flush valve assembly for mainlines at low points in reclaimed water mainline and on all dead end pipe runs and approved by the Purveyor.
c) 4 inch minimum pipe size for flush valve assembly.
d) Sized to provide minimum velocity of 2.5 fps in the main.

2.16 Purple Coloration and Warning

All covers for meter boxes, valve boxes, flush valves, pressure reducing vaults, air/vac release assemblies, and all other appurtenances requiring vaults or boxes shall be purple in color (Pantone Color #512), labeled "RECLAIMED WATER" and have secured or locking lids. Purple coloration shall be obtained from the manufacturer or be applied by powder coating or epoxy paint. All appurtenances shall have a purple tag attached with the wording "WARNING RECLAIMED WATER DO NOT DRINK" and "AVISO AGUA IMPURA NO TOMAR". A debris cap with purple coloration shall be installed inside all round boxes.

All above ground piping shall be epoxy painted purple (Pantone Color #512) and have a purple tag attached with the wording "WARNING RECLAIMED WATER DO NOT DRINK" and "AVISO AGUA IMPURA NO TOMAR".

2.17 CORROSION PROTECTION

a) As recommended by the pipe manufacturer for actual soil conditions, not less than the following:
b) Polyethylene Pipe Encasement, AWWA C105, 8-mil minimum thickness. All buried DIP, fittings, and valves shall be encased with low-density, polyethylene film (min. 8-mils thick). The polyethylene film shall be in tube form and colored purple. The film shall be clearly marked "RECLAIMED WATER" in BLACK letters at regular intervals.
c) Mastic shall be applied to all bolts and exposed steel.

2.18 SEWER / WATER SEPARATION STANDARDS

a) NAC 445A.6715 - 445A.67215

2.19 CROSS CONNECTION CONTROL

a) Direct connections between potable water piping and reclaimed water piping shall not exist under any condition, with or without backflow protection. Reference Section 603.3.5 of the Uniform Plumbing Code, Latest Edition and potable water purveyor backflow prevention and cross connection control policy.

2.20 FLOW CONTROL FACILITIES

Automated line break detection (i.e. flow sensor, pressure sensor) should be included at the tanks and pressure reducing stations.

2.21 SERVICE LATERALS

a) Polyethylene (PE) pressure pipe per AWWA C901 for 3/4 inch to 2-inch service connections. Purple in color or purple striped.
b) Sized to provide peak demand without excessive pressure loss through the meter and setter.
c) Minimum service size is 3/4 inch.
d) Service lateral shall be installed perpendicular to the water main and the meter, unless otherwise approved by the Purveyor.
e) All services 3-inch and larger shall include a tee, gate valve and valve box.
f) Maintain minimum separation between reclaimed water and potable water per required separation standards (NDEP).
g) A pressure reducing valve shall be installed downstream of the reclaimed water meter below grade in a rectangular box of sufficient size to easily allow repair or replacement. Pressure reducing valve shall be pre-set at a pressure 10 psig lower than the minimum expected on-site pressure associated with the potable domestic service as measured downstream of the backflow assembly. This pressure setting will be confirmed by potable water purveyor Backflow Administrator at start up of the reclaimed system and confirmed during annual shut down tests and surveys. A lower pressure differential may be accepted by potable water purveyor's Backflow Administrator.
h) Provide pressure gauge before and after pressure reducing valve.

2.22 RECLAIMED WATER SERVICE CONNECTIONS (PUBLIC / PRIVATE OWNERSHIP AND MAINTENANCE)

a) Transitions from publicly owned facilities (Purveyor) to privately owned facilities (Customer) shall be clearly delineated. Typically, the meter at the point of connection shall serve as the point of transition, with facilities upstream of the meter being owned and maintained by the Purveyor, and facilities downstream of the meter being owned and maintained by the Customer. In cases where mainlines exist within public right-of-way downstream of a meter (typically a "master" meter), the transition between Purveyor owned and maintained facilities and Customer owned and maintained facilities shall be delineated by, and include an isolation valve and test station located as near possible to the boundary (property line) between public right-of-way and private property, if applicable.
b) All piping and appurtenances located on private property shall be owned and maintained by the Customer, unless within a dedicated easement and approved in writing by the Purveyor.
c) Publicly owned facilities (Purveyor) and privately owned facilities (Customer) shall be clearly delineated and labeled on the design drawings.

2.23 METERS

a) Meter manufacturer shall be specified by the reclaimed water Purveyor.
b) Meter shall be rated for reclaimed water use:
  i) Purple colored register and lid.
  ii) Non-potable water symbol on register lid.
  iii) The word "RECLAIMED" is cast or engraved in the meter body, and printed on the register dial face and lid.
d) For meters 6 inch and larger, provide upstream plate strainer.
e) Minimum meter size shall be 3/4 inch.
f) Meters shall be supplied by the Purveyor, unless otherwise stated in the Reclaimed water Agreement with the Purveyor.
g) Meter enclosure and setter with idler shall be constructed by the Customer, per the applicable detail.
h) The meter shall be installed within the public utility easement on the property served immediately adjacent to the public right-of-way.

3.0 RECLAIMED WATER MAIN EXTENSIONS

In cases where extension of the Purveyor's main is required to provide a reclaimed water supply to the property, the Customer may construct a mainline service pipe, at his own expense, from points of use to a point where connection can be made directly to the Purveyor's then-existing main. These need the approval of the reclaimed water purveyor and be in accordance with the design standards include herein.

3.1 STANDARD MAIN EXTENSIONS

Main extensions constructed by a Customer shall not be considered as reserved for supply to those properties exclusively. Extensions of and connections to such mains shall be permitted when, in the opinion of the Purveyor, such connections will not substantially affect supply to the original property.

The cost of all main extensions to be constructed under this section, including service laterals and other appurtenances, shall be borne by the Customer.

A person proposing an extension to the Purveyor reclaimed water distribution system shall submit an application and construction plans.

Reclaimed water mains and appurtenances shall be located within dedicated rights-of-way or within easement grants to the Purveyor not less than 20 feet in width, or as the Purveyor may otherwise specify. All rights-of-way or easements shall be indicated on the construction plans submitted and recorded prior to release of approved plans.

The minimum size of any main to be constructed as part of the Purveyor's distribution system shall be six inches in diameter; except in certain dead end locations where future extensions are not possible, the Purveyor may allow mains four (4) inches in diameter.

Reclaimed water service will not be activated until the Purveyor accepts the construction.

3.2 OVERSIZED MAIN EXTENSIONS

An oversize main extension proposed for construction under this section is subject to 3.1 of this section and the Purveyor reserves the right to:

- Determine its appropriate location; and
- Enter into an agreement with the developer in which the Purveyor's participation in construction costs is set forth.

Participation by the Purveyor for the over-sizing of a main extension shall be based on the difference in actual cost of pipe, fittings, and valves between the size required for the main extensions and the size required for over-sizing. The cost difference shall be established by a certified price list from the supplier. Prices quoted on the list shall be the actual prices charged to the buyer. The Purveyor may, in lieu of a lump sum payment of the Purveyor's portion of the construction costs, arrange with the Developer or Customer for an alternate method of payment.

3.3 INDIVIDUAL HOMES

Main extensions will not be allowed to individual homes. Reclaimed water mains will only be extended to approved subdivisions.

Draft Non-Residential On-Site Reclaimed Water Design And Construction Standards

1.0 INTRODUCTION AND GENERAL POLICIES

The design and construction of non-residential on-site reclaimed water facilities shall include, but not be limited to common area and streetscaping landscape irrigation systems, systems used for industrial processes, construction purposes, recreational impoundment systems, and agriculture uses. These facilities shall comply with the following: these standards set forth herein, the Effluent Management Plan, and any conditions, standards, and requirements set forth by the Purveyor in addition to these standard specifications.

1.1 INTERPRETATION

The Purveyor shall decide all questions of interpretation of "good engineering practice", guided by the various standards and manuals.

1.2 APPLICABLE CODES AND POLICIES

Ordinances, requirements, and applicable standards of governmental agencies having jurisdiction within the Purveyor's service area shall be observed in the design and construction of reclaimed water systems. Such requirements include but are not limited to current revisions of the following:

- NDEP WTS-1A: General Design Criteria for Reclaimed Water Irrigation Use
- NDEP WTS-1B: General Criteria for Preparing an Effluent Management Plan
- NDEP WTS-37: Guidance Document for Design of Wastewater Detention Basins
- NDEP WTS-4: Guidance Document for Design of Groundwater Monitoring Wells
- NDEP Discharge Permit application forms, DMR form, and Permit fees
- NAC 445A.275 – 445A.280, Use of Effluent (Reuse Regulations)
- NAC 445A.6715 – 445A.67215, Water/Sewer System Separation Regulations
- Potable water purveyor standards
- AWWA Standards
- Standard Specifications for Public Works Construction, Latest Edition
- Uniform Plumbing Code, Latest Edition

1.3 JURISDICTION

The Purveyor and potable water purveyor are responsible for the approval of plans and inspection of all non-residential on-site reclaimed water systems within the Purveyor's service area. Where repairs or replacement of a service line on the upstream side of the meter is required, it shall be the responsibility of the Purveyor, unless it is a system upgrade, in which case the owner or customer will be billed for the work. Conversely, the cost of repairs or replacement of the on-site facilities shall be the responsibility of the property owner.

1.4 Developer's Engineer/Landscape Architect Responsibility

These standards establish uniform policies and procedures for the design and construction of on-site reclaimed water facilities. They are not intended to be a substitute for knowledge, judgment, or experience. The contained procedures shall be reviewed by the engineer/landscape architect and shall be applied as necessary to the project. Proposed deviations to these standards shall be submitted in writing in conjunction with the plan review submittal.

The plans shall be revised or supplemented at any time it is determined that the Purveyor's requirements have not been met.

Before design, the developer must obtain approval to use reclaimed water for the proposed system and verification of locations and size of proposed points of connection.

1.5 Reference Specifications

References to standards such as the Standard Drawings of the Purveyor, AWWA, and ASTM shall refer to the latest edition or revision of such standards unless otherwise specified.

1.6 Certified Contractors

The Purveyor maintains a list of "Approved Landscaping Companies" who have attended the Purveyor's orientation class on reclaimed water installation and use.

If hiring a contractor to design, install, modify or repair a reclaimed water irrigation system, only "Approved Landscaping Companies" are authorized to work on the systems. Please check with the Purveyor for the most current list of "Approved Landscaping Companies".

1.7 Prohibitions And Limitations

Design of on-site reclaimed water facilities shall conform to the following:

- The reclaimed water system shall be separate and independent of any potable water system. Cross connections between potable water facilities and reclaimed water facilities are prohibited.
- Hose bibs on reclaimed water facilities are prohibited. Where potable and reclaimed water is used on-site, potable water hose bibs must be attached to the building.
- Drinking fountains shall be protected from the spray of reclaimed water in an approved manner prior to installation.
- Overspray and run-off shall be prevented.
- Potable and reclaimed water lines must maintain required separation at all times.
- Reclaimed water shall not be used for any purpose other than the approved uses as set forth in the NDEP Permit and Effluent Management Plan.

- The system shall be designed for the spray irrigation to occur within the hours set forth in the Effluent Management Plan. Drip systems may operate at any time.
- The reclaimed water irrigation shall not cause objectionable odors on or off the site.

1.8 Backflow Prevention And Cross Connection Control

Backflow prevention devices may be required on the reclaimed water service. Examples of sites that may be required to install backflow protection devices are:

- irrigation sites where direct chemical fertilizer injections systems are installed on the irrigation system,
- irrigation sites where recycled water impoundment may cause a backflow hazard

A reduced pressure principal backflow prevention assembly shall be installed immediately downstream of the potable water meter in an above grade orientation and installed in a freeze proof enclosure as required by NAC and potable water purveyor rules. Potable water fire service backflow prevention shall be per potable water purveyor.

No connection between the reclaimed waterline and the potable waterline is allowed.

2.0 CONVERSION OF WATER SYSTEMS

2.1 Potable To Reclaimed Water System

In general, all irrigation facilities converting from a potable to a reclaimed water supply shall conform to the Purveyor's construction specifications and the Effluent Management Plan. The Purveyor will notify the required state agencies of the intent to convert and solicit their involvement throughout the process and approval. The facilities to be converted shall be investigated in detail including review of any record drawings, preparation of the required Effluent Management Plan, potholing of existing facilities, and determinations by the Purveyor of measures necessary to bring the system into full compliance with these standard specifications. The applicant, owner, or customer shall pay all costs to convert the system.

3.0 PLAN PREPARATION AND REVIEW

3.1 General

Completed construction drawings for all on-site non-residential reclaimed water systems must be submitted to the Purveyor and the potable water purveyor for plan checking and approval before construction. Fifteen (15) working days should typically be allowed for plan check. Two (2) plan sets, 24" x 36", and two sets of the specifications (only the portion regarding the reclaimed water system) must be submitted to each purveyor. If there are potable water systems within the design area, one set of plans showing the potable water system and reclaimed water system facilities together shall also be submitted to each purveyor. The Purveyor and potable water purveyor will review the plans and will return one set with any comments. After all revisions have been incorporated into the plans and specifications, two (2) sets of the plans must be submitted to the Purveyor. Minor changes to the system will be reviewed by the Purveyor and potable water purveyor. If major changes are made to the irrigation system, the owner, applicant, or customer shall provide new plan sets.

3.2 SUBMITTAL

The submittal of improvement plans for plan checking is to ensure that the proposed use of reclaimed water conforms to the approved uses as set forth in the Effluent Management Plan.

3.3 AGREEMENTS

Before reclaimed water can be supplied to a site, a Standard Agreement for Use of Reclaimed water must be signed and recorded. This Agreement sets forth the requirements for service.

3.4 DATA REQUIRED ON PLANS

Specific information is required to be included in the plan set as described below.

General On- Site Reclaimed water Notes - On- site reclaimed water notes are to be shown on all on-site non-residential reclaimed water system construction plans. The notes shall be as shown in the Standard Details.

Meter Data - The following information shall be provided and shown at each meter location desired:

- The meter location and size (inches).
- The peak flow through the meter (gpm).
- The (static) design pressure at the meter (psi).
- The total area served through the irrigation meter (acres).
- An estimate of the yearly water requirement through the meter (acre-feet) by zone showing area (acres).

Irrigation Equipment Legend - For irrigation systems, a legend showing the pertinent data for the materials used in the system shall be recorded on the plans. The legend shall include a pipe schedule listing pipe sizes and materials of construction, a listing of valve types and quick couplers, and the following information for each type of sprinkler head:

- Manufacturer name and model number
- Sprinkler radius range (feet)
- Sprinkler pattern
- For each valve, the following information is required:
- Controller station number
- Flow through the valve (gpm)

- Control valve size (inches)

Sheets to be Included - The following sheets shall be included in the set:

- Cover sheet showing project location and overall irrigation plan.
- Composite sheet showing on-site potable waterlines if applicable.
- Reclaimed Water Irrigation Plan showing all pertinent information
- Detail sheet with all applicable details

3.5 DRINKING FOUNTAINS AND EATING AREAS

Exterior drinking fountains and eating areas must be shown and called out on the plans. If no exterior drinking fountains or eating areas are present in the design area, it must be specifically stated on the plans that none exist. The potable water line supplying the drinking fountain must have warning tape and maintain proper separation from reclaimed water lines. Drinking fountains must be protected from the direct spray of reclaimed water either by proper placement within the design area or the use of a covered drinking fountain approved for this purpose. Eating areas shall be protected from the direct or indirect spray of reclaimed water by proper placement within the design area.

3.6 APPROVAL FOR CONSTRUCTION

Upon receipt of two (2) sets of the approved construction plans, a pre-construction meeting shall be scheduled. A pre-construction meeting shall be scheduled by contacting the Purveyor a minimum of two (2) working days in advance.

4.0 USER OPERATION AND MAINTENANCE PLAN

4.1 PREPARATION

If the effluent management plan is issued to the Purveyor, the user shall prepare an operation and maintenance plan.

4.2 DATA REQUIRED FOR PREPARATION

Specific information is required to be incorporated in the operation and maintenance plan including the following:

- Inspection, operation, and maintenance responsibilities
- Designation of site supervisor
- Inspection and testing frequency
- Inspection criteria and response
- System modification
- Contacts

5.0 DESIGN AND CONSTRUCTION REQUIREMENTS

The reclaimed water irrigation system shall be designed to standard potable water system requirements except as specified herein. The irrigation system shall meet the reclaimed water distribution system requirements.

5.1 PIPE SELECTION

All buried on-site piping in the reclaimed water system shall be purple PVC pipe with stenciling identifying it as reclaimed water in accordance with the AWWA Guidelines for the Distribution of Non-potable Water. All on-site reclaimed water piping shall be installed in accordance with the Uniform Plumbing Code and all other local governing codes, rules, and regulations.

5.2 SLEEVES FOR IRRIGATION PIPING

All irrigation piping under hardscaped public right-of-way improvements (roads, curb & gutter, sidewalk, etc.), that is not SCH-40 PVC pipe shall be placed inside sleeves.

Sleeves shall be SDR-35 PVC pipe, colored purple or otherwise identified for reclaimed water.

Sleeves shall be sized by the Design Engineer to accommodate the irrigation piping, but in no case shall be less than 4-inch diameter.

Sleeves shall extend a minimum of 3 feet beyond hardscaped public right-of-way improvements.

Sleeves shall be installed per Typical Trench Section Detail. Design depth of cover = 4 feet.

Tracer wire shall be installed on all sleeves.

5.3 DEPTH OF PIPING

For on-site non-residential reclaimed water piping, the minimum depth shall be twelve (12) inches below sub-grade or twelve (12) inches below the potable waterline.

5.4 SEPARATION REQUIREMENTS

All new buried piping, whether for a new system or an existing facility converting to reclaimed water use, must be installed in accordance with the pipe separation requirements indicated below.

- NAC 445A.6715 - 445A.67215

5.5 PIPE MARKING

Warning tape shall be installed 3-inches above the top of pipe center and shall run continuously for the entire length of the mainline piping. This is applicable to both on-site non-residential reclaimed and potable waterline.

- Reclaimed water - Warning tape shall be purple plastic with black printing having the words "RECLAIMED WATER – DO NOT DRINK" imprinted in minimum 1-inch high letters. Imprinting shall be continuous and permanent. The overall width shall be a minimum of 3-inches.

- Potable Water - Warning tape shall be blue plastic with black printing having the words "CAUTION BURIED WATER LINE BELOW" imprinted in minimum 1-inch high letters. Imprinting shall be continuous and permanent. The overall width shall be a minimum of 3-inches.

All buried irrigation piping upstream of an electrical control valve shall be purple plastic pipe or be encased in purple polyethylene or bags labeled "CAUTION: BURIED RECLAIMED WATER LINE BELOW" at intervals no greater than 5 feet. For polyethylene (PE) service pipe, purple stripes are acceptable.

All piping downstream of an electric control valve shall be purple plastic or have purple reclaimed warning tape placed on top of the pipe. This does not apply to flexible polyethylene tubing used in drip zones.

All above ground piping shall be epoxy painted purple (Pantone Color #512) and have a purple tag attached with the wording "RECLAIMED WATER DO NOT DRINK" and "AVISO AGUA IMPURA NO TOMAR".

5.6 Tracer Wire And Test Stations

Tracer wire shall be provided for all irrigation reclaimed water piping 3-inches diameter and larger, both within public right-of-way and private property, and shall be placed on top of pipe and attached with duct tape at 6 feet maximum intervals. Tracer wire shall be long enough to extend four (4) feet above ground and shall terminate in appropriate irrigation control/valve box at maximum 500 feet intervals. Wire shall be #12 AWG, insulated, stranded copper, THHN 600V. Prior to acceptance of the reclaimed waterline(s) by the Purveyor, the contractor shall perform a continuity test after backfilling the trench to the satisfaction of the Purveyor Inspector and/or Engineer.

5.7 Sprinklers

Sprinklers shall be easily recognized as being used in a reclaimed water system. All sprinklers shall have purple identification.

5.8 Quick-Couplers

Hose bibs are prohibited on the reclaimed water system. Quick-couplers may be used in reclaimed water systems. All quick coupler valves shall have purple, lockable covers.

5.9 Valve Boxes

Valves, both above and below grade, shall be housed in an approved lockable purple valve box. A label reading "CAUTION: RECLAIMED WATER – DO NOT DRINK" shall be installed, as approved by the Purveyor.

All gate valves, manual control valves, electrical control valves, and pressure reducing valves for on-site non-residential reclaimed water systems shall be installed below grade in a purple valve box. Electrical and manual control valve boxes shall have a warning label permanently molded into or affixed onto the lid with rivets, bolts, etc.

5.10 IRRIGATION CONTROLLERS

All irrigation controller enclosures shall be labeled inside and outside warning that the system uses reclaimed water.

5.11 WARNING TAGS

Tags shall be weatherproof plastic, 3" by 4", purple in color, with the words "RECLAIMED WATER - DO NOT DRINK". Imprinting shall be permanent and black in color.

All reclaimed water sprinkler control valves, pressure regulators, quick couplers, and isolation valves shall be tagged with purple warning tags.

One tag shall be attached to each appurtenance in one of the following manners:

- Attach to valve stem directly with plastic tie wrap, or
- Attach to solenoid wire directly with plastic tie wrap, or
- Attach to the body of the relative appurtenance with a plastic tie

5.12 SIGNAGE

All areas where reclaimed water is used shall be posted with conspicuous signs in a size no less than 4-inches high by 8-inches wide, that include the following wording: "RECLAIMED WATER - DO NOT DRINK ". Each sign shall also display the international "DO NOT DRINK" symbol, such as a glass of water with a slash through it. Locations of signs shall have prior approval by the Purveyor.

5.13 CONTROL OF RUNOFF AND MINIMIZE PUBLIC EXPOSURE

The reclaimed water irrigation system shall be designed and operated to avoid reclaimed water exposure to the public.

- Irrigation may be scheduled seven days per week.
- Maximize areas of drip irrigation in lieu of spray irrigation.
- Spray heads shall be adjusted to minimize overspray onto areas not under the control of the customer, i.e. pool decks, private patios, streets, and sidewalks.
- Adjust irrigation duration to minimize reclaimed water runoff.
- Grade surface to minimize runoff to paved travel ways.

5.14 WEATHER STATIONS FOR SPECIFIC FACILITIES

Provide anemometer and automatic system shutdown to prevent aerosol drift IF required per NDEP discharge permit.

5.15 RECLAIMED WATER FACILITIES WITH TEMPORARY POTABLE WATER SERVICE

Where reclaimed water is not immediately available for use when the site is ready for construction, and if the Purveyor has determined that reclaimed water will be supplied in the future, the on-site facilities shall be designed to use reclaimed water. Provisions shall be made as directed by the Purveyor, the potable water purveyor, and these specifications, to allow for connection to the reclaimed water facilities when they become available. In the interim, potable water will be supplied to the reclaimed water facilities through a temporary potable water connection as coordinated and approved by the potable water purveyor. Until reclaimed water is available, potable water rates will be charged. A backflow prevention device will be required as long as the on-site facilities are connected to potable water. The backflow prevention device shall be downstream of the meter and a part of the on-site facilities.

When reclaimed water becomes available, the backflow prevention device will be removed and the on-site non-residential facility disconnected from the potable waterline and connected to the reclaimed water meter at the owner's expense. Prior to commencement of reclaimed water service, an inspection of the on-site facilities will be conducted to verify that the facilities have been maintained and are in compliance with the reclaimed water permit and current requirements for service. Upon verification of compliance, reclaimed water shall be served to the parcel for the intended use. If the facilities are not in compliance, the applicant shall be notified of the corrective actions necessary and shall have at least thirty (30) days to take such actions prior to initiation of enforcement proceedings.

6.0 INSPECTION AND TESTING REQUIREMENTS

6.1 GENERAL

The Purveyor will inspect the construction of on-site non-residential facilities and shall be notified two working days in advance of construction by the applicant, owner, or customer. In no case shall irrigation lines be backfilled before inspection by the Purveyor.

If the on-site non-residential system is installed prior to plan approval and/or inspection, all or any portion of the system shall be exposed and corrected as directed by the Purveyor in accordance with these standard specifications. Failure to comply may result in termination of service.

Subsequent to plan approval, field conditions may dictate modifications to the on-site non-residential system either in material or in intended use. If directed by the Purveyor the owner, applicant, or customer shall perform all changes or modify the on-site non-residential system to fully comply with these standards.

6.2 Inspection And Testing

Inspection and testing of water systems receiving reclaimed water shall be in accordance with the Ordinance. Random inspections may also occur.

The property owner shall be responsible for providing access and cooperation to the Purveyor representative, to perform cross-connection inspection or other system inspections that the Purveyor requires. This inspection shall include a visual check of the entire system to verify that no cross-connections have been made. The owner shall be responsible for correcting any work, at their sole expense, which violates the Purveyor regulations.

6.3 Coverage Test

The owner, applicant, or customer is responsible for controlling overspray and runoff of new systems. To ensure the limitation of overspray and runoff is in accordance with the Effluent Management Plan, an inspection of the completed on-site facilities by the Purveyor is required. When the sprinkler system is completed and the planting installed, the owner or owner's representative shall contact the Purveyor and arrange for a coverage test walk through. The owner or owner's representative shall be in attendance and have persons capable of making system adjustments present. If modifications to the system are required, other than minor adjustments, the owner will be notified in writing of the changes required. To avoid termination of service, the modifications must be made in a timely manner. All modifications to the system are the responsibility of the owner, applicant, or customer and said owner, applicant, or customer shall pay all costs associated with such modifications.

6.4 Purveyor Acceptance

If reclaimed water service can be delivered to the site, the project shall be accepted by the Purveyor once the following criteria have been met:

- All applications for service shall be covered by an effluent management plan and permit approved by the State of Nevada, Department of Conservation and Natural Resources, Division of Environmental Protection issued to the Purveyor or the applicant. All effluent management plans and permits shall be maintained on file with the Purveyor and compliance with all provisions of those plans and permits is required by this ordinance.
- Operation and maintenance plan, if required
- An Agreement has been signed by the user
- Final inspection by the Purveyor
- Submission of record drawings
- Training in the use of reclaimed water has been provided
- Payment of any outstanding monies

The on-site facilities shall be owned, operated, and maintained by the Owner.

6.5 RECORD DRAWINGS

Record drawings shall be prepared and show all changes in the work constituting departures from the original drawings. All conceptual or major design changes, including any changes that may be affected by the requirements of these standard specifications, shall be approved by the Purveyor before implementing the change in the construction contract. Failure to receive prior approval may result in termination of service.

The applicant, owner, or customer shall provide a complete set of "RECORD DRAWINGS" to the Purveyor upon completion of construction. Failure to provide record drawings may result in termination of service.

6.6 FAILURE TO COMPLY

Failure to comply with any or all of the standards herein is a violation of the Policies and Regulations and may result in termination of service until the appropriate corrective steps have been taken.

6.7 RECLAIMED WATER SUPERVISOR

The user must designate a "Reclaimed Water Supervisor" to be responsible for the day-to-day activities and long-term operation and maintenance of the system. In addition, all personnel involved with operating and maintaining the reclaimed water system must have training provided by the Purveyor.

Draft Residential On-Site Reclaimed Water Design And Construction Standards

1.0 INTRODUCTION AND GENERAL POLICIES

1.1 SCOPE

The design and construction of residential single family on-site reclaimed water facilities for landscape irrigation systems shall comply with these standards set forth herein, NDEP permit, the Effluent Management Plan, and any conditions, standards, and requirements set forth by the Purveyor in addition to these standard specifications.

1.2 INTERPRETATION

The Purveyor shall decide all questions of interpretation of "good engineering practice", guided by the various standards and manuals.

1.3 APPLICABLE CODES AND POLICIES

Ordinances, requirements, and applicable standards of governmental agencies having jurisdiction within the Purveyor's service area shall be observed in the design and construction of reclaimed water systems. Such requirements include but are not limited to current revisions of the following:

- NDEP WTS-1A: General Design Criteria for Reclaimed Water Irrigation Use
- NDEP WTS-1B: General Criteria for Preparing an Effluent Management Plan
- NDEP WTS-37: Guidance Document for Design of Wastewater Detention Basins
- NDEP WTS-4: Guidance Document for Design of Groundwater Monitoring Wells
- NDEP Discharge Permit application forms, DMR form, and Permit fees
- NAC 445A.275 – 445A.280, Use of Effluent (Reuse Regulations)
- NAC 445A.6715 – 445A.67215, Water/Sewer System Separation Regulations
- Potable water purveyor standards
- AWWA Standards
- Standard Specifications for Public Works Construction, Latest Edition
- Uniform Plumbing Code, Latest Edition

1.4 JURISDICTION

The Purveyor is responsible for the approval of plans and inspection of all residential on-site reclaimed water systems within the Purveyor's service area. Where repairs or replacement of a service line on the upstream side of the meter is required, it shall be the responsibility of the Purveyor, unless it is a system upgrade, in which case the owner or customer will be billed for the work. Conversely, the cost of repairs or replacement of the on-site facilities shall be the responsibility of the property owner.

