City of San Diego
Water Reuse Study 2005

Water Reuse Goals, Opportunities & Values

American Assembly Workshop I
October 6-7, 2004

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The Water Reuse Study website address is:

http://www.sandiego.gov/water/waterreusestudy/index.shtml

CITY OF SAN DIEGO
WATER REUSE STUDY 2005

American Assembly Workshop I -
Water Reuse Goals, Opportunities and Values
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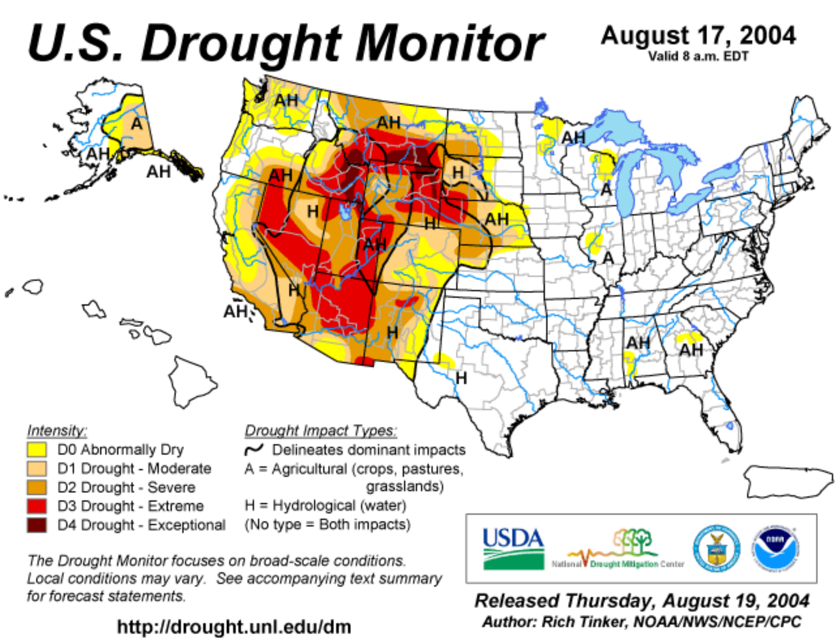
Introduction

Water is essential to San Diego's economy, quality of life and world-famous environment. Meeting the City's current and future water supply needs is the mission of the City's Water Department. The City has been fulfilling this mission for over 103 years. Now, in 2004, the City has a water supply and demand challenge. The City's current population of 1.3 million will grow to an estimated 1.9 million in 2030. By that time, San Diego will need 25 percent more water than it uses now.

As San Diego has few local sources of water, the City imports between 80 and 90 percent of its water from hundreds of miles away. Our arid, Mediterranean climate receives an average of about ten inches of rain each year, enough to supply only a fraction of our current population. Local supplies from stored local runoff are impacted by dry weather conditions. The City's conservation programs have helped reduce the City's dependence on that imported water and each year, save enough water to meet the needs of 40,000 typical households.

Many factors outside the City also contribute to our increased future water needs: California's access to surplus water from the Colorado River has been reduced and recurring droughts in both the western United States and the Colorado River watershed have affected imported water supplies. Competing interests statewide between urban users, agricultural uses and environmental interests are being resolved, but water allocations to each will continue to be adjusted in the future.



Reference: Drought Monitor website http://drought.unl.edu/dm

How will San Diego meet its future water needs? Water conservation, local runoff and more imported water aren't the only answers. Desalination and groundwater may offer some relief in the future. But the real answer is diversification. The City must diversify its sources of water and increase the use of locally produced water to assure an adequate and reliable supply for the future. One local source of water is already being produced – recycled water.

Recycled water is municipal wastewater that has been treated to a high level so that it can be reused for a variety of beneficial purposes. The water is distributed through a separate pipeline to customers that use it for irrigation, manufacturing, construction and many other purposes. Recycled water can also be used for wetlands creation, agriculture and industrial processing. Above-ground fixtures are color-coded purple to distinguish from the potable water (drinking water) system. Water that is recycled and reused locally helps reduce the demand for imported water, and is an available water supply even during a drought.

Since 1997, the City has been delivering recycled water for irrigation and industrial use to customers from the North City Water Reclamation Plant located in the University City area. An annual average of six million gallons per day (MGD), which peaks to nine MGD in summer due to irrigation demands, is distributed from the facility. There are 66 miles of recycled water distribution pipelines and 320 meters (City of San Diego customers) receiving recycled water from the North City Water Reclamation Plant. The City's recycled water distribution system also includes pump stations, pressure-reducing stations and a nine million gallon reservoir. The City of Poway is a wholesale customer receiving recycled water produced at the North City facility.

The South Bay Water Reclamation Plant, located in the Otay Mesa area, is currently awaiting final approval from a state regulatory agency for the distribution of recycled water. The facility began operations in 2002 and is currently treating wastewater to a secondary level. Agreements are in place to deliver six million gallons of recycled water per day to customers once construction of the distribution system is completed.

Both plants are able to increase the production of recycled water as they were constructed to handle larger amounts of wastewater than are currently being treated. Each year additional customers are connected to the City's recycled water distribution system and plans are underway to further expand the distribution system. The City is also pursuing additional inter-agency agreements. However, it is possible that more can be done to optimize water reuse in San Diego.

On January 13, 2004, the San Diego City Council adopted Resolution R-29878, provided as Attachment A, directing the City Manager to conduct a study of one-year duration evaluating all aspects of a viable increased water reuse program. The study will include evaluations of the following opportunities to expand the City's use of recycled water:

- Groundwater storage,
- Expansion of the distribution system,
- Reservoirs for recycled water,
- Live stream discharge,
- Wetlands development,
- Reservoir augmentation and
- Gray water use.

For each of the above opportunities, the study will provide an assessment of public health, public acceptance, costs, reliability, and current science and technology issues.

Project Mission and Goals

As part of the planning process the study team, consisting of consultant engineers, scientists, public relations specialists and City Water Department staff, developed an objective, a mission statement and goals for the project:

Objective

To conduct an impartial, balanced, comprehensive and science-based study of all recycled water opportunities so the City of San Diego can meet current and future water needs.

Mission

To pursue opportunities to increase local water supply and reliability, and optimize local water assets, through a comprehensive study of recycled water.

This mission statement is intended to guide the study team to achieve their objective of conducting an impartial, balanced, comprehensive, science-based study of all recycled water opportunities so the City can meet current and future water supply needs. Coupled with the mission are the three primary goals, which were established by the study team. The goals are aligned with the City Council Resolution R-298781 and are listed below.

Goals

- To develop opportunities for recycled water that are safe, economically viable, environmentally sustainable, protect human health, and reflect public values through a fair and unbiased evaluation of recycled water uses.
- To partner with residents, businesses, agencies and government to help policy makers make informed decisions on how to best use recycled water.
- To provide tools to expand the public's awareness, knowledge and involvement, and present information in a way that is understandable and accessible to all San Diegans.

The overall study goal is to develop viable choices for policy makers seeking to optimize water reuse. The opportunities will be vetted through public involvement sessions, and an Independent Advisory Panel of experts will provide insight, critique, and recommendations on study efforts.

WATER REUSE STUDY TERMINOLOGY

Recycled water or reclaimed water (terms are interchangeable). Water that originated as municipal wastewater and has undergone a high level of treatment at a water reclamation facility so that it can be beneficially reused for a variety of purposes. The degree of treatment for recycled water depends on the water quality needed for the specific use and for public health protection.

Water reuse. The planned use of recycled water for a specific beneficial purpose.

Study Approach

To fulfill the City Council Resolution R-298781, the following approach to the development of a Water Reuse Study has been developed. The steps envisioned to accomplish this study include the following:

Step 1: Assemble Stakeholders and Identify Issues

The first American Assembly workshop seeks feedback from stakeholders on the appropriateness of the study goals and confirmation that they are ready to participate with constructive views on the water reuse opportunities.

Over fifty years ago, Dwight Eisenhower founded the American Assembly to illuminate issues of vital public interest. The American Assembly is a process that brings together academicians, business people, government officials, the media, policy makers, community leaders, and other interested individuals. This "assembly" of stakeholders examines the aspects of public policy questions and moves toward consensus in making recommendations for action. The American Assembly process includes development of white papers defining key issues, formulation of key policy questions, and a facilitated workshop (or series of workshops) to allow participants of varying views, experiences, and interests to come together for intense discussions. Their deliberations conclude with the adoption of an Assembly Statement formalizing their views.

The first American Assembly workshop for the Water Reuse Study seeks feedback from stakeholders on the appropriateness of the study goals and confirmation that they are ready to participate with constructive views on the water reuse opportunities. The Assembly will reconvene about six months later to discuss water reuse opportunities developed based on those goals.

Step 2: Develop a Public Involvement Program

The public involvement strategy is intended to inform and update the public regarding beneficial reuse opportunities. Through strong public outreach, input from a representative cross-section of stakeholders will be solicited. Critical to meeting the study needs is the ability to obtain stakeholder input at strategic milestones for the project. The public involvement program will be structured to obtain input toward study objectives and screening processes. Upon development of conceptual reuse opportunities, the public involvement program will solicit input from stakeholders to screen and refine the reuse opportunities. Components of the public involvement program will include the following:

- Telephone Polling Research
- Focus Group Research
- Stakeholder Interviews
- Speaker's Bureau Presentations
- Dedicated Study Website
- Public Outreach

In June 2004, the study team coordinated efforts with the San Diego County Water Authority who was conducting a telephone survey of regional residents regarding water issues. The study team also arranged for two focus group sessions to be conducted to solicit public opinions regarding recycled water use in San Diego. City residents have indicated their awareness that the region's water supply is primarily imported water and that conservation is important. Those surveyed generally accept recycled water for outdoor irrigation and industrial uses and believe that education would be helpful in expanding water reuse opportunities.

In addition, a Speaker's Bureau has been established for City staff to meet with various San Diego service clubs, planning groups and professional organizations to provide information regarding the Water Reuse Study. Stakeholder interviews are being conducted with community leaders and professional groups, as well as minority and ethnic groups, to establish in-depth communication on recycled water issues. A web page has also been developed and is accessible from the City's general website. The internet address is www.sandiego.gov/water/waterreusestudy. This website includes a description of the study, a public opinion survey on water reuse issues and links to other water reuse projects, organizations and regulatory agencies. These public involvement activities will continue throughout the duration of the study.

Step 3: Identify Reuse Opportunities and Investigate Issues

The water reuse opportunities developed and issues investigated in this study will include:

- Distribution and storage options for non-potable uses at irrigation sites, industrial and manufacturing sites, high-rise buildings, and other non-potable uses;
- Wetlands creation and live-stream discharge; and
- Indirect potable reuse options such as reservoir augmentation and groundwater storage, including an assessment of potential health affects.

Non-potable Reuse: Includes all recycled water use applications except those related to drinking water.

Indirect Potable Reuse: The addition of advanced treated recycled water to a natural water source that supplies water directly to a drinking water treatment facility.

The information will be compiled and reviewed by the Independent Advisory Panel that will work with the study team to ensure that all important components are covered and thoroughly reviewed. The panel members are contracted through the National Water Research Institute (NWRI) Research Advisory Board.

The NWRI was selected to ensure an unbiased and thorough examination of all possible water reuse opportunities. The NWRI promotes the protection, maintenance and restoration of water supplies and aquatic environments through the development of cooperative research work. Advisory panel members are from across the United States.

Panelists selected for the Water Reuse Study are renowned experts in the fields of water and wastewater technology, public health, epidemiology, toxicology, water quality, economics, environmental science, public utilities and industry regulations. The panel also includes a local citizen representative. The 11-member panel met in July in San Diego to review this white paper, and will meet once again before the second American Assembly workshop.

Step 4: Assess Reuse Opportunities Based on Community Values

Viable reuse opportunities will be presented to the stakeholders participating in the American Assembly process. A second white paper will be developed to provide information on each reuse opportunity and what value it brings to the San Diego community. A second American Assembly workshop will be conducted to assess stakeholder viewpoints on opportunities for reuse.

Based on the Statement of Views developed at the second American Assembly workshop and the review of the information by the Independent Advisory Panel, the project opportunities will be refined and presented in a final report. The final report will be submitted to City Council for their consideration.

First Milestone – White Paper

The first significant project milestone is completion of a white paper. This white paper functions as a broad framework document for the Independent Advisory Panel and the first American Assembly Workshop. The purpose is to identify potentially important areas for the project team and, ultimately, the stakeholders to consider. The stakeholders will provide input into the importance and emphasis of issues to be explored in the second white paper. This first white paper includes the following information:

1. OVERVIEW OF WATER REUSE IN SAN DIEGO
   A brief overview of the City's water supply system and water reuse program is included with the intent of providing stakeholders a background and context for the Water Reuse Study.

