Technical and Physical Feasibility Fact Sheet

Alternative 27: Reuse Treated Effluent

Acknowledgements: This fact sheet was written by Sue E. Umshler, Esq., P.E. as part of the "Evaluation of Alternative Actions for Technical, Physical, Hydrological, Environmental, Economic, Social, Cultural, and Legal Feasibility and Water Quality Issues and Legal Overview" contracted to Daniel B. Stephens & Associates, Inc. The format and organization of the fact sheet and definition of the alternative were developed by the Water Assembly.

1. Definition of Alternative

A-27: Reuse treated wastewater for nonpotable uses.

As further stated by the Water Assembly:

> The cost to bring wastewater to a state where it can be used for watering lawns, etc., is much lower than cleaning the water to a drinkable level. Find a way to distribute the treated wastewater for any or all non-drinking needs. The treated wastewater can be reused once or several times before it is returned to the river or lost to evaporation. Several implementation approaches are possible. One approach is to retrofit homes and businesses with a second set of water pipes. Another approach is to apply this to new construction only.

2. Summary of the Alternative Analysis

This alternative is technically and physically feasible and can result in a reduction of water diversion or pumping demand on a per capita basis if the recycled water is effectively deployed to offset other consumptive uses (e.g., turf irrigation, cooling water, or other nonpotable uses). However, the reductions will not completely offset growing water demand from increased population or new uses. Treated effluent is currently being used for nonpotable purposes such as the addition water to the river and riparian system, irrigation activities downstream from National Pollutant Discharge Elimination System (NPDES) outfalls, and to meet compact requirements on the Rio Grande. Shifting water from one place to another and one use or another is the essence of this alternative, and such shifts must be considered carefully as they affect the entire region.

Significant infrastructure is required for treatment that reliably and consistently brings the wastewater to the high quality levels necessary for uses that involve human contact. Also, depending on the distance from the treatment plant to the reuse location(s), significant costs may be incurred for the dual piping system required to distribute the treated wastewater. The time required to implement this alternative is depends on the required treatment level and associated treatment facilities, pipeline locations and lengths, permit acquisition, and public acceptance. Retrofitting established facilities or servicing scattered, remote locations would be more costly than the establishment of such systems in new areas of construction or implementing on-site use for larger industrial and commercial applications. Public education concerning potential health risks is also a key component of such a program and would affect any implementation schedule.

This alternative can reduce per capita demand by reusing water that has already been diverted from surface or groundwater sources, thereby reducing the need to divert or pump additional water for consumptive demands supplied by reuse. However, water is not really saved or lost from the consumption/depletion cycle because overall demand is not really reduced; it is simply met with a recycled supply, resulting in a delay of water extraction. Reuse can result in more efficient use of water supplied to urban and suburban developments in the region. It can also result in evaporation and leakage losses from treatment and other processes that may not occur if the effluent is released to a surface watercourse. If the reuse system cannot be deployed because of failure to meet water quality requirements or loss of demand for nonpotable water at the reuse location, treated water must be released through a NPDES permitted location. If this occurs on either an irregular or permanent basis, the efficiency savings or reduced demands on other water supply sources would not be realized.

The water demand curve is of some significance to the feasibility of this alternative. For example, the demand for turf irrigation is high in the spring, summer, and early fall months, but drops to very low levels in the winter. If reuse water designated for turf irrigation cannot be applied to other more constant demands (such as industrial uses) during the low season, storage facilities must be constructed to hold the water until demand increases. In such cases, it may be possible to use underground storage or aquifer replenishment in the winter months to level the demand for the reuse water. However, if the demand cannot be leveled by suitable year-round demand centers or the construction and maintenance of large storage areas, the water must be released at a NPDES discharge outfall. Such releases reduce the benefits of the alternative.