1.5 DEVELOPER'S ENGINEER/LANDSCAPE ARCHITECT RESPONSIBILITY

These standards establish uniform policies and procedures for the design and construction of on-site reclaimed water facilities. They are not intended to be a substitute for knowledge, judgment, or experience. The contained procedures shall be reviewed by the engineer/landscape architect and shall be applied as necessary to the project. Proposed deviations to these standards shall be submitted in writing in conjunction with the plan review submittal.

The plans shall be revised or supplemented at any time if it is determined that the Purveyor's requirements have not been met.

1.6 REFERENCE SPECIFICATIONS

References to standards such as the Standard Drawings of the Purveyor, AWWA, and ASTM shall refer to the latest edition or revision of such standards unless otherwise specified.

1.7 CERTIFIED CONTRACTORS

The Purveyor maintains a list of "Approved Landscaping Companies" who have attended the Purveyor's orientation class on reclaimed water installation and use.

If hiring a contractor to design, install, modify or repair a reclaimed water irrigation system, only "Approved Landscaping Companies" are authorized to work on the systems. Please check with the Purveyor for the most current list of "Approved Landscaping Companies".

1.8 PROHIBITIONS AND LIMITATIONS

Design of on-site reclaimed water facilities shall conform to the following:

- The reclaimed water system shall be separate and independent of any potable water system. Cross-connections between potable water facilities and reclaimed water facilities are prohibited.
- Hose bibs on reclaimed water facilities are prohibited. Where potable and reclaimed water is used on-site, potable water hose bibs must be attached to the house.
- Patios, swimming pools, spas, etc. shall be protected from the spray of reclaimed water.
- Overspray and run-off shall be prevented. Irrigate in a manner that will minimize runoff, pooling, and ponding.
- Potable and reclaimed water lines shall maintain required separation at all times.
- Reclaimed water shall not be used for any purpose other than landscape irrigation.
- Individual irrigation zones within a system shall not exceed 10 gpm at any time.

- The system shall be designed to irrigate the on-site turf areas within the hours specified in the effluent management plan and NDEP permit. Drip systems may operate at any time.

1.9 BACKFLOW PREVENTION AND CROSS-CONNECTION CONTROL

Backflow prevention devices may be required on the reclaimed water service.

A reduced pressure principal backflow prevention assembly shall be installed immediately downstream of the potable water meter in an above grade orientation and installed in a freeze proof enclosure as required by NAC and potable water purveyor rules.

double check if NAC will allow.

No connection between the reclaimed waterline and the potable waterline is allowed.

2.0 PLAN PREPARATION AND REVIEW

2.1 GENERAL

Completed construction drawings for all on-site reclaimed water systems must be submitted to the Purveyor for plan checking and approval before construction. Fifteen (15) working days will be allowed for plan check. Two sets of the plans (landscape sheets only), 24" by 36" shall be submitted. Plans may also be submitted electronically in PDF format. The plans shall show both the potable water system and reclaimed water system facilities. The Purveyor will review the plans and will return one set with required corrections, if needed. After all revisions have been incorporated into the plans, two sets of the plans shall be resubmitted to the Purveyor. Minor changes to the system will be reviewed by the Purveyor. If major changes are made to the irrigation system, the owner, applicant, or customer shall provide new plans.

2.2 SUBMITTAL

The submittal of landscape irrigation plans for plan checking is to ensure that the proposed use of reclaimed water conforms to the approved uses as set forth in the Effluent Management Plan and NDEP permit.

2.3 AGREEMENTS

Before reclaimed water can be supplied to a residential site, a Homebuyer Notification Regarding Residential Use of Reclaimed Water must be signed. The notification sets forth the requirements for service.

In a residential subdivision where all homes are required to use reclaimed water for landscape irrigation, deed restrictions are detailed in the documents: "Declaration of Restrictions Regarding the Use of Reclaimed Water for Landscape Irrigation."

2.4 DATA REQUIRED ON PLANS

Specific information is required to be included in the plan set as described below.

General On-Site Reclaimed Water Notes - On-site reclaimed water notes are to be shown on all on-site residential reclaimed water system construction plans. The notes shall be as shown in the Standard Details.

Irrigation Equipment Legend - For irrigation systems, a legend showing the pertinent data for the materials used in the system shall be recorded on the plans. The legend shall include a pipe schedule listing pipe sizes and materials of construction, a listing of valve types, and the following information for each type of sprinkler head:

- Sprinkler radius (feet).
- Sprinkler pattern (90°, 180°, 360°)
- Flow (gpm).
- Operating pressure (psi).

Irrigation Valves - The following information for each valve shall be provided:

- Manufacturer name and model number
- Flow (No valve or irrigation zone shall exceed 10 gpm at any time. Flow is determined by adding the gpm of all the sprinklers connected to a valve.)

Sheets to be Included - The following sheets shall be included in the set:

- Cover sheet with site address and all reclaimed and potable on-site water lines.
- Reclaimed water irrigation plan
- Irrigation details.

2.5 APPROVAL FOR CONSTRUCTION

Upon approval of the on-site irrigation plans, a pre-construction meeting shall be scheduled by contacting the Purveyor a minimum of two (2) working days in advance.

3.0 DESIGN AND CONSTRUCTION REQUIREMENTS

3.1 RECLAIMED WATER SYSTEM DESIGN GUIDELINES FOR YARDS - GENERAL REQUIREMENTS

Reclaimed water service and domestic potable water service for each residential lot will be provided by the subdivision developer. The reclaimed water service is typically provided at the opposite lot end from the potable service.

Reclaimed water shall not be used for any other purpose except for irrigation. Reclaimed water lines shall not enter the house.

The piping system for the reclaimed water irrigation system shall be constructed and maintained to be easily differentiated from the potable water piping system. The reclaimed water system piping shall be purple plastic pipe.

Drip irrigation systems are required for shrub plantings and some groundcover plantings. Environmental factors such as evaporation and wind tend to have the least effect on this type of irrigation system. Additionally, drip irrigation systems contribute minimally to soil erosion problems on sloped planting areas. However, physical maintenance of this type of system is usually higher.

It is recommended to install purple irrigation PVC sleeves beneath driveways, walkways or other paved areas. Install the necessary number of sleeves, properly sized, to accommodate the irrigation system mainline, lateral lines, and controller wiring. The sleeving shall extend six inches on each side of the slab.

Sprinkler heads and spray patterns shall be contained within the home lot property line and shall not overlap or overspray onto the adjacent property. Adjust sprinkler heads and spray patterns to minimize overspray onto adjacent hardscapes, patios, decks, pools, fences, etc.

Space and install sprinklers and turf rotors no more than 80% of the manufacturer's recommended radius listing for that particular head. Ensure head to head coverage of the spray pattern with no dry spots.

The maximum flow for each valve system or irrigation zone shall not exceed 10 gallons per minute, nor shall operating flows exceed 10 gallons per minute at any one time.

For drip irrigation systems, install an in-line pressure reducing valve down stream of the remote control valve. The pressure reducing valve shall be placed below grade in a purple plastic valve box and adjusted to the proper operating pressure for the drip system.

For drip irrigation systems, install an in-line Wye filter downstream of the remote control valve and upstream of the pressure reducing valve. The filter shall be placed below grade in a purple plastic valve box.

Install drip tubing a minimum of four (4) inches below grade.

Hose bibs and quick coupling valves are prohibited on the residential reclaimed water system. No white PVC piping shall be allowed for use in reclaimed water irrigation systems.

Monitor and maintain the system to minimize equipment and material failure. Broken sprinkler heads, leaks, unreliable valves, clogged filters, etc., shall be repaired as soon as they become apparent.

Irrigate in a manner that will minimize runoff, pooling, and ponding. The application rate shall not exceed the infiltration rate of the soil. This procedure may be facilitated by the efficient scheduling of the automatic control clocks (i.e., employing the repeat function to break up the total irrigation time into cycles that will promote maximum soil absorption).

Remote control valves shall be buried below grade in an approved purple valve box. Anti-siphon control valves shall not be allowed.

Educate all maintenance personnel, family members, and guests, on a continuous basis, of the presence of reclaimed water and that it is not approved for drinking purposes.

Obtain prior approval for all proposed changes and modifications to any on-site facilities. Such changes shall be submitted to and approved by the Purveyor and designed in accordance with these standards.

3.2 Potable Water System Design Guidelines – General Requirements

The potable water service and the reclaimed water service for each home shall be provided by the homebuilder's underground contractor.

The potable water system shall be protected by an appropriate backflow prevention device at the potable water meter when reclaimed water will be used for irrigation. Assemblies shall be installed downstream of, but immediately next to, the potable water meter and the pressure

The water used within the residence and outside in the yard(s) through hose bibs shall be potable water.

All hose bibs shall be attached to the house.

Fill lines for pools and/or water features of any kind are prohibited on the reclaimed water system. These uses shall be connected to the potable water system. Polyethylene pipe will be used for all potable lines extending from the house and into the yard(s). The location of the polyethylene lines shall be indicated on the irrigation plans. The Purveyor requires inspection of the polyethylene pipe installation prior to the covering of the pipe.

3.3 Irrigation System Materials For Reclaimed Water

Irrigation systems for residential landscapes shall be designed and constructed with proven name-brand equipment, materials and automatic controllers. All materials and equipment shall be listed and indicated on the irrigation plan submittal for approval by the Purveyor.

3.4 Pipe Selection

All buried on-site piping in the reclaimed water system shall be purple PVC pipe with stenciling identifying it as reclaimed water in accordance with the AWWA Guidelines for the Distribution of Non-potable Water. All on-site reclaimed water piping shall be installed in accordance with the Uniform Plumbing Code and all other local governing codes, rules, and regulations.

The potable water line from the meter to the house shall be white PVC. All other potable water lines in landscapes shall be polyethylene lines. Examples of potable water uses outside of the house include pools, fountains, or other uses not designated as acceptable for reclaimed water.

3.5 DEPTH OF PIPING

For on-site residential reclaimed water piping, the minimum depth shall be twelve (12) inches below sub-grade or twelve (12) inches below the potable waterline.

3.6 SEPARATION REQUIREMENTS

All new buried piping, whether for a new system or an existing facility converting to reclaimed water use, must be installed in accordance with the pipe separation requirements indicated below.

- NAC 445A.6715 - 445A.67215

3.7 WARNING TAPE

Warning tape shall be installed 3 to 6 inches above the top of pipe center and shall run continuously for the entire length of main and lateral line piping. This is applicable to both reclaimed and potable waterlines.

- Reclaimed Water - Warning tape shall be purple plastic with black printing having the words "RECLAIMED WATER – DO NOT DRINK" imprinted in minimum 1-inch high letters. Imprinting shall be continuous and permanent. The overall width shall be a minimum of 3-inches.

- Potable Water - Warning tape shall be blue plastic with black printing having the words "CAUTION BURIED WATER LINE BELOW" imprinted in minimum 1-inch high letters. Imprinting shall be continuous and permanent. The overall width shall be a minimum of 3-inches.

3.8 WARNING LABELS

Warning labels, as approved by the Purveyor, shall be installed on facilities, such as controller panels. Warning labels shall be constructed of a purple weatherproof material with the warning permanently stamped or molded into the label. The warning shall contain the following information: "RECLAIMED WATER – DO NOT DRINK" and the international "Do Not Drink" symbol, such as a glass of water with a slash through it. Attach to the inside or outside of the controller cabinet door.

3.9 VALVE BOXES

Valves shall be housed in an approved lockable, purple valve box. A tag reading "CAUTION: RECLAIMED WATER – DO NOT DRINK" shall be installed on each valve, as approved by the Purveyor.

All gate valves, manual control valves, electrical control valves, and pressure reducing valves for on-site reclaimed water systems shall be installed below grade in a purple valve box. Electrical and manual control valve boxes shall have a warning label permanently molded into or affixed onto the lid with rivets, bolts, etc.

3.10 WARNING TAGS

Tags shall be weatherproof plastic, 3" by 4", purple in color, with the words "WARNING - RECLAIMED WATER - DO NOT DRINK". Imprinting shall be permanent and black in color.

All reclaimed water sprinkler control valves, pressure regulators, and isolation valves shall be tagged with purple warning tags.

One tag shall be attached to each device in one of the following manners:

- Attach to valve stem directly with plastic tie wrap, or
- Attach to solenoid wire directly with plastic tie wrap, or
- Attach to the body of the relative accessory with a plastic tie wrap.

3.11 SPRINKLERS

Sprinklers shall be easily recognized as being used in a reclaimed water system. All sprinklers shall have purple identification.

3.12 SIGNAGE

All subdivisions where reclaimed water is used shall be posted with conspicuous signs in a size no less than 4-inches high by 8-inches wide, that include the following wording: "RECLAIMED WATER - DO NOT DRINK". Each sign shall also display the international "DO NOT DRINK" symbol, such as a glass of water with a slash through it.

3.13 CONTROL OF RUNOFF

On-site reclaimed water facilities shall be designed to prevent discharge onto areas not under control of the user.

- Irrigation may be scheduled seven days per week.
- Maximize areas of drip irrigation in lieu of spray irrigation.
- Spray heads shall be adjusted to minimize overspray onto areas not under the control of the customer, i.e. pool decks, private patios, streets, and sidewalks.
- Adjust irrigation duration to minimize reclaimed water runoff.
- Grade surface to minimize runoff to paved travel ways.

4.0 INSPECTION AND TESTING REQUIREMENTS

4.1 GENERAL

The Purveyor will inspect the construction of residential irrigation installations and shall be notified a minimum of two working days in advance of the desired inspection date by the contractor or customer. In no case shall irrigation lines be backfilled or covered before inspection by the Purveyor.

If the residential on-site irrigation system is installed prior to plan approval and/or inspection, all or any portion of the system shall be exposed and corrected as directed by the Purveyor in accordance with these standard specifications. Failure to comply may result in termination of service.

Subsequent to plan approval, field conditions may dictate modifications to the residential on-site irrigation system either in material or in intended use. If directed by the Purveyor, the owner, applicant, or customer shall perform all changes or modify the on-site residential system to fully comply with these standards and with the Purveyor Rules and Regulations.

4.2 INSPECTION AND TESTING

Inspection and testing of water systems receiving reclaimed water shall be in accordance with the Ordinance. Random inspections may also occur.

For single-family residences receiving reclaimed water, the owner shall be responsible for providing access and cooperation to the Purveyor representative, to perform cross-connection inspection or other system inspections that the Purveyor requires. This inspection shall include a visual check of the entire system to verify that no cross-connections have been made. The owner will be responsible for correcting any work that violates the Purveyor regulations at the Owner's sole expense.

4.3 COVERAGE TEST

The owner, applicant, or customer is responsible for controlling overspray and runoff of the system. To ensure the limitation of overspray and runoff, an inspection of the completed on-site irrigation system is required by the Purveyor. When the sprinkler system is completed and the planting installed, the owner or owner's representative shall contact the Purveyor and request a coverage test or final inspection. The owner or owner's representative shall be in attendance and have persons capable of making system adjustments present. If modifications to the system are required, other than minor adjustments, the owner will be notified in writing of the changes required. To avoid termination of service, the modifications must be made in a timely manner. All modifications to the system are the responsibility of the owner, applicant, or customer and said owner, applicant, or customer shall pay all costs associated with such modifications.

4.4 PURVEYOR ACCEPTANCE

If reclaimed water service can be delivered to the site, the project shall be accepted by the Purveyor once the following criteria have been met:

- All applications for service shall be covered by an effluent management plan and permit approved by the State of Nevada, Department of Conservation and Natural Resources, Division of Environmental Protection issued to the Purveyor or the applicant. All effluent management plans and permits shall be maintained on file with the Purveyor and compliance with all provisions of those plans and permits is required by this ordinance.

- An Agreement has been signed by the user
- Final inspection by the Purveyor
- Submission of record drawings
- Training in the use of reclaimed water has been provided
- Payment of any outstanding monies

The on-site facilities shall be owned, operated, and maintained by the Owner.

4.5 RECORD DRAWINGS

Record drawings or irrigation plans shall be prepared and show all changes in the work constituting departures from the original drawings. The Purveyor shall approve all conceptual or major design changes, including any changes that may be affected by the requirements of these standard specifications, before implementing the change. Failure to receive prior approval may result in termination of service.

4.6 FAILURE TO COMPLY

Failure to comply with any or all of the standards herein is a violation of the Purveyor Policies and Regulations and may result in termination of service until the appropriate corrective steps have been taken.

4.7 RECLAIMED WATER SUPERVISOR

The user, namely the homeowner or home occupant in case the home is rented, is responsible for the day to day activities and long term operation and maintenance of the system.

APPENDIX C - Reno's Advanced Treatment Pilot Test

- *Field Evaluation of MF-Ozone-BAC Process Train for the Removal of Microconstituents from Wastewater Effluent*, written by Vijay Sundaram, ECO:LOGIC Engineering, Robert W. Emerick, Ph.D., P.E., ECO:LOGIC Engineering, and Stanley E. Shumaker, P.E., City of Reno Public Works Department

Field Evaluation of MF-Ozone-BAC Process Train for the Removal of Microconstituents from Wastewater Effluent

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Abstract

Removing microconstituents from wastewater for subsequent reuse is gaining in importance. Water quality concerns include potential human and aquatic life impacts resulting from exposure to Endocrine Disrupting Chemicals (EDCs), Pharmaceuticals, Personal Care Products (PPCPs), and other wastewater-derived organics, and long-term salinity built-up. At present, microconstituents are most typically removed by advanced treatment facilities utilizing Membrane Filtration (MF), Reverse Osmosis (RO), and an oxidation step consisting of high-energy ultraviolet radiation (UV) coupled with hydrogen peroxide (Peroxide). The MF-RO-UV-Peroxide process is expensive, energy intensive, potentially increases effluent corrosivity, and generates a relatively large reject stream containing concentrated salts and microconstituents that require further treatment and/or disposal. An alternative multi-barrier treatment train to reduce overall costs and energy usage was developed and pilot tested on secondary effluent at the Reno-Stead Water Reclamation Facility (RSWRF). The pilot process train consists of (in the order of use): Membrane Filtration (MF), Ozone, and Biological Activated Carbon (BAC) treatment. MF-Ozone-BAC treatment consumes less power, is more sustainable, does not generate a reject stream, and does not increase effluent corrosivity.

This comprehensive study presents the wastewater community and water resource community with in-depth knowledge about an advanced process train which: 1) does not generate a reject stream; 2) does not cause disturbance to the ionic stability of the effluent; 3) reduces post-treatment biofilm growth potential; and 4) is sustainable, consumes less energy, and requires lesser O&M effort than other alternatives.

Introduction

The City of Reno (City) is expanding the wastewater treatment and disposal capacity of its Reno-Stead Water Reclamation Facility (RSWRF) to serve continuing community growth. Because water resources in the Reno area are limited, reuse of treated wastewater is an important part of City planning. Two effluent storage options are 1) storage in conventional open-topped reservoirs and 2) storage in a local aquifer (i.e. subsurface storage in the natural groundwater reservoir). Of the two, subsurface storage is believed to be superior because 1) effluent water quality in open-topped reservoirs deteriorates because of algae growth and wildlife use, 2) water is lost from open-topped reservoirs by evaporation thereby increasing effluent salinity, and 3) costs associated with open-topped reservoirs are dependent on land topography and availability. This pilot testing was conducted to demonstrate that an advanced multi-barrier wastewater treatment system can reliably produce an effluent suitable for subsurface storage from an environmental and public health protection perspective, and still be affordable.

At present, advanced Water Reclamation Facilities (WRFs) are either utilizing 1) Membrane Filtration (MF) followed by Reverse Osmosis (RO) and an oxidation step consisting of high-energy ultraviolet radiation (UV) and hydrogen peroxide (Peroxide), or 2) Ozonation coupled with Biological Activated Carbon (Ozone-BAC) (Asano, 2006; Sheng, 2005). MF-RO-UV-Peroxide treatment train has high-energy demands and produces a waste stream of concentrated contaminants needing additional treatment and/or disposal.

Best Apparent Process Alternative

MF-Ozone-BAC was selected over MF-RO-UV-Peroxide for the RSWRF application because 1) MF-Ozone-BAC has expected lower cost and power consumption, 2) MF-Ozone-BAC does not produce a waste stream needing specialized treatment and/or disposal, and 3) a reduction in effluent salinity prior to subsurface storage is neither necessary nor desired in the RSWRF situation. A side-by-side comparison of these two advanced treatment process trains is provided in Table 1 with highlights being discussed below:

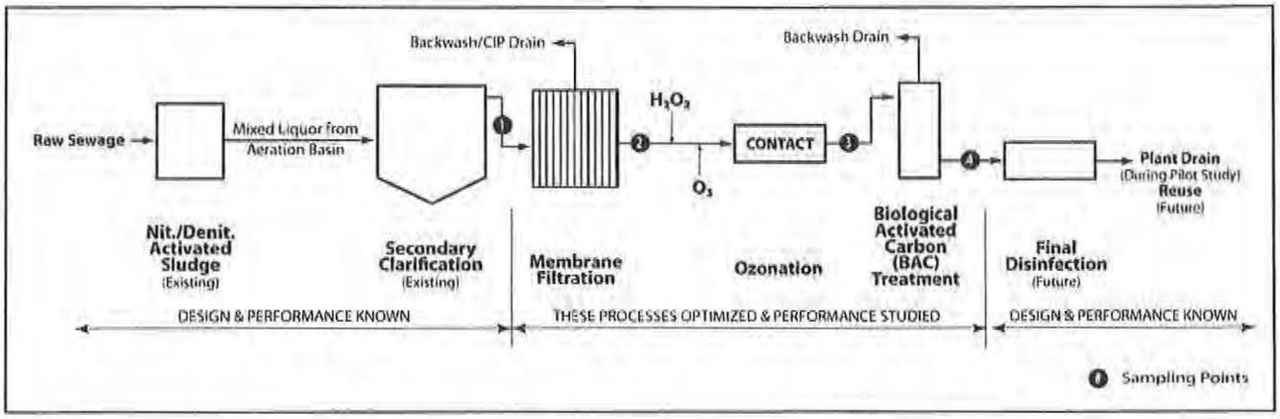
- *Microconstituents Removal:* In both the ozonation and BAC processes, microconstituents are effectively destroyed rather than concentrated in a reject stream (as with RO) or transferred to another substrate (as with Granular Activated Carbon [GAC] treatment) requiring further treatment and/or disposal.
- *Energy and Sustainability:* MF-Ozone-BAC is a more sustainable process than MF-RO-UV-peroxide because MF-Ozone-BAC requires less energy, fewer replacement parts, and minimal maintenance. In addition to the energy required to operate RO, the energy required by high-energy UV lamps for hydroxyl radical generation is seven to eight times greater than the energy consumed by conventional UV lamps commonly used for wastewater disinfection.
- *Reject/Side Streams:* The RO component of a MF-RO-UV-Peroxide advanced treatment train produces a reject stream (often roughly 20% of the effluent volume) needing complex disposal strategies in inland facilities such as RSWRF where ocean disposal is not possible.
- *Salinity:* The main water quality difference between MF-RO-UV-Peroxide and MF-Ozone-BAC is that MF-RO-UV-Peroxide treatment removes salts and organics present in the effluent, whereas MF-Ozone-BAC treatment mainly removes organics. The salt concentration of RSWRF effluent is below 500 mg/L, therefore salt reduction does not appear to be needed at this time, which makes the costly RO step unnecessary. Ultimately, a salinity control or reduction element will have to be added to the City's overall water resource plan to control salt built-up in the groundwater resource over time.
- *Corrosivity:* In cases such as RSWRF where effluent salt concentrations are already low, a further reduction in effluent salinity by use of the MF-RO-UV-Peroxide process increases the corrosivity of the treated effluent. Increasing the corrosivity of effluent injected into groundwater increases the probability that naturally occurring metals in subsurface soils, such as arsenic in the Reno area, will leach into the injected effluent and groundwater resource.

Table 1: Side-by-Side Comparison of Advanced Treatment Process Trains

Category	MF-Ozone-BAC	MF-RO-UV-Peroxide
Microconstituents	Degraded	Concentrated (in a side stream)
Energy	Substantially less usage	
Sustainability	Lower materials and labor needs	
Reject/Side Streams	Minor (periodic backwash water)	Major (± 20% of flow)
Salinity	Unchanged	Decreased Substantially
Corrosivity	Unchanged	Increased

The effectiveness of MF-Ozone-BAC at removing microconstituents from secondary effluent under field conditions with continuous flow from an operating wastewater treatment plant was investigated. This level of investigation has not been undertaken in previous studies. The secondary effluent to be studied is from the existing RSWRF nitrification/denitrification activated sludge process operated at a mean cell residence time (MCRT) of approximately 25 days. Effluents from shorter MCRT process are expected to have different microconstituent characteristics (Clara, 2005). A few of the critical MF-Ozone-BAC process design variables studied include: (1) the optimum ozone dosage to remove selected wastewater indicator microconstituents, (2) an effective strategy for bromate mitigation; and (3) the sustainability of a GAC column functioning as a BAC biofilter when receiving membrane-filtered and ozonated effluent without any supplemental carbon source or microorganisms. The overall treatment process schematic for RSWRF with inclusion of the MF-Ozone-BAC train is shown in Figure 1.

Figure 1: RSWRF Pilot Process Schematic



The first component of the MF-Ozone-BAC pilot is the MF step to remove turbidity, total suspended solids (and associated heavy metals and contaminants), and pathogens such as Giardia Lamblia and Cryptosporidium that are commonly present in the secondary effluent. The second component, ozonation, with or without peroxide, (1) reduces microconstituent concentrations and estrogenic activity, 2) provides some disinfection (Zhou, 2002); 3) reduces Trihalomethane Formation Potential (Zhou, 2002); 4) increases the dissolved oxygen concentration of the effluent; and 5) eliminates colorants and odor causing compounds present in the effluent. However, the performance of ozonation in removing microconstituents is heavily influenced by the quality of the effluent being treated, and the addition of peroxide. The effect of various ozone dosages in removing Selected Organic Wastewater Indicator microconstituents, and effect of peroxide in minimizing bromate formation were studied.

It has been reported that ozonation will increase the Biodegradable Dissolved Organic Carbon (BDOC) concentration, and therefore biologically mediated well clogging (Juhna, 2006; Page, 2006). BAC (the third component of the pilot) has been demonstrated to reduce BDOC present in ozonated effluent (Juhna, 2006). However, the benefits of integrating BAC into an advanced wastewater treatment process train for microconstituent removal has not been reported in the literature. Because, Filtrasorb F-400 (Calgon Carbon) GAC medium has been used successfully in numerous BAC water and wastewater treatment investigations (Levine, 2000; Nishijima, 2004), this medium was selected for use in this project.

Methods

The MF-Ozone-BAC pilot treatment train system was operated on a continuous basis from September 2008, with performance data being available for this paper through May 2009. The effluent flow rate through the train was 10.7 gal/min. The effluent source was undisinfected secondary effluent from the RSWRF. After passing through membrane filtration, the RSWRF effluent was stored in a 10,300 gallon "day tank" to assure 1) operation of ozonation and BAC units was not interrupted during the periodic cleaning of membrane, and 2) influent to the ozone unit was independent of any temporary, atypical, upset of the RSWRF process.

Membrane Filtration

WesTech supplied a packaged membrane filtration skid. The membrane filters were pressure-driven hollow fibers of Polysulfone utilizing an outside-in flow configuration manufactured by Polymem. The nominal pore size of the membrane was 0.01 μm. The maximum pressure differential across the membrane filters was 30 psi. Membrane periodic maintenance steps included backwash with or without hypochlorite, Clean-in-Place (CIP) cleaning using caustic and hypochlorite, and membrane integrity testing.

Ozonation

Applied Process Technology supplied a skid-mounted ozonation unit based on their HiPOx™ technology. The skid included a liquid oxygen-fed, solid-state, ozone generator capable of producing 4 lb/day of ozone at 10 percent concentration. The ozonation skid was operated in a direct gas injection mode both with and without peroxide addition, under a system pressure of 15 psi.

Biological Activated Carbon (BAC)

WesTech manufactured the skid-mounted BAC unit, specifically for this project. The unit included a stainless steel, vertical pressure vessel designed to operate in the downflow mode. The 3.5 ft diameter vessel contained 1250 lbs of Filtrasorb F-400 (Calgon Carbon), resulting in a carbon media bed depth of about 4.5 ft. Headspace was more than 50% of the bed depth to allow for bed expansion during backwash without losing media. The BAC unit also had provisions for obtaining carbon media samples at various depths from the media bed. Previous studies on BAC have found that the performance of BAC is heavily dependent on the Empty Bed Contact Time (EBCT) (Juhna, 2006; Page, 2006). EBCTs ranging from 20 to 30 minutes have been utilized for full-scale BAC treatment processes (Asano, 2006; Page, 2006). An EBCT of 30 minutes was selected for this pilot study to provide reliability and mitigate temperature effects on bacterial activity in this biofilter. RSWRF effluent temperature can be as low as 46 °F in winter. The BAC biofilter was backwashed every two weeks to remove the build-up of particles and decaying microorganisms.