2. OVERVIEW OF WATER REUSE OPPORTUNITIES IN SAN DIEGO
   Conceptual reuse opportunities to be considered in the Water Reuse Study are briefly discussed. The benefits and challenges associated with the various opportunities are presented to prompt open discussion, debate and consideration of the broad spectrum of considerations for each reuse opportunity.

3. VALUE-BASED ASSESSMENT OF REUSE OPPORTUNITIES
   In order to assess the portfolio of reuse opportunities that could be developed in San Diego, a framework of values and standards for developing opportunities is proposed.

4. RECYCLED WATER TECHNOLOGY
   In this section, the treatment processes required to produce recycled water are presented. The advanced treatment processes required for indirect potable reuses are also discussed.

5. CASE STUDIES - LEARNING FROM EXPERIENCE
   In this section, relevant examples of pertinent reuse projects across the United States are discussed.

Questions Posed to Stakeholders

In the course of this white paper we will ask you to consider certain issues and questions regarding the information provided. Below is a summary of the key points on which we would like your input and feedback.

1. Have the appropriate goals and objectives been identified?
2. Are there other goals and objectives that should be considered?
3. What water reuse opportunities should be considered?
4. What are the key considerations associated with these reuse opportunities?
5. What should the study team investigate?
6. Are the values presented appropriate for comparing the reuse opportunities?

At the beginning of each section of this white paper, a challenge will be posed to you, the American Assembly, to understand, evaluate and provide input on what is being presented in that section. As valued stakeholders in the process of developing the City's Water Reuse Study, your thoughtful and constructive review of the material presented is critical to the success of the study.

CHALLENGE TO STAKEHOLDERS

Your first challenge is to consider whether you are comfortable with the mission statement and goals of this study, and why or why not?

1.0 Overview of Water Reuse in San Diego

> CHALLENGE TO STAKEHOLDERS
>
> To understand our water supply challenges and opportunities.
>
> To understand how the City's water reuse program has evolved.

Currently, the 1.3 million people of San Diego use approximately 235,000 acre-feet per year (AFY), which is equivalent to 210 million gallons per day (MGD), of potable water. The City's population is projected to increase 50 percent in the next 25 years. Because there are industrial, commercial and governmental water uses in the city, as well as water conservation efforts, an increase in population does not correlate directly with an increase in water use. Therefore, this 50 percent increase in population is expected to result in a 25 percent (59,000 AFY/52 MGD) increase in the demand for potable water.

> UNDERSTANDING ACRE-FEET
>
> The water world is built on a long tradition of rules and measures. One of these is the way we measure large volumes of water.
>
> When we size a treatment plant we do that based on the amount of water it must treat each day. The measure is usually in millions of gallons per day or "MGD". The North City Water Reclamation Plant is designed to treat 30 MGD.
>
> When we plan on how much water we want to use in a year, we refer to agriculture and think about how much water we need to deliver for each acre that has been planted. A typical crop might require that we use about four feet of water a year to irrigate it. That means that the amount of water required to irrigate the acre over the year would stand four feet deep if we applied the water all at once.
>
> As a result, when we plan for how much water we need each year for a large area like a state, a county or a city we measure the water needed in units of acre-feet per year (AFY). An acre-foot is approximately 326,000 gallons. The City of San Diego uses about 235,000 AFY or 210 MGD of potable water.

In 1999, the San Diego County Grand Jury reviewed the status of the City's water supply and expressed their opinion as follows:

> *"Water is a scarce commodity in the rapidly growing San Diego region. In the face of increased demand for water from other geographical areas, imported water and water from transfers are not reliable sources of water for the future. Many decisions about water supply for San Diego are made by the state and federal governments and thus out of local control. In order to increase the reliability of its overall water supply, the City of San Diego must expand its supply of local water. Long-term focus is absolutely necessary in planning for future water needs.*

Exacerbating this situation, the San Diego region is a desert, dependent on imported water for 80 to 90% of its water supply. The imported water is unreliable since years of ample rainfall and plentiful water can be followed by years of drought and water scarcity. Also, in times of earthquake or other emergency and, in view of projected population increases, adequate imported water may not be available. Therefore, increasing locally controlled water supplies is vital to the region."

1.1 Recycled Water as a Local Water Resource

The City has long recognized the need to develop local water supplies to balance and reduce the dependence on imported water. A diversified water "portfolio" would provide the City needed reliability and local control of its water supply. In 1997, the City prepared the *Strategic Plan for Water Supply*, a significant initial effort at documenting the diversification needed to address water supply needs through 2015. This report was updated with the more detailed *Long-Range Water Resources Plan* (Long-Range Plan) completed in 2002, outlining a phased approach to satisfy water supply needs through 2030.

The recommended approach included the development and use of 15,000 AFY of recycled water by 2010, which would provide approximately 6 percent of the City's total water demand and up to 33,000 AFY by 2030, which would provide as much as 11 percent of the City's total water demand. It is clear that water reuse is a significant component of the City's long-range water resources plan.

The need for local water supply development is echoed by the San Diego County Water Authority (Water Authority) in their *2004 Annual Water Supply Report*, subtitled *Supply Reliability through Diversification*. This report states, "A critical component of future reliability is development and management of local supplies and conservation programs by the Water Authority's member agencies." It also addresses water reuse by saying, "implementation of water recycling is essential to using the region's water supplies efficiently", and specifically references the City's Water Reuse Study 2005 as an example of what is needed.

1.2 History of Water Reuse in San Diego

The City has been a pioneer in the field of water recycling. In 1981, the 25,000-gallon per day (GPD) Aqua I pilot aquaculture plant began operation in Mission Valley, with the water produced used to irrigate a sod farm adjacent to Jack Murphy Stadium (now Qualcomm Stadium). In 1984, the Aqua II Water Reclamation Facility, a second, larger pilot research installation, began treating 180,000 GPD of wastewater. This water was sold to Caltrans for use in irrigating freeway landscaping beginning in 1987. In 1991, the Aqua III Water Reclamation Facility and Aqua 2000 Research Center were located in the San Pasqual Valley, north of the community of

Rancho Bernardo, where the City continued to use aquaculture treatment to reclaim wastewater. This facility had the capacity to treat 1 MGD for agricultural use and irrigation. The Research Center continued to study the concept of advanced water treatment and potable reuse using a variety of treatment methods until 2001 when the project was discontinued. Since September 1997, with the completion of the North City Water Reclamation Plant (NCWRP), the City has been delivering recycled water to customers for irrigation and industrial use on a larger scale. The amount of water reused has reached the current total of approximately 5 MGD.

The following discussion briefly recounts some of the key historical events that spurred the recycled water program, describes the main features of the existing recycled water system and planned expansions, and provides an overview of the City's prior repurification project.

1.3 Legal and Regulatory Background

In addition to a critical water supply need, wastewater management also drives the need to maximize local water recycling. The legal and regulatory background associated with these wastewater management issues is provided below.

Since 1963 the City has treated its wastewater at the Point Loma Wastewater Treatment Plant, which provides advanced primary treatment before disposal in an ocean outfall. In 1972, the federal Clean Water Act (CWA) was adopted which requires that wastewater plants provide a minimum of secondary treatment. Section 301(h) of the CWA allowed facilities that discharge to certain marine waters to apply for a waiver from secondary treatment standards by 1982. The City originally applied for the waiver, but then withdrew it. In 1987, the U.S. Environmental Protection Agency (EPA) and environmental groups sued the City for not meeting the provisions of the CWA. The Ocean Pollution Reduction Act (OPRA) was passed in 1994 to allow San Diego to reapply for the Section 301(h) waiver. The lawsuit was resolved later that year when the waiver was granted, saving the City an estimated $3 billion in avoided capital costs for additional facilities.

The City has 45 MGD of recycled water treatment capacity in place.

As part of the Section 301(h) application, the City committed to implementing a water reclamation program that would create a system capacity to treat 45 MGD by 2010. The City has fulfilled the treatment capacity requirement with the completion of the 30 MGD NCWRP in 1997 and the 15 MGD South Bay Water Reclamation Plant (SBWRP) in 2002. A 1995 federal court order further required the City to construct an "optimized recycled water distribution system" in conjunction with building the NCWRP. The majority of the distribution facilities that comprise the optimized system were installed between 1995 and 1998 to enable delivery of recycled water upon completion of the reclamation plant.

The EPA provided a grant that helped fund the construction of the NCWRP. Conditions of the grant award are quoted as follows:

> *Upon certification of the NCWRP, flows into the plant will constitute a minimum of 75 percent of the plant's design capacity (i.e. at least 22.5 MGD). Of these flows the City will beneficially reuse at least 10 percent upon certification and shall attempt to meet the following goals:*
>
> a. *Beneficial reuse of 25 percent of the flows treated at the NCWRP by December 31, 2003.*
> b. *Beneficial reuse of 50 percent of the flows treated at the NCWRP by December 31, 2010.*

Based on anticipated flows, the City established reuse goals of 6 MGD by the end of 2003 and 12 MGD by the end of 2010 to fulfill the EPA grant goals.

Presently, NCWRP treats 22.5 MGD (75 percent of capacity) of wastewater to secondary standards. The requirement to reuse 10 percent of the treated flows was achieved in 1998, when about 2.4 MGD of recycled water was distributed. Currently, more than 5 MGD of recycled water is beneficially reused. Through the retrofit program for existing water customers and by requiring developers in the NCWRP service area to construct recycled water conveyance systems to new developments, the City has diligently pursued the fulfillment of the water reuse goals. The 2003 goal of 6 MGD is expected to be met before the end of 2004, when facilities will be completed to allow new customers to receive recycled water. Additional plans for system expansion are in place to enable meeting the 2010 goal of beneficially reusing 12 MGD by 2010. It is anticipated that the full 30 MGD NCWRP treatment capacity will be utilized after 2010 as the service area becomes built-out and flows to the NCWRP increase. These plans are documented in the December 2000 *Updated Water Reclamation Master Plan* and the subsequent February 2003 report entitled *Accelerated Implementation of Beneficial Reuse*, both prepared by PBS&J.

Regarding the City's 301(h) waiver application in 2000, disagreements arose as to the interpretation of OPRA, primarily over the quantity of suspended solids that could be discharged from the Point Loma Wastewater Treatment Plant into the Pacific Ocean. These disagreements were the subject of two administrative appeals to the Environmental Appeals Board (EAB) and a lawsuit. The City appealed the EPA's application of OPRA to the new waiver, which would require the City to continue to reduce the quantity of suspended solids each waiver period and continue to attain at least 58 percent removal of the biological oxygen demand. Three environmental groups also appealed the new waiver on a number of issues, including that the quantity of suspended solids should be reduced further. In addition, an environmental group filed an action in Superior Court of San Diego County challenging the State Board's

Suspended Solids: Solids in water that can be trapped by a filter.

Biological Oxygen Demand (BOD): A measure of how much dissolved oxygen is being consumed as microbes breakdown organic matter. A lower BOD indicates improved removal of organic pollution typically by a treatment facility.

reinstatement of the 15,000 metric tons per year limit of suspended solids. The Superior Court challenge was dismissed and all appeals were stayed as the parties agreed to discuss possible alternative solutions to the OPRA issues. The parties met regularly from January 2003 to March 2004 and agreed on a Settlement Agreement and Joint Stipulation for Withdrawal of Appeals. The Settlement Agreement commits the City to (a) evaluate improved ocean monitoring, (b) pilot test biological aerated filters as a form of technology to increase solids removal, and (c) study increased water reuse. The 2005 Water Reuse Study is intended to fulfill the City's commitment to study increased water reuse.

1.4 Seasonal Demand for Recycled Water

Irrigation demand is seasonal... much more recycled water is needed in the summer than the rest of the year.

The availability of wastewater flows and the subsequent supply of recycled water are relatively consistent year-round. Conversely, recycled water is used primarily for irrigation needs, so more water is used in the summer than in the winter. As illustrated in Figure 1.1, the typical maximum day demand is twice the average day demand (average daily use over a year), which results in only 50 percent of the recycled water produced being used every year. Figure 1.2 illustrates how seasonal storage of recycled water could increase the overall amount of recycled water used annually. The Water Reuse Study will evaluate several opportunities for storing this unused recycled water to increase overall reuse.