The volume of effluent available for a reuse program can be reduced through domestic conservation programs or the implementation of on-site recycling programs at industrial facilities. However, in the Middle Rio Grande (MRG) planning area, the greatest constraint to effluent reuse may be the need to meet return flow requirements related to groundwater pumping permits and the water rights of downstream users. Past pumping debts must be repaid as the aquifer cone of depression deepens. In addition, the new Albuquerque diversion permit proposal depends on wastewater flow to return "borrowed" surface water. These could become serious limitations and must be fully evaluated in the implementation of a nonpotable reuse program.

Initially, reuse may reduce the pumping demand on the aquifer and thus reduce the likelihood of aquifer consolidation and subsequent subsidence; however, increased demand over time will likely result in increased pumping, so that this alternative only delays potential future adverse impacts. Also, reuse of treated wastewater would decrease the amount of effluent discharged into surface water courses, thus decreasing the amount of water in riparian areas. The reduction in effluent discharged to the Rio Grande by the City of Albuquerque, Rio Rancho, and other municipal treatment plants would directly reduce the flow in the river. This would require offsets from native waters to assure that minimum flow requirements for the Rio Grande silvery minnow are met. If return flow is mandated by the user's water rights permits, any reductions in effluent return could require acquisition of additional water rights, probably from agricultural interests, to assure compliance with New Mexico Office of the State Engineer permit conditions.

Finally, both the City of Albuquerque and City of Rio Rancho have some limited nonpotable water reuse programs in place and are in the process of evaluating and developing expanded programs. The City of Albuquerque and some industrial users currently irrigate some turf areas with treated effluent, and the Albuquerque wastewater plant reuses about 1 million gallons per day (mgd) of treated effluent for plant utility and wash water purposes. Rio Rancho has used reclaimed effluent to irrigate the city golf course and a local cemetery uses treated effluent for its grounds. Albuquerque's "Nonpotable Surface Water Reclamation Project" proposes to use treated effluent along with nonpotable surface water for industrial purposes and the irrigation of large turf areas. Demand, proximity of users to the treatment facilities, and ability to meet health and safety requirements (and obtain public acceptance) are all important factors in the decision to pursue a nonpotable reuse program.

3. Alternative Evaluation

3.1 Technical Feasibility

Enabling New Technologies and Status

- No new technologies are required for this alternative.

- Current technologies exist to collect and treat wastewater to the level needed to meet quality standards for nonpotable uses and to distribute the water to the reuse locations.

Infrastructure Development Requirements

- New or expanded treatment plants would be needed to treat wastewater to current federal and state reuse standards.

- Potential pump stations would be needed to lift water if gravity flow is not available.

- Winter storage facilities such as tanks, surface impoundments, or underground storage may be needed.

- Pipelines would be needed to distribute wastewater from the plant to potential reuse locations, including residences if economically feasible.

- Administrative processes to support the infrastructure project, such as permitting, easement acquisition, sampling, monitoring, reporting, and public outreach and education would be necessary.

Total Time to Implement

Total time depends upon:

- Potential reuse location

- Distance from wastewater treatment plant to reuse locations (pipeline length and location)
- Funding acquisition (grants, loans, rate increases, etc.)
- Easement acquisition
- Resource procurement such as design and construction personnel and materials
- Public outreach and education campaign needed to gain acceptance of the concepts and specific projects
- Time required to amend of local ordinances to permit and regulate installation and control of reuse facilities

Based on these factors, the total time to implement a program could be between five and ten years. If a National Environmental Policy Act (NEPA) analysis is required to secure federal funds and the necessary public outreach is extensive, the initial implementation would be lengthy.

3.1.1 Physical and Hydrological Impacts

Effect on Water Demand

- There would be no effect on overall water demand.

- Reuse to meet consumptive purposes would result in more efficient use of water withdrawn, thus delaying the need for new diversions or increased pumping.

Effect on Water Supply (surface and groundwater)

- Could result in short-term reduction in water pumped or diverted and potential long-term reduction in per capita demands on water supply if reuse offsets current consumptive demands.

- Provides an alternative source of water to meet nonpotable consumptive demands.

- Reuse could result in complete consumption of the recycled water, or if applied to some nonconsumptive purposes, could have about a 50 percent decay (i.e., about 50 percent of the reuse water is returned to the system, thus requiring some input of new water sources). These estimates are highly system-dependent and exact values are inappropriate for this level of study. However, the concept of decay is relevant for determining water volumes for planning purposes.