The GAC column was converted to a BAC biofilter without any supplemental carbon source or microorganisms over a two-month period by continuous application of membrane-filtered and ozonated secondary effluent. During the conversion process, the optimized ozone and peroxide dosages were maintained and the biological activity of the carbon column was monitored regularly by measuring Phospholipid Fatty Acids (PLFAs). The result was a pilot-scale BAC biofilter with biomass amounts varying with depth in the media bed, as occurs in full-scale BAC units (Juhna, 2006).

Process Monitoring

- *Selected Organic Indicator Microconstituents:* Microconstituents monitored during the ozone optimization phase of this study included compounds with characteristic of the microconstituents listed in California draft groundwater recharge regulations (CDPH, 2008). Microconstituents are quantified using EPA Method 1694 for PPCPs, USGS Method 4 for wastewater indicators, and a lab-specific method developed by AXYS Analytical Services for alkyl phenols. The majority of microconstituents monitored in this study are typically found in municipal wastewater treatment plant effluent (Lietz, 2004).

- *Estrogenic Activity (E-Screen):* The E-screen test is an in vitro bioassay used to determine the relative estrogenic activity (Estradiol Equivalents; EEQ) of a sample. E-screen uses a breast cancer cell line (MCF-7) that responds to estrogens by proliferating. In this assay, a sample of effluent is applied to a plate of breast cancer cells, and after five days, the increase in the numbers of cells is determined. Tests are run concurrently with standard water samples of known estrogen concentrations. Cell proliferation in the effluent is compared to the cell proliferation in the standard samples. The result of the comparison is reported as the effluent EEQ in ng/L.
- *Phospholipid Fatty Acids (PLFAs):* PLFAs occur in viable cell membranes and provide a quantitative tool for assessing microbial populations, and their responses to their environment (Page, 2006). PLFA analyses conducted by Microbial Insights provided broad-based information about the entire microbial community in the BAC biofilter: viable biomass concentrations, community composition, and metabolic status.
- *Ozonation Byproducts:* Bromide and bromate were monitored since they are critical constituents that play a vital role in the design and operation of an ozonation process. Bromate and bromide were quantified using Methods 317, and 300.1, respectively. Organic ozonation byproducts are quantified using EPA Method 556.
- *Organic Carbon Fractions:* Total Organic Carbon (TOC) is an overall indicator of organics present in the effluent, which are removed by several processes in the pilot's multi-barrier process train. Dissolved Organic Carbon (DOC) was analyzed to provide insight on the dissolved organics fraction that passes through the membranes. TOC and DOC were quantified using EPA Method 5310C. The MWH Laboratories conducted BDOC analyses in order to evaluate the effectiveness of BAC.
- *Gaseous and Dissolved Ozone:* Gaseous and dissolved ozone were monitored using online ozone monitors (Teledyne API Models 460H and 460M). Dissolved ozone residuals at various sampling ports were measured using an online ozone analyzer (HACH Ultra Analytics) and a sample sequencer (Sentry Equipment). Ambient atmospheric ozone concentrations were monitored in the pilot testing area to ensure ozone concentrations were below OSHA standards.

Results and Discussion

The MF-Ozone-BAC pilot testing at RSWRF consisted of several critical steps including ozone dosage optimization, bromate mitigation, and conversion of GAC to BAC as discussed below.

Ozone Dosage Optimization

Ozone dosage is a critical process parameter that was optimized during the initial stage of the pilot study by testing the effect of three transferred ozone dosages (3, 5, and 7 mg/L) on membrane-filtered effluent. Reactions of ozone and instantaneous demand for ozone-based oxidants in the wastewater are dependent on various site-specific parameters such as TOC, suspended solids, alkalinity, nitrite, and temperature. In the case of RSWRF, influent to the ozonation using from the MF unit had an average TOC of 6.4 mg/L; and an alkalinity of 92 mg/L. Nitrite concentrations remained negligible (< 60 μg/L) throughout the study. Effluent temperature varied from 62 to 64 °F. The effect of ozonation on effluent quality was measured at specific locations in the ozone contact pipe at which the measured ozone residual was negligible (< 50 μg/L), thus ensuring complete utilization of ozone-based oxidants. Estimated contact times at which ozone residuals were negligible were 3.6, 7.7, and 13.5 minutes for 3, 5, and 7 mg/L transferred ozone dosages, respectively.

Microconstituent occurrences and removals obtained from the ozone optimization study are presented in Table 3. About one-third of the microconstituents were not detected consistently in the MF unit effluent. This could be a result of the long MCRT (±25 days) that was maintained at RSWRF and/or of removal of these microconstituents by MF. Another third of the indicator microconstituents were removed to a level below the detection limits by an ozone dose of 3 mg/L or more. These compounds have high reactivities with ozone-based oxidants (Snyder, 2007). Microconstituents with Quality Control (QC) parameters outside acceptable limits of the analytical methods used were grouped under "Inconsistent Results". The presence of several microconstituents in the "Inconsistent Results" grouping emphasizes the importance of including field blanks, field duplicates, and other lab QC steps during sampling and analysis. Figure 2 shows removal of some microconstituents, and EEQs as a function of ozone dosage. EEQs were below detection limits when the ozone dosage was more than 3 mg/L. Meprobamate was found to be the most recalcitrant microconstituent to oxidation by ozone.

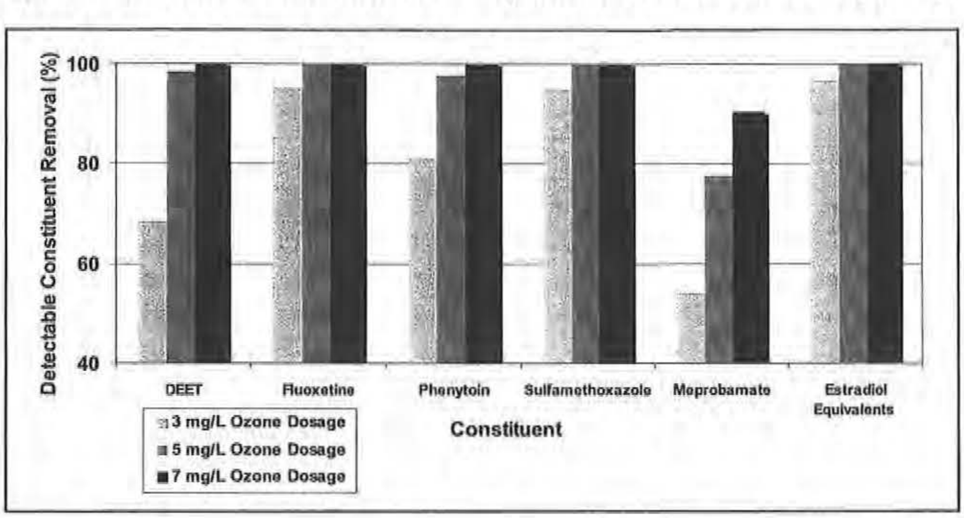
Table 3: Microconstituents Results[1]

Removal by Ozone at 3 mg/L Dose or More		**Occurrence: Non-Detects[2]**	**Inconsistent Results: Failed QC**
99% or More Removal	**99% – 50% Removal (See Figure 2)**		
Oxybenzone (2 ng/L)	DEET (5 ng/L)	Acetaminophen (10 ng/L)	Phenol (50 ng/L)
Estrone (1 ng/L)	Fluoxetine (1 ng/L)	Ibuprofen (10 ng/L)	TDCPP (50 ng/L)
Carbamazepine (1 ng/L)	Phenytoin (5 ng/L)	Caffeine (50 ng/L)	TCEP (50 ng/L)
Diclofenac (2 ng/L)	Meprobamate (5 ng/L)	Estradiol (2 ng/L)	Bisphenol A (10 ng/L)
Gemfibrozil (1 ng/L)	Estradiol Equivalents (0.027 ng/L)	Diethylstilbestrol (2 ng/L)	Salicylic Acid (10 ng/L)
Hydrocodone (1 ng/L)	Sulfamethoxazole (1 ng/L)	Ethinyl Estradiol (2 ng/L)	Triphenylphosphate (25 ng/L)
Methadone (5 ng/L)		Iopromide (100 ng/L)	Atrazine (1 ng/L)
Naproxen (1 ng/L)		Pentoxifyline (1 ng/L)	Diazepam (1 ng/L)
Trimethoprim (5 ng/L)		Progesterone (10 ng/L)	4-Methylphenol (25 ng/L)
Octylphenol (1.1 ng/L)		Testosterone (10 ng/L)	
4-Nonylphenol diethoxylates (14.5 ng/L)		Estriol (1 ng/L)	
4- Nonylphenol monoethoxylates (5 ng/L)		alpha-Estradiol (1 ng/L)	
		Androstendione (10 ng/L)	

[1] *Detection limits shown in parentheses.*

[2] *Microconstituents not detected in influent to the ozonation unit from the MF unit.*

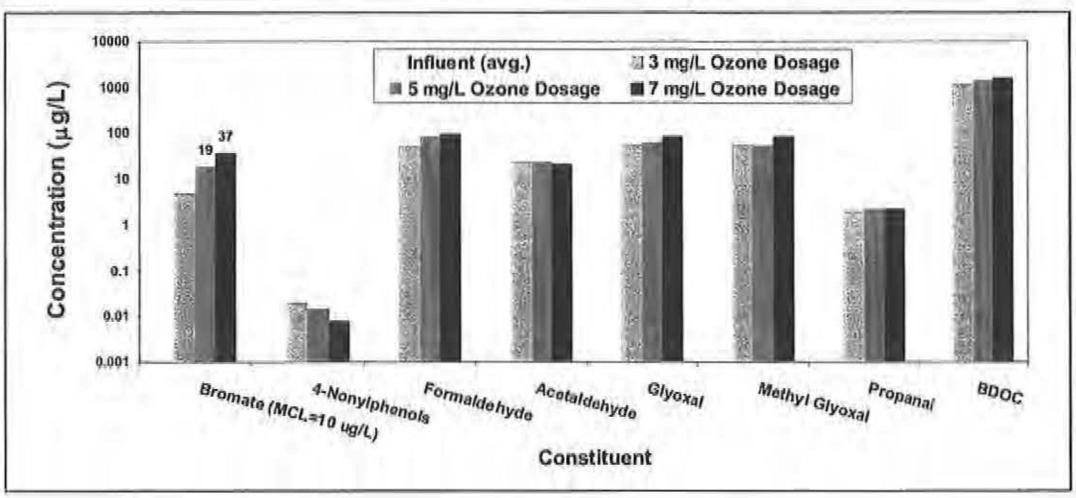
Figure 2: Microconstituent Removals by Ozone as a Function of Ozone Dose



Ozonation Byproduct Formation

Formation of byproducts is a critical concern with effluent ozonation process. Ozonation byproduct concentrations monitored during the ozone optimization study are shown in Figure 3. Bromate is a byproduct of special concern because it has a drinking water Maximum Contaminant Level (MCL) of 10 μg/L, which may be lowered to 5 μg/L. Ozone dosage, presence of ammonia, and background bromide levels are major determinants of bromate formation. Influent bromate concentrations and 3 mg/L ozone dosed effluent bromate concentrations were below the detection limit (<5 μg/L). Effluent bromate concentrations were 19 μg/L for 5 mg/L ozone doses, and 37 μg/L for 7 mg/L ozone doses. Figure 3 also shows ozone forming 4-Nonylphenols (4-NP), various aldehydes, and other short chain organic compounds as a result of oxidation of more complex organic compounds. With 4-NP, increasing the ozone dose from 3 mg/L to 5 mg/L and 7 mg/L resulted a decreases in 4-NP concentrations as a result of further oxidation of this ozonation byproduct at higher ozone doses. BDOC was also monitored as an indicator of whether refractory organics were being oxidized by ozone to more biodegradable compounds. Figure 3 confirms the observations presented elsewhere that BDOC increases with increases in ozone dosage.

Figure 3: Ozonation Byproduct Formation



Bromate Mitigation

The literature reports several strategies for minimizing bromate formation during ozonation. The strategies include: 1) pH depression to as low as 6.8, 2) addition of ammonia, 3) addition of peroxide, and 4) addition of alkalinity (EPA, 1999; Rakness, 2005). Since the average pH of RSWRF effluent was 6.9, further depression of pH would not be considered materially beneficial. Adding ammonia, and alkalinity would negatively impact effluent quality by increasing total nitrogen, and dissolved solids concentrations. Therefore, addition of ammonia and alkalinity were not suitable bromate mitigation measures. Adding peroxide with ozone generates more potent hydroxyl radicals, reduces the required contact time, and does not negatively impact water quality as it decomposes to oxygen and water. Peroxide addition was the implemented ozone mitigation measure.

Previous studies have indicated that the addition of peroxide can minimize bromate formation by several pathways such as peroxide competing with bromide for molecular ozone, and/or generating hydroxyl radicals that convert bromine to bromide (Amy, 1998). Results from previous investigations also showed mixed performance from peroxide depending on pH (Amy, 1998). Therefore, the effect of peroxide on bromate mitigation was investigated comprehensively in this study. The ozone-peroxide system design parameters tested during the study are summarized in Table 4.

Table 4: Bromate Mitigation Study[1]

Factors	Range of Studied Design Variables					
O_3 Dose (mg/L)	3	5	7			
H_2O_2-O_3 Molar Ratio	0	0.25	0.5	0.7	1	1.5
O_3 Injection Points	1	3				
Injection sequence	H_2O_2 First	H_2O_2 Last				

1 – Shaded cells indicate levels that have been selected for further analysis.

Some results from the bromate mitigation study are shown in Figures 4, 5, and 6. Any addition of peroxide reduced bromate formation at all ozone dosages as shown in Figure 4 (results obtained from 3 mg/L and 7 mg/L ozone dosages are not shown for clarity). The extent of bromate formation was found to be mainly a function of ozone dose and peroxide concentration. In the case of 7 mg/L ozone dosage, the concentration of bromate was close to 10 μg/L even after adding peroxide at the maximum 1.5 molar ratio investigated in this study. Previous studies have shown that peroxide molar ratios higher than 2 can diminish the oxidation efficiency (Beltran, 2004). Adding the specified ozone by means of multiple injection points reduced bromate further; however, the incremental benefits were minimal (see Figure 5). Results also showed that bromate formation was not dependent on the injection sequence of peroxide and ozone injection (see Figure 6).

Figure 4: Effect of Peroxide Dose -5 mg/L Ozone; 1.1 mg/L Ammonia;

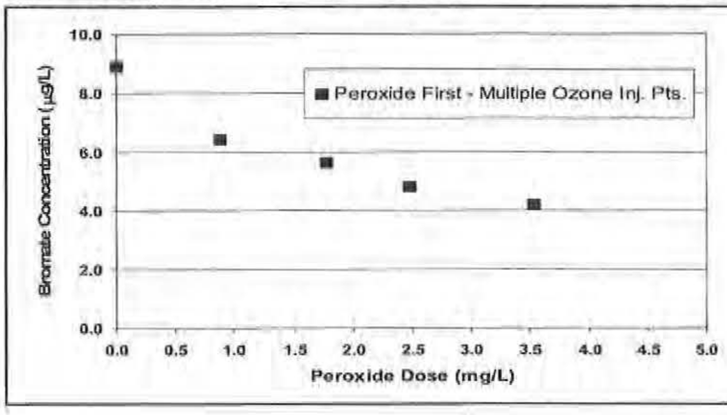


Figure 5: Effect of Ozone Injection Strategy - 5 mg/L Ozone, 1.1 mg/L Ammonia

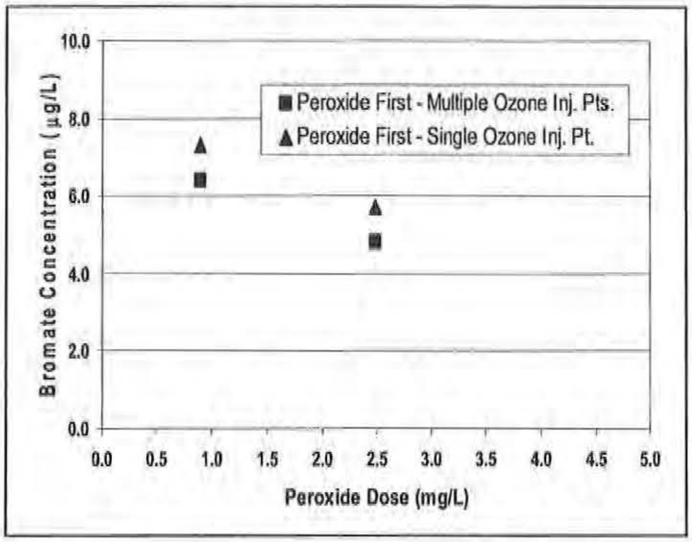
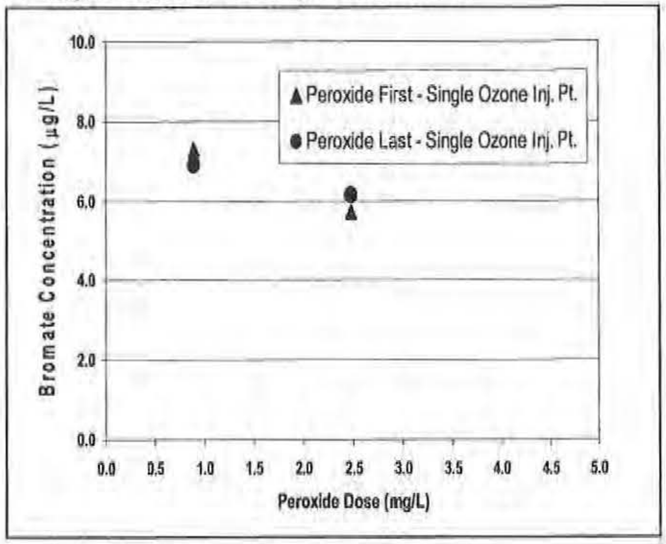


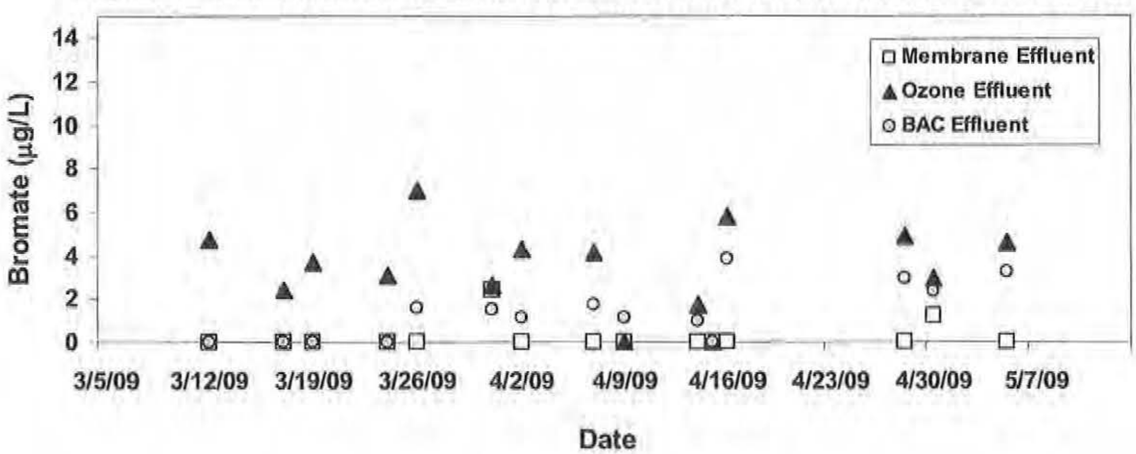
Figure 6: Effect of Ozone Peroxide Injection Sequence - 5 mg/L Ozone; 1.1 mg/L Ammonia



Based on the results obtained from ozone optimization and bromate mitigation studies, an ozone dosage of 5 mg/L injected at one location, with peroxide added at 1 molar ratio prior to ozonation was selected for further analysis, and steady state testing and sampling. An ozone dose of 7 mg/L was not selected due to the higher peroxide concentration requirement to mitigate bromate. Additionally, the higher peroxide requirement could reduce the oxidation efficiency, or require a more complex ozone reactor configuration. A single point ozone injection design was selected for analysis because the benefits of a multiple ozone injection strategy were minimal for this specific effluent.

Effluent bromate concentrations after implementing the bromate mitigation strategy are shown in Figure 7. Results from composite sample monitoring of ozonation unit influent and effluent bromate concentrations indicate successful control of bromate formation during this study. It is significant to note from Figure 7 that effluent bromate concentrations appear to be reduced further by BAC treatment. This phenomenon will be investigated further in this study.

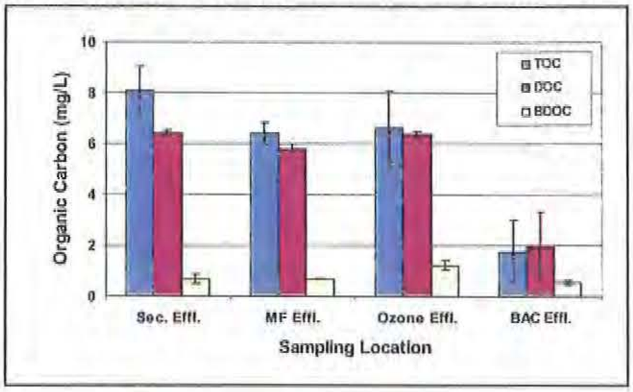
Figure 7: Effluent Bromate Concentrations Under Steady-State Pilot Operation



BAC Unit Process Development

Steady state operation of the pilot process provided the time necessary for development of microbial colonies converting GAC biofilter media into a BAC biofilter. The GAC was "conditioned" into a BAC biofilter process by passing membrane-filtered and ozonated effluent produced by the pilot process through the bed of GAC on a continuous basis for two months at a flow rate of 10.7 gpm. During the conditioning period, the optimized ozone and peroxide dosages were maintained; and the BAC unit was backwashed every two weeks. Biological activity in the BAC was monitored by 1) measuring concentrations of various forms of organic carbon monitored before and after the BAC unit (see Figure 8) and 2) measuring PLFAs in the BAC media at various bed depths before each backwash (see Figures 9,10, and 11).

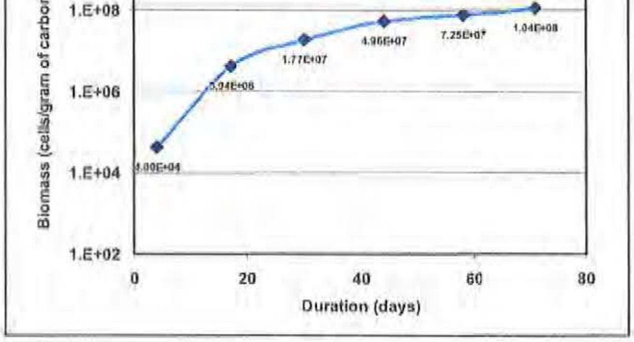
Figure 8: Organic Carbon Profile Across Pilot Treatment Process



When considering the Figure 8 data, membranes removed TOC associated with particulates. TOC remained unchanged by ozonation because ozone-based oxidants are cleaving the aromatic and long-chain aliphatic compounds, but not mineralizing organic carbon to inorganic carbon-di-oxide. However, these cleavages transform slowly biodegradable DOC to readily biodegradable DOC, resulting in an increase in BDOC across the ozonation unit, though the TOC remains unchanged. The BAC unit reduces ozone-created BDOC to background concentrations, and in doing so reduces TOC and DOC. These reductions improve effluent biostability, and decrease the effluent's biofilm growth potential.

PLFA analysis is a reliable and accurate way to determine viable microbial biomass in GAC conditioned into BAC. Phospholipids break down rapidly upon cell death; therefore, biomass calculations based on PLFA content do no contain lipids from dead cells. Figure 9 shows biomass concentrations in the upper six inches of the BAC medium as a function of time based on PLFA results. Biomass values increased from low levels ($\leq 4x10^4$ cells/gram of carbon) to high levels ($1x10^8$ cells/gram of carbon) over the course of 71 days since startup. The flattening of the biomass concentration curve signifies that the GAC has been conditioned and converted to BAC.

Figure 9: Biomass Growth with Time at Bed Depth of 0.5 ft



Changes in the PLFA profile (or microbial community structure) during the conditioning period was monitored (see Figure 10). The initial microbial community during the startup was limited in biomass and diversity. Opportunistic microbes (categorized as the Normal Saturated Group or "Nsats") were the dominant microbial population. The microbial community increased in biomass and diversity over time. Fast growing, hydrocarbon utilizing proteobacteria (the Monoenoic Group or "Monos") became dominant. Anaerobic metal reducing bacteria (Branched Monoenoic Group or "Brmonos"), Nsats, and eukaryotes such as fungi (Polyenoic Group or "Polys") were also present.

The change in PLFA profile or microbial community structure with increasing depth in the BAC bed is shown in Figure 11. The microbial community structure throughout the conditioned BAC bed was fairly uniform, with there being comparatively less biomass towards the bottom the bed, where a scarcity of food source is expected.

Figure 10: PLFA Profile (and Biomass Concentrations) with Time at Bed Depth of 0.5 ft

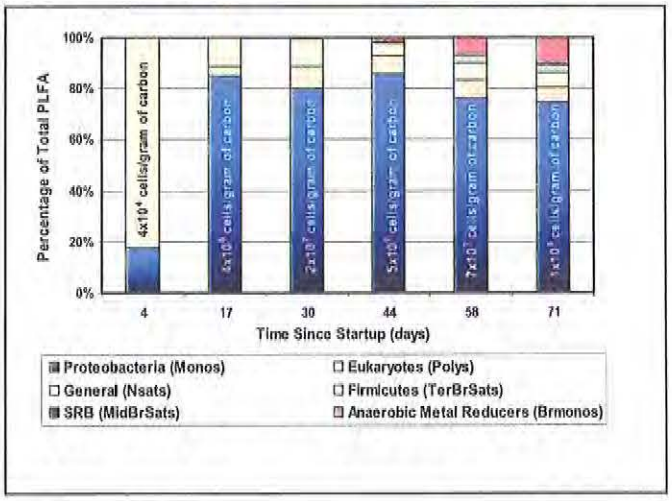
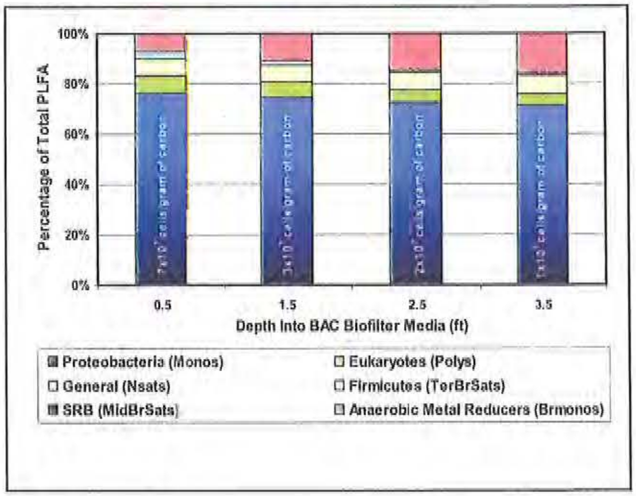


Figure 11: PLFA Profile (and Biomass Concentrations) with Bed Depth on the 58th Day



Conclusions

Results from this pilot study show that ozonation is effective in substantially reducing the concentrations of many microconstituents of treated wastewater. For RSWRF effluent after membrane filtration, a transferred ozone dose of 5 mg/L is recommended for microconstituents removal. Addition of peroxide is found to be an effective bromate mitigation strategy. Injecting ozone at multiple points along with peroxide provides minimal benefits in reducing bromate concentration. The injection sequence between ozone and peroxide is not significant with respect to reducing bromate concentration.

PLFA analysis is an effective tool for assessing and monitoring the microbial population in a BAC biofilter. Based on PLFA analyses, converting GAC to BAC for treatment of MF-Ozone effluent requires about two months. This was unknown prior to this study. BAC removes almost all BDOC generated by ozonation. BAC removes substantial amounts of TOC, and some bromate. These two parameters will be monitored regularly during the rest of the pilot testing. Extensive testing of around 300 effluent contaminants, mostly microconstituents, is planned. The RSWRF MF-Ozone-BAC pilot process is being operated continuously at the time of this paper.

Acknowledgement

We appreciate and acknowledge the vital support for this work provided by: Michael A. Drinkwater, Stephen Long, and Scott Nelson of the City of Reno, Public Works Department; Matt Schultz, John Enloe, Steven L. Beck, and Michael J. Harrison of ECO:LOGIC Engineering; Keel Robinson and Ricky Villalobos of Applied Process Technology; Bryce Meyers, Kim Sorensen, and Steve Lahn of WesTech Engineering; and Greg Davis of Microbial Insights.