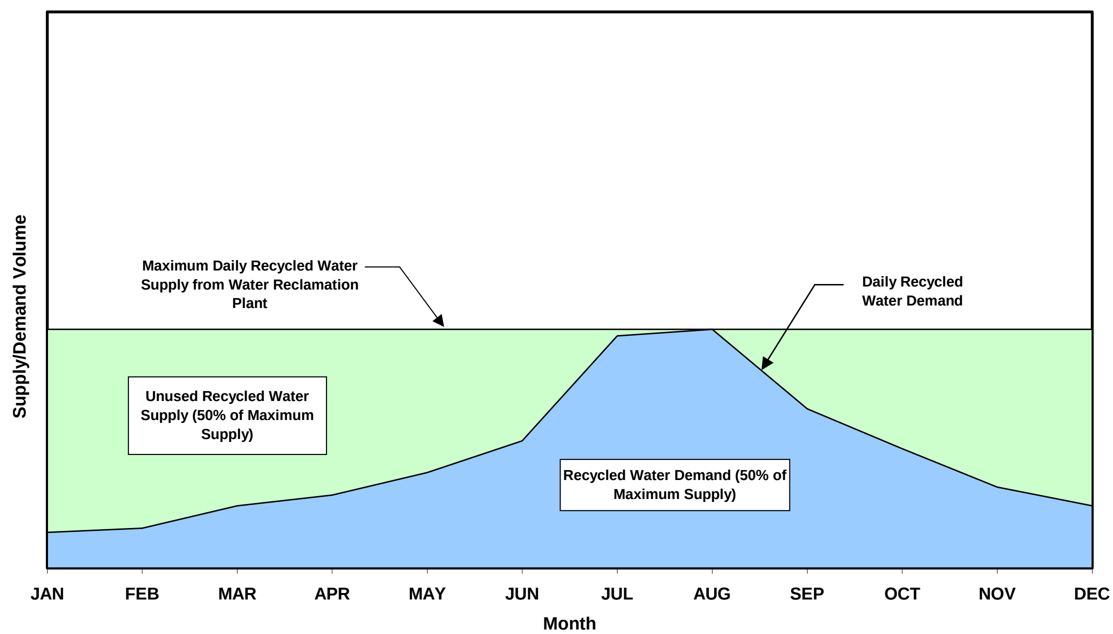


Figure 1.1 – Recycled Water Demand without Seasonal Storage (Annual Supply = 50 Percent Demand + 50 Percent Unused)

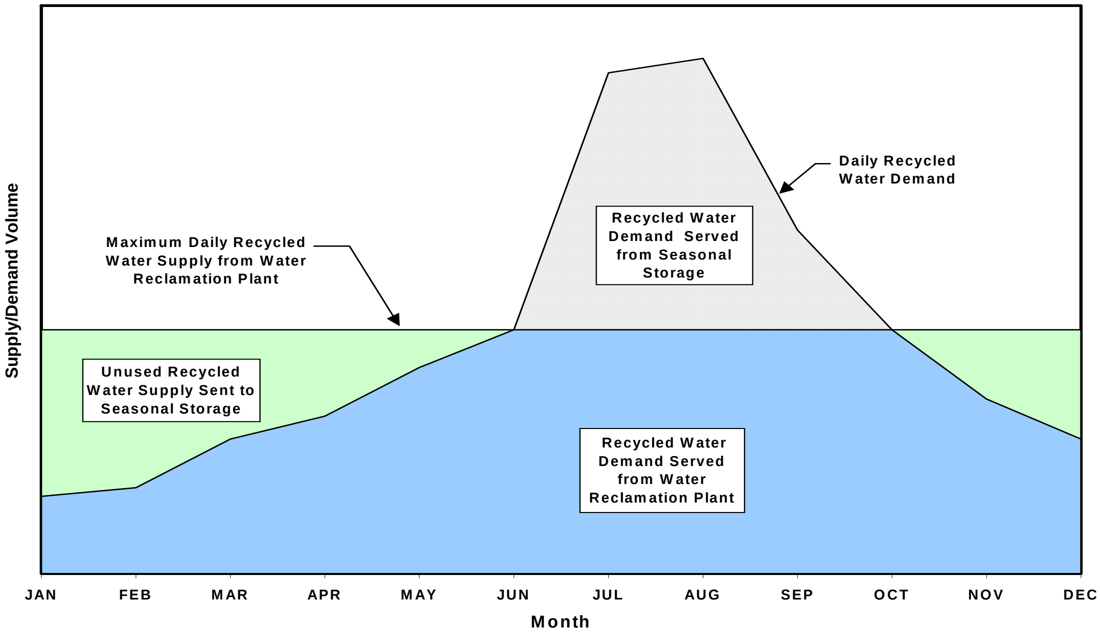


Figure 1.2 – Recycled Water Demand with Seasonal Storage (Annual Supply = Annual Demand)

1.5 Existing Northern Recycled Water System

NCWRP is operated by the City's Metropolitan Wastewater Department and currently treats 22.5 MGD of wastewater to secondary standards (75 percent of capacity). Secondary treatment is explained in detail in Section 4.1.2. The amount treated is limited by both the available influent wastewater flow and the existing recycled water demand. A portion of the secondary treated wastewater is further processed to meet recycled water quality standards by filtration, for additional removal of suspended solids and microorganisms, and demineralization, for reduction of dissolved mineral salts. The remaining secondary treated flow is conveyed to Point Loma for disposal through the ocean outfall.

The City has committed to its recycled water customers that the total dissolved solids (TDS) content in the water will not exceed 1000 milligrams per liter (mg/l). TDS is an important water quality consideration for irrigation and industrial users. This goal is met using a process for demineralization called electrodialysis reversal (EDR). Currently, there is EDR capacity to produce 9 MGD of recycled water. Expansion of the NCWRP EDR facilities in 2004 will allow up to 15 MGD of recycled water to be available for customers. Additional demineralization capacity will be needed to enable delivery of recycled water beyond 15 MGD.

The City has committed to its recycled water customers that the total dissolved solids (TDS) content in the water will not exceed 1000 milligrams per liter (mg/l).

Total Dissolved Solids (TDS): All the solids (usually salts) that are dissolved in water.

Electrodialysis Reversal (EDR): A process in which salts are removed from water.

Figure 1.3 illustrates the distribution facilities that comprise the "optimized system" for the northern service area (the area served by NCWRP), which includes the 9 million gallon (MG) Miramar Reservoir, 2 pump stations and about 66 miles of pipeline. This system also features a large backbone main in Miramar Road. These facilities extend from the coast to the City of Poway and serve customers in four pressure zones.

1.6 Existing Northern Service Area Recycled Water Customers

The City provides over 5 MGD of recycled water to 520 customers.

As of May 2004, the City provides over 5 MGD of recycled water to 320 customers, including a single connection with the City of Poway, for distribution to an additional 200 customers. Most of these customers use recycled water for irrigation. A few customers use recycled water for industrial purposes. In addition to the City of Poway, other large customers include the NCWRP; the City's Metropolitan Biosolids Center; Caltrans; City Parks and Recreation Department; General Atomics; Miramar Landfill; Mitchell International; Motorola; Nissan Design; Pacific Retail Trust; San Diego California Temple; Superior Readymix; Timberland II; University of California, San Diego; and the Torrey Pines and Miramar Marine Corps Air Station golf courses. Infill opportunities still exist for perhaps 150 to 200 additional, relatively small connections to the optimized system, including public parks, freeway medians, and private customers.

1.7 Planned Expansion of the Northern Service Area

New recycled water customers with larger demand requirements can be reached by expanding the optimized system. Plans are being implemented to extend the optimized system to new areas in phases, as shown in Figure 1.4. In the initial phases of expansion, the City sought to take advantage of new development by installing recycled water pipelines as roads were constructed.

Phase I of the recycled water system expansion will be completed in late 2004. New customers will include the Black Mountain Ranch golf courses and parks, and the Olivenhain Municipal Water District (OMWD). Thirteen miles of pipeline have been installed through the Rancho Penasquitos community to the Black Mountain Ranch area and a pump station has been constructed. In addition, to further serve the area, the 3 MG Black Mountain Reservoir will be completed by 2006. Phase I customers are anticipated to generate an initial recycled water demand of approximately 2,000 AFY/1.8 MGD with the 2004 improvements and a total of 3,300 AFY/2.9 MGD after 2006.

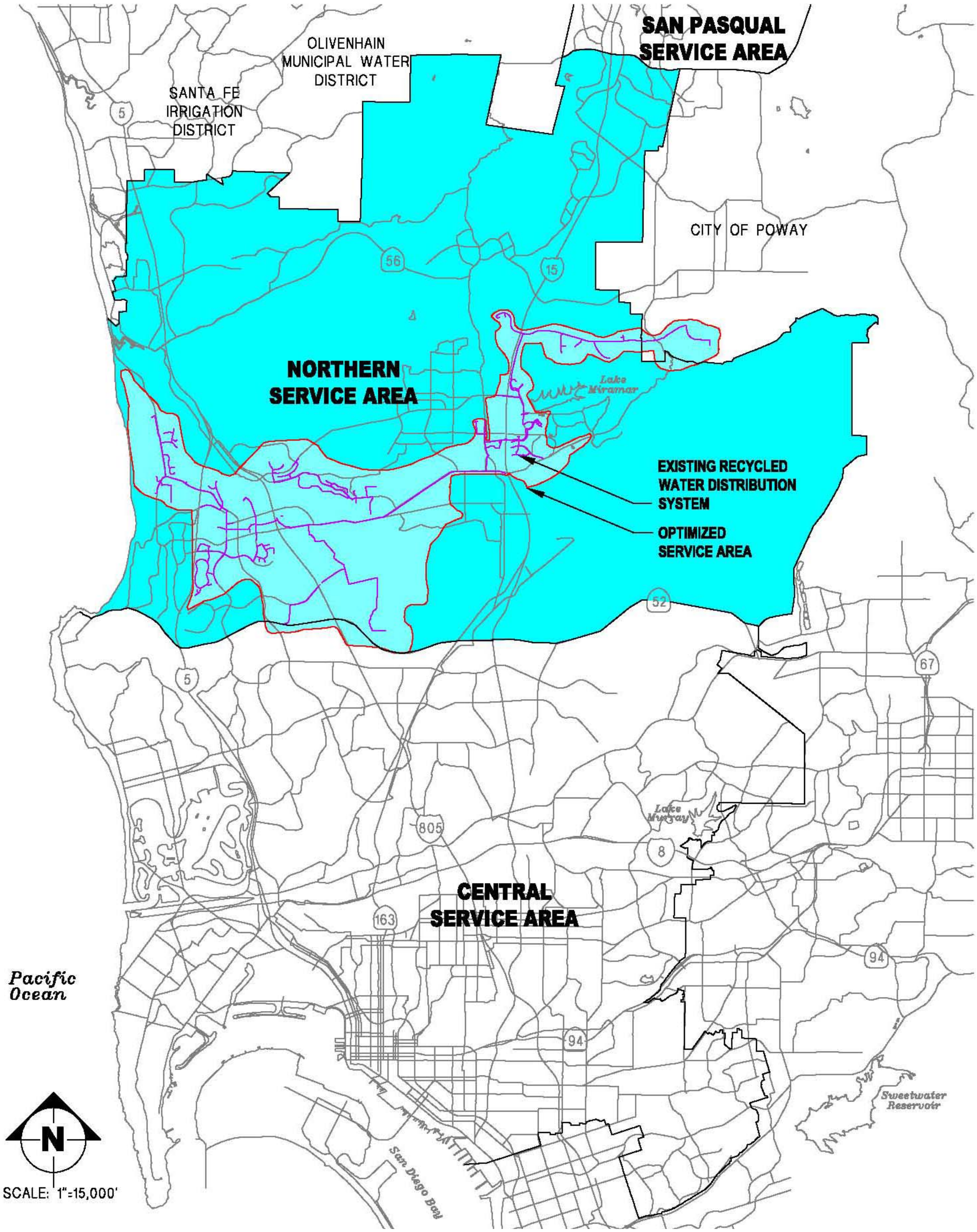
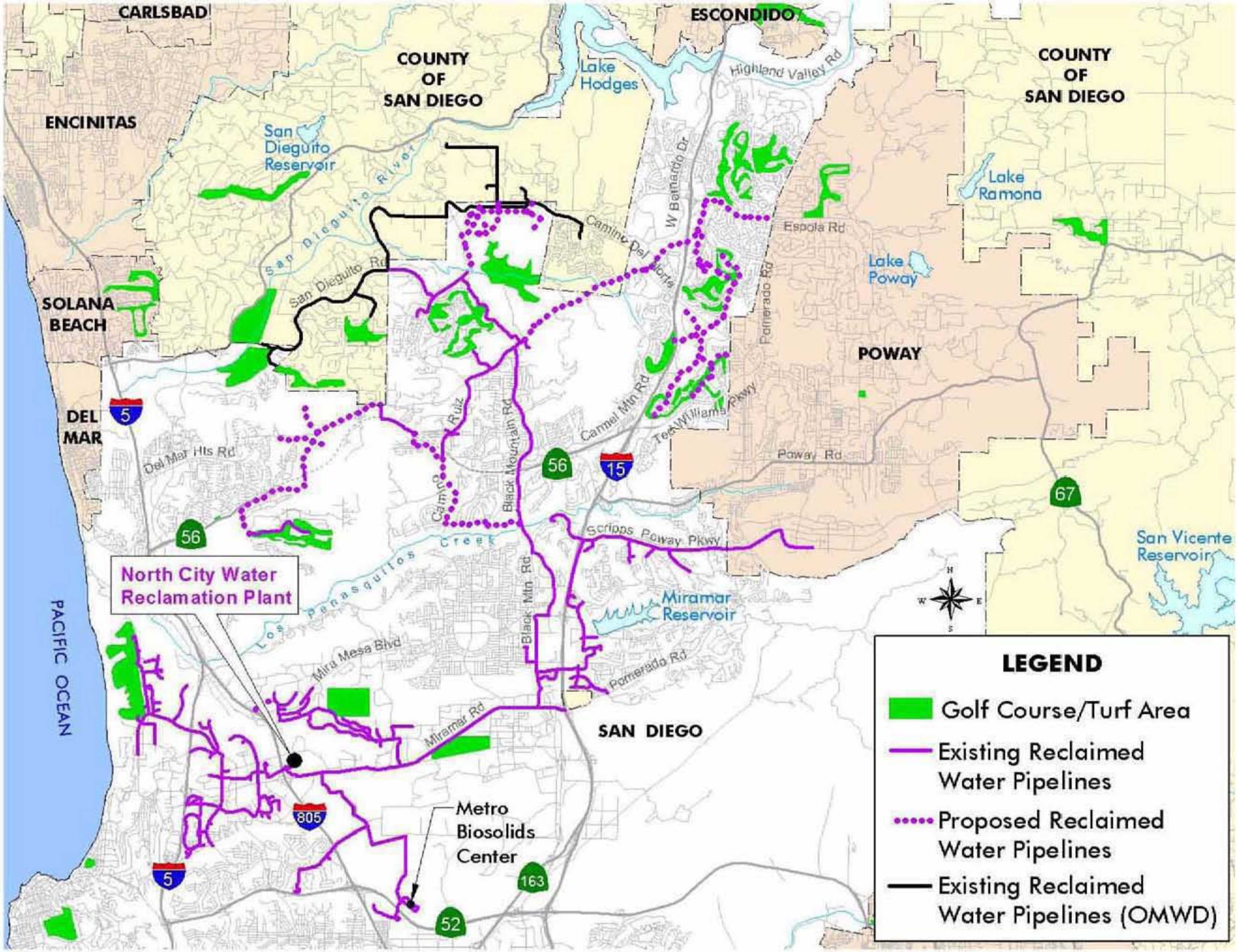


