
FINAL DRAFT



Southern California Water Recycling
Projects Initiative
Recycled Water Project
Implementation Strategies
Technical Memorandum

Cooperative Effort Funded and Managed by:

The United States Bureau of Reclamation

In Partnership with:

Big Bear Area Regional Wastewater Agency
California Department of Water Resources
Central Basin and West Basin Municipal Water Districts
City of Los Angeles
City of San Diego
Los Angeles County Sanitation Districts
Metropolitan Water District of Southern California
Orange County Sanitation District
San Diego County Water Authority
Santa Ana Watershed Project Authority
South Orange County Wastewater Authority
Yucaipa Valley Water District

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Prepared by:

CH2MHILL
3 HUTTON CENTRE DRIVE, SUITE 200
SANTA ANA, CA 92707

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Abbreviations and Acronyms

CALFED	CALFED Bay-Delta Program
CEQA	California Environmental Quality Act
DHS	California Department of Health Services
EVWRP	East Valley Water Recycling Project
FY	Federal Fiscal Year
GWRS	Groundwater Replenishment System
IEMT	Initiative Executive Management Team
IEUA	Inland Empire Utilities Agency
Initiative	Southern California Water Recycling Projects Initiative
IRWD	Irvine Ranch Water District
LADWP	City of Los Angeles Department of Water and Power
MGD	Million Gallons per Day
MNWD	Moulton Niguel Water District
MOA	Memorandum of Agreement
NEPA	National Environmental Policy Act
OCSD	Orange County Sanitation District
OCWD	Orange County Water District
O&M	Operation and Maintenance
PDMWD	Padre Dam Municipal Water District
PI&E	Public Information And Education
PPCPs	Pharmaceuticals and Personal Care Products

RO	Reverse Osmosis
RWQCB	Regional Water Quality Control Board
SCWD	Santee County Water District
SDCWA	San Diego County Water Authority
SWFWMD	Southwest Florida Water Management District
SWRQB	State Water Resources Control Board
TM	Technical Memorandum
TMDL	Total Maximum Daily Load
TOC	Table of Contents
TSS	Total Suspended Solids
WBMWD	West Basin Municipal Water District
WRP	Water Reclamation Plant
WWTP	Wastewater Treatment Plant

1 Introduction

1.1 Contents of this Section

- Project Background
- Objective of the Study
- Plan of Study

1.2 Project Background

The Southern California Water Recycling Projects Initiative (the Initiative) is a multi-year planning study, which commenced in Federal fiscal year (FY) 2000. The project is funded as part of the Southern California Investigations Program and is managed out of Reclamation's Southern California Area Office. The Initiative is funded on a 50/50 percent cost sharing basis between Reclamation, 11 local agencies, and the State of California Department of Water Resources, who together form the Initiative's Executive Management Team (IEMT). Table 1.1 lists the 13 members of the IEMT. The purpose of the IEMT is to formulate, guide, and manage the technical activities of the project.

The Initiative is composed of two major components, a project-specific work component and a regional component. The project-specific work component consists of identifying and funding recycled water planning projects. The regional component consists of performing work in the following categories: public information and education, financial support opportunities, and evaluation of regional concerns including water quality. The purpose of this technical memorandum (TM) is to discuss implementation of successful strategies for recycled water projects as part of the regional analysis.

TABLE 1.1
LIST OF IEMT MEMBERS

Big Bear Area Regional Wastewater Agency	Orange County Sanitation District
California Department of Water Resources	San Diego County Water Authority
Central Basin and West Basin MWD	Santa Ana Watershed Project Authority
City of Los Angeles	South Orange County Wastewater Authority
City of San Diego	U.S. Bureau of Reclamation
Los Angeles County Sanitation Districts	Yucaipa Valley Water District
Metropolitan Water District of Southern California	

1.3 Objective of the Study

The goal of the Initiative is to build upon the regional partnerships to develop water recycling in southern California. This is accomplished by assisting local water and wastewater agencies in the final planning and documentation leading to implementation of their recycled water projects. In addition, the Initiative assists local agencies in addressing regional concerns including:

- Development of a regional water quality issues analysis to investigate impediments to successful implementation of water recycling projects in southern California.
- Development of a program addressing public information strategies designed to assist southern California water and wastewater agencies in successfully implementing their recycled water projects.
- Development of a compendium of successful project implementation strategies and providing a source list and guide outlining how to apply for financial/funding options for recycled water projects.

1.4 Plan of Study

The Plan of Study for the Initiative includes two major tasks:

- Implementation of project-specific work
- Implementation of regional work

The regional work is defined as actions that benefit local agencies in the implementation of water recycling in southern California. During the development of the Plan of Study, the IEMT identified issues that needed to be addressed during implementation of water recycling projects, including water quality impacts, methods to address public and regulatory agencies' concerns, funding considerations for future phases, and environmental impacts. The IEMT also identified broader issues that could be addressed on a regional or subregional basis to avoid duplication of effort by multiple agencies addressing the same concerns. The IEMT determined to focus the regional work on the following issues:

- Consideration of regional water quality issues and concerns related to implementation of a recycled water program throughout southern California with respect to public health, surface waters, groundwater, and receiving waters for brine and effluent disposal.
- **Preparation of an overall description of successful implementation strategies and approaches to obtain financial support for recycled water projects.**
- Development of a program to address public perception issues regarding recycled water and its uses, and communication of the overall objectives for the Southern California Water Recycling Projects Initiative.

As highlighted in the second bullet, this TM discusses successful implementation strategies. Separate memoranda address financing opportunities and options, public information and education (PI&E) component strategies, and the objectives of the Initiative Regional Partnership. These four memoranda together address the second and third items above.

The following section of this TM provides a foundation on which to base successful projects. Section 3 presents a flowchart and associated series of steps, which describe successful strategies for project implementation from conception through operation and maintenance (O&M).

2 Basis for Successful Implementation

2.1 Contents of this Section

- Introduction
- The Water 'Re' Cycle
- Success Defined
- Consistency and Transparency of Process
- Learning from Experience

2.2 Introduction

A discussion regarding recycled water projects must begin with a common understanding of the terminology used, and how water moves from initial use, through water reuse, and finally to discharge.

Successful implementation is more than merely delivering recycled water to a point of use. There are long-term concerns regarding matching supplies and demands, planning adequately for increased demands, and identifying alternative supply sources if the recycled water supply is inadequate to meet demands. Because success may mean different things to different people, a set of criteria are proposed for use in this TM that enable success to be qualitatively, and in some cases, quantitatively determined. While this TM is intended to provide guidance on successful strategies it is not intended to represent the only approach to successful project implementation. It is recognized that project proponents and their customers have unique relationships that determine how individual projects are approached and implemented.

In developing this TM, a number of agencies were contacted and telephone interviews were conducted to provide first-hand experience in dealing with issues facing recycled water projects. These discussions have been integrated into Section 3, and are referenced throughout the document. From the interviews conducted as well as sources reviewed in preparation of this TM, one overarching element to successfully implementing a project was

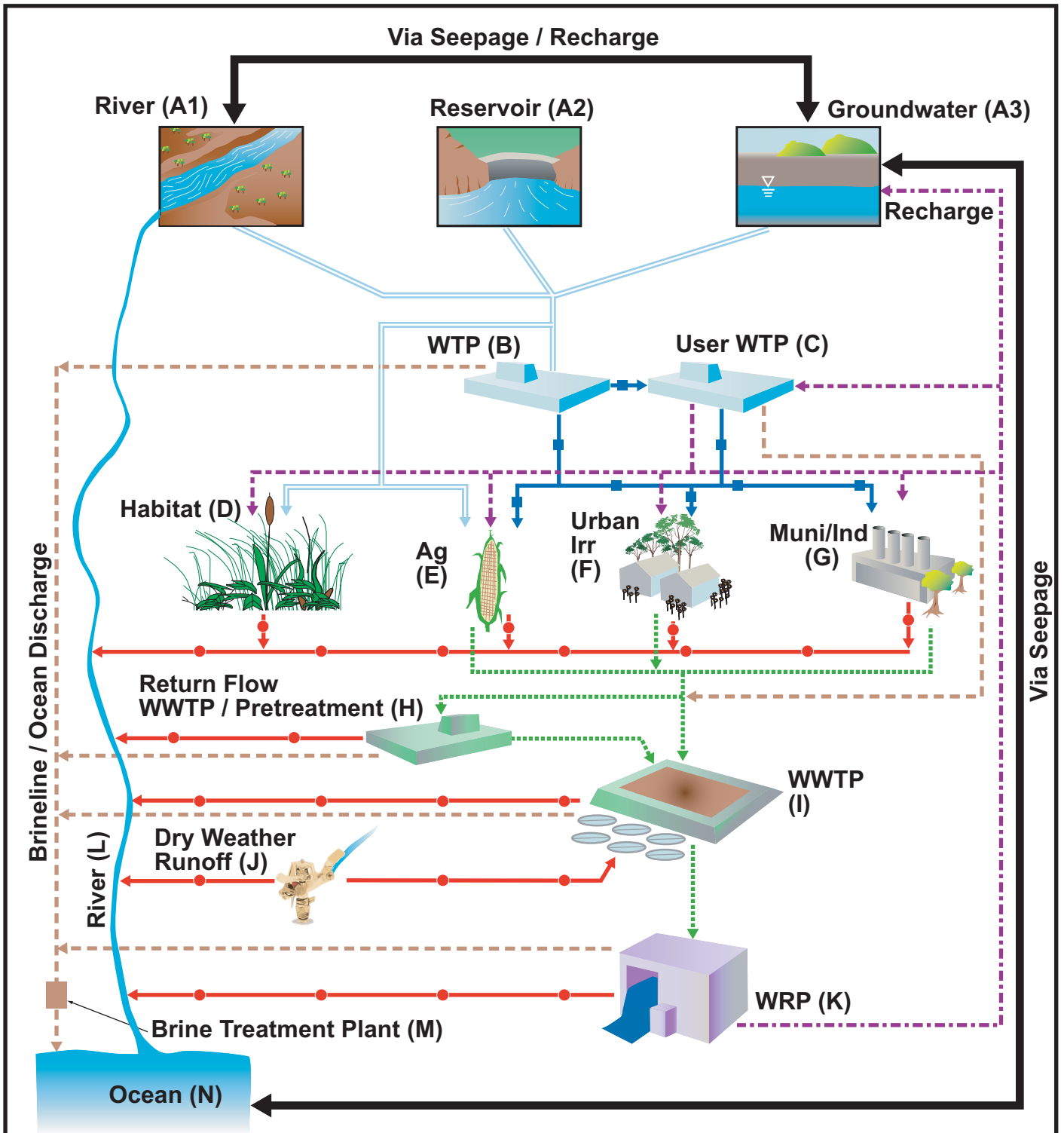
identified. This element is obtaining public support and belief that the project was developed in an open process with the public good in mind. It is important to note that the process by which a recycled water project moves from conception through implementation can engender either support or opposition from the public and special interest groups. Open and transparent processes provide fewer opportunities for claims of railroading or ‘back room deals’. Therefore, a transparent process is a key element to the success of a water recycling project.

2.3 The Water ‘Re’ Cycle

The various stages of the ‘lifecycle’ of recycled water are presented and linked to provide background in Figure 2.1. The diagram begins with raw water sources of the system, which include rivers (A1), reservoirs (A2), groundwater basins (A3), or some combination of these sources. The diagram shows the typical path of water as it flows through various systems and indicates where it is used (D, E, F, G) and treated (B, C, H, I, K, M).

There are four use types described in the diagram. They are habitat (D), agricultural use (E), urban irrigation (F), and municipal or industrial uses (G). Each of these use types, except agricultural and habitat (see Figure 2.1), requires some degree of water treatment (B) of raw water. In addition to standard water treatment, some users may require supplementary user-specific treatment (C). Once water is used by one of the four use types (D, E, F, G), it is either discharged directly to a river (L) or the ocean (N); treated at a return flow wastewater treatment plant (WWTP)/Pretreatment (H) and discharged to a river (L), the ocean (N), or a WWTP (I); or treated at a WWTP (I) and either discharged to a river (L), the ocean (N), or a water reclamation plant (WRP, K). After the wastewater is treated for reuse at a WWTP (I) or WRP (K), it can be supplied to users.

Some applications, which have limited human contact such as fodder irrigation, can be allocated secondary treatment water. However, if the water undergoes tertiary (or better) treatment at a WRP (K), it can be supplied to a wider group of users including agricultural users (E), urban irrigation (F), municipal users (G), or industrial users (G), habitat for beneficial use (D), or be blended with raw or potable water for groundwater recharge (A3).



Legend:

- | | | | | | |
|-----|------------------------------------|-----------|---|--|---------------------------------|
| (X) | Node Identification (See Table XX) | - - - - - | Brine Line or Ocean Discharge | | Agriculture (Ag) |
| | Raw Water | | Seepage/Recharge | | Municipal/Industrial (Muni/Ind) |
| | Potable Water | | User Water Treatment Plant (WTP) | | Urban/Irrigation (Urban/Irr) |
| | Sewer Water | | User Specific Wastewater Treatment Plant (WWTP) | | |
| | Recycled Water | | Wastewater Treatment Plant (WWTP) | | |
| | Effluent/Runoff | | Water Reclamation Plant (WRP) | | |

Figure 2.1
Recycled Water Flow Diagram
 Southern California Water Recycling Projects Initiative Phase II

Water utilized for urban irrigation (F), municipal uses (G), or industrial uses (G) may undergo further treatment (C) to produce water that is suited for a specific use. In addition, water utilized for municipal (G) or industrial purposes (G) may undergo a post-use treatment process (H) before the water is discharged to surface waters (L or N). Water utilized for beneficial use of habitat (D) will return flow into surface waters (L or N).

Water that is recharged into a groundwater basin (A3) may intermingle through seepage with surface water (L) or the ocean (N). In addition, groundwater can be pumped and treated (A3), after a sufficient detention time, which is determined and approved by the Regional Water Quality Control Board (RWQCB) and California Department of Health Services (DHS). This water can be used as a potable water source that is supplied to end users (F).

2.4 Success Defined

For the purposes of this TM, a working definition of a ‘successful’ project is useful, and is provided in a series of seven broad criteria and 12 more specific points. The emphasis placed on each criterion will vary. This can depend on the type of project (and degree of treatment of wastewater required), location, local regulations, local regulatory agency representatives, public opinion, funding agency requirements, the specific challenges faced in getting recycled water of sufficient quality and quantity to the user, and whether the success is to be measured in the short or long term.

The most important aspect of a workable definition is that all parties influenced by the project should agree on what constitutes success. Broadly, projects that are to be successful require:

- Public support
- Political support
- Sufficient demands and returns to justify investment (the community’s return on investment may not always be monetary)
- Sources and supplies that match demands (quantity, timing, quality)
- Adequate monitoring of the installation as well as operation and maintenance of recycled water and dual-plumbed systems to ensure that cross connections are

prevented¹ (Cross connections and proper O&M of projects are vital to maintaining public and regulatory support for and trust in the safety of the project.)

- Adequate funding/financing
- Other criteria specific to the project or jurisdiction

These broad criteria are interdependent, and a failure in one area can compromise the success of the project.

Public support is proving to be one of the most important, and potentially volatile, aspects of successful recycled water project implementation. As the public becomes more aware of the use and role of recycled water, more attention may be focused on applications, potential contact with humans or other plants or animals that humans come in contact with or ingest, and potential health concerns related to recycled water (particularly in non-industrial uses). New pollutants are emerging, and will continue to emerge, as testing technologies improve, and potential health effects of the pollutants (or combinations of pollutants) are discovered. Current examples include endocrine disrupters, pharmaceuticals, and personal care products (PPCPs). Initially there will be limited scientific information related to these contaminants due to low pollutant concentration levels, detection limitations, statistical error, complexity of the pollutants, limitations in treatment technologies, and lack of long-term epidemiological data. Agencies, the public, and politicians will have to weigh relative risks against real and perceived costs, increasing water demands, and in many cases, diminishing quality and quantity of raw water supplies. Successful promotion and implementation of recycled water projects will require proactively addressing these concerns through education, research, advancements in water treatment technologies, O&M practices, and public outreach.

The points below expand on the broad ‘success’ criteria previously discussed. Not every project will be able to satisfy all these points, and many projects may not need to do so to be successful. Varying degrees of emphases will be required, depending on the recycled water use, and many other aspects of the project.

¹ Two recent examples of cross-connection contamination of residential potable water systems with recycled water include San Antonio, Texas in April 2002, and Cape Coral, Florida in June 2003.

The most successful projects will tend to have:

- Public and political acceptance and support of the identified use(s), proposed or planned facilities, monitoring and safety protocols, long-term O&M procedures, and overall acceptance of the sponsoring agency and its ability to successfully build and operate the project
- Well-defined project purpose(s) and identified project driver(s), including (but not limited to) offsetting of potable water use, reducing pollutant loads and discharge volumes in receiving waters, and reducing treatment volumes in possible downstream treatment facilities
- Regulatory and project sponsor support of the project at all levels including the ability of the sponsoring agency to successfully build and operate the project
- Full assessment (to the extent possible) of health and safety implications of recycled water being used for its identified purpose(s)
- Ability, through diversions, storage, expansion of existing facilities, or construction of new facilities, to supply each user's demand when and as it is needed
- Full assessment of environmental advantages and disadvantages of the project, including handling of treatment facility waste streams
- Full consideration of how the project fits into other possible integrated planning efforts
- Construction or acquisition of adequate conveyance facilities to deliver recycled water to the locations of use
- Full assessment of the cost of the project(s), incorporating anticipated future supply restrictions, waste stream management, and anticipated adjustments, if any, to costs and available funding sources
- Full assessment of alternatives, with strong public involvement
- Attainment of adequate funding for any required acquisition and construction, and arrangement for long-term O&M funding for project infrastructure and facilities
- Long-term project performance and water quality that meets or exceeds commitments and expectations

2.5 Consistency and Transparency of Process

In the draft white paper on public information and education, the State of California Department of Water Resources 2002 Recycled Water Task Force, which consisted of a blue-ribbon panel of experts brought together to recommend ways to increase California’s supply of recycled water, commented upon general public perception of recycled water project planning:

“The issues raised by the public were compounded by the public’s general belief that the utilities were proceeding ahead on specific projects without warning or proper public input. Some agencies were taken aback by the strong public reactions, believing they had fulfilled their legal responsibilities for public notification and hearings on their projects, and that they were working for the good of the community.”²

This statement adds justification for maintaining a transparent planning process to help the proponent speak with a single clear voice, and clearly identify benefits, while acknowledging and incorporating criticisms or new ideas into the planning process. This may not always be the most efficient process, but it may be the vital difference between a project’s ultimate success or failure. The clearest recent example of this is in the City of Redwood City, where a substantial effort is currently underway to re-address the public process for the use of recycled water for landscape irrigation. The City fulfilled its legal public involvement requirements as part of its initial permitting application process, only to later encounter public opposition, which halted the project (refer to the text box on page 53, for more information on this project).

The guidelines below define a transparent planning process by demonstrating a pro-active and earnest effort in the creation of a successful project implementation process. These guidelines are not new, and many will already have been incorporated into current practice. They are presented here as a summary of ‘common sense’ practices, which were identified through a literature review and personal communications undertaken as part of the development of this TM. The more completely each of these practices can be addressed, the clearer the message will be delivered to the receiving community and regulatory agencies. It

² 2002 Recycled Water Task Force White Paper of the Public Information, Education, and Outreach Workgroup on Better Public Involvement in the Recycled Water Decision Process – DRAFT, Department of Water Resources, State Water Resources Control Board, Department of Health Services, Feb 4, 2003, p. 4.

is also important to note that project implementation often occurs as an iterative process. Thus, clarifying, improving, and refining communications as the project develops are important components to successful communication. It is also important to continue to gain knowledge and receive feedback in the communication process because not all information and issues regarding the project may be fully addressed at any one stage of a project's development. Also, every project has unique issues that arise that may not apply to any other project. Therefore, it is vital to keep the project process transparent during its development as it makes addressing refinements or alterations in project details more acceptable to the public and regulatory agencies. If the process is transparent, the public and regulators will be able to follow a clear progression of decisions made regarding the project as well as the reasons behind these decisions. It is also important that some aspects of the project are consistent so that confusion does not arise.

1. Consistency should be maintained in:

- Statement of project purpose
- Language and terminology
- Signage and labeling of facilities and appurtenances
- Application of agency's policy and regulatory interpretation (both across and within agencies)
- Public outreach methods
- Recognition of advantages and disadvantages of the project
- Support and voicing of principles, such as (but not limited to):
 - Priority of health concerns and recognition of the limited state of knowledge of long-term effects of 'new' pollutants, such as endocrine disrupters, PPCPs, and combinations of these and other complex pollutants
 - Sponsoring agency's commitment to, belief in, and willingness to assume liability for the project
 - Sponsoring agency's commitment to the principal of environmental justice. This commitment is illustrated by ensuring that stakeholders are given an opportunity to express concerns about the project and these concerns are taken into consideration during the project development process

- Priority of meeting the agency’s area long-term projected water needs, through implementation of water conservation, including the use of recycled water
 - Cost and financing
2. Clear benefits should be defined and proven defensible by:
- Community benefits like water supply reliability, water supply self-reliance, economic stability and growth, and quality of life issues such as aesthetics
 - Environmental (water conservation, habitat enhancement, reduced wastewater discharges, and improved water quality)
 - Helps to meet Federal, state, or local regulatory requirements or policies, such as:
 - NPDES Discharge permits
 - Total maximum daily loads [TMDLs]
 - RWQCB Basin Plan Objectives
 - Raw water supply reductions in southern California set down as part of CALFED and the 1922 Colorado River Compact Agreement, Article 3
 - The State of California’s policies that encourage water reuse, such as “Reasonable Use Doctrine” (Refer to Section 3.3.9.4 for additional information)
 - Helps to offset future potable water uses where potable water use is not necessary
3. Alternatives should be assessed without bias by asking:
- What other avenues can produce the desired result?
 - Why are the alternatives less (or more) advantageous than the proposed project?
4. Participation in advancement of knowledge and understanding:
- Participate in efforts to raise ‘best available knowledge’ and ‘best available technology’ for testing and monitoring of pollutants and health effects
 - View all implementation decisions in terms of possible future findings: “If in the future, a negative health/environmental effect is determined has everything reasonably possible been done at all times to discover, understand, mitigate, and share knowledge on the negative effect?”

5. Anticipate pitfalls, and seek to proactively prevent them (e.g., misunderstandings or differing interpretations of requirements by regulatory staff in different field offices, or misinformation, errors or sensationalism reported by the media)
6. Anticipate public mistrust and accusations of bias by developing open policies and approaches, such as providing information in a format (e.g. non biased or agenda driven) that allows the public to make informed decisions, that can withstand current and potential future public scrutiny

2.6 Learning from Experience

Although the water recycling environment in California is in flux (e.g., Recycled Water Task Force recommendations, Draft Title 17 and 22 revisions, streamlining efforts between DHS and SWRCB or RWQCBs), valuable lessons can be learned from current or completed projects – both the successful ones, and those that met roadblocks which either prevented their completion, or changed their purpose. Recycled water projects that were constructed and were either not implemented, or not implemented as originally planned, can provide information on where in the project planning and development that problems may arise. These projects also illustrate where in the project planning process that project proponents need to be prepared for potential issues to arise. Examination of projects currently under review can also reveal how changing regulations may affect the review and approval process.

Several projects were examined in developing this TM to identify key project successes and pitfalls through key project personnel interviews and by reviewing available literature. Lessons learned from these projects have been identified and discussed where appropriate in the step-by-step process developed in Section 3 of this TM. Table 2.1 lists most of the projects, jurisdictions, and agencies that provided source material.

TABLE 2.1

PARTIAL LIST OF CONTACTS AND INFORMATION SOURCES

JURISDICTION/AGENCY	PROJECT	SOURCE
California Department of Health Services	All	Mr. Jeff Stone, DHS www.dhs.ca.gov/ps/ddwem/publications/waterrecycling
City of Los Angeles Department of Water and Power (LADWP)	East Valley Water Recycling Project (EVWRP)	Mr. Bill VanWagoner, LADWP www.ladwp.com
City of Redwood City	Redwood Shores Area Recycling Project	Ms. Valerie Young, CH2M Hill www.redwoodcity.org
City of San Diego	City of San Diego Water Repurification Project	Marsi Steirer, Deputy Water Department Director City of San Diego www.sandiego.gov
Inland Empire Utilities Agency (IEUA)	IEUA Groundwater Recharge Project	Mr. Dennis Smith, CH2M Hill www.ieua.org
Irvine Ranch Water District (IRWD)	Various	Mr. Ken Thompson, CH2M Hill (formerly of IRWD) www.irwd.com
Orange County Water District / Orange County Sanitation District (OCWD/OCSD)	Groundwater Replenishment System (GWRS)	Ms. Cindy Ferch www.gwrssystem.com
Moulton Niguel Water District (MNWD)	Various	Mr. Dave Blythe, MNWD www.mnwd.com
Padre Dam Municipal Water District (PDMWD)	Santee Lakes	Mr. Harold Bailey, PDMWD www.padredam.org
West Basin Municipal Water District (WBMWD)	West Basin Water Recycling Project	Mr. Joe Walters, WBMWD Mr. Marc Serna, WBMWD www.westbasin.com
San Diego County Water Authority	City of San Diego Water Repurification Project	Mr. Cesar Lopez, San Diego County Water Authority (SDCWA) www.sdcwa.org
State Water Resources Control Board	All	Mr. Rich Mills, SWRCB www.swrcb.ca.gov

3 Successful Implementation Strategies

3.1 Contents of this Section

Introduction
Step-by-Step Approach to Implementation
Summary of Implementation Experiences

3.2 Introduction

This section combines analysis of issues with examination of southern California projects that did and did not proceed to implementation. Examination of these real-world projects assisted in identification of steps to successful implementation of projects. The analysis on these real-world projects consisted of investigating key factors to project success as well as roadblocks faced during project implementation. A flexible step-by-step process is presented below, which could increase the chance of successfully implementing a recycled water project in southern California. While the details of each step will vary depending on regulatory and funding agency requirements, and many factors specific to each project, the framework described will provide useful guidance.

3.3 Step-By-Step Approach to Implementation

The following steps are discussed in this subsection:

- Identification of Project Needs and Project Drivers
- Project Planning
- Identification and Characterization of Recycled Water Sources
- Public Involvement and Public Information and Education
- Market and Infrastructure Assessments
- Environmental Issues and Approval

- Economic and Financial Review
- Project Outline Submission to DHS and RWQCB
- Regulatory Review and Approval by local, state, and Federal regulators
- Project Design and DHS ‘Title 22’ Report
- Funding Mechanisms
- The Permitting Process
- Construction
- Project Commissioning and Delivery of Services
- Operation and Maintenance

The decision-making process for a typical recycled water project is represented in Figure 3.1. The decisions and questions identified in the figure are derived from examination of each of the steps described in this section. The key numbers in Figure 3.1 correspond to the circled numbers next to the headings of discussions in this section.

Several of these steps can be done concurrently, and the order altered to fit specific needs. There is no single ‘best order’ to these steps, as regulatory or permitting agencies may each have different information or formatting requirements, or specific understanding of their community’s needs necessitating several different formats. The purpose of this ‘example’ decision process is to provide general guidance, and not to anticipate every possible alternative or requirement.

3.3.1 Identification of Project Needs and Project Drivers 1

The purpose of this step is to look at the ‘big picture’ to see how water recycling can (or must) fit into the overall water supply and management structure of an area.

3.3.1.1 Discussion

Recycled water demands can come from the four areas identified in the Recycled Water Flow Diagram (Figure 2.1): habitat, agricultural, urban irrigation, and municipal/industrial (including groundwater injection for recharge, storage, or seawater intrusion barrier). These

Typical Recycled Water Project Implementation Steps

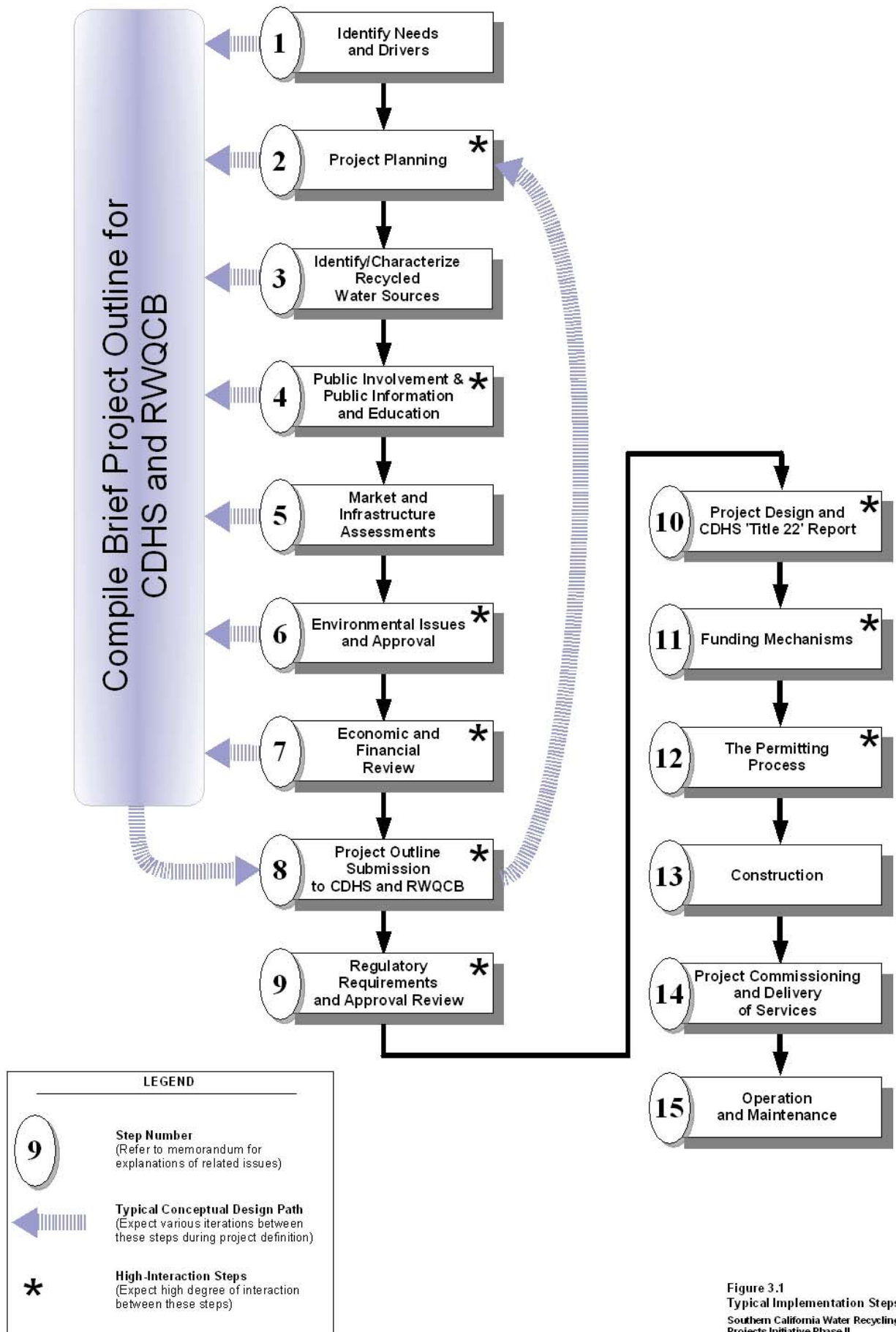


Figure 3.1
Typical Implementation Steps
Southern California Water Recycling
Projects Initiative Phase II

demands can translate into project drivers. Drivers other than direct demand can also be the impetus behind a project. Examples include restricted supply, supply balancing, avoided costs (especially wastewater discharges), revenue generation or cost recovery, and potential cost reduction if recycled water can be supplied safely and at a lower cost than potable for an authorized use. Whether the need is ‘pulled’ into existence via an identified application or user, or ‘pushed’ into existence through a regulatory force or other driver, the same considerations and regulations apply.

When researching needs and drivers, it is important to plan five, 10, 20, or even 30 years ahead. Planning, construction, and expansion of infrastructure becomes more costly and less feasible as development increases, land values rise, water becomes scarcer, and demands increase. Integration of the planning for water supply, wastewater, and recycled water use also should assist in the development of a more efficient overall water plan.

Caution must be exercised if recycled water is to offset existing potable use. The Service Duplication Act³ in California requires water reuse agencies that are supplying users within another water agency’s boundaries to compensate that agency for the loss of customer revenue. This requirement could make supplying recycled water to some users economically infeasible if reasonable agreements with the water supply agency cannot be reached. In addition, this issue can create barriers to project implementation when augmenting potable water with recycled water; however, proactive planning and integration of these systems can often eliminate potential conflicts.

3.3.1.2 Lessons Learned

- Up-front negotiation with water purveyors may be necessary to avoid conflict, particularly concerning the Service Duplication Act. Partnerships (with water purveyors, community, and users) can smooth project implementation by establishing an early environment of cooperation.⁴ The IRWD has implemented a number of recycled water projects whose success has been predicated upon the relationships developed between the IRWD, the public, and users. See the IRWD Case Study below for more information on the IRWD recycled water project.

³ California Public Utilities Code, Section 1501

⁴ Personal conversation with Ken Thompson previously of Irvine Ranch Water District (IRWD) for IRWD case study.

- Even in cases where recycled water is demonstrably necessary to meet future water demands, opposition can swell. Do not assume that the need for recycled water is a ‘no brainer.’⁵ This is evident from the Redwood Shores Area Recycling Project, which was a project with a clear water supply project driver that only met opposition in the final planning stages.
- Reducing wastewater discharge through water recycling can eliminate or offset construction of larger or new outfalls, and other infrastructure, and increase the economic benefits of the recycled water project through associated avoided costs.⁶ In Orange County, the Groundwater Replenishment System is avoiding costs associated with construction of a new ocean outfall through reduction of its discharge of effluent by recharging groundwater basins with advanced treated recycled water.
- Be cautious of how drivers are presented: is recycling another ‘waste sink’, or is it a water source?⁷ One example of this is the GWRS project, which is viewed by residents of Orange County as a water supply project due to a positive public outreach program that explained the need for the project.

CASE STUDY: IRVINE RANCH WATER DISTRICT SYSTEM

Project Description: The Irvine Ranch Water District Michelson Water Reclamation Plan can produce up to 15 million gallons per day of disinfected tertiary-treated Title-22 compliant water for reuse. The distribution system consists of 245 miles of pipe, eight storage reservoirs, and 12 pump stations. Reclaimed water is stored in winter months, and some is exported to the Orange County Water District. Water recycling has been a significant water resource in the IRWD service area for decades. Through a combination of proactive public education, reduced rates for recycled water, encouragement of voluntary recycled water use, strong partnerships with the private sector and regulators, the use of pilot projects, and a demonstrated need through long-term planning for recycled water as augmentation for water supply, the IRWD has been extremely successful in implementation of non-potable recycled water projects. The IRWD was the first district in the U.S. to obtain permits for the use of community-supplied reclaimed water for interior (toilet flushing) within IRWD facilities and other commercial buildings. This has reduced potable demand in these buildings by up to 75 percent.

Project Relevance: This project demonstrates the degree of success and support attainable through significant front-end outreach, and a long-term integrated approach clearly recognizing the importance and necessity of recycled water as a water supply resource. This positive approach and interaction with the public and users has ensured smooth implementation of recycled water projects.

Lesson Learned: Leadership and support at the highest level of the organization are critical, and will result in the right value statement for customers, and the right mind-set within the organization ensuring long-term success. Partnerships negotiated ahead of time and voluntary recycled water use are keys to IRWD’s success.

⁵ Personal conversation with Valerie Young of CH2M HILL, and from presentation to XVIII WateReuse Symposium titled, “Redwood City’s Water Supply Challenge” by Craig Lichty and Valerie Young, September 8, 2003.

⁶ Personal conversations with Cesar Lopez for San Diego County Water Authority (SDCWA) case study and Cindy Ferch for Groundwater Replenishment System case study.

⁷ Personal conversation with Cindy Ferch for Groundwater Replenishment System case study.

3.3.1.3 Questions

The questions below will help focus the research into the identification of needs and/or drivers.

- How do short and long-term water demands compare with projected supply?
- How is climate change expected to affect the local region, and what impact is it expected to have on supply/demands?
- If (additional) users can be found or developed, how difficult will it be to supply recycled water to them?
- Are there WWTPs or WRPs planned for construction or expansion (i.e. new sources of, or sources of more, recycled water)?
- Are there avoided costs such as wastewater discharges that can be realized with implementation of the recycled water project?
- What is the real cost of potable water, what will happen to the cost over time, and can recycled water be potentially cost-effective in the short or long term?
- If recycled water does not at first appear cost-effective, do other criteria (such as long-term potable supply limitations) mandate implementation?
- What environmental or permitting requirements will, or are likely to be introduced or in force, in the short and long-term?
- What is local public opinion on the use of recycled water for various purposes? Are there any organized groups or outspoken individuals that oppose the use of recycled water?

Once a need has been identified, further analysis will determine how well the need is likely to be met, and what levels of effort and time are required to ultimately match sources to uses.

3.3.2 Project Planning 2

In the short-term, the purpose of this step is to implement the recycled water project. In the long-term, planning should broadly determine how water recycling will fit into short and long-term water use and supply.

3.3.2.1 Discussion

A recycled water project has distinct characteristics, because of the public perception of recycled use, the permitting and regulatory requirements, and the parallel infrastructure needed to deliver the water. Planning, particularly for ‘first-time’ recycled use, should therefore proceed cautiously, with significant public involvement, and should be given sufficient time for public review and assimilation.

Short-term planning is iterative, and proceeds only when the details of a project are determined viable. This viability is dependent on a project being identified, selected, approved, designed, constructed, and ultimately operated. In addition, project phasing based on timing and constraints of funding is important. Increases in capacity and recycled water demand, water treatment process upgrades, expansion of distribution network, and end use are also important factors in plan development.

A long-term view is often taken through an integrated resource planning approach, which views recycled water in context of other water supply sources and water management and wastewater treatment and disposal strategies. In an integrated resource planning approach all non-potable water uses of water are considered suitable for recycled water. If public support can be obtained for irrigation, stream augmentation, or other public uses (excluding indirect potable), recycled water implementation should be relatively straightforward. If public support is not easily attainable, industrial, commercial or other non-public uses may provide the impetus for implementation – if these users can provide sufficient demand. Public support may follow if safe use is demonstrated over time, and public information and education is thoroughly addressed.

At some point in both short and long-term planning, commitment from identified users must be formalized. The earlier this commitment can be obtained, the easier the justification for implementation. Experience has shown that demand will not develop just because the infrastructure is built but must be developed over time by identifying and working with potential users.