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APPENDIX D - Regulatory Collaboration

- Technical Memorandum from John M. Gaston, P.E., CH2MHILL, dated October 17, 2008, titled *Water Reuse in Washoe County*
- Presentation by Robert W. Emerick, Ph.D., P.E., to NDEP and WCDHD on December 15, 2008, titled *State of California Title 22 Reclaimed Water Regulations*

Water Reuse in Washoe County

PREPARED FOR: Washoe County Water Resources

PREPARED BY: John M. Gaston, P.E.
Vice President
CH2M HILL

DATE: October 17, 2008

Introduction

This Technical Memorandum is a summary of the issues relative to the barriers to water reuse in Washoe County and suggested improvements to the process to help facilitate development of additional projects.

Information was gathered at a meeting held at the offices of the Nevada Division of Environmental Protection and interviews with several interested parties. Review of the current Nevada Water Reuse Regulations and other associated documents allowed development of a summary document entitled: Washoe County Nevada: Water Reuse Background and Planning for Future Projects. This was used to frame the issues and solicit comments from the interested parties.

Issues Identified as Barriers to Reuse

The following are a series of issues and questions designed to clarify the potential impediments to new reclaimed water projects. Also included are the responses by the individuals interviewed.

- NAC 445A.2762 Reuse Category A indicates that this reclaimed water may be used for spray irrigation of land used as a cemetery, commercial lawn, golf course, greenbelt or park, and that the public access to the reclaimed water use area is not controlled and may be expected to occur. This reclaimed water may also be used in an impoundment where human contact can reasonably be expected to occur.

The questions that were addressed and the responses are as follows:

1. Do these uses include irrigation of common areas and use in water features such as fountains and ponds in residential developments, specifically single family residences?

Response: Not yet. Single family reuse has not been addressed at this time and it is unlikely to be approved until other issues, such as cross connections and homeowner initiated plumbing changes, have been clarified.

2. Do residential developments include apartments, condominiums, townhouses, and single family units?

Response: Yes, only as "commercial landscape" as defined as common areas. It does not include plumbing under the control of the resident.

3. Are there additional operational restrictions that should be considered?

Response: Maybe; it will be case specific and might include restrictions as to when irrigation can occur, additional signage, public outreach/education, pressure differentials between the domestic supply and the reclaimed water and other measures.

4. Are there additional backflow control requirements that should be employed?
Response: Not at this time; the existing regulations and procedures are adequate but a testing and control plan must be included in an operations plan and individual homeowner changes must be prevented. One thought that was discussed was the use of backflow prevention devices on individual water meter connections. This would serve to protect other consumers if an individual property was re-plumbed and a cross connection established.

- The California-Nevada Section of the American Water Works Association has published a document entitled "Guidelines for the On-Site Retrofit of Facilities Using Disinfected Tertiary Recycled Water" to provide guidance for the design, installation, and operation of new non-potable delivery systems to multiple customers.

The questions that were addressed and the responses are as follows:

1. Do these guidelines provide adequate protection for consumers?
Response: This document had not been reviewed and was an unknown addition to the process. The portions of the document that is specific to Nevada were reviewed and comments received.

2. Are there additional requirements that should be added?
Response: The document needs to be reviewed.

3. Are there changes that need to be made to NAC 445A.276 (Reuse Categories: Requirements for bacteriological quality of effluent?)
Response: Maybe; adding a requirement for effluent filtration may be justified.

- Many new projects may involve installation of urban irrigation in new construction for residential units such as apartments and condominium/townhouses.

The questions that were addressed and the responses are as follows:

1. Can projects be proposed that involve retrofitting of existing units including single family dwellings?
Response: Condominium/Townhouse units might be acceptable depending on the individual case; single family units are not possible at this time.

- Proposals are being considered for projects involving "Aquifer Storage and Recovery" (ASR) which would include groundwater recharge with reclaimed water and later extraction for non-potable uses.

The questions that were addressed and the responses are as follows:

1. Does ASR fall under the category of NAC 445A.280 (Waiver or modification of requirements?)

Response: Maybe; ASR will require some new requirements. It is thought to be possible under the existing regulations.

2. If acceptable, what additional requirements are being considered?

Response: Filtration is a strong possibility; identification of a non-potable aquifer is a must. Public outreach and identification of private wells in the area would be needed. More issues are developed in later sections of this TM.

- NAC 445A.2752 (Signs: required placement and contents) requires that signs be placed at the area to inform the public about the use of reclaimed water.

The questions that were addressed and the responses are as follows:

1. Are there other public education/communication requirements that are being considered?
Response: Yes; it will depend upon the project.

- What other issues should be addressed? Are there different requirements for public and private projects? Are new regulations being considered?

The questions are contained in the issue framed above; the responses were as follows:
1. More information on new projects must be provided. Some proposed projects are presented in a very sketchy outline without enough information as to operation, design, etc.
2. The licensing of the reclaimed water operators is a possibility to insure adequate training and skills.

3. Private projects must be under the control of a public entity such as a water system or waste water system. Permitting of the project is required and this may not be possible for "private" projects.

4. Filtration of tertiary systems is a strong possibility.

General Issues to be Addressed

As a general rule the NDEP staff feels that new projects come in with not enough details. The following are general comments that were gathered during the investigation/interview process.

A suggestion was made that a uniform project report format should be developed for project proponents to follow. Elements of an engineering report should, as a minimum, include the following:

- Description of the design of the proposed system with the following elements:
  - Flexibility in the design to allow the highest degree of treatment with varying influent and other conditions such as weather.
  - Alarm systems and effluent diversion facilities.
  - Redundant power supplies or diversion facilities.
  - Reliability and redundant treatment facilities.
- Contingency planning to prevent use of inadequately treated water.
- Personnel and training requirements. Registration and or licensing should be addressed.
- Preventive maintenance and operations planning.
- Operating records and reporting requirements.
- A plan for public education/outreach in the reuse area and to all potentially impacted consumers.

For ASR projects it is likely that filtration will be required as a minimum. Other ASR operations require total suspended solids (TSS) be limited to very low levels to allow the water to be injected into an aquifer. Project planning for ASR projects require extensive chemical characterization of the ambient groundwater and the water to be injected to ensure compatibility. Treatment of the extracted water may also be required depending upon the intended reuse operations. Characterization of the aquifer will be required and identification of all public and private wells in the recharge/injection area. Modeling may be required to predict groundwater movement. An engineering report for each project should be required.

A partnership between the domestic water system serving the reuse area and the waste water producer must be required. An operations plan for all reuse projects is essential.

Conclusions

From our investigation and interviews it seems as though there is a good potential for additional reuse projects in Washoe County without regulatory changes. Improvement in the engineering report process is needed, but this, according to NDEP, can be done without regulatory changes.

The initial response to suggested ASR projects was that they are possible under the existing regulations, but some changes may be needed in the following areas:

- Effluent filtration with turbidity and/or TSS requirements.
- Operator training and/or licensing requirements.
- Public education/outreach requirements.
- Before single family irrigation projects can be approved/permitted additional work must be done to provide protection from homeowner plumbing changes.

Suggested Actions

Develop a model engineering report format for use by project proponents. NDEP did not indicate that they were going to develop a document, but that they would be willing to participate in the development as an "interested party". Other parties should include water purveyors, waste water operators, and public health agencies.

Interview existing reuse operations personnel to develop a list of issues that they have encountered at their facilities.

State of California
Title 22 Reclaimed Water Regulations

Robert W. Emerick, Ph.D., P.E.
Principal, ECO:LOGIC Engineering

Protection of Public Health

- **Wastewater discharges from municipalities and industries**
- **Pathogens** - virus, bacteria, protozoans
- **Carcinogens** - increase risk of cancer
- **Toxins** - poisonous to living organisms (heavy metals, organics such as pesticides, PCBs and PAHs)

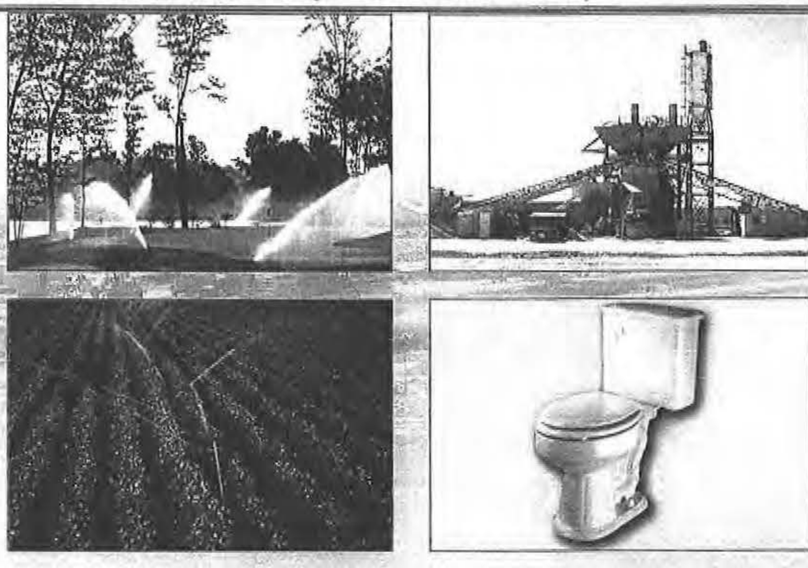
Protection of Environment

- Humans, aquatic life, water fowl
- Toxins
- Dissolved oxygen (DO)
- pH
- Temperature
- Biostimulation

Maintain or Enhance Water Resources

- Beneficial uses – drinking water, industrial, agriculture, recreation, fishery
- Quantity and quality
- Non-degradation policy

Reclamation (Beneficial Reuse)



Reclamation: State of California Governing Laws and Regulations

Best description is in "The Purple Book" covering California health laws related to recycled water. Available at:

www.dhs.ca.gov/ps/ddwem/waterrecycling/PDFs/purplebookupdate6-01.PDF

- **Health and Safety Code (Division 104)**
  - Augmenting potable water supplies with effluent
  - Cross-connection control
- **Water Code (Division 7)**
  - Legislative intent
  - Types of permits
  - Salinity exception
- **Title 22 of the California Code of Regulations (Division 4)**
  - Effluent reclamation regulations

Reclamation Via Irrigation

(Title 22, Division 4, Chapter 3, Article 3, Starts on page 51 of the Purple Book)

- **Disinfected tertiary recycled water uses:**
  - Food crops where effluent is in contact with the edible portion
  - Parks, playgrounds, schools, residential landscaping, unrestricted access golf courses
  - All other irrigation uses not specified below or prohibited by Title 22.
- **Disinfected secondary – 2.2 recycled water uses:**
  - Surface Irrigation (spray or flood, but not subsurface irrigation) of food crops where the edible portion is above ground and does not contact the effluent

Reclamation Via Irrigation *(cont.)*

- **Disinfected secondary – 23 recycled water uses:**
  - Surface Irrigation (spray or flood) of:
    - Cemeteries
    - Freeway landscaping
    - Restricted access golf courses
    - Ornamental nursery stock and sod farms with non-restricted public access
    - Pasture for animals producing milk for human consumption
    - Non-edible vegetation where access is controlled so that the irrigation area cannot be used as if it were a park, playground, or school yard.

Reclamation Via Irrigation *(cont.)*

- **Undisinfected secondary recycled water uses:**
  - Surface Irrigation (spray or flood) of:
    - Orchards and vineyards where the effluent does not contact the edible portion of the crop
    - Non food-bearing trees provided no effluent irrigation occurs within 14 days of harvesting
    - Pasture for animals not producing milk for human consumption
    - Fodder and fiber crops
    - Seed crops not eaten by humans
    - Food crops that must undergo a commercial pathogen-destroying process
    - Ornamental nursery stock and sod farms provided no effluent irrigation occurs within 14 days of harvesting

Stormwater runoff from the effluent use area may need to be contained to some extent if effluent disinfection does not occur.

Effluent Impoundments

- **Disinfected tertiary recycled water for non-restricted recreational impoundments**
- **Disinfected secondary - 2.2 recycled water for restricted recreational impoundments**
- **Disinfected secondary - 23 recycled water for landscape impoundments that do not use decorative fountains (that would cause spray or mists)**

Commercial / Industrial Reclamation

- **Disinfected tertiary recycled water* uses:**
  - Cooling and air conditioning processes involving the possibility of sprays or mists
  - Flushing toilets and urinals (these create aerosols)
  - Decorative fountains
  - Commercial laundries
  - Snow making
  - Car washes
  - Consolidation of backfill around potable water pipes

*Some minor variations in requirements exist; check the Purple Book

Rapid Infiltration or Injection Into Freshwater Resources

- **Regulations are currently under development:**

  www.dhs.ca.gov/ps.ddwem/waterrecycling/PDFs/rechargeregulationsdraft-01-04-2007.pdf

Some Aspects of the Proposed GRRP Regulations

- **Pathogens are controlled (§60320.010)**
- **Nitrogen compounds are controlled (§60320.020)**
- **TOC (Total Organic Carbon) is controlled (§60320.045)**
- **The recycled water is to comply with most drinking water standards (§60320.030)**
- **Effluent may be only a portion of the water (termed the "Recycled Water Contribution", or RWC) applied to the infiltration basin or injection well depending on GRRP-specific conditions (§60320.041)**
- **RWC =** $\frac{\text{Effluent Applied (gal)}}{\text{Effluent Applied (gal)} + \text{Diluent Water Applied (gal)}}$
- **Priority pollutants and other toxicants are monitored (§60320.047)**

Critical Sections in the Proposed Regulations

- **Section 60301.390. Groundwater Recharge Reuse Project**

  "Groundwater recharge reuse project (GRRP)" means a project that uses recycled water and has been planned and is operated for the purpose of recharging a groundwater basin designated in the Water Quality Control Plan [defined in Water Code § 13050(j)] for use as a source of domestic water supply, and that has been identified as a GRRP by a RWQCB".

- **The critical phrase is "has been planned and is operated for the purpose of recharging a groundwater basin." What does that mean?**
  - Many wastewater projects apply effluent to land for the purpose of effluent disposal. Any recharge of the groundwater basin is incidental. There is no claim of benefit from recharging groundwater, such as may occur in an adjudicated groundwater basin. Would the proposed regulations apply?
  - Would the regulation apply to reclamation projects where a portion of the applied effluent must percolate to below the root zone to leach salts left in the root zone soils by the vegetation's evapotranspirative process?
  - If a hypothetical answer to the first project is "yes" and the second project is "no", then where is the legal dividing line between these two projects on when the proposed regulations would apply?
  - Would the proposed regulation apply to individual, clustered, or small community leachfield systems?

Overview of Tertiary Treatment in California

Overview of Tertiary Treatment in California

- **In California** "Tertiary Treatment" means a treatment process train demonstrated to remove 99.999% of the virus still remaining after secondary treatment. Tertiary treatment produces an essentially pathogen-free effluent: bacteria, virus, protozoa, etc.
- **Elsewhere** "Tertiary Treatment" usually means some level of nutrient removal (nitrogen and/or phosphorus) to control eutrophication (i.e., excessive biostimulation) in a receiving water.

The Keys to Creating an Essentially Pathogen-Free Effluent

- **Eliminate solids and fine particulates in which pathogens would be sheltered from the toxic effects of a disinfectant**
  - Effluent filters after secondary treatment (removes particulates)
- **Remove dissolved organics that may utilize, absorb, or otherwise interfere with the disinfection process**
  - Secondary treatment
- **Apply a wide-spectrum toxicant to the effluent from the foregoing processes**
  - Chlorine (actually hypochlorous acid, HOCl)
  - Ultraviolet light (UV)
  - Ozone (O_3)

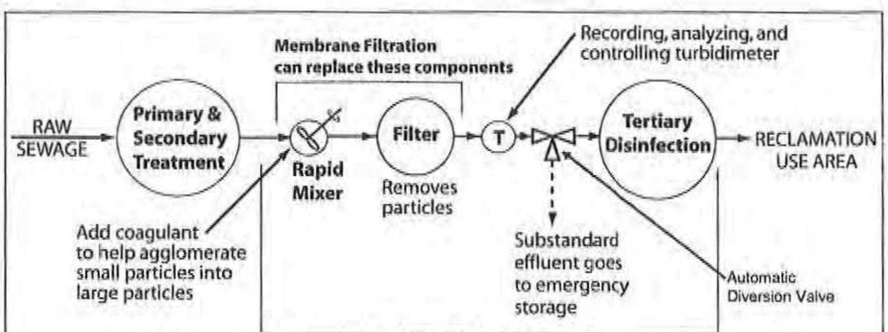
Is the Resulting Effluent Essentially Pathogen-Free?

- **Because it is infeasible to monitor for the presence of all types of pathogens that could be in effluent (e.g., the myriad of known pathogenic bacteria, virus, protozoa), with tertiary treatment we monitor three "indicators" of whether the effluent being produced is essentially "pathogen-free":**
  1. Is the Title 22 treatment process being operated correctly?
  2. Does effluent turbidity comply with Title 22 requirements?
  3. Do total coliform monitoring results comply with Title 22 requirements?
- **If the answer is "yes" to all three questions, then there is a high probability that the effluent being produced is essentially pathogen-free.**

An Important Note About Tertiary Treatment

- Title 22 tertiary treatment provides assurance that the effluent is essentially pathogen-free, i.e., it poses no significant risk of causing pathogen-based disease in people exposed to the effluent.
- Neither Title 22 nor tertiary treatment addresses specifically whether the chemical quality of the effluent poses any risk to:
  - People exposed to the effluent (very unlikely); or,
  - The planned use of the effluent (e.g., salinity for irrigation uses, nutrients for water feature uses, etc.).
- The health risk posed by toxic compounds in effluent is considered to be minor because of the limited exposure by inhalation and the health records of WWTP operators.
- However, tertiary effluent may not be of a chemical quality suitable for some reclamation uses.

Typical Tertiary Treatment Schematic (There are variations)



The Tertiary Treatment Process

Coagulation

- **Coagulant: A chemical that aids in the agglomeration of smaller particles into larger particles**
- **Types of coagulants:**
  - Alum (aluminum sulfate = $Al_2(SO_4)_3$) dose around 20 to 60 mg/L
  - Ferric chloride = $FeCl_3$ **(troublesome to use)**
  - Polymers (specialized long-chain organic compounds)
    - Low weight polymer dosage $\geq$ 10 mg/L
    - High weight polymer dosage ~ 1 mg/L
- **Coagulant dose** is very wastewater specific and may vary seasonally with changes in effluent temperature and/or pH. Do bench-scale tests to determine best coagulant and dose.
- **Polymers** do not add as much metals or salts to the effluent.
- **Rapid Mixer** mixes coagulant into effluent within 1 second ($G > 3500$/sec).

Filter Types

- **Deep bed filters: Water passes through several inches to feet of filter media:**
  - Sand, anthracite, garnet, mixtures of same, etc.
  - Synthetic media such as fuzzy balls made of synthetic fibers
  - Many particle removal mechanisms are operative.
- **Surface filters: Water passes through thin particle straining surface:**
  - Cloth screens (synthetic fibers, e.g., polyester)
  - Membranes (polypropylene, cellulose acetate, etc.)
- **Note: With membrane filtration, coagulants are not used.**

Title 22 Filter Performance

- **Membrane filters: Effluent turbidity is not to exceed:**
  - 0.2 NTU more than 5% of any 24-hour period.
  - 0.5 NTU at any time
- **All other filters:**
  - The filter equipment has been demonstrated to produce an effluent that can be disinfected to Title 22 tertiary standards.
  - Average turbidity ≤ 2 NTU in any 24-hour period.
  - Turbidity ≥ 5 NTU no more than 5% of any 24-hour period
  - Turbidity ≤ 10 NTU at all times
- **For either filter type, any effluent not meeting these standards shall not be delivered to the effluent reclamation area.**

Tertiary Disinfection (Title 22 §60301.230)

- **If chlorine is the disinfectant:**
  - CT ≥ 450 mg • minutes/L at all times
  - Where:

    C = Chlorine residual at end of chlorine contact basin, mg/L

    T = Modal time the effluent has been in contact with the chlorine, minutes
  - T ≥ 90 minutes based on peak (e.g., 3 hour) effluent design flows during the dry season (little to no rain)

Tertiary Disinfection (Title 22 §60301.230) *(con't)*

- **Example Problem:**
  - Field dye studies produced the modal contact time response curve on the following page.
  - **Case 1:** At a flow of 0.5 Mgal/d, the chlorine residual at the end of the basin was 3.0 mg/L. Was this tertiary disinfected effluent?

    From the modal contact time response curve, for a flow of 0.5 Mgal/d, T = 160 minutes.

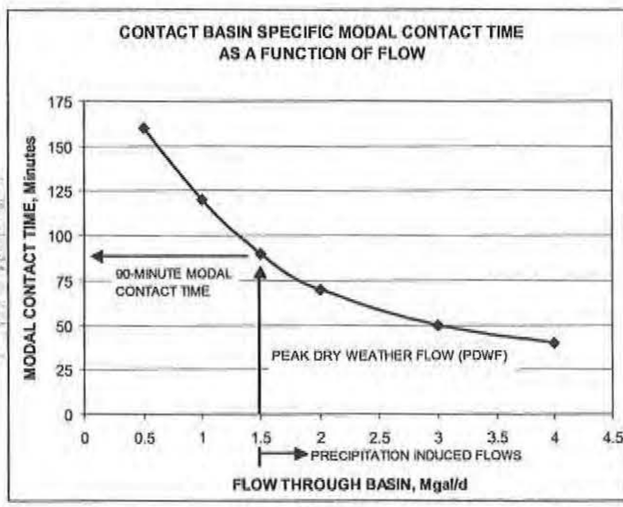
    Calculation: (3.0 mg/L) x (160 minutes) = 480 mg • min/L

    Check: 480 mg • min/L > 450 mg • min/L **OK**

    Check: T = 160 minutes > 90 minutes **OK**

    Answer: Yes

Tertiary Disinfection *(con't)*



Tertiary Disinfection *(con't)*

- **Example Problems:**
  - **Case 2:** At a flow of 2.0 Mgal/d, the chlorine residual at the end of the basin was 5.2mg/L. Was this tertiary disinfected effluent?

    From the modal contact time response curve, T = 72 minutes.

    Calculation: (5.2 mg/L) x (72 minutes) = 364 mg • min/L
    Check: 364 mg • min/L < 450 mg • min/L **NO GOOD**
    Answer: No

Tertiary Disinfection *(con't)*

- **Case 3:** At a flow of 2.0 Mgal/d, the chlorine residual at the end of the basin was 7.3mg/L. Was this tertiary disinfected effluent?

  From the modal contact time response curve, T = 72 minutes.

  Calculation: (7.3 mg/L) x (72 minutes) = 526 mg • min/L
  Check: 526 mg • min/L > 450 mg • min/L **OK**
  Check: T = 72 minutes < 90 minutes **ASK ADDITIONAL QUESTION**

  Was the 2.0 Mgal/d flow caused by precipitation? If the answer is "yes", then the effluent was tertiary effluent. If the answer is "no", then the effluent was not tertiary effluent and needed to be diverted from reclamation use because T must be ≥ 90 minutes except during precipitation-induced high flows.

Tertiary Disinfection (Title 22 §60301.230)

- If a disinfectant other than chlorine is used (e.g., UV or O_3), then it is necessary to demonstrate that the filter and disinfection process, together, inactivate or remove 99.999% of polio virus or MS2 bacteriophage (a bacterial virus) present in secondary effluent.
- For all disinfectants, the monitoring and basis for compliance assessments are based on total coliform effluent testing:
  - Conducted daily
  - 7-day median shall not exceed 2.2 MPN/100 mL
  - One result may exceed 23 MPN/100 mL in any 30-day period
  - No result shall exceed 240 MPN/100 mL

Alarm Features (Title 22 §60335)

- To cover failure of:
  - Normal power supply
  - Biological treatment process
  - Disinfection process
  - Coagulation process
  - Filtration process
  - Any other process for which a warning system is required by the regulatory agency

Failure of Power Supply

- Alarm and automatically actuated standby power for all facilities to treat the wastewater
- Alarm and automatic diversion of effluent to emergency storage with at least 1 day of storage capacity*
- Automatic diversion of effluent to emergency storage with at least 20 days of storage capacity*

* The storage facility needs an independent power supply to operate equipment related to storing the effluent without causing nuisance odors

Failure of Biological Treatment Process *(Including Secondary Sedimentation)*

- **Monitor? The best monitor for failure appears to be turbidity; therefore, use a recording turbidimeter immediately after the non-pond biological treatment process**
  - Alarm and diversion to standby biological treatment unit. Note, where did the "standby biology" come from if the failure was water quality related and not equipment related?
  - Alarm and diversion to at least 1 day of storage or less demanding alternative disposal method (LDADM) if replacement equipment is on-site.
  - Alarm and diversion to at least 20 days of storage or a less demanding alternative disposal method (LDADM).

Failure of Coagulation

- **Typical Control:** Flow and possibly turbidity control of coagulant dosage rate
- **Monitor?** Coagulant flow meter (and possibly coagulant amount in storage).
  - Alarm plus standby feed system.
  - Alarm and diversion to at least 1 day of storage or LDADM if replacement equipment is on-site.
  - Alarm and diversion to at least 20 days of storage or LDADM.

Failure of Filtration

- **Monitor? Recording turbidimeter immediately after filtration.**
  - Alarm plus standby filtration unit.
  - Alarm and diversion to at least 1 day of storage or LDADM if replacement equipment is on-site.
  - Alarm and diversion to at least 20 days of storage or LDADM.

Failure of Chlorine Disinfection

- **Typical Control:** Flow control of chlorine dosage rate. Possible chlorine residual control of chlorine dosage rate.
- **Monitor?** Recording chlorine residual analyzers at beginning and end of chlorine contact chamber. Flow meter and modal contact time curve for the specific chlorine contact basin to allow calculation of CT if tertiary effluent is being produced (see detailed discussion of tertiary disinfection).
  - Alarm plus standby chlorination unit.
  - Alarm and diversion to at least 1 day of storage or LDADM if replacement equipment is on-site.
  - Alarm and diversion to at least 20 days of storage or LDADM.

Title 22 Engineering Report (Title 22 §60323)

- **All direct effluent reuse projects must be covered by an Engineering Report (stamped by a qualified P.E.).**
- **Report describes specifically how the reclamation project complies with Title 22 requirements on effluent:**
  - Production (the WWTP)
  - Distribution (conveyance piping)
  - Use (Use Area requirements)
- **Report describes the Contingency Plan to assure that substandard effluent is not delivered to the Use Area.**

Tertiary Effluent Storage Problems

When tertiary effluent is stored in an open basin for any significant length of time, water quality tends to deteriorate as a result of:

- Wildlife feces (i.e., poop)
- Algae growth
- Other environmental factors

Title 22 does not address this issue. The Environmental Disclosure document for the reclamation project may or may not disclose the deterioration of effluent water quality during storage.

Overview of Use Area Requirements in California

Effluent Irrigation Use Area Requirements (§60310)

(Check the Purple Book for exceptions and special conditions)

- **Tertiary Effluent**
  - No irrigation within 50 feet of any domestic water well
  - No impoundment within 100 feet of any domestic water well
- **Secondary – 2.2 and Secondary – 23 Effluents**
  - No irrigation or impoundment within 100 feet of any domestic water well
- **Undisinfected Secondary Effluent**
  - No irrigation or impoundment within 150 feet of any domestic water well
- **No spray irrigation within 100 feet of residence, park, playground, or schoolyard, except with tertiary effluent.**

Effluent Irrigation Use Area Requirements (§60310)

(Check the Purple Book for exceptions and special conditions)

- **No effluent spray, mist, or runoff (regardless of effluent quality) shall enter dwellings, designated outdoor eating areas (e.g., picnic tables), or food handling facilities (e.g., barbeque areas), or shall contact drinking water fountains**
- **Effluent use areas shall be posted with signs: "Recycled Water – Do Not Drink"**
- **No hose bibs in areas accessible by the general public**

Title 22 Effluent Water Quality Standards

- The only aspects of water quality specifically regulated by Title 22 are designed to protect public health from pathogens
- Other water quality characteristics that may be important to a specific effluent reclamation use that are not regulated by Title 22 include:
  - Salinity
  - Chloride
  - SAR (Sodium Absorption Ratio)
  - Boron
  - Nutrients
  - Organics
  - Pesticides
  - Metals
- Environmental review documents for the reclamation project should analyze the propriety of effluent chemical quality to the proposed use

Draft Regulations: Backflow Prevention and Cross Connection Control

Recycled Water Backflow Prevention Criteria

- **The public water supply shall not be used as a backup or supplemental source of water for a dual-plumbed recycled water system unless the connection between the two systems is protected by an air-gap separation.**
- **Prior to initial operation of the dual plumbed recycled water system, the recycled water agency shall ensure that the dual-plumbed system is inspected and tested for possible cross-connections with the potable water system.**
  - Dual plumbed system shall be inspected annually
  - Tested for cross-connections at least once every four years
  - Inspections shall be performed by a Cross Connection Control Specialist

Recycled Water Backflow Prevention Selection Criteria

- **Air Gap Separation**
  - Recycled water supply system that is interconnected to a piping system that contains water received from a potable water system.
- **Reduced Pressure Principle Assembly**
  - Recycled water system that is not interconnected to a piping system that contains water received from a potable water system.
  - Recycled water supply used only for landscape irrigation in an approved dual-plumbed use area used for sites other than individually owned residential units.
- **Double Check Valve Assembly**
  - Recycled water supply used only for landscape irrigation in an approved dual-plumbed use area used for individually owned residential units.