Figure 1.3 – San Diego Northern "Optimized" Service Area

Figure 1.4 – North City Recycled Water Distribution System



Service to Carmel Valley and the State Route 56 corridor comprises Phase II of the system expansion. The 16 miles of pipeline needed to implement this phase are under various stages of design or construction. This area would be served by branching off of the Black Mountain Road recycled water main at Canyonside Park in Los Penasquitos Canyon, and merging with the SR-56 alignment at Camino Ruiz. The terminal point is the Del Mar National Golf Club (formerly Meadows Del Mar) in Carmel Valley. Other significant customers will be served along the way, including Caltrans, Pacific Highlands Ranch parks, and the Palacio Del Mar Golf Course. Recycled water use along this corridor is anticipated to generate a recycled water demand of approximately 1,000 AFY/0.9 MGD when the entire length of pipeline is completed in 2009.

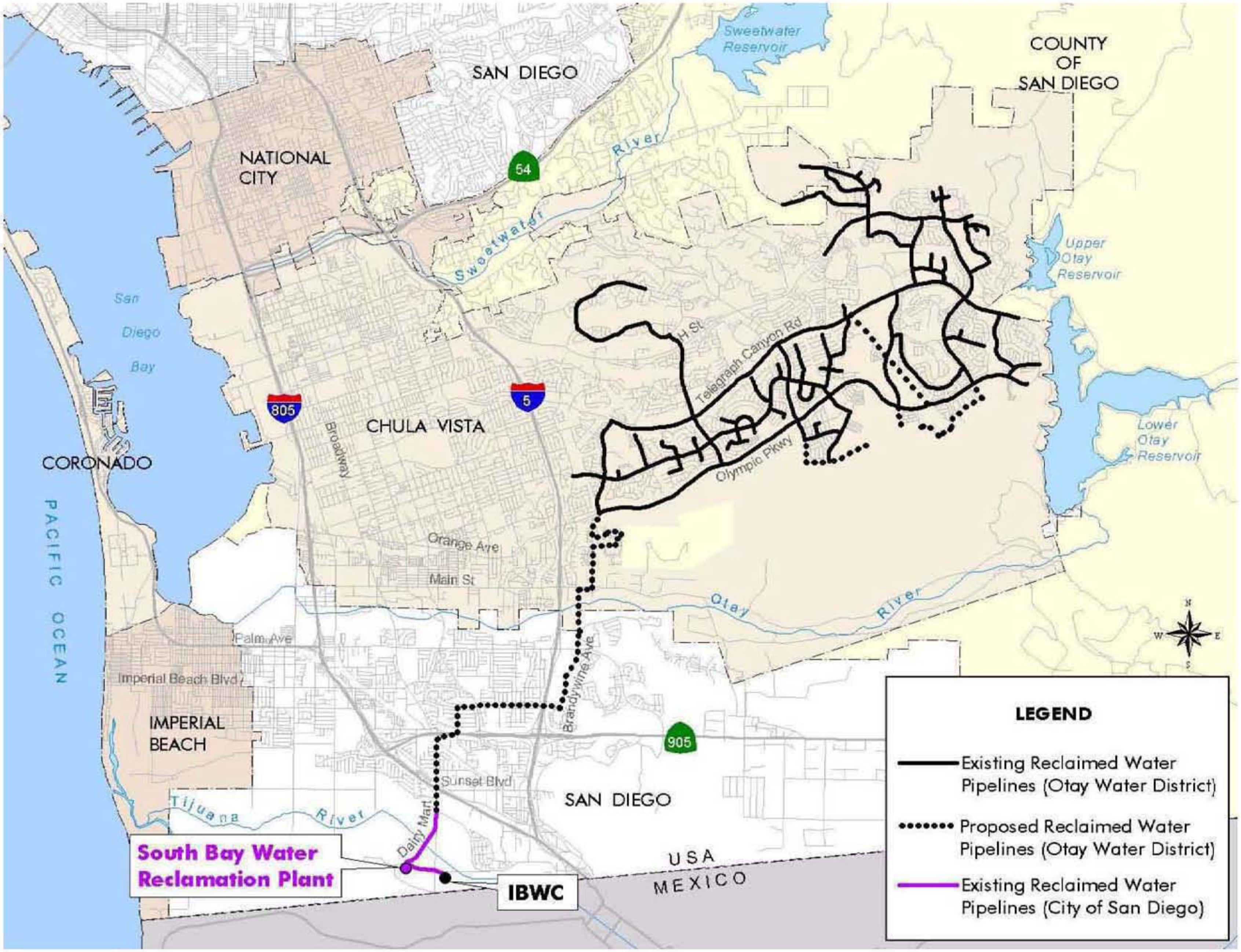
The Phase III service area identified in the *2000 Updated Water Reclamation Master Plan* includes the Rancho Bernardo/Interstate 15 corridor. This area is densely populated and built out, but has numerous parks and golf courses that would benefit from recycled water service. The recycled water demand in this service area, including two golf courses in Poway, is estimated to be approximately 1,800 AFY/1.6 MGD. Providing service to this area would require investment in 17 miles of pipeline, a pump station, and the siting of at least one large storage reservoir. These facilities are in the planning stage and their implementation may be subject to a comparison of costs and benefits associated with the opportunities developed as part of the 2005 Water Reuse Study.

Collectively, if implemented as described, the phased system expansions outlined above will allow the City to meet the 12 MGD water reuse goal by 2010.

1.8 South Bay System and Service Area

The 15 MGD SBWRP became operational in the summer of 2002. It currently produces 5 to 6 MGD of secondary treated wastewater that is disposed of via an ocean outfall. Production of recycled water is pending certification of the tertiary treatment facilities by the Regional Water Quality Control Board (RWQCB). On October 16, 2003, the San Diego City Council executed an agreement to sell 6 MGD of recycled water to the Otay Water District (OWD). OWD will have infrastructure in place to take this water by January 1, 2007. Construction of facilities was recently completed to deliver 0.7 MGD of recycled water to the adjacent International Boundary and Water Commission (IBWC) Treatment Plant. In addition, Caltrans has expressed interest in using recycled water for freeway landscape irrigation at the southern ends of Interstates 5 and 805, and the 905 interchange. Other potential users are being identified; however, the City recycled water service area in the South Bay is small and surrounded by other water agencies. Figure 1.5 illustrates the facilities that comprise the distribution system for the southern service area.

Figure 1.5 – South Bay Recycled Water Distribution System



Prepared for the American Assembly Workshop I
Oct. 6, 7, & 29, 2004

1.9 Water Repurification Project and Subsequent Activity

In December 1996, the City submitted a recycled water Marketing and Implementation Plan to EPA per the NCWRP grant condition. A central feature of the plan was a Water Repurification Project that was being pursued and was scheduled for completion in 2001. The Water Repurification Project was envisioned to take recycled water treated at NCWRP and further process it using several advanced treatment technologies, including membrane filtration, reverse osmosis (RO), ion exchange and ozonation, with peroxide, and chlorination to create what was termed repurified water. About 20,000 AFY/18 MGD of repurified water would be pumped 23 miles to the 90,000 acre-foot San Vicente Reservoir, one of the City's open storage reservoirs, where it would be discharged into the upper portion and blended with imported water (primarily Colorado River Water), the current source of supply to San Vicente Reservoir. The repurified water would remain for more than one year in the reservoir allowing further natural treatment to occur. San Vicente Reservoir water would then be treated at the Alvarado Water Treatment Plant before being distributed to customers.

The Water Repurification Project had its beginning in June 1993 when the Water Authority initiated a feasibility study to explore the concept. In September 1993, the City and the Water Authority agreed to work jointly in its pursuit. A public involvement campaign began late that year and an Independent Advisory Panel was convened early the following year to help frame the project concept. A formal proposal was developed and presented for review by California Department of Health Services (CDHS), which granted conditional approval to proceed with project development in August 1994.

Based on a review of water quality and operational testing results at the City's Aqua 2000 pilot treatment plant, CDHS issued a subsequent statement in August 1996 affirming that the proposed repurified water technologies can produce safe, high quality drinking water that meets or exceeds state and federal standards. In September 1996, the City's Metropolitan Wastewater Department (MWWD) became the lead for this project, with the Water Department and the Water Authority assuming support roles. Detailed planning and environmental review of the proposed project were conducted in 1995 and 1996, with public review and issuance of a final Environmental Impact Report (EIR) in the summer of 1997. The project then proceeded into the design phase.

Until late 1998, the project had been widely supported by a broad variety of groups, including the local Medical Society, EPA Region 9, the Sierra Club, U.S. Bureau of Reclamation, CDHS and a variety of local business interests, as well as receiving the approval of a special citizen's panel convened by the Water Authority.

Also at this time, the first signs of public opposition to the repurification effort began to surface. Public perception of the project's urgency -- from the water supply standpoint -- had been eroding with each passing year since the end of the drought. The public relations efforts behind the proposed Imperial Irrigation District (IID) water transfer substantially reduced remaining concerns about the region's need for additional water supplies. In addition, the shift in responsibility for the repurified water project from the San Diego County Water Authority to the City Water Department and thence to the City's Metropolitan Wastewater Department altered the way the project was viewed by the public. While the overall messages did not change, project spokespeople now were affiliated with the City's wastewater department. This created a significant shift in the project public image -- from a "water resources" solution to a "wastewater disposal" solution. In fact, the project always benefited both areas, but public support was clearly more dependent on concern for water resource needs, not cost-effective wastewater disposal.