- An estimate of reuse water available to meet nonpotable demands is as follows:

  - 2003: 1,224 million gallons per year (mg/y) (3,745 acre-feet per year [ac-ft/yr]) to 3,240 mg/y (9,914 ac-ft/yr)
  - 2050: 2,300 mg/y (8,500 ac-ft/yr) to 9,100 mg/y (27,900 ac-ft/yr)

Water Saved/Lost (consumption and depletions)

- Water is neither saved nor lost, simply allocated to a different use in the water cycle.

- Less water may be pumped from the aquifer, but water would be lost to riparian and river systems when effluent is diverted back to urban and suburban areas for consumptive uses.

- If water is treated and used for aquifer replenishment, some water may be saved through lower evaporation; however, water will still be lost to the surface systems.

Impacts to Water Quality (and mitigations)

- Water would be treated to reuse standards. However, any recycling results in concentration of salts and metals, which are then loaded in the soils or recycled to undergo treatment again. Such concentration must be offset by dilution with fresh water to maintain dissolved salts at acceptable levels.

- Dissolved solids, nitrogen species, and other pollutants result in adverse impacts if the soil loading exceeds acceptable levels for turf or foliar irrigation. Salt or nitrogen from reuse water may also migrate through the vadose zone and degrade underlying groundwater. To mitigate for this, regulatory loading limits must be met through the use of vigilant monitoring systems, dilution of reuse water with fresh supplies, and/or the use of higher (and more costly) treatment levels at the plant.

- Treatment sludges and brines must be properly handled to avoid depositing impurities in landfills, thus creating a different point source of the pollution.

- Significant water quality concerns must be addressed to protect the public health and safety of workers, citizens, and water users. This increases treatment requirements, public education and outreach needs, and costs.

Watershed/Geologic Impacts

- There would be no change to the watershed.

- Aquifer conditions could be positively impacted if groundwater withdrawals rates are reduced by reusing pumped water for nonpotable uses. However, this would be a per capita reduction and as population increases, the benefits may be offset by new demand. Thus, the benefit is a delay, not an absolute protection.

3.1.2 Environmental Impacts

Impact to Ecosystems

- There would be a reduction in the volume of treated effluent that is currently being released from municipal treatment plants to the river or other surface water courses.

- This reduction could affect the minimum flow levels in the river or the water levels in the riparian areas immediately adjacent to the current outfalls.

- The reuse water would concentrate salts and metals, which could change the ecosystems where it is reused.

Implications to Endangered Species

- Decreased river flow below the current wastewater treatment outfalls could impact the silvery minnow if the water required is not offset by native or other surface flows.

- If the riparian areas adjacent to the surface water courses are affected, there could be an impact on willow flycatcher habitat.

3.2 Financial Feasibility

3.2.1 Initial Cost to Implement

Estimated initial costs to implement this alternative are provided in Table 27-1 for 2003 and 2050.

Table 27-1. Initial Cost to Implement, 2003 and 2050

Needed Infrastructure	2003 (millions of $)	2050 (millions of $)
Treatment plant (build or expand)	20.25 to 65.36	511.4 to 1,000.0
Interceptor collection pipeline(s)	0.68 to 1.87	5.7 to 16.7
Administrative costs: permits, easements, etc.	0.68 to 1.87	5.7 to 16.7
Storage costs for three days of production	32.4 to 61.6	272.7 to 550.0
Total capital costs	54.0 to 130.7	795.5 to 1,583.4

3.2.2 Potential funding source

- Rate increase
- Bureau of Reclamation Title XVI, Reclamation, Recycling and Water Conservation
- State/federal grants
- State/federal loans
- Private loans
- Revenue bonds
- Effluent and reuse water sales

3.2.3 Ongoing Cost for Operation and Maintenance

- 2003: First year costs would range from $5.74 to 14.01 million
- 2050: First year costs would range from $48.30 to $125.00 million

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