3.3.2.2 Lessons Learned

- Don't rush – invest in planning. Fast-tracking a new recycled water project is very risky.⁸ Fast tracking a recycled water project may result in project development occurring before public acceptance and/or regulatory approval is gained, which can result in increased costs due to changes in the project.
- Chronic problem projects are those that, once built, don't deliver as promised: users that were identified were not connected. Rich Mills of the State Water Resources Control Board (SWRCB) has asserted that 75 percent of projects deliver less than 75 percent of designed capacity; and 50 percent of projects deliver less than 50 percent of designed capacity.⁹
- An integrated approach to planning should link the needs of water, wastewater, recycled water, and related infrastructure.¹⁰ The City of Los Angeles is currently developing an Integrated Resource Plan, which has brought together a large number of stakeholders from within the City's boundaries to review and assist in planning the future infrastructure of the City. By undertaking this large program, the City has integrated the planning of future facilities within its different departments as well as obtained public buy-in and suggestions of how to address issues associated with growth and changing regulations. Integrating the planning efforts of the City has also enabled solutions to be formulated that balance and address water supply, stormwater, wastewater, and recycled water related issues in this urban environment.
- Identify users and obtain formal commitment before implementation.¹¹ Identifying users, especially large water users or groups of water users in close proximity to one another, can ensure a project's viability by making implementation more economical. The WBMWD has been able to expand its system and connect smaller local users by having a basic infrastructure, which was developed to service large industrial users. Requiring new developments to be dual plumbed also can provide an existing and identified set of users when a recycled water system expands into an area (with minimal or no retrofit costs). An example of this is the new development occurring in South Orange County, which is being dual plumbed even though recycled water is not currently available for service to the development.
- Develop a program for education, inspection, cross-connection control, and inventory of users before installing the first recycled system.¹² An example of a successful program was the South Florida Water Management District's (SWFMWD) comprehensive information and education program for its employees, member districts, and the public. One key aspect of this program was the emphasis on ensuring public safety by having all of the key member agencies implement regulations as well as education programs. These efforts were developed for agency

⁸ From personal conversation with Rich Mills, SWRCB.

⁹ IBID.

¹⁰ IBID., and from personal conversation with Valerie Young of CH2M HILL for City of Redwood City case study.

¹¹ From personal conversation with Ken Thompson previously of IRWD for IRWD case study.

¹² Reclaimed Water Guide, Southwest Florida Water Management District, June 1999, p.114.

employees and users to provide best management practices for handling and using recycled water.

3.3.2.3 Questions

The following are questions that should be considered when planning recycled water projects:

- Who else has done a project similar to that proposed? What were their experiences?
- Have other local recycled water projects been successful or unsuccessful? Will attention immediately focus on the problems or successes of these nearby experiences?
- Is the intent to fast track the project?
- What is the prevailing public opinion of recycled water in the local service area?

3.3.3 Identification and Characterization of Recycled Water Sources 3

The purpose of this step is to identify all the relevant properties of the recycled water and its sources to enable available water to be matched to appropriate uses and users. This step also provides a baseline for determining what additional treatment or facilities may be required if the supply characteristics don't match identified uses (e.g., a plant upgrade to tertiary treatment or beyond, or storage reservoir to augment lower night-time treatment flows and deliver more consistent supply to users).

3.3.3.1 Discussion

Recycled water sources are generally wastewater treatment plants that produce tertiary treated water conforming to Title 22 Regulations (refer to the sidebar, *Wastewater Treatment Processes*, for descriptions of the most basic treatment processes). In some cases, only secondary treatment is required. In other cases, greater treatment (up to advanced processes including reverse osmosis [RO]) is needed. Non-potable groundwater or surface water may also be sources, depending on how the water characterization matches up with identified needs. Because the largest source of recycled water is treated wastewater, the following discussion focuses on this source, but may be reasonably extended to include other sources. It is important to note that for recycled water to be of benefit, it must meet quality, quantity, and timing needs of the end user.

3.3.3.2 Water Quality

The levels of treatment of wastewater, and the chemical composition of the resulting recycled water, determine which uses are permissible under California Administrative Code Title 22 regulations administered by California

Department of Health Services. This issue is discussed in depth in Section 3 of the Initiative's *Technical Memorandum No. 2 Water Quality Analysis*. Several tables from that TM are included here as a summary of that discussion. Table 3.1, was developed by the National WaterReuse Association and provides a breakdown of the different recycled water use types in California, along with the level of treatment required for each specific use. Table 3.2 identifies the total coliform limits and turbidity guidelines for each of the different use types and treatment levels. Table 3.3, developed with input from the IEMT, identifies additional constituents that can cause problems for specific types of uses.

Wastewater Treatment Processes

Pretreatment removes or shreds coarse debris and grit.

Primary Treatment removes 70 to 85 percent of the organic and inorganic solids, which either settle out or float to the top.

Secondary Treatment mixes the remaining suspended waste solids with microorganisms and air. The microorganisms convert the waste solids to biomass that settles out.

Tertiary Treatment filters out most of the remaining solids through a granular media (for example, sand or anthracite coal) or a membrane, with the final product water being disinfected with chlorine or UV light to kill off any remaining bacteria, virus or other microorganisms.

Source:

Recycled Water User's Guide, Revised Draft, Los Angeles County Recycled Water Advisory Committee, February 25, 2003.

3.3.3.3 Water Quantity and Supply Timing

Wastewater flows are, by nature, cyclical. A typical pattern of domestically influenced flow follows a diurnal pattern, peaking significantly in the mornings and evenings (shower and cooking times), and dropping off markedly at night. This is illustrated in Figure 3.2. Some uses, such as irrigation, may require heavy nighttime flows. Industrial cooling or other processes may require more constant flows throughout the day and night. Storage may therefore be required to balance out the water supply, by collecting the excess day time flows, and then releasing water to augment the lower night time flows to end users.

The design treatment capacity of a plant sets an upper limit on how much recycled water can be produced. The ultimate design capacity of a plant may be altered if the plant must be

upgraded to a more stringent treatment level (e.g., secondary to tertiary, or tertiary to micro-filtration/reverse osmosis), while staying within its existing footprint. This may further limit the number or type of potential uses.

3.3.3.4 Lessons Learned

- The recycled water supply may need to be tailored to specific users' needs. It is important to match water treatment levels to users carefully, and consider special treatment processes for 'boutique water' if key users require it.¹³ Both the IRWD and the West Basin Municipal Water District (WBMWD) have incorporated or coordinated with users to meet specific demands including insuring water quality consistency for carpet dyeing and installing denitrification and reverse osmosis treatment processes for boiler feed make-up water at refineries.
- High levels of Total Suspended Solids (TSS) can limit recycled water applications if not reduced. This is an important parameter for which to monitor and test.

FIGURE 3.2

TYPICAL SANITARY SEWER DIURNAL FLOW PATTERN

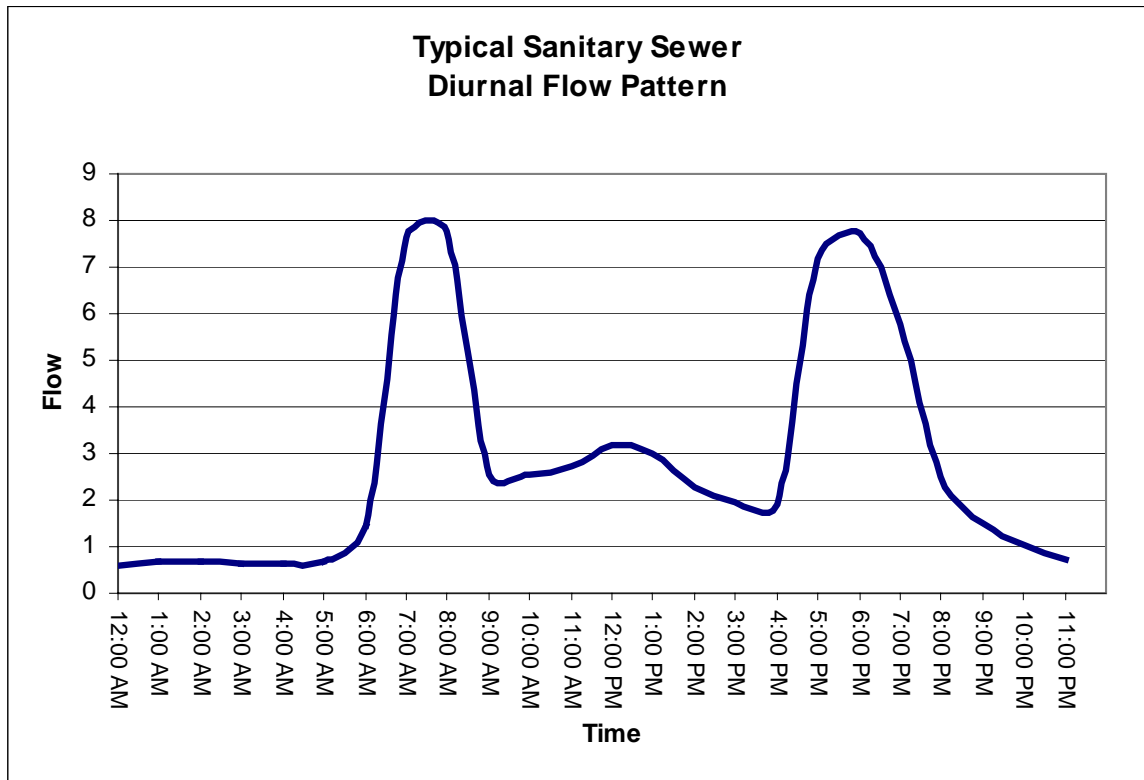


Table 3.1
Recycled Water Uses Allowed in California

Irrigation	Treatment Level			
	Disinfected Tertiary Recycled Water	Disinfected Secondary-2.2 Recycled Water	Disinfected Secondary-23 Recycled Water	Undisinfected Secondary Recycled Water
Food crops where recycled water contacts the edible portion of the crop, including all root crops	Allowed	Not Allowed	Not Allowed	Not Allowed
Parks and playgrounds	Allowed	Not Allowed	Not Allowed	Not Allowed
School yards	Allowed	Not Allowed	Not Allowed	Not Allowed
Residential landscaping	Allowed	Not Allowed	Not Allowed	Not Allowed
Unrestricted access golf courses	Allowed	Not Allowed	Not Allowed	Not Allowed
Any other irrigation uses not prohibited by other provisions of the California Code of Regulations	Allowed	Not Allowed	Not Allowed	Not Allowed
Food crops where edible portion is produced above ground and not contacted by recycled water	Allowed	Allowed	Not Allowed	Not Allowed
Cemeteries	Allowed	Allowed	Allowed	Not Allowed
Freeway landscaping	Allowed	Allowed	Allowed	Not Allowed
Restricted access golf courses	Allowed	Allowed	Allowed	Not Allowed
Ornamental nursery stock and sod farms	Allowed	Allowed	Allowed	Not Allowed
Pasture for milk animals	Allowed	Allowed	Allowed	Not Allowed
Nonedible vegetation with access control to prevent use as a park, playground or school yard	Allowed	Allowed	Allowed	Not Allowed
Orchards with no contact between edible portion and recycled water	Allowed	Allowed	Allowed	Allowed
Vineyards with no contact between edible portion and recycled water	Allowed	Allowed	Allowed	Allowed
Non food-bearing trees, including Christmas trees not irrigated less than 14 days before harvest	Allowed	Allowed	Allowed	Allowed
Fodder crops (e.g. alfalfa) and fiber crops (e.g. cotton)	Allowed	Allowed	Allowed	Allowed
Seed crops not eaten by humans	Allowed	Allowed	Allowed	Allowed
Food crops that undergo commercial pathogen-destroying processing before consumption by humans	Allowed	Allowed	Allowed	Allowed
Ornamental nursery stock, sod farms not irrigated less than 14 days before harvest	Allowed	Allowed	Allowed	Allowed

Supply for Impoundment	Treatment Level			
	Disinfected Tertiary Recycled Water	Disinfected Secondary-2.2 Recycled Water	Disinfected Secondary-23 Recycled Water	Undisinfected Secondary Recycled Water
Non-restricted recreational impoundments, with supplemental monitoring for pathogenic organisms	Allowed ¹	Not Allowed	Not Allowed	Not Allowed
Restricted recreational impoundments and publicly accessible fish hatcheries	Allowed	Allowed	Not Allowed	Not Allowed
Landscape impoundments without decorative fountains	Allowed	Allowed	Allowed	Not Allowed

Notes:

Table developed by WaterReuse and available on their website at <<http://www.watereuse.org/Pages/information.html>>.

Refer to the full text of the latest version of Title-22: California Water Recycling Criteria. This chart is only a guide to the September 1998 version.

Footnotes:

¹With "conventional tertiary treatment." Additional monitoring for two years or more is necessary with direct filtration.

²Drift eliminators and/or biocides are required if public or employees can be exposed to mist.

³Refer to Groundwater Recharge Guidelines, California Department of Health Services.

Table 3.1
Recycled Water Uses Allowed in California

Other Uses	Treatment Level			
	Disinfected Tertiary Recycled Water	Disinfected Secondary-2.2 Recycled Water	Disinfected Secondary-23 Recycled Water	Undisinfected Secondary Recycled Water
Groundwater recharge	Allowed under special case-by-case permits by RWQCBs ³			
Flushing toilets and urinals	Allowed	Not Allowed	Not Allowed	Not Allowed
Priming drain traps	Allowed	Not Allowed	Not Allowed	Not Allowed
Industrial process water that may contact workers	Allowed	Not Allowed	Not Allowed	Not Allowed
Structural fire fighting	Allowed	Not Allowed	Not Allowed	Not Allowed
Decorative fountains	Allowed	Not Allowed	Not Allowed	Not Allowed
Commercial laundries	Allowed	Not Allowed	Not Allowed	Not Allowed
Consolidation of backfill material around potable water pipelines	Allowed	Not Allowed	Not Allowed	Not Allowed
Artificial snow making for commercial outdoor uses	Allowed	Not Allowed	Not Allowed	Not Allowed
Commercial car washes not done by hand & excluding the general public from washing process	Allowed	Not Allowed	Not Allowed	Not Allowed
Industrial boiler feed	Allowed	Allowed	Allowed	Not Allowed
Nonstructural fire fighting	Allowed	Allowed	Allowed	Not Allowed
Backfill consolidation around nonpotable piping	Allowed	Allowed	Allowed	Not Allowed
Soil compaction	Allowed	Allowed	Allowed	Not Allowed
Mixing concrete	Allowed	Allowed	Allowed	Not Allowed
Dust control on roads and streets	Allowed	Allowed	Allowed	Not Allowed
Cleaning roads, sidewalks and outdoor work areas	Allowed	Allowed	Allowed	Not Allowed
Flushing sanitary sewers	Allowed	Allowed	Allowed	Allowed

Supply for Cooling or Air Conditioning	Treatment Level			
	Disinfected Tertiary Recycled Water	Disinfected Secondary-2.2 Recycled Water	Disinfected Secondary-23 Recycled Water	Undisinfected Secondary Recycled Water
Industrial or commercial cooling or air conditioning involving cooling tower, evaporative condenser, or spraying that creates a mist	Allowed ²	Not Allowed	Not Allowed	Not Allowed
Industrial or commercial cooling or air conditioning not involving a cooling tower, evaporative condenser, or spraying that creates a mist	Allowed	Allowed	Allowed	Not Allowed

Notes:

Table developed by WateReuse and available on their website at <<http://www.watereuse.org/Pages/information.html>>.

Refer to the full text of the latest version of Title-22: California Water Recycling Criteria. This chart is only a guide to the September 1998 version.

Footnotes:

¹ With "conventional tertiary treatment." Additional monitoring for two years or more is necessary with direct filtration.

² Drift eliminators and/or biocides are required if public or employees can be exposed to mist.

³ Refer to Groundwater Recharge Guidelines, California Department of Health Services.

Table 3.2
Water Quality Limits by Use Type

Treatment Level	Use Type	Total Coliform Limit	Turbidity
Undisinfected Secondary Standard	(1) Orchards where the recycled water does not come into contact with the edible portion of the crop.	None Required	None Required
	(2) Vineyards where the recycled water does not come into contact with the edible portion of the crop.		
	(3) Non food bearing trees (Christmas tree farms are included in this category provided no irrigation with recycled water occurs for a period 14 days prior to harvesting or allowing access by the general public.)		
	(4) Fodder and fiber crops and pasture for animals not producing milk for human consumption.		
	(5) Seed crops not eaten by humans.		
	(6) Food Crops that must undergo commercial pathogen destroying processing before being consumed by humans.		
	(7) Ornamental nursery stock and sod farms provided no irrigation with recycled water occurs for a period of 14 days prior to harvesting, retail sale, or allowing access by the general public.		
	(8) Flushing of sanitary sewers.		
Disinfected Secondary-23 Recycled Water	(1) Cemeteries.	< 23 total coliform per 100 mL < 240 total coliform per 100 mL in more than one sample in any 30-day period	2 NTU
	(2) Freeway landscaping.		
	(3) Restricted access golf courses.		
	(4) Ornamental nursery stock and sod farms where access by the general public is not restricted.		
	(5) Pasture for animals producing milk for human consumption.		
	(6) Any nonedible vegetation where access is controlled so that the irrigated area cannot be used as if it were part of a park, playground, or school yard.		
	(7) Landscape impoundments with decorative fountains.		
	(8) Industrial boiler feed water.		
	(9) Nonstructural fire-fighting.		
	(10) Backfill consolidation around nonpotable piping		
	(11) Soil compaction.		
	(12) Mixing Concrete.		
	(13) Dust Control and Cleaning of road streets, sidewalks and outdoor work areas.		
Disinfected Secondary-2.2 Recycled Water	(1) Restricted recreational impoundments and publicly accessible fish hatcheries	< 2.2 total coliform per 100 mL < 23 total coliform per 100 mL in more than one sample in any 30-day period	None Required
	(2) Food crops where edible portion is produced above ground and not contacted by recycled water		
Disinfected Tertiary Recycled Water	(1) Food crops where recycled water contacts the edible portion of the crop, including all root crops	≤ 2.2 total coliform per 100 mL < 23 total coliform per 100 mL in more than one sample in any 30-day period 240 total coliform per 100mL maximum CT value of 50 mg-min/L at all times with a modal CT of at least 90 min. or MS_2 bacteriophage or poliovirus concentration reduction of 5 logs	2 NTU
	(2) Parks and playgrounds.		
	(3) School yards.		
	(4) Residential landscaping.		
	(5) Unrestricted access golf courses.		
	(6) Any other irrigation uses not prohibited by other provisions of the California code of Regulations		
	(7) Flushing Toilets and urinals.		
	(8) Priming drain pipes.		
	(9) Industrial process water that may come into contact with workers.		
	(10) Structural fire fighting.		
	(11) Decorative fountains.		
	(12) Commercial laundry.		
	(13) Consolidation of backfill around potable water pipelines.		
	(14) Artificial snow making for commercial outdoor use		
	(15) Commercial car washes, including hand washes if the recycled water is not heated, where the general public is excluded from the washing processes.		
	(16) Industrial or commercial cooling or air conditioning involving cooling tower, evaporative condenser, or spraying that creates a mist.		

Note:
This table was developed from "California's New Water Recycling Criteria and Their Effect on Operating Agencies" by James Crook, Laura Johnson, and Ken Thompson.

Table 3.3

Constituents of Concern for Recycled Water Use

Constituent of Concern	Description	Sources	Impacts	Solutions/ Treatment Options
Endocrine Disrupters (EDCs) or Hormonally Active Agents (HAAs)	EDCs are natural and synthetic compounds that can interfere with normal endocrine system functions by mimicking the actions of naturally-occurring hormones, by blocking the receptors in cells that receive hormones, or by affecting synthesis, transport, metabolism, and excretion of hormones.	Wastewater effluents Urban runoff Confined animal feeding operations Groundwater contamination Industrial sources	Interferes with normal endocrine system of organisms resulting in significant negative impacts in the hormonal functioning. Accumulation in the environment, especially in biota for some EDCs. Potential mutagens and/or carcinogens.	Advanced treatment (e.g., ultrafiltration or reverse osmosis membrane or adsorption processes) in wastewater treatment systems. More efficient monitoring and source control in industrial operations. Collection and advanced treatment of urban runoff. Use of more biodegradable, less toxic, and environmentally benign chemicals in industries.
Pharmaceuticals and Personal Care Products (PPCPs)	A diverse group of bioreactive chemicals including pharmaceutical and the active ingredients in personal care products for both humans and animals.	Wastewater effluents Urban runoff	Accumulation in the environment, especially in biota, due to slow (or no) biodegradation. Some PPCPs may behave as EDCs. Some PPCPs may be mutagenic and/or carcinogenic.	Advanced treatment (e.g., ultrafiltration or reverse osmosis membrane processes) in wastewater treatment systems. Collection and diversion of urban runoffs.
Antibiotics	Human and veterinary antibiotics.	Wastewater effluents Urban runoff Confined animal feeding operations	Accumulation in the environment. Modification in the spectrum of naturally-occurring organisms due to selective antibiotic activity.	Advanced treatment (e.g., ultrafiltration or reverse osmosis membrane or adsorption processes) in wastewater treatment systems. Collection and advanced treatment of wastes from confined animal feeding operations.
Pesticides	Any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest (i.e. any insects, mice and other animals, unwanted plants (weeds), fungi, or microorganisms like bacteria and viruses).	Agricultural runoff Wet-weather urban runoff Domestic wastewater	Accumulation in the environment, especially in biota, due to slow (or no) biodegradation. Some pesticides proven to be toxic and carcinogenic. Contamination of groundwaters (due to infiltration) and surface waters (due to runoff) from agricultural sources where pesticides were applied.	Effective collection and treatment of agricultural or urban runoff. Use of more biodegradable, less toxic and environmentally benign pesticides. Advanced treatment (e.g., nanofiltration or ultrafiltration membrane or adsorption processes) in wastewater treatment systems.

Table 3.3

Constituents of Concern for Recycled Water Use

Constituent of Concern	Description	Sources	Impacts	Solutions/ Treatment Options
Total Organic Carbon (TOC)	Total organic carbon is a measure of the organically bound carbon in a water or wastewater sample.	Natural organic matter from drinking water treatment processes Anthropogenic compounds added by domestic or industrial water users such as organic micropollutants Soluble microbial products derived from wastewater treatment processes	Treating for TOC reduces the potential for health hazards by lowering the concentrations of micropollutants and SMPs in the water.	Advanced treatment (e.g., ultrafiltration or reverse osmosis membrane, advanced oxidation or adsorption processes) in wastewater treatment systems.
Disinfection By-Products (DBPs)	By-products formed by reactions of disinfectants with organic and inorganic constituents in the source water.	Disinfected wastewater effluents Produced from chlorine based oxidants as well as ozone or ultraviolet light	Suspected carcinogens and mutagens to many organisms. Fairly persistent in the environment due to slow biodegradation.	Implement non-chemical based disinfection processes such as ultraviolet light, or high-pressure membrane systems to be used for reduction in organic precursors and target microorganisms.
Organic Micropollutants	Chemicals that are developed by industrial or other activities that use water and discharge wastewater.	Wastewater effluents Urban runoff Industrial sources Groundwater contamination	Accumulation in the environment, especially in biota, due to slow (or no) biodegradation. Groundwater contamination Majority of synthetic micropollutants are suspected mutagens and/or carcinogens.	Advanced treatment (e.g., ultrafiltration or reverse osmosis membrane, advanced oxidation or adsorption processes) in wastewater treatment systems. More efficient monitoring and source control in industrial operations. Collection and advanced treatment of urban runoff.
NDMA	N-nitrosodimethylamine (NDMA) is a defined carcinogen that has historically been associated with the production of rocket fuels, antioxidant additives for lubricants, softeners of copolymers in the rubber industry, and trace amounts in cured meat products such as bacon and smoked fish.	Industrial sources Wastewater effluents Groundwater contamination	Suspected carcinogen and mutagen although more studies needed for health effects. Groundwater contamination from industrial sources and wastewater effluents.	Advanced treatment (e.g., ultrafiltration or reverse osmosis membrane or advanced oxidation processes) in wastewater treatment systems. More efficient monitoring and source control at industrial operations. Replace chlorination with ultraviolet light or other disinfection processes to avoid formation.

Table 3.3

Constituents of Concern for Recycled Water Use

Constituent of Concern	Description	Sources	Impacts	Solutions/ Treatment Options
Soluble Microbial Products (SMPs)	Soluble microbial products (SMPs) are organic polymeric products released from biomass during biological wastewater treatment processes.	Wastewater effluents	Major portion of SMPs are relatively more biodegradable than synthetic chemicals; thus accumulated less in the environment. Exception is the humus type residues from microbial activity in biological treatment systems. Some naturally occurring SMPs (mainly humic and fulvic acids) are not considered to have negative impacts on organisms.	Tertiary treatment (e.g., ultrafiltration or reverse osmosis membrane, or adsorption processes) of secondary effluents in wastewater treatment systems.
Pathogens	Pathogens are either bacteria, viruses, or parasites.	Wastewater effluents Urban runoff Confined animal feeding operations Natural sources (e.g., animal and plant excretes and decaying organisms)	Health effects (e.g., diseases, etc).	Advanced treatment (e.g., ultrafiltration or reverse osmosis membrane or effective disinfection processes such as ozone or ultraviolet light) in wastewater treatment systems. Collection, and diversion of urban runoffs for further advanced treatment.
Metals	Metals include cadmium, copper, lead, nickel, silver, selenium, mercury, chromium, arsenic, calcium, zinc, and cyanide.	Wastewater effluents Urban runoff Industrial sources	Accumulation in the environment, especially in marine biota and sediments due to complexation and further precipitation. Heavy metals generally are toxic to organisms through bioaccumulation in the tissues.	Advanced treatment (e.g., ultrafiltration or reverse osmosis membrane or adsorption processes) in wastewater treatment systems. Collection and diversion of urban runoffs for further advanced treatment. More efficient monitoring and source control at industrial operations.

Table 3.3
Constituents of Concern for Recycled Water Use

Constituent of Concern	Description	Sources	Impacts	Solutions/ Treatment Options
Nutrients	Nitrogen and phosphorus.	Agricultural drainage/runoff Wastewater effluents Urban runoff Industrial sources Septic systems	Nutrients may result in microbial regrowth, oxygen depletion (due to microbial activity), and eutrophication in receiving waters. Nutrients may cause groundwater contamination through infiltration.	More efficient biological nutrient removal processes (e.g., improved nitrification/denitrification and phosphorus removal) in wastewater treatment. Collection and diversion of urban runoffs for further advanced treatment. More efficient monitoring and source control in industrial operations. Use of more biodegradable detergents and fertilizers. Effective collection of agricultural runoff/drainage.
Salinity	Salinity is used to denote the presence of sodium (Na+) and/or other cations and/or other anions.	Wastewater effluents Agricultural and urban runoff Water Reuse Industrial sources Self-regenerating water softening or conditioning appliances	Deterioration of water quality which results in difficulties in the treatment and production of reclaimed water or drinking water. High-TDS reclaimed waters to be used for irrigation are detrimental to soil, plants, crops, etc. Sodium may cause soil permeability problems.	Advanced softening treatment (e.g., high-pressure membrane) in wastewater treatment systems. Prevention of agricultural runoff to surface waters and more effective use of fertilizers. Regulation and public education regarding the use of self-regenerating water softening or conditioning appliances.
Brine	Brine or membrane concentrate disposal is a water stream where constituents have been concentrated due to membrane processes such as reverse osmosis. Constituents in brine range from salt, coagulants, antiscalants, disinfection chemicals, dechlorination chemicals, membrane-cleaning chemicals to metals, DBPs, and pathogens.	Water treatment Wastewater treatment Industrial pretreatment	High concentration of contaminants in brine may be toxic to organisms in receiving waters due to sudden shock effect of high concentrations. Significant quantities of pathogens may be present in brine. Ammonia is of concern due to its toxicity. Heavy metal may bioaccumulate in marine biota.	Brine disposal methods with less negative environmental impacts, which is mostly site-specific. Studies to determine how to control toxicity issues at outfalls need to be performed for each specific outfall location to prevent degradation of ecosystems.

3.3.3.5 Questions

The following questions will help identify and characterize recycled water sources:

- Where are the sources (WWTPs/WRPs) located?
- What level of treatment is provided?
- Is the wastewater source primarily residential? Institutional? Commercial? Industrial? Military or special research?
- What pollutants are present, and in what concentrations?
- What are the flow characteristics of the plant (average daily dry-weather discharge, average day time dry-weather flow (MGD), average night time dry-weather flow (MGD), and the corresponding values for wet-weather flow)?
- What impact will removing flow from the effluent and concentrating pollutants have on the WWTP discharge permit? Also what impacts result from returning waste streams from the effluent of the WWTP back to the WWTP?
- What is the current design capacity of the plant?
- When is the capacity expected to be reached?
- Is a plant or distribution system expansion or upgrade planned (is there physical room for expansion)?
- Does the treatment plant have available storage for recycled water use? How much storage is available and where is it located?
- What is known of public opinion on plant expansion, and other related issues?

3.3.4 Public Involvement and Public Information and Education (PI&E) ④

Public outreach has emerged as one of the most volatile and potentially unpredictable aspects of some water recycling projects. The purpose of this step is to obtain public participation and support in the planning and implementation of a proposed recycled water project, or to understand the opposition and develop alternatives to gain public support.

CASE STUDY: WEST BASIN WATER DISTRICT SYSTEM AND PHASE 4 EXPANSION

Project Description: The West Basin Water District is a wholesaler of recycled water. WBMWD provides five types of recycled water from a total of four treatment plants. These water types include supplying specialized 'boutique water' to industrial (petroleum refinery) customers, supplying reverse osmosis treated water for seawater barrier (groundwater) injection, and supplying tertiary treated water for irrigation users through the Water Replenishment District (WRD).

The WBMWD El Segundo Water Reclamation Plant, built in 1995, processes secondary-treated effluent received from the City of Los Angeles' Hyperion Wastewater Treatment Plant. The El Segundo WRP then feeds three satellite plants (built between 1999-2000), each of which polishes the water for a specific industrial user. The industrial users pay a higher rate for the recycled water, but this cost is offset and justified due to the consistency of water quality and quantity. When compared to existing potable water supplies, whose reliability can be effected by droughts, having a reliable and drought resistant water supply source is overall very economical.

The types of water produced include *Barrier Water* (MF/RO with some additional treatment), *Double-pass RO*, *MF/RO*, *Title 22*, and *Nitrified*. Infrastructure is primarily funded through bonds and Federal grants. O&M funding and infrastructure loan repayment comes primarily through recycled water revenues.

The Phase 4 Expansion Project, which got underway in November 2003, will expand Title 22 water production from 30 mgd to 40 mgd, and Barrier Water from 7.5 mgd to 12.5 mgd with UV disinfection. The Project will also shift the mix of injected Barrier Water from a ratio of 50/ 50 between recycled and potable to a 75/25 recycled to potable ratio. Within six to ten years the objective is to move to 100 percent recycled water for injected barrier water. It is projected that the Phase 4 Expansion will save over 17.5 mgd of potable water when completed.

Project Relevance: This project demonstrates the extent to which recycled water can be customized successfully for specialized users, and the amount of use possible with community and customer support.

Lesson Learned: Pro-active public and customer outreach enables implementation of creative and innovative applications of recycled water. The pro-active approach ensures issues are not left to speculation.

3.3.4.1 Discussion

The following discussion summarizes the aspects of the June 2003 report written for the California Department of Water Resources, entitled "Water Recycling 2030, The Recommendations of California's Recycled Water Task Force." In addition, a separate TM, which is being developed as part of the Initiative, expands on these and other PI&E recommendations and issues.

The following was reported by the 2002 Recycled Water Task Force in its draft white paper on public involvement in the recycled water decision process:

"In California, water and wastewater agencies have implemented recycled water projects with varying levels of success, depending on the type of project and other factors. Nonpotable reuse... has been generally accepted by local communities and elected officials."

"The hurdles faced by traditional uses of recycled water; however, pale in comparison to projects in which the eventual end use will be a source of potable (drinking) water. In general, the public's initial response to using recycled water is a visceral reaction from knowing that the

source is from water mixed with human sewage (commonly referred to as the “yuck factor”).”¹⁴

The white paper also provides over three pages of PI&E focused recommendations and was incorporated into the June 2003 report “Water Recycling 2030 - Recommendation of California’s Recycled Water Task Force”¹⁵. Most of the public outreach recommendations from this report seek to improve support and participation in water recycling projects at the local level. The report identifies the following as key participation principles for recycled water projects¹⁶:

1. The public needs to be involved in all phases of project planning with opportunities for involvement in developing and selecting alternatives, not just to be informed of final decisions.
2. Members of the public need to be listened to and responded to with respect. Their values and needs should be incorporated into the decision criteria. Their fears and concerns should be considered real and valid and mitigated with accurate information and, if necessary, changes in project design. Interaction should follow common courtesies of appropriate language, body gestures, and cordiality to keep focus on project issues.
3. Adequate and understandable information needs to be disseminated in many forums on proposed projects and water supply issues in general.
4. Recycled water projects need to be justified on fundamental needs of community desires, such as an adequate and safe water supply or prevention of water pollution.
5. Principles of environmental justice need to be incorporated. The public expects that costs and benefits of projects should be equitably shared.
6. The public needs broad understanding of water supply issues to have a context in which to evaluate recycled water.

Broad PI&E recommendations from the report encompass state, local government, and community actions. The recommendations fall under the following categories:

- Community value-based decision-making model for project planning
- Leadership support for water recycling
- Educational curricula

¹⁴ White Paper of the Public Information, Education, and Outreach Workgroup on Better Public Involvement in the Recycled Water Decision Process – DRAFT, California’s Recycled Water Task Force, Feb 4, 2003, p. 3.

¹⁵ Water Recycling 2030, Recommendations of California’s Recycled Water Task Force, Department of Water Resources, June 2003.

¹⁶ IBID, p. 22.

- State-sponsored media campaign

The primary recommendations under each of these categories are included in Table 3.4. Because of the possibility of negative public opinion, and the great importance in obtaining public support for successful project implementation, it is important to commit to a proactive and open public outreach process. Depending on gauged initial support, public outreach may precede marketing surveys or other potential customer contacts. More favorable and knowledgeable responses to marketing-related questions may be obtained from potential users, including the public, if they first have an opportunity to learn the pros and cons of recycled water use.

3.3.4.2 Lessons Learned

- By far the most important lesson is to begin public involvement and education early in the process, and to make this a significant effort. The importance of this cannot be overstated; those that seek out involvement on their own are already committed one way or the other.¹⁷
- If recycled water promotion is seen as a sewage reduction problem, opposition can swell. If promotion focuses on water supply, the ‘yuck factor’ is reduced.¹⁸ The GWRS project is an example of a success story in promotion of a project as a water supply project. In the City of San Diego Water Repurification Project, the media and project opponents used negative terminology to galvanize public support against the project.
- Educate politicians well ahead of project publicity so that all have an understanding of water recycling issues.¹⁹
- Out-of-context comments are difficult to debunk²⁰ and the Internet is not always right.²¹
- Opposition with time and resources requires equal (or more) time and resources from the project proponent.²²

¹⁷ From personal communication with Cesar Lopez for SDCWA case study, Bill Van Wagoner for East Valley Water Recycling Project case study.

¹⁸ From personal communication with Cindy Ferch for Groundwater Replenishment System case study.

¹⁹ From personal conversations with Cesar Lopez for SDCWA case study.

²⁰ Presentation to XVIII WaterReuse Symposium titled, “Redwood City’s Water Supply Challenge” by Craig Lichty and Valerie Young, September 8, 2003.

²¹ IBID.

²² IBID.

TABLE 3.4

SUMMARY OF PI&E RECOMMENDATIONS FROM THE CALIFORNIA DWR 2002 RECYCLED WATER TASK FORCE

REPORT REFERENCE†	RECOMMENDATION
2.1	Community Value-Based Decision-Making Model for Project Planning
2.1.1	Public participation should be increased through vigorous outreach, augmenting the notification requirements stipulated by California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA).
2.1.2	Project planners should hold more public meetings to gather and supply information at appropriate venues.
2.1.3	Project developers should make project decisions that respect and incorporate the community's values and concerns...
2.1.4	Project planners should convene an independent advisory committee composed of experts in the field and consumers from a variety of viewpoints... to review the proposed project alternatives...
2.1.5	Water recycling should be presented to the public with other alternatives for locally achieving water supply goals.
2.1.6	Local agencies should cultivate and utilize media opportunities for their projects...
2.2	Leadership Support for Water Recycling
2.2.1	The State should take a leadership role on water recycling...
2.2.2	State funding should be provided for public education and outreach.
2.2.3	The State should work closely with local agencies on water recycling. [Vis-à-vis technical assistance, education, and recycled water informational programs].
2.2.4	Appropriate local agencies should adopt well-defined local recycled water ordinances.
2.2.5	Local planning, building code enforcement, health, and public works departments should effectively enforce local recycled water ordinances, through adequate staff and resources. Building inspectors and code enforcement officers should effectively enforce the installation of types of plumbing that would allow the use of recycled water...
2.2.6	Convene a statewide independent review panel on indirect potable reuse to summarize the existing and on-going scientific research and address public health and safety as well as other concerns, such as environmental justice, economic issues and increased public awareness.
2.3	Educational Criteria
2.3.1	A statewide panel should be convened to recommend changes to public schools and higher education curricula...
2.4	State-Sponsored Media Campaign
2.4.1	The State should develop a water issues information program for radio, television, print, and other media.
2.4.2	The State should work with organizations that have produced videos on water issues, including recycled water, and fund updates and expanded programming...
2.4.3	State agencies should prepare opinion editorial pieces for publication in newspapers throughout the State.
2.4.4	The State should retain an advertising agency/public relations firm to assist in the development of short messages with specific information on urgent topics such as drought, conservation, pollution prevention, water quality, stormwater, wastewater, or recycled water including indirect potable reuse.
† Water Recycling 2030, Recommendations of California's Recycled Water Task Force, California Department of Water Resources, June 2003, pp. 23–38.	

- Emotional drama can overshadow scientific analysis (but science alone will not solve the debate).²³ This is evident from a number of projects including the San Diego Repurification Project and the East Valley Water Recycling Project, which have faced stumbling blocks to project implementation when the public became fixated on a perceived injustice or health and safety issues. Both of these projects faced growing public opposition when the term “toilet to tap” was used by the media as an elementary manner of describing the project to the public.
- Know your neighborhoods and elected officials – support for recycled water from the highest levels of the organization is essential.²⁴
- It is much easier to build and maintain trust at the beginning of the process than to try and establish it later on.²⁵ The Redwood Shores Area Water Recycling Project is an example of a project that had to be rechartered due to public opposition. See the case study at the end Section 3.3.6.2 for a complete description of the project.
- Implementing pilot and demonstration projects three to four years ahead of full project implementation can build community acceptance and assist in getting State agencies on board. Pilot and demonstration projects also allow for time to test the viability of partnerships and community alliances.²⁶
- Make the recycled water program prominent (e.g., all staff wears purple shirts, provide purple promotional materials).²⁷ Make your reclaimed water program as visible as possible. For example, Largo Reclaimed Water personnel wear purple golf shirts and khaki pants as uniforms, and all promotional items (hats,

CASE STUDY:**CITY OF SAN DIEGO REPURIFICATION**

Project Description: The City of San Diego Repurification Project was developed to augment the City's water supply. The proposed project consisted of construction of a water repurification facility with a capacity of up to 20 million gallons per day (MGD) which would take treated water from the North City Water Reclamation Plant, and treat it to advanced levels using reverse osmosis, microfiltration, ozone disinfection, and other processes. This water would be blended with surface water in San Vicente Reservoir and treated further. The repurified water would then be transported over 20 miles to the San Vicente Reservoir to be blended with imported raw water supplies from the San Diego Aqueduct. After a minimum of one-year retention time, the blended water would be conveyed to the City's Alvarado Filtration Plant and treated further before being introduced into the City's potable water delivery system. The project was developed in part to satisfy the future water supply needs of San Diego, which was a clear driver for project need. However, the City of San Diego put the project on indefinite hold due to negative public perspectives regarding the project's public health and safety.

Project Relevance: This project demonstrates that although a clear need may exist and the necessary precautions are in place to meet regulatory requirements, the project may not be successfully implemented if the public is not convinced of, or comfortable with, the safety of recycled water for the intended use.