Community and political figures, including members of the initial citizen review panel, continued their support for the project. However, during the 1998 political campaigns, the water repurification project became a target for several candidates in closely contested races. The City Council and state assembly candidates targeted the project for criticism at public hearings, in the media and in direct mail campaigns. The project area was also inaccurately portrayed as targeting poor and ethnic communities, when, in fact, the water would have been available to nearly half of the City's residents.

Borrowing the term, "Toilet to Tap" from an earlier public campaign against a proposed groundwater recharge project in the San Gabriel Valley, opponents gained ground in their efforts to erode stakeholder support. These few opponents raised questions about the health effects from potential "unknown" contaminants that might be present in the sewage and might pass through the water repurification process. The fate of several, specific contaminants were addressed, but technologists supporting the project found it difficult to demonstrate the removal of contaminants not yet identified.

In 1998, the National Research Council (NRC) Report *Issues in Potable Reuse* was released. The report was largely supportive of indirect potable reuse, citing, as its general conclusion, "that planned, indirect potable reuse is a viable application of reclaimed water." Nevertheless, the media focused on one phrase from the same paragraph, that potable reuse, "is an option of last resort." It was this phrase that overshadowed the entire report and became the sound bite used by potable reuse opponents.

Strengthened by the comment in the NRC report, candidates for City Council made charges of environmental injustice and took their concerns before a City Council committee. Residents of one of the City Council districts near the Alvarado water treatment plant, mistakenly under the impression that the water was to be "tested" on their community first, appeared at the Council Committee meeting and expressed fears that the City planned to single out the African American community and use them as guinea pigs. In reality, the distribution system from the Alvarado plant served water to 500,000 City residents living in a large geographic area that extended from La Jolla to La Mesa and south to National City and north to SR 52.

On January 17, 1999, the San Diego City Council voted to stop the water repurification project. In the meantime the County Grand Jury also examined the project. On March 27, 1999, the Grand Jury came out in favor of the project stating, "It is time for the City Council to take a position of leadership and to make policy which will result in the development of additional sources of water". On May 19, 1999, the City Council reaffirmed the decision it had made in January to not pursue the repurified water project.

Since the City was still committed to beneficially using its recycled water per the goals established as a condition of the EPA grant, an alternate means to proceed was developed. The Water Department initiated the Beneficial Reuse Project that produced the *2000 Updated Water Reclamation Master Plan* and the numerous planned and implemented system improvements to maximize non-potable use of recycled water, as previously described.

In November 2003, the City Council's Natural Resources Committee agreed unanimously that all options for use of recycled water and associated issues should be re-evaluated. In January 2004, the San Diego City Council adopted Resolution R-298781 directing the City Manager to conduct a study of one-year duration evaluating all aspects of a viable increased water reuse program, including both non-potable and indirect potable uses of recycled water.

2.0 Overview of Water Reuse Opportunities in San Diego

CHALLENGE TO STAKEHOLDERS

To consider how recycled water can be used in San Diego.

To understand the regulatory framework that governs water reuse in California.

The City is committed to optimizing the use of recycled water as an important component in the development of local water supplies and reduction of its dependence on imported water. The following discussion provides an overview of the water reuse opportunities that will be addressed in the Water Reuse Study. A description of the regulatory environment that exists for recycled water in California is also presented.

2.1 Water Supply

The western United States is entering its sixth year of drought, but even during normal rainfall years, this is a desert community.

The City has long recognized the need to develop local water supplies to balance and reduce its dependence on imported water. The City currently supplies water to 1.3 million City residents at an average rate of approximately 210 MGD. In 2030, the population is projected to be about 1.9 million people and will cause an increase in demand for water of about 25 percent (to 265 MGD) even with aggressive conservation programs. The western United States is entering its sixth year of drought, but even during normal rainfall years, this is a desert community. Average rainfall is approximately 10 inches per year in San Diego, and collected runoff within the City would only support an estimated 100,000 residents.

Eighty to ninety percent of the water used in the City is imported. There are two sources of imported water to San Diego County: about two-thirds is conveyed through the Colorado River Aqueduct and the remaining one-third comes from the State Water Project. Figure 2.1 is a map showing these water supply sources. Metropolitan Water District of Southern California (MWD) facilities convey this water to approximately the northern border of San Diego County. As a member agency of MWD, the Water Authority purchases the water from MWD and transports it throughout the County for delivery to its member agencies, including the City. The City stores and treats this water prior to distribution to City residents. The City operates three drinking water treatment facilities.

The remaining 10 percent of the water used in the City comes from local resources. Rainfall runoff to local reservoirs provides approximately 8 percent of the City's water supply, and recycled water currently provides 2 percent. The City has developed a successful voluntary water conservation program that is currently estimated to have reduced overall water use by 8 percent based on per capita decline in water use.

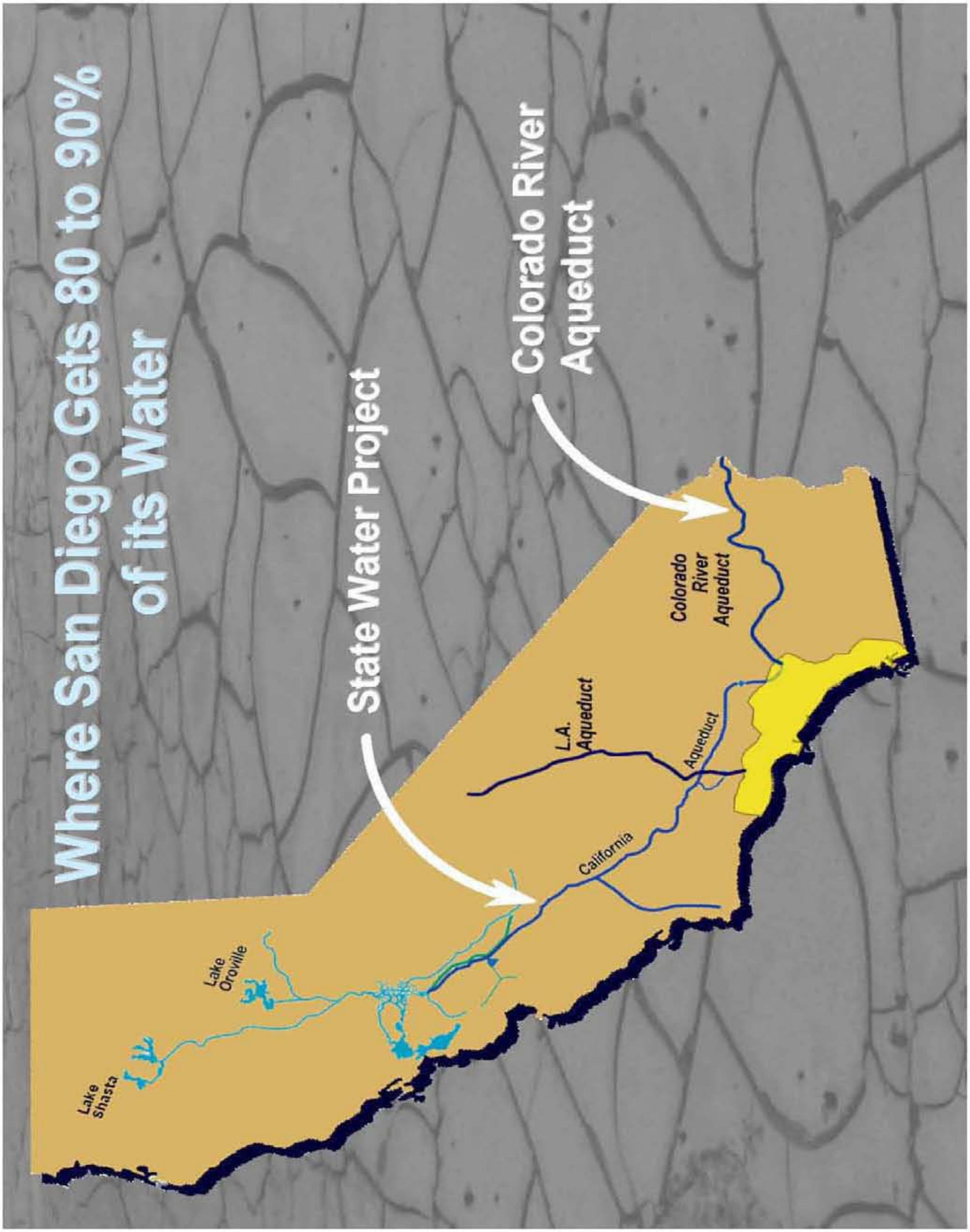


Figure 2.1 – San Diego Imported Water Sources

The City's plans to diversify its water supply and develop more local sources of water include:

- increasing water conservation efforts;
- developing groundwater basins; and
- increasing water reuse.

Water transfers, such as the Water Authority's agreement with the Imperial Irrigation District (IID) increasing from 30,000 AFY in 2005 to 200,000 AFY in 2025, will not increase the available water supply to Southern California, but instead offsets the region's dependence on MWD as a source of water and will provide greater reliability to the Water Authority's service area. However, with the lining of the All-American and Coachella Canals, new water (up to 100,000 AFY) will be available to San Diego County.

The United States Geological Survey predicts continued drought in the Colorado River Basin over the next few decades.

Historically, MWD has drawn as much water as it needed from the Colorado River, often beyond its entitlement. Today, the Colorado River aqueduct is running about half-full because of the drought in the river basin. The United States Geological Survey predicts continued drought in the Colorado River Basin over the next few decades. Alternative water supplies, such as ocean desalination, are being considered regionally. As more costly solutions are implemented to keep pace with Southern California's need for more water, water rates are anticipated to steadily rise.

The Water Authority's 2004 Annual Water Supply Report, adopted by its Board in June 2004, indicates that recycled water is essential to using the region's water supplies efficiently.

In January 2002, the California State Legislature adopted Senate Bills 610 and 221. These two new laws are intended to link information on water supply availability with land use decisions made by cities and counties throughout the state. The laws require that the water purveyor provide verification that sufficient current and future water supplies are available for new development prior to the approval of a tentative map. In response to this legislation, MWD and the Water Authority issued statements that indicated that there is sufficient, reliable water supply for Southern California to accommodate future needs based on the planning done by these agencies. These agencies' plans depend on more local water development by the cities and agencies within their service areas. The Water Authority's 2004 Annual Water Supply Report, adopted by its Board in June 2004, indicates that recycled water is essential to using the region's water supplies efficiently. It specifically references the City's intention to evaluate all aspects of a viable increased water reuse program.

The City's continued dependence on imported water is precarious and potentially costly. By diversifying its water resources, and including additional sources, the City will ensure its residents of a more reliable and independent water supply. The City's Long-Range Plan was developed to document a road map to achieve this diversity. Recycled water plays an important role in fulfilling the goals of the City's Long-Range Plan.

As shown in Figure 2.2, by 2010, the City plans for recycled water to supply 5 percent of its overall water demand, up from the current level of about 2 percent.

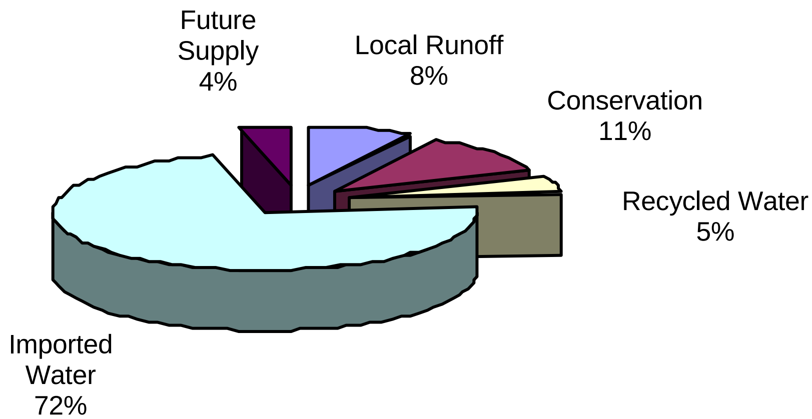


Figure 2.2 – Projected City Diversification of Water Resources in Year 2010

2.2 Description of Opportunities for Increased Water Reuse in San Diego

City Council Resolution R-298781, provided as Attachment A, requires an evaluation of "all aspects of a viable increased water reuse program, including but not limited to groundwater storage, expansion of the distribution system, reservoirs for reclaimed water, live stream discharge, wetlands development, and reservoir augmentation." This section provides a brief description of each of the opportunities that are proposed to be evaluated in the 2005 Water Reuse Study. These opportunities fall into two distinct categories: non-potable reuse and indirect potable reuse. Examples of these types of reuse are provided in Section 5.0.