Problem Areas Associated with Reclamation in California

Dilemmas with Reclamation

- Strongly encouraged by the Water Code (§13511)
- Reclamation is discouraged by aspects of reality:
  - Incidental runoff of effluent from Use Area.
  - Groundwater degradation.
  - Effluent mists from spray irrigation.

Incidental Runoff

- There will be runoff from irrigated areas from time to time
- Does the Clean Water Act discuss how to permit incidental effluent runoff to a surface water?
- If incidental runoff is identified as occurring in a permit, does that constitute authorization of incidental runoff? If so, then are effluent limitations needed for that authorized discharge?
- Incidental runoff may not meet effluent limitations for discharge to surface waters regardless of whether the source of irrigation water is:
  - Effluent
  - Groundwater
  - Surface water
  - Potable water

Incidental Runoff *(con't)*

- **If incidental runoff is not authorized by a wastewater permit, then the reporting requirements for incidental runoff are as specified in Water Code §13529.2:**
  - < 50,000 gallons (per day?) of tertiary effluent need not be reported.
  - < 1,000 gallons (per day?) of lesser recycled water need not be reported.
  - "Need not be reported" does not mean the discharge was "legal"
- **What is the legal authority for "Incidental Runoff"?**

Example: Golf Course Reclamation

- **Water hazards that overflow from stormwater must not contain effluent by any planned means:**
  - Direct piping
  - Effluent irrigation runoff
  - Sprinkler throw
- **Irrigation pipe drainage while making repairs must be contained**
- **No effluent irrigation during high winds or rainfall (use automatic controls)**

Groundwater Degradation

- **Effluent quality vs. groundwater quality**
- **Reclamation, almost always a problem if:**
  - The reclamation site was not irrigated historically
  - The historical irrigation water was of better quality
  - Upgradient land use fosters first recoverable groundwater of high quality

Effluent Salinity Issues

- Irrigation of plants results in evapotranspirative concentration of effluent salt. Different crops remove different amounts of salt.
- The evapotranspiratively concentrated salt must be leached from the soil to:
  - Groundwater; or
  - Surface water (e.g., via tile drains); or,
  - A brine conveyance and disposal system.

Effluent Salinity Issues *(con't)*

- Is such salinity degradation of groundwater or surface water acceptable?
- Water Code §13523.2 " salinity exception" states:

> A regional board may not deny issuance of water reclamation requirements to a project which violates only a salinity standard in the basin plan.

- How should we comply with or change this law with respect to legislative intent regarding salinity and reclamation?

Ground Degradation, Nutrients

- Crop uptake efficiency of nitrogen typically does not exceed about 50%.
- Permits allowing nitrogen application at nitrogen uptake rates (as cited in the Western Fertilizer Handbook) are unacceptable.

Mists Resulting From Spray Irrigation

- Title 22 §60310 (e)(2) reads:

  "Spray, mist, or runoff shall not enter dwellings, designated outdoor eating areas, or food handling facilities."
- What is a mist? There are many definitions.
- Normal spray irrigation practice generates small droplets that some would classify as "mists" that can drift for hundreds of feet.
- Does spray irrigation of effluent on golf courses, residential landscaping, and park landscaping violate this regulation when dwellings, picnic tables, and barbeques may be nearby?
- Ask the engineer stamping the Engineering Report to clarify compliance with this regulation in the Engineering Report.

APPENDIX E - Cost of Service Evaluation

- Reclaimed Water Distribution System Cost/Benefit Table
- Cost/Benefit Matrix for Implementing a Regional Reclaimed Water Distribution System in the North Valleys
- Cost/Benefit Feedback Form for Implementing a Regional Reclaimed Water Distribution System
- Reclaimed Water Cost Summaries - 3 Comparative Scenarios, including detail on assumptions and associated back-up information
- Scenario Qualitative Comparison (Summary)
- Reno-Sparks Dual System Analysis - Final Results Memorandum, by Optimatics, dated March 31, 2009

IMPLEMENTING A REGIONAL RECLAIMED WATER DISTRIBUTION SYSTEM
COSTS & BENEFITS TO AFFECTED UTILITIES, DEVELOPERS AND CUSTOMERS

Items Identified as Potential Costs and/or Benefits	Perceived as a Cost, 'C', Benefit, 'B', Both, 'C/B', or Not Applicable, 'N/A', to the Below Entities					Estimated Level of Effort to Quantify in North Valleys Example (E - Easy, M - Moderate, D - Difficult)
	Waste water Utility	Water Utility	Reclaimed Water Utility	Developer	Customer	
1. Cost to develop and manage a Public Outreach campaign/process	C	C	C	C	N/A	M
2. Decreased customer fees for potable water use (assumes reclaimed water is piped and available; temporary revenue loss)	N/A	C	N/A	N/A	B	E
3. Decreased connection fees for potable water (connection fees based on lot size and MDD; temporary revenue loss)	N/A	C	N/A	B	B	Wasn't connection fee the same because fire flows drive potable system sizing? E
4. Decreased potable water rights dedication requirements	N/A	C?	N/A	B	B	E
5. Decreased operating costs to service potable water - lower peak demands	N/A	B	N/A	N/A	B	M

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Items Identified as Potential Costs and/or Benefits	Perceived as a Cost, 'C', Benefit, 'B', Both, 'C/B', or Not Applicable, 'N/A', to the Below Entities					Estimated Level of Effort to Quantify in North Valleys Example (E - Easy, M - Moderate, D - Difficult)
	Waste water Utility	Water Utility	Reclaimed Water Utility	Developer	Customer	
6. Deferred capital costs for potable water facility expansions - lower peak demands	N/A	B	N/A	B	B	M
7. Deferred or avoided expenditures on future water importation projects	N/A	B?	N/A	B?	B?	D
8. New customer fees for reclaimed water use	N/A	N/A	B	N/A	C	M
9. New connection fees for reclaimed water	N/A	N/A	B	C	C	M
10. New water rights fees for reclaimed water	N/A	N/A	B	C	C	M

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COSTS & BENEFITS TO AFFECTED UTILITIES, DEVELOPERS AND CUSTOMERS

Items Identified as Potential Costs and/or Benefits	Perceived as a Cost, 'C', Benefit, 'B', Both, 'C/B', or Not Applicable, 'N/A', to the Below Entities					Estimated Level of Effort to Quantify in North Valleys Example (E - Easy, M - Moderate, D - Difficult)
	Waste water Utility	Water Utility	Reclaimed Water Utility	Developer	Customer	
11. Increased costs associated with second system to operate and maintain (including monitoring, annual tests, inspections, etc.)	C	C	C	N/A	C	M
12. Costs to retrofit certain systems to displace existing potable water with reclaimed water used for irrigation	N/A	C/B	C/B	N/A	B	who pays, wouldn't developer? D
13. Added costs for upgrading WWTP facilities to Category A+ water	C	N/A	C	C	C	E
14. Added costs for upgrading WWTP facilities to indirect potable reclaimed water quality	C	N/A	C	C/B	C/B	E
15. Deferred or avoided costs (including increased operating costs) of alternate disposal options	B?	N/A	N/A	B?	B?	M

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COSTS & BENEFITS TO AFFECTED UTILITIES, DEVELOPERS AND CUSTOMERS

Items Identified as Potential Costs and/or Benefits	Perceived as a Cost, 'C', Benefit, 'B', Both, 'C/B', or Not Applicable, 'N/A', to the Below Entities					Estimated Level of Effort to Quantify in North Valleys Example (E - Easy, M - Moderate, D - Difficult)
	Waste water Utility	Water Utility	Reclaimed Water Utility	Developer	Customer	
16. Cost of reclaimed distribution systems	N/A	N/A	C	C	C	M
17. Cost of developing the program and going through the required political, regulatory and public processes	C	C	C	C	N/A ? C	D
18. Cost of ongoing regulatory oversight	C	C	C	C	C	D
19.						
TOTALS	C = 6 B = 1 N/A = 11	C/B = 1 C = 7 B = 3 N/A = 7	C/B = 1 C = 7 B = 3 N/A = 7	C/B = 1 C = 7 B = 5 N/A = 5	C/B = 1 C = 8 B = 8 N/A = 1	

Notes:

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COST BENEFIT MATRIX FOR IMPLEMENTING A REGIONAL RECLAIMED WATER DISTRIBUTION SYSTEM IN THE NORTH VALLEYS

Items Identified as Potential Costs and/or Benefits			Cost/Benefit Rating for the Below Entities, on a scale from 0 to 5 (1 = least cost, least benefit; 5 = greatest cost, greatest benefit; 0 = Not Applicable)					Estimated Level of Effort to Quantify in North Valleys Example (E - Easy, M - Moderate, D - Difficult)
			Wastewater Utility	Water Utility	Reclaimed Water Utility	Developer	Customer	
1	Cost to develop and manage a Public Outreach campaign/process	Cost:	1	1	1			M
		Benefit:						
2	Decreased customer fees for potable water use (assumes reclaimed water is piped and available; temporary revenue loss)	Cost:		2				E
		Benefit:					1	
3	Decreased connection fees for potable water (connection fees based on lot size and MDD; temporary revenue loss)	Cost:		2				E
		Benefit:				3	3	
4	Decreased potable water rights dedication requirements	Cost:		1				E
		Benefit:				3	2	
5	Decreased operating costs to service potable water - lower peak demands	Cost:						M
		Benefit:		2			1	
6	Deferred capital costs for potable water facility expansions - lower peak demands	Cost:						M
		Benefit:		2		2	1	
7	Deferred or avoided expenditures on future water importation projects	Cost:						D
		Benefit:		2		2	2	
8	New customer fees for reclaimed water use	Cost:					2	M
		Benefit:			3			
9	New connection fees for reclaimed water	Cost:				3	3	M
		Benefit:			3			
10	New water rights fees for reclaimed water	Cost:				3	2	M
		Benefit:			3			
11	Increased costs associated with second system to operate and maintain (including monitoring, annual tests, inspections, etc.)	Cost:	2	1	4		1	M
		Benefit:						
12	Costs to retrofit certain systems to displace existing potable water with reclaimed water used for irrigation	Cost:		1	4		1	D
		Benefit:		2	3		2	
13	Added costs for upgrading WWTP facilities to Category A+ water	Cost:	5		3	3	1	E
		Benefit:						
14	Added costs for upgrading WWTP facilities to indirect potable reclaimed water quality	Cost:	5		1	2	1	E
		Benefit:				3	2	
15	Deferred or avoided costs (including increased operating costs) of alternate disposal options	Cost:						M
		Benefit:	5			3	1	
16	Cost of reclaimed distribution systems	Cost:			4	3	2	M
		Benefit:						
17	Cost of developing the program and going through the required political, regulatory and public processes	Cost:	2	2	2	1	1	D
		Benefit:						
18	Cost of ongoing regulatory oversight	Cost:	2	2	3	1	1	D
		Benefit:						
COST/BENEFIT TOTALS		Cost:	17	12	22	16	15	
		Benefit:	5	8	12	16	15	

Prepared By: ECO:LOGIC, 2/18/09
Print Date: 9/2/2009

COSTS & BENEFITS TO UTILITIES IN IMPLEMENTING A REGIONAL RECLAIMED WATER DISTRIBUTION SYSTEM

Items Identified as Costs and/or Benefits to Utilities	Feedback on Potential Impacts to Utilities
1. Cost to develop and manage a Public Outreach campaign/process	• Everyone will end up contributing to the costs.
2. Decreased customer fees for potable water use (assumes reclaimed water is piped and available; temporary revenue loss)	• Negative to water purveyors for ongoing revenue. • Positive to customer; though customers will have fees associated with reclaimed water service.
3. Decreased connection fees for potable water (connection fees based on lot size and MDD; temporary revenue loss)	• If fire flow is dictating potable water pipe size, may not be much, if any, of a decrease. • However, if size of potable water service lines to residences is smaller, connection fees should be less. This benefits customer and developer. • Less revenue to purveyor for same number of connections; therefore, would take longer to recoup costs already incurred for infrastructure (Stranded Investment Concept [1])
4. Decreased potable water rights dedication requirements	• As the supply decreases, cost of water rights dedication increases. • Any change in dedication requirements would depend on which utility/purveyor is providing the water.
5. Decreased operating costs to service potable water - lower peak demands	• If demand for potable water decreases, the utilities/purveyors could save on power, chemicals, etc. needed to treat and supply the water.

COSTS & BENEFITS TO UTILITIES IN IMPLEMENTING A REGIONAL RECLAIMED WATER DISTRIBUTION SYSTEM

Items Identified as Costs and/or Benefits to Utilities	Feedback on Potential Impacts to Utilities
6. Deferred capital costs for potable water facility expansions - lower peak demands	• (No specific feedback)
7. Deferred or avoided expenditures on future water importation projects	• Benefit for everyone.
8. New customer fees for reclaimed water use	• Monthly bills would be distributed just as for potable water.
9. New connection fees for reclaimed water	• (No specific feedback)
10. New water rights fees for reclaimed water	• Water resource cost. • Most difficult concept to get elected officials to accept and approve.
11. Increased costs associated with second system to operate and maintain (including monitoring, annual tests, inspections, etc.)	• Partially dependent upon who runs the system. • Could TMWA be contracted/designated to operate the system initially?

COSTS & BENEFITS TO UTILITIES IN IMPLEMENTING A REGIONAL RECLAIMED WATER DISTRIBUTION SYSTEM

Items Identified as Costs and/or Benefits to Utilities	Feedback on Potential Impacts to Utilities
12. Costs to retrofit certain systems to displace existing potable water with reclaimed water used for irrigation	• Would result in the displacement of water rights, which could cause an imbalance among the utilities/purveyors that would have to be worked out. • Economic development incentive: perhaps new businesses moving into already developed areas may use reclaimed water for certain processes[2].
13. Added costs for upgrading WWTP facilities to Category A+ water	• Could 'in-line' treatment be an option? For example, Sparks would take TMWRF water and treat it further just prior to the distribution point(s).
14. Added costs for upgrading WWTP facilities to indirect potable reclaimed water quality	• (No specific feedback)
15. Deferred or avoided costs (including increased operating costs) of alternate disposal options	• The alternative is no additional growth. • Water would already have to be treated to some required level in order to transport it outside of the region (i.e. Long Valley Creek export option). To the same level?
16. Cost of reclaimed distribution systems	

COSTS & BENEFITS TO UTILITIES IN IMPLEMENTING A REGIONAL RECLAIMED WATER DISTRIBUTION SYSTEM

Items Identified as Costs and/or Benefits to Utilities	Feedback on Potential Impacts to Utilities
17. Cost of developing the program and going through the required political, regulatory and public processes	
18. Cost of ongoing regulatory oversight	
19.	

Notes:

1. Stranded investment is defined as the historic financial obligations of utilities incurred in the regulated market that become unrecoverable in a competitive market. In the past, utility investments, i.e. "Financial Obligations," have been made in the regulated market, the market in which utilities "historically" operated. In that market, utilities anticipated that investment would be recovered in rates charged to customers. These obligations may become "unrecoverable in a competitive market" because prices in a competitive market are uncertain, and as such, may be below regulated prices. If a utility cannot charge as much in a competitive market as it would have charged in a regulated market, a portion of the asset becomes "unrecoverable" or "stranded." Thus the change from a regulated to a competitive market can create stranded investment.

2. Per the Uniform Plumbing Code (2006 edition referenced), Chapter 16, Section 1613.0(A), "The provisions of this chapter shall apply to the installation, construction, alteration, and repair of reclaimed water systems intended to supply water closets, urinals, and trap primers for floor drains and floor sinks. Use is limited to these fixtures that are located in nonresidential buildings. Fixtures within residential buildings are excluded from the list of approved uses."

Reclaimed Water Scenarios Cost Summary

One Time Costs

Item		Scenario 1 Total Cost	Scenario 2 Total Cost	Scenario 3 Total Cost	Scenario 1 Cost per Unit	Scenario 2 Cost per Unit	Scenario 3 Cost per Unit
A	Wastewater treatment plant expansion (#9 or #10), and disposal pipe (Scenario 1 #11 [b])	56,100,000	39,100,000	47,400,000	6,143	4,282	5,191
B	Wastewater connection fee (#14)	48,180,000	48,180,000	48,180,000	5,276	5,276	5,276
C	Potable water right fees (#4)	66,740,000	40,360,000	40,360,000	7,308	4,420	4,420
D	Potable water connection fees (#3)	68,070,000	28,830,000	68,070,000	7,454	3,157	7,454
E	Reclaimed Water-includes public outreach (#1), reclaimed water distribution system (#11) [b] and cost to develop reclaimed water program (#12)	0	54,900,000	20,600,000	0	6,012	2,256
F	Reclaimed water connection/ resource fee (#7)	16,100,000	54,000,000	27,600,000	1,763	5,913	3,066
	Total	$255,190,000	$265,370,000	$252,610,000	$27,944	$29,060	$27,663

[a] Based on 9132 dwelling units

[b] Only pipeline capacity for 2 mgd has been included. The pipe would not be built in phases, and therefore there is more initial cost than shown in the table.

Annual Costs

Item		Scenario 1 Annual Cost	Scenario 2 Annual Cost	Scenario 3 Annual Cost	Scenario 1 Cost per Unit	Scenario 2 Cost per Unit	Scenario 3 Cost per Unit
G	Wastewater treatment plant O&M costs and pumping costs (Scenario 1) and/or reclaimed water O&M costs (#8)	475,000	1,730,000	430,000	52	36	47
H	Potable water operational costs(#5)	1,040,000	530,000	1,040,000	114	102	114
I	Potable water customer fees (#2)	3,680,000	2,350,000	3,680,000	403	257	403
J	Regulatory oversight (#13)	0	200,000	200,000	0	131	22
K	Reclaimed water customer fees (#6)	0	1,590,000	0	0	174	0
	Total	$5,195,000	$6,400,000	$5,350,000	$569	$700	$586

[a] Based on 9132 dwelling units

Scenario 1: Single Use of Water-Discharge to Long Valley Creek

	Potential Revenue or Cost	Wastewater Utility	Water Utility	Reclaimed Water Utility	Developer	Customer
1	Cost to develop and manage a Public Outreach campaign/process ($/campaign)					
2	Annual customer fees for potable water use ($/year)		3,680,000			-3,680,000
3	Connection fees for potable water ($)		68,070,000		-68,070,000	
4	Potable water rights dedication requirements ($)		66,740,000		-66,740,000	
5	Operating costs to service potable water ($/year)		-1,040,000			
6	Customer fees for reclaimed water use ($/year)					
7	New reclaimed water connection/ resource fee ($)	16,100,000			-16,100,000	
8	Costs associated with second system to operate and maintain (including monitoring, annual tests, inspections, treatment plant O&M) ($/year)	-475,000				
9	Costs for upgrading WWTP facilities to Category A+ water ($/project)	-40,100,000				
10	Costs for upgrading WWTP facilities to indirect potable reclaimed water quality ($/project)					
11	Cost of reclaimed distribution systems ($)	-16,000,000				
12	Cost of developing the program and going through the required political, regulatory and public processes ($)					
13	Cost of ongoing regulatory oversight ($/year)					
14	Existing Wastewater Connection Fee ($)	48,180,000			-48,180,000	
	One Time	8,180,000	134,810,000	0	-199,090,000	0
	Annual	-475,000	2,640,000	0	0	-3,680,000

(a) Revenue shown as positive numbers. Expenses shown as negative numbers.
(b) Blue highlighted cells are relevant to this scenario.
(c) Only pipeline capacity for 2 mgd has been included to Long Valley Creek. The pipe would not be built in phases, and therefore there is more initial cost than shown in the table.

Scenario 2: Residential Reclaimed Water Use

	Potential Revenue or Cost	Wastewater Utility	Water Utility	Reclaimed Water Utility	Developer	Customer
1	Cost to develop and manage a Public Outreach campaign/process ($/campaign)			-2,500,000		
2	Annual customer fees for potable water use ($/year)		2,350,000			-2,350,000
3	Connection fees for potable water ($)		28,830,000		-28,830,000	
4	Potable water rights dedication requirements ($)		40,360,000		-40,360,000	
5	Operating costs to service potable water ($/year)		-530,000			
6	Customer fees for reclaimed water use ($/year)			1,590,000		
7	New reclaimed water connection/ resource fee ($)			54,000,000	-54,000,000	
8	Costs associated with second system to operate and maintain (including monitoring, annual tests, inspections, treatment plant O&M) ($/year)	-330,000	-400,000	-1,000,000		
9	Costs for upgrading WWTP facilities to Category A+ water ($/project)	-39,100,000				
10	Costs for upgrading WWTP facilities to indirect potable reclaimed water quality ($/project)					
11	Cost of reclaimed distribution systems ($)			-52,100,000		
12	Cost of developing the program and going through the required political, regulatory and public processes ($)			-300,000		
13	Cost of ongoing regulatory oversight ($/year)			-200,000		
14	Existing Wastewater Connection Fee ($)	48,180,000			-48,180,000	
	One Time	9,080,000	69,190,000	-900,000	-171,370,000	0
	Annual	-330,000	1,420,000	390,000	0	-2,350,000

(a) Revenue shown as positive numbers. Expenses shown as negative numbers.
(b) Blue highlighted cells are relevant to this scenario.
(c) Only pipeline capacity for 2 mgd has been included to the reservoir. The pipe would not be built in phases, and therefore there is more initial cost than shown in the table.

Scenario 3: Indirect Reuse

	Potential Revenue or Cost	Wastewater Utility	Water Utility	Reclaimed Water Utility	Developer	Customer
1	Cost to develop and manage a Public Outreach campaign/process ($/campaign)			-2,500,000		
2	Annual customer fees for potable water use ($/year)		3,680,000			-3,680,000
3	Connection fees for potable water ($)		68,070,000		-68,070,000	
4	Potable water rights dedication requirements ($)		40,360,000		-40,360,000	
5	Operating costs to service potable water ($/year)		-1,040,000			
6	Customer fees for reclaimed water use ($/year)					
7	New reclaimed water connection/ resource fee ($)			27,600,000	-27,600,000	
8	Costs associated with second system to operate and maintain (including monitoring, annual tests, inspections, treatment plant O&M) ($/year)	-430,000				
9	Costs for upgrading WWTP facilities to Category A+ water ($/project)					
10	Costs for upgrading WWTP facilities to indirect potable reclaimed water quality ($/project)	-47,400,000				
11	Cost of reclaimed distribution systems ($) (c)		-8,600,000	-9,200,000		
12	Cost of developing the program and going through the required political, regulatory and public processes ($)			-300,000		
13	Cost of ongoing regulatory oversight ($/year)			-200,000		
14	Existing Wastewater Connection Fee ($)	48,180,000			-48,180,000	
	One Time	780,000	99,830,000	16,000,000	-184,210,000	0
	Annual	-430,000	2,640,000	-200,000	0	-3,680,000

(a) Revenue shown as positive numbers. Expenses shown as negative numbers.
(b) Blue highlighted cells are relevant to this scenario.
(c) Only pipeline capacity for 2 mgd has been included to and from the recharge area. The pipe would not be built in phases, and therefore there is more initial cost than shown in the table.

Assumptions

Based on 9,132 units that will produce 2 mgd of wastewater (2.19 people per house 100 gallons per capita for RSWRF)
Assumes 5,303 units (6,300 sf lots), and 3,829 units based on Peek Unit 6 and 7, and the lots next to Peek Unit 6 and 7.

	Potential Revenue or Cost	Assumptions
1	Cost to develop and manage a Public Outreach campaign/process ($/campaign)	Assumed $500,000 per year, for 5 years.
2	Annual customer fees for potable water use ($/year)	Based on 2008 rates in Washoe County Water Ordinance 1286, and average County metered water use records in South Truckee Meadows for MDS (3 units/acre) and HDS (7 units/acre) properties for July 2005-June 2006.
3	Connection fees for potable water ($)	Based on TMWA Rule 5 for Stead, using MDD calculated based on [MDD (GPM) for Single Family Unit (SF) = 0.009037 x (unit size (ft2))^0.5] Scenario 2- Assumed MDD=0.3 gpm per unit.
4	Potable water rights dedication requirements ($)	Based on assumed $20,000 per AF. TMWA Rule 7 for total water rights. Assumed 6,000 gallons per month for indoor use to calculate reduced water rights.
5	Operating costs to service potable water ($/year)	Assumed $0.80 per 1,000 gallons. Scenario 1 and 3- Based on ADD=MDD/2.61. Scenario 2- Based on 6,000 gallons per month per unit.
6	Customer fees for reclaimed water use ($/year)	Based on County monthly rate and outdoor water use multiplied by average of County and Sparks usage rates.
7	New reclaimed water connection/ resource fee ($)	Based on cost of #9 or #10 and #1, #11 and #12 minus $40 million that the existing wastewater connection fee will cover.
8	Costs associated with second system to operate and maintain (including monitoring, annual tests, inspections, etc.) ($/year)	Scenario 1- Additional WRF O&M costs, and pumping to Long Valley costs. Scenario 2-Additional WRF O&M costs. Reclaimed water system operation based on Sparks operating costs approximately $0.93 per 1,000 gallon), extra inspection for water and reclaimed water, and pumping to storage reservoir in winter. Scenario 3- Additional WRF O&M costs, and pumping costs to injection field.
9	Costs for upgrading WWTP facilities to Category A+ water ($/project)	Scenario 1- Based on 2 mgd of reliable additional RSWRF capacity including headworks, secondary treatment, membranes, UV and cooling towers. Scenario 2- Based on 2 mgd of additional RSWRF capacity including headworks, secondary treatment, membranes and UV.
10	Costs for upgrading WWTP facilities to indirect potable reclaimed water quality ($/project)	Based on 2 mgd of additional reliable RSWRF capacity including headworks, secondary treatment, membranes, ozone, UV, and BAC.
11	Cost of reclaimed distribution systems ($)	Scenario 1- Assumed 2 mgd capacity pipeline to Long Valley Creek. Scenario 2-Internal piping cost based on Optimatics model with a 2 MG tank. Piping to project based on TMSA costs. For winter disposal assumes reservoir, pipeline, pump station, and mechanical treatment. Scenario 3- Assumed 4 wells and piping to and back from recharge area (2 MG capacity).
12	Cost of developing the program and going through the required political, regulatory and public processes ($)	Assumed $100,000 per year for 3 years.
13	Cost of ongoing regulatory oversight ($/year)	Assumed $200,000 per year.
14	Wastewater Connection Fee ($)	Based on Reno 2009 wastewater connection fees.

Base Demand Calculations

Based on 9,132 units that will produce 2 mgd of wastewater (2.19 people per house 100 gallons per capita for RSWRF)

Assumes 5,303 units (6,300 sf lots), and 3,829 units based on Peek Unit 6 and 7, and the lots next to Peek Unit 6 and 7.