Lesson Learned: Project sponsors must recognize the potential for strong controversy with indirect potable projects. Project timing must be considered in the broader sense to avoid political opportunism, if possible. With such projects, a thorough education and cooperation of politicians and potential users is mandatory for success.

²³ IBID.

²⁴ IBID.

²⁵ IBID., and personal communication with Bill Van Wagoner for East Valley Water Recycling Project case study

²⁶ From personal communication with Bill Van Wagoner for East Valley Water Recycling Project case study and Ken Thompson for IRWD case study.

²⁷ Reclaimed Water Guide, SWFMWD, June 1999, p.114.

mugs, pencils, rain gauges, etc.) are purple. This has enabled the recycled water program to be well recognized, as well as assist in promoting the safety and reliability of recycled water as a water supply source.

3.3.4.3 Questions

The following questions may help to identify the degree of public or potential user opinion and support for recycled water:

- Have other recycled water projects been successfully implemented (or attempted but not implemented) in the area?
- Was there organized public support or opposition to the project?
- How broadly based was the support/opposition?
- Were the voiced concerns accurate, or sensationalized?
- What were the major concerns with the project and/or the use of recycled water?
- What public outreach effort was made: timing, number and scope of public meetings, educational material developed/distributed, web site, availability of staff/resources for answering questions from public?
- How was support for the implemented project gained, why was the project ultimately supported, or, if not implemented, why was support not achieved?
- What community opposition and support are anticipated in the local area, and from where?
- What are (or are likely to be) the primary issues of opposition? What is the best method to address these?

3.3.5 Market and Infrastructure Assessments (5)

The purpose of this step is to identify a water reuse market and assess the infrastructure requirements. Once a market is identified and demands quantified then a comparison between the cost of infrastructure development and the revenue or benefits can be preformed.

3.3.5.1 Discussion

The most common recycled water uses in urban areas are landscape irrigation in parks, schools, golf courses, nurseries, playgrounds and street medians, and water for industrial processes and cooling (e.g., cement plants, dust control, fire protection, and power generation stations). Other common uses include recreational uses (lake or stream augmentation), groundwater recharge, and agricultural irrigation. Relatively new, but growing uses include, gray water use in dual-plumbed office buildings and industrial buildings, which use recycled water for toilet and urinal flushing, and floor drain trap priming. Gray water uses can potentially reduce potable water use by up to 80 percent²⁸. Use of recycled water, including gray water applications, in governmental facilities is often a preferred application as it provides a controllable and predictable market for recycled water. It can also serve as a showcase for the effective and safe use of recycled water.

The assessment of potential uses and users can be determined from zoning data, and by examining aerial photos to identify irrigated areas near the supply. GIS data and analysis, particularly in urban areas, can quickly identify business or industry types, green spaces, and other potential uses. Identification of water use records can also reveal particularly heavy users, or a list of those using a greater quantity of water than some specified threshold. By contacting these businesses or agencies and discussing basic water quantity, quality, and timing needs, a list of potential users can be developed. Surveys can be circulated, and public notices distributed. Even at this early stage, the gathering of basic information about potential users should be combined with balanced information and education efforts. Initial contacts, survey interviews, and follow-up calls can also serve as educational opportunities.

Distribution infrastructure is a major problem in many urban settings. Because the distribution infrastructure must be completely isolated hydraulically from the potable system, the initial cost of providing recycled water to the user can be very high if an entirely new distribution system must be constructed to convey the water. However, once built, other users can tap the distribution system, and share in the recovery of infrastructure costs. One approach to assisting in reducing distribution costs is to require new development to be dual

²⁸ Guidelines for Distribution of Non-potable Water, AWWA, p.76

plumbed. Dual plumbing of new communities provides new users and also a more cost effective supply infrastructure, which can help in reducing distribution costs. Another method that agencies can employ to reduce costs or assist in getting facilities built is to leverage grant and loan opportunities. A discussion of where to locate and obtain implementation financing for recycled water projects is provided in the Initiative’s Financial Support Opportunities TM.

Another important component in developing uses of recycled water is characterization of desired water quality. The characterization of recycled water (subsection 3.3.3) allows the proponent to immediately determine if supplied water can meet the quality requirement of specific uses. Some example industrial processes and their corresponding constituent concentration limits are provided in Table 3.5. In addition, knowing user water quality requirements can assist agencies in determining whether additional treatment is a viable option. Developing ‘boutique water’ may prove to be a good solution to meeting either large users’, or groups of users’ water quality needs. Table 3.6 lists potential obstacles and solutions to using recycled water by use type.

Another factor in identifying users is the careful consideration and review of the Service Duplication Act²⁹ prior to project implementation. The Service Duplication Act of California requires water reuse agencies that are supplying users within another water agency’s boundaries to compensate that agency for the loss of customer revenue. This may be a moot point if the recycled water agency is the same as that supplying the potable water. If not, up-front negotiation with water purveyors is essential.

The importance of an informed and supportive general public and identification of the potential customer base was emphasized in the previous section. The market and infrastructure assessment should be carefully coordinated with the public outreach effort to ensure that the potential market is well informed.

²⁹ The Service Duplication Act of California can be found in the California Public Utilities Code §§1501-1507.

3.3.5.2 Lessons Learned

- Choose the right value statement for prospective customers.³⁰ The SWFWMD emphasized the assumptions asserted by the Florida Water Reuse Work Group Water Conservation Initiative to gain public acceptance but also understanding. Asserting the value of recycled water as a supply source was the right value statement for the SWFWMD. See the case study at the end of Section 3.3.5.2 for more information on this project.
- Make the use of recycled water voluntary, but provide incentives to make it economically attractive to users. User commitment can be maintained and expanded for recycled water by implementing successful public education and incentives as well as providing product water that is of good quality, consistency, and reliability. This point is made evident in the Urban Water Recycling Feasibility Assessment Guidebook, which states “Experience has shown that the use of incentives and a mutual commitment to problem solving is more effective in securing user commitment than mandatory use ordinances.”³¹ In addition, the WBMWD and IRWD systems are examples of voluntary recycled water systems that have been implemented successfully.
- Implement a Mandatory Use Ordinance. Some agencies have found that using ordinances is the only way to make a recycled water project feasible and sustainable from an economic standpoint. In addition, a number of funding mechanisms require implementation of a mandatory use ordinance before funding will be allocated to a project. Mandatory use ordinances have been used by the SWFWMD and Redwood City to ensure that the recycled water is utilized. Recycled water (depending on the nature of wastewater cycles and storage) can provide a more stable water supply for industry particularly during drought conditions.³² Due to the semiarid climate as well as the nature of water supply in southern California, recycled water can attract users because it is a drought resistant supply of water. This is especially evident for agencies having a high reliance on imported water supply and little local groundwater supply sources.
- Users of recycled water can benefit from the associated ‘green image’. On the LADWP’s East Valley Water Recycling project, environmentalists supported the project to reduce water supply draws from Mono Lake as part of a court settlement. In addition, environmentalist supported the responsible reuse of water because it uses an already existing source of water instead of importing additional water for non-potable water uses.

³⁰ Personal conversation with Ken Thompson for IRWD case study.

Urban Water Recycling Feasibility Assessment Guidebook, Atwater et. al., California Urban Water Agencies with assistance from WaterReuse Association of California, September 1988, p. 5-15. Also personal conversation with Ken Thompson for IRWD case study, presentation to XVIII WaterReuse Symposium titled, “Redwood City’s Water Supply Challenge” by Craig Lichty and Valerie Young, September 8, 2003.

³² Personal conversation with Ken Thompson for IRWD case study.

Table 3.5
INDUSTRIAL PROCESS WATER QUALITY REQUIREMENTS*

Parameter	Mechanical Pumping	Chemical, Unbleached	Pulp and Paper, Bleached	Chemical	Petrochemical and Coal	Textile Products		Cement
						Sizing Suspension	Scouring, Bleaching, Drying	
Al								
Cu						0.05	0.01	
Fe	0.3	1	0.14	0.1	1	0.3	0.1	2.5
Mn	0.1	0.5	0.05	0.1		0.05	0.01	0.5
Zn								
Ca		20	20	68	75			
Mg		12	12	19	30			
Cl	1000	20	200	500	300			250
NH ₄								
HCO ₃				128				
NO ₃				5				
SO ₄				100				
SiO ₂		50	50	50				
Hardness		100	100	250	350	25	25	
Alkalinity				125				400
TDS				1000	1000	100	10	600
TSS		10	10	5	10	5	5	500
COD								
Color	30	30	10	20		5	5	
pH	6 - 10	6 - 10	6 - 10	6.2 - 8.3	6 - 9			6.5 - 8.5
CCE								1

* All values in mg/l except color and pH

Source: Urban Water Recycling Feasibility Assessment Guidebook, California Urban Water Agencies, Bookman-Edmonston Engineering Inc., Table 2.7

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TABLE 3.6

POTENTIAL OBSTACLES TO USING RECYCLED WATER BY USE TYPE

(Reproduced Table 3.13 from IEMT TM No. 2, from brainstorming session for the Initiative's TM No. 2: Water Quality Analysis, January 2003)

USE TYPE	SPECIFIC USE	ASSOCIATED PROBLEMS DUE TO CONSTITUENTS ADDED DURING RECYCLED WATER USE	SOLUTIONS/TREATMENT OPTIONS
AGRICULTURAL IRRIGATION	Crop Irrigation	Permeability of soil may decrease due to carbonates and bicarbonates	Provide treatment to remove carbonates and bicarbonates.
		Canning of crops can be affected due to presence of constituents as well as due to concerns about human consumption	Provide treatment to address constituents of concern and provide human health protection.
		Lower yields and non-productivity can be induced by accumulation of ions such as boron, chloride, and sodium	Provide advanced softening treatment (e.g., high-pressure membrane) in wastewater treatment systems or add soil conditioners and occasionally leach soil to remove excessive minerals. Conduct upstream controls to reduce salinity in wastewater prior to treatment.
		Sensitivity of some crops such as flowers to nutrients	Provide biological nutrient removal processes (e.g., improved nitrification/ denitrification and phosphorus removal) in wastewater treatment.
		Biological damage may be caused by heavy metals such as cadmium, lead and mercury	Provide advanced treatment (e.g., ultrafiltration or reverse osmosis membrane or adsorption processes) in wastewater treatment systems.
		Clogging of irrigation heads may occur	Install pre-filters at user's site.
		Groundwater quality may be impacted as well as undesirable vegetation growth and inferior fruit quality may occur due to high nitrogen/ nitrate contents	Biological nutrient removal processes (e.g., improved nitrification/ denitrification) in wastewater treatment.
GROUNDWATER	Recharge/ Infiltration	Public perception concerns regarding the effect of recycled water on groundwater basin water quality	Develop public outreach program to address concerns.
MISCELLANEOUS	Fire Prevention	Periodic seasonal or diurnal shortage may result from inadequate storage or wastewater supply	Provide adequate storage to meet peak demands and seasonal variations in supply.
		Fire trucks may not allow reclaimed water in their pump trucks	Supply fire flow pumping system within facility or supply capability to chlorinate water for fire equipment.

TABLE 3.6

POTENTIAL OBSTACLES TO USING RECYCLED WATER BY USE TYPE

USE TYPE	SPECIFIC USE	ASSOCIATED PROBLEMS DUE TO CONSTITUENTS ADDED DURING RECYCLED WATER USE	SOLUTIONS/ TREATMENT OPTIONS
URBAN IRRIGATION	Landscape/ Golf Course Irrigation	Spots of ferric chlorosis may be caused by low iron content	Recommend foliar applications of iron sulfate or iron chelates.
		Permeability of soil may decrease due to salinity	Provide advanced softening treatment (e.g., high-pressure membrane) in wastewater treatment systems or add soil conditioners and occasionally leach soil to remove accumulated minerals.
		Unacceptable odors may occur during irrigation	Provide treatment to reduce potential for hydrogen sulfide and maintain chlorine levels below nuisance level. Conduct upstream salinity controls to reduce salinity in wastewater prior to treatment.
		Fungal infections may occur in fall resulting from excessive nitrogen contributions during summer irrigation	Provide fungicide application to prevent or eliminate infections.
	Water Features/ Fountains	Odor and other nuisances may result from constituents. Excessive algae may result from excessive nutrients	Provide adequate design and operation of system to prevent nutrient buildup (i.e. additional of chemicals).
	Surface Water Augmentation	Algal blooms/eutrophication may result from excess nutrient levels	Provide biological nutrient removal processes (e.g., improved nitrification/ denitrification, and phosphorus removal) in wastewater treatment.
TOILET FLUSHING	Toilet Flushing	Periodic seasonal or diurnal shortage may result from inadequate storage or supply	Provide adequate storage to meet peak demands and seasonal variations in supply.
	Sanitary Sewer Flushing	Potential risk to human health due to human (workers) contact	Provide required health protection and protective gear (i.e. protective suits and masks). Tertiary treatment may be required for use.
HABITAT	Wetlands	Public perception concerns regarding affect on water quality on wetland	Develop public outreach program to address concerns.
		Odor problems may result from constituents	Provide adequate design and operation of system so that system is aerated and constituents do not buildup (i.e. proper flow rates and detention times in wetland cells).
		Algal blooms/eutrophication may result from excess nutrient levels	Provide adequate design and operation of system to prevent against excess nutrient accumulation (i.e. proper flow rates and detention times in wetland cells).
		Habitat may be adversely affected due to high concentration of heavy metals and synthetic organic compounds	Provide advanced treatment (e.g., ultrafiltration or reverse osmosis membrane or adsorption processes) in wastewater treatment systems. Enhance pretreatment control for commercial/industrial customer wastewater discharges

TABLE 3.6

POTENTIAL OBSTACLES TO USING RECYCLED WATER BY USE TYPE

USE TYPE	SPECIFIC USE	ASSOCIATED PROBLEMS DUE TO CONSTITUENTS ADDED DURING RECYCLED WATER USE	SOLUTIONS/TREATMENT OPTIONS
INDUSTRIAL/ COMMERCIAL	Carpet Dyeing	Dyeing process may be impacted. Other nuisances such as odor may occur	Evaluate water quality requirements. Pilot test batch products and provide additional treatment if required.
	Boiler Feed Water	Excessive scaling or corrosion may occur	Demineralize water prior to use.
	Commercial Car Washing	Excessive spotting may occur on vehicles	Soften wash water and demineralize final rinse water.
	Dust Control	Contamination of tanker trucks	Dedicate and label truck using non-potable water or perform appropriate disinfection practices between switching between domestic and non-potable water use.
	Power Plant Cooling Water/ Evaporative Cooling	Precipitation of minerals in cooling towers may result due to high carbonate content	Provide adequate filtration to remove carbonate.
		Cooling process may be affected by potential ammonia and in rare cases nitrogen sensitivity	Provide improved nitrification/ denitrification in wastewater treatment.
		Excessive corrosion of soft metal may occur due to ammonia	Provide ammonia removal prior to use at site.
		Excessive scaling may occur	Reduce cycles or demineralize water prior to use.
	Chemicals Industry	Undesired constituents to chemical processing	Provide membrane filtration treatment to remove constituents.
	Textile Industry	Dye process may be interfered with by high concentrations of iron and zinc being deposited on the material	Provide treatment to remove iron and zinc.
Dye process may be affected by high concentrations of metals		Provide advanced treatment (e.g., ultrafiltration or reverse osmosis membrane or adsorption processes) in wastewater treatment systems.	
Dye process may be affected by color in water resulting from high concentrations of iron and manganese		Provide treatment to remove iron and manganese.	
Petroleum and Coal Products	Undesired constituents to chemical processing	Provide membrane filtration treatment to remove constituents.	

CASE STUDY: SOUTH FLORIDA MANAGEMENT DISTRICT

Project Description: Water reuse in Florida is recognized as an important component of both wastewater and water resource management. Reuse offers an environmentally sound means for managing wastewater that dramatically reduces environmental impacts associated with discharge of wastewater effluent to surface waters. In addition, use of recycled water provides an alternative water supply for many activities that do not require potable quality water (i.e. irrigation and toilet flushing), that serves to conserve available supplies of potable quality water. Finally, some types of reuse offer the ability to recharge and augment available water supplies with high quality recycled water.¹ In 2001, recycled water from reuse systems was used to irrigate 122,382 residences, 419 golf courses, 405 parks, and 188 schools. Irrigation of these areas accessible to the public represented about 44 percent of the 584 MGD of recycled water reused². As a result of the state supporting recycled water, local agencies such as the Southwest Florida Water Management District (SWFMWD) have been able to maximize water resources and implement recycled water projects. These projects are successful through the use of ordinances, pricing of water, and public outreach efforts.

Project Relevance: Florida and California both face potable water supply scarcity issues. The state of Florida has committed to maximizing the use of recycled water through recognition of finite fresh water resources, and expanding population and future demands. The Water Reuse Work Group Water Conservation Initiative asserts³ that:

- All water is reused.
- Water is a limited resource.
- Water is water (even raw sewage is 99.9 percent water by weight).
- Water is undervalued and under priced.
- The price of water normally does not reflect scarcity.

As a result of this support, as well as public outreach efforts, the SWFMWD has been able to successfully implement a number of recycled water projects including lawn irrigation. In addition, because of its comprehensive recycled water program, the SWFMWD has been able to implement recycled water projects that have public support and understanding. This program has also been successful in explaining to the public the safety and value of recycled water.

Lesson Learned: Through the integration of recycled water projects into the overall water resource and environmental preservation plans targeted for the area, the SWFMWD has been able to successfully implement an extensive recycled water treatment and distribution system. Viewing the natural water systems in the area as an integrated system has enabled the SWFMWD to focus and refine water management methods to maximize limited resources. This approach helps the public to understand that recycled water is another component of the integrated system and assists with gaining acceptance for its use in new ways. In addition, having political and regulatory support for recycled water projects makes them more acceptable to the public from a public health and safety standpoint.

Source:

¹ *Water Reuse for Florida – Strategies for Effective Use of Reclaimed Water*, Reuse Coordinating Committee and the Water Conservation Initiative Water Reuse Work Group, June 2003, p. 4.

² *IBID*, p. 5.

³ *IBID*, p.p. 8-12.

3.3.5.3 Questions

The following questions can help identify and characterize potential recycled water users, and to determine the general magnitude of infrastructure needs based on identified or projected users.

Questions to potential users:

- How much water do you use/need for: [list of applications], of what quality, and on what daily, seasonal, or other cycle? How far ahead can you project these needs?
- How important is a more drought-tolerant supply?
- What possible concerns do you have about using recycled water?

Questions regarding infrastructure needs:

- Will there be enough recycled water to meet the potential projected demand?
- What upgrades will be required at existing WRPs to meet volume, quality, and timing needs? Considerations may include:
 - Larger treatment plant footprint
 - Increased capacity
 - Alterations or new treatment processes
 - Off-line storage facilities
 - Conveyance system upgrades or expansion at the treatment plant
 - O&M procedures
 - Odor control, sludge and brine stream waste handling
 - Community acceptance
 - Technical consultation with industrial and commercial irrigation users
- What infrastructure exists to deliver recycled water to each user? What additional infrastructure will be required?
- What limitations to implementation can be foreseen? Examples may include:
 - Public opposition

- Water rights or right-of-way (property) issues
- Regulatory agency issues (permitting problems)
- No suitable match between specific user needs, and the quantity, quality or timing of the recycled water
- Insufficient or improperly-timed funding for project

3.3.6 Environmental Issues and Approval 6

The purpose of this step is to determine what environmental review process will be required and what approvals and permits (other than those obtained from the DHS and the RWQCB) will be required.

3.3.6.1 Discussion

The lead agency for recycled water projects will need to complete an environmental document under CEQA (California Environmental Quality Act). The document may also need to comply with NEPA (National Environmental Protection Act) if federal permits are required for construction (such as a 404 permit for dredging/filling of wetlands along pipeline routes) or if the project receives Federal funding. The type of CEQA and/or NEPA document and the extent of the analysis will depend upon the range of alternatives and the level of changes that will occur in the community. Projects with minimal construction activities and changes in water supply that will not have significant environmental impacts (such as providing recycled water to an industry) may require a relatively simple initial study. However, projects with more complicated issues will require completion of an environmental impact report. The environmental impact report needs to be responsive to the requirements of all permits because the permitting agencies will use the environmental documentation to determine impacts and consider mitigation requirements. Table 3.7 provides a list of the most common environmental or regulatory agencies and their purviews, which may require consultation during project planning and development.

As with public outreach, determining and involving the correct agencies early in the process is important to timely implementation. The CEQA EIR process provides an opportune forum for working through specific opposition issues to address and allay concerns.

3.3.6.2 Lessons Learned

- The CEQA documentation process can provide a framework for addressing public opposition and providing education.³³ The Redwood Shores Area Recycled Water Project is a prime example of a project whose CEQA documentation was streamlined due to lack of understanding of the potential public concerns regarding the project. However once the public opposition to the project was detected, the proponents were able to address concerns by utilizing the CEQA process. In addition, the city was able to turn public opposition to the project into public involvement in developing solutions to address public concerns.
- Involve non-governmental environmental organizations to gain early support.

3.3.6.3 Questions

A couple of important questions that should be considered when addressing environmental documentation include:

- Does existing treatment plant effluent discharge into a stream, river, wetland, or other receiving water that sustains habitat? If so, will the implemented project(s) alter the quantity or quality of the discharge to the identified habitat?
- What level of CEQA review is required?

3.3.7 Economic and Financial Review (7)

The purpose of this step is to identify possible funding sources for design, construction, and O&M, and to develop internal financing options (e.g., rate structures, taxation options, debt repayment, etc.).

3.3.7.1 Discussion

There are many potential funding sources for the implementation of recycled water projects. Different sources may be required depending on the nature of a project and the project proponent (private versus public, new development versus infrastructure upgrade, public versus private planned customer base, cross-jurisdictional requirements or limitations). Tables 3.8 to 3.11 (at the end of this section) summarize local government

³³ Personal conversation with Valerie Young, and from presentation to XVIII WaterReuse Symposium titled, "Redwood City's Water Supply Challenge" by Craig Lichty and Valerie Young, September 8, 2003.

CASE STUDY: REDWOOD SHORES RECYCLED WATER PROJECT

Project Description: Redwood City, California consumes 1,100 acre-feet per year (afy) more imported water (from San Francisco Hetch Hetchy system) than its contractual allowance of 12,243 afy. The City has determined that water conservation in conjunction with water recycling is the only viable long-term solution to reduce water supply need to the city's Hetch Hetchy allotment. A pilot recycling project, "First Step Project", began operating in August 2000, and provided disinfected tertiary-treated (Title 22) water for irrigation to nearby landscape customers. In addition, two recycled water project feasibility studies were produced in 2001. These studies identified the Redwood Shores community, located near the South Bayside System Authority Treatment Works Plant, as the most reasonable location for implementation of an urban irrigation recycled water system. During the environmental review for the expanded implementation of the pilot project a Negative Declaration, instead of a more detailed Environmental Impact Report was developed because no significant impacts were identified. During the public outreach for the project only two individuals attended sessions, and few public/agency comments were received. Due to the requirements set forth to qualify for SWQCB funding of the project, a mandatory connection ordinance needed to be passed. Because of the ordinance requirement and the minimal feedback received during the public outreach effort, the project was placed on a fast track schedule. When the ordinance came up for review by the city council, public resistance to the project emerged regarding health and safety concerns, and the implementation of the mandatory connection ordinance. In order to allay concerns regarding the project, Redwood City addressed public concerns by creating a community taskforce and technical/legal team, conducting a public hearing, producing a draft CEQA documentation addendum and a response to comments addendum, establishing a 'no mandatory use' policy, and using 'expert advice' for public reassurance.

Project Relevance: This project demonstrates that proposing a generally accepted and common recycled water application, such as landscape irrigation, can still be met with opposition. A community that has not used recycled water, and is unfamiliar with the history and facts surrounding recycled water use, may require a more aggressive public outreach effort. Also, it is important to understand the underlying factors behind what is driving public opposition to a project so that the necessary steps can be taken to address these factors. The taskforce established by Redwood City enables citizens to develop an alternative plan which will be implemented as long as it is feasible from an engineering and financial stand-point to do so.

Lesson Learned: Public involvement in the project planning process is essential. Regardless of the public's interest in a project at the start, it is important for agencies to continue to identify and address community concerns. This is essential to developing public trust in a project, as well as gaining and solidifying support from elected officials for the project. Rebuilding trust, once lost, is a very expensive and time-consuming process.

Project Outcome: The Community Taskforce, set up by Redwood City, presented their alternatives and recommendations to the City Council on March 22, 2004. The Taskforce objective was to identify ways to reduce potable water demand by 2,000 acre-feet per year by 2010 in a financially feasible manner by providing alternatives to using recycled water at schools and playgrounds. The Task Force recommended that a combination of recycled water use, replacement of natural turf with artificial turf at selected schools and parks (sport fields only), continued use of groundwater at specified locations, and additional water conservation programs be implemented. The implementation of these activities would result in total potable water savings of 2,002 afy at minimal additional cost to the City. In addition, the taskforce recommended that other measures, such as additional use of groundwater and conservation measures; a commercial toilet replacement program; potential ordinance to implement additional conservation measures; consideration of low-flow urinals, electric eye faucets, and other conservation devices; potential water swaps with other water conveyers; evaluation of automated landscape irrigation technology and treatment technology, be investigated and potentially implemented.¹

Source:

¹City of Redwood City Recycled Water Taskforce Report, March 3, 2004, http://www.redwoodcity.org/publicworks/water/recycling/press_release_04-3-18.htm, and <http://www.redwoodcity.org/publicworks/water/recycling/index.html>.

TABLE 3.7

ENVIRONMENTAL/REGULATORY AGENCIES WITH INPUT INTO RECYCLED WATER APPLICATION

Agency Name	Regulatory Mission
State Agencies	
California Department of Health Services	Protect and Improve Human Health
California Coastal Commission	Protect, Conserve, Restore, and Enhance Environmental Resources and Access
California Fish and Game	Manage and Protect Fish and Wildlife
State Water Resource Control Board/ Regional Water Quality Control Boards	Preserve, Enhance, and Conserve Quality of Surface Water and Groundwater
Federal Agencies	
US Army Corps of Engineers	Environmental Restoration and Flood Control
US Fish and Wildlife Service	Conserve/Protect/Enhance Fish & Wildlife Habitat Consultation on Special Status Species
U.S. Environmental Protection Agency	Protect Human Health and Natural Environment
National Marine Fisheries Service	Consultation on Special Status Species with Commercial Value

agencies, state, Federal, and non-governmental entities that provide funding. Details of these funding sources are provided in 3.11. A separate TM, the Financial Support Opportunities TM, identifies the sources, criteria, and application process for the listed programs. With so many options, deciding which agency to pursue is difficult. The following key criteria can quickly shorten the list:

- The funding program period must coincide with the project term.
- Some agencies may only fund public projects or proponents.
- The amount of funding available may not make the application process and required effort worthwhile.
- Timing of funds is important when provided by multiple sources.
- Constraints on use of funding by differing sources may also increase the complexity of implementation.

The funding sources for recycled water capital improvements in most cases are similar to those for wastewater and stormwater. Wastewater agencies may consider water recycling projects as an alternative method of reducing wastewater effluent discharges, providing water

for the natural habitat, or decreasing pollutant loading in a receiving water body. Integrated plans which coordinate wastewater, potable water, stormwater, and recycled water systems have somewhat blurred the boundaries between such projects, and therefore may justify a project on more than one front. Ultimately, funding and revenue support generally come from a combination of local, and state, Federal, or other external sources. Common sources cited by water recycling agencies for project funding include state grant and loan programs, re-directed savings from offset infrastructure construction (due to recycled water use), and rate structures.

In addition to financing debt, the primary source of operation, maintenance, and capital funding is user fees from these integrated systems. Table 3.12 summarizes additional funding mechanisms or sources for recycled water, wastewater, and stormwater projects that could be generated from each agency's existing programs.

3.3.7.2 Lessons Learned

- Most jurisdictions reported little difficulty in obtaining funding for recycled water project implementation. Many of the major recycled water projects in California, including the City of San Diego's North City WRP and South Bay WWTP, the WBMWD Recycled Water Project, and the East Valley Water Recycling Projects were all funded under P.L. 102-525 Title XVI administered by the United States Bureau of Reclamation.

3.3.7.3 Questions

Each potential funding agency has an application process and criteria that are explained in the Financial Support Opportunities TM. Many of the answers that must be provided to these agencies for funding eligibility assessment will be produced by following the steps outlined in that TM. Each agency may require the information in a different order, and with emphasis focused in different areas, but the information requirements for funding review are, in general, quite similar. As an example, the SWRCB Office of Water Recycling Water Recycling Funding Guidelines, Appendix C – *Recommended Planning Outline for Water Recycling Projects* is included as Appendix A. Referring to potential funding agency information requirements can help in tailoring what questions are asked of potential users, and how the collected information is catalogued.

TABLE 3.8

POTENTIAL LOCAL GOVERNMENT FUNDING MECHANISMS FOR RECYCLED WATER PROGRAMS

Organization	Program
Metropolitan Water District of Southern California (MWDSC)	<ul style="list-style-type: none"> • City Makeover Program • Community Partnership Program • Innovative Conservation Program • Innovative Supply Program • Local Resources Program
San Diego County Water Authority (SDCWA)	<ul style="list-style-type: none"> • Financial Assistance Program (FAP) • Reclaimed Water Development Fund (RWDF) Program

TABLE 3.9

POTENTIAL STATE GOVERNMENT FUNDING MECHANISMS FOR RECYCLED WATER PROGRAMS

Organization	Program
California State Department of Water Resources, Division of Planning and Local Assistance (DWR-DPLA)	<ul style="list-style-type: none"> • AB 303 – Local Groundwater Assistance Fund Grant Program • Proposition 13 Programs <ul style="list-style-type: none"> - Agricultural Water Conservation Capital Outlay Loan - Groundwater Storage Construction Grant - Groundwater Recharge Construction Loan - Infrastructure Rehabilitation Construction Grant - Infrastructure Rehabilitation Feasibility Study Grant - Local Water Supply Project Construction Program - Urban Water Conservation Capital Outlay Grant • Proposition 50 Programs • Proposition 82 Programs <ul style="list-style-type: none"> - Local Water Supply Project Feasibility Study Loan • Urban Streams Restoration Program
California State Water Resources Control Board (SWRCB)	<ul style="list-style-type: none"> • Nonpoint Source (NPS) Grant: 319 (NonPoint Source) • Proposition 13 Programs <ul style="list-style-type: none"> - Water Recycling Facilities Planning Grant Program - Water Recycling Construction Program (WRCP) • Proposition 40 Programs <ul style="list-style-type: none"> - Clean Beach Initiative (CBI) • Small Community Grants • State Revolving Fund (SRF) Program <ul style="list-style-type: none"> - SRF Loan Program - Water Recycling Projects - SRF Program – Nonpoint Source Loan • Water Recycling Construction Program • Wastewater Recycling Loan Program
California Trade and Commerce Agency	<ul style="list-style-type: none"> • Rural Economic Development Infrastructure Program (REDIP)

TABLE 3.10

POTENTIAL FEDERAL FUNDING MECHANISMS FOR RECYCLED WATER PROGRAMS

Organization	Program(s)
U.S. Army Corps of Engineers (USACE)	<ul style="list-style-type: none"> • Section 206 Aquatic Ecosystem Restoration • Section 503 Watershed Management, Restoration, and Development (Order 96-Water) • Section 1135 Project Modifications for the Improvement of the Environment • Water Resources Development Act (WRDA), Section 219-“Environmental Infrastructure”
U.S. Bureau of Reclamation	<ul style="list-style-type: none"> • P.L. 102-575 Title XVI - Reclamation Wastewater and Groundwater Study and Facilities Act
U.S. Department of Agriculture (USDA) – Rural Development (formerly the Farmers Home Administration) and Natural Resources Conservation Service	<ul style="list-style-type: none"> • Water and Wastewater Disposal Loans and Grants Program
Department of Commerce, Economic Development Administration	<ul style="list-style-type: none"> • Economic Development Administration (EDA) Fund • Grants for Public Works and Economic Development
U.S. Department of Energy	<ul style="list-style-type: none"> • National Industrial Competitiveness through Energy, Environment, and Economics (NICE3)
U.S. Department of Housing and Urban Development (HUD)	<ul style="list-style-type: none"> • Community Development Block Grant (CDBG) Program • HUD Grant for Construction of Wastewater Treatment Facilities • Super Notice of Funding Availability (SuperNOFA)
U.S. Department of Transportation (DOT)	<ul style="list-style-type: none"> • Metropolitan Transportation Improvement Program - Transportation Equity Act for the 21st Century (TEA-21)
U.S. Environmental Protection Agency (USEPA)	<ul style="list-style-type: none"> • Brownfields Economic Redevelopment Initiative • Clean Lake Grants Program • Clean Water Act (CWA) Section 104(b)(3)- Wetlands Program Development Grant • Clean Water State Revolving Fund • Drinking Water State Revolving Fund • Environmental Education Grants Program • National Estuary Program (NEP) • Nonpoint Source Water Pollution Control • Pollution Prevention Incentives for States (PPIS) • State and Tribal Assistance Grants (STAG) • State and Tribal Enforcement Grant Program • Water Quality Cooperative Agreements under Clean Water Act 104(b)(3) • Watershed Assistance Grant (WAG)

TABLE 3.11

POTENTIAL NON-GOVERNMENTAL FUNDING MECHANISMS FOR RECYCLED WASTEWATER PROGRAMS

Organization	Program(s)
California Municipal Utilities Association (CMUA)	<ul style="list-style-type: none"> Financing Authority for Resource Efficiency of California (FARECal)
California Special Districts Association (CSDA)	<ul style="list-style-type: none"> CSDA Finance Corporation's Program
League of California Cities	<ul style="list-style-type: none"> California Statewide Communities Development Authority (CSCDA)
WaterReuse Foundation	<ul style="list-style-type: none"> Research Contracts

3.3.8 Project Outline Submission to DHS and RWQCB 8

The purpose of this step is to present an outline of the proposed project to the two state agencies most involved in the approval and permitting of a recycled water project to obtain a conceptual review and guidance on formal regulatory review submission requirements.

3.3.8.1 Discussion

Since each recycled water project may have different informational, permitting, and environmental requirements, the DHS recommends³⁴ that a brief conceptual project overview be submitted for review and discussion prior to in-depth planning. This is particularly true if the project is related to indirect potable use, as the formal submission requirements are substantially greater for this type of project. From the submission, the DHS and RWQCB can recommend the level of detail required for the submission, as well as comment on the permit types required.

There is no specific format for this informal submission. Because each applicant will have unique circumstances, it is best to contact DHS and the RWQCB for guidance on format and content. The idea here is present the general plan before significant effort is invested in detailed planning.

³⁴ Personal communication with Jeff Stone, Recycled Water Program Coordinator, DHS, August 12, 2003

TABLE 3.12
ADDITIONAL POTENTIAL FUNDING MECHANISMS

Recycled Water

Reclaimed Water Fees

Inter Agency Transfers and Agreements

Wastewater

Sewer Service Charges

Revenue Bond Long Term Debt

Sewerage Contracts – Capital and O&M

Industrial Waste Quality Surcharge

Interest Income – Construction and Maintenance Fund & Bond

Disaster Cost Reimbursement

Grant Reimbursement

Direct Federal Appropriations

Water and Wastewater Facility Peak Load Reduction and Energy Efficiency Program

Water and Wastewater Generation Retrofit Program

Direct State Appropriations

Privatization

Special Reserves

Special Assessments

Pay-as-you-go

Stormwater

Stormwater Utility Fees

Grant Reimbursement

Interest Income

System Development Charges

Impact Fees

Special Purpose Local Option Sales Tax

A 1996 Memorandum of Agreement (MOA) between DHS and the SWRCB defines the roles of DHS and the nine regional water quality control boards, and is:

“...intended to assure that the respective authority of the Department, the SWRCB, and the RWQCBs relative to use of reclaimed water will be exercised in a coordinated and cohesive manner designed to eliminate overlap of activities, duplication of effort, gaps in regulation, and inconsistency of action. To that end, this establishes basic principles relative to activities of the agencies hereto and the RWQCBs, clarifies primary areas of responsibility and authority between these agencies, and provides for methods and mechanisms necessary to assure ongoing, continuous future coordination of activities relative to use of reclaimed water in this State.³⁵”

Even with this memorandum, interpretation of requirements and circumstances can and does differ across different state DHS and regional board offices. This underscores the importance of a preliminary review by both agencies.

3.3.8.2 Lessons Learned

- Expect iterative review of documents with regulators.³⁶
- DHS will provide recommendations to the RWQCB, which will issue approvals and permits.³⁷ For example, the IEUA was able to supply 3,000 afy of recycled water to the Reliant Energy Etiwanda Power Plant for cooling tower blowdown water and a fire protection system. Working proactively with regulators, the IEUA was able to incorporate design elements into the project to address concerns and gain approval from DHS and the RWQCB. This proactive approach was also useful when dealing with the local fire department to gain their support, cooperation, and approval for using recycled water in the fire protection system.

3.3.8.3 Questions

DHS is willing to assist proponents of recycled water projects in the development of formal proposals. The local DHS and RWQCB offices should be contacted early on in the planning stages. The more information that a project sponsor has available to provide to the local DHS and RWQCB at an early stage, the smoother the process with the regulatory agencies may proceed. The DHS will need to know the type of project proposed, the level of treatment to be

³⁵ Memorandum of Agreement Between the Department of Health Services and the State Water Resources Control Board On Use of Reclaimed Water, 1996, Appendix B of *Water Recycling 2030 Recommendations of California's Recycled Water Task Force*, Department of Water Resources.

³⁶ Personal conversations with Rich Mills, SWRCB, and Jeff Stone, California Department of Health Services.

³⁷ IBID.

provided, planned alterations to existing plant discharge, what receiving bodies are affected, and what type of permits are currently in place.

3.3.9 Regulatory Review and Approvals 9

The purpose of this step is to determine what specific environmental, health, and other reviews and permits will be required for the successful implementation of a proposed recycled water project. This is facilitated through the informal review described in Step 8 above.

3.3.9.1 Discussion

The water recycling regulatory environment was experiencing important changes at the time of development of this TM. Among these ongoing changes to the regulatory environment are the recommendations from the Water Recycling 2030 and the draft revised Title 22 regulations. The June 2003 report (Water Recycling 2030) contains approximately 70 recommendations, which affect every party in the implementation process. The revised draft Title 22 regulations formalize additional detailed documentation and planning requirements for recycled water projects, particularly for indirect-potable projects. In addition to these regulatory changes, inter-agency streamlining of the application and review process (the MOA between the SWRCB and RWQCBs) is a very positive step, and is making the application process with the two agencies less complex, although some regional confusion may still occur. This should diminish over time as regional representatives become more familiar with (and apply) the streamlined processes.

The shifting regulatory framework surrounding recycled water use presents a particular challenge, as recycled water use planning is increasingly tied to other long-term planning efforts (water supply and other aspects of integrated resource planning). Planning efforts are also more difficult for wastewater treatment agencies that must now consider stormwater management.

3.3.9.2 Recycled Water Hydrodynamic Cycle: Applicable Regulations

Regulations impact a number of locations within the recycled water hydrodynamic system where water is treated for use, treated before discharge to surface waters, or recycled. Figure 2.1 provides a schematic of the recycled water hydrodynamic cycle in southern California. This figure will be used to delineate where regulatory requirements are imposed on recycled water.

From the originating water source of the system, whether it is a river (A1), reservoir (A2), groundwater basin (A3), or some combination of the sources, each time water is used or treatment occurs, there is a potential need for regulatory compliance. Recycled water utilized for agricultural irrigation (E) must meet non-disinfected secondary standard treatment requirements. However, crops where recycled water comes in direct contact with the edible portion of the crop must be supplied with disinfected tertiary treated recycled water.