2.2.1 Non-Potable Reuse

Non-potable reuse encompasses all recycled water applications that do not involve blending with the public water supply. Examples of non-potable reuse are irrigation of golf courses and parks; most agricultural irrigation; industrial use for cooling towers and boilers; car washes and commercial laundries; and flushing of toilets and urinals. It can also include environmental enhancement opportunities through live stream discharge or creation of wetlands.

Distribution System Expansion Opportunities. As previously described, the City successfully operates a recycled water program that currently reaches over 300 customers in the NCWRP service area. These customers use about 5 MGD of recycled water for non-potable purposes, and more customers are scheduled to come online in the near future as their onsite retrofits are completed. With the goal of reusing 12 MGD by 2010 from NCWRP, the City has several projects in various stages of development that would expand its distribution system beyond the "optimized" service area. In the South Bay, the City has signed an agreement to sell Otay Water District 6 MGD of recycled water beginning in 2007. Design of the pipeline connection to Otay Water District facilities is underway. Additionally, the concept of building a water reclamation plant in Mission Valley to facilitate water reuse in the City's central service area is being evaluated as part of this study. Figure 2.3 illustrates the existing and proposed recycled water service areas within the City. Opportunities to further expand recycled water service within the City, as well as to interconnect with adjacent municipal or agency operated recycled water systems, will be developed as part of the Water Reuse Study.

Seasonal storage would allow better utilization of existing treatment capacity and increase the amount of recycled water available in the summer.

Seasonal Storage Opportunities. The majority of recycled water produced by the City is used for irrigation, which is a seasonal demand. In fact, the maximum daily usage in the summer is about twice the annual daily average. This means that a significant portion of treatment capacity cannot be used in off-season months unless seasonal storage is provided. By providing seasonal storage the City could produce a constant flow of recycled water year round and store the off-season flows to meet peak irrigation demands during the summer months. Opportunities for seasonal storage include groundwater recharge and recovery, or a dedicated recycled water reservoir. Both of these opportunities would have to have the capacity to store very large amounts of recycled water, up to 50 percent of the recycled water produced at the treatment facility annually. This amount of water cannot be stored in a constructed steel or concrete tank, so an open reservoir or groundwater basin is necessary for seasonal storage. The Water Reuse Study will explore the feasibility of potential seasonal storage opportunities.

Wetlands Creation and Live Stream Discharge Opportunities. The Water Reuse Study will investigate using recycled water for discharge to existing streams (live stream discharge) as well as the creation or enhancement of wetlands. Potential wetlands sites are anticipated to be located in the City's canyons, in the vicinity of the sources of recycled water supply. A potential benefit of wetlands creation is the ability to establish a wetlands bank for environmental mitigation of future City projects. The study will also evaluate the potential for wetlands creation in areas upstream from the City's surface water reservoirs. This latter concept will be further developed in conjunction with the indirect potable reuse surface water opportunities.

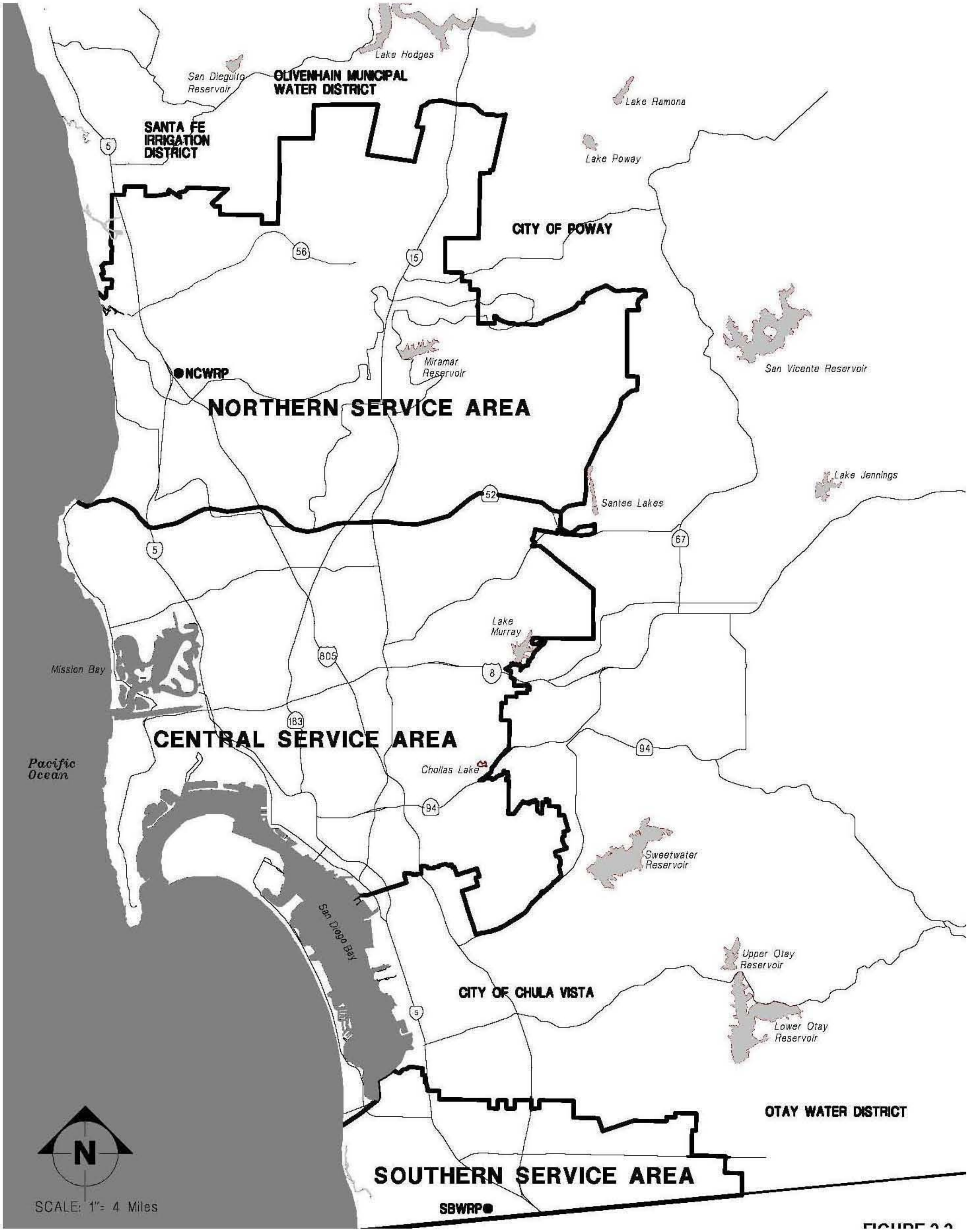


Figure 2.3 – Existing and Proposed San Diego Recycled Water Service Areas

Gray Water Opportunities. Gray water is defined as wastewater from a household or small commercial establishment that does not include water from a toilet, kitchen sink, dishwasher, or water used for washing diapers. Gray water systems require permits and are typically used at single-family residences to collect shower water and non-kitchen sink water and use this water for outdoor irrigation. The Water Reuse Study will investigate opportunities and constraints of gray water use.

2.2.2 Indirect Potable Reuse Opportunities

Indirect potable reuse is the practice of taking recycled water that meets all regulatory requirements for non-potable use, further treating it with several advanced treatment processes, and adding it to an untreated potable water supply. This may be either a surface water body or a groundwater aquifer. Neither use is restricted by seasonal demands. Following a long residence time where the waters will blend and benefit from additional natural treatment, the water is processed as appropriate for drinking water purposes before being distributed to customers for potable use. The term "indirect" refers to the distinction that the highly treated recycled water, also known in California as repurified water, is not plumbed directly to the potable distribution system.

It may be more proper to call this opportunity "planned indirect potable reuse" to distinguish it from unplanned reuse that has been commonly practiced for decades in cities on the major river systems of this country. According to the National Research Council of the National Academy of Sciences, "more than two dozen major water utilities use water from rivers that receive wastewater discharges amounting to more than 50 percent of the stream flow during low flow conditions."

Surface Water Opportunities. Repurified water may be used to augment the potable water supply by discharging the advanced treated recycled water into a surface water reservoir. This is known as reservoir augmentation. It is recommended that the repurified water be stored in a reservoir for a specified minimum time, perhaps six months to one year, to blend with the untreated water within the reservoir and undergo a measure of natural treatment. Natural treatment may also be accomplished by delivering the repurified water to a point upstream from the reservoir, facilitating the enhancement of existing wetlands or the creation of a new one. This study will identify opportunities and constraints of conveying repurified water to augment existing, City-owned, surface water reservoirs. As mentioned above, consideration will also be given to the development of wetlands upstream from a surface water reservoir to further enhance the water's quality through natural treatment prior to its entering the reservoir.

Groundwater Opportunities. Repurified water may also be added to the groundwater and later be recovered for use as a drinking water supply. This practice, known in this study as groundwater storage, is regulated by DHS and must meet minimum residence times and other stringent quality criteria. Methods already in practice in California and elsewhere include recharge from spreading basins and direct injection. Once extracted, a significant level of additional treatment may be necessary to achieve the required drinking water quality. The concept described in this section involves a more rigorous design and approval process than the seasonal storage of recycled water for non-potable use. The Water Reuse Study will identify opportunities and constraints of conveying repurified water to City groundwater basins for subsequent use as a potable water supply.

2.3 Recycled Water Regulations

More than 200 water recycling projects have been designed, constructed and permitted in California, requiring the involvement of many entities at all levels of government. Water supply and sanitation districts are primarily responsible for the planning, design, and implementation of the recycling projects. Regulation of water recycling is vested by State law in the State Water Resources Control Board (SWRCB) and the CDHS. A permit is issued to each water recycling project by one of the nine Regional Water Quality Control Boards (RWQCB) that are a part of the SWRCB. This permit requires water quality protections as well as public health protections by incorporating criteria established by CDHS. The criteria issued by CDHS are found in Title 22 of the California Code of Regulations; the RWQCBs uphold these criteria through enforcement of their permits.

Recycled water treatment levels are defined in the California Code of Regulations. Table 2.1 shows the allowable uses for each of these levels of recycled water treatment.

Table 2.1 – Treatment Levels for Recycled Water Uses

Types of Use	Treatment Level		
	Disinfected Tertiary	Disinfected Secondary	Undisinfected Secondary
Urban Uses and Landscape Irrigation			
Fire Protection	✓		
Toilet and Urinal Flushing	✓		
Irrigation of Parks, Schoolyards, Residential Landscaping	✓		
Irrigation of Cemeteries, Highway Landscaping		✓	
Irrigation of Nurseries		✓	
Landscape Impoundment	✓	✓*	
Agricultural Irrigation			
Pasture for Milk Producing Animals		✓	
Fodder and Fiber Crops			✓
Orchards (no contact between fruit and recycled water)			✓
Vineyards (no contact between fruit and recycled water)			✓
Non-Food Bearing Trees			✓
Food Crops Eaten After Processing		✓	
Food Crops Eaten Raw	✓		
Commercial/Industrial			
Cooling & Air Conditioning – w/ cooling towers	✓	✓*	
Structural Fire Fighting	✓		
Commercial Car Washes	✓		
Commercial Laundries	✓		
Artificial Snow Making	✓		
Soil Compaction, Concrete Mixing		✓	
Environmental and Other Uses			
Recreational Ponds with Body Contact (Swimming)	✓		
Wildlife Habitat/Wetland		✓	
Aquaculture	✓	✓*	
Groundwater Recharge			
Seawater Intrusion Barrier	✓*		
Replenishment of Potable Aquifers	✓*		

* Restrictions may apply
Source: WaterRecycling 2030, California's Recycled Water Task Force, June 2003.

3.0 Value Based Assessment of Reuse Opportunities

CHALLENGE TO STAKEHOLDERS

To review example values for the assessment of reuse opportunities:

Are these appropriate values?

Are there any significant values not represented?

Sustainability is the planned development of a project that meets the needs of the present without compromising our ability to meet the needs of future generations. Sustainability recognizes the interdependence of environmental, social and economic systems and promotes equality and justice. Sustainable use of our water resources can be achieved through cooperation between water agencies that share a source of water, efficient water use, and a reduction in pollution and contamination. Use of recycled water, as an asset that offers value to San Diego, is affected by the public's willingness to use it, the regulatory agencies' ability to permit it and the City's ability to make it safe and reliable. For each reuse opportunity, there may be varying conditions that affect the sustainability associated with that opportunity.

This study will provide an assessment for each reuse opportunity in terms of community-based values.