Area	# of Lots	Units/ acre	Size of lot (sf)	MDD (gpm/unit) (a)	MDD (gpm) (b)	Rule 7 (AF/unit) (c)	Total Outdoor Use (AF/unit) (d)	Annual use based on MDD/2.61 (gal)	Reduced Annual use based on 6000 gal/month *12 months (gal)	Rule 7 dedication (AF)	Reduced Rule 7 dedication due to RW use (AF)	Reduced MDD due to RW use (gpm) (e)
V1 Buf Zn Lot	14	2.9	15000	1.11	15.50	0.57	0.35	3,120,539	1,008,000	8	3	4.2
V2 Buf Zn Lot	3	2.9	15000	1.11	3.32	0.57	0.35	668,687	216,000	2	1	0.9
V3 Buf Zn Lot	22	2.9	15000	1.11	24.35	0.57	0.35	4,903,704	1,584,000	12	5	6.6
V4 Buf Zn Lot	18	2.9	15000	1.11	19.92	0.57	0.35	4,012,122	1,296,000	10	4	5.4
V5 Buf Zn Lot	13	2.9	15000	1.11	14.39	0.57	0.35	2,897,643	936,000	7	3	3.9
V7 Buf Zn Lot	5	2.9	15000	1.11	5.53	0.57	0.35	1,114,478	360,000	3	1	1.5
V10 Buf Zn Lot	11	2.9	15000	1.11	12.18	0.57	0.35	2,451,852	792,000	6	2	3.3
V11 Buf Zn Lot	15	2.9	15000	1.11	16.60	0.57	0.35	3,343,435	1,080,000	8	3	4.5
V16 Buf Zn Lot	16	2.9	15000	1.11	17.71	0.57	0.35	3,566,330	1,152,000	9	4	4.8
Near Peek 6 and 7	300	4.7	9350	0.87	262.16	0.46	0.24	52,793,811	21,600,000	138	66	90.0
Additional Units	5303	6.9	6300	0.72	3803.93	0.37	0.15	766,033,660	381,816,000	1973	1172	1590.9
Village 3	149	6.9	6300	0.72	106.88	0.37	0.15	21,523,480	10,728,000	55	33	44.7
Village 14	145	6.9	6300	0.72	104.01	0.37	0.15	20,945,669	10,440,000	54	32	43.5
Village 16	173	6.9	6300	0.72	124.10	0.37	0.15	24,990,349	12,456,000	64	38	51.9
Village 17	142	6.9	6300	0.72	101.86	0.37	0.15	20,512,310	10,224,000	53	31	42.6
Village 1	167	7.5	5775	0.69	114.69	0.35	0.13	23,096,619	12,024,000	59	37	50.1
Village 5	142	7.5	5775	0.69	97.52	0.35	0.13	19,639,042	10,224,000	50	31	42.6
Village 11	115	7.5	5775	0.69	78.98	0.35	0.13	15,904,858	8,280,000	41	25	34.5
Village 13	141	7.5	5775	0.69	96.84	0.35	0.13	19,500,738	10,152,000	50	31	42.3
Village 15	134	7.5	5775	0.69	92.03	0.35	0.13	18,532,617	9,648,000	47	30	40.2
Village 18	131	7.5	5775	0.69	89.97	0.35	0.13	18,117,707	9,432,000	46	29	39.3
Village 20	147	7.5	5775	0.69	100.96	0.35	0.13	20,330,557	10,584,000	52	32	44.1
Village 4	190	8.3	5250	0.65	124.42	0.33	0.11	25,054,700	13,680,000	63	42	57.0
Village 6	204	8.3	5250	0.65	133.58	0.33	0.11	26,900,836	14,688,000	68	45	61.2
Village 10	185	8.3	5250	0.65	121.14	0.33	0.11	24,395,366	13,320,000	62	41	55.5
Village 19	156	8.3	5250	0.65	102.15	0.33	0.11	20,571,227	11,232,000	52	34	46.8
Village 22	165	8.3	5250	0.65	108.05	0.33	0.11	21,758,029	11,880,000	55	36	49.5
Village 2	136	9.2	4725	0.62	84.49	0.31	0.09	17,013,582	9,792,000	42	30	40.8
Village 7	180	9.2	4725	0.62	111.82	0.31	0.09	22,517,977	12,960,000	56	40	54.0
Village 8	139	9.2	4725	0.62	86.35	0.31	0.09	17,388,882	10,008,000	43	31	41.7
Village 9	133	9.2	4725	0.62	82.62	0.31	0.09	16,638,283	9,576,000	41	29	39.9
Village 12	168	9.2	4725	0.62	104.36	0.31	0.09	21,016,778	12,096,000	52	37	50.4
Village 21	170	9.2	4725	0.62	105.61	0.31	0.09	21,266,978	12,240,000	53	38	51.0
Total	9132			26.23	6,468	13		1,302,522,844	657,504,000	3337	2018	2740

(a) Calculated based on TMWA formula (MDD (GPM) for Single Family Unit (SF) = 0.009037 x (unit size (ft2))^0.5)

(b) MDD (gpm) = MDD (gpm/ unit)* units

(c) Water resources requirement (Acre feet/year/unit) = 1/(1.1+(10,000/Lot Size))

(d) Based on Rule 7 minus 6,000 gal/month/unit inside water use.

(e) Calculated based on an assumed MDD of 0.3 gpm per unit.

1- Cost to develop and manage a Public Outreach campaign/process ($/campaign)

Source: Assumed.

Scenario 1
Not applicable

Scenario 2

$/yr	years	$	Notes
500,000	5	2,500,000	Assumed

Scenario 3

$/yr	years	$	Notes
500,000	5	2,500,000	Assumed

2- Annual customer fees for potable water use ($/year)

Source: Based on 2008 rates in Washoe County Water Ordinance 1286, and average County metered water use records in South Truckee Meadows for MDS (3 units/acre) and HDS (7 units/acre) properties for July 2005-June 2006.

Scenario 1

Land Use	Lots	Annual Cost	Total Annual Cost ($)
MDS (2-5 units/acre)	417	576	240,248
HDS (6-9 units/acre)	8715	395	3,443,937
Total			3,680,000

Scenario 2

Land Use	Lots	Annual Cost	Total Annual Cost ($)
MDS (2-5 units/acre)	417	258	107,600
HDS (6-9 units/acre)	8715	257	2,244,044
Total			2,350,000

Scenario 3

Land Use	Lots	Annual Cost	Total Annual Cost ($)
MDS (2-5 units/acre)	417	576	240,248
HDS (6-9 units/acre)	8715	395	3,443,937
Total			3,680,000

MDS (3 units per acre) Median of 2957 County accounts in STM

	Jul-05	Aug-05	Sep-05	Oct-05	Nov-05	Dec-05	Jan-06	Feb-06	Mar-06	Apr-06	May-06	Jun-06	Total
Usage	19,000	43,000	31,000	20,000	10,000	4,000	5,000	3,000	5,000	4,000	15,000	30,000	189,000

Month	Annual Irrigation Distribution (%)	Monthly Demand (gpm)	Tier 1 usage	Tier 2 usage	Tier 3 usage	Tier 4 usage	Tier 5 usage	Total
January	2.6%	5,000	5,000					5,000
February	1.6%	3,000	3,000					3,000
March	2.6%	5,000	5,000					5,000
April	2.1%	4,000	4,000					4,000
May	7.9%	15,000	6,000	7,000	2,000			15,000
June	15.9%	30,000	6,000	7,000	12,000	5,000		30,000
July	10.1%	19,000	6,000	7,000	6,000			19,000
August	22.8%	43,000	6,000	7,000	12,000	13,000	5,000	43,000
September	16.4%	31,000	6,000	7,000	12,000	6,000		31,000
October	10.6%	20,000	6,000	7,000	7,000			20,000
November	5.3%	10,000	6,000	4,000				10,000
December	2.1%	4,000	4,000					4,000
Total	100.0%	189,000	63,000	46,000	51,000	24,000	5,000	189,000
		Cost ($/gal)	0.0017661	0.002101	0.002558	0.003086	0.00339	
		Cost ($)	111.3	96.6	130.4	74.1	17.0	429
Base fee	12.05	12	1.015	146.8				

includes 1.5% for regional water management fee

Potable Water Cost $ 576 per MDS unit
Potable Water Cost with RW serving T $ 258 per MDS unit

HDS (7 units per acre) Average of 1005 County accounts in STM

	Jul-05	Aug-05	Sep-05	Oct-05	Nov-05	Dec-05	Jan-06	Feb-06	Mar-06	Apr-06	May-06	Jun-06	Total
Usage	15803	18450	17700	13634	10732	4413	4423	3888	3765	4198	10435	16959	124,399

Month	Annual Irrigation Distribution (%)	Monthly Demand (gpm)	Tier 1 usage	Tier 2 usage	Tier 3 usage	Total
January	3.6%	4,423	4,423			4,423
February	3.1%	3,888	3,888			3,888
March	3.0%	3,765	3,765			3,765
April	3.4%	4,198	4,198			4,198
May	8.4%	10,435	6,000	4,435		10,435
June	13.6%	16,959	6,000	7,000	3,959	16,959
July	12.7%	15,803	6,000	7,000	2,803	15,803
August	14.8%	18,450	6,000	7,000	5,450	18,450
September	14.2%	17,700	6,000	7,000	4,700	17,700
October	11.0%	13,634	6,000	7,000	634	13,634
November	8.6%	10,732	6,000	4,732		10,732
December	3.5%	4,413	4,413			4,413
Total	100.0%	124,399	62,687	44,167	17,545	124,399
		Cost ($/gal)	0.0017661	0.002101	0.002558	
		Cost ($)	110.7	92.8	44.9	248
Base fee	12.05	12	1.015	146.8		

includes 1.5% for regional water management fee

Potable Water Cost $ 395 per HDS unit
Potable Water Cost with RW serving T $ 257 per HDS unit

3- Connection fees for potable water ($)

Source: Based on TMWA Rule 5 for Stead and Silver Lake, using MDD calculated based on [MDD (GPM) for Single Family Unit (SF) = 0.009037 x (unit size (ft2))^0.5] Scenario 2- Assumed MDD=0.3 gpm per unit.

Scenario 1

	Fee	MDD	Total
Feeder Main Charge	6,048	6,468	39,120,330
Supply and Treatment Facility Charge	3,236	6,468	20,931,447
Storage Facility Charge	1,240	6,468	8,020,703
Total			68,070,000

Scenario 2

	Fee	MDD	Total
Feeder Main Charge	6,048	2,740	16,569,863
Supply and Treatment Facility Charge	3,236	2,740	8,865,753
Storage Facility Charge	1,240	2,740	3,397,260
Total			28,830,000

Scenario 3

	Fee	MDD	Total
Feeder Main Charge	6,048	6,468	39,120,330
Supply and Treatment Facility Charge	3,236	6,468	20,931,447
Storage Facility Charge	1,240	6,468	8,020,703
Total			68,070,000

4- Potable water rights dedication requirements ($)

Source: Based on assumed $20,000 per AF. TMWA Rule 7 for total water rights. Assumed 6,000 gallons per month for indoor use to calculate reduced water rights.

Scenario 1

Water Rights Dedication (AF)	$/AF	$
3,337	20,000	66,740,000

Scenario 2

Water Rights Dedication (AF)	$/AF	$
2,018	20,000	40,360,000

Scenario 3

Water Rights Dedication (AF)	$/AF	$
2,018	20,000	40,360,000

5- Operating costs to service potable water ($/year)

Source: Assumed $0.80 per 1,000 gallons. Scenario 1 and 3- Based on ADD=MDD/2.61. Scenario 2- Based on 6,000 gallons per month per unit.

Gal/ yr from Base Demand Calculation spreadsheet

Scenario 1

Annual Use (Gal/yr)	$/1000 gal	$
1,302,583,527	0.0008	1,040,000

Scenario 2

Annual Use (Gal/yr)	$/1000 gal	$
657,534,247	0.0008	530,000

Scenario 3

Annual Use (Gal/yr)	$/1000 gal	$
1,302,583,527	0.0008	1,040,000

6- Customer fees for reclaimed water use ($/year)

Source: Based on County monthly rate and outdoor water use multiplied by average of County and Sparks usage rates.

Scenario 1
Not applicable.

Scenario 2

	Unit Cost	Units		Cost	Notes
Base Rate	8.31	9132	DU	910,685	County base rate, as Sparks does not have a rate for a 3/4" meter
Usage Fees	0.00106	645,049,281	gallons/yr	683,752	Average of Sparks $0.96, and County Zone 1 $1.16
Annual Cost				1,590,000	

Scenario 3
Not applicable.

7- New reclaimed water connection/ resource fee ($)

Source: Based on cost of #9 or #10 and #1, #11 and #12 minus $40 million that the existing wastewater connection fee will cover.

Scenario 1

Reclaimed water cost	$56,100,000
Offset by existing wastewater connection fee	$40,000,000
Reclaimed water connection/ resource fee ($)	$16,100,000

Scenario 2

Reclaimed water cost	$94,000,000
Offset by existing wastewater connection fee	$40,000,000
Reclaimed water connection/ resource fee ($)	$54,000,000

Scenario 3

Reclaimed water cost	$67,600,000
Offset by existing wastewater connection fee	$40,000,000
Reclaimed water connection/ resource fee ($)	$27,600,000

8- Costs associated with second system to operate and maintain (including monitoring, annual tests, inspections, treatment plant O&M) ($/year)

Source: Scenario 1- Additional WRF O&M costs, and pumping to Long Valley costs.
Scenario 2-Additional WRF O&M costs. Reclaimed water system operation based on Sparks operating costs approximately $0.93 per 1,000 gallon),
extra inspection for water and reclaimed water, and pumping to storage reservoir in winter.
Scenario 3- Additional WRF O&M costs, and pumping costs to injection field.

Scenario 1

Summary		
Pumping cost (Energy)	125,000	
WRF O&M	350,000	
Total WW	475,000	

Pumping Cost To Reservoir from RSWRF		
Flow (cfs)	3	
Head (ft)	356	
Pump (hp)	125	
Average Power Consumption (Kw-h/day)	2,238	Assume 24 hours, 365 days
Cost of Electricity ($/Kw-h)	$0.12	
Total Energy Cost ($/year)	$100,000	

Pumping Cost From Reservoir to LV Creek		
Flow (cfs)	3	
Head (ft)	92	
Pump (hp)	32	
Average Power Consumption (Kw-h/day)	578	Assume 24 hours, 365 days
Cost of Electricity ($/Kw-h)	$0.12	
Total Energy Cost ($/year)	$25,000	

WRF O&M	
Membrane replacement, chemical usage, electrical power costs for pumping	$250,000
UV Lamp and Ballast Replacement	$80,000
Power costs for pumping and the cooling fans	$20,000
Additional annual O & M costs	$350,000

Scenario 2

Summary

	Gal/yr	$/1000 gal	Cost	Notes
Reclaimed Water O&M Costs	645,049,281	0.00093	600,000	Sparks operating costs approximately $0.93 per 1,000 gallon)
Winter Disposal-Reservoir			50,000	
Reclaimed Water Inspection			400,000	Assumed
Potable Water Inspection			400,000	Assumed
WRF O&M			330,000	
Total			1,780,000	

Pumping Cost To Reservoir from RSWRF		
Flow (cfs)	3	
Head (ft)	356	
Pump (hp)	125	
Average Power Consumption (Kw-h/day)	2,238	Assume 24 hours
Cost of Electricity ($/Kw-h)	$0.12	
Total Energy Cost ($/year)	$50,000	For 6 months (winter only)

WRF O&M	
Membrane replacement, chemical usage, electrical power costs for pumping	$250,000
UV Lamp and Ballast Replacement	$80,000
Additional annual O & M costs	$330,000

Scenario 3	
Summary	
Pumping cost (Energy)	60,000
WRF O&M	370,000
Total	430,000

Pumping Cost To Injection		
Flow (cfs)	3	
Head (ft)	226	
Pump (hp)	79	
Average Power Consumption (Kw-h/day)	1,421	Assume 24 hours
Cost of Electricity ($/Kw-h)	$0.12	
Total Energy Cost ($/year)	$60,000	365 days

WRF O&M	
Membrane replacement, chemical usage, electrical power costs for pumping	$250,000
Power costs for Generating Ozone	$20,000
UV Lamp and Ballast Replacement	$60,000
Virgin Carbon Media Replacement, power for backwash pumping	$40,000
Additional annual O & M costs	$370,000

9- Costs for upgrading WWTP facilities to Category A+ water ($/project)

Source: Scenario 1- Based on 2 mgd of reliable additional RSWRF capacity including headworks, secondary treatment, membranes, UV and cooling towers. Scenario 2- Based on 2 mgd of additional RSWRF capacity including headworks, secondary treatment, membranes and UV.

Scenario 1

Construction of two new secondary clarifiers, two reactor basins, splitter boxes, RAS/WAS pump station, scum pump station, additional grit removal equipment, new blowers in the blower building and associated process piping, equalization facilities	$20,290,000
Construction of three 1 Mgal/d Membrane skids within an enclosed building with mechanical strainers, chemical feed facilities, backwash storage tanks, chemical cleaning tanks, and pumps and ancillary equipment	$9,867,000
System would consist of high intensity low pressure ultraviolet (UV) lamps in a three channel arrangement. Each channel would be rated for 1 Mgal/d capacity. Each channel would consist of three banks of UV modules. Channels would be enclosed in a building.	$2,480,000
System would consist of a two vertical turbine pumps, two induced draft cross flow cooling units with vertical air discharge and two cooling fans	$800,000
Subtotal	$33,437,000
Engineering Admin, CM	$6,687,400
Total Capital Cost	$40,100,000

Scenario 2

Construction of two new secondary clarifiers, two reactor basins, splitter boxes, RAS/WAS pump station, scum pump station, additional grit removal equipment, new blowers in the blower building and associated process piping, equalization facilities	$20,290,000
Construction of three 1 Mgal/d Membrane skids within an enclosed building with mechanical strainers, chemical feed facilities, backwash storage tanks, chemical cleaning tanks, and pumps and ancillary equipment	$9,867,000
System would consist of high intensity low pressure ultraviolet (UV) lamps in a three channel arrangement. Each channel would be rated for 1 Mgal/d capacity. Each channel would consist of three banks of UV modules. Channels would be enclosed in a building.	$2,480,000
Subtotal	$32,637,000
Engineering Admin, CM	$6,527,400
Total Capital Cost	$39,200,000

Scenario 3

Not applicable

10- Costs for upgrading WWTP facilities to indirect potable reclaimed water quality ($/project)

Source: Based on 2 mgd of additional reliable RSWRF capacity including headworks, secondary treatment, membranes, ozone, UV, and BAC.

Scenario 1
Not applicable

Scenario 2
Not applicable

Scenario 3

Construction of two new secondary clarifiers, two reactor basins, splitter boxes, RAS/WAS pump station, scum pump station, additional grit removal equipment, new blowers in the blower building and associated process piping, equalization facilities	$20,290,000
Construction of three 1 Mgal/d Membrane skids within an enclosed building with mechanical strainers, chemical feed facilities, backwash storage tanks, chemical cleaning tanks, and pumps and ancillary equipment	$9,867,000
System would consist of three 1 Mgal/d Ozone generators with an ozone injector system, contact piping and an ozone destruct unit. The equipment would be enclosed in a building.	$2,890,000
System would consist of high intensity low pressure ultraviolet (UV) lamps in a three channel arrangement. Each channel would be rated for 1 Mgal/d capacity. Each channel would consist of two banks of UV modules. Channels would be enclosed in a building.	$2,108,000.0
System would consist of three concrete BAC Basins each with a capacity of 1 Mgal/d. The system would also include a filter backwash system and would be installed in an enclosed building	$4,310,000
Subtotal	$39,465,000
Engineering Admin, CM	$7,893,000
Total Capital Cost	$47,400,000

11- Cost of reclaimed distribution systems ($)

Source: Scenario 1- Assumed 2 mgd capacity pipeline to Long Valley Creek and non-residential reclaimed water system in Peek.
Scenario 2-Internal piping cost based on Optimatics model with a 2 MG tank. Piping to project based on TMSA costs.
For winter disposal assumes reservoir, pipeline, pump station, and mechanical treatment.
Scenario 3- Assumed 4 wells and piping to and back from recharge area (2 MG capacity).

Scenario 1

Facility	Length (ft)	Diameter (in)	Pump Q (MGD)	Subtotal
Discharge Piping to Long Valley Creek	70,800	12		$10,195,200
Pump Station			2	$900,000
Total				$11,100,000
Engineering (20%)				$2,200,000
Contingency (20%)				$2,700,000
Total				$16,000,000

[1] Pipeline cost assumed as $12/in/LF
[2] Pump cost assumed as $250,000+$1M*(Q_{peak}/3)
[3] Discharge piping sized at 12" based on less than 5 fps.

Scenario 2

Summary

	Cost	Source
Onsite piping	10,000,000	Based on Optimatics model with a 2 MG tank.
Onsite piping for other homes	14,000,000	1.4*Peek piping cost (9132 units/ 3829 units)
Pipe and Pump Station to Development	4,100,000	
Winter Disposal- Reservoir, Pipeline, Pump Station and Mechanical Treatment	24,000,000	
Total	52,100,000	

Pipe and Pump Station to Peek

Facility	Length (ft)	Diameter (in)	Pump Qpeak (MGD)	Subtotal
Distribution Piping	5,000	8		$480,000
	12,800	10		$1,536,000
Pump Station [4]			2	$900,000
2 MG Storage Tank				
Subtotal				$2,900,000
Engineering (20%)				$580,000
Contingency (20%)				$580,000
Total				$4,100,000

Reservoir

Facility	Length (ft)	Diameter (in)	Subtotal
Stormwater Bypass	5,500	36	$1,188,000
Dam/Earthwork			$4,573,000
Subtotal			$5,800,000
Engineering (20%)			$1,200,000
Contingency (20%)			$1,200,000
Total			$8,200,000

[1] Storm drain pipe cost assumed as $6/in/LF
[2] Reservoir dam/earthwork costs based on SRK Consulting estimate "Scenario 2 - 50% Clay Haul", March 2007
[3] A second dam construction scenario was proposed by SRK. For "Scenario 1 - Bentonite", dam/earthwork total would be $9,641,000

2 mgd pipe to Reservoir and Pump Station

Facility	Length (ft)	Diameter (in)	Pump Q (MGD)	Subtotal
Discharge Piping	37,800	12		$5,443,200
Pump Station			2	$900,000
Total				$6,300,000
Engineering (20%)				$1,300,000
Contingency (20%)				$1,500,000
Total				$9,100,000

Mechanical Treatment

$15,300,000	From Draft North Valleys Reclaimed Water Reservoir Treatment Analysis for 6.5 MGD
$6,700,000	Based on 2 mgd capacity (2MGD/6.5 MGD)^0.7

Scenario 3

Well Injection

Facility	Length (ft)	Diameter (in)	Pump Q (MGD)	Subtotal
Discharge Piping to Wells	31,000	12		$4,464,000
Pump Station			1	$600,000
Well			2	$1,000,000
Total				$6,100,000
Engineering (20%)				$1,200,000
Contingency (20%)				$1,500,000
Total				$8,800,000

[1] Pipeline cost assumed as $12/in/LF

[2] Pump cost assumed as $250,000+$1M*(Qpeak/3)

[3] Discharge piping sized at 12" based on less than 5 fps.

Recovery Wells

Facility	Length (ft)	Diameter (in)	Pump Q (MGD)	Subtotal
Return Piping to Water Distribution System	31,000	12		$4,464,000
Well			2	$1,500,000
Total				$6,000,000
Engineering (20%)				$1,200,000
Contingency (20%)				$1,400,000
Total				$8,600,000

[1] Pipeline cost assumed as $12/in/LF

[2] Pump cost assumed as $250,000+$1M*(Qpeak/3)

[3] Discharge piping sized at 12" based on less than 5 fps.

12- Cost of developing the program and going through the required political, regulatory and public processes ($)

Source: Assumed $100,000 per year for 3 years.

Scenario 1
Not applicable.

Scenario 2

$/yr	years	$	Notes
100,000	3	300,000	Assumed

Scenario 3

$/yr	years	$	Notes
100,000	3	300,000	Assumed

13- Cost of ongoing regulatory oversight ($/year)

Source: Assumed $200,000 per year.

Scenario 1
Not applicable

Scenario 2

$/yr	years	$	Notes
200,000	1	200,000	Assumed

Scenario 3

$/yr	years	$	Notes
200,000	1	200,000	Assumed

14- Existing Wastewater Connection Fee ($)

Source: Based on Reno 2009 wastewater connection fees.

Scenario 1

Unit Cost	Units	Cost	Notes
5,276	9,132	48,180,000	Based on Reno 2009 rate

Scenario 2

Unit Cost	Units	Cost	Notes
5,276	9,132	48,180,000	Based on Reno 2009 rate

Scenario 3

Unit Cost	Units	Cost	Notes
5,276	9,132	48,180,000	Based on Reno 2009 rate

Scenario Qualitative Comparison

Scenario 1

Relatively easy, continue with the status quo

Lost opportunity to use water if disposed of to California

Does not increase water supply

Scenario 2

Good use of water resources

Defers capital costs for water system expansion

Defers expenditures on future water importation projects

Provides drought proof, reliable water supply

Investment in pipes, dual system required

Difficult to regulate, high operations, maintenance and inspection costs

Still requires a winter disposal solution

Scenario 3

Most efficient use of water resources

Defers expenditures on future water importation projects

Potential solution to groundwater basin over-drafting

Provides drought proof, reliable water supply

Investment in water quality

Potential long term accumulation of salts

Lower public health risks and simplifying regulatory issues, when compared with other reclaimed-water options

Optimatics

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Water System Optimization

To: Janelle Thomas, City of Sparks Public Works

CC: John Enloe and David Kershaw, Eco:Logic

From: Elsie Mann and Jeff Frey, Optimatics

Date: March 31, 2009

Subject: **Reno-Sparks Dual System Analysis – Final Results Memorandum**

1 Introduction

The aim of the Reno-Sparks Dual System Optimization Analysis is to aid the City of Sparks in the design of least-cost, hydraulically feasible designs for subdivisions, as well as in the assessment of the feasibility of including recycled water in new development areas.

A proposed subdivision in the Lemmon Valley area has been used as a case study. The layout of the subdivision is shown in Figure 1 below. The three reservoirs represent the locations of potable supply from a transmission main along the west side of the system. The effluent reuse supply source option is located at the southwest corner of the system.

Due to the range of elevations in the study area, the system will be separated into two zones. In the potable system the low and high zones will be supplied from different hydraulic grades and separated by a check valve. Supply to the low zone irrigation demands in the effluent reuse system will be via pressure reducing valves (PRVs) to protect against high pressures.

The hydraulic model of the system has 321 nodes and 409 pipes. There are 31.1 miles of pipe. The optimization determines the best combination of pipe sizes for the subdivision, based on the design parameters listed below. These parameters include the demand cases, design criteria, potential options and unit costs.

2 Design Data and Constraints

2.1 Demand Cases

Optimatics received three EPANET model scenarios of the subdivision to be evaluated, with different demands:

1. Potable water for both household and irrigation demands during maximum day demand (MDD) period (MDD = 2,664 gallons per minute (gpm)).
2. Potable water for household demands only, during maximum day demand period, without irrigation (MDD = 532 gpm; Assume demand occurs over 10 hours = 1,330 gpm during periods of use).
3. Demands for irrigation which will be associated with an effluent reuse system model (MDD = 2,132 gpm; Assume 8 hours of irrigation = 6,396 gpm during periods of use).

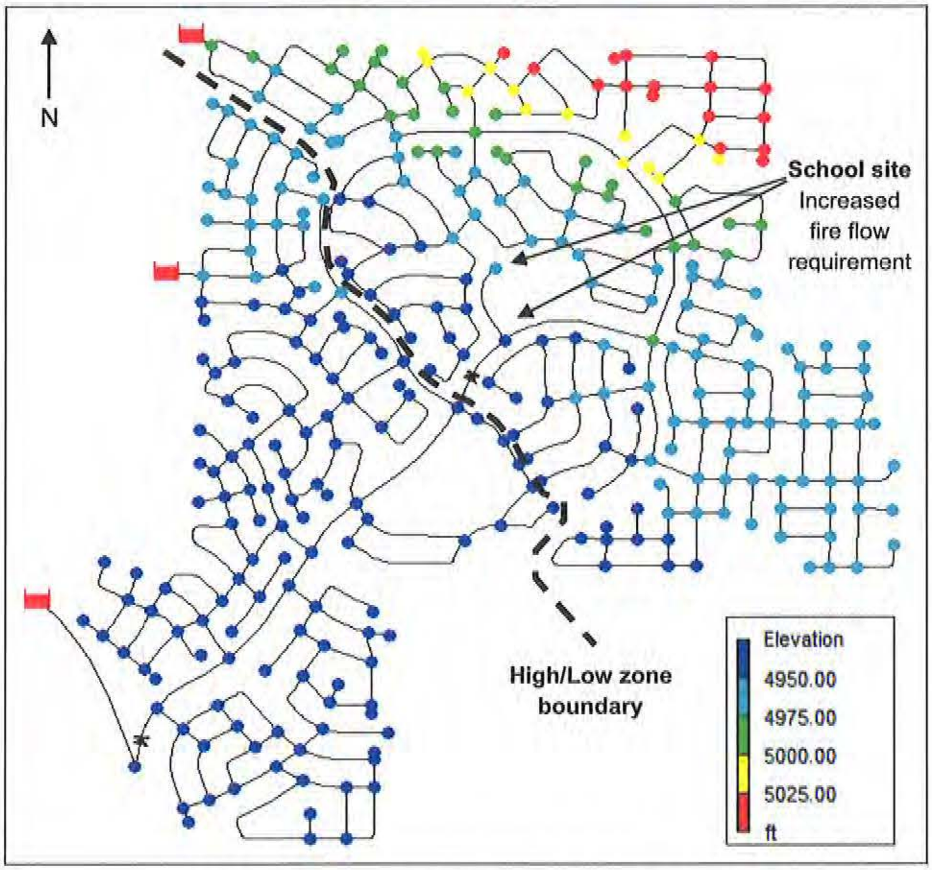


Figure 1 – Lemmon Valley Subdivision area

2.2 Design Criteria

The optimization was formulated to consider the following design criteria:

- Minimum allowable potable water pressure at any node, MDD: 45 psi
- Minimum allowable effluent water pressure at any node (irrigation only scenario): 35 psi
- Minimum allowable pressure at any node during a fire flow event: 20 psi
- Maximum allowable pipe velocity, MDD: 5 feet per second
- Maximum allowable pipe velocity, MDD + fire flow: 10 feet per second
- Minimum fire flow for potable water system in all scenarios: 1,500 gpm (the only exception is the proposed school site, shown in Figure 1, having a required fire flow of 2,500 gpm at each identified node)

The check valve between zones in the development should remain closed during MDD and can open during a fire flow event.