Once water is used and treated for reuse at a WWTP (I) or WRP (K) it can be supplied to users. Water utilized in some applications, which have limited human contact such as fodder irrigation, can be supplied water that has undergone only secondary treatment. However, if the water undergoes tertiary or advanced treatment at a WRP (K), it can be supplied to a wider group of users including agricultural users (E), urban irrigation (F), municipal users (G), or industrial users (G), habitat for beneficial use (D), or be blended with raw or potable water for groundwater recharge (A3). Water utilized for urban irrigation (F), municipal uses (G), or industrial uses (G) may undergo further treatment (C) to produce water that is specifically suited for the intended use. In addition, water utilized for municipal (G) or industrial purposes (G) may undergo a post-use treatment process (H) to meet discharge requirements or basin plan objectives for TDS or other constituents before the water is discharged to surface waters (L or N). Water utilized for beneficial use of habitat (D) will return flow into surface waters (L or N); therefore, water discharge to habitat must meet regulatory requirements or the habitat must be utilized to assist in meeting the water quality objectives, such as the use of a treatment wetland to remove constituents from the water.

Water that is recharged into a groundwater basin (A3) may intermingle through seepage with surface water and/or the ocean (L or N) so it is important that the water recharged into the

basin conform to TDS and other water quality objectives set by the prevailing RWQCB. In addition, groundwater can be pumped and treated (A3), after a sufficient detention time, which is determined at the basin through hydrogeologic studies and approval from the RWQCB and DHS. This water can be used as a raw water source that is supplied to end users (F). All locations along the hydrodynamic system (B, C, H, I, K, and M) where water is treated to remove constituents must conform to RWQCB and DHS standards, criteria, and regulations to protect human health and the environment. In addition, these treatment locations may produce concentrated brine. This brine residual may be disposed of by either landfilling of the material or discharging it via a brineline to the ocean, inland waters, or through deep well injection (N). Both of these disposal mechanisms are regulated by the State of California and involve complying with DHS and RWQCB requirements. All locations along the hydrodynamic system (D, E, F, G, H, I, J, K, and M) where water is either discharged to groundwater (A3), surface water (L), or the ocean (N) must also comply with DHS, SWQCB, or prevailing RWQCB requirements (e.g., Basin and Ocean Plan Objectives). The following sections will outline the regulatory requirements that affect recycled water on a local, state, and Federal level.

3.3.9.3 Types of Regulations

There are three primary types of water reuse regulations in California. They are policies that regulate water reuse, water quality regulations, and public health regulations. The first type of regulation falls primarily under state and local jurisdiction while the remaining two types are under Federal in addition to the local and state jurisdiction.

3.3.9.4 Policies that Encourage Water Reuse

The use of recycled water in southern California is vital to the state's ability to maintain water supply for existing and projected populations as the amount of water available from the State Water Project and Colorado River is reduced. These imported water reductions are necessary

to meet requirements set down in CALFED and the 1922 Colorado River Compact³⁸ Agreement, Article 3.

Due to the importance of recycled water as a supply source, the state has instituted a number of policies to encourage the use of recycled water as a means to provide conservation of fresh waters. Table 3.13 provides a description of the policies that encourage water reuse in California. These guidelines were developed in response to water scarcity and growth issues facing California. One of these policies is the *Reasonable Use Doctrine*³⁹, which prohibits the waste of water and encourages the use of recycled water where possible for greenbelt irrigation. In addition the State of California established the 2002 DWR Recycled Water Task Force, which is another example of the State’s continued encouragement and commitment to implementing recycled water projects as well as planing for the State’s future water supply needs.

The WateReuse Association has also produced a recycled water ordinance template, which summarizes existing California legislation supporting recycled water use. These legislative sections and ordinance template are included as Appendix B. The following paragraph is extracted from the WateReuse Association’s web site, and is the pre-amble to the contents of Appendix B:

The intent of the model water recycling ordinance is to maximize resource conservation and streamline implementation of water recycling projects in conformance with recent changes in state law. The ordinance, which mandates the use of recycled water, is a generic model to be tailored by public agencies to conform with their rules and regulations. It is based in part on California Water Code sections 1009 and 13550-13556 and Government Code sections 65601-65605 which authorize water public agencies to require the installation of separate systems for use of recycled water on private property and state that the continued use of potable water for greenbelt irrigation and certain other non-potable water uses is an unreasonable use of water if recycled water is available and usable for such purposes.⁴⁰

³⁸The Colorado River Compact apportioned annual flows from the Colorado River between the “States of the Upper Division,” (Colorado, New Mexico, Utah, and Wyoming), and the “States of the Lower Division,” (Arizona, California, and Nevada). The Compact was signed by representatives of the seven states in Santa Fe, New Mexico, on November 24, 1922.

³⁹ California Water Code Division 1 Chapter 6, Article 2, Section 461; also Porter-Cologne Water Quality Control Act (California Water Code, Division 7), Chapter 7, Article 2, Sections 13510, 13511, 13512, and Article 7, Section 13550;

⁴⁰ WateReuse Association web site: www.watereuse.org

3.3.9.5 Water Quality Regulations

In addition to the policies that regulate water reuse, the State of California is also involved in ensuring that the recycled water produced meets water quality objectives to protect human health and also inhibits habitat and riverine degradation. Table 3.14 provides a list of water quality regulations that govern the production and use of recycled water. Included in this list are the USEPA *Antidegradation Policy* and the California *Antidegradation Policy*.⁴¹ The California *Antidegradation Policy* establishes a standard that “no degradation of water quality should occur unless an important social or economic need exists that is in the best interest of the State.” The California *Antidegradation Policy* was the main driver behind the development of RWQCB Ocean Plan, Bays and Estuaries Plan, Inland Surface Water Plans and Basin Plans (Water Quality Plans).

An important feature of the Water Quality Plans is the beneficial use designations, which provide a mechanism for the RWQCBs to set numerical limits for water quality objectives. There are twenty-four beneficial use designations that have been defined by the SWQCB. These designations are listed in Table 3.15. The most common use designations in southern California are municipal and domestic supply (MUN), industrial service supply (IND), groundwater recharge (GWR), contact water recreation (REC-1), and non-contact water recreation (REC-2).

3.3.9.6 Public Health Regulations

Public health regulations also govern the use of recycled water in California. Title 22 of the California Health and Safety Code of Regulations establishes the criteria for water quality standards and treatment reliability related to use of recycled water. These criteria were developed and are regulated by DHS. Table 3.16 provides a list of applicable public health regulations including guidelines for the level of treatment required for each type of recycled water use. There are four levels of treatment common to recycled water, which are set based on the associated water use. They are:

⁴¹ 40 CFR 131.12

Table 3.13
Policies that Encourage Use of Recycled Water

Government Level	Regulation	Description
Federal	Clean Water Act Policy	The Policy encourages water reclamation through continuing support of information and education programs which utilize innovative water treatment and reuse technology. The Clean Water Act Policy also provides for research grants that support the development of methods for reclaiming and reusing water.
	U.S. Bureau of Reclamation Water Reuse Policy	Places a high priority on water reclamation in the western states. Authorizes the Secretary of the Interior, through the Reclamation Projects Authorization and Adjustment Act of 1992, to undertake measures which stimulate demand for and eliminate obstacles to the use of reclaimed water. The Act also appropriates funds as necessary to carry out these measures.
State	California Water Code Water Recycling Act of 1991	Set goals for the beneficial reuse of water: 700,000 acre-ft of water per year by the year 2000 and 1,000,000 acre-ft of water per year by the year 2010. In order to achieve this goal, this Act requires retail water suppliers to identify potential uses for reclaimed water within their service areas, potential customers for reclaimed water service within their service areas, and within reasonable time, potential sources of reclaimed water.
	California Department of Water Resources 2002 Recycled Water Task Force	The 2002 Recycled Water Task Force was established by Assembly Bill 331(Goldberg), passed by the Legislature and approved by Governor Davis on October 7, 2001 (Water Code Section 13578). The Task Force is a cooperative effort of the California Department of Water Resources, the State Water Resources Control Board, and the Department of Health Services. The Task Force is charged with evaluating the current framework of State and local rules, regulations, ordinances, and permits to identify the opportunities, obstacles or disincentives to maximizing the safe use of recycled water. The recommendations of the Task Force must be reported to the Legislature by DWR before July 1, 2003.
	State Water Board Water Reclamation Policy	This policy commits both the State and Regional Water Boards to support reclamation and to undertake all possible steps to encourage development of water reclamation facilities. This policy also requires the Regional Water Board to conduct reclamation surveys and specifies actions to be implemented by the State and Regional Water Boards and other agencies. Guidelines exist for the State and Regional Water Boards' efforts in encouraging the development of reclaimed water.
	California Public Utilities Code Service Duplication Law	The law states that when a water supplier extends its facilities into the service area of another with the same type of service, this act constitutes a taking of property from the utility for a public purpose and must be compensated. The compensation must be mutually agreed upon and fixed in a court of law. This law applies to all reclaimed water utilities except those located in Los Angeles County who supply recycled water to their own recycled water and landfill facilities.
	California Water Code Urban Water Management Act	This act facilitates that the planning for reclamation facilities needed to meet the State goals for beneficial reuse of water would be undertaken by local agencies by requiring urban water agencies serving in excess of 3,000 customers or more than 3,000 acre-ft per year for municipal and industrial purposes to prepare the Urban Water Management Plan (UWMP). The UWMP includes a description of water reclamation and reuse activities in the provider's service areas. It also requires that purveyors, who exceed the minimum level of service and project a need for expanded or additional water supplies, prepare a plan which includes information on reclaimed water and its potential for use as a water source in the service area of the urban water supplier.
	California State Constitution Reasonable Use Doctrine	The "rule of reasonable use" applies a uniform prohibition on the waste of water by requiring that all rights to water be limited to that which is required for the specific beneficial use. An extension of this policy is the water reuse mandate. This mandate was enacted by the Legislature to encourage the use of recycled water by prohibiting use of potable water for specific purposes. The mandate requires the use of recycled water where it is available for landscape irrigation of greenbelts.

- Undisinfected secondary treatment
- Disinfected “23 standard” secondary treatment
- Disinfected “2.2 standard” secondary treatment
- Tertiary treatment

These levels of required treatment were incorporated as revisions to the *Title 22* standards in 2000. This update made the use of primary effluent unacceptable even for previously acceptable uses such as irrigation of fodder, fiber, and seed crops. The updated regulations require this type of irrigation to be supplied with at least undisinfected secondary treated effluent. The new secondary standards are based on the amount and type of possible human contact with the effluent or use area requirements. Uses with a lower potential for incidental human contact require less stringent treatment before reuse than uses with potential human contact.

The development of dual plumbing systems is another important mechanism used in California to increase the allocation of recycled water. The most important component of the California Health and Safety Code of Regulations dealing with dual plumbing systems is the protection against cross connection between the potable and recycled water systems. The cross connection control guidelines, established in *Title 17*, were developed to ensure that recycled water lines are clearly marked and easily identifiable (typically by utilizing purple pipe) as well as to ensure that recycled water does not enter the potable water system. DHS has released a draft of the proposed changes to *Title 17* for preliminary comments. This proposal shifts the cross connection control requirements from *Title 17* to *Title 22*, Chapter 19. In addition, the proposed draft reorganizes the wording and sections of the requirements and places a greater emphasis on hazard assessment and backflow prevention.

In addition to the changes in the cross connection control guidelines, the Los Angeles Chapter of the WaterReuse Association is developing an operations manual for recycled water. This manual will provide information and operator training for recycled water users in order to prevent the occurrence of incidents including cross connection of lines as well as unsafe use of recycled water.

3.3.9.7 Lessons Learned⁴²

- Changes in treatment plant discharge or use of effluent will likely trigger required changes to, or new, discharge permits from the RWQCB.
- RWQCB generally does not require an independent report submission, but prefers to receive and incorporate recommendations from DHS before issuing permits. DHS does not approve or issue permits but advises the RWQCBs on permits.
- Other permits or approvals (typically a building permit) may be required from environmental agencies and should be investigated early in the project development process.
- A CEQA review will be required for any project. The level of detail and the type of CEQA document will be dependent upon the level of disturbance during construction and operation, the potential for significant environmental impacts, and the need to evaluate a wide range of alternatives.

3.3.9.8 Questions

Because of the direct linkage between regulatory requirements and ultimate recycled water use, the DHS and RWQCB should be consulted early on in the planning stage (Step 8 above) to determine what regulations will apply and what type of permits may be required. The Title 22 Report and other DHS and RWQCB requirements will likely be unique to each project.

3.3.10 Project Design and DHS 'Title 22' Report 10

The purpose of this step is to complete the engineering design and to finalize the implementation details to the satisfaction of DHS and other permitting/approving agencies.

3.3.10.1 Discussion

The effort required to complete the Title 22 engineering report required by the DHS will depend greatly on the type of project proposed and the ultimate use of the recycled water. The DHS will coordinate and confer with the RWQCB, which ultimately issues the required permits, and which may have additional requirements.

⁴² All "Lessons Learned" from personal conversations with Rich Mills, SWRCB, and Jeff Stone, DHS.

CASE STUDY: PADRE DAM- SANTEE LAKES

Project Description: The Santee County Water District (SCWD), which was formed in 1958 and now is part of the Padre Dam MWD, completed a 0.5 mgd pilot water recycling plant in 1959. The tertiary-treated effluent from the plant was chlorinated and discharged into one of five lakes, which were constructed to study the effects of treated effluent in a public contact setting. The pilot study ended in 1962, with a total of seven interconnected lakes with a combined surface area of approximately 65 acres. The lakes were used for boating, fishing, and in some areas, provide for swimming and wildlife habitat. Discharge from the farthest downstream lake was chlorinated and used for golf course and tree farm irrigation. Excess discharge flowed into the San Diego River via Sycamore Creek. The lakes and adjacent green belts, which are used for hiking, biking and picnicking, are very popular and have attracted national and international attention. Construction of the pilot plant, and the subsequent expansion to 1.0 mgd capacity, were funded by federal grants.

In 1968, a new 4.0 mgd activated sludge plant began discharging effluent from secondary clarifiers through oxidation ponds into percolation basins. After percolating 400 feet down through the soil, the effluent was collected, chlorinated, and discharged into Santee Lakes. Due to an elevated water table and vector control issues resulting from the increased discharge from the lakes, the RWQCB mandated in 1974 that SCWD reduce the amount of effluent discharged into the San Diego River. By the end of 1975 the SCWD had arranged to discharge effluent in excess of 1 mgd (the amount required for sustaining Santee Lakes) to the existing Metro sanitary system for treatment at the Point Loma Wastewater Treatment Plant. In 1976, the Padre Dam Municipal Water District was formed through the merger of the SCWD and the Rio San Diego Municipal Water District. In 1977, the original 4 mgd-capacity activated sludge plant was upgraded to an advanced biological nutrient-removal system, which had a resulting capacity of 2 mgd. The plant then provided 1 mgd of recycled water through a new distribution system to customers, while still delivering 1 mgd to Santee Lakes. Today PDMWD serves 166 metered services in addition to Santee Lakes. Recycled water is currently provided to customers at a rate that is 85 percent of the cost of potable water. The infrastructure costs are primarily funded by State loans and Federal grants. Operations and maintenance is funded by recycled water revenues and wastewater cost offsets. PDMWD anticipates that future NPDES permit requirements will decrease the concentrations of nitrogen and phosphorous that PDMWD can discharge into the San Diego River through Santee Lakes.

Project Relevance: This project demonstrates the degree of success obtainable, even for potential contact water recreation beneficial use projects. While evolving water quality standards may require future changes in how the Santee Lakes Recreation Preserve is managed, recycled water is accepted by the public while providing the Padre Dam MWD with an economical solution to its discharge and water supply issues.

Lesson Learned: Working with regulators in the planning and design phase can lengthen a project's viable life span. Although today's regulators most likely would not approve this project due to recent changes in the regulatory climate, it was considered state of the art when the project was implemented in the 1960's. In addition, even with a long project history of no adverse health affects, continued acceptance and operation of this facility could be in jeopardy due to the changing regulatory climate. This project illustrates how important it is to continue to work with regulators and the public to educate them so that recycled water projects that have a reliable history are not discarded due to changes in regulatory perspective. In addition, this project illustrates that the success of a recycled water project is often "... more of a PR (public relation) effort than an engineering effort." (Bailey, 2003)

Sources:

Bailey, Harold, Padre Dam Municipal Water District. November 2003. Personal communication.
Jamieson, Jon R., *Raw Sewage to Reclaimed Water – A History of the Sewerage Systems in the Metropolitan San Diego-Tijuana Region*, Nimbus Press, Chula Vista CA, 2002, pp. 66-168
Padre Dam Municipal Water District website: www.padredam.org

Modifications to an existing project (e.g., adding another user under an existing master permit) may require a very limited Title 22 report. Conversely, new projects, which will be considered as indirect potable supplies, will require more detailed reports. For complex or new projects, design must proceed in step with the creation of the report, because of the level of detail that is required by the report. For example, all technologies used in the treatment process stream must be on the DHS ‘approved’ list. Technologies, processes, or devices that are not on the list can be assessed for approval by the DHS, but the proponent must specify how the effectiveness and safety of the technology, process, or device will be demonstrated, and must cover the cost of researching and presenting this evidence. Because the approval list is manufacturer-specific, design to at least that level of detail is necessary. The list of approved technologies is included in Appendix C.

Guidelines for writing the Title 22 engineering report are provided by DHS, and are included in Appendix D. The guidelines state:

“The report should contain sufficient information to assure the regulatory agencies that the degree and reliability of treatment is commensurate with the requirements for the proposed use, and that the distribution and use of the recycled water will not create a health hazard or nuisance.

The intent of these guidelines is to provide a framework to assist in developing a comprehensive report, which addresses all necessary elements of a proposed or modified project. Such a report is necessary to allow for the required regulatory review and approval of a recycled water project.”⁴³

In general, the guidelines require the report to address the following (refer to the guidelines in Appendix D for complete details):

- Individual entities involved in the design, construction, and operation of the facilities, and legal arrangements outlining roles and responsibilities if there are multiple entities proposing the project.
- Rules and regulations that will be enforced for design, construction, O&M, distribution, and use, including compliance program details.
- Descriptions of roles and responsibilities for water producers, distributors, and users.

⁴³ Guidelines for the Preparation of an Engineering Report for the Production, Distribution and Use of Recycled Water, California Department of Health Services, March 2001, pp. 1-2.

Table 3.14
Water Quality Regulations Governing Recycled Water Use

Governing Body	Regulation	Description
Federal	Water Pollution Control Act (Clean Water Act)	A NPDES permit is required for all reclaimed water discharges to surface waters. A single NPDES permit meets requirements for both state and federal law. (NPDES discharge permits are administered by the state Water Resources Control Boards through (in California) the 9 Regional Water Quality Control Boards).
	U.S. Environmental Protection Agency Antidegradation Policies	This policy requires that deviations from established standards be justified as necessary to accommodate important social and economic development. Mandates State policy to be consistent with three principles: 1) Existing instream water uses, and water quality to protect those uses, be maintained. 2) Where the quality of water exceeds that necessary to support existing uses, a lowering of quality be allowed only to accommodate important social and economic development, but cannot be lowered below that needed to support existing uses. 3) Where high quality waters constitute an outstanding national resource (ONR), such as waters of national and state parks and wildlife refuges and water of exceptional or ecological significance, no lowering of quality be allowed.
State	California State Water Resources Control Board Antidegradation Policies	Establishes a general principle of nondegradation, with flexibility to allow some changes in water quality which is in the best interests of the state. are allowed only where it is in the public interest and beneficial uses are not unreasonably affected. Incorporates the three principles set forth in the Federal Antidegradation Policy.
	Porter-Cologne Water Quality Control Act	Defines "reclaimed" or "recycled" water as water which, as a result of treatment of waste, is suitable for a direct beneficial use or controlled use that would otherwise not occur and is therefore considered a valuable resource. This act establishes the State Water Board and the Regional Water Boards as the principal state agencies responsible for water reclamation. This act empowers the Regional Water Boards to formulate and adopt a Water Quality Control Plan (Basin Plan) which designates beneficial uses and establishes water quality objectives which will ensure reasonable protection of beneficial uses and the prevention of nuisances.
	California State Water Resources Control Board California Inland Surface Water Plan	This Plan is used as a guideline by the Regional Water Board and California Department of Fish and Game in accessing potential impacts of discharges to surface waters. The plan also promulgates numerical water quality objectives for inland surface waters to protect freshwater aquatic life and human health. USEPA <i>Region IX's Effluent Dominated Streams and Water Reclamation Policy</i> provides guidance on how to comply with the use-attainability provisions of the federal regulations when developing water quality standards for ephemeral streams and how to demonstrate the benefits of water reclamation use.
	California State Water Resources Control Board California Ocean Plan	This plan sets forth the water quality requirements that are necessary to "ensure reasonable protection of beneficial uses and the prevention of nuisance." The standards set forth in the plan are not applicable to inland waters or enclosed bays and estuaries

Table 3.15
Beneficial Use Types from California State Water Quality Control Board

Beneficial Use Type	Description of Beneficial Use Type	Designated Uses within RWQCB Region ¹		
		Los Angeles RWQCB Region	Santa Ana RWQCB Region	San Diego RWQCB Region ²
Municipal and Domestic Supply (MUN)	Includes uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.	X	X	X
Agricultural Supply (AGR)	Includes uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.	X	X	X
Industrial Process Supply (PROC)	Includes uses of water for industrial activities that depend primarily on water quality.	X	X	X
Industrial Service Supply (IND)	Includes uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well re-pressurization.	X	X	X
Ground Water Recharge (GWR)	Includes uses of water for natural or artificial recharge of ground water for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.	X	X	X
Freshwater Replenishment (FRSH)	Includes uses of water for natural or artificial maintenance of surface water quantity or quality (e.g., salinity).	X		X
Navigation (NAV)	Includes uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.	X	X	X
Hydropower Generation (POW)	Includes uses of water for hydropower generation.	X	X	X
Contact Water Recreation (REC-1)	Includes uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water skiing, skin and SCUBA diving, surfing, white water activities, fishing, or use of natural hot springs.	X	X	X
Non-contact Water Recreation (REC-2)	Includes the uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.	X	X	X
Commercial and Sport Fishing (COMM)	Includes the uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.	X	X	X
Aquaculture (AQUA)	Includes the uses of water for aquaculture or mariculture operations including, but not limited to, propagation, cultivation, maintenance, or harvesting of aquatic plants and animals for human consumption or bait purposes.	X		X
Warm Freshwater Habitat (WARM)	Includes uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish or wildlife, including invertebrates.	X	X	X
Cold Freshwater Habitat (COLD)	Includes uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish or wildlife, including invertebrates.	X	X	X
Inland Saline Water Habitat (SAL)	Includes uses of water that support inland saline water ecosystems including, but not limited to, preservation or enhancement of aquatic saline habitats, vegetation, fish, or wildlife, including invertebrates.			
Estuarine Habitat (EST)	Includes uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds).	X	X	X
Wetland Habitat (WET)	Uses of Water that support wetland ecosystems, including, but not limited to, preservation or enhancement of wetland habitats, vegetation, fish, shellfish, or wildlife, and other unique wetland functions which enhance water quality, such as providing flood and erosion control, stream bank stabilization, and filtration and purification of naturally occurring contaminants.	X	X	
Marine Habitat (MAR)	Includes uses of water that support marine ecosystems including, but not limited to, preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., marine mammals, shorebirds).	X	X	X
Wildlife Habitat (WILD)	Includes uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.	X	X	X
Preservation of Biological Habitats of Special Significance (BIOL)	Includes uses of water that support designated areas or habitats, such as established refuges, parks, sanctuaries, ecological reserves, or Areas of Special Biological Significance (ASBS), where the preservation or enhancement of natural resources requires special protection.	X	X	X
Rare, Threatened, or Endangered Species (RARE)	Includes uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened or endangered.	X	X	X
Migration of Aquatic Organisms (MIGR)	Includes uses of water that support habitats necessary for migration, acclimatization between fresh and salt water, or other temporary activities by aquatic organisms, such as anadromous fish.	X		X
Spawning, Reproduction, and/or Early Development (SPWN)	Includes uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish. This use is applicable only for the protection of anadromous fish.	X	X	X
Shellfish Harvesting (SHELL)	Includes uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g., clams, oysters and mussels) for human consumption, commercial, or sport purposes.	X	X	X

Note:

¹All information regarding the beneficial use designations in each of the region as well as the definitions of beneficial uses are from the RWQCB Basin Plans for the Los Angeles, Santa Ana, and San Diego Regions.

²Wetland Habitat was not a designated use when the San Diego Basin Plan was developed and adopted.

Table 3.16
Public Health Regulations

Governing Body	Regulation	Description
State	California Water Code Water Recycling in Landscape Act	A state mandated local program that requires any local public or private entity that produces reclaimed water and determines that within 10 years it will provide reclaimed water within the boundaries of a city or county agency, to notify the local city or county agency of the fact. The local agency must adopt and enforce a specified reclaimed water ordinance within 180 days of the notification unless the local agency adopted a reclaimed water ordinance or other regulation requiring the use of reclaimed water in its jurisdiction prior to January 2001. The new ordinance developed by the local agency must require that new development plan include infrastructure required to support the use of reclaimed water for the applications included in the reclaimed water purveyor's notification.
State	California Water Code Water Quality Standards and Treatment Reliability Criteria (Title 22) Tertiary Treatment Criteria Secondary Treatment Criteria Disinfected Secondary 2.2 Standard Disinfected Secondary 23 Standard Undisinfected Secondary Standard	This criteria, established by California Department of Health Services, sets water quality standards and treatment reliability for water reclamation operations. The water quality standards are bacteriological standards which are based on the degree of contact the public will have with the reclaimed water. Thus higher levels of public contact require tertiary or advanced treatment while lower levels of public contact require secondary treatment. Tertiary treatment consists of the following steps; secondary treatment, coagulation, clarification, filtration, and disinfection. Tertiary treatment is required for the following use type; food crops where contact with edible portion of the crop occurs, parks and playgrounds, school yards, residential landscaping, unrestricted access golf courses, nonrestricted recreational impounds, industrial cooling and air conditioning, flushing of toilets and urinals, decorative fountains, consolidation of backfill material around potable pipes, structural fire fighting and snow making. In addition, there should be no irrigation of reclaimed water within 50 feet and no impoundment of reclaimed water within 100 feet of any domestic water supply well. There are three acceptable levels of secondary treatment each with its own list of suitable applications, the three levels of treatment are disinfected secondary where the median concentration of total coliform bacteria measured in the disinfected effluent does not exceed 2.2 per 100 mL, disinfected secondary where the median concentration of coliform bacteria measured in the disinfected effluent does not exceed 23 per 100 mL, and undisinfected secondary. Spray and mist control must be provided when utilizing secondary treated reclaimed water and no spray irrigation is permitted within 100 feet of a residence or place of public exposure. Suitable applications for the disinfected secondary 2.2 standard are food crops where food crop is above the ground and does not come in contact with reclaimed water, restricted recreational impoundments and fish hatcheries. In addition, the criteria states that no irrigation or impoundment of reclaimed water should occur within 100 feet of any domestic water supply well. Suitable applications for the disinfected secondary 23 standard are cemeteries, freeway landscaping, restricted access golf courses, ornamental nursery stock and sod farms, pasture for animals, industrial boiler feed, nonstructural fire fighting, backfill consolidation around nonpotable pipes, soil compaction, mixing concrete, dust control, flushing sewers and street cleaning. In addition, the criteria states that no irrigation or impoundment of reclaimed water should occur within 100 feet of any domestic water supply well. Suitable applications for the undisinfected secondary standard are orchards and vineyards when no contact occurs with edible portion of the crop and reclaimed water, crops not grown for human consumption, and processes food crops. In addition, the criteria states that no irrigation or impoundment of reclaimed water should occur within 150 feet of any domestic water supply well.
	California Water Code Cross Connection Control (Title 17)	This code requires all reclaimed water pipes installed after 1993 to be either purple in color or wrapped in purple tape. Facilities that have established markings for reclaimed water systems are exempt from this requirement. The water supplier has the primary responsibility for ensuring against reclaimed water entering the potable water system. Where dual systems exist at a facility the potable water system must be protected with a reduced pressure principle backflow device or a double check valve assembly backflow device. Blending of potable and reclaimed water at a site must be done through an approved air gap separation which must be at least double the diameter of the supply pipe, measured vertically above the top rim of the receiving vessel, and can not be less than one inch.

Table 3.16
Public Health Regulations

Governing Body	Regulation	Description
State	California Department of Health Services California Water Code Dual Plumbing Plan Design and Monitoring Criteria	A Dual Plumbing Plan is required where potable and reclaimed water are delivered to the same facility. The plan consists of a report providing the number, location and type of facilities in use proposing to use dual plumbed systems, average number of persons served by each facility, map showing boundaries of use site and locations of each facility served, dual system responsible party at each facility, specific use of reclaimed water, proposed piping system, type and location of outlets and fixtures available to public, backflow prevention method, and cross connection prevention method. In addition to the report, there must be inspected and tested for cross connections and a report written documenting the findings of the test. Any incidents of backflow or cross connection of reclaimed water into the potable water system must be reported to DHS within 24 hours of incident.
	California Department of Health Services Groundwater Recharge Guidelines	Current regulations for groundwater recharge are determined on a case by case basis by DHS; however, DHS has developed draft recharge regulations. These regulations stipulate that a project developed for the recharge of groundwater must meet either the treatment standards under the filtered wastewater or disinfected tertiary treatment definitions. For surface spreading recharge the groundwater must be retained underground for a minimum of 6 months prior to extraction for use as a water supply and shall not be extracted within 500 feet of the point of recharge. For groundwater injection the recycled water must be retained underground for a minimum of 9 months prior to extraction for use as a water supply and shall not be extracted within 2000 feet of the point of recharge. Recycled water can only compose 50% of the total amount of water recharged unless otherwise permitted by DHS.
	Proposed New Guidelines	The new guidelines apply only to planned projects; however, existing projects are encouraged to meet the requirements. Recycled water must meet MCL and shall not exceed any public health goal for a contaminant, or the level of the contaminant in the receiving groundwater, whichever is higher, unless approved by DHS. Existing project can continue as long as the total nitrogen in recycled water is 10 mg/L; however, no increase in recycled water contribution (RWC) can occur. If the RWC is to be increased then the total nitrogen limit permitted is 3 mg/L. In addition, unregulated and unknown contaminant levels permitted in planned or where RWC is to be increased are required to meet a TOC of less than 0.5 mg/L per RWC instead of the existing limits of a TOC less than 1 mg/L per RWC. The DHS has a goal of the TOC being less than 0.1 mg/L per RWC. In addition, DHS will permit on an incremental basis the increase of the RWC up to 75 %+, if the project is proven to meet the DHS's water quality standards. Also the distance required before extraction can be reduced to up to 200 feet if the retention time required can be met and proven by tracer testing.
California Department of Health Services Augmentation of Domestic Reservoir with Recycled Water	DHS conceptually approved a proposal to use highly treated reclaimed water for augmentation of a domestic water supply reservoir in 1994. The approval was contingent upon the following being met; all of the reclaimed water will be processed utilizing advanced water treatment processes including RO, a reliability assurance plan is established ensuring the reclaimed water delivered to the reservoir meets or exceeds federal drinking water standards, no more than 50% of the water drawn over a 36 month period will be reclaimed water, adequate steps will be taken to maximize retention and minimize short circuiting of the reservoir, and the water supply permit issued for the project will be conditional. An unconditional permit could be obtained after 3 years of successful operation of the project.	

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- Detailed characterization of the quality of the recycled water, proportion and types of industrial waste, and all source control programs.
- A schematic of the treatment train explaining processes, including loading rates and contact times. Include filtration design criteria, chemicals to be used, degree of mixing, dosages, storage and handling facilities, etc.
- Detailed discussion of plant reliability features, including alarm systems and notification details, and staffing arrangements.
- Supplemental water supply details, including purpose, source quality, quantity, and cross-connection control.
- Monitoring and reporting program, including sampling plan details.
- Detailed contingency plans.
- Transmission and distribution system details, including maps showing ownership and location of all water, sewer, and recycled water lines in the use area.
- Extensive use area information, including land use, regulatory agencies with jurisdiction, containment measures, well locations, public/employee access, signage, and cross-connection control.
- Employee training details and manuals.

In addition to these general requirements, the guidelines have specific additional requirements for the following types of uses:

- Irrigation
- Impoundments
- Cooling
- Groundwater recharge
- Dual plumbed use areas
- Other industrial uses

As evidenced by this extensive list of requirements, some projects may require design beyond the pre-design level to satisfy the reporting requirements.

3.3.10.2 Lessons Learned

- Title 22 regulatory requirements are onerous and project-specific for indirect potable projects. Indirect potable projects require an advanced degree of design, a very detailed Title 22 report, and an iterative review process with the DHS.⁴⁴
- A Title 22 report is required for all recycled water projects, but the level of detail required can vary greatly by project type.⁴⁵
- A sample Title 22 report Table of Contents (TOC) for an indirect potable groundwater recharge project is included as Appendix E. The TOC (and report) structure was developed with the DHS for this particular recharge project example. While this TOC is representative of the level of detail required for indirect potable projects, each project will require its own case-specific details. The TOC as presented was in a state of flux as the DHS worked to implement the revised Title 22 regulations, which were under development while the report was being written.

3.3.11 Funding Mechanisms 11

The purpose of this step is to identify funding sources, including any specific constraints, and discuss contractual arrangements.

3.3.11.1 Discussion

If funding is tied to ordinances, their adoption must be planned. Internal financing sources, such as rate structure changes, water/wastewater fees, connection fees, or property tax adjustments must be put in place in advance of implementation of a recycled water project. This step is simply the implementation of economic or financial funding mechanisms, which are described in Section 3.3.7. Also, an extensive discussion of funding mechanisms can be found in a separate TM entitled Financial Support Opportunities TM.

3.3.11.2 Lessons Learned

- Recycled water need not always be provided at a lower cost than potable: the ‘drought-proof’ nature of recycled water may be worth a premium to large industrial users.⁴⁶ An example of this is the City of San Marcos, Texas’ recycled water rates, which are composed of the actual cost of the water as well as a commodity charge. The City was able to implement this rate structure due to the nature of its reuse system and the lack of available and reliable water supplies for new industrial users.

⁴⁴ Personal communications with Dennis Smith, CH2MHILL project manager for a Title 22 permit for Inland Empire Utility Agency, and Jeff Stone, DHS.

⁴⁵ IBID.

⁴⁶ Personal conversation with Ken Thompson for IRWD case study.

3.3.12 The Permitting Process 12

The purpose of this step is to obtain required permits prior to the start of construction and service delivery.

3.3.12.1 Discussion

Permit requirements will have been identified through the analysis done in previous steps, including Environmental Issues and Approval (Section 3.3.6), Project Outline Submission to DHS and RWQCB (Section 3.3.8), and most importantly, Regulatory Requirements and Approval Review (Section 3.3.9). By this stage of the process, if public outreach has been successful, acquisition of the permits should be straightforward. However, agencies should still be prepared to either deal with new issues, or to readdress existing issues during the permitting process.

CASE STUDY:

CITY OF LOS ANGELES DEPARTMENT OF PUBLIC WORKS EAST VALLEY WATER RECYCLING PROJECT

Project Description: The East Valley Water Recycling Project (EVWRP) was to deliver an initial 10,000 acre-feet per year of disinfected tertiary-treated recycled water from the Donald C. Tillman Water Reclamation Plant to Hansen Spreading Grounds (just below Hansen Dam, City of Los Angeles) for groundwater recharge. A three-year demonstration project was approved by the RWQCB, the DHS, and the Upper Los Angeles River Area Watermaster, and began operation in 1999. If water quality monitoring showed favorable results after the three-year demonstration, recharge was to be increased to as much as 35,000 acre-feet per year. This project was also part of the long-term effort to replace water supply lost as part of the Mono Lake Decision and was supported by area environmental groups. Public perception was initially positive, but public participation was not particularly high during the EIR process. However, significant public opposition arose when the local media used the phrase "Toilet to Tap" to describe the project while the project was politicized by mayoral candidates. Despite a history of approximately 40 years of recycled water groundwater replenishment in the Los Angeles County Montebello Forebay area, the use of the phrase and inference that the public would be forced to drink untreated wastewater caused the project to be put on hold after delivering 62 acre-feet of recycled water. Currently, the City of Los Angeles is performing investigations to determine how to best utilize the existing infrastructure for urban irrigation, commercial, and industrial non-potable uses.

Project Relevance: This project demonstrates that project success depends upon an accurate assessment of public opinion, public buy-in on the project, and extensive continued proactive public and political involvement in project planning, design, construction, and operation. It also shows that if the public is not properly informed or believes that the project is unsafe that implementation is unlikely.

Lesson Learned: Public opinion and opposition can derail a project at any stage of development. The EVWRP was constructed, operational and had been tested when its operation was halted due to public pressure. Public outreach must continue during all phases of the project. In addition, if project opposition arises, the public may need to be reformed regarding the project need/drivers as well as have the steps undertaken to develop the project reviewed.

3.3.12.2 Lessons Learned

- The RWQCB can issue an interim permit to keep the project moving until the final permit is issued.⁴⁷

⁴⁷ Personal conversation with Rich Mills, SWQCB.

3.3.13 Construction 13

The purpose of this step is to build the infrastructure, or make the necessary modifications, so that the users' identified recycled water needs can be met. A key component of this effort is informing the public and gaining acceptance for the inconveniences and disturbances to normal activities that may occur during construction.

3.3.13.1 Discussion

Construction and commissioning should be implemented in a phased approach, if possible, to allow the benefits of water recycling to be demonstrated sooner, and if the project is new, to allow untried procedures to be tested and modified on a progressive scale. It can also help keep water recycling 'in the spotlight' by demonstrating incremental successes. In addition, the project may need to be phased because of funding limitations or sheer project size.

Alternatively, single-phase construction can offer the following benefits:

- Decreased public inconvenience.
- Revenue stream established sooner.
- Reduced cost and risk (less overhead required to administer more and longer contracts, less inherent risk of construction claims).
- Accelerated drought preparedness and customer supply.

Whichever approach is taken, thorough testing and attention to detail applied during construction will help to ensure, particularly where dual plumbed systems are installed, that the potential for negative public reactions is minimized.

3.3.13.2 Lessons Learned

- Keep the public well informed of construction activities, and seek to minimize construction-related inconveniences to the public and future users.⁴⁸ The public information and education program implemented during the construction of the WBMWD recycled water project is an illustration of the potential for successful communication of project goals, identification and addressing public issues, and implementation of a recycled water project.

⁴⁸ Personal conversation with Cesar Lopez for San Diego County Water Authority case study.

- Test purple marking paint and meter/hydrant paint prior to use in the field – some brands fade to white, or worse, blue when exposed to ultraviolet light.⁴⁹ This was a lesson learned by the City of Largo, Florida when marking paint faded to white.

3.3.14 Project Commissioning and Delivery of Services (14)

The purpose of this step is to transition smoothly from construction and testing to supply of recycled water.

Various inspections are required to ensure that there are no cross-connections between the potable and non-potable systems by the DHS. Attention to water quality testing and O&M procedures are particularly critical at start-up, as staff and users must become accustomed to the new services and operations. It is important to note, that a number of recycled water projects have experienced strong public opposition prior to initial delivery of water.