The Water Reuse Study will assess the advantages and disadvantages, or value, associated with each water reuse opportunity identified, but will not provide a specific recommended project. At the discretion of the San Diego City Council, a project, which may be comprised of one or a combination of reuse opportunities developed in the Water Reuse Study, may be pursued for implementation.

In order to make an informed decision on a course of action, the policy makers must have access to comparable information associated with each reuse opportunity to ensure sustainability. This study will provide an assessment for each opportunity in terms of community-based values. We have identified eight examples of key values that will be addressed for each reuse opportunity evaluated in this study. These proposed values are listed, in no particular order, in Table 3.1 below. For each value, the objective and performance measure for meeting that value is identified. Following the table, a brief discussion of the anticipated components of each value is provided.

Table 3.1 – Example Water Reuse Values to be Addressed

Value	Objective	Performance Measure
Health and Safety	To protect human health and safety with regard to recycled water use and maintain the City's 103 year record for providing safe drinking water	Meets or exceeds state and local Department of Health criteria for recycled water uses and best available technologies are applied.
Social Value	To maximize beneficial use of recycled water with regard to quality of life and equal service to all socioeconomic groups	Comparison of beneficial uses and their effect on human needs and aesthetics, as well as public perception.
Environmental Value	To enhance, develop or improve local habitat or ecosystems and avoid or minimize negative environmental impacts	Comparison of environmental impacts and/or enhancements, environmental impacts avoided, and permits required.
Local Water Reliability	To increase the percentage of water supply that comes from water reuse, thereby offsetting the need for imported water	Increases percent of water recycling and improves local reliability.
Water Quality	Meets or exceeds level of quality required for the intended use and customer needs	To meet all customer quality requirements.
Operational Reliability	To maximize ability of facilities to perform under a range of future conditions	Level of demand met and opportunities for system interconnections and operational flexibility are addressed.
Cost	To minimize total cost to the community	Comparison of estimated capital improvement costs, operational costs, and revenues for each reuse opportunity, as well as comparison of estimated avoided costs such as future regional water and wastewater infrastructure costs and costs to develop alternative water supplies (e.g. desalination).
Ability to Implement	To evaluate viability or fatal flaws	Level of difficulty in physical, social or regulatory implementation.

3.1 Health and Safety

The long history of water reuse experience in the United States and around the world provides reassurance that inherent risks can be safely managed through appropriate technology and risk management decisions without compromising public health. Several studies have looked at the health outcomes of populations potentially exposed to recycled water use over time. These particular epidemiological studies have not identified any health problems related to ingestion of drinking water from either a groundwater source of supply in the Los Angeles basin that has been partially recharged with recycled water or from direct potable reuse of treated wastewater in southern Africa.

Experience provides reassurance that inherent risks can be safely managed through appropriate technology and risk management decisions without compromising public health.

Recent developments and improvements in analytical methods are producing a larger database of detected chemicals and microbes in all sources of water (i.e., recycled water, rivers, lakes and groundwater). Newly identified contaminants are being subjected to toxicological testing and studied to determine to what degree they are removed by currently available treatment technologies. Some of the emerging sources of potential environmental or human concern are:

- Endocrine disrupting chemical compounds
- Genetically engineered products
- Complex chemical mixtures
- Disinfection byproducts
- Trace levels of personal care and pharmaceutical products
- Pathogenic bacteria, viruses and parasites

Good risk management decisions result from a process that asks the input of those who will be affected by the decisions, i.e., the stakeholders.

Risk management is the process of identifying, evaluating, selecting, and implementing actions to reduce risk to human health and the environment. Good risk management decisions result from a process that asks the input of those who will be affected by the decisions, i.e. the stakeholders. In the interest of managing both known and unknown risks, advanced water treatment processes are increasingly being deployed in recycled water projects to provide added assurance that unknown risks are mitigated.

The key questions to be addressed by the study team for each reuse opportunity are:

- What are the perceived risks vs. actual risks associated with the intended use of this opportunity?
- What are the standard safety guidelines/requirements for this intended use and how are they enforced (water quality monitoring/reporting, signage, cross-connection testing, inspections)?
- What are the best available technologies to address health and safety issues?

3.2 Social Value

The use of recycled water can impact the quality of life in our San Diego community. Community awareness regarding how each reuse opportunity affects our quality of life is necessary so that policy makers can make publicly supported and informed decisions on the best uses of recycled water in San Diego.

Recycled water impacts on our quality of life include aesthetic enhancement of our environment through either landscape irrigation or ornamental and recreational ponds, even during times of drought. Advanced treated recycled water can be used to replenish reservoirs that are a source of San Diego's drinking water supplies, or to improve the water quality of our groundwater basins.

Nonpotable water reuse generally enjoys widespread public acceptance in communities where it is practiced. Focus groups, stakeholder interviews and the American Assembly process will provide additional input to the City about proposed water reuse opportunities. They will explore how the community might optimize recycled water as a resource, provide a benefit to all members of the San Diego community (environmental justice), and maintain public trust.

The key questions to be addressed by the study team in this category for each reuse opportunity are:

- How does this reuse opportunity impact quality of life in San Diego (recreational, aesthetics, drought-proof landscaping, water quality, etc.)?
- Does the proposed opportunity provide a benefit during drought conditions?
- Based on stakeholder input gathered throughout this study, what are the public's concerns regarding the intended use of this opportunity?
- Are there special interest groups that oppose the intended use of this opportunity? If so, who and why? Are there compromises that can be reached that can make this project more attractive to these special interest groups?
- Is environmental justice observed through this opportunity? Are all community members benefiting equally from this opportunity? Is any one group of citizens bearing undue burdens from this opportunity?
- Are there regional agencies that need to support this project to ensure success?
- Are there opportunities for developer support of this opportunity?
- What can be done to maintain the public's trust regarding the safe use of recycled water for this reuse opportunity? Is there a need for education of the general public on the safe use of recycled water for this reuse opportunity?

3.3 Environmental Value

Although this study does not include a detailed environmental analysis of benefits or constraints, key anticipated environmental impacts will be identified. The proposed opportunities for water reuse should avoid or minimize environmental impacts to biological, hydrogeological, and cultural resources and to land use due to the construction or operation of reuse facilities.

The key questions to be addressed by the study team in this category for each reuse opportunity are:

- What are the environmental benefits associated with this opportunity? Are they measurable?
- What are the potential environmental impacts with this opportunity? Are they measurable? Are they avoidable or mitigable?
- What environmental documentation or permitting is required for this reuse opportunity?
- Is this opportunity growth inducing?

3.4 Local Water Reliability

The City is seeking to increase the amount of its water supply from local sources and decrease its demand for imported water. In addition, the City established a goal of beneficially reusing 12 MGD of recycled water from NCWRP by 2010. By the end of 2004, the City will use approximately 6 MGD of recycled water. Thus, the goal is to increase this use by at least an additional 6 MGD. The environmental community in San Diego has strongly encouraged the City to become more aggressive in implementing reuse opportunities, including establishing more ambitious future goals. Opportunities will be developed that optimize water reuse beyond the stated 2010 goal, as proposed in City's Long-Range Water Resources Plan.

The key questions to be addressed by the study team in this category for each reuse opportunity are:

- How much recycled water does this opportunity use?
- Is this a seasonal or year-round usage?
- How much imported water use does this opportunity offset?
- Does this intended use of recycled water increase San Diego's ability to provide a local solution to its long-term water needs?

3.5 Water Quality

To optimize recycled water use in San Diego, water quality regulations as well as customer needs must be met. California Code of Regulations, Title 22 requirements prescribe levels of treatment required for health protection. Beyond these water quality requirements, certain uses have specific water quality needs. For example, high total dissolved solids (TDS) can be harmful to plants; water hardness can cause scaling in residential plumbing and industrial or manufacturing processes; and nitrogen and phosphorous can stimulate growth of algae in ponds or cooling towers. Advanced treatment comprised of various treatment processes is sometimes needed to remove specific components that would make the recycled water unsuitable for its intended use.

The key questions to be addressed in this category for each reuse opportunity are:

- What is the water quality requirement for this intended use that meets both the regulatory requirement and the user's needs?
- What constituents are of concern and are they regulated?
- Are there anticipated changes in the regulations that need to be addressed?
- What additional monitoring or testing is required to ensure that water quality needs are being met?

3.6 Operational Reliability

For any reuse opportunity there are hydraulic considerations for the conveyance of the recycled water to the point of use. The ability to maximize the use of the available supply of recycled water and to make adjustments for future supply and demand is a prudent approach to water resource planning. In addition, hydraulic reliability associated with redundancy, and storage to maintain recycled water service to customers, must be integrated with the infrastructure design, and City design standards must be met. The ability to integrate the infrastructure with regional recycled water plans would also enhance hydraulic performance and reuse flexibility.

The key questions to be addressed by the study team in this category for each reuse opportunity are:

- What infrastructure is required to convey recycled water to the point of use?
- How does this opportunity balance supply and demand of recycled water resources?
- How much storage is needed for this reuse opportunity to be successful?
- Does the infrastructure associated with this opportunity conform to City design criteria?
- Is there operational flexibility inherent in the proposed design of this opportunity?
- How can this opportunity be phased?
- How can this opportunity be integrated with other opportunities or regional projects?
- Does the infrastructure proposed in this opportunity have emergency (back-up) reliability or redundancy?

3.7 Cost

For each reuse opportunity, a range of costs for planning purposes will be developed. The present-worth cost analysis will include capital costs and life cycle operation and maintenance costs. The analysis will compare the unit (per acre-foot) cost of reuse alternatives with published costs of other sources of water, including potable water, raw water, and desalinated water. The analysis will also include an evaluation of the avoided costs for unnecessary City water and wastewater projects if the reuse project is implemented.

The key questions to be addressed by the study team in this category for each reuse opportunity are:

- What is the cost per acre-foot associated with the infrastructure needed to support this opportunity?
- What are the operation and maintenance costs associated with this opportunity?
- How much of the operation and maintenance cost is energy cost?
- Are there onsite retrofit costs associated with this opportunity? Who will bear that cost?
- What is the revenue to the City associated with this opportunity?
- What are the avoided costs associated with this opportunity?
- Are there other costs related to implementing this opportunity, such as public education and involvement costs?
- Does the City have to purchase property to implement this opportunity?
- Are there grant/funding resources available for this opportunity?

3.8 Ability to Implement

For each reuse opportunity, there may be varying conditions regarding the City's ability to implement that opportunity. This category will attempt to identify those conditions and to evaluate their effect on the viability of the project and /or quantify their affect on the project schedule.

The key questions to be addressed by the study team in this category for each reuse opportunity are:

- Are there regulatory requirements to meet associated with this opportunity (Permitting, approvals)?
- Are there successful projects that serve as a model for the intended use of this opportunity?
- Is funding available to support this opportunity?
- Is there technical risk associated with the construction of this opportunity?
- Are there physical (land use or geological) conditions or unknowns that may affect the viability of this opportunity?
- Are there political or public perception issues that may affect the viability of this opportunity?

4.0 Recycled Water Technology

CHALLENGE TO STAKEHOLDERS

To achieve a basic understanding of how recycled water is produced.

The purpose of this section is to explain the recycled water treatment process. Understanding the treatment process is helpful, but not essential to understanding the case studies presented in Section 5.0 (starting on page 49), and this somewhat technical section may be skipped if you desire.

Health-based standards for water recycling projects are established by State of California regulatory agencies: the Department of Health Services Drinking Water and Environmental Management Branch and the Regional Water Quality Control Boards, the latter through their permitting authority and the former through enforcement of water quality/treatment regulations and criteria. Controlling pathogens (viruses, bacteria, and protozoa) and trace levels of chemicals in recycled water, and attaining drinking water standards at a minimum, are the requirements for nearly all water recycling projects in California. These criteria are applicable to both non-potable reuse and indirect potable reuse.

The regulatory pathway for developing drinking water standards is exhaustive, takes many years, and ultimately results in a careful balance between the health risk reduction benefits determined through a toxicological or biological risk assessment process and the costs associated with compliance. There are nearly 200 individual constituents now regulated in drinking water.

The level of treatment required depends on the intended use of recycled water.

Regulating a limited number of individual constituents in recycled water based on their allowable maximum levels in drinking water raises the question "what might be there that we don't know about?" In other words, are there contaminants present that we either don't measure or can't measure with existing analytical technology, and could these contaminants, if present, lead to public health concerns? Routine monitoring for many pathogens and chemicals is still not feasible, so unidentified constituents cannot be regulated on an individual basis. Therefore, it is critical to incorporate treatment technologies in a multi-barrier approach to manage the potential risk from these unknowns. With that in mind, California mandates specific physical, biological, and chemical treatment technologies to provide multiple barriers to a wide variety of contaminant classes.