The design fire flow event may occur at any single node. For the effluent reuse scenario, it has been assumed that fire flows need to be met from the potable system.

2.3 Design Options

The models provided by ECO:LOGIC specified the pipe routes to be considered in the optimization. The optimization was formulated to consider the appropriate size for each pipe, subject to meeting the design constraints at least cost.

The potable system is supplied from a transmission main on the western side of the system. Three supply points are simulated as fixed head reservoirs in the hydraulic model. The upper zone is supplied from a hydraulic grade line (HGL) of 5,190 ft. The lower zone supply points have an HGL of 5,120 ft.

The effluent reuse system has been designed assuming a delivery supply HGL of approximately 5,250 ft. The delivery pressure from this source was considered as an option in the optimization.

Inclusion of a storage tank has been considered in the effluent reuse system design. The cost of the tank has been assumed to be $2,000,000. Having a tank in the system will reduce peak flows from the supply point, reducing the required pipe capacity and thus overall cost. The potential tank site is in the northeast corner of the system with a pad elevation of 5,220 ft. The length of water main to this site would be approximately 1,500 ft.

Hydraulic modeling demonstrates that a tank pad elevation of 5,175 ft could be sufficient to maintain satisfactory pressures in the effluent reuse system. The optimization considered different elevations in developing the final solution. The benefit of a lower tank elevation is that the supply pressure does not need to be raised in order to refill the tank.

2.4 Pipe Costs

Table 1 shows the pipe diameters and unit costs considered in the optimization. These costs represent updated costs received from ECO:LOGIC on Jan 16, 2009. Optimatics notes that there is little difference in the unit cost for 4-, 6- and 8-inch diameter mains.

Table 1 - Pipe cost

Pipe Diameter (inches)	Roughness	Cost per foot ($)
4	130	45
6	130	48
8	130	50
10	130	60
12	130	65
14	130	72
16	130	80
18	130	90
20	130	100
24	130	120

4-inch diameter pipe was not considered as an option for the potable system. As the effluent reuse system does not need to support fire flow demands, Optimatics suggested considering 4-inch diameter pipe as the minimum allowable size for this system.

3 Final Optimization Results

After interim results were reviewed, Optimatics was advised that design criteria for the effluent system should be modified to determine the impact on the required system capacity. These changes were:

- Assume demand occurs over a 12-hour period, reducing the peak flow rate
- Increase the maximum allowable velocity to 8 feet per second

The optimization formulation was modified to consider these alternative design criteria.

The following sections present the system layouts and estimated costs for each of the demand cases considered. The solutions have been refined since the interim results were presented and comments on the Interim Results Memorandum have been incorporated into this Final Results Memorandum.

Hydraulic results for each solution presented in Section 3 are provided in Appendix A. A summary of the results is presented in Section 4.

3.1 Potable system with irrigation – final design

The best solutions generated using the optimization for the potable systems have very little in the way of a trunk main system, particularly in the Low zone. Figure 2 shows the layout for the Potable system with irrigation generated from the optimization.

The significant amount of looping in this system has led to a design with a number of locations where there are smaller diameter mains supplying a larger diameter main. These situations occur because fire flow is being considered at every node. At any location where there is a dead-end main, that main must be sized to carry 1,500 gpm. If velocity is to be maintained below 10 fps the minimum main size is 8 inches. However, where there are two lines supplying a fire flow demand, it is possible to have sufficient capacity with 6-inch diameter mains.

In both potable system designs there are a number of fire flow cases where supply is diverted from the 'low' zone to the 'high' zone through the check valve in the center of the system.

The most promising design generated for the Potable system with irrigation scenario has an estimated cost of $8,145,000. The solution meets all of the design criteria.

Storage for this system is to be provided as part of the transmission system, and for the Potable system with irrigation is estimated to cost $2,085,000, bringing the total cost to $10,230,000.

Figure 2 - Optimized solution - Potable system with irrigation

3.2 Potable system without irrigation – final design

Similar observations can be made about designs generated for the potable system without irrigation demands with regard to the system layout. Although the irrigation demands are reasonably significant, it is the fire flow requirements that govern the necessary capacity in most areas of the system. The cost of the potable-only network is only slightly less expensive compared to the system supplying both potable and irrigation demands. Figure 3 shows the layout of the final design. The estimated cost of this design is $8,034,000. Again, storage for this system is to be provided as part of the transmission system, and for the Potable system without irrigation is estimated to cost $1,230,000, bringing the total cost to $9,264,000.

Figure 3 - Optimized solution - Potable only system, all mains

3.3 Effluent reuse system, 8-hr irrigation – final design

The interim solution (presented previously) for the effluent reuse system considered 8-hour irrigation. The layout had larger pipes for the trunk main but utilized a significant amount of smaller diameter pipe elsewhere in the system compared to the potable systems. This is illustrated in Figure 4. The delivery pressure from the supply point in this design is 5,250 ft.

The estimated cost of this design is $7,893,000 plus $2 million for the tank, bringing the total to $9,893,000. Considering a minimum diameter size of 4 inches does help to reduce the cost of the effluent reuse system; there is a significant length of 4-inch diameter main. However, there is not much difference between the cost of 4-inch and 6-inch diameter main. Comparative costs of a solution with a minimum size of 6 inches are approximately $390,000 higher.

The volume of the tank is satisfactory at 2 MG. It would be possible to have it slightly smaller, however this is not recommended. The level fluctuates between 8 and 19 ft, as shown in Figure 5. The height of the tank is 24 ft.

Figure 4 - Optimized solution – Effluent reuse system, original design criteria

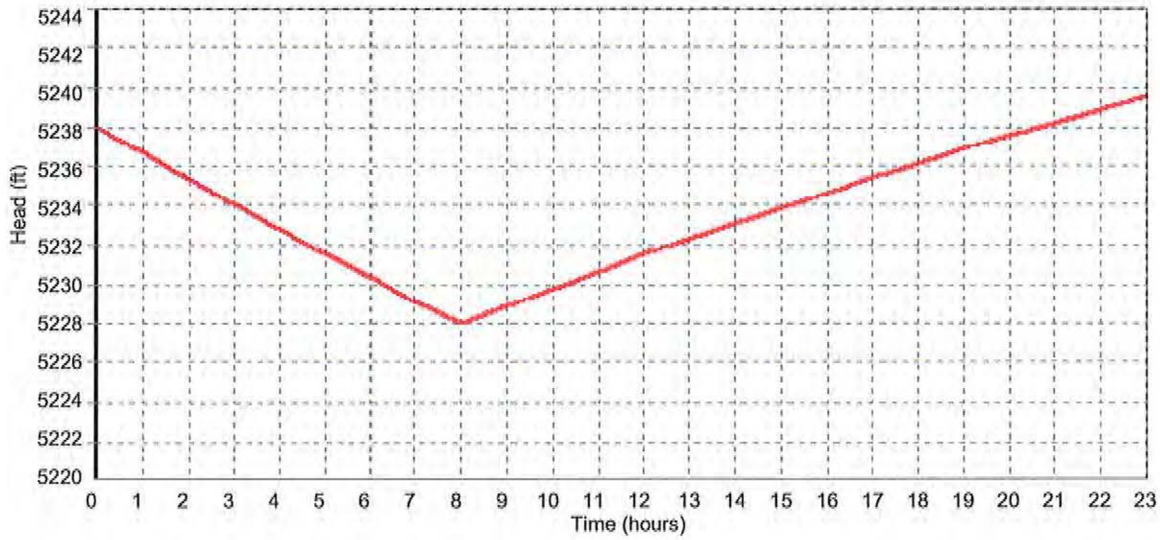


Figure 5 – Tank profile – Effluent reuse system, original design criteria

3.4 Effluent reuse system, 12-hr irrigation

As mentioned above, after the interim results were presented the optimization formulation was modified to consider

- reduced irrigation demand (4,264 gpm) over a longer time period (12-hours), and
- a higher maximum velocity constraint of 8 fps.

The solution from this formulation has significantly smaller mains on the transmission line between the source and the tank. The layout is show in Figure 6. The delivery pressure from the supply point in this design is 5,250 ft. The tank pad elevation is 5,175 ft in this design. The tank profile in Figure 7 shows the level fluctuates between 6 ft and 18 ft.

The estimated cost of this design is $7,591,000 plus $2 million for the tank, bringing the total to $9,591,000. If the minimum pipe size was 6-inch, this would increase the cost by $400,000.

Figure 6 - Optimized solution – Effluent reuse system with modified design criteria

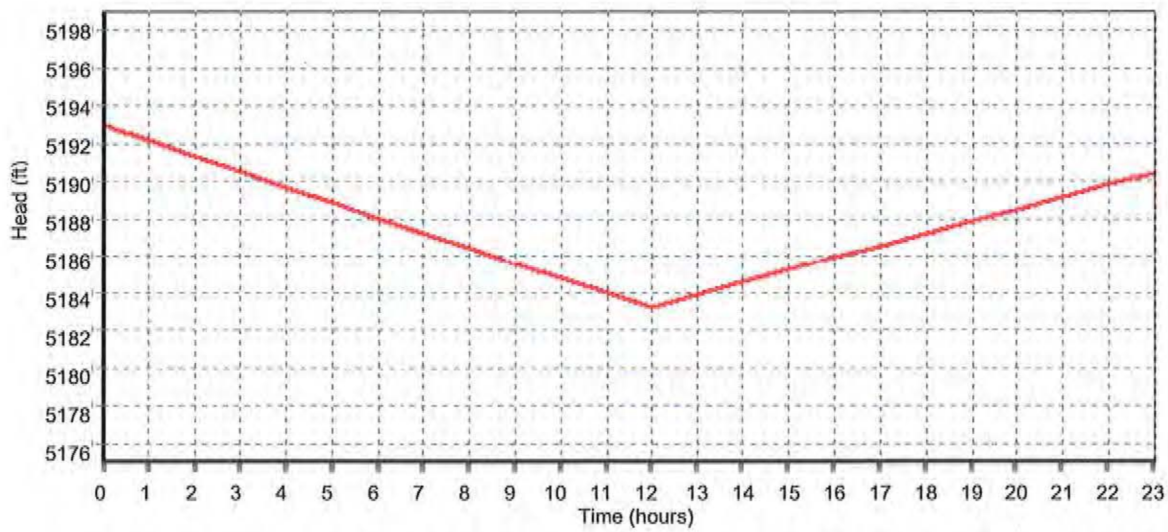


Figure 7 – Tank profile – Effluent reuse system with modified design criteria

4 Summary of Results

Table 2 summarizes the costs for each solution, showing cost per zone, and cost per dwelling unit. There are 3,829 units for the Lemmon Valley subdivision.

Table 2 – Cost summary ($)

Design	Low Zone	High Zone	Storage	Total	Cost per Unit
Potable and irrigation	3,506,000	4,639,000	2,085,000	10,230,000	2,672
Potable only	3,485,000	4,549,000	1,230,000	9,264,000	2,419
Effluent reuse – original design criteria	2,999,000	4,894,000*	2,000,000	9,893,000	2,584
Effluent reuse – modified design criteria	2,928,000	4,663,000*	2,000,000	9,591,000	2,505

* Effluent reuse High zone includes transmission main from southwest supply point

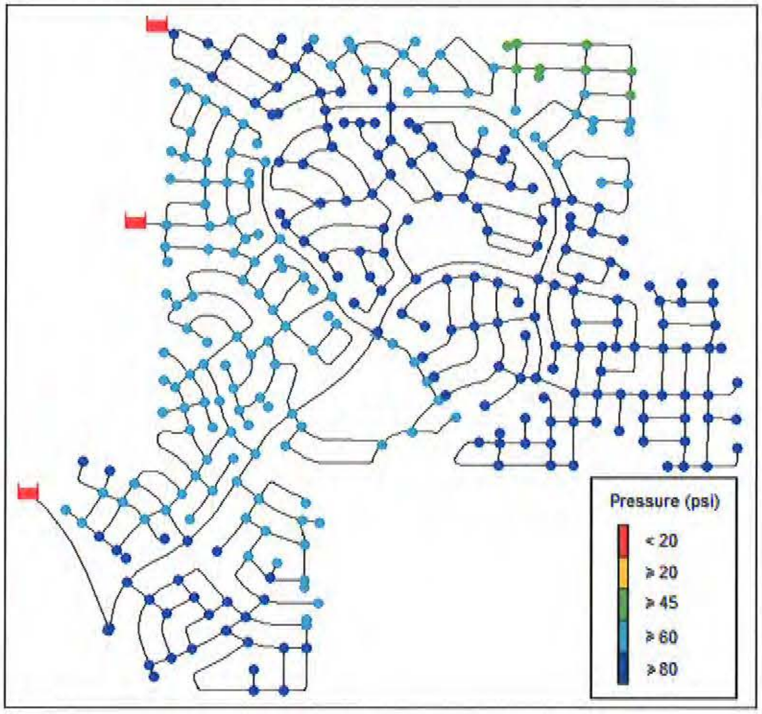
Using these costs it is possible to make a comparison of the cost of a dual system to a solely potable system. The cost of a dual system ($18,855,000) is just under twice the cost of a combined system ($10,230,000). Interestingly, the effluent reuse system is more expensive than the joint potable and irrigation system. This is due to the fact that there is only one source, requiring a much larger trunk main system.

With only $2-$3 per linear foot difference in the cost of small diameter pipes (4-, 6- and 8-inch), the variation in diameter sizes within the distribution system in these designs has little impact on the overall cost. It is the maximum main size and total length of main greater than 8-inch diameter that has the greatest impact on the overall cost.

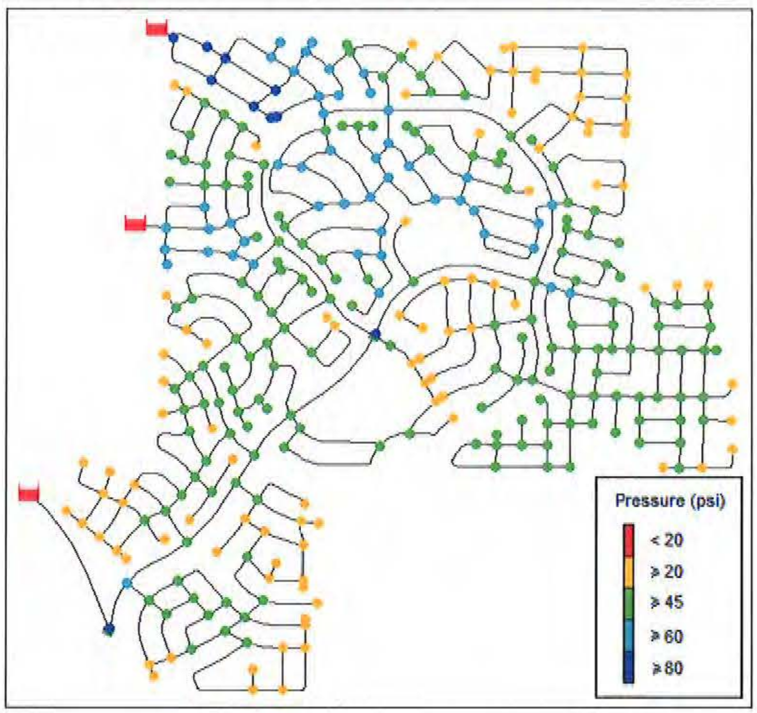
Appendix A – Hydraulic performance

Potable and irrigation system design

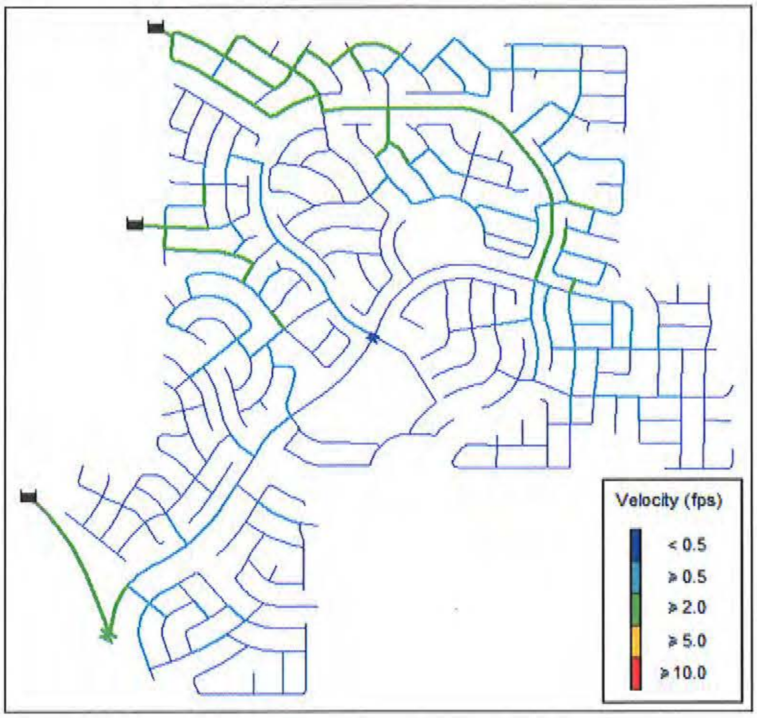
Pressure during MDD



Minimum pressure (fire flow)



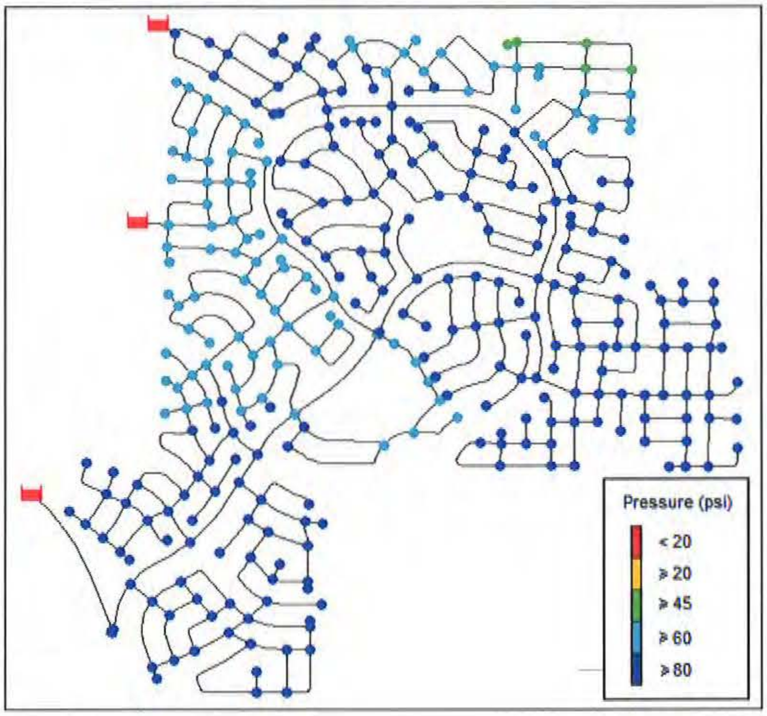
Velocity during MDD



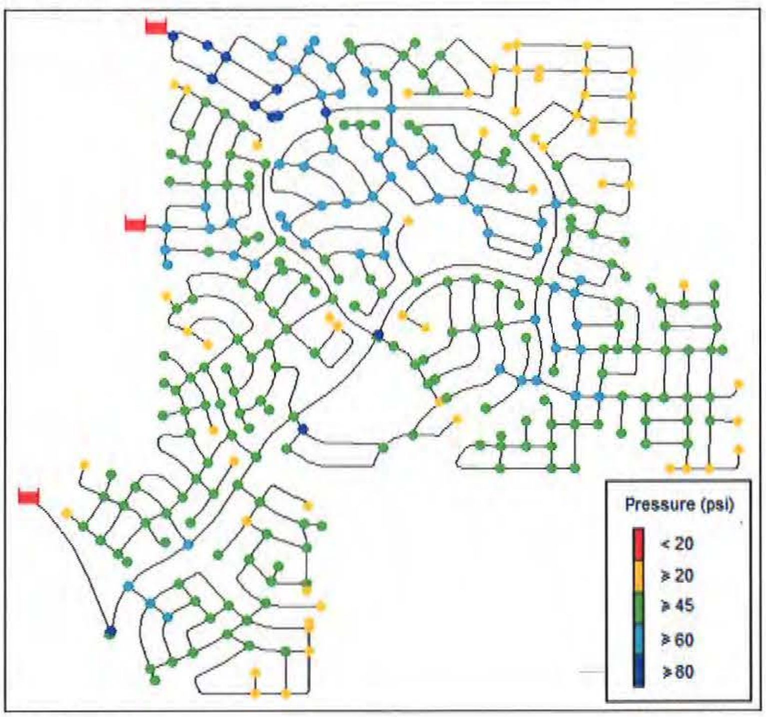
Maximum velocity (fire flow)

Potable only system design

Pressure during MDD



Minimum pressure (fire flow)

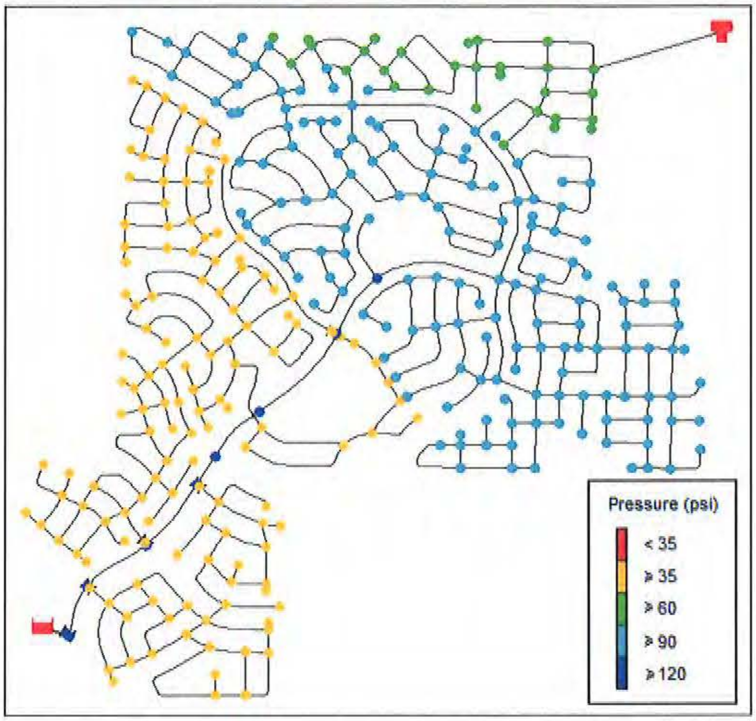


Velocity during MDD

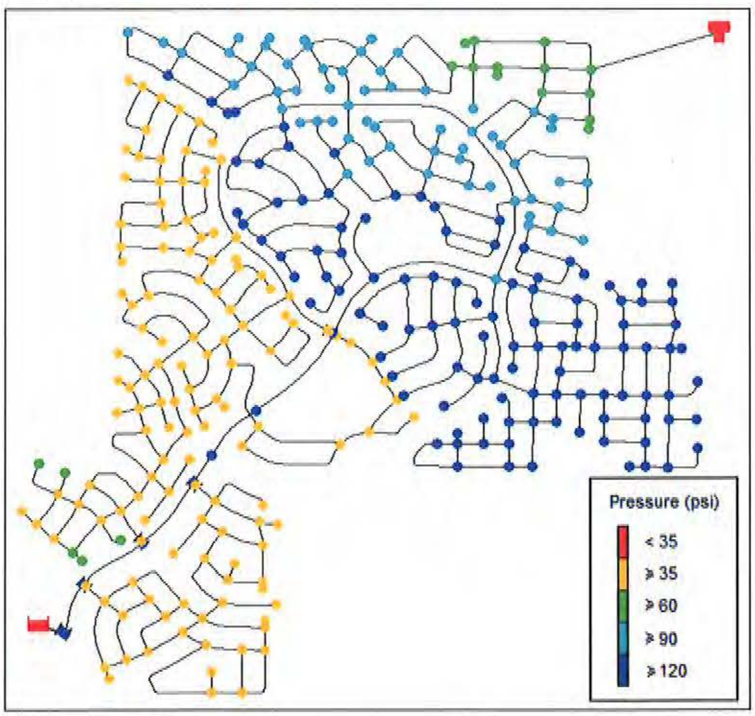
Maximum velocity (fire flow)

Effluent system, original design criteria (8-hr)

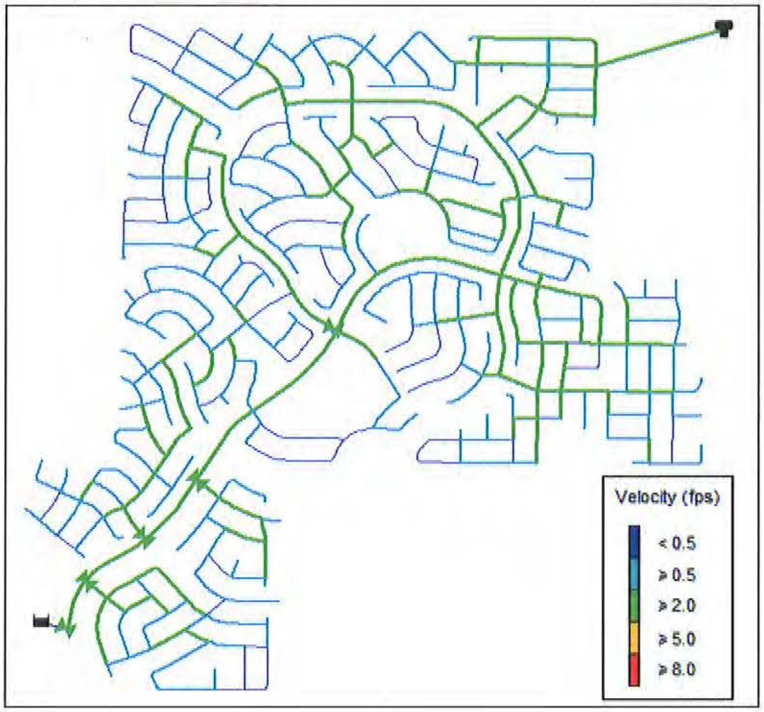
Pressure during MDD



Static pressure (tank refill)

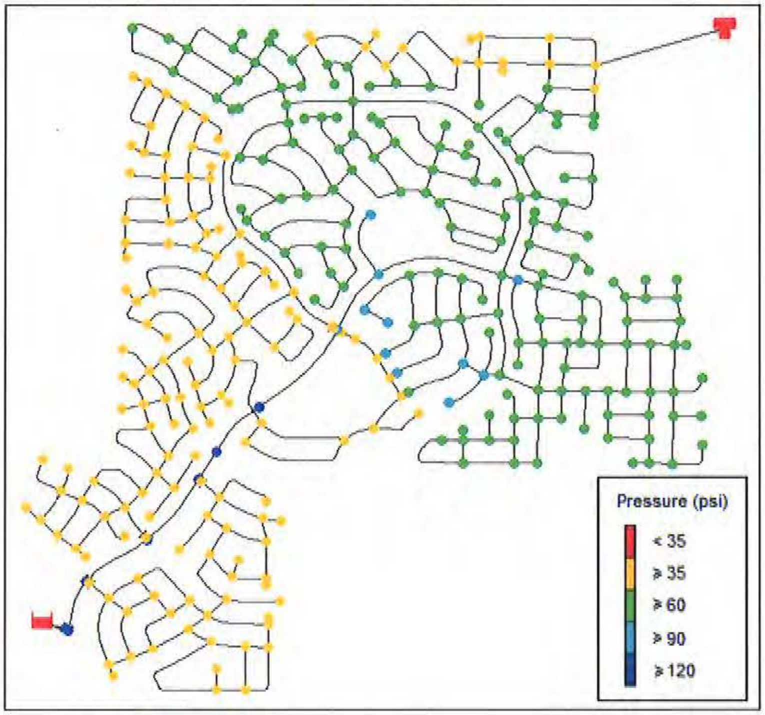


Maximum velocity (Peak hour)

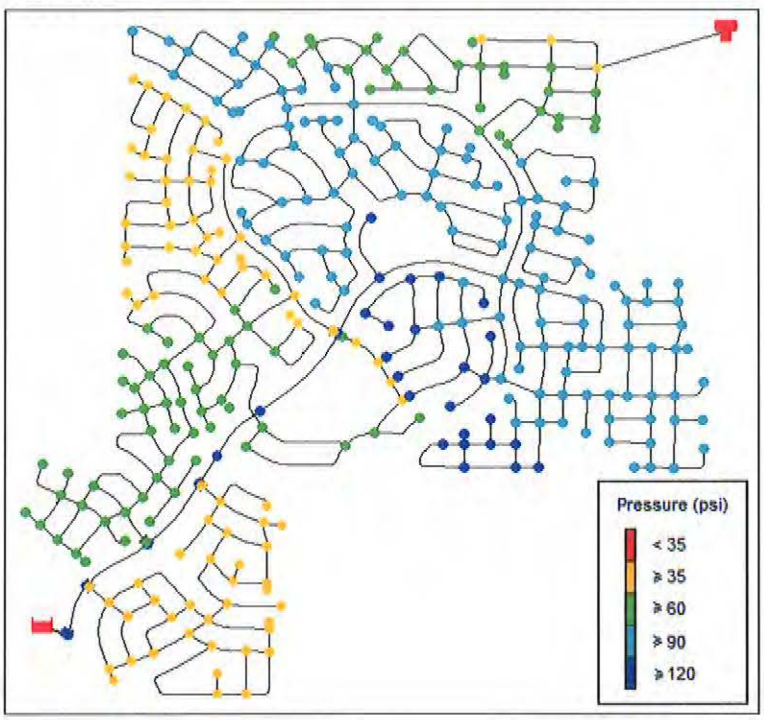


Effluent system, modified design criteria (12-hr)

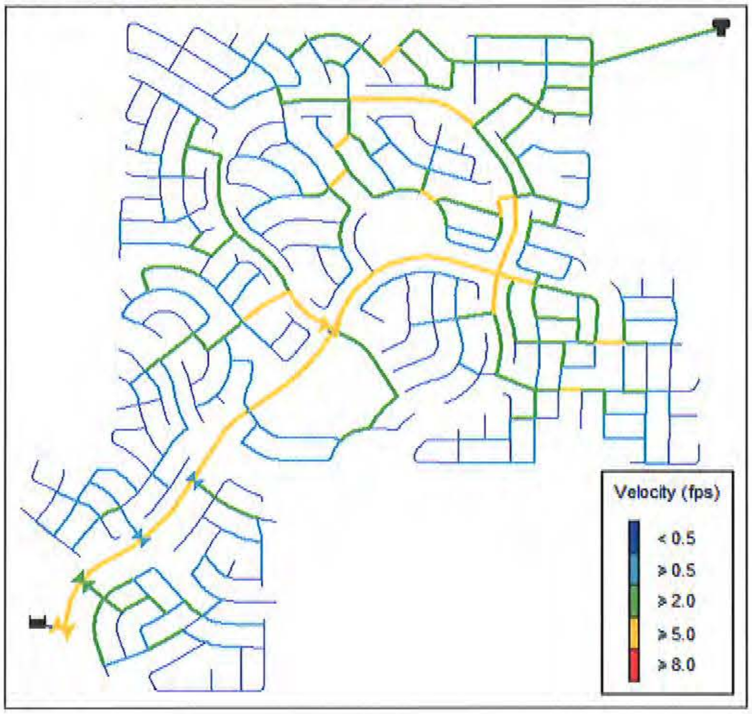
Pressure during MDD



Static pressure (tank refill)



Maximum velocity (Peak hour)



APPENDIX F - Coordination with Regional Wastewater Planning / Next Steps

- Recycled Water Dialogue and Decisions Presentation, by John Ruetten, Resource Trends, Inc., held on March 10, 2009 at WCDWR
- Washoe County Reclaimed Water Workshop - Notes and Recommendations, by John Ruetten, Resource Trends, Inc., dated March 16, 2009
- Washoe County Groundwater Recharge (GWR) Executive Summary, Tasks and Timeline - August 20, 2009 (resulting from second John Ruetten workshop held at WCDWR on June 25, 2009)

Recycled Water
Dialogue and Decisions

Washoe County, Nevada
March 10, 2009

John Ruetten
Resource Trends, Inc.