Therefore, it is imperative to time the startup of a recycled water project so that it can not be used during an election year as an issue or politically rallying point. The LADWP EVWRP and the City of San Diego Repurification projects are two examples whose implementation have been hindered late in the project development process due to the politicization of the project utilizing the ‘toilet to tap’ label.

3.3.15 Operation and Maintenance (15)

The purpose of this ongoing step is to provide effective long-term O&M. If the project is an indirect potable reuse project, the detailed O&M plan will have been developed as part of the Title 22 report. Regardless of the type of recycled water project, regular water quality testing and periodic inspections of infrastructure will be required. Specific requirements will be detailed in the various permits, but will not likely be onerous, with the exception of groundwater recharge projects, which have extensive groundwater testing requirements.

As with all other steps in the development of the recycled water project, public outreach continues to be important. Consistency in signage, service response, continuous user evaluation, regular testing, and other proactive measures can help ensure that a fully informed public comes to expect water recycling solutions to water supply and demand issues.

⁴⁹ Reclaimed Water Guide, Southwest Florida Water Management District, June 1999, p.114.

3.3.15.1 Lessons Learned

- Annual cross connection testing by the DHS is required for dual-plumbed systems. Other periodic testing and monitoring will also be required, and will depend on the type of project.⁵⁰ The Moulton Niguel Water District covers the cost of annual testing and monitoring as a method of ensuring safety of use and also assisting users with meeting these addition O&M costs.

CASE STUDY: MOULTON NIGUEL WATER DISTRICT

Project Description: The Moulton Niguel Water District (MNWD) has been providing recycled water to irrigation users since 1965. Faced with discharge limitations in the 1980s when surrounding cities sought to expand, MNWD increased recycled water production and use as a means of limiting wastewater discharge to ocean outfalls and complying with discharge permits.

MNWD distributes approximately 14 mgd of tertiary-treated water produced at three plants, which are jointly owned and operated by the South Orange County Wastewater Authority. Seasonal supply for irrigators is regulated by a storage reservoir in the Santa Margarita Water District. Infrastructure is funded primarily through state grants and loans. By 2010 the MNWD will be supplying approximately 9,800 acre-feet of recycled water through 1,200 services in five cities and two school districts.

State-mandated use of recycled water for irrigation is enforced by the MNWD where potable water is not necessary or otherwise justified. Through strong education and outreach programs (facility tours, school and resident association presentations, etc.) and creative support and funding programs, the MNWD encourages transition to recycled water use.

Qualifying schools and cities receive a 20 percent discount from potable water rates, or can take advantage of a 6 percent loan repayable through water rates over a period of up to 20 years. Recycled water users must pay the cost of retrofitting their irrigation system for recycled water, but the water district's recycled water distribution system has no direct cost to the customer. The MNWD also covers the cost of State-mandated requirements, such as inspections and testing.

Those targeted for transition to recycled water use can obtain deferrals or exemptions depending on individual circumstances, as the MNWD seeks to engender and maintain support for the program. Those failing to respond adequately to a request to retrofit, after several follow-up attempts, can be issued a Surcharge Notice, after which potable water rates are increased by 50 percent. However, this is considered a last resort.

Project Relevance: This case study demonstrates how mandated recycled water use can be successfully implemented through education, encouragement, and as a last resort, implementation of a surcharge on potable water. The MNWD promotes a generational shift to a long-term water conservation mindset through interactions with school children, and through a pro-active advisory and support role on education on water conservation and recycling.

Lesson Learned: Education, particularly of children, is essential for long-term acceptance. The importance of getting out into the community and providing clear justifications for recycled water use cannot be over-stated. Because of the long transition periods for acceptance of recycled water in jurisdictions, board members often change, and continuity is often lost; starting over from scratch is not uncommon.

⁵⁰ Personal conversations with Jeff Stone, DHS, and Cesar Lopez for SDCWA case study.

4 Conclusions and Recommendations

Although there has been a long history of success for recycled water projects in California since implementation of the first project to use treated wastewater (beyond septic tank treatment) in 1912, as regulations and technology evolve, key factors driving successful implementation also change. Thus, there is no single ‘best path’ to implementation of recycled water projects that applies across all project types and all jurisdictions because each combination must be considered individually. However, a critical factor that contributes to the success of a recycled water project is effective, early and continual public outreach. Effective public outreach enables project sponsors to reduce opposition to recycled water by representing it as a valuable alternative water source rather than a means of reducing sewage discharges or volumes. In addition, it is important to have a transparent project development process so that the motives and reasons for the project are not questioned. Another key factor in successfully developing a recycled water project is the project type. This is important because the approval process for a direct or indirect potable recycled water project is significantly more complex and prone to stronger opposition, than non-potable applications. In addition, non-potable applications can be more straightforward to implement, particularly under a master Title 22 permit.

For agencies in southern California interested in implementing a recycled water project, there is a wealth of experience, information, and knowledge of how to be successful. Due to this experience, along with a long history of responsible recycled water, there is not a need for an agency to ‘forge new ground’ in project implementation. The case studies highlighted in this document provide ‘lessons learned’ that show the importance of learning from past experiences. The history of implementing recycled water projects has illustrated that it is of primary importance that public outreach begin very early in the project development process. In addition, the public outreach program must have a strong commitment from the project sponsor. Other key factors in implementing a recycled water project include:

- Maintaining an open and transparent planning process, and not rushing project planning (especially important if public awareness of recycled water is low).
- Focusing the project message on recycled water as a water supply resource instead of a means of sewage discharge.
- Utilizing resources from agencies that support recycled water, such as the American Water Works Association, WateReuse Association, DHS, SWRCB, and the associated regional boards.
- Seeking the advice and guidance of DHS and the RWQCB early in the process to ascertain the level of effort required to obtain approval and permits.
- Seeking out successful project implementation experience from other southern California jurisdictions.
- Ensuring that a recycled water project is not politicized by timing sensitive project milestones to not coincide with local political elections.

Appendix A SWRCB Water Recycling Funding Guidelines

WATER RECYCLING FUNDING GUIDELINES



April 17, 1997

**California State Water Resources Control Board
Office of Water Recycling
WATER RECYCLING FUNDING GUIDELINES**

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**California State Water Resources Control Board
Office of Water Recycling**

WATER RECYCLING FUNDING GUIDELINES

April 17, 1997^a

PART ONE: BACKGROUND INFORMATION

I. INTRODUCTION

The State Water Resources Control Board (SWRCB) has three programs to provide financial assistance to local agencies for water recycling projects. The purpose of these guidelines is to explain the types of assistance available under each program and describe the procedures and funding criteria for applicants to obtain funds. Definitions of terms and abbreviations used in these guidelines are provided in Appendices A and B.

Grant funding assistance is available for water recycling project planning under the Water Recycling Facilities Planning Grant Program (FPGP). In addition, low interest loans are also available for planning under the State Revolving Fund (SRF). Low interest loan funds are available for design and construction of water recycling projects under the Water Recycling Loan Program (WRLP) or the SRF. The guidelines are presented in three parts. The first part includes background information applicable to all funding programs. A description of the FPGP is provided in the second part. Part Three has descriptions of the WRLP and SRF loan assistance programs.

These guidelines apply to all projects that have not received a preliminary grant or loan commitment from the SWRCB as of April 17, 1997. The provisions of these guidelines dealing with mandatory use ordinances for recycled water market assurances do not apply to agencies where their ordinances have received approval for the current loan application prior to June 16, 1994.

Funding for the WRLP is provided by three bond laws described below. The basis for the FPGP is the Safe, Clean, Reliable Water Supply Act (1996 Bond Law). The SRF is funded by federal grants and various state and local sources. These guidelines are also applicable to the SRF for all water recycling projects except those justified only on the basis of meeting pollution control needs (classified as Category II recycling projects later in these guidelines). In addition to these water recycling guidelines, the "Policy for Implementing the State Revolving Fund for Construction of Wastewater Treatment

^a These guidelines were adopted by the State Water Resources Control Board on April 17, 1997.

Facilities" (SRF Policy) also applies to agencies applying for an SRF loan. Because of some differences in the laws and policies governing the WRLP and SRF, an SRF applicant should refer to "State Revolving Fund Loan Program Funding for Water Recycling Projects." (Refer to Appendix E to obtain other SWRCB publications related to these programs.)

A. Clean Water Bond Law of 1984

A Water Reclamation Account was established under the Clean Water Bond Law of 1984 (1984 Bond Law) which authorized up to \$25 million for low-interest loans to municipalities to assist in the design and construction of water recycling projects. Repayments of principal and interest are returned to the Water Reclamation Account to make additional loans. Also, the first \$30 million in principal and interest repaid for loans for wastewater facilities from the Clean Water Construction Grant Account, provided for in the 1984 Bond Law, will be deposited in the Water Reclamation Account. Loans for water recycling projects can be for a period of up to 25 years at an interest rate equal to 50 percent of the rate paid by the State on the most recent sale of state general obligation bonds. A moratorium on payments of principal and interest is not permitted. No single project may receive more than a \$10 million loan from this program. Loans can cover any part of a project up to 100 percent of eligible project design and construction costs.

B. Clean Water and Water Reclamation Bond Law of 1988

Up to \$30 million was initially available under the Clean Water and Water Reclamation Bond Law of 1988 (1988 Bond Law) for low-interest loans to local public agencies to aid in the design and construction of water recycling projects. In addition, the SWRCB exercised authority under the 1988 Bond Law to transfer an additional \$10 million into the Water Reclamation Account. "Local public agencies" do not include state agencies, which are included in the 1984 Bond Law as part of "municipalities". Loan repayments from these funds do not become part of a revolving fund as is the case of the 1984 Bond Law. The loan provisions are the same as for the 1984 Bond Law with the exceptions that the maximum loan period is 20 years instead of 25 years, no maximum loan amount per project is specified, and state agencies cannot receive loans.

C. Safe, Clean, Reliable Water Supply Act of 1996

A Water Recycling Subaccount was established in the Safe, Clean, Reliable Water Supply Act (1996 Bond Law) for low-interest loans for design and construction of water recycling projects and for grants for facilities planning of recycling projects. Loans for water recycling projects can be for a period of up to 20 years at an interest rate equal to 50 percent of the rate paid by the State on the most recent sale of state general obligation bonds. A moratorium on payments of principal and interest is not permitted. Loans may cover up to 100 percent of eligible project design and construction costs. Loan repayments are returned to the subaccount to make additional loans. Grants are limited to \$75,000 per planning study.

D. State Revolving Fund

The State Revolving Fund Loan Program provides low interest loans for planning, design, and construction of collection, treatment, disposal and recycling of municipal wastewater, for implementation of nonpoint source and storm drainage pollution control management programs, and for the development and implementation of estuary conservation and management programs. SRF loan provisions are similar to those in the bond laws described above for the WRLP. A detailed description of SRF provisions is provided in the SRF Policy.

E. Water Recycling Project Categories

There are four sources of funding under two programs for providing loans for the design and construction of water recycling projects. Because each funding source has its own legal constraints and primary objectives, it is necessary to define four categories of water recycling projects. The categories and their funding sources are described below.

- Category I. **New Water Supply:** A cost-effective alternative for augmenting the state water supply by offsetting new freshwater development by reclaiming municipal wastewater. Generally, this category would involve wastewater that is discharged into marine or brackish waters. The recycled water users served must be water users that were using or would have used fresh water without the availability of recycled water. Category I projects with an eligible cost of less than \$15 million will be funded by the WRLP. SRF funds will be available if the eligible cost exceeds either the funds available in the WRLP or \$15 million.
- Category II: **Pollution Control:** An essential component of the cost-effective alternative for the treatment and disposal of municipal wastewater to meet waste discharge requirements imposed for water pollution control. Category II projects will be funded only by the SRF.
- Category III: **Local Water Supply:** A cost-effective alternative that would augment a local water supply by reclaiming municipal wastewater but that may not augment the state's water supply. Development of a local recycled water supply for one area can reduce the availability of recycled water already being used in another area. A project in Category III must not result in a net decrease in the state's water supply. The recycled water users served must be water users that were using or would have used fresh water without the availability of recycled water. Generally, this category would involve wastewater that is being discharged into fresh water or a usable groundwater basin and is being reused indirectly. Category III projects will be funded only by the WRLP with 1996 Bond Law funds.
- Category IV: **Miscellaneous:** Any water recycling project not included in the other categories. The source of water that is recycled may be municipal wastewater or groundwater that has become polluted primarily because of

human activities. The project must be cost-effective based on the project objective. Category IV projects will be funded by the WRLP with 1984 or 1996 Bond Law funds or by the SRF, depending on a case-by-case evaluation of eligibility under the specific funding source.

F. Further Information and Assistance

To apply for a recycling planning grant or construction loan, complete an application form and submit it and supporting documents to the Office of Water Recycling (OWR) of the SWRCB.

Additional information can be secured by use of the order form in Appendix E. The OWR is available to answer questions and advise the applicant during the planning process. An agency anticipating a possibility of seeking a loan in the future is encouraged to contact OWR early in the planning to ensure that the scope and content of planning will cover the key issues necessary for loan approval. Advice on which category a project would fall in can be provided. The OWR can be contacted by writing to

Office of Water Recycling
State Water Resources Control Board
P. O. Box 944212
Sacramento, California 94244-2120

This office can also be contacted by telephone at (916) 227-4580 or 227-4400 or by Fax at (916) 227-4595.

II. FACILITIES PLANNING CONCEPTS

The planning process generally comprises three levels of detail--conceptual, feasibility, and facilities. At the conceptual level, a potential project is sketched out, rough costs are estimated, and a potential recycled water market is identified. At this level little investigation has occurred and information is generally preliminary in nature.

At the feasibility level, a preliminary market assessment is performed, including direct consultation with potential recycled water users. Alternative facilities are screened, considering economics, technical constraints, and other factors. The most promising project is then investigated sufficiently to determine whether it is appropriate to proceed to the facilities planning stage.

The facilities planning level represents the final stage of the planning process. Agencies are expected to complete this stage of the planning process at the conclusion of a planning grant or before filing a loan application. At the facilities planning stage, a thorough cost-effectiveness analysis is conducted for all potential alternatives. Such an analysis includes evaluation of economics, environmental and social factors, and technical feasibility. Environmental, technical, and institutional issues are identified and potential obstacles are resolved. All necessary facilities of the recommended project have been identified, and the project is described with sufficient detail to seek funding

and approvals by regulatory agencies. Potential recycled water users have been informed of the conditions for using recycled water, including probable price. A detailed market assessment is performed, and a construction financing plan and revenue program are developed. Agencies initiate formal discussions with suppliers, wholesalers, retailers, and users of the recycled water, and institutional arrangements are decided upon. Market assurances, such as mandatory use ordinances or letters of intent from users, are obtained.

As part of the planning process the agency must conduct an environmental review. Environmental review should be consistent with requirements for obtaining SRF funding from the SWRCB. Guidance is provided in 'Environmental Review Process Guidelines for State Loan and Small Community Grant Applicants.' It will also be necessary to obtain clearance from the SWRCB's Division of Water Rights regarding compliance with Water Code Section 1211, if the proposed water recycling project will modify a current wastewater discharge to a surface water course by changing the point of discharge, place of use, or purpose of use of the treated wastewater. Because of the time involved in state water rights review, the Petition Unit of Division of Water Rights should be contacted early in the planning process. The SWRCB will not authorize a loan commitment until water recycling requirements have been issued by the Regional Water Quality Control Board (RWQCB).

The completed facilities planning should be documented in a report, which is to be submitted in fulfillment of a planning grant or with a loan application form. The information that should be contained in a facilities planning report is shown in Appendix C. Monetary analyses, market assessment, and market assurances are described in the following sections and Appendix D.

A. Monetary Analyses

An important factor in the cost-effectiveness analysis of water recycling is an analysis of monetary costs and benefits. Monetary costs and benefits can be analyzed in different ways depending on the use of the results. In water resources planning two general categories of monetary analyses have been established: economic analysis and financial analysis. The purpose of the economic analysis is to determine whether a project alternative is justified by quantifying all monetary costs and benefits regardless of who pays the costs or receives the benefits. The intent is to determine the alternative of least net cost. The economic analysis does not have the viewpoint of any particular public agency or private entity. A financial analysis is intended to determine who pays the costs and receives the benefits and to determine financial feasibility. This analysis should indicate costs and benefits to the recycled water user, the taxpayer, and the water retailer or wholesaler, and the sources of funds to implement the project alternatives being evaluated. A detailed discussion of monetary analyses can be found in Interim Guidelines for Economic and Financial Analyses of Water Projects (see Appendix F to order this).

1. Economic Analysis

The first step in an economic analysis is to identify all items of increased or decreased cost as a result of each alternative under consideration, including continuing without a project. The economic analysis should include the costs of all future components necessary to obtain the estimated recycled water yield for a project. If a proposed project or loan application is for system component that in itself would be insufficient to produce and transport recycled water to potential users, the costs for all associated facilities should be estimated. Costs experienced by entities other than the project sponsor must also be identified. For example, recycled water users may incur additional costs to convert to recycled water or may incur savings in fertilizer use because of nutrients in recycled water. If indirect reuse is taking place downstream from an effluent discharge, diversion of the effluent for direct reuse may result in increased water supply costs downstream.

The basis of comparison for justifying a water recycling project will depend on which category applies to the project. Some general principles apply to the analysis regardless of category. All monetary values are expressed in current dollars, excluding inflation. Because the debt service or fixed operating costs of existing facilities would not be reduced by use of recycled water, these costs are not included in the economic analysis. In an economic analysis, the present value of all immediate and future cost increases and decreases is calculated, including those experienced by other entities. The present values should be computed using a discount rate (a type of interest rate) specified by the SWRCB. To be able to compare the net cost of recycling alternatives and proposed water supply developments on a common basis, dollars per acre-foot of water developed should be computed. A water recycling alternative is considered economically justified if its net cost is less than the least net cost of other alternatives to achieve the same project objective.

Category I: For Category I the basis of comparison for justifying a water recycling project is a new freshwater supply that will be needed to serve the area of the recycled water project. The appropriate freshwater alternative for comparison is established in the facilities planning report in which the freshwater needs are projected and available facilities are discussed. The costs for use in the economic analysis of the new freshwater supply consist primarily of the capital and operation and maintenance costs of the new freshwater facilities and the variable costs of operating any existing water facilities that are needed in conjunction with the new facilities to deliver the new supply to the same market area as of the recycled water.

Category II: The basis of comparison for Category II projects is the least cost alternative pollution control project that would be needed to meet Regional Water Quality Control Board waste discharge requirements for the protection of receiving waters.

Category III: The basis of comparison for Category III projects is existing or new freshwater supplies, analyzed similarly to Category I projects. If the effect

of recycling would be to reduce the water supply to another agency, the economic effects of this must be included in the analysis.

Category IV: The factors to include in economic analyses will be determined on a case-by-case basis because the basis of Category IV projects may include objectives that do not include water supply, such as environmental enhancement. In general terms the economic analysis will include a comparison with appropriate alternatives to achieve the same project objectives. The economic effects of reduced water supply to another agency must be included, if appropriate.

2. Financial Analysis

The financial analysis actually consists of several analyses. An agency developing a water recycling project must determine the costs and savings it will experience for each potential alternative to determine whether an alternative is financially feasible. It must identify sources of funds to finance proposed alternatives. The construction financing plan and revenue program demonstrate the basic financial feasibility from the perspective of the agency. These are described in Appendix D.

Important information for the recycled water users is the cost or savings they will experience. Recycled water prices must be compared to the cost of fresh water that the users would otherwise use. The costs of on-site conversion to recycled water use must be estimated. Savings in fertilizer use should be considered.

In performing financial analyses, it is appropriate to use inflated dollars for future costs and to use an interest rate in present value analyses that is based on an agency's borrowing cost.

B. Recycled Water Market Assessment

The completion of a detailed recycled water market assessment is a critical element of the facilities planning process and crucial to the success of any water recycling project. A market assessment involves the identification of potential recycled water users, collection of information related to the users, and evaluation of the suitability of the recycled water to serve the potential market. Information is needed about and from the users to determine design criteria for a recycled water system, a recycled water pricing policy, financial feasibility, the amount and source of fresh water displaced, the institutional framework for the project, and the capability and willingness of users to take recycled water. The suitability of the recycled water is governed both by health and water pollution concerns and by the water quality needs of the users. Costs are a key element in bringing together recycled water and the potential water market. The general expectations of users is that the conditions of recycled water service will be comparable to alternative freshwater supplies, particularly for users already accustomed to taking potable water.

The recycled water market assessment process generally includes two levels of detail--preliminary and detailed. Agencies typically perform a preliminary market assessment during the feasibility planning stage. The preliminary market assessment is developed through consultation with users and provides general data, such as the number of potential users, and the amount and type of potential recycled water use. While this information is adequate to allow an agency to determine whether a project warrants further consideration, additional information is necessary to determine the economic and financial feasibility of the project.

Agencies are required to conduct a detailed market assessment as part of the facilities planning process. The market assessment shall include, as a minimum, all of the users or service area for the capacity of the facilities for which loan funding is or may be requested. Like the preliminary market assessment, the detailed market assessment must be developed through direct consultation with potential users. The following information should be included in the detailed market assessment:

A. General Information

1. List and map of potential users in the study area and types of uses.
2. State and local health department recycled water quality requirements and delivery requirements (backflow prevention, irrigation methods, levels of treatment, etc.) for each type of use.
3. Regional Water Quality Control Board recycled water quality and delivery requirements for each type of use and any restrictions in certain geographical areas for protection of ground water or surface water.
4. An estimate of the probable water quality of recycled water that could be made available in the future and a comparison of this quality to the health and water quality requirements of potential users.
5. An estimate of future freshwater supply costs to users.
6. An estimate of costs for facilities or modifications needed on user sites to accept recycled water for each type of user site.

B. Individual User Information

1. Specific potential uses of recycled water.
2. Location of user.
3. Present and future quantity needs. (For existing water users, present water use should be documented with three previous years of water usage.)

4. Timing of needs (seasonal, daily, hourly demands).
5. Quality needs.
6. Reliability needs regarding availability and quality of recycled water.
7. Needs regarding disposal of used recycled water.
8. Internal capital investment for on-site treatment or plumbing retrofit needed to accept recycled water (also gather data to develop an independent estimate to compare with user's estimate). (This item is required for planning grant recipients only.)
9. Needed savings on recycled water to recover on-site costs or desired pay-back period and rate of return on investment. (This item is required for planning grant recipients only.)
10. Present source of water, present water retailer, cost of present source of water.
11. When user would be prepared to begin using recycled water.
12. Future land use trends that could eliminate recycled water use, such as conversion of farm lands to urban development.
13. For undeveloped future potential sites, the year in which water demand is expected to begin, current status and schedule of development (with supporting evidence, such as subdivision maps, land use permits, general plan land use designations, irrigated acreages, etc.).
14. Evidence that the prospective user was informed of a potential water recycling project, was asked for a preliminary impression of willingness to use recycled water, and what response the prospective user gave regarding willingness. This evidence may be presented in the forms of a table with a list of users, correspondence from users, or some other record of user response. Users should be informed of applicable health and RWQCB restrictions, potential recycled water quality available depending on treatment level, future cost, and quality of fresh water. (This item is required for planning grant recipients only.)
15. The data listed above may be grouped into categories for numerous small users of similar characteristics. However, please consult with OWR before doing so.

Determination of the market for recycled water in future development depends upon various sources of information of varying reliability. For near-term development that is proposed for inclusion in the ninth-year eligible capacity, information will generally be expected directly from land developers of their intentions, following the model format available from the Office of Water Recycling. This information shall be submitted for review before facilities plan approval is issued. Undeveloped sites may be included as part of the first year delivery commitment if the development has proceeded sufficiently through design and received sufficient approvals and permits that the SWRCB can safely assume that the user will be ready to accept recycled water upon completion of construction of the recycling project.

The preparation of the market assessment should not be viewed as a data collection exercise, but as an integral step in the recycled water marketing process. Potential customers should be familiarized with details of the proposed project, including the proposed project schedule, the projected water quality and reliability, and the projected price of recycled water in comparison with alternative water supplies (if such water supplies would be available to the customer). An agency that has adopted a mandatory use ordinance should also provide information about the ordinance and the customer's responsibility under the ordinance. Evidence of this effort to inform potential users (e.g., a copy of the information package provided to potential users) should be included in the detailed market assessment. The detailed market assessment should be documented in the facilities planning report.

C. Market Assurances

Reclaimed water market assurances serve to ensure that the water produced by a project will be utilized within the time frame envisioned in the facilities planning documents. Market assurances take the forms of 1) binding measures to ensure the participation of recycled water users upon initial project operation and 2) the agency's plans for connecting additional users later to fulfill the entire eligible capacity of the project. The binding measures for securing the initial recycled water users generally take two forms: 1) mandatory use ordinances in which potential users are mandated to participate in the project or 2) user contracts in which potential users voluntarily commit themselves to participate in the project. The two forms of assurances are described in Section IX in Part Three. Which approach to take should be evaluated during facilities planning.

PART TWO: PLANNING GRANT PROGRAM

III. WATER RECYCLING FACILITIES PLANNING GRANT PROGRAM

A. Introduction

The Water Recycling Facilities Planning Grant Program (FPGP) provides grants to public agencies for facilities planning studies for water recycling. The program is administered by the Office of Water Recycling (OWR) of the SWRCB. The grant program's statutory requirements, policies and procedures are provided in this section.

B. Purpose

The purpose of the FPGP is to assist local agencies in the preparation of facilities planning studies for water recycling using treated municipal wastewater. In addition to encouraging new recycling planning studies, the SWRCB intends that these funds be used to supplement local funds to enhance the quality of local planning efforts and to produce documents needed by the SWRCB to evaluate applications for design and construction loans if a cost-effective project is identified.

C. General Guidelines

Public agencies may apply for the grants. Grants will be provided for facilities plans to determine the feasibility of using recycled water that will offset new freshwater development and augment the state's or a local water supply. Pollution control studies, in which water recycling is an alternative, will not be eligible for a grant. The grant will cover 50 percent of eligible costs up to a maximum grant of \$75,000.

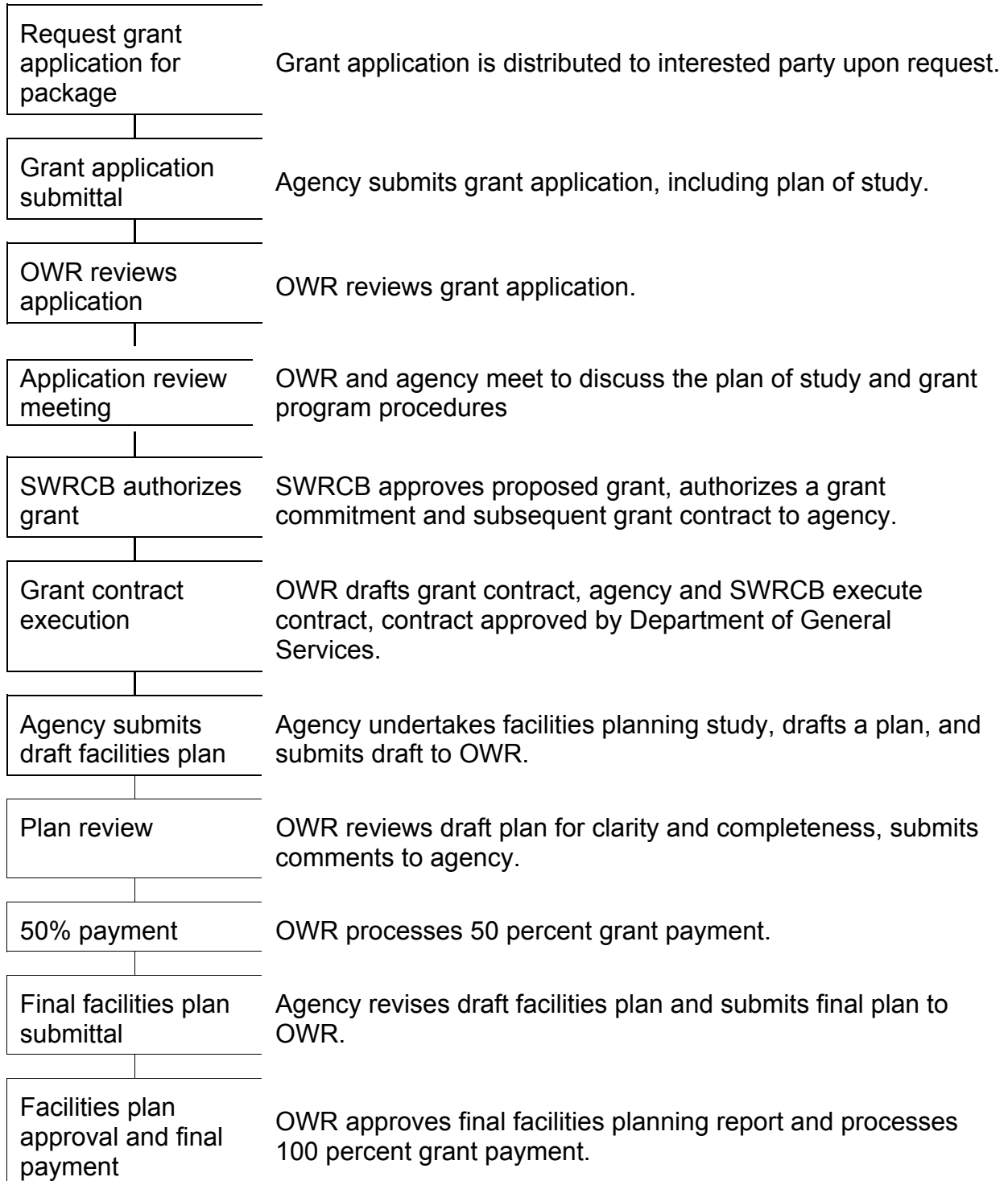
Each grant must result in a complete facilities planning report. The report will include an analysis of all of the essential components of potential operable projects. The plan will designate a potential recycled water service area and analyze the feasibility of serving all or portions of the designated study area. An agency may receive more than one grant. The OWR will not recommend approval of a grant application if the scope of the study is not sufficiently distinct from previous studies performed by an agency.

The SWRCB will establish a time limit in its resolution of grant approval for submitting a final facilities planning report. The allowable time will be the time estimated by the agency in the grant application to prepare and submit a final facilities planning report. This limit will be the basis of the grant contract term. At any point during a grant an agency may submit one request for an extension of the grant term and an increase in costs accompanied by a justification. After review of the request, OWR may approve an extension of the grant contract of up to twelve months from the date specified in the SWRCB resolution or an increase in maximum grant by up to 50 percent from the amount authorized in the resolution. OWR staff shall bring to the SWRCB for approval 1) any increases in grant contract term or amount beyond these amounts or 2) additional requests for changes after the first one. After approval, a grant contract

amendment will be processed, subject to approval, if necessary, by the Department of General Services.

D. Grant Process

The overall process of a FPGP grant is illustrated in the following flow chart.



E. Grant Application

The grant application will consist of an application form, a resolution by the agency authorizing the grant application, and a plan of study.

The plan of study should describe the nature and scope of the proposed facilities planning study. The following components should be included:

1. A description of the recycled water service area that will be investigated.
2. The sources of recycled water that will be investigated and a brief summary of the unit processes currently in use at existing treatment facilities.
3. A description of the current fate of the effluent that could be recycled.
4. A map of the study area showing the sources of recycled water and potential service area.
5. Identification of the water supply and wastewater agencies having jurisdictions over the sources of recycled water or the potential service area.
6. General description of water recycling and freshwater supply alternatives that will be evaluated.
7. A description of the opportunities for participation of the public, potential recycled water users, and other affected agencies in the study.
8. A schedule with the starting and completion dates of specific tasks associated with the facilities planning study.
9. A list of potential problems that could cause delays in the progress of the study and description of the means to reduce the impact of these potential problems.
10. Identification of the entities that will be conducting the study and description of their roles; description of proposed subcontracts with consultants or interagency agreements with other agencies, and any force account work.
11. Proposed budget for study, including estimated costs of specific tasks, sources of financing, sources of funds for cash flow until grant reimbursement.

After an initial review of the application, the OWR will schedule a meeting with the agency to discuss the plan of study and grant program procedures. Upon completion of application review by OWR, the application will be presented to the SWRCB with staff recommendation whether to approve and authorize execution of a grant contract.

F. Facilities Plan Review and Approval

The facilities planning study consists of facilities planning and associated environmental impact analysis. Where a recommended project has been identified, completion of the study for the purposes of the grant consists of submittal of the following items:

1. a final facilities planning report that fully documents all aspects of the study
2. a copy of a resolution certifying or adopting the environmental document as required under the California Environmental Quality Act.

Background information on facilities planning, monetary analyses, recycled water market assessment, and recycled water market assurances is found in Part One of these guidelines. Appendix C includes an outline of information that should be obtained or issues that should be addressed during facilities planning. The information and analysis of issues are documented in the facilities planning report. The report must include an analysis of all of the essential components of potential operable projects. The level of detail should be commensurate with the size and complexity of the proposed project. While some factors listed in the outline may not be relevant to a particular project, all should at least be considered. If the conclusion of the study is a recommendation to proceed with implementation of a water recycling project, the agency should have completed initial work on assuring a recycled water market and drafted any necessary water recycling ordinances and/or interagency agreements.

During the course of planning, it may be concluded that a viable recycling project cannot be recommended. In this case, after consultation with the OWR and approval, the planning may be terminated before completion of all of the tasks specified in these guidelines. The results of the work completed and the basis for the conclusion should be documented in a report. After submittal of the report, the agency will receive grant funds for the work completed in the study and preparation of the report.

While it is appropriate to extract information from previous studies, the product submitted for a grant should not be an assemblage of copied material. Any extracted material should be revised and made consistent as needed prior to incorporation in a facilities planning report.

Environmental review should be consistent with requirements for obtaining SRF funding from the SWRCB. Guidance is provided in 'Environmental Review Process Guidelines for State Loan and Small Community Grant Applicants.'

An essential component of facilities planning is to identify the potential recycled water users that will participate in the recommended project. The agency should have determined how it will secure the recycled water market, generally through recycled water user contracts or use of a mandatory use ordinance. At the conclusion of facilities planning, the agency should either have obtained letters of intent to use recycled water from potential users or drafted a water recycling mandatory use ordinance and contacted all potential users regarding the project.

G. Funding Restrictions and Eligible Costs

An agency may conduct the facilities planning study by force account with its own resources or by contract with consulting firms or another public agency. Costs incurred either way are eligible insofar as they are for work within the scope of work approved in the grant application. A billing code should be established by the agency to assign grant eligible costs. In general, force account eligible costs will be limited to direct costs, including labor overhead, chargeable to the planning study. More specific guidance is provided in WRLP 'Guidelines on Force Account Eligible Costs.' If the agency uses consulting services, the scope of work for the services should distinguish between grant-eligible and ineligible work and such work should be billed separately. It is recommended that the agency provide an opportunity for the OWR to review the consultant contracts prior to their execution to ensure that the scope of work separates grant-eligible tasks from other tasks for billing purposes.

Eligible costs are costs incurred after execution of the grant contract.

A grant will be provided to reimburse the agency for 50 percent of eligible costs up to a maximum grant of \$75,000. The remaining 50 percent share of costs is the responsibility of the agency, but may include grants or loans from other entities, such as federal, state, or regional agencies. To prevent duplication of funding, the grant will be reduced if the agency receives more than 50 percent financial assistance from other sources.

H. Disbursement of Grant Funds

Grant funds will be provided in two disbursements. Disbursement of 50 percent of the total estimated grant will be made upon submittal of a draft facilities plan. A final disbursement will be made after approval by the OWR of the final facilities plan, including associated documents, such as the environmental impact analysis.

Requests for disbursement will be made on forms provided by the OWR. The requests must be accompanied by documentation, including a copy of consulting contracts, billings from consulting firms, and a monthly summary of agency staff hours and associated costs.

PART THREE: LOAN FUNDING PROGRAMS

IV. LOAN FUNDING PROGRAMS

The Water Recycling Loan Program (WRLP) and the State Revolving Fund Loan Program (SRF) provide low interest loans to local agencies to design and construct water recycling projects. Water recycling loan applications are processed by the Office of Water Recycling (OWR) of the SWRCB. The purpose of the WRLP is to encourage the development of cost-effective water recycling projects by providing low interest loans to local agencies to lower the cost of reclaiming and reusing treated wastewater.

A. Program Funding Criteria

Generally, available funds will be committed to projects for which facilities planning is complete, provided the project meets the loan program requirements and is ready to proceed. However, the SWRCB reserves the right to manage the program to achieve the best use of loan funds. For example, the SWRCB may reserve funds for projects deserving special consideration or offer partial loans to achieve the maximum use of available loan funds.

Multiple-purpose projects may consist of components in more than one category. The components will be analyzed in accordance with the criteria of the applicable category and eligibility will be established accordingly.

Depending on the source of loan funds, there may be a cap on the total amount of a loan. The SWRCB establishes a cap on SRF loan funds annually based on the availability of SRF funds. There is a \$10 million statutory cap per project for loans made from 1984 Bond Law funds. The SWRCB has established a \$15 million cap per project for loans made from 1996 Bond Law funds.

B. General Eligibility

The general basis of eligibility of a water recycling project is established in the various bond laws and the SRF statutes, regulations, and policies. Projects for reclaiming ground water, including desalting and nitrate removal projects, are eligible under the WRLP (1996 Bond Law funds only) if the water to be treated has become unusable primarily because of human activities. Under the SRF, funding is restricted to projects reusing water of municipal wastewater origin. All projects must be cost-effective based on the project objective and the available alternatives to achieve the objective.

While the loan terms for the WRLP and the SRF are essentially the same, such as interest rate, there are some important procedural and eligibility differences that can jeopardize funding under one program or the other if applicants are not alert to program requirements from the commencement of project planning through completion of construction. As an agency begins planning, it may not be possible for the SWRCB to assure the agency of which program might be available for funding for Category I and IV

projects. In addition, because the SWRCB incorporated the Water Reclamation Account of the 1984 Bond Law into the SRF as a subaccount in order to secure additional federal matching funds, certain SRF requirements will apply to 1984 Bond Law loans. Therefore, all potential loan applicants for Category I, II, and IV projects should place their proposed projects on the SRF priority list and follow SRF environmental procedures.

It is the policy of the SWRCB that loans from the WRLP or the SRF shall be provided to cover 100 percent of eligible costs, excepting annual loan caps that may be established by the SWRCB. The agency may receive funds from other local, state, or federal programs to pay for ineligible costs or a share of eligible costs, provided that there is no duplication of funding of eligible components.

All applicants will be subject to the SWRCB 'Environmental Review Process Guidelines for State Loan and Small Community Grant Applicants.' The SWRCB cannot authorize a loan until the environmental review process is complete. The SWRCB must be notified immediately of any change in the project after completion of the environmental review process or after facilities plan approval (also called concept approval) by the SWRCB. Such changes may result in the need to revise environmental documents.

V. WATER RECYCLING LOAN PROGRAM PROCESS

The WRLP loan application process begins with the OWR staff distributing loan application packages to interested agencies upon request. The completed applications, including project planning documents, are submitted by the applicant for review. The OWR staff make a preliminary determination regarding the appropriate category assignment and which source of funds is most appropriate to fund the proposed project.

After the OWR staff has determined that the loan application is complete, that is, that project planning is complete and all other application requirements have been met, that the project is ready to proceed, and that loan funds are available, staff will issue facilities plan approval. The application will then be presented to the SWRCB for approval of a preliminary loan commitment and subsequent loan contract. If loan funds are not currently available, consideration may be given to reserving future repayments returning to one of the revolving funds.

If OWR determines that a proposed project is not cost-effective, OWR will provide a written explanation to the agency. Upon request by the agency, the OWR will bring the proposed project before the SWRCB with the explanation of the decision of OWR and the agency's request for review and authorization for facilities plan approval.

The preliminary loan commitment will expire at the end of the time period specified in the SWRCB resolution approving the loan commitment. The end of the period will be 8 weeks after the applicant's scheduled date for submittal to the state of final plans and specifications to account for time for the Division of Clean Water Programs (Division) to review plans and specifications. If biddable plans and specifications are not received

and approved by the expiration date of the preliminary loan commitment, the OWR may approve up to a 90 day extension for a good cause.

The procedures and administration of the SRF differ somewhat from the WRLP. Refer to the “Policy for Implementing the State Revolving Fund for Construction of Wastewater Treatment Facilities” (SRF Policy) for projects funded under the SRF. **The procedures described below apply to the WRLP.**

Submittal of preliminary design plans for review by the OWR is encouraged, but not required. Once the project design is completed, OWR reviews and approves the plans and specifications, final market assurances, construction financing plan, and revenue program. An approval to advertise is then issued to the applicant, and a loan contract is drafted. When the applicant has awarded the construction contract, the loan contract is executed and loan disbursements may commence. Loan repayments from the applicant to the SWRCB must begin within two years after the date of the loan contract. The entire application process is summarized below.

Request for application package	Application is distributed to interested party upon request.
Facilities planning and environmental compliance by applicant	Agency does planning without financial assistance from the Loan Program. OWR staff is available for meetings and guidance. Agency must comply with environmental review, water rights, State Health Department, and other requirements.
Application completed	Agency submits completed application, authorizing resolution, and planning documents to SWRCB.
SWRCB review	OWR staff reviews and comments on the application and planning documents. Agency prepares responses, if necessary.
Project facilities plan approval and eligibility determination	OWR staff issues project facilities plan approval, makes preliminary eligibility determination and determines availability of loan funds.
SWRCB authorizes loan	SWRCB approves the proposed project, authorizes a loan commitment and subsequent loan contract to the agency.
Design submittals	Agency submits 100% design submittal, including cost estimate, construction financing plan, revenue program, final market assurances, and plan for the use of remaining project capacity.

Design review and approval to advertise	OWR staff reviews and comments on the design submittal; Agency prepares responses, if necessary. Staff makes final eligibility determinations, issues approval to advertise the construction contract, and drafts a loan contract.
Construction contract award	Agency awards construction contract and submits related information to OWR.
Loan contract issued	SWRCB and agency execute loan contract.
Loan disbursements to agency	Agency requests loan disbursements. SWRCB issues loan disbursements to agency.
Construction monitoring	Staff monitors status of construction and of users converting to recycled water use, reviews final revenue program. Agency submits financial report and final project summary after completion of construction.
Loan repayments to SWRCB	Agency begins loan repayments within two years after date of loan contract.
Annual Reports	Agency submits reports annually for the specified period (See Section XIV).

VI. STATE REVOLVING FUND PROCESS

The procedures and administration of the SRF are described in the SRF Policy. Category II recycling projects are administered under the SRF Policy only. In addition to the SRF Policy, the Water Recycling Funding Guidelines are applicable to the Category I and IV water recycling projects funded under the SRF. A copy of the SRF Policy may be obtained by request (refer to Appendix E).

VII. PLANNING REVIEW CRITERIA

In order for a project to be approved for a loan, a project must be cost-effective. A water recycling project will be considered cost-effective when, compared with the development of other alternatives to achieve the project objective, the proposed project will result in the minimum total resources costs over time to meet project objectives. Resource costs to be evaluated include monetary costs as well as nonmonetary factors, including social and environmental effects. An economic analysis, which considers all monetary costs associated with each alternative, is given primary consideration unless other factors are overriding. Other important factors include an assessment of the

recycled water market, availability of recycled water, financial feasibility, energy consumption, and engineering.

VIII. FACILITIES PLANNING

OWR staff will not consider a loan application for funding until the facilities planning process has been completed. Agencies are encouraged to notify OWR staff of their interest in applying for a loan early in the planning process. OWR staff can then advise agencies about the availability of funding and assist agencies in developing facilities planning documents that comply with funding guidelines and preparing loan applications. The facilities planning concepts discussed in Part One will be applicable. If the loan application and supporting documents are incomplete, the applicant will be advised about what additional information is necessary. Funds are available to assist in facilities planning either through the FPGP or an allowance under the SRF. No planning cost allowance is available under the WRLP.

IX. MINIMUM USE REQUIREMENTS

Existing users are expected to begin use in the first year of operation unless phasing of these users is justified. Projects are expected to reach certain minimum usage levels during the operating life of the project. These minimum levels are based on the eligible project capacity determined in accordance with Section XI.A.6. These minimum usage levels are explained below.

- A. At least 50 percent of the total eligible project capacity must serve users that will exist by the time of completion of construction. (See Appendix A for definition of 'existing user'.)
- B. Generally, all existing water users proposed to be included in the eligible project capacity will be expected to be connected to the system upon initial project operation. Proposals to connect existing users after initial project operation must be approved in the facilities plan approval based on the market assurances explained in Section X.C.
- C. During the first year of project operation, the agency will be expected to use at least 25 percent of the eligible project capacity. The agency will also be expected to reach use of the total project capacity in accordance with the schedule of project usage approved in the facilities plan approval.

X. RECLAIMED WATER MARKET ASSURANCES

Documentation is required to provide an assurance of participation of users in the project. Existing users must be covered by a mandatory use ordinance or user contract. Documentation must be provided if phasing of project usage is proposed. These provisions are explained below.

A. Mandatory Use Ordinances

A mandatory use ordinance is a law adopted by a retail water purveyor requiring the use of recycled water in place of another source of water. For the ordinance to be an acceptable form of market assurance, it shall contain certain provisions:

1. Specification of the types of use of water for which recycled water must be used.
2. Specification of the conditions under which recycled water must be used or new development must be plumbed for future recycled water use.
3. Procedure for determining which water users are required to either convert to recycled water service or be plumbed to accept recycled water upon new water service.
4. Procedure to provide notice to potential users that they are subject to the ordinance and specification that the notice include information about the project, the responsibilities of the users under the ordinance, the price of the recycled water, and description of the on-site retrofit facilities requirements.
5. Procedure for request by the users for a waiver.
6. A penalty for noncompliance with the ordinance. Acceptable penalties are discontinuance of freshwater service, a freshwater rate surcharge of at least 50 percent of the freshwater rate, or an equally effective penalty.

If the agency implementing the recycled water project does not have the legal authority to enforce a mandatory use ordinance (for example, a sewerage agency), the mandatory use ordinance may be implemented by the retail water purveyor.

The OWR staff will review a copy of the adopted ordinance along with the loan application. Facilities plan approval of the project will establish the eligible capacity of the project based on the market assessment.

The SWRCB's resolution approving a loan commitment will include a requirement that the local public agency submit either 1) copies of letters of intent to participate in the project or 2) copies of the notifications to the users subject to the ordinance, a statement of whether any notified users appealed the conditions of recycled water use, and documentation showing the disposition of any appeals. The resolution will require that these items be submitted to the OWR staff before approval to advertise for construction, but in no case later than six months from the date of the resolution. The OWR staff will have 60 days from the date of receipt of submittals to approve or reject them, otherwise the submittals will be considered adequate. The SWRCB's resolution will include a provision that if the agency does not submit these items within six months or if the submittal is considered inadequate by the OWR staff, the resolution is null and void, and the project will need to be resubmitted for approval. Submittal of copies of letters of intent or notifications of users may be waived by OWR for users that have their

sites already plumbed and metered for use of recycled water, but are temporarily using potable water. Considerations for a waiver will include, but not be limited to, the number of years of successful recycling experience of the agency and the type of water use.

There may be limitations on the application of mandatory use ordinances. Certain potential users may not be subject to the ordinance for various reasons, for example, a user may not be obtaining water service from the agency with the ordinance or the user may be outside of the service area of the agency. In such situations, user contracts may be expected to cover users intending to take recycled water during the first year of operation. The ordinance shall apply to sufficient users such that in aggregate they represent most of the recycled water deliveries for water users that will exist by the time of completion of construction.

B. User Contracts

A user contract is a binding agreement between recycled water purveyors and users, signed by both parties. For the OWR staff to accept a user contract as an acceptable form of market assurance the contract must contain certain provisions:

1. A commitment to use the recycled water for a minimum period of 10 years.
2. The amount of recycled water the user intends to take annually.
3. The sites and the types of use of the recycled water.
4. Specification of the conditions of recycled water use, including the water quality.
5. The price of the recycled water.
6. Description of the regulatory and water purveyor requirements for on-site retrofit facilities needed to convert from freshwater to recycled water.
7. Date when recycled water use will commence.

User contracts are required from sufficient users such that in aggregate they represent most of the recycled water deliveries for water users that will exist by the time of completion of construction. The agency must submit with the loan application letters of intent from the proposed recycled water users intended to execute user contracts. The content of the letters should follow the model format provided by the Office of Water Recycling. The user contracts shall be submitted before OWR approval to advertise for construction.

C. Documentation of Future Connections

If the agency proposes to connect users after initial project operation, market assurances should include a description and schedule of the future connection of users to the eligible project facilities. Anticipated delay in connection of existing users after

initial project operation should be supported by adequate reasons for the delay in connection and a firm schedule for the construction of facilities to make the connections. The plan for use of the full eligible project capacity or pipeline capacities should be submitted with the loan application and updated, if necessary, with the submittal of final plans and specifications. An approved schedule of deliveries to reach the eligible project capacity will be included in the facilities plan approval.

XI. ELIGIBILITY CRITERIA

The following eligibility policies have been established by the SWRCB regarding costs and types of projects eligible and ineligible for loans.

A. Eligible Costs

1. Costs of construction for water recycling treatment, storage, and distribution systems shall be eligible for loans.
2. Allowances:
 - a. WRLP: The eligible cost may include an allowance, if requested by the loan recipient, to cover engineering, legal and administrative services associated with the design and construction of the eligible recycling project. The amount of such allowance shall be up to 15 percent of the eligible cost of construction.

In addition, the eligible cost may include an allowance, if requested by the loan recipient, to cover design services only for design costs of future phased expansions of facilities on the same site as facilities to be constructed as part of the loan. The phased expansions may include a capacity for up to 20 years after completion of construction. The amount of the allowance shall be up to 10 percent of the engineer's estimate of the construction cost of expansions based on 100 percent design.
 - b. SRF: The eligible cost may include allowances for facilities planning, design, construction management, administration, and prime engineering. The SRF Policy should be consulted for details.
3. Project facilities which are eligible must remain in public ownership and have provision for adequate operation and maintenance and adequate right-of-way.
4. Reclaimed water distribution systems from the source of supply to the property line of the reuse sites shall be eligible for a loan. Eligibility of a system on the property of the user should be limited to:
 - Reclaimed water service line up to and including the water meter if the meter is located in the proximity of the property line.

- Reclaimed water service line up to a main storage facilities serving the user on the reuse site or, if there are more than one use areas that are widely separated on the property, up to the point of initially dividing the water flow.
5. A recycled water distribution pipeline shall be eligible if the terminal point serves a user that is committed by mandatory use ordinance or by user contract to take recycled water during the initial operation of the project. If only a portion of a pipeline serves users secured by a firm commitment, then eligibility shall extend to the most downstream user secured by a firm commitment.
 6. The capacity of a project eligible for a loan shall be that capacity which can be used within nine years of completion of construction. However, pump station wet wells and buried pipelines at the treatment facility or in the distribution system shall have an eligible capacity of up to twenty years when documented by a market assessment showing the twenty year service area and identifying and analytically projecting all existing and future uses to be served by the recycled water pipeline proposed for loan funding. These eligible capacities are measured in terms of annual recycled water deliveries. Eligible sizes of facilities components are based on reasonable design criteria, including peaking factors, to serve these annual deliveries. There shall not be any restriction on the capacity of a project. Capacity in excess of the eligible project shall be funded with funds other than the SWRCB loan. Eligible costs for partially eligible capacity will be determined on an incremental cost rather than pro rata cost basis.
 7. Agencies constructing pipelines or treatment facility capacity in excess of that which can be utilized within five years of completion of construction must demonstrate that adequate reclaimable water supplies will be available to support that future capacity. This documentation may take the form of: 1) an urban water management plan or equivalent water supply planning document which specifically identifies measures intended to assure that, in a year of normal supply and demand, an adequate supply of water will be available to support the projected growth in wastewater flows or, 2) certification by the agency that existing tributary wastewater flows will meet or exceed the capacity of the proposed recycling project at the time of the completion of the project.
 8. Reasonable costs to provide an emergency backup water supply for the recycled water system are eligible.

B. Ineligible Costs

1. The following costs are not eligible for WRLP loan funds:
 - costs of planning for a project
 - costs of applying for a loan
 - costs of land, easements, and rights of way
 - costs for operation and maintenance of project facilities

- legal and court costs resulting from violation of state and federal laws, excluding the cost of capital facilities required to be built as a condition or result of a legal or court settlement.
2. Eligible costs of construction performed by the loan recipient's work force shall not include indirect costs, that is, expenses not readily identifiable with the eligible recycling project, such as ordinary operating expenses of the loan recipient. A more detailed discussion may be found in "Water Reclamation Loan Program Guidelines on Force Account Eligible Costs."

C. Miscellaneous

1. Multiple-purpose projects shall be eligible in proportion to the costs allocated to water recycling. In addition, projects utilizing supplemental sources of water are eligible in proportion to the costs allocated to the recycled water. An example of a multiple-purpose project would be a ground water recharge project that percolates both storm water runoff and treated wastewater. For projects using multiple sources of water, costs will be allocated to each source on a pro rata basis.
2. Projects for reclaiming ground water, including desalting and nitrate removal projects, are eligible under the WRLP (1996 Bond Law funds only) if the water to be treated has become unusable primarily because of human activities. This includes municipal, industrial, or agricultural activities. The degraded source water may be provided to the project directly, such as from a wastewater treatment plant, or indirectly, such as pumping from a brackish or polluted ground water basin. Projects for desalting naturally occurring saline or brackish waters are not eligible for a loan.
3. Recycling of industrial wastewater is eligible for a loan provided the loan applicant is a municipality, public agency, or a local public agency, depending on the source of loan funds, as defined in Appendix A. In-plant recycling projects are not eligible for a loan.
4. Project changes are permitted after approval of the project by the SWRCB, provided that there is no change in the scope of the project. If there is a change in scope of a project, the OWR staff shall bring the project to the SWRCB for reapproval. The scope of a project is considered to have changed if there is any of the following:
 - a. A decrease in the recycled water deliveries projected for the ninth year following completion of construction by more than 15 percent.
 - b. A change required in the environmental documents prepared under the California Environmental Quality Act such that the SWRCB is required to reconsider the environmental documents.

- c. An increase in the total economic cost of the project such that the cost exceeds the alternative benchmark, such as the freshwater cost, by more than 15 percent.
- d. An increase in the total eligible project cost such that it exceeds the preliminary loan commitment amount by more than 50 percent.
- e. An adverse effect on the engineering or financial feasibility of the project.

The SWRCB Project Manager shall be promptly informed of project changes during construction. Because changes may affect project eligibility or require reapproval by the SWRCB, substantial changes during construction should be approved before initiating the change.

The maximum loan amount will be based on bid amount at the time of award of the construction contract, as described in Section XII. All project changes during construction that result in cost increases above the maximum loan amount shall be the responsibility of the loan recipient. Changes during construction may result in decreases in eligible costs. Such decreases may offset cost increases for eligible project costs. Eligible cost increases may result from 1) overruns in quantities beyond estimates in original bids for eligible work specified at the time of bid or 2) change orders for changed work which has been approved for eligibility. The final loan amount will be adjusted downward for any decreases in eligible cost items less any eligible offsetting cost increases, up to the maximum loan amount. Change orders will be reviewed for eligibility only if there is a request from the loan recipient and there is an offsetting cost decrease.

- 5. Retroactive funding of construction is not eligible for loan funds under the WRLP, with the exception that eligibility may be reserved for advance construction of minor portions of a proposed project with prior approval by OWR staff. Advance construction is not eligible for any facilities commencing construction before submittal of the loan application. Advance construction shall be justified based on the cost savings or time coordination with the main portion of the project. Prior approval does not constitute an assurance of final eligibility. Such eligibility is determined at the time of plans and specifications approval of the main project. The SRF Policy should be consulted for the retroactive funding policy under the SRF.

XII. LOAN FINANCIAL PROVISIONS

The provisions for the disbursement and repayment of loan funds under the SRF are discussed in the SRF Policy. The following discussion on loan provisions applies only to the WRLP. Successful loan applicants will receive loan funds during project construction based on evidence of satisfactory construction progress. No loan funds will be advanced during design. Interest charges on loan funds begin to accrue as soon as loan funds are disbursed. The maximum loan amount will be based on bid amount at the time of award of the construction contract. An allowance for design costs and

engineering, legal, and administrative costs may be included. Increases in the loan amount will not be permitted due to changes in cost during construction. The standard loan provisions will provide for equal annual repayments for a 20-year term following the date of the loan contract. However, shorter repayment periods are encouraged and may be imposed. The repayment will consist of principal and interest. The initial repayment shall be made not later than two years after the date of the loan contract. Additional details regarding the financial aspects, as well as general contractual requirements, can be found in Appendix D and in the model loan contract, which can be obtained upon request (refer to Appendix E).

XIII. DESIGN AND CONSTRUCTION

Before a project can receive approval to advertise the construction contract under the WRLP or plans and specifications approval under the SRF, Division staff must ensure that:

1. The design is consistent with the project described in the facilities plan approval;
2. The construction contract documents comply with all state and, if applicable, federal administrative requirements and contain provisions specified in the loan contract;
3. Agency has the required market assurances; and
4. All other state and facilities plan approval conditions have been met.

The procedures applicable to design, plans and specifications review, and approval to award construction for the SRF are described in the SRF Policy. The following discussion applies only to the WRLP. Staff must review final plans and specifications and other documents before issuing approval to advertise. The final design submittal consists of the following: 1) complete, biddable, and signed plans and specifications; 2) a detailed, itemized engineer's cost estimate; 3) updated revenue program; 4) updated construction financing plan and; 5) recycled water market assurances.

Promptly upon award of the construction contract or contracts, the agency shall notify the SWRCB Project Manager of the award. The notice shall be accompanied by a tabulation of bids received, the most recent engineer's estimate of project cost, a copy of the lowest acceptable bid proposal, a description of any bid protest received together with a description of how the protest was resolved, a copy of any project changes or addenda issued since approval to advertise was given, and a copy of the signed construction subcontract. If the agency awarded to anyone other than the apparent low bidder, the reasons for not awarding to the apparent low bidder shall be provided.

XIV. OPERATION

Agencies are encouraged to adopt a recycled water ordinance or regulation to ensure the long term successful operation of a recycling project in compliance with health, safety, and water quality requirements. A recycled water ordinance can include conditions under which users accept recycled water and define the requirements for on-

site facilities design, construction, operation, monitoring and inspection, connection fees and service charges, enforcement, and penalties. An ordinance can ensure that certain design criteria and standards incorporated into the original project can be carried on in project expansion as new users are added.

Agencies are also encouraged to prepare a recycled water user manual. The manual is used by personnel employed by users of recycled water who handle recycled water on a daily basis, such as park maintenance staff. The manual, usually a two to ten page guide, would cover in simplified language such topics as irrigation scheduling, precautionary measures, emergency procedures, control of runoff, and routine maintenance. It can also include a simplified description of the treatment that recycled water receives before reuse and the overall recycled water system.

Once the project begins operation, the project will be monitored for progress in connecting recycled water users and delivering recycled water. Annual reports must be submitted by the loan recipient until at least one full year after all proposed users are connected up to a maximum of nine years.

APPENDIX A DEFINITIONS

Award of Construction Contract: The formal approval of selection of a construction contractor by the governing board of the agency.

Completion of Construction: The date, as determined by the Division of Clean Water Programs after consultation with the loan recipient, that the construction of the project is substantially complete.

Construction Financing Plan: The demonstration of the financial capability to design and construct a project.

Cost-Effectiveness Analysis: An analysis to determine which project alternative will result in the minimum total resources cost (opportunity cost) over time to meet the project objectives, including local, state and federal requirements.

Economic Analysis: The procedure to determine the total monetary costs and benefits of all the resources committed to a project regardless of who in the society contributes them or who in the society receives the benefits.

Eligible Water Recycling Project: A water recycling project that is cost-effective based on the project objective when compared to the appropriate alternatives to achieve the objective. The project shall comply with applicable water quality standards, policies, and plans.

Existing user: An entity that currently exists or will exist before the completion of project construction and is using or would be expected to use fresh water if recycled water were not made available.

Financial Analysis: The procedure to determine financial feasibility through the determination of expenditures and incomes of or other financial impacts on the agency implementing the project, recycled water users, or others affected by the project.

Future user: An entity that currently does not exist and will not exist before the completion of project construction.

Local Public Agency: Any city, county, district, joint powers authority, or any other local public body or political subdivision of the state created by or pursuant to state law and involved with water or wastewater management (based on 1988 Bond Law). State agencies are not included in this term.

Municipality: Municipality shall have the same meaning as in the federal Clean Water Act (33 U.S.C. Sec. 1251 et. seq.) and shall also include the state or any agency, department, or political subdivision thereof (based on 1984 Bond Law).

Planning Period: The period over which a water development project is evaluated for cost-effectiveness. This period is not necessarily the same as the useful lives of the facilities under consideration. The planning period begins with the system's initial operations and is defined to be 20 years for the Water Recycling Loan Program.

Preliminary Grant Commitment or Preliminary Loan Commitment: A formal action by the SWRCB approving and reserving funds for a study or project.

Public Agency: Public agency shall have the same meaning as municipality.

Recycled Water: Water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur. (This term is synonymous with 'reclaimed water'.) (Based on California Water Code, Section 13050(n).)

Revenue Program: The demonstration of the financial feasibility of a project for the period after operation has begun.

Water Recycling: The process of treating wastewater to produce water for beneficial use, the storage and distribution of recycled water to the place of use, and the actual use of recycled water.

APPENDIX B LIST OF ABBREVIATIONS

CEQA	California Environmental Quality Act
Division	Division of Clean Water Programs
FPGP	Water Recycling Facilities Planning Grant Program
OWR	Office of Water Recycling
RWQCB	Regional Water Quality Control Board
SRF	State Revolving Fund Loan Program
SRF Policy	“Policy for Implementing the State Revolving Fund for Construction of Wastewater Treatment Facilities”
SWRCB	California State Water Resources Control Board
WRLP	Water Recycling Loan Program
1984 Bond Law	Clean Water Bond Law of 1984 (Proposition 25 on the November 6, 1984 ballot)
1988 Bond Law	Clean Water and Water Reclamation Bond Law of 1988 (Proposition 83 on the November 8, 1988 ballot)
1996 Bond Law	Safe, Clean, Reliable Water Supply Act (Proposition 204 on the November 5, 1996 ballot)

APPENDIX C RECOMMENDED PLANNING OUTLINE FOR WATER RECYCLING PROJECTS

This outline contains the components of a facilities planning report for water recycling. The facilities planning report outline emphasizes the information relevant to water recycling and its application for water supply purposes. For water pollution control facilities plans, additional information would be required to define the water quality problem and planning constraints and analyze the appropriate pollution control alternatives in addition to water recycling.

Facilities Plan/Project Report

A. Maps and diagrams

1. Vicinity Map.
2. Detailed map of study area boundaries.
3. Topographic map.
4. City boundaries.
5. Wholesale and retail water supply entity boundaries within study area and adjacent to study area.
6. Wastewater agency boundaries within and adjacent to study area.
7. Existing recycled water distribution pipelines, storage, and customers.
8. Ground water basin boundaries, major streams, streams receiving waste discharges.
9. Present and projected land use.
10. Each recycled water facilities alternative (including recommended project), showing locations of potential customers and approximate pipeline routes.
11. Wastewater treatment schematic--existing and proposed.

B. Study Area Characteristics

1. Hydrologic features.

2. Ground water basins, including quantities extracted by all users, natural and artificial recharge, losses by evapotranspiration, inflow and outflow of basins, and safe yield or overdraft.
3. Water quality--ground water and surface water.
4. Land use and land use trends.
5. Population projections of study area.
6. Beneficial uses of receiving waters and degree of use, portion of flow that is effluent.

C. Water Supply Characteristics and Facilities

1. Description of all wholesale and retail entities.
2. All sources of water for study area and major facilities, their costs, (costs should be broken down into fixed and variable), subsidies, and customer prices.
3. Capacities of present facilities, existing flows, estimated years when capacities to be reached for major components (water treatment plants, major transmission and storage facilities).
4. Ground water management and recharge, overdraft problems.
5. Water use trends and future demands, prices and costs.
6. Quality of water supplies.
7. Sources for additional water and plans for new facilities (for both the local entity and the wholesalers).

D. Wastewater Characteristics and Facilities

1. Description of entities.
2. Description of major facilities, including capacities, present flows, plans for new facilities, description of treatment processes, design criteria.
3. Water Quality of effluent and any seasonal variation.
4. Additional facilities needed to comply with waste discharge requirements.
5. Sources of industrial or other problem constituents and control measures.

6. Existing recycling, including users, quantities, contractual and pricing arrangements.
 7. Existing rights to use of treated effluent after discharge.
 8. Wastewater flow variations--hourly and seasonal.
- E. Treatment Requirements for Discharge and Reuse
1. Required water qualities for potential uses.
 2. Required health-related water qualities or treatment requirements for potential uses, operational and on-site requirements (such as backflow prevention, buffer zones).
 3. Wastewater discharge requirements, anticipated changes in requirements.
 4. Water quality-related requirements of the RWQCB to protect surface or ground water from problems resulting from recycled water use.
- F. Recycled Water Market
1. Description of market assessment procedures.
 2. Descriptions of all users or categories of potential users, including type of use, expected annual recycled water use, peak use, estimated internal capital investment required (on-site conversion costs), needed water cost savings, desire to use recycled water, date of possible initial use of recycled water, present and future source of water and quantity of use, quality and reliability needs, and wastewater disposal methods.
 3. Summary tables of potential users and related data.
 4. Definition of logical service area based on results of market assessment.
- G. Project Alternative Analysis
1. Planning and design assumptions:
 - a. Delivery and system pressure criteria.
 - b. Peak delivery criteria.
 - c. Storage criteria.
 - d. Cost basis: cost index, discount rate, useful lives, etc.
 - e. Planning period.

2. Water Recycling Alternatives to be Evaluated
 - a. Treatment alternatives:
 - i. Alternative levels of treatment.
 - ii. Alternative unit processes to achieve a given level of treatment.
 - b. Pipeline route alternatives.
 - c. Alternative markets:
 - i. Based on different levels of treatment.
 - ii. Geographical areas.
 - d. Alternative storage locations.
 - e. Subalternatives of selected alternative:
 - i. Marginal analysis for selected alternative for certain categories of users or certain geographic areas.
 - ii. Varying storage, pump rates, and pipeline diameters.
 - iii. Use of fresh water blending during peak irrigation months.
3. Non-recycled water alternatives.
 - a. Discussion of other potentially viable new sources of water.
 - b. Provide economic costs.
4. Water conservation/reduction analysis.
 - a. Analysis.
 - b. Impact on recycling, if any.
 - c. Recommendation.
 - d. Implementation.
5. Pollution control alternatives (if applicable) needed to comply with waste discharge requirements, and possible allocation of costs between recycling and pollution control.
6. No project alternative.
7. Information supplied for each alternative to include, but not be limited to:
 - a. Cost tables for each alternative with breakdown of costs by total capital (without grants), O&M, unit processes, and with equivalent annual cost and per acre-foot cost.
 - b. Lists of potential users assumed for each alternative.
 - c. Economic analysis.
 - d. Energy analysis for each alternative, including direct and construction energy.
 - e. Water quality impacts:
 - i. Effect on receiving water by removing or reducing discharge of effluent, including effect on beneficial uses resulting from reduced flow.
 - ii. Ground water impacts.
8. Comparison of above alternatives and recommendation of specific alternative.

H. Recommended Plan

1. Description of all proposed facilities and basis for selection.
2. Preliminary design criteria and refined pipeline routes.
3. Cost estimate based on time of construction.
4. List of all potential users, quantity of recycled water use, peak demand, commitments obtained.
5. Reliability of facilities as compared to user requirements.
6. Implementation plan:
 - a. Coordination with water suppliers, determination of recycled water supplier and needed agreements or ordinances.
 - b. Ability and timing of users to join system and make on-site investments.
 - c. Tentative water recycling requirements of RWQCB.
 - d. Commitments from potential users.
 - e. Water rights impact.
 - f. Permits, right-of-way, design, construction.
 - g. Detailed schedule.
7. Operational plan--responsible people, equipment, monitoring, irrigation scheduling, etc.

I. Construction Financing Plan and Revenue Program

1. Sources and timing of funds for design and construction.
2. Pricing policy for recycled water.
3. Costs which can be allocated to water pollution control.
4. Annual projection of:
 - a. Fresh water prices for each user or category of users.
 - b. Recycled water used by each user.
 - c. Annual costs (required revenue) of recycling project.
 - d. Allocation of costs to users.
 - e. Unit costs to serve each user or category of users.
 - f. Unit price of recycled water for each user or category of users.
 - g. Sensitivity analysis assuming portion of potential users fail to use recycled water.
5. Sunk costs and indebtedness.

J. Appendices

1. Tables of all abbreviations.
2. Copies of letters of interest or intent from recycled water users, or other documentation of support from potential users.
3. Draft of recycled water mandatory use ordinance or model user contract.
4. Drafts of necessary agreements, such as wholesale-retail agreement, joint powers agreement, etc.

APPENDIX D LOAN REPAYMENT AND FINANCIAL ANALYSES

I. Introduction

Typically, money is an essential ingredient for a feasible water recycling project. It must be raised to finance design and construction, to provide positive cash flow during construction, and, once operation has commenced, to repay debts and pay for operation and maintenance. These guidelines contain the repayment provisions for loans from the Water Recycling Loan Program and the desired documentation to demonstrate financial feasibility. More detailed information on financial analyses can be found in the SWRCB's Interim Guidelines for Economic and Financial Analyses of Water Reclamation Projects.

Two financial reports are required: a construction financing plan and a revenue program, which covers the period commencing with initial facilities operation. These two reports must be submitted with the loan application (as part of the facilities plan) and updated and submitted with the 100 percent design submittal. A final revenue program must be submitted at completion of construction.

II. Loan Repayment Provisions

Loans from the Water Recycling Loan Program will have an interest rate set at 50 percent of the average interest rate paid by the State on the most recent sale of general obligation bonds. The term of the loans may be for a period of up to 20 years. The loan term begins from the loan contract date. Repayments will begin on the last day of the month following two years after award of the prime construction contract.

III. Construction Financing Plan

It must be demonstrated that there are sufficient financial resources to finance the design and construction of the project. The construction financing plan generally consists of at least the following items:

1. An up-to-date capital cost estimate, including construction, engineering, legal, and administrative costs with a reasonable allowance for contingencies.
2. A cash flow analysis consisting of a monthly forecast of expenses during design and construction and sources of funds to meet those expenses.
3. The sources and amounts of funds for capital costs, including the status and timing in securing those funds.

There will be no disbursements of loan funds from the Water Recycling Loan Program until the award of construction contracts. Thus, the loan recipient must carry design costs until the initiation of construction. Loan disbursements will be made during construction in proportion to eligible costs incurred. If there are multiple construction

contracts, the loan disbursements will be proportioned amongst each construction contract.

The cash flow analyses should be based on the above procedures for loan disbursements and the assumption that receipt of loan funds will take 60 days from date of request.

IV. Pricing Policy

There are a variety of potential methods for determining the price customers will pay for recycled water. The most typical include:

1. The recycled water price is set to match exactly production costs.
2. The recycled water price is set at a given percentage discount from whatever potable water prices are.
3. The recycled water price is set at a given dollar discount from whatever potable prices are.

Some agencies charge a meter charge or have multiple rates if they have both wholesale and retail sales.

Some of the considerations involved in establishing recycled water rates are:

1. The costs that are expected to be recovered by recycled water revenue.
2. The costs and inconvenience to recycled water customers resulting from switching part of their water use to recycled water.
3. Whether the water agency will pay for on-site conversion costs of recycled water customers.
4. The degree of integration of the recycled water supply into the water agency's overall sources of supply, and thus the integration of costs and revenue from the various sources of supply.

Within the limits of financial feasibility, it is the recommendation of the Office of Water Recycling that the price of recycled water be as high as reasonable, taking into consideration the value of recycled water as compared to the price of fresh water. A reasonable discount from fresh water prices is often the most equitable.

V. Revenue Program

The financial feasibility of a project once it has started operation is shown in a revenue program. In general, a period of 10 years should be forecast. The following items should generally be included for each year:

1. recycled water demand by each user
2. fresh water prices applicable to the recycled water users
3. recycled water prices
4. total recycled water revenue
5. debt repayment
6. operation and maintenance costs, broken down by category with fixed and variable costs separated
7. supplementary funds provided to accommodate any revenue deficiency
8. sensitivity analysis assuming portion of potential users fail to use recycled water.

The assumptions and bases for all numbers should be fully stated and referenced. The pricing policy for the recycled water should be explained. It may be necessary to allocate project costs between pollution control and water supply or between categories of users.

Water supply agencies frequently have more than one source of water. The finances for these various sources are usually integrated, and customers are charged a common melded price, even if they receive water from only one of the sources. Likewise, recycled water should not be viewed as an alien source of water, but rather as simply an added supply to meet the overall water demands of a water supply agency. Its only distinction is that its quality restricts its uses. As such, it is desirable that the finances for a recycled water system be integrated with those for the fresh water sources of supply. Once it has been determined that recycled water costs are justifiable compared to other sources of supply, the recycled water supply should not be treated as an independent system financially.

With recycled water viewed as a complement to a water system, Recycled water prices should be established using the same standards as fresh water, taking into consideration some of the peculiarities mentioned in the previous section. If revenues from recycled water are insufficient to cover all expenses from the recycled water system, as is common in the initial years of operation, the shortfall can be made up with revenue from the fresh water system. Likewise, excess recycled water revenues can be used to cover other agency expenses, allowing all customers to benefit.

Because recycled water is serving as a replacement for fresh water, there inevitably is an effect on fresh water costs and revenue. It is desirable to quantify these effects and include them in the revenue program to describe fully the costs and benefits derived from the recycled water. This is often useful to provide justification for using fresh water revenue to help pay for a recycled water system.

APPENDIX E ORDER FORM FOR ADDITIONAL INFORMATION

Please review the below list of additional documents relating to the Water Recycling Loan Program. If you wish to obtain any of the documents, please provide the requested information.

A. Check the items desired:

- 1. Clean Water Bond Law of 1984
- 2. Clean Water and Water Reclamation Bond Law of 1988
- 3. Safe, Clean, Reliable Water Supply Act (1996 Bond Law)
- 4. Sample Letter of Intent for Use of Reclaimed Water
- 5. Desirable Provisions of Reclaimed Water User Contracts
- 6. Model Recycling Loan Contract
- 7. Interim Guidelines for Economic and Financial Analyses of Water Reclamation Projects
- 8. Background Information on Economic Analyses of Reclamation Projects
- 9. Loan Application Package (Application Form, Water Recycling Funding Guidelines, and Environmental Review Process Guidelines for State Loan and Small Community Grant Applicants)
- 10. Policy for Implementing the State Revolving Fund for Construction of Wastewater Treatment Facilities

B. Provide the mailing address:

NAME: _____

TITLE: _____

AGENCY: _____

MAILING ADDRESS: _____

CITY, STATE, ZIP CODE: _____

C. Fold this order form in half, affix postage, and mail to pre-printed address on reverse side.

Place
Stamp
Here

Office of Water Recycling
Division of Clean Water Programs
State Water Resources Control Board
P. O. Box 944212
Sacramento, CA 94244-2120

WATER RECYCLING FUNDING GUIDELINES, April 17, 1997
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Appendix B
California Water Reuse Legislation Summary and Mandatory
Use Ordinance Template (WaterReuse Association)

MODEL WATER RECYCLING ORDINANCE

The intent of the model water recycling ordinance is to maximize resource conservation and streamline implementation of water recycling projects in conformance with recent changes in state law. The ordinance, which mandates the use of recycled water is a generic model to be tailored by public agencies to conform with their rules and regulations. It is based in part on California Water Code sections 1009 and 13550-13556 and Government Code sections 65601-65605 which authorize water public agencies to require the installation of separate systems for use of recycled water on private property and state that the continued use of potable water for greenbelt irrigation and certain other non-potable water uses is an unreasonable use of water if recycled water is available and usable for such purposes. The following materials are included herein:

Appendix	Contents	Page
A	Water Recycling Policy Provisions	2
B	Mandatory Use Requirements	4
C	Mandatory Plumbing Requirements	11
D	Model Water Recycling Ordinance	17

It should be noted that the State Water Resources Control Board, which administers the state's water recycling loan and grant program, requires agreements from recycled water users before a low interest loan or grant can be authorized. With an adopted ordinance, the agreements become optional, thus streamlining the application procedure and possibly improving chances for a loan or grant.

Appendix A

California Water Code Water Recycling Policy Provisions

§ 461. Purpose

It is hereby declared that the primary interest of the people of the state in the conservation of all available water resources requires the maximum reuse of water in the satisfaction of requirements for beneficial uses of water.

History: Added by Stats.1974, c. 1128, p. 2414, § 2, amended by Stats. 1994 (A.B.2797), c ____, § 3.

§ 13510. Public interest

It is hereby declared that the people of the state have a primary interest in the development of facilities to recycle water containing waste to supplement existing surface and underground water supplies and to assist in meeting the future water requirements of the state.

History: Added by Stats.1969, c. 482, p. 1074, § 18, operative Jan. 1, 1970.

§ 13511. Legislative findings

The Legislature finds and declares that a substantial portion of the future water requirements of this state may be economically met by beneficial use of recycled water.

The Legislature further finds and declares that the utilization of recycled water by local communities for domestic, agricultural, industrial, recreational, and fish and wildlife purposes will contribute to the peace, health, safety and welfare of the people of the state. Use of recycled water constitutes the development of "new basic water supplies" as that term is used in Chapter 5 (commencing with Section 12880) of Part 6 of Division 6.

History: Added by Stats.1969, c. 482, p. 1075, § 18, operative Jan. 1, 1970.

§ 13512. Legislative intent

It is the intention of the Legislature that the state undertake all possible steps to encourage development of water recycling facilities so that recycled water may be made available to help meet the growing water requirements of the state.

History: Added by Stats.1969, c. 482, p. 1075, § 18, operative Jan. 1, 1970.

Appendix B

California Constitution and Water Code Mandatory Use Requirements

CALIFORNIA CONSTITUTION

ARTICLE X. WATER

§ 2. Conservation of water resources; restriction on riparian rights

Sec. 2. It is hereby declared that because of the conditions prevailing in this State the general welfare requires that the water resources of the State be put to beneficial use to the fullest extent of which they are capable, and that the waste or unreasonable use or unreasonable method of use of water be prevented, and that the conservation of such waters is to be exercised with a view to the reasonable and beneficial use thereof in the interest of the people and for the public welfare. The right to water or to the use or flow of water in or from any natural stream or water course in this State is and shall be limited to such water as shall be reasonably required for the beneficial use to be served, and such right does not and shall not extend to the waste or unreasonable use or unreasonable method of use or unreasonable method of diversion of water. Riparian rights in a stream or water course attach to, but to no more than so much of the flow thereof as may be required or used consistently with this section, for the purposes for which such lands are, or may be made adaptable, in view of such reasonable and beneficial uses; provided, however, that nothing herein contained shall be construed as depriving any riparian owner of the reasonable use of water of the stream to which the owner's land is riparian under reasonable methods of diversion and use, or as depriving any appropriator of water to which the appropriator is lawfully entitled. This section shall be self-executing, and the Legislature may also enact laws in the furtherance of the policy in this section contained.