Dialogue and Decisions

- Implementation of Recycled Water will Involve One or More Policy Decisions
- Will Depend on the Quality of the Community Dialogue
  - The Case for Investment
  - Trust in the Sponsoring Utility
  - Trust in the Recycled Water Product
- Decisions Have a Long Impact Horizon

Today's Topics and Discussion

- Principles of Public Perceptions and Branding
- The Branding of Recycled Water
- Framework for Ensuring Good Policy Decisions
- Recycled Water Case Studies
- Discussion of Specific Washoe County Issues
- A Washoe County Plan for Success

What is Branding?

- Not Spin, Not Advertising
- Good Branding - Not What You Say, Who You Are
- Brand Not "Defined" by a Logo or Look
- Addresses Trust, Support, Price, and Investment
  - Investing in Recycled Water, Trust in Water Quality.......
- Building a Brand
  - More Precise Objective than "Public Education"

Why Branding for Utilities?

- **Being Branded with No Branding Strategy!**
  - Both Organizations and Products
  - Vulnerable to Misleading or Negative Perceptions
- Need More Local Investment – Good Policy Decisions
  - More Water Resources - Higher Water Quality
  - Aging Infrastructure - Rising Construction Costs
  - Stringent Regulations - Emerging Contaminants
  - Climate Change and Carbon Footprint
  - Sewer Overflows……etc.

Utilities Are Competing for Dollars!

Must Be Clear on Value – Must Be <u>Trusted!</u>

Benefits of Branding

- **Increased Trust, Support, and Investment**
- Highly Integrated Organization (Integrity)
  - Planning, Decision Making, Service, Communications
- Better Relationships with Policy Makers and Public
- Insulation Against Negative Events
- More Effective and Efficient Communications
  - Results Focused – Connection to Policy Decisions

Branded!

- Constantly Happening
  - People, Products, and Organizations
- Judgments, Perceptions, Expectations
- Negatively Branded
  - Management Shake-Ups, Corporate Failure

The Brand

- The Set of Perceptions
  - Defined By You and/or Others

The Coca-Cola Company

- An <u>Asset</u> or Liability
  - Coca Cola Brand Worth Over $60 Billion
- Logo is an Identifier
  - Not the Essence of the Brand!

Branding

- Creating and Communicating Value
- Can Be Simple Ideas of Value
  - Volvo = Safe Cars
  - Southwest Airlines = Low Cost / On-Time Airline
- **Not a Slogan or Single Idea – An Experience!**

Oakley Sunglasses

- Good Optics
- UV Protection is Real
- Lenses and Frames are Shatter Resistant
- Well Designed – Functional
- Nose Piece – Glasses Don't Fall Off
- Oakley Will Replace Anytime
- Worth the Higher Price

Brand = Price!

Branding Sampler

Branding of Words

Bailout
Stimulus
Deficit
Earmarks
Spending
Investment

A Meaningful Dialogue?

The Utility Brand What People Can Count On!

Organization's Commitments

- Customer Service
- Long-Term Planning, Appropriate Investment
  - Sustainability
- Specific Value Standards
  - Water Reliability
  - Water Quality, Public Health
  - Environmental Stewardship
  - Producer of Valuable Resources
- Increasing Efficiency, Financially Competent

Staff Character Traits

- Honesty, Openness
- Having Integrity
- Being Clear
- Problem Solvers
- Collaborative
- Innovative Leaders
- Professional

Add One More Thing

- Organizational Commitments
- Staff Character Traits
- **A Clear Strategic Direction (Vision)**
  - Simple Big Idea or 2-3 Ideas
  - An Important Brand-Building Vehicle
  - Demonstrated By Major Projects or Investments
  - Gives People a Reason to Pay Attention
- This Can Be an Indirect Potable Reuse Project!

Utility Product Branding

Tap Water

Conservation, Water Use Efficiency

Reclaimed Water

Biosolids, Organics

Tap Water and Conservation

- Tap Water
  - Reliable
  - Safe But Not Healthy
  - Utility Needs to Become the "Source of Quality"
  - Create Water Quality Confidence

- Conservation, Water-Use Efficiency
  - Need for Clarity
  - Conserving So We Can Build More Houses?
  - Drought Measures Versus Efficiency Measures?
  - Financial – Getting the Most Out of Our Assets?

Branding of "Recycled Water"

The Name!

Source = Quality

It's Not Water!

A Manufactured Product!

Irrigation Water - Do Not Drink

Multiple Products - Multiple Uses

A Positive and Strategic Message

Organics Markets

- Biosolids
  - Not a Product – Ingredient
  - Provisions for Brand Management in Contracts?
- Soil Amendment Markets
  - Separation Between Utility Brand and Fertilizer Brand
  - Utilities – Investors in Market Assets
  - Formulations, Brands, Sales and Distribution Channels

Are We Renting or Building Equity?

To Drink...

..... t to

Drink

- Investing in Water Quality or More Pipes?
- Maximizing Water Reliability?
- Getting the Most Out of Our Storage Assets?
- Regulatory Simplicity or Complexity?
- Higher or Lower Risks?
- Maximizing Wastewater Discharge Reliability?

A Framework for Ensuring Good Policy Decisions

Defining Recycled Water
Investing in Water Reliability
Creating Water Quality Confidence

Conflict Management
Relationship Building, Communications

Defining "Recycled Water"

The Name!

Source = Quality

It's Not Water!

Multiple Products - Multiple Uses

A Manufactured Product!

Irrigation Water - Do Not Drink

Quality Tailored to the Use

Investing in Water Reliability

- Make a Compelling Case for Investment
  - Disposal Not Very Compelling, Especially for IPR
- Define the Problem, Challenge, or Vision
- Outline Options for Solving the Problem
  - Share Costs of Options in Terms of Rate Impacts
- Make a Recommendation
- Show Your Work
  - Logic Behind Recommendation
- **Commitment is to Reliability, Not the Method**

Creating Water Quality Confidence

- **Utility = <u>Source of Quality</u>**
- Water Quality Comes from Process, Ethics
- Treatment and Testing
  - Multi-Step, Natural
  - Common Sense Perceptions – Motivations Behind Actions
  - Increasing Knowledge, Diligence, Carefulness, Redundancy
- Utility and Industry Track Record
- Emerging Contaminants, Water Quality Plan
  - Increasing Knowledge

Conflict Management

- Attitude Toward Conflict
  - Some Amount Unavoidable – Don't Avoid, Embrace!
  - Opportunity to Build Relationships and Advocates
- Don't Create "Unnecessary" Conflict
  - Clarity of Communications and Meaningful Information
  - Listen and Refine Program and Message
  - Embracing a Meaningful Dialogue……. or Defensive?
- Early Conflict Not a Problem
  - Find Opponents, or People Who Disagree, <u>Early</u>

Communication Tactics = Building Relationships

Objective: A Good Policy Decision

The Relationship with Policy Makers

- Branding of Staff Members
  - Financial Competency?
  - Efficient? Committed to Increasing Efficiency?
  - Clear, Proactive, Collaborative ……or Bureaucratic?
- Branding of Policy Makers
  - Not Knowledgeable
  - Motivations - Politics, Career or……?
  - Willingness to Vote for Rate Increases, Investment?

The Staff Must Lead!

The "Authorizing" Public

- The Top 50-500
  - Elected Officials, Policy Makers
  - Leaders of Influential Groups
  - People Who Are Concerned, Interested, Active
  - Those Who Disagree, Opponents
  - Develop Champions – Ask for Written Support

Give Policy Makers the "Cover" to Make Good Policy Decisions!

Other Tactics

- Adopt a Collaborative Communication Style
- Use Public Meetings to Identify Opponents and Champions
- Listen and Catalog Public Sentiments and Ideas
- Become the Trusted Source of Information for the Media

Traditional Communications
Make Sure They Are Effective!

- Websites, Newsletters, Press Releases
- No Information without Motivation
  - More Meaningful Communications
- Avoid Long Sentences and Overly Technical Information
- **Don't Spend Money on Ineffective Communications**

Motivations
Meaningful Value Standards

"Completion of the water quality laboratory will allow Metro Water to meet its goal to improve water quality and increase its knowledge of water quality issues."

"The North Fork Reservoir project plan has been approved by the City Council, which is a critical milestone in improving water reliability and drought resiliency in the region. This project will allow our region to weather multi-year droughts with little or no cutback in service."

Case Study Review

West Basin Municipal Water District, CA
Orange County Groundwater Replenishment System
City of San Diego, CA
City of Scottsdale, AZ
Dublin, San Ramon, CA

What the Case Studies Tell Us

- Our Organizations and Products are Being Branded
  - Especially if We Make a Provocative Proposal
  - Need a Utility and Product Branding Strategy
- Sponsoring Agency Needs to be a Drinking Water Agency
- Utility Communication Practices Were Not Prepared to….
  - Understand the Provocative Nature of Potable Reuse
  - Address the Issue of the "Policy Decision"
  - Understand and Improve Effectiveness of Communications
- Utilities Can Create Predictable Outcomes

West Basin Recycled Water

- "Designer Water"
- Produce Five Grades of Recycled Water
  - Irrigation – Tertiary
  - Cooling Tower, Nitrified
  - Low Pressure Boiler Feed – Single Pass RO
  - High Pressure Boiler Feed – Double Pass RO
  - Seawater Barrier Injection – Single Pass RO + Oxidation
- Processed, Manufactured Product!

AQUAFINA

Orange County GWRS

Groundwater Replenishment System™

- Benefits of Project Were Clear
  - More Water, Groundwater Protection, Environmental
- Created Water Quality Confidence
  - Track Record with Water Factory 21
  - Water Quality Ethics, Treatment, Testing, Transparency
- Trusted Source of Information with Media
- Comprehensive Relationship Building Effort
  - Focused on Individuals, Leaders
  - Multi-Year, Prior to Design and Construction
  - **Asked for Written Support**

City of San Diego, CA

- Driver Was Related to Wastewater Discharge Waiver
  - Needed to Meet Recycled Water Goals to Maintain Waiver
- Sponsoring Department was Wastewater Department
  - Water Department and SDCWA Were Not the Leaders
  - Difficult to Establish Water Quality Ethics and Confidence
- Environmental Justice Issue Took Hold
  - Poor Drinking the Wastewater of the Rich
- Conventional Wisdom???
  - Can't Discharge to a Lake or Reservoir
  - "Politics" Happens

Scottsdale Water Campus

- Need for Water in the Desert
  - Arizona Groundwater Management Code
- Water Campus – Impressive, Clean Facility
  - Academic Flavor - On-Site Water Quality Laboratory
- Water Resources Manager
  - Good Relationship with City Council and Media
- Avoided Environmental Justice Issues
  - Campus Located in New Growth Area
  - Water Resources Manager Lived There

Dublin San Ramon, CA

- DSRSD "Clean Water Revival" Project
- Driver – Failure to Get Ocean Outfall Approved
  - Growth Conflict Between Communities – Pleasanton, Livermore
  - **Can't Dispose of It – Want You to Drink It**
- Wastewater Department – Main Sponsor
  - Accused of Not Having a Water Quality Plan
- Behavior of Utility – Response to Conflict
  - Defensive, Condescending, Opponents Not Heard
- Accused of "Indoctrinating" Children

Discussion

Washoe County Issues

Stakeholder Attitudes on Potable and Non-Potable Reuse

Technical Issues - Branding of Technology

Public Perception Issues

Growth

Environmental Justice Issues

???????

Discussion

A Plan for Washoe County

Wrap-Up

Insights, Next Steps

John Ruetten
John@ResourceTrends.com

The following notes and recommendations are based on the reclaimed water workshop held on March 10 at the Washoe County Department of Water Resources in Reno, Nevada.

Background and General Comments

The workshop presentation, provided by John Ruetten of Resource Trends, Inc., established a context for the ensuing discussions about implementation of reclaimed water in the Washoe County region. The presentation covered the following important topics:

- Branding principles and how they relate to the value and acceptance of reclaimed water
- The specific benefits of groundwater replenishment using reclaimed water
- The best way to lead a dialogue with the community about investing in reclaimed water

The Attractiveness of Groundwater Replenishment – As with many regions and communities, water professionals in Washoe County increasingly see the potential benefits of groundwater replenishment using reclaimed water. These benefits include:

- Adding a cost-effective, drought-proof water resource to the regional water portfolio
- Finding a reliable solution to the water balance problem (wastewater discharge sustainability)
- Investing in water quality instead of pipes
- Resolving groundwater overdraft issues
- Improving the health of the natural environment
- Lowering public health risks and simplifying regulatory issues, when compared with other reclaimed-water options

These general benefits are clear. However specific project boundaries, costs, and benefits to Washoe County must be defined before engaging in a dialogue with the community. Once this case for investment is in place, a decision on who will be the lead or sponsoring agency has to be made. As stated in the workshop, this lead water agency will need to have drinking water credibility (be capable of becoming "the source of quality").

The Value of the New Groundwater Resource – In general, it is not wise to ask people to drink treated wastewater so the community can resolve a wastewater disposal problem. However, the compelling nature of groundwater replenishment goes beyond the value of the water resource, as noted in the benefits listed above. With a compelling case for investment, and a well-managed community dialogue that starts early in the process, there does not have to be a dire need for water for people to accept potable reuse. However, Washoe County leaders should continue to collaborate with each other about the value of the water resource for two important reasons. First, this process will improve the case for investment in groundwater replenishment. Second, and possibly more importantly, the process will ensure that current thinking and water resource planning are considering all relevant risks and scenarios within the next 20-30 years. This should include considering the increased cost of new water supplies. The incremental cost of groundwater replenishment should only include the additional investment required above what would be required to resolve the wastewater disposal issue. Solving the wastewater disposal problem is imperative in any scenario. If whiskey is for drinking and water is for fighting in Nevada, it seems like a new water resource should have significant value.

Choosing the Lead Agency – Ideally, the lead agency for a groundwater replenishment project would have a long track record as a drinking-water utility. However, history and experience are not absolutely necessary. Branding experience tells us that focus is a powerful tool for building trust and credibility. Newly formed "Joint Powers Authorities" can often develop trust quickly because of their focus on a specific problem or task. There are specific case studies that demonstrate this capability to build trust. Similarly, special service districts seem to have a branding advantage over municipalities because of their focus. Forming a new agency is something to consider, especially if the groundwater basin is under-managed or needs a focused steward to supervise its yield and quality. In any event, the designation of a lead agency should be done after the project boundaries, benefits, and the value of the new water resource are well defined. This will help keep organizational politics to a minimum while the important "value" issues are resolved.

Growth – The issue of growth always comes up, and should come up, when investments in water resources and infrastructure are being considered. The foundational strategy for the sponsoring water agency should be to emphasize its water and public health commitments. Theses commitments require that the utility consider growth projections when performing its long-range planning. It would be malpractice not to. It is also useful to remember that growth in itself is not bad. Growth can bring about increased diversity of jobs and activities and make a community more vibrant. Growth becomes a problem only when infrastructure and environmental needs are not adequately funded, making growth synonymous with increased traffic, noise, declining air quality, and crowded schools. An equitable approach to sharing the costs of new infrastructure is important. It is not necessarily fair for "new residents" to shoulder the entire burden. Existing residents also benefit from well-managed growth. Finally, the community dialogue about growth is important. People can also become frustrated if they feel they do not have a voice in growth decisions.

Water agencies have the opportunity to lead when it comes to growth planning. They can make it clear that water reliability, water quality, and environmental stewardship will improve with time if appropriate investments are made. Also, the lead agency on a groundwater replenishment project can carry out a dialogue with the community that offers people the chance to provide input. People will develop trust in the water agency independent of their feelings about growth. So, water agencies have a choice. They can complain that growth is not their issue or not well managed, or implement a process related to water investments that sets an example.

Specific Recommendations

Develop an Investment Executive Summary - Implement a collaborative process between water professionals in the region designed to produce a compelling case for investment in groundwater replenishment and reclaimed water. This case should take the form of an executive summary that covers the following:

- The investment/project boundaries, including who is paying for the project

- The appropriate planning horizon
- A statement of the problem or key issues that require attention
- A recommended course of action and its benefits
- A review of alternative approaches

This investment case will need to properly value new water resources. The collaborative process should include regulators and other important gate keepers. It is important to remember that this executive summary is a proposal designed to stimulate dialogue with community leaders. It is not cast in concrete. Once the community dialogue begins, the proposal can be refined based on feedback from the process.

Select or Create the Sponsoring Agency - Select the lead agency for the project after you have consensus on the value of the investment to the region and the benefits to specific communities and water agencies. Consider the need to manage the yield and water quality of the groundwater asset when selecting the agency or creating a new one. Proper stewardship of this asset is important because it is directly tied to the value of groundwater replenishment.

Develop Simple and Inexpensive Communications Materials - Develop a PowerPoint presentation and a fact sheet to support a community outreach process. Focus more on being clear and building relationships than on producing communication materials.

Start Developing Relationships - Begin a process of contacting and interacting with important community members. Listen to and document their opinions and concerns about the use of reclaimed water for augmenting the potable water supply. Don't be concerned about starting this process early. It is never too soon to learn, identify barriers and opponents, and refine your approach. Water from a groundwater replenishment project is ten years in the future even if you start the community dialogue soon. Use the feedback from the community to start a productive dialogue with policy makers about public support. Ask people if they would be willing to put their support for the proposal in writing, and give them an easy way to do this if they are willing.

Incorporate Key Best Practices – Tap into knowledge developed by the WateReuse Foundation relating to the community dialogue and potable reuse. This includes making a compelling case for investment, creating water quality confidence, understanding and managing conflict, and implementing efficient outreach tactics.

Workshop Easel Notes on Page 4

Workshop Easel Notes

- Negative brand of growth – Growth paying for itself, or paying its fair share?
    - Not only with respect to water
- Unpacking the sustainability word
- Linkage of growth and water reuse
- Regulators involvement and comments
    - Just want to ensure that the water is safe for the use
    - Reliably safe – This implies that the utility needs to be the source of quality because the issue is the robustness of the design and the diligence of the utility
    - Community might ask the regulators and they need to be prepared to comment
    - Regulators should be part of the development and the dialogue
- Individual technologies are proven – Local or regional application of technologies will be different or even somewhat unique
    - This further supports the utility as the "source of quality" idea
- Long-term TDS balance or build-up is an issue
- Define boundaries, problems, recommended solution, and options first, and then select or define the sponsoring agency
    - This allows you to focus on the value of investing instead of organizational politics
- Problems and reclaimed water drivers
    - Primary driver appears to be the need for wastewater disposal capacity
    - Continuity of perceptions of the value of reclaimed water as a resource
    - There are areas where groundwater has been depleted
    - Comparison of the marginal cost of new water supplies? Wastewater treatment requirements need to be factored into the marginal cost of groundwater replenishment
    - Who is the customer for a reclaimed water groundwater resource – Domestic well owners and .....?
- What is the impact of the planning horizon on the problem statement and valuing the reclaimed water resource?
- Benefits of groundwater replenishment
    - Overall financial benefit of the GWR approach
    - Add to resource base and reliability
        - Drought- proof local supplies – Great insurance
        - Connection to other supplies
    - Environmental benefits – Feeling the pressure to increase treatment of wastewater
    - Water balance issues (reliable wastewater management)
    - Groundwater overdraft
    - Less complicated and lower public health risks
    - Investing in water quality or pipes?

Washoe County GWR Executive Summary

Tasks and Timeline – August 20, 2009

Plan Objectives

The following plan defines a series of collaborative processes designed to produce an executive summary for a Washoe County groundwater recharge (GWR) project using reclaimed water. This process will also prepare for both a community based and county-wide outreach process with the public. The collaborative approach is important because it taps into the knowledge of water-industry stakeholders and develops consensus on several important issues. Each process will bring together the appropriate stakeholders for the specific issue. In general, the work products of these processes are:

- Consensus on feasibility on implementing groundwater recharge
- Clear definition of overall water resource benefits to the region
- A plan and agreements for addressing public health, water quality, and regulatory issues
- Selection of the sponsoring agency for the initial project or projects
- An executive summary for the initial project or projects

Why Focus on Groundwater Recharge

It is important to be clear about the significance of establishing the feasibility of groundwater recharge. Establishing feasibility is important because the ability to implement it, or not, impacts implementation of other forms of reuse. In many cases groundwater recharge provides the most efficient and productive use of reclaimed water resources. It can also result in higher overall water quality for the region. However, we know from past experience that using reclaimed water to replenish potable water supplies can meet resistance due to people's concerns about water quality. So the feasibility issue is primarily a public acceptance issue. If groundwater recharge is not accepted in Washoe County, future reclaimed water programs are limited to non-potable applications, independent of specific conditions or the compelling benefits of groundwater recharge. The likely result is the loss of efficiency and improved water quality. Consequently, it is highly beneficial for a community or region to know early on whether or not groundwater recharge can be successfully implemented. This focus does not diminish the benefits of implementing non-potable reuse in specific areas and applications, nor does it drive the water quality needed for these applications. Reclaimed water is not one product, but multiple products where the water quality is tailored to the use.

Collaborative Processes for Addressing Key Issues

Addressing Feasibility Issues and Beliefs

Although there may be few hydrological or technical hurdles with implementing groundwater recharge in Washoe County, important industry stakeholders need to be aware of and comfortable with what is known and unknown. Key feasibility issues are long-term salt build-up (and balance) and the storage capacity of the different groundwater basins. Also, key stakeholders need to understand treatment technology options and the differences between Reverse Osmosis (separation) and ozone/BAC (destruction) treatment.

Proposed Participants: Washoe County, TMWA, Reno, Sparks, SVGID and technical stakeholders including representatives from other agencies

Specific Work Product: Fill information gaps on feasibility and establish consensus that we have adequate information to proceed with a community and county outreach process on implementing groundwater recharge

Establishing Water Resource Benefits

Precise valuation of the water resources that are produced from groundwater recharge is difficult and could lead to unnecessary conflict. However, it is important to establish both the local and county-wide benefits of more water resources (beyond the ability to build more houses). This process provides the opportunity to elevate the idea of watershed sustainability with water suppliers. This is important because many water utilities do not view themselves as water resource managers. We can define watershed sustainability has "having enough high quality water for people, a healthy economy, and a healthy environment. Including "the environment" in the equation highlights environmental needs for water and the benefits of more water being dedicated to the environment. In general, water resource benefits will include water supply reliability for both municipal and domestic wells, a new source of water to help meet water rights and water quality obligations, and more water left for the Truckee River and the environment. This process should be coordinated with the Regional Water Management Plan efforts.

Proposed Participants: TMWA, Washoe County, City of Reno, City of Sparks, SVGID, TMWRF

Specific Work Product: This process will allow participants to come to consensus on the benefits of additional water resources and develop key messages covering the value of the water resources. This process will support the lead utility with compelling water resource messages.

Public Health Issues, Regulations, and Public Perceptions

This process covers three important issues related to water quality that need to be considered in conjunction with each other. Water quality and public health are the primary regulatory issues and the water quality approach and final regulatory framework are impacted by public perceptions. For example, employing reverse osmosis (RO) as part of the purification process is arguably not technically necessary, but clearly helps with respect to gaining public acceptance. Specifically, this process will need to address the technical and public perception issues of implementing a project using ozone/BAC (destruction) versus RO (separation) treatment.

Proposed Participants: State Regulators, local and State Public Health Officials, Trusted Public Health Leaders….

Specific Work Product: This process will produce an initial regulatory strategy and permitting approach, treatment requirements, and a water quality management plan (monitoring, testing, oversight…) acceptable for supporting an outreach process with the public. It is important that this effort be in step with the State regulatory process, including key messages and talking points related to public health and adoption of new regulations.

Roles and Leadership Opportunities

The natural leader for an initial groundwater recharge project is Truckee Meadows Water Authority. This could include an expanded role in county water resources management. However, this process needs to help TMWA leaders and their board feel comfortable with this role, which will require them to assess benefits and potential risks in a safe environment.

Proposed Participants: TMWA, Washoe County Department of Water Resources, Reno, Sparks, SVGID

Specific Work Product: The work product of this process is the identification of the appropriate entity that will step up and be the lead agency on a proposed groundwater recharge project.

Initial Project Selection and Completing the Executive Summary

This effort will use the results from the previous collaborative processes and select a specific groundwater recharge proposal in a specific community. This will require developing the information to complete an executive summary similar to the North Valleys Initiative sample.

Proposed Participants: Washoe County, TMWA, Reno, Sparks, SVGID and technical stakeholders including representatives from other agencies

Specific Work Product: A defined project(s) and the investment executive Summary

Schedule

The process to complete the executive summary and to be prepared for designing an outreach process can be completed in the next 12 months. This should coincide with the completion and public review/approval process for the Regional Water Management Plan Update. This process and executive summary needs to consider the county-wide opportunities for reaching out to the community about groundwater recharge (beyond the community-based outreach for the chosen project).

Oct – Dec, 2009
Continue Feasibility Assessment
Evaluate Water Resource Benefits Identified from September Workshop
Initiate Public Health/Regulatory/PR Collaboration Processes

Jan – Mar, 2010
Complete Feasibility Assessment
Continue Water Resources Benefits Process

Begin Roles and Leadership Identification Process
Continue Public Health/Regulatory/PR Processes

Apr – Jun, 2010
Complete Water Resources Benefits process
Complete Roles and Leadership Identification Process
Begin Selection of Proposed Project or Projects
Continue Public Health/Regulatory/PR Process

July – Sept, 2010
Continue Public Health/Regulatory/PR Process
Complete Selection of Proposed Project or Projects
Complete Investment Executive Summary for Inclusion in the Regional Water Management Plan