History: Originally codified as Article XIV, Section 3 of the California Constitution. Reenacted verbatim and recodified on June 8, 1976.

ARTICLE 7. WATER REUSE

§ 13550. Legislative findings and declarations; use of potable water for nonpotable uses prohibited

- (a) The Legislature hereby finds and declares that the use of potable domestic water for nonpotable uses, including, but not limited to, cemeteries, golf courses, parks, highway landscaped areas, and industrial and irrigation uses, is a waste or an unreasonable use of the water within the meaning of Section 2 of Article X of the California Constitution if recycled water is available which meets all of the following conditions, as determined by the state board, after notice to any person or entity who may be ordered to use recycled water or to cease using potable water and a hearing held pursuant to Article 2 (commencing with Section 648) of Chapter 1.5 of Division 3 of Title 23 of the California Code of Regulations:
- (1) The source of recycled water is of adequate quality for these uses and is available for these uses. In determining adequate quality, the state board shall consider all relevant factors, including, but not limited to, food and employee safety, and level and types of specific constituents in the recycled water affecting

these uses, on a user-by-user basis. In addition, the state board shall consider the effect of the use of recycled water in lieu of potable water on the generation of hazardous waste and on the quality of wastewater discharges subject to regional, state, or federal permits.

(2) The recycled water may be furnished for these uses at a reasonable cost to the user. In determining reasonable cost, the state board shall consider all relevant factors, including, but not limited to, the present and projected costs of supplying, delivering, and treating potable domestic water for these uses and the present and projected costs of supplying and delivering recycled water for these uses, and shall find that the cost of supplying the treated recycled water is comparable to, or less than, the cost of supplying potable domestic water.

(3) After concurrence with the State Department of Health Services, the use of recycled water from the proposed source will not be detrimental to public health.

(4) The use of recycled water for these uses will not adversely affect downstream water rights, will not degrade water quality, and is determined not to be injurious to plantlife, fish, and wildlife.

- (b) In making the determination pursuant to subdivision (a), the state board shall consider the impact of the cost and quality of the nonpotable water on each individual user.
- (c) The state board may require a public agency or person subject to this article to furnish information which the state board determines to be relevant to making the determination required in subdivision (a).

HISTORY: Added by Stats.1977, c. 1032, p. 3090, § 1, eff. Sept. 23, 1977. Amended by Stats.1978, c. 380, p. 1205, § 148; Stats.1978, c. 894, p. 2821, § 1, eff. Sept. 20, 1978; Stats.1991, c. 553 (A.B.174), § 1.

§ 13551. Industrial and irrigation uses of potable water prohibited; use of recycled water

A person or public agency, including a state agency, city, county, city and county, district, or any other political subdivision of the state, shall not use water from any source of quality suitable for potable domestic use for nonpotable uses, including cemeteries, golf courses, parks, highway landscaped areas, and industrial and irrigation uses if suitable recycled water is available as provided in Section 13550; however, any use of recycled water in lieu of water suitable for potable domestic use shall, to the extent of the recycled water so used, be deemed to constitute a reasonable beneficial use of that water and the use of recycled water shall not cause any loss or diminution of any existing water right.

HISTORY: Added by Stats.1977, c. 1032, p. 3090, § 1, eff. Sept. 23, 1977. Amended by Stats.1978, c. 894, p. 2822, § 2, eff. Sept. 20, 1978; Stats.1991, c. 553 (A.B.174), § 2.

§ 13552. Amendments to §§ 13550 and 13551; effect

The amendments to Sections 13550 and 13551 of the Water Code made during the first year of the 1991-92 Regular Session are not intended to alter any rights, remedies, or obligations which may exist prior to January 1, 1992, pursuant to, but not limited to, those sections or Chapter 8.5 (commencing with Section 1501) of Part 1 of Division 1 of the Public Utilities Code.

HISTORY: Added by Stats.1991, c. 553 (A.B.174), § 3.

§ 13552.2. Irrigation of residential landscaping use of potable water prohibited; use of recycled water

- (a) The Legislature hereby finds and declares that the use of potable domestic water for the irrigation of residential landscaping is a waste or an unreasonable use of water within the meaning of Section 2 of Article X of the California Constitution if recycled water, for this use, is available to the residents and meets the requirements set forth in Section 13550, as determined by the state board after notice and a hearing.
- (b) The state board may require a public agency or person subject to this section to submit information that the state board determines may be relevant in making the determination required in subdivision (a).

History: Added to the Water Code by Chapter 980 (S.B.365) effective January 1, 1994.

§ 13552.4. Requirements

- (a) Any public agency, including a state agency, city, county, city and county, district, or any other political subdivision of the state, may require the use of recycled water for irrigation of residential landscaping, if all of the following requirements are met:
 - (1) Recycled water, for this use, is available to the user and meets the requirements set forth in Section 13550, as determined by the state board after notice and a hearing.
 - (2) The use of recycled water does not cause any loss or diminution of any existing water right.
 - (3) The irrigation systems are constructed in accordance with Chapter 3 (commencing with Section 60301) of Division 4 of Title 22 of the California Code Regulations.
- (b) This section applies to both of the following:
 - (1) New subdivisions for which the building permit is issued on or after March 15, 1994, or, if a building permit is not required, new structures for which construction begins on or after March 15, 1994, for which the State Department of Health Services has approved the use of recycled water.
 - (2) Any residence that is retrofitted to permit the use of recycled water for landscape irrigation and for which the State Department of Health Services has approved the use of recycled water.

- (c)
 - (1) Division 13 (commencing with Section 21000) of the Public Resources Code does not apply to any project which only involves the repiping, redesign, or use of recycled water for irrigation of residential landscaping necessary to comply with a requirement prescribed by a public agency under subdivision (a).
 - (2) The exemption in paragraph (1) does not apply to any project to develop recycled water, to construct conveyance facilities for recycled water, or any other project not specified in this subdivision.

History: Added to the Water Code by Chapter 980 (S.B.365) operative January 1, 1994.

§ 13552.6. Floor trap priming; cooling towers; and air-conditioning devices; use of potable water prohibited; use of recycled water

- (a) The Legislature hereby finds and declares that the use of potable domestic water for floor trap priming, cooling towers, and air-conditioning devices is a waste or an unreasonable use of water within the meaning of Section 2 of Article X of the California Constitution if recycled water, for these uses, is available to the user, and the water meets the requirements set forth in Section 13550, as determined by the state board after notice and a hearing.
- (b) The state board may require a public agency or person subject to this section to submit information that the state board determines may be relevant in making the determination required in subdivision (a).

History: Added to the Water Code by Chapter 980 (S.B. 365) operative January 1, 1994.

§ 13552.8. Requirements

- (a) Any public agency, including a state agency, city, county, city and county, district, or any other political subdivision of the state, may require the use of recycled water in floor trap priming, cooling towers, and air-conditioning devices, if all of the following requirements are met:
 - (1) Recycled water, for these uses, is available to the user and meets the requirements set forth in Section 13550, as determined by the state board after notice and a hearing.
 - (2) The use of recycled water does not cause any loss or diminution of any existing water right.
 - (3) If public exposure to aerosols, mist, or spray may occur, appropriate mist mitigation or mist control is provided, such as the use of mist arrestors or the addition of biocides to the water in accordance with criteria established pursuant to Section 13521.
 - (4) The person intending to use recycled water has prepared an engineering report pursuant to Section 60323 of Title 22 of the California Code of Regulations

that includes plumbing design, cross-connection control, and monitoring requirements for the public agency, which are in compliance with criteria established pursuant to Section 13521.

- (b) This section applies to both of the following:
 - (1) New industrial facilities and subdivisions for which the building permit is issued on or after March 15, 1994, or, if a building permit is not required, new structures for which construction begins on or after March 15, 1994, for which the State Department of Health Services has approved the use of recycled water.
 - (2) Any structure that is retrofitted to permit the use of recycled water for floor traps, cooling towers, or air-conditioning devices, for which the State Department of Health Services has approved the use of recycled water.
- (c)
 - (1) Division 13 (commencing with Section 21000) of the Public Resources Code does not apply to any project which only involves the repiping, redesign, or use of recycled water for floor trap priming, cooling towers, or air-conditioning devices necessary to comply with a requirement prescribed by a public agency under subdivision (a).
 - (2) The exemption in paragraph (1) does not apply to any project to develop recycled water, to construct conveyance facilities for recycled water, or any other project not specified in this subdivision.

History: Added to the Water Code by Chapter 980 (S.B. 365) operative January 1, 1994.

§ 13553. Legislative findings and declarations; use of potable water for toilet and urinal flushing in nonresidential and other designated structures

- (a) The Legislature hereby finds and declares that the use of potable domestic **water** for toilet and urinal flushing in structures is a waste or an unreasonable use of **water** within the meaning of Section 2 of Article X of the California Constitution if recycled **water**, for these uses, is available to the user and meets the requirements set forth in Section 13550, as determined by the state board after notice and a hearing.
- (b) The state board may require a public agency or person subject to this section to furnish whatever information may be relevant to making the determination required in subdivision (a).
- (c) For the purposes of this section and Section 13554, "structure" or "structures" means commercial, retail, and office buildings, theaters, auditoriums, schools, hotels, apartments, barracks, dormitories, jails, prisons, and reformatories, and other structures as determined by the State Department of Health Services.
- (d) Nothing in this section or Section 13554 applies to a pilot program adopted pursuant to Section **13553.1**.

HISTORY: Added by Stats.1991, c. 723 (A.B.1698), § 1.

§ 13554. Use of recycled water for toilet and urinal flushing in nonresidential and other designated structures; requirements; application of section

- (a) Any public agency, including a state agency, city, county, city and county, district, or any other political subdivision of the state, may require the use of recycled water for toilet and urinal flushing in nonresidential structures and those structures defined in Group I-3 in Table No. 5-A of the Uniform Building Code, except a mental hospital or other facility operated by a public agency for the treatment of persons with mental disorders, if all of the following requirements are met:
- (1) Recycled water, for these uses, is available to the user and meets the requirements set forth in Section 13550, as determined by the state board after notice and a hearing.
 - (2) The use of recycled water does not cause any loss or diminution of any existing water right.
 - (3) The public agency has prepared an engineering report pursuant to Section 60323 of Title 22 of the California Code of Regulations that includes plumbing design, cross-connection control, and monitoring requirements for the use site, which are in compliance with criteria established pursuant to Section 13521.
- (b) This section applies only to either of the following:
- (1) New structures for which the building permit is issued on or after March 15, 1992, or, if a building permit is not required, new structures for which construction begins on or after March 15, 1992.
 - (2) Any construction pursuant to subdivision (a) for which the State Department of Health Services has, prior to January 1, 1992, approved the use of recycled water.
- (c) Division 13 (commencing with Section 21000) of the Public Resources Code does not apply to any project which only involves the repiping, redesign, or use of recycled water by a nonresidential structure necessary to comply with a requirement issued by a public agency under subdivision (a). This exemption does not apply to any project to develop recycled water, to construct conveyance facilities for recycled water, or any other project not specified in this subdivision.

HISTORY: Added by Stats.1991, c. 723 (A.B.1698), § 2.

Appendix C

California Water Code and Gov't Code Mandatory Plumbing Requirements

§ 1009. Water conservation programs

Any supplier of water in this state for municipal use, including the state, or any city, county, city and county, district, individual, partnership, corporation, or any other entity, may undertake a water conservation program to reduce water use and may require, as a condition of new service, that reasonable water-saving devices and water reclamation devices be installed to reduce water use.

§ 13555.2. Recycled water delivery systems; purpose

The Legislature hereby finds and declares that many local agencies deliver recycled water for nonpotable uses and that the use of recycled water is an effective means of meeting the demands for new water caused by drought conditions or population increases in the state. It is the intent of the Legislature to encourage the design and construction of water delivery systems on private property that deliver water for both potable and nonpotable uses in separate pipelines.

HISTORY: Added by Stats.1992, c. 418 (A.B.2627), § 1.

§ 13555.3. Recycled water; nonpotable and potable uses; separate pipelines

- (a) Water delivery systems on private property that could deliver recycled water for nonpotable uses described in Section 13550, that are constructed on and after January 1, 1993, shall be designed to ensure that the water to be used for only potable domestic uses is delivered, from the point of entry to the private property to be served, in a separate pipeline which is not used to deliver the recycled water.
- (b) This section applies to water delivery systems on private property constructed within either of the following jurisdictions:
 - (1) One that has an urban water management plan that includes the intent to develop recycled water use.
 - (2) One that does not have an urban water management plan that includes recycled water use, but that is within five miles of a jurisdiction that does have an urban water management plan that includes recycled water use, and has indicated a willingness to serve the water delivery system.
- (c) This section does not preempt local regulation of the delivery of water for potable and nonpotable uses and any local governing body may adopt requirements which are more restrictive than the requirements of this section.

HISTORY: Added by Stats.1992, c. 418 (A.B.2627), § 2.

Appendix D

Model Water Recycling Ordinance

WaterReuse Association
October 10, 2001

October 10, 2001

MODEL WATER RECYCLING ORDINANCE

*Ordinance No.
An Ordinance of the
Establishing A Water Recycling Master Plan
And Implementing Procedures*

WHEREAS, the people of the state of California have a primary interest in the development of facilities to recycle water containing waste to supplement existing surface and underground water supplies and to assist in meeting the future water requirements of the state (California Water Code, Section 13510); and

WHEREAS, conservation of all available water resources requires the maximum reuse of wastewater for beneficial uses of water (Water Code Section 461); and

WHEREAS, continued use of potable water for irrigation of greenbelt areas and other non-potable uses may be an unreasonable use of such water where recycled water is available;

*NOW, THEREFORE, the (District)(City)(County)
Does hereby ordain:*

SECTION 1. FINDINGS

The state policies described above are in the best interest of the _____. This ordinance is necessary to protect the common water supply of the region which is vital to public health and safety, and to prevent endangerment of public and private property. _____ is highly dependent on limited imported water for domestic, agricultural and industrial uses. The reliability of the supply of imported water is uncertain. By developing and utilizing recycled water, the need for additional imported water can be reduced. In light of these circumstances, certain uses of potable water may be considered unreasonable where recycled water is available. Recycled water should be more readily available in seasons of drought when the supply of potable water for nonessential uses may be uncertain.

SECTION 2: WATER RECYCLING POLICY

It is the policy of _____ that recycled water determined to be available pursuant to Section 13550 of the Water Code shall be used for nonpotable uses within the designated Recycled Water Use Areas set forth by within the jurisdiction wherever there is not an alternative higher or better use for the recycled water, its use is economically justified, financially and technically feasible, and consistent with legal requirements, preservation of public health, safety and welfare, and the environment.

SECTION 3: DEFINITIONS The following terms are defined for purposes of this ordinance:

3.1 AGRICULTURAL PURPOSES: Agricultural purposes include the growing of field and nursery crops, row crops, trees, and vines and the feeding of fowl and livestock.

3.2 ARTIFICIAL LAKE: A human-made lake, pond, lagoon, or other body of water that is used wholly or partly for landscape, scenic or noncontact recreational purposes.

3.3 COMMERCIAL OFFICE BUILDING: Any building for office or commercial uses with water requirements which include, but are not limited to, landscape irrigation, toilets, urinals and decorative fountains.

3.4 RECYCLED WATER DISTRIBUTION SYSTEM: A piping system intended for the delivery of recycled water only and which is separate from any potable water distribution system.

3.5 GREENBELT AREAS: A greenbelt area includes, but is not limited to, golf courses, cemeteries, parks and landscaping.

3.6 INDUSTRIAL PROCESS WATER: Water used by any industrial facility with process water requirements which include, but are not limited to, rinsing, washing, cooling and circulation, or construction, including any facility regulated by the industrial waste discharge ordinance of _____.

3.7 OFF-SITE FACILITIES: Water facilities from the source of supply to the point of connection with the on-site facilities, including the water meter.

3.8 ON-SITE FACILITIES: Water facilities under the control of the owner, downstream from the water meter.

3.9 POTABLE WATER: Water which conforms to the federal, state and local standards for human consumption.

3.10 RECYCLED WATER:
Recycled water means water which, as a result of treatment of wastewater, is suitable for a direct beneficial use or controlled use that would not otherwise occur. (See Water Code Section 13050(n).)

SECTION 4: WATER RECYCLING MASTER PLAN

4.1 GENERAL: Upon adoption of this ordinance, the _____ shall prepare and adopt a Water Recycling Master Plan to define, encourage, and develop the use of recycled water within its boundaries. The Master Plan shall be updated not less often than every five years.

5.4 CONTENTS OF THE WATER RECYCLING MASTER PLAN:
The Master Plan shall include, but not be limited to, the following:

4.2.1 PLANTS AND FACILITIES. Evaluation of the location and size of present and future reclamation treatment plants, distribution pipelines, pump stations, reservoirs, and other related facilities, including cost estimates and potential financing methods.

4.2.2 RECYCLED WATER SERVICE AREAS. A designation, based on the criteria set forth in Section 2 and the information derived from Section 4.2.1 and 4.2.2, of the areas within the boundaries of _____ that can or may in the future use recycled water in lieu of potable water. Recycled water uses may include, but are not limited to, the irrigation of greenbelt and

agricultural areas, filling of artificial lakes, and appropriate industrial and commercial uses.

4.2.3 MANDATORY RECYCLED WATER USE. For each recycled water service area, evaluate whether greenbelt irrigation, agricultural irrigation, commercial office buildings, filling of artificial lakes, or industrial processes shall be limited to the use of recycled water. As appropriate, mandate construction of recycled water distribution systems or other facilities in new and existing developments for current or future recycled water use as a condition of any development approval or continued water service if future water recycling facilities are proposed in the Master Plan that could adequately serve the development, in accordance with the procedures described in Section 5. Identify resources and adopt measures to assist water users in the financing of necessary conversions.

4.2.4 RULES AND REGULATIONS. Establish general rules and regulations governing the use and distribution of recycled water.

SECTION 5. PROCEDURES

5.1 EXISTING POTABLE WATER SERVICE:

5.1.1 PRELIMINARY DETERMINATION. Based upon the Master Plan, upon the designation of each recycled water service area or the commencement of the design of new recycled water facilities, the shall make preliminary determinations as to which existing potable water customers shall be converted to the use of recycled water. Each water customer shall be notified of the basis for a determination that conversion to recycled water service will be required, as well as the proposed conditions and schedule for conversion.

5.1.2 NOTICE. The notice of the preliminary determination, including the proposed conditions and time schedule for compliance, and a recycled water permit application shall be sent to the water customer by certified mail.

5.1.3 OBJECTIONS; APPEALS. The water customer may file a notice of objection with the within (30) days after any notice of determination to comply is delivered or mailed to the customer, and may request reconsideration of the determination or modification of the proposed conditions or schedule for conversion. The objection must be in writing and specify the reasons for the objection. The preliminary determination shall be final if the customer does not file a timely objection. Staff (to be specified) shall review the objection and shall confirm, modify or abandon the preliminary determination. Upon issuance of a final

determination by staff, customer may appeal the determination as follows: (The desired appeal process should here be described.)

5.2 DEVELOPMENT AND WATER SERVICE APPROVALS:

5.2.1 CONDITIONS. *Upon application by a developer, owner or water customer (herein referred to as "applicant") for a new industrial, commercial, or residential subdivisions located within the designated Recycled Water Use Areas for which a tentative map or parcel map is required pursuant to Government Code Section 66426 [or for new or altered water service ~Note: Applicable to water districts only], the staff shall review the Master Plan and make a preliminary determination whether the current or proposed use of the subject property is required to be served with recycled water or to include facilities designed to accommodate the use of recycled water in the future. Based upon such determination, use of recycled water and provision of recycled water distribution systems or other facilities for the use of recycled water, and application for a permit for such use may be required as a condition of approval of any such application, in addition to any other conditions of approval [or service.(Note: Applicable in water districts only; such Conditions should normally be placed upon projects at the earliest possible stage, e.g. subdivision map approval.)]*

5.2.2 ALTERATIONS AND REMODELING. *On a case by case basis, upon application for a permit for the alteration or remodeling of multi-family, commercial or industrial structures (including, for example, commercial office buildings), the staff shall review the Master Plan and make a preliminary determination whether the subject property shall be required to be served with recycled water or to include facilities designed to accommodate the use of recycled water in the future. Based upon such determination, use of recycled water and provision of recycled water distribution systems or other facilities for the use of recycled water, and application for a permit for such use, may be required as a condition of approval of the application.*

5.2.3 NOTICE OF DETERMINATION. *A notice of the basis for the preliminary determination, proposed conditions of approval and schedule for compliance shall be provided to the applicant prior to approval of the development application [or application for water service (Water districts only.)]. (Note: Since in most cases, development conditions can be negotiated or appealed through established procedures, no new process is provided here.)*

5.2.4 REQUESTED SERVICE. *On a case by case basis, upon application for a permit to use recycled water on a property not covered by Sections 5.1.1, 5.2.1, or 5.2.2 above, the shall review*

the Master Plan and make a determination whether the subject property shall be served with recycled water. Based upon such determination, the application for the permit shall be accepted and processed subject to Section 5.3.

5.3 RECYCLED WATER PERMIT PROCESS: Upon a final determination by the _____ that a property shall be served with recycled water, or adoption of a condition of development approval [or water service (Water districts only)] requiring use or accommodation of the use of recycled water, the water customer, owner or applicant shall obtain a recycled water permit.

5.3.1 PERMIT CONDITIONS. The permit shall specify the design and operational requirements for the applicant's water distribution facilities and schedule for compliance, based on the rules and regulations adopted pursuant to Section 4.2 and shall require compliance with both the California Department of Health Services Wastewater Recycling Criteria (see California Code of Administrative Regulations, Title 22), and requirements of the Regional Water Quality Control Board.

5.3.2 PLAN APPROVAL. Plans for the recycled and non recycled water distribution systems for the parcel shall be reviewed by the _____ and a field inspection conducted before the permit is granted.

5.3.3 PERMIT ISSUANCE. Upon approval of plans the permit shall be issued. Recycled water shall not be supplied to a property until inspection by the _____ determines that the applicant is in compliance with the permit conditions. Recycled water service shall not commence within the designated Recycled Water Use Area in any service area of a private utility, as defined in Section 1502 of the Public Utilities Code, or to any service area of a public agency retail water supplier that is not a city, county or city and county, except in accordance with a written agreement between the recycled water producer and the private utility or public agency retail water supplier.

5.4 TEMPORARY USE OF POTABLE WATER:

At the discretion of the _____, potable water may be made available on a temporary basis, until recycled water is available. Before the applicant receives temporary potable water, a water recycling permit, as described in Section 5.3, must be obtained for new on-site distribution facilities. Prior to commencement of recycled 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 recycled water permit and current requirements for service. Upon verification of

compliance, recycled 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.

5.5 RECYCLED WATER RATE: The rate charged for recycled water shall be established by resolution of the _____.

SECTION 6. SANCTIONS

6.1 PUBLIC NUISANCE: Discharge of wastes or the use of recycled water in any manner in violation of this ordinance or of any permit issued hereunder is hereby declared a public nuisance and shall be corrected or abated as directed by _____. Any person creating such a public nuisance is guilty of a misdemeanor.

6.2 INJUNCTION: Whenever a discharge of wastes or use of recycled water is in violation of this ordinance or otherwise causes or threatens to cause a condition of nuisance, the _____ may seek injunctive relief as may be appropriate to enjoin such discharge or use.

6.3 PERMIT REVOCATION: In addition to any other statute or rule authorizing termination of water service, the _____ may revoke a permit issued hereunder if a violation of any provision of this ordinance is found to exist or if a discharge of wastes or use of recycled water causes or threatens to cause a nuisance.

6.4 PENALTY: Any owner and/or operator who violates this ordinance shall, for each day of violation, or portion thereof, be subject to a fine not exceeding \$1,000. In addition, water service to the property may be discontinued.

SECTION 7. VALIDITY

If any provision of this ordinance or the application thereof to any person or circumstance is held invalid, the remainder of the ordinance and the application of such provisions to other persons or circumstances shall not be affected thereby.

Appendix C DHS Recognized Technologies for Water Recycling Treatment

DEPARTMENT OF HEALTH SERVICES

DIVISION OF DRINKING WATER AND ENVIRONMENTAL MANAGEMENT

TECHNICAL OPERATIONS SECTION

RECYCLED WATER UNIT

1180 Eugenia Place, Suite 200

CARPINTERIA, CALIFORNIA 93013

(805) 566-1326

FAX (805) 745-8196



**STATE OF CALIFORNIA
DIVISION OF DRINKING WATER
AND
ENVIRONMENTAL MANAGEMENT**

**TREATMENT TECHNOLOGY REPORT
FOR
RECYCLED WATER**

June 2003

This document has been developed to serve as a reference source for those seeking information concerning technologies that have been recognized by the California State Department of Health Services (CDHS) as being acceptable for compliance with treatment requirements of the California Recycled Water Criteria. This is a “living” document that will be updated periodically as needed. Readers who find errors or omissions should contact Jeff Stone of the SDHS Recycled Water Unit at jstone1@dhs.ca.gov.

STATE OF CALIFORNIA
DEPARTMENT OF HEALTH SERVICES
DIVISION OF DRINKING WATER
AND
ENVIRONMENTAL MANAGEMENT

TREATMENT TECHNOLOGY REPORT FOR RECYCLED WATER

June 2003

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5. APPENDIX

'A' - California Department of Health Services Requirements
for Demonstration of Reduction of Virus and Bacteria
by Filtration and Disinfection

**State of California
Department of Health Services
Division of Drinking Water**

Treatment Technology Report for Recycled Water

June 2003

1. INTRODUCTION

The purpose of this document is to provide general reference information concerning those treatment technologies that are being utilized for meeting the filtration performance and disinfection requirements for compliance with the California Recycled Water Criteria (Title 22, et. seq.). The information contained herein was generated from a review of files and correspondence of the California State Department of Health Services (CDHS), and discussions with Field Operations Branch District Staff, SWRCB Staff, industry representatives and manufacturers. All referenced reports, letters and other documents are on file with the Department's Recycled Water Unit. This reference document may not reflect all treatment technologies in place in California, but will be updated as additional information is obtained.

The California Water Recycling Criteria (adopted December 2000) define Disinfected Tertiary Recycled Water as a wastewater, which has been oxidized and meets the following:

- A. Has been coagulated* and passed through natural undisturbed soils or a bed of filter media pursuant to the following:
 - 1. At a rate that does not exceed 5 GPM/ft² in mono, dual or mixed media gravity or pressure filtration systems, or does not exceed 2 GPM/ft² in traveling bridge automatic backwash filters; and
 - 2. The turbidity does not exceed any of the following; a daily average of 2 NTU, 5 NTU more than 5% of the time within a 24-hour period, and 10 NTU at any time.

*Note: Coagulation may be waived if the filter effluent does not exceed 2 NTU, the filter influent is continuously measured, the filter influent turbidity does not exceed 5 NTU, and automatically activated chemical addition or diversion facilities are provided in the event filter effluent turbidity exceeds 5 NTU.

OR

- B. Has been passed through a micro., nano., or R.O. membrane following which the turbidity does not exceed any of the following: 0.2 NTU more than 5% of the time within a 24-hour period and 0.5 NTU at any time.

AND

- C. Has been disinfected by either:
1. A chlorine disinfection process that provides a CT of 450 mg-min/l with a modal contact time of not less than 90 minutes based on peak dry weather flow, or
 2. A disinfection process that, when combined with filtration, has been demonstrated to achieve 5-log inactivation of virus.

2. GENERAL GUIDANCE

The following guidance is consistent with the Water Recycling Criteria and will serve as the basis for CDHS review and acceptance of treatment technologies for compliance with the filtration and disinfection requirements of the Criteria.

FILTRATION

Filters meeting the definition of "filtered wastewater" under Section 60301.320 (a&b) and those demonstrating equivalency under Section 60320.5 ("Other Methods of Treatment") outlined in the Water Recycling Criteria are allowed the option of either disinfection approach outlined in Section 60301.230 without additional restrictions or requirements.

The Department considers a properly filtered and disinfected recycled water meeting the turbidity performance and coliform requirements outlined in the criteria to be essentially pathogen free. As noted by Asano et al.⁽¹⁾, "To achieve efficient virus removal or inactivation in tertiary treatment, two major criteria must be met: 1) the effluent must be low in suspended solids and turbidity prior to disinfection to prevent shielding of viruses and chlorine demand, and 2) sufficient disinfectant must be applied to the wastewater." Treatment requirements determined necessary to meet the disinfected tertiary - 2.2 criteria outlined in the Criteria include media filtration to reduce turbidity to less than a daily average of 2 NTU or membrane filtration to reduce turbidity to less than a daily average of 0.2 NTU, and disinfection to ensure a minimum CT of 450 milligram-minutes per liter at all times. This treatment

scheme is intended to remove solids (including some pathogens) and properly prepare the water for effective disinfection in order to achieve an approximately five-log reduction of virus.

However, with respect to many existing technologies, there has yet to be a demonstrated correlation between turbidity and pathogen concentration. The current turbidity performance standards for media and membrane filtration are based on achievable turbidity performance and do not assure any specific minimum level of pathogen removal. This is a recognized issue in the regulations that needs to be addressed by the Department and the water recycling industry.

Since the Pomona Virus Study⁽²⁾, biological treatment has introduced additional variables into the picture, as the type of biological treatment can impact the particle size distribution and downstream filter and disinfection performance. However, the integration of these processes, into a process train, are not well understood at this time and must be addressed by industry and regulators. Nevertheless, it remains the intent of the Department to produce an essentially pathogen free effluent by maintaining a 5-log virus removal/inactivation barrier through filtration and disinfection.

Additional information concerning treatment technologies may be found in Appendix A (California Department of Health Services-Reduction of Virus and Bacteria by Filtration and Disinfection, October 2001).

It must be recognized that the Title 22 filtration performance requirements, as outlined under Section 60301.320, must be reliably met by all filtration technologies. It is suggested that recycled water producers develop and implement plant performance optimization plans and make a reasonable effort to minimize effluent turbidity levels. Furthermore, all treatment facilities should be operated in accordance with the manufacturer's recommendations and specific conditions of approval developed by CDHS.

1. Asano, T.; Tchobanoglous, G.; and Cooper, R.C (1984), "Significance of Coagulation-Flocculation and Filtration Operations in Wastewater Reclamation and reuse", in Symposium Proceedings, The Future of Water Reuse, Water Reuse Symposium III, San Diego, California, August 26-31, 1984. American Waterworks Association Research Foundation.

2. County Sanitation Districts of Los Angeles County (1977), "Pomona Virus Study, Final Report", Prepared for Calif. State Water Resources Control Board, Sacramento, Calif., and USEPA, Washington, D.C

UV DISINFECTION

UV Disinfection Guidelines were published in 1993 by the National Water Research Institute (NWRI). Since that time, the field of ultraviolet disinfection has taken great strides forward. As a result of the progress made in understanding the UV disinfection process, the CDHS and the NWRI agreed that it was time to revise and update the guidelines. NWRI and the American Water Works Association Research Foundation (AWWARF) pooled their resources in order to revise the current guidelines, which now cover water recycling and drinking water UV disinfection applications. As a result of these efforts the "*Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse*" were published by NWRI/AWWARF in December 2000. CDHS endorses these Guidelines and refers to them when evaluating UV disinfection proposals. One major recommendation of the guidelines is that all UV equipment (including previously approved equipment) be tested and validated under these new guidelines before being accepted by the Department. It is believed that existing UV disinfection systems that were properly designed should comply with the elements of the revised guidelines.

The implication of the recommendations contained in the revised guidelines is that even the horizontal low-pressure low intensity UV systems must be validated before they are accepted for a UV disinfection application. Previously accepted UV technologies that were considered to be nonconforming under the 1993 guidelines will also have to be retested using the recommended testing procedure. The UV technologies listed herein include a note indicating whether compliance with the December 2000 guidelines has been demonstrated by the manufacturer.

Agencies that are in the stages of planning or early design have the most flexibility and should be able to require completion of UV validation testing before they accept delivery of the UV equipment. Therefore, the agency can plan and begin the design work around a given UV system, but not allow delivery of equipment until validation testing is completed. This will allow comparison of the UV reactor design to the validation test results in order to ensure adequate sizing and performance of the UV system. This could be done as part of design review process, i.e., while the design is not yet complete.

If the design process has been completed and the contract for equipment has been signed, there will be fewer recourses for the utility. However, the utility can require a demonstration of

performance or performance guarantee on the equipment for their own protection.

It is important to note that these are only "guidelines" and are therefore not limiting with respect to alternative approaches a manufacturer or project proponent may propose for consideration on a case-by-case basis. It is possible however that future regulations may be based on these guidelines.

(Continued on next page)

3. FILTRATION TECHNOLOGIES

Granular Media Type Filters

The following technologies have demonstrated their ability to meet the performance objectives of Title 22. The "STATUS" designation gives an indication as to which technologies have been given formal Departmental recognition. For projects proposing a technology which is not listed herein or whose "STATUS" is unknown, a review of the proposal should be conducted by the Recycled Water Unit prior to acceptance.

Dynasand

Status--Accepted

Parkson Corporation

2727 N.W. 62nd Street
Fort Lauderdale, Florida 33340-8399
(305) 974-6610

Description: Upflow deep bed continuous backwash

Media configuration:

Media Depth (inches)	Effective Size (mm)	Uniformity Coefficient
sand: 40	1.30	1.50

Acceptance / Reference:

- Listed in the CDHS Direct Filtration Guidelines (1988)
- Conditional acceptance letter dated 12/1/86 from CDHS
- Conditions of acceptance include: 1) media design specs. as noted above, 2) complete recycling of filter medium every three to four hours.
- Letter dated 4/23/97 from the San Francisco District Office to the Sewerage Agency of South Marin
- Memo dated 7/18/97 from Mike Finn (CDHS) re: two performance studies (S.F. Bureau of water Pollution Control and Sewerage Agency of South Marin)

Comments: Classified as direct filtration.

Installations: Sewerage Agency of Southern Marin (Evaluation outlined in a Pilot Test Final Report for the Agency dated June 1989); San Francisco-Bureau of Water Pollution Control has a pilot unit at the Oceanside WWTP, and others.

WATERLINK SuperSand
Waterlink Separations, Inc.
29850 N. Skokie Hwy. (U.S. 41)
Lake Bluff, Illinois 60044-1192
(847) 473-3700

Status--Accepted

Description: Upflow deep bed continuous backwash

Media configuration:

Media Depth (inches)	Effective Size (mm)	Uniformity Coefficient
sand: 40	1.30	1.50

Acceptance / Reference:

-Conditional acceptance letter dated 1/14/2000 from CDHS.
-Conditions of acceptance include: 1) media design specs.
as noted above, 2) complete recycling of filter medium
every three to four hours.

-Note: Waterlink holds the patents for the design of the
filter approved as the "DynaSand" marketed by Parkson Corp.
under licensing agreements. Master file contains all
documentation.

Comments: Classified as direct filtration.

Installations: Proposed for Delta Diablo Sanitation District
(Pittsburg, CA), Coachella Valley and Escondido.

WESTECH TECHNASAND
Westech Engineering, Inc.
3625 South West Temple
Salt Lake City, Utah 84119-0068
(801) 265-1000

Status--Accepted

Description: Upflow deep bed continuous backwash

Media configuration:

Media Depth (inches)	Effective Size (mm)	Uniformity Coefficient
sand: 40	1.30	1.50

Acceptance / Reference:

- Conditional acceptance letter dated 4/5/2002 from CDHS.
- Conditions of acceptance include: 1) media design specs. as noted above, 2) complete recycling of filter medium every three to four hours.

-Note: Mftr. has indicated they will warrant the Technasand Filter to meet Title 22 filtration requirements. Same principle as the Parkson Dynasand. Master file contains all documentation.

Comments: Classified as direct filtration.

Installations: Proposed for Carmel Valley Ranch.

Hydro-Clear
U.S. Filter
Zimpro Environmental, Inc.
 301 W. Military Rd.
 Rothschild, WI 54474
 (715) 359-7211

Status--Accepted

Description: Shallow pulsed bed filter

Media configuration:

Media Depth (inches)	Effective Size (mm)	Uniformity Coefficient
sand: 10-12	0.45	1.50

Acceptance / Reference:

- Listed in the CDHS Direct Filtration Guidelines (1988)
- Conditional acceptance letter dated 11/17/81 from CDHS.
- Conditions of acceptance include: 1) minimum bed depth of 10-inches of sand with E.S. of 45 mm, 4) at least 6 minutes between pulses and no more than 25 pulses per filter run.
- U.C. Davis Evaluation Report; "Evaluation of the Pulsed-Bed Filter For Wastewater Reclamation in California", 1981.

Comments: Classified as direct filtration

Installations: Moulton Niguel WD, San Luis Obispo, San Clemente, Rancho Murrieta, Fallbrook, and others.

Infilco-Degremont, Inc.
Automatic Backwash (ABW)
P. O. Box 71390
Richmond, Va 23255-1390
(804) 756-7697

Status--Accepted

Description: shallow bed, traveling bridge

Media configuration:

Media Depth (inches)	Effective Size (mm)	Uniformity Coefficient
sand: 11	0.55	1.50

Acceptance / Reference:

- Listed in the CDHS Direct Filtration Guidelines (1988)
- U.C. Davis Evaluation Report; "Evaluation of the Enelco ABW Automatic Backwash Filter For Wastewater Reclamation in California", dated November 1988.

Comments: Loading rate limited to 2 gpm/ft²; Max. influent turbidity <10 NTU.

Installations: Sacramento County, Sepulveda Water Reclamation, Folsom WWTP, Victor Valley WWRP, LA City-Tillman WRP, Shasta Lake WWTP, and others.

Aqua-Aerobic Systems, Inc.
Automatic backwash filter (AquaABF)
P.O. Box 2026
6306 N. Alpine Road
Rockford, IL 61111
(815) 654-2501

Status--Accepted

Description: Shallow bed traveling bridge

Media configuration:

Media Depth (inches)	Effective Size (mm)	Uniformity Coefficient
sand: 11	0.55	1.50

Acceptance / Reference:

- Listed in the CDHS Direct Filtration Guidelines (1988)

-U.C. Davis Evaluation Report entitled "Evaluation of the Aqua-Aerobic Automatic Backwash Filter For Wastewater Reclamation in California" dated July 1986.

Comments: Loading rate limited to 2 gpm/ft²; Max. influent turbidity <10 NTU.

Installations: None known

Tetra Technologies, Inc. **Status--Accepted**

Tetra-Denit.

1628 Tiburon Blvd.
Tiburon, CA 94920
(1-800-364-4617)

Description: Tetra Deep Bed-Denitrification Filters

Media configuration:

Media Depth (inches)	Effective Size (mm)	Uniformity Coefficient
Silica sand: 48-72	2.2	1.35

Acceptance / Reference:

- Conditional acceptance letter signed by M. Kiado (CDHS)
re: LADWP dated 3/17/92
- Letter dated 10/6/97 from Parsons Engineering Science
regarding LA-Glendale Water Reclamation Plant pilot study.

Comments: Mono-media granular sand; 4-6 foot depth; intended for direct filtration with chemical addition.

Installations: City of Los Angeles (Glendale WWTP), Lake Arrowhead CSD, Padre Dam MWD, Scotts Valley WD.

Centra-flo

Applied Process Technology

Status--Accepted

35 Wellington Lane
Conroe, Texas 77304
(409) 539-4099

Description: Centra-flo Gravity Sand Filter
Downflow Continuous Wash Filter

Media configuration:

Media Depth (inches)	Effective Size (mm) (graded)	Uniformity Coefficient
sand: 40	0.5 - 3.0	1.50

Acceptance: CDHS letter dated January 6, 1999 for landscape irrigation

Comments: Pilot testing conducted at Union Sanitary District's Alvarado WWTP (1994); loading rate up to 4.4 GPM/ft².

Installations: Tejon Ranch Development '99 (I-5 @ Tejon Pass)

Fluidsand

Fluidyne Corporation

Status--Accepted

2816 West First Street
Cedar Falls, IA 50613
(319) 266-9967

Description: Fluidyne Fluidsand Filter
Upflow Continuous Backwash Filter

Media configuration:

Media Depth (inches)	Effective Size (mm) (graded)	Uniformity Coefficient
silica sand: 40	0.8 - 1.0	1.6

Acceptance / Reference:

- Conditional acceptance letter dated 5/03/2000 from CDHS.
- Conditions of acceptance include: 1) media design specs. as noted above, 2) complete recycling of filter medium every three to four hours.
- Engineering Report dated June 9, 1997 submitted by Questa Engng. for the Canada Woods Reclamation Facility.

Comments: Classified as direct filtration. Designed for waters containing TSS up to 20 mg/l (per manufacturer); Performance data submitted by the manufacturer demonstrates this technology's ability to comply with the turbidity performance standards. Design and operation conceptually similar to Dynasand.

Installations: Tenaya Lodge located in Fish Camp (Evaluated in a "facilities Review" report by Carollo Engineers dated September 1990). Canada Woods Development ('99) in the Monterey area (without SDHS approval). Castanoa Ranch ('99) in San Mateo County.

Hydrasand

Status--Accepted

Andritz Ruthner, Inc.

1010 Commercial Blvd. So.
Arlington, Texas 76017
(817) 465-5611

Description: Upflow, continuous wash filter

Acceptance / References:

- Conditional acceptance letter dated June 23, 2000 from CDHS.
- Conditions of acceptance include: 1) media design specs. as noted above, 2) complete recycling of filter medium every three to four hours.
- Report available entitled "Microbial Assessment of the Lanai Auxiliary Reclamation Facility to Produce Wastewater Effluent for Unrestricted, Non-potable Reuse" dated October 1998.

Comments: Mftr. has indicated they will warrant the Hydrasand Filter to meet Title 22 requirements. Same principle as the Parkson DynaSand.

Installations: None in California (proposed for City of Corona), installed in Trumansburg NY and Lanai City, HI.

Volcano

Status--NOT YET ACCEPTED

Description: Continuous wash downflow sand filter

Acceptance / References:

- Documentation of CDHS approval does not exist. The Recycled Water Unit has no technical data on this process.

Comments: Future proposals for use of this filtration technology will require an acceptability assessment prior to approval.

Installations: Boulder Creek G.C. (Santa Cruz County), Sierra Heights WWTP (Santa Clarita), Carmel Valley WWTP, Shelter Cove (Humbolt)

Other Media Type Filters

Fuzzy Filter

Schreiber LLC

Status--Accepted

100 Schreiber Drive
Trussville, Alabama 35173

Description: "Fuzzy Filter"-compressible plastic filter media
Upflow design

Media configuration:

	Media Depth (inches)	Effective Size (mm)	Uniformity Coefficient
Synthetic: Plastic	30 (variable)	(1.25")	1.50

Media is quasi spherical, highly porous and compressible

Acceptance / Reference:

-Conditional acceptance letter date February 24, 2003 from CDHS.

-Conditions of acceptance include: 1) media design specs. as noted above, 2) filtration rate not to exceed 30 gpm/ft², 3) all Title 22 installations shall have design changes as outlined by Schreiber in correspondence dated January 21, 2003 (i.e. - backwash with filtered water, wash outlet below filtered outlet, valving position alarms), 4) individual operations plans shall include recommended operational configurations (i.e. percent compression and loading rate) based on secondary quality.

-Evaluated by U.C. Davis (Report dated September 1996)

Comments: Evaluated at loading rates up to 30 GPM/ft²; media configuration/porosity/depth varies based on percent compression; water passes through media rather than around media.

Installations: City of Yountville

Membrane Technologies

ZENON

Zenon Environmental Services, Inc.

3239 Dundas Street West
Oakville, Ontario L6M 4B2
(905) 465-3030

Cycle-Let (Thetford)

Status--Accepted

Description: Membrane ("Ultra") filtration (originally marketed as Thetford Cycle-Let); complete package unit including pretreatment, biological oxidation, membrane ultra-filtration, GAC and U.V.

Acceptance / References:

- CDHS acceptance memorandum to LARWQCB dated November 12, 1993 regarding the Water Gardens Project.
- Report entitled "Evaluation of the Thetford Cycle-Let Reclamation System's Ability to Meet Title 22, prepared by Engineering-Science, dated August 1991.
- Report entitled "Thetford Systems Inc. Cycle-Let Wastewater Treatment and Recycling System - Water Garden Project, Santa Monica, CA" dated July 1993 prepared by CDM

Comments: Membrane approved has average pore size of .005 micron.

Installations: "Water Gardens" (Santa Monica), Sony Music Campus (Santa Monica).

ZeeWeed / Zenogem

Status--Accepted

Description: Variant of the Cycle-Let, OCP Bio-reactor / Microfiltration process

Acceptance / References:

- Conditional acceptance letter from CDHS dated August 12, 1999
- Draft Final Report "California DHS Certification Testing-for Zenon (ZeeWeed) Membrane" prepared by Montgomery Watson (1/8/99).

Comments: Approval based on use of the "OCP" membranes only. Conditions of approval include: membrane integrity tests required; max. flux of 49.8 GFD.

Installations: Unknown

ZeeWeed 1000 UF

Status--Accepted

Description: Submerged Hollow Fiber Ultrafiltration Membrane

Acceptance / References:

- Conditional acceptance letter from CDHS for T-22 compliance dated October 12, 2001
- Report entitled "California Department of Health Services Certification Testing For Zenon ZeeWeed 1000 Membrane", prepared by Montgomery Watson (June 2001). This report was prepared for demonstrating compliance with the California Surface Water Treatment Rule.

Comments: Approval based on use of the hollow fiber polymer "ZeeWeed 1000 UF Membrane" with a 0.02 micron nominal pore size. Conditions of approval include: max. flux of 30 GFD; max. TMP of -10 psi; membrane integrity tests required.

Installations: Unknown

U. S. Filter / MEMCOR

STATUS--Accepted

4116 Sorrento Valley Blvd.
San Diego, CA 92121
(619) 445-0578

Memcor Continuous Microfiltration (CMF)

Description: 0.2 micron *Polypropylene* Hollow Fiber Micro-Filtration - Pressure Filtration

Acceptance / References:

- Conditional acceptance letter from CDHS dated 1/10/2000
- Approved under the SWTR using 0.2 micron membrane.

Comments: Flux rate not to exceed 0.5 gpm/m², transmembrane pressure not to exceed 18 PSI, membrane integrity tests required.

Installations: West Basin MWD, Orange County Water District,
City of Livermore, Dublin/San Ramon SD

Memcor Continuous Microfiltration (CMF)

Description: 0.1 micron Polyvinylidene Fluoride (PVDF) Hollow
Fiber Micro-Filtration - Pressure Filtration

Acceptance / References:

- Conditional acceptance letter from CDHS dated 1/10/2000
- Approved under the SWTR using 0.2 micron membrane.

Comments: Flux rate not to exceed 0.5 gpm/m², transmembrane
pressure not to exceed 18 PSI, membrane integrity tests
required.

Installations: West Basin MWD, Orange County Water District,
City of Livermore, Dublin/San Ramon SD

Memcor Continuous Microfiltration Submerged (CMF-S)

Description: 0.2 micron Polypropylene Hollow Fiber Micro-
Filtration - Submerged/Vacuum Filtration

Acceptance / References:

- Conditional acceptance letter from CDHS dated 1/10/2000

Comments: Flux rate not to exceed 0.5 gpm/m², transmembrane
pressure not to exceed 18 PSI, membrane integrity tests
required.

Installations: Unknown

Memcor Continuous Microfiltration Submerged (CMF-S)

Description: 0.1 micron Polyvinylidene Fluoride (PVDF) Hollow
Fiber Micro-Filtration - Submerged/Vacuum
Filtration

Acceptance / References:

-Conditional acceptance letter from CDHS dated 1/10/2000

Comments: Flux rate not to exceed 0.5 gpm/m², transmembrane pressure not to exceed 18 PSI, membrane integrity tests required.

Installations: Unknown

U. S. Filter/Jet Tech Products-Memjet™ **STATUS--Accepted**

1051 Blake
Edwardsville, KS 66111

Description: 0.1 micron Polyvinylidene Fluoride (PVDF) Hollow
Fiber Micro-Filtration - SBR/Vacuum Filtration

Acceptance / References:

-Conditional acceptance letter from CDHS dated 10/7/2002

Comments: Flux rate not to exceed 25 gfd, transmembrane pressure not to exceed 7.2 PSI, membrane integrity tests required.

Installations: Unknown

PALL Corporation **STATUS -- Accepted**

25 Harbor Park Drive
Port Washington, NY 11050 USA
(516) 484-3600

Description: PVDF Hollow Fiber Microza Microfiltration
0.1 micron (P/N XUSV-5203)

Acceptance / References:

- Conditional acceptance letter from CDHS dated 1/10/2000
- Approved for compliance under the SWTR base on report entitled "California Department of Health Services Certification Testing for Pall (Microza) Microfiltration Membrane" prepared by Montgomery-Watson (July 1999).
- Performance study conducted at OCWD Water Factory 21 (SLS Report 7725) "Long-Term Testing of Pall Microza 0.1 um MF System on Secondary Effluent at Water Factory 21, Fountain Valley, CA" (September 23, 1998).

Comments: Flux rate not to exceed 32 GFD, transmembrane pressure not to exceed 25 PSI, membrane integrity tests required.

Installations: Unknown

MITSUBISHI

Mitsubishi International Corp.

STATUS -- Accepted

333 South Hope Street West, Suite 2500
Los Angeles, CA 90071

Description: Mitsubishi Membrane Bioreactor (MBR)
Sterapore HF 0.4 micron hollow fiber polyethylene

Acceptance / References:

- Conditional acceptance letter from CDHS dated April 23, 2001
- Report entitled "Assessing the Ability of Membrane Bioreactor to Meet Existing Water Reuse Criteria (Mitsubishi Rayon Co., Ltd.)" prepared by Montgomery-Watson (March 2001).

Comments: Flux rate not to exceed 13 GFD; max. operating pressure of -5.8 psi; membrane integrity tests required.

Installations: Unknown

KUBOTA

STATUS -- Accepted

Description: Kubota Membrane Bioreactor (MBR); Type 510 0.4 micron chlorinated polyethylene flat sheet membrane

Acceptance / References:

- Conditional acceptance letter from CDHS dated March 18, 2003
- Report entitled "Assessing the Ability of the Kubota Membrane Bioreactor to Meet Existing Water Reuse Criteria" prepared by Montgomery-Watson-Harza (February 2003).

Comments: Flux rate not to exceed 20 GFD; max. operating vacuum pressure of <3.0 psi; membrane integrity tests required; turbidity performance limited to Section 60301.320 (b) of the Water Recycling Criteria.

Installations: Unknown

Cloth Filter Technologies

AQUA AEROBIC Systems, Inc.

Status--Accepted

6306 N. Alpine Rd.
Rockford, IL 61130-0026
(815) 654-2501

Description: **Submerged Cloth-Media Rotating Disk Filter
(Utilizing the 102 needle felt fabric)**

Acceptance / References:

- Conditional acceptance letter from CDHS dated June 29, 2001
- Report entitled "Evaluation of the Aqua-Aerobic Systems Cloth-Media Disk Filter (CMDF) for Wastewater Recycling Applications in California" prepared by UC Davis (March 2001).
- Report entitled "Evaluation of Aqua-Aerobics Systems AquaDisk Filter Technology at Orange County Water District, Fountain Valley, California" (February 25, 2000).

Comments: Utilizes the "102 needle felt fabric", operates under vacuum. Conditions of acceptance: loading rate not to exceed 6 gpm/ft²; technology must be complimented with a disinfection process capable of achieving 5-log virus inactivation in accordance with Section 60301.230 (T-22); acceptance limited to the random woven NF-102 needle felt cloth media having openings ranging from 10 to 30 microns and a thickness of 3.8 mm; influent turbidity not exceed 10 NTU more than 5-percent of the time within a 24-hour period; Operations plan shall specify minimum FTW cycle following high pressure wash based on displacement of two filtrate volumes and effluent turbidity below 2 NTU; scheduled inspections of cloth conditions; ensure adequate sludge wasting; Turbidity performance limited to Section 60301.320(a) of the Water Recycling Criteria.

Installations: None known

Description: **Submerged Cloth-Media Rotating Disk Filter
(Utilizing the PA-13 nylon pile fabric)**

Acceptance / References:

- Conditional acceptance letter from CDHS dated May 6, 2002)

-Report entitled "Use of PA-13 Pile Fabric, Supplement to: Evaluation of the Aqua-Aerobic Systems Cloth-Media Disk Filter (CMDf) for Wastewater Recycling Applications in California" prepared by UC Davis (February 2002).

Comments: Utilizes the "PA-13 nylon pile fabric", operates under vacuum. Conditions of acceptance: loading rate not to exceed 6 gpm/ft²; technology must be complimented with a disinfection process capable of achieving 5-log virus inactivation in accordance with Section 60301.230 (T-22); acceptance limited to the PA-13 nylon pile fabric (as tested); influent turbidity not exceed 10 NTU more than 5-percent of the time within a 24-hour period; scheduled inspections of cloth conditions; ensure adequate sludge wasting; turbidity performance limited to Section 60301.320(a) of the Water Recycling Criteria.

Installations: None known

4. DISINFECTION TECHNOLOGIES

Gaseous chlorine or hypochlorite is the most commonly used disinfectant, however alternative technologies are recognized as being acceptable. On-site chlorine generators are also available for industry use.

ULTRAVIOLET

Trojan Technologies, Inc.

3020 Gore Rd.
London, Ontario Canada N5V 4T7

Description: UV 4000 (Medium Pressure) **Status—Accepted***
 UV 3000 (Low Pressure/Low Intensity) " ******

Acceptance/References:

- Conditional acceptance letter from CDHS dated September 8, 1995 for UV4000.
- "Trojan System UV4000 UV Disinfection Pilot Study. Riverside, California", May 1995
- "Equivalency of the Trojan System UV4000 and System UV3000 in Meeting California Wastewater Reclamation Criteria at Pacifica, California", June 1994
- "Technical Review: Ultraviolet Disinfection of Wastewater to California Wastewater Reclamation Criteria (Title 22,

Division 4, Chapter 3, of the California Code of Regulations) Using Trojan Technologies' System UV4000 (High Intensity UV Lamp Technology", August 1995.

Comments: Acceptance for the UV4000 conditioned on 1) continuous monitoring/recording of filter effluent turbidity (pre UV), daily coliform monitoring (disinfected effluent) and 3) provide UV dose of at least 100 mW-sec/cm² under worst operating conditions at peak daily instantaneous flow with a minimum of three banks in operation and a UV dose of at least 140 mW-sec/cm² with a minimum of four banks in operation, subject to all of the conditions indicated in the NWRI Guidelines.

Installations: City of Pacifica, City of Vallejo, Central Contra Costa S.D., City of Corona, City of San Diego (South Bay WRF), Western Riverside WRF, Olivenhain WD, City of Santa Rosa

***Acceptance granted under the outdated 1993 NWRI Guidelines. Compliance with the NWRI/AWWARF Guidelines has not been demonstrated**

****Acceptance granted under the December 2000 NWRI/AWWARF Guidelines.**

PCI-Wedeco Environmental Technologies, Inc. Status-Accepted*
One Fairfield Crescent
West Caldwell, NJ 07006

-Specktrotherm 33-TAK UV

Description: (Low pressure/High Intensity)

Acceptance/References

-Conditional acceptance letter dated 3-31-98 from CDHS and follow-up letter dated 5/21/99 transferring approval from Aquafine to Wedeco).

-Tested at OCWD as the AWES-Spectrotherm TAK UV System

Comments: Currently marketed as the PCI-Wedeco Spectrotherm 33 TAK UV System. Requires UV dose of 160 mWs/cm² at max. week flow, 120 mWs/cm² at peak flow (max. day), and an average of \geq 160 mWs/cm² and conform to NWRI Guidelines.

Installations: Leucadia CWD(proposed)

***Acceptance granted under the outdated 1993 NWRI Guidelines. Compliance with the NWRI/AWWARF Guidelines has not been demonstrated**

Wedeco - Ideal Horizons LCI-20L

Status-Accepted*

Description: (Low pressure/High Intensity)
Model LCI-20L

Acceptance/ References

- Conditional acceptance letter from CDHS dated 2-23-99 for Tejon Ranch.
- Report entitled "Ultraviolet Dose Bioassay of the Ideal Horizons Horizontal Lamp Disinfection System" by HydroQual, Inc. (September 1998).

Comments:

Installations: Tejon Ranch Development (I-5 @ Tejon Pass)

***Acceptance granted under the outdated 1993 NWRI Guidelines. Compliance with the NWRI/AWWARF Guidelines has not been demonstrated**

Wedeco - Ideal Horizons TAK 55

Status-Accepted**

Description: (Low pressure/High Intensity/open channel)
TAK 55

Acceptance/References

- Conditional acceptance letter dated 12-4-01 from CDHS.
- Report entitled "Wedeco-Ideal Horizons Low-Pressure, High Intensity Ultraviolet Disinfection System Pilot Study at Orange County Water District" by CH2M Hill (November 2000)

Comments:

Installations: Unknown

****Acceptance granted under the December 2000 NWRI/AWWARF Guidelines.**

Aquionics
Aquionics, Inc.

Status-Accepted*

21 Kenton Lands Rd.
Erlanger, Ky 41018

Description: (Medium Pressure/In-line)

Acceptance/Reference:

- Conditional acceptance letter dated 2-28-00 from CDHS.
- CH2M Hill, "Aquionics Medium Pressure, High-Intensity Ultraviolet Disinfection System Pilot Study at Orange County Water District" by CH2M Hill (May 1999)

Comments:

Installations: Unknown

***Acceptance granted under the outdated 1993 NWRI Guidelines. Compliance with the NWRI/AWWARF Guidelines has not been demonstrated**

Service Systems International, Ltd.

Status-Accepted*

2800 Ingleton Avenue
Burnaby, B.C. Canada, V5C 6G7

ULTRAGUARD UV System

Description: (Open Channel/Low Pressure/High Intensity/vert. lamp)

Acceptance/Reference:

- Conditional acceptance letter dated 2-1-00 from CDHS.
- Report: Chen, C. L.; El Jacj, Z; Kuo, J., UV Inactivation of Bacteria and Coliphages in Tertiary Effluent Using Low-Pressure High-Intensity Lamps, November 18, 1999, County Sanitation Districts of Los Angeles County.

Comments:

Installations: Unknown

***Acceptance granted under the outdated 1993 NWRI Guidelines. Compliance with the NWRI/AWWARF Guidelines has not been demonstrated**

Aquaray

Ondeo-Degremont

2924 Emerywood Parkway
P.O. Box 71390
Richmond, VA 23255-1390

Aquaray 40 VLS

Status-Accepted**

Description: Vertical lamp/low Pressure/low intensity

Acceptance: Conditional acceptance letter dated 10/24/97 from CDHS

Comments: Evaluation memo dated 4/30/97 from SDHS concerning transmittance restriction be set at >55%.

Installations: Scotts Valley, Town of Windsor, Dublin/San Ramon CSD

****Acceptance granted under the December 2000 NWRI/AWWARF Guidelines.**

UltraTech Systems

15 Kay Fries Drive
Stoneypoint, NY 10980

Terminator

Status-Accepted*

Description: Vertical/Low Pressure/Low Intensity

Acceptance/References

-Conditional acceptance letter dated October 23, 2000 from CDHS

-Report entitled "Ultraviolet Dose Bioassay of the Ultratech Systems Vertical Lamp Disinfection System (65% Transmittance)" by HydroQual, Inc. (February 2000).

Comments:

Installations: Unknown

***Acceptance granted under the outdated 1993 NWRI Guidelines.
Compliance with the NWRI/AWWARF Guidelines has not been
demonstrated**

See Appendix A

Alt. Tech. disk - Recycle water Technology listing3-03.doc

APPENDIX A

Recognized Filtration and Disinfection Technologies for Recycled Water

CALIFORNIA DEPARTMENT OF HEALTH SERVICES REDUCTION OF VIRUS AND BACTERIA BY FILTRATION AND DISINFECTION (October 2001)

Title 22 of the California Code of Regulations (Recycled Water Criteria) require extensive treatment of wastewater that is to be used for irrigation of parks and playgrounds or for spray irrigation of food crops. Recycled water for such irrigation is to be oxidized, filtered, and disinfected. Section 60301.320 defines filtered wastewater and Section 60301.230 defines disinfected tertiary recycled water. Additionally, Section 60320.5 allows for "other methods of treatment" provided they are found acceptable to the Department.

Treatment equivalent to that stipulated in sections 60301.320 and 60301.230 is prescribed to greatly reduce the concentration of viable enteric viruses in wastewater. Such a reduction makes it very unlikely that a person would contaminate his hands with a virus when touching a surface wet with reclaimed water. Enteric viruses are excreted by individuals with an intestinal virus infection. They can cause incapacitating disease states in susceptible persons. Those disease states include meningitis, hepatitis, and others.

Capability of Treatment That Sections 60301.320 and 60301.230 Cite

The County Sanitation Districts of Los Angeles County (CSDLAC, 1977) determined the capability of treatment that sections 60301.320 and 60301.230 cite, to reduce the concentration of viable virus in activated sludge effluent. CSDLAC added laboratory-cultured poliovirus and 150 milligrams of alum coagulant per liter of the activated sludge effluent and passed it through pilot-scale treatment facilities comprised of a clarifier and a sand filter to meet the turbidity limits that section 60301.320 cites in the definition of filtered wastewater: turbidity shall not exceed 2 turbidity units as a daily average and shall not exceed 5 turbidity units more than five percent of the time. Filter effluent was chlorinated in a chamber with a two-hour theoretical contact period and a 90-minute actual, modal contact period.

Such treatment reduced the concentration of virus plaque-forming units to 1/100,000th of the concentration in wastewater upstream from the filter, when the chlorine residual was at least 5 milligrams per liter and at least sufficient to reduce the concentration of total coliform bacteria to less than 2 per hundred milliliters. Sections 60301.320 and 60301.230 require that disinfection shall limit the concentrations of total coliform bacteria in the effluent so that the median of consecutive daily samples does not exceed 2.2 per hundred milliliters, as determined from the bacteriological results of the last seven days for which analyses have been completed.

Equivalent Treatment By Granular Media Bed Filtration and Disinfection

Section 60320.5 of Title 22 allows the regulatory agency to accept processes other than those that Sections 60301.320 and 60301.230 cite if the applicant demonstrates to the satisfaction of DHS that the other processes will assure an equal degree of treatment. DHS deems other treatment equivalent to that cited in sections 60301.320 and 60301.230 when: (1) a proponent demonstrates that the proposed alternative treatment consistently reduces the concentration of viable virus to a level 1/100,000th of the concentration of seeded virus in influent to the filter; and (2) the proponent will provide reliability features equivalent to those that Title 22 cites, and will comply with all other applicable stipulations of Title 22.

Past demonstrations are sufficient to allow DHS to accept the combination of granular media bed filtration and disinfection of oxidized wastewater as equivalent to treatment that sections 60301.320 and 60301.230 cite, when the following four conditions are obtained:

- (1) coagulant is added when the turbidity of the oxidized wastewater (i.e. secondary effluent) exceeds 5 NTU for more than 15 minutes (or exceeds 10 NTU at any time) upstream from the filter;
- (2) the turbidity of filter effluent does not exceed a daily average of 2 NTU, 5 NTU more than 5 percent of the time, and 10 NTU at any time;
- (3) the concentration of viable total coliform bacteria in the final effluent does not exceed 2.2 per hundred milliliters as a median in samples taken in seven consecutive days, and does not exceed 23 per hundred milliliters in more than one sample in a 30-day period; and

- (4) the disinfection process complies with (a) or (b) below:
- (a) if chlorination is used it provides a CT (chlorine concentration times modal contact time) value not less than 450 milligram-minutes per liter at all times with a modal contact time at least 90 minutes at the peak daily flow rate; or
 - (b) if ultraviolet light irradiation is used, the design and operation of the UV light disinfection process complies with the stipulations of the NWRI/AWWARF document cited below under the heading References Cited.

Demonstration With Other Filtration and Disinfection Processes

The particle size distribution (PSD) of secondary sewage treatment effluent filtered by a membrane, cloth, or similar medium will differ significantly from that of effluent of a granular media bed filter, insofar as PSD affects the effectiveness of the downstream disinfection process. The term "size distribution" refers to the number of particles per milliliter in each of several specific ranges of sizes. Polycarbonate membrane laboratory filters with pore sizes of 12, 8, 5, 3, 1, and 0.1 micron can be used (Levine, et al., 1985; NCC, 1984), with minimal equipment requirements. A particle counter can be used to determine PSD for the following size ranges, in microns: 1.2 to 2, 2 to 5, 5 to 10, 10 to 20, 20 to 50, 50 to 100, 100 to 200, and larger than 200 (Stahl et al., 1994).

If a filter other than a granular media bed filter is proposed to be used and the use of reclaimed water requires equivalence with treatment that section 60301.320 or 60301.230 cites, the proponent must undertake a demonstration to show DHS what operating conditions guarantee that the filter and disinfection process will consistently reduce the concentration of virus to 1/100,000th of the virus concentration in wastewater upstream from the filter and limit the concentration of total coliform bacteria to comply with concentrations that sections 60303 and 60313(b) cite. The demonstration will involve operation of the filter and disinfection process under the following conditions:

- ° the filter receives the type of wastewater from which recycled water is proposed to be produced;
- ° the range of qualities of wastewater received by the filter includes qualities that are expected to occur when recycled water is produced, and are the most challenging to the

effectiveness of the filter and disinfection process (e.g., concentration of suspended solids is at the maximum);

- laboratory-grown viruses are added to the wastewater upstream from the filter;
- samples are taken upstream from the filter and downstream from the disinfection process for determination of numbers of plaque-forming units of virus per volume of sample;
- samples are taken of wastewater upstream and immediately downstream from the filter for determination of concentration of total suspended solids;
- turbidity of the filter effluent is continuously measured by a continuous recording turbidimeter;
- samples of disinfected effluent are taken for determination of the concentration of total coliform bacteria;
- additionally if disinfection is by chlorination, samples are taken of wastewater upstream from the filter for determination of concentration of ammonia and samples of disinfected effluent are taken for determination of concentration of chlorine residual;
- additionally if disinfection is by UV irradiation, fluid transmittance at 254 nm (% T) and flow rate of filter effluent are continuously measured and recorded;
- The greatest appropriate time between backwashes, or other actions that renew filter yield or efficacy, is determined by experiment, with turbidity of filter effluent allowed to range as high as needed for economically practicable treatment (but not to exceed 2 NTU as a daily average, 5 NTU more than 5 percent of the time, or 10 NTU at any time); and

A test run is comprised of one continuous operation between two consecutive backwashes (or other actions that renew filter yield or efficacy). A demonstration shall have at least three test runs during which the quality and/or flow rate of influent to the filter is most challenging for the disinfection process.

Qualities most challenging to UV disinfection might include high concentration of suspended solids, high turbidity and low transmittance. Qualities most challenging to chlorine disinfection might include high concentration of suspended solids, high turbidity and high chlorine demand.

If the proponent wants to propose a CT value or minimum chlorine contact time that differs from that cited above under the heading Equivalent Treatment By Granular Media Bed Filtration and Disinfection, or a UV dose that differs from what the NWRI/AWWARF Guidelines cite, the proponent shall perform as many test runs as necessary to construct a dose-response curve for virus reduction. The curve shall show the required value(s) of such parameters at which the concentration of viable viruses in the disinfected effluent is reduced to 1/100,000TH of the concentration in the influent to the filter.

During each test run, viruses shall be added to wastewater in numbers sufficient to determine whether the concentration in disinfected effluent is less than 1/100,000th of the concentration in wastewater upstream from the filter. The viruses added to wastewater upstream from the filter shall be F-specific bacteriophage MS2, polio virus, or other virus that is at least as resistant to disinfection as polio virus. F-specific bacteriophage MS2 is a strain of a specific type of virus that infects coliform bacteria that is traceable to the American Type Culture Collection (ATCC 15597B1) and is grown on lawns of E. coli (ATCC 15597). Chlorine residual in samples of chlorinated effluent taken for determination of concentrations of virus plaque-forming units and total coliform bacteria shall be neutralized with a reducing agent approved by DHS, when those samples are taken.

The proponent shall submit to DHS a proposed protocol for all work to be undertaken in the demonstration. The proponent will undertake the demonstration only pursuant to a protocol DHS has approved.

The demonstration must identify operating conditions that consistently achieve that virus reduction and compliance with the above-cited limits on the concentration of total coliform bacteria. The regulatory agency will cite those operating conditions and will stipulate that they will be maintained.

The combination of a filtration process and a separate disinfection process provides multiple barriers to limit the concentration of viable viruses somewhat when the other malfunctions. DHS will not accept filtration alone, or disinfection alone, as complying with Title 22.

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Appendix D DHS Title 22 Report Outline



**GUIDELINES FOR THE
PREPARATION OF AN ENGINEERING REPORT
FOR THE PRODUCTION, DISTRIBUTION AND USE OF RECYCLED WATER**

March 2001

(Replaces September 1997 Version)

1.0 INTRODUCTION

The current State of California Water Recycling Criteria (adopted in December 2000) require the submission of an engineering report to the California Regional Water Quality Control Board (RWQCB) and the Department of Health Services (DHS) before recycled water projects are implemented. These reports must also be amended prior to any modification to existing projects. The purpose of an engineering report is to describe the manner by which a project will comply with the Water Recycling Criteria. The Water Recycling Criteria are contained in Sections 60301 through 60355, inclusive, of the California Code of Regulations, Title 22. The Criteria prescribe:

- * Recycled water quality and wastewater treatment requirements for the various types of allowed uses,
- * Use area requirements pertaining to the actual location of use of the recycled water (including dual plumbed facilities), and
- * Reliability features required in the treatment facilities to ensure safe performance.

Section 60323 of the Water Recycling Criteria specifies that the engineering report be prepared by a properly qualified engineer, registered in California and experienced in the field of wastewater treatment.

Recycled water projects vary in complexity. Therefore, reports will vary in content, and the detail presented will depend on the scope of the proposed project and the number and nature of the agencies involved in the production, distribution, and use of the recycled water. The report should contain sufficient information

to assure the regulatory agencies that the degree and reliability of treatment is commensurate with the requirements for the proposed use, and that the distribution and use of the recycled water will not create a health hazard or nuisance.

The intent of these guidelines is to provide a framework to assist in developing a comprehensive report which addresses all necessary elements of a proposed or modified project. Such a report is necessary to allow for the required regulatory review and approval of a recycled water project.

References which may assist in addressing various project elements include:

- State of California Water Recycling Criteria (December 2000)
- State of California Regulations Relating to Cross-Connections
- California Waterworks Standards
- California Water Code
- Guidelines for the Distribution of Non-potable Water, (California-Nevada Section-AWWA, 1992)
- Guidelines For The On-Site Retrofit of Facilities Using Disinfected Tertiary Recycled Water (California-Nevada Section-AWWA, 1997)
- Manual of Cross-Connection Control/Procedures and Practices (DOHS)
- Ultraviolet Disinfection - Guidelines for Drinking Water and Water Reuse (NWRI/AWWARF, December 2000)

2.0 RECYCLED WATER PROJECT

The following sections discuss the type of information that should be presented and described in the engineering report. Some sections may be applicable only to certain types of uses.

2.1 General

The report shall identify all agencies or entities that will be involved in the design, treatment, distribution, construction, operation and maintenance of the recycled facilities, including a description of any legal arrangements outlining authorities and responsibilities between the

agencies with respect to treatment, distribution and use of recycled water. In areas where more than one agency/entity is involved in the reuse project, a description of arrangements for coordinating all reuse-related activities (e.g. line construction/repairs) shall be provided. An organizational chart may be useful.

2.2 Rules and Regulations

The procedures, restrictions, and other requirements that will be imposed by the distributor and/or user should be described. In multiple projects covered under a Master Permit issued by the Regional Boards where the reuse oversight responsibility is delegated to the distributor and/or user, the requirements and restrictions should be codified into a set of enforceable rules and regulations. The rules and regulations should include a compliance program to be used to protect the public health and prevent cross connections. Describe in the report the adoption of enforceable rules and regulations that cover all of the design and construction, operation and maintenance of the distribution systems and use areas, as well as use area control measures. Provide a description of the organization of the agency or agencies who has the authority to implement and enforce the rules and regulations, and the responsibilities of pertinent personnel involved in the reuse program. Reference to any ordinances, rules of service, contractual arrangements, etc. should be provided.

2.3 Producer - Distributor - User

The producer is the public or private entity that will treat and/or distribute the recycled water used in the project. Where more than one entity is involved in the treatment or distribution of the recycled water, the roles and responsibilities of each entity (i.e. producer, distributor, user) should be described.

2.4 Raw Wastewater

Describe the chemical quality, including ranges with median and 95th percentile values;

Describe the source of the wastewater to be used and the proportion and types of industrial waste, and

Describe all source control programs.

2.5 Treatment Processes

Provide a schematic of the treatment train;

Describe the treatment processes including loading rates and contact times;

All filtration design criteria should be provided (filtration and backwash rates, filter depth and media specifications, etc.). The expected turbidities of the filter influent (prior to the addition of chemicals) and the filter effluent should be stated;

State the chemicals that will be used, the method of mixing, the degree of mixing, the point of application, and the dosages. Also describe the chemical storage and handling facilities, and

Describe the operation and maintenance manuals available.

2.6 Plant Reliability Features

The plant reliability features proposed to comply with Sections 60333 - 60355 of the Water Recycling Criteria should be described in detail. The discussion of each reliability feature should state under what conditions it will be actuated. When alarms are used to indicate system failure, the report should state where the alarm will be received, how the location is staffed, and who will be notified. The report should also state the hours that the plant will be staffed.

2.7 Supplemental Water Supply

The report should describe all supplemental water supplies. The description should include:

- * Purpose
- * Source
- * Quality
- * Quantity available
- * Cross-connection control and backflow prevention measures

2.8 Monitoring and Reporting

The report should describe the planned monitoring and reporting program, including all monitoring required by the Water Recycling Criteria, and include the frequency and location of sampling. Where continuous analysis and recording equipment is used, the method and frequency of calibration

should be stated. All analyses shall be performed by a laboratory approved by the State Department of Health Services.

2.9 Contingency Plan

Section 60323 (c) of the Water Recycling Criteria requires that the engineering report contain a contingency plan designed to prevent inadequately treated wastewater from being delivered to the user. The contingency plan should include:

- * A list of conditions which would require an immediate diversion to take place;
- * A description of the diversion procedures;
- * A description of the diversion area including capacity, holding time and return capabilities;
- * A description of plans for activation of supplemental supplies (if applicable);
- * A plan for the disposal or treatment of any inadequately treated effluent;
- * A description of fail safe features in the event of a power failure, and

A plan (including methods) for notifying the recycled water user(s), the regional board, the state and local health departments, and other agencies as appropriate, of any treatment failures that could result in the delivery of inadequately treated recycled water to the use area.

3.0 TRANSMISSION AND DISTRIBUTION SYSTEMS

Maps and/or plans showing the location of the transmission facilities and the distribution system layout should be provided. The plans should include the ownership and location of all potable water lines, recycled water lines and sewer lines within the recycled water service area and use area(s).

4.0 USE AREAS

The description of each use area should include:

- * The type of land uses;
- * The specific type of reuse proposed;

- * The party(s) responsible for the distribution and use of the recycled water at the site;
- * Identification of other governmental entities which may have regulatory jurisdiction over the re-use site such as the US Department of Agriculture, State Department of Health Services, Food and Drug Branch, the State Department of Health Services, Licensing and Certification Section, etc. These agencies should also be provided with a copy of the Title 22 Engineering Report for review and comment.
- * Use area containment measures;
- * A map showing:
 - Specific areas of use
 - Areas of public access
 - Surrounding land uses
 - The location and construction details of wells in or within 1000 feet of the use area
 - Location and type of signage
- * The degree of potential access by employees or the public;
- * For use areas where both potable and recycled water lines exist, a description of the cross-connection control procedures which will be used.

In addition to the general information described above, the following should be provided for the following specific proposed uses:

4.1 Irrigation

- Detailed plans showing all piping networks within the use area including recycled, potable, sewage and others as applicable.
- Description of what will be irrigated (e.g. landscape, specific food crop, etc.);
- Method of irrigation (e.g. spray, flood, or drip);
- The location of domestic water supply facilities in or adjacent to the use area;

- Site containment measures;
- Measures to be taken to minimize ponding;
- The direction of drainage and a description of the area to which the drainage will flow;
- A map and/or description of how the setback distances of Section 60310 will be maintained;
- Protection measures of drinking water fountains and designated outdoor eating areas, if applicable;
- Location and wording of public warning signs,
- The proposed irrigation schedule (if public access is included), and
- Measures to be taken to exclude or minimize public contact.

4.2 Impoundments

- The type of use or activity to be allowed on the impoundment;
- Description of the degree of public access;
- The conditions under which the impoundment can be expected to overflow and the expected frequency, and
- The direction of drainage and a description of the area to which the drainage will flow.

4.3 Cooling

- Type of cooling system (e.g. cooling tower, spray, condenser, etc.);
- Type of biocide to be used, if applicable;
- Type of drift eliminator to be used, if applicable, and
- Potential for employee or public exposure, and mitigative measures to be employed.

4.4 Groundwater Recharge

An assessment of potential impacts the proposal will have on underlying groundwater aquifers. The appropriate information

shall be determined through consultation with the Department on a case by case basis.

4.5 Dual Plumbed Use Areas

In accordance with Sections 60313 through 60316 of the Water Recycling Criteria.

4.6 Other Industrial Uses

The appropriate information shall be determined on a case by case basis.

4.7 Use Area Design

The report should discuss how domestic water distribution system shall be protected from the recycled water in accordance with the Regulations Relating to Cross-Connections and the California Waterworks Standards, and how the facilities will be designed to minimize the chance of recycled water leaving the designated use area. Any proposed deviation from the Water Recycling Criteria and necessity therefore, should be discussed in the report.

4.8 Use Area Inspections and Monitoring

The report should describe the use area inspection program. It should identify the locations at the use area where problems are most likely to occur (e.g. ponding, runoff, overspray, cross-connections, etc.) and the personnel in charge of the monitoring and reporting of use area problems.

4.9 Employee Training

The report should describe the training which use area employees will receive to ensure compliance with the Recycled Water Criteria, and identify the entity that will provide the training and its' frequency. The report should also identify any written manuals of practice to be made available to employees.

Appendix E
Example Title 22 Table of Contents for
Groundwater Recharge Project

Report

**Title 22 Engineering Report
Sample TOC for
Groundwater Recharge Project**

CH2MHILL

3 Hutton Centre Drive

Suite 200

Santa Ana, CA 92707

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