The level of treatment required depends on the intended use of recycled water. Because indirect potable reuse involves human consumption of the water, it requires the most stringent treatment technology requirements. Multiple, redundant treatment processes are therefore mandatory.

The following sections provide an overview of the various treatment processes commonly used to produce recycled water of various qualities and end uses.

4.1 Standard Treatment Processes

As a result of treatment, recycled water is suitable for specified beneficial uses. The degree of treatment provided for recycled water depends on the quality of water needed for the specific use and for public health protection. The separate treatment processes, aligned in series, form the entire "treatment train" (i.e., the treatment plant). Substantial protection is the goal of this multiple treatment barrier approach. A requirement for multiple barriers will assure that the public is safe, even if one treatment barrier fails. Figure 4.1 illustrates the steps employed at the NCWRP, which produces recycled water for irrigation and industrial use.

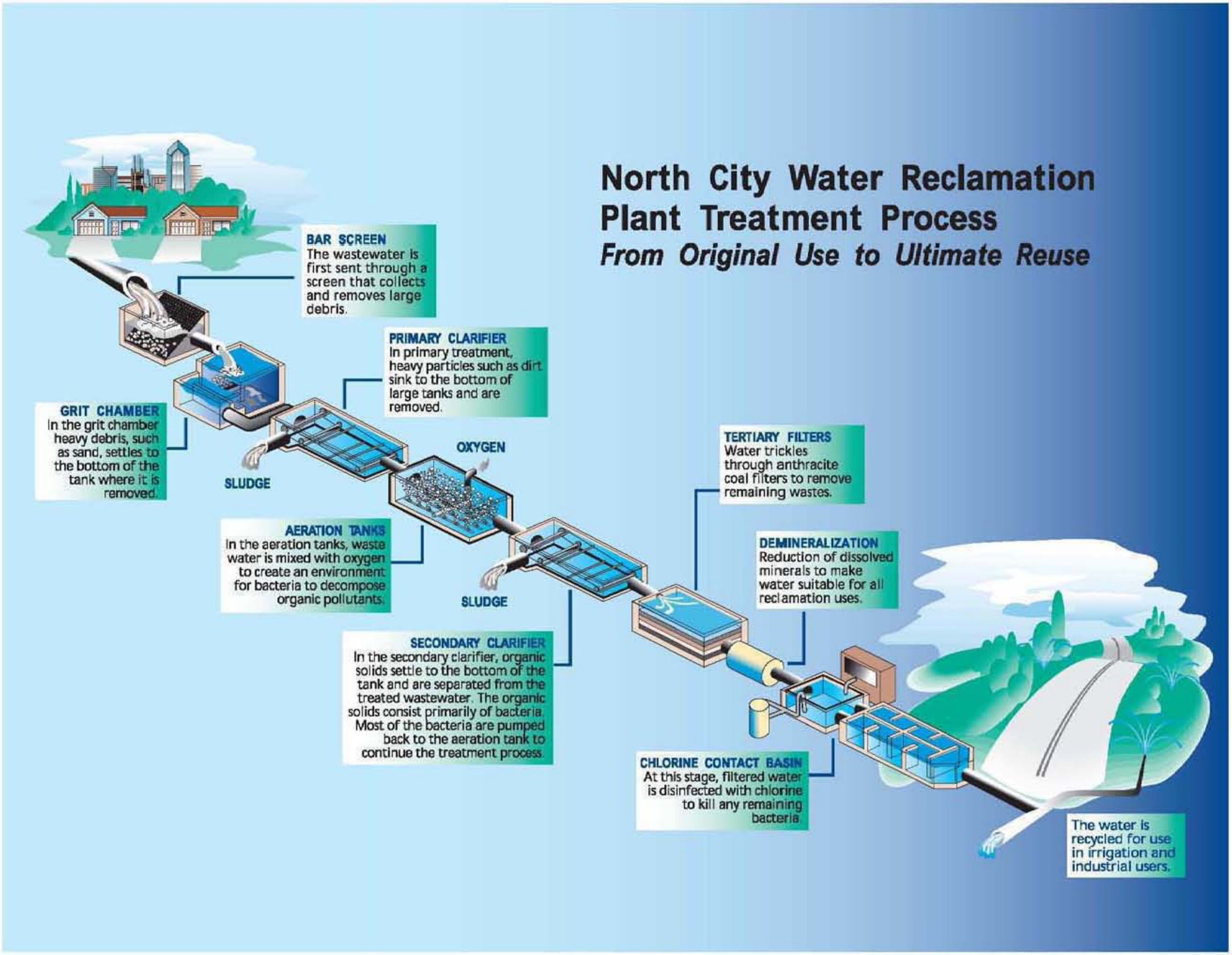
4.1.1 Primary Treatment

Primary treatment removes materials that are suspended in the water (suspended solids). In most large facilities this is accomplished by passing the water through large tanks (sedimentation tanks) where suspended materials gradually settle out of the water. This is the method by which suspended solids are removed at the City's two water reclamation plants. After this stage of treatment, the wastewater is called primary effluent. Such an effluent is suitable for ocean disposal in special circumstances. The City's Point Loma Wastewater Treatment Facility has one of only a few permits in the United States allowing a "primary" discharge level. Most other cities provide secondary treatment.

4.1.2 Secondary Treatment

Additional treatment of the primary effluent is what allows water to be recycled for some types of irrigation and industrial uses. Secondary treatment removes biodegradable organic matter and pathogenic microorganisms. Biological treatment is customarily used as secondary treatment. In this process, the primary effluent is mixed with natural soil bacteria and agitated using fresh air, which supplies oxygen to the bacteria. The bacteria respond by growing and multiplying, using the organic matter as a food source. After spending several hours in these aeration basins, the water is again settled, to remove the bacteria and all of the organic matter they have absorbed. Secondary effluent has much lower levels of both biodegradable organic matter and pathogenic microorganisms than primary effluent, and it meets the

Figure 4.1 – North City Water Reclamation Plant Treatment Process



standards that EPA requires for discharge to most rivers, estuaries and the ocean. CDHS also allows its use for irrigation of a limited number of crops (e.g., irrigation of food crops where the irrigating water does not contact the edible portion, or fodder and fiber crops).

4.1.3 Title 22 Treatment

Title 22 treatment, named after the state regulation section that defines it, consists of filtration through sand and/or anthracite, followed by disinfection, usually with chlorine. Title 22 treatment eliminates almost all pathogenic organisms. The filtration step removes particles from the water that might protect the microorganisms from the disinfectant. It also removes some of the organisms themselves. Following filtration, disinfection is very efficient at eliminating remaining pathogens.

Title 22 treatment has become recognized throughout the United States and around the world as the standard for recycled water to be used for a wide variety of types of irrigation and industrial applications.

Since its development in California in the mid 1970s, Title 22 treatment has become recognized throughout the United States and around the world as the standard for recycled water to be used for a wide variety of types of irrigation and industrial applications. Throughout the world, golf courses, parks, school grounds, freeway medians, and other public areas are irrigated with water treated to meet California's Title 22 standard. Title 22 treatment is also used as a standard for discharge to lakes and reservoirs where swimming and other body contact may occur. The City's water reclamation plants are constructed to achieve Title 22 treatment standards.

4.2 Advanced Treatment Processes (Beyond Title 22)

More sophisticated, higher technology water treatment processes that go beyond Title 22 treatment may be employed in water recycling when very specific constituents must be removed. Such constituents may be removed because they are detrimental to the intended use(s), or the water is intended to enter the source of a potable water supply, such as a groundwater basin or surface water reservoir (otherwise known as reservoir augmentation or indirect potable reuse).

Advanced treatment of recycled water used for indirect potable reuse involves the use of filtration processes. The advent of alternative filtration technologies, notably membrane filtration, has recently supplanted more traditional forms of filtration because it can be installed in a smaller area, is more easily automated, and may be more reliable than traditional granular filtration.

The treatment technologies used to produce recycled water for these applications include Reverse Osmosis (RO), Ultraviolet (UV) treatment, advanced oxidation, and ion exchange treatment.

The water quality goals that can be achieved using these technologies include:

- Reduced salinity or salt removal
- Disinfection
- Contaminant removal and /or destruction
- Ammonia and nitrate reduction

These advanced treatment technologies, described in detail below, allow recycled water uses that require more reliable and demanding water quality targets. Such applications might include uses that require prevention of source degradation, low- and high-pressure boiler feed water, and indirect potable reuse. These uses either require low total dissolved solids concentrations to prevent scaling and precipitation, or require reliable pathogen removal and the capability to meet strict water quality regulations.

The indirect use of recycled water to augment potable supplies is permissible under California law and is currently allowed via groundwater recharge using direct injection or surface spreading and via surface water reservoir augmentation. Water quality and treatment processes are not explicitly defined for indirect potable reuse, but are evaluated on a case-by-case basis by the CDHS. CDHS is charged with the responsibility of assuring that the proposed treatment process, including method of distribution, produces recycled water that is protective of public health. The regulations for groundwater recharge are presently under revision by CDHS. The draft proposed groundwater recharge regulations for augmentation via direct injection anticipate that such projects will provide multi-barrier protection by employing the following advanced treatment processes:

- *RO treatment* – the RO membrane is a physical barrier that is capable of rejecting pathogens, organic contaminants, and dissolved solids;
- *UV light and hydrogen peroxide addition* – this advanced oxidation process is a chemical barrier that provides additional disinfection and certain types of contaminant removal, addressing the marginal possibility that undesirable constituents may pass the RO membrane; and
- *Chlorine disinfection* – this final chemical barrier provides residual, long-lasting disinfection to maintain water quality during distribution.

It should be noted that no single treatment process is an absolute barrier to pathogens or contaminants, but that a series of treatment processes that includes RO treatment is the most aggressive and thorough approach. The advanced treatment processes detailed below are capable of meeting all current and draft water quality regulations in existence both in California and elsewhere.

4.2.1 Soil Aquifer Treatment

Recycling projects that have indirect potable reuse (which is ultimately a drinking water use) as their goal are customarily given treatment beyond Title 22. The most common practice is to use soil aquifer treatment. In soil aquifer treatment, the water is first treated to Title 22 standards and then it is spread in basins (such as dry river beds) from which it slowly percolates into the groundwater. Studies conducted over the past forty years have shown that a broad variety of organic and inorganic constituents are removed from the water as it percolates through the soil. The Water Replenishment District of Southern California has been working with the Los Angeles County Sanitation Districts to conduct indirect potable reuse along the San Gabriel River in this manner since the 1960s. CDHS regulates this activity and in 2003 issued draft regulations that are expected to significantly influence the practice of groundwater recharge. Among other things, these regulations specify the time the water must spend in the aquifer before it is extracted.

4.2.2 Reverse Osmosis (RO)

Some other indirect potable reuse projects operate by directly injecting treated water into the aquifer itself. Because these projects cannot benefit from soil aquifer treatment, regulations require that they provide additional treatment. Historically, all of these projects have used RO treatment. RO may also be used in water recycling treatment when the intended use requires very low levels of salts. For instance, use of Title 22 recycled water for industrial boilers would not be practical because the levels of salts in the recycled water would cause severe damage to the boilers. RO, a process by which salts can be removed to very low levels, is commonly used to make recycled water acceptable for these types of salt-sensitive applications. RO is also the primary process used in desalination.

Removal is accomplished by the passage of the water through a semipermeable membrane. The membrane is a very thin material typically made of synthetic organic polymers. RO membranes do not have “holes” for the water to travel through. Under pressure, the water passes through the membrane by the process of molecular diffusion, the movement of molecules from a high to a low concentration. As a result, all solid particles and much of the dissolved materials are removed. Significantly, any remaining pathogens are also removed. Tests have shown that modern RO membranes properly manufactured and properly installed completely prevent the passing of viruses, bacteria, and protozoa, making this technology an excellent protective barrier against water-borne diseases.

4.2.3 Membrane Filtration

Membrane filtration is capable of completely removing all pathogens from the water, an important development where recycling is concerned. It has also been found that water treated first by membrane filtration is much more easily treated by RO since there are no particles to clog the RO membrane. In water recycling, membrane filtration is most commonly used as a pre-treatment stage for RO in indirect potable reuse, but can also be used to replace sand and anthracite filtration in the Title 22 treatment process.

Membrane filtration is not new, but it is relatively new to water treatment. Water is pushed through a porous membrane. The pores in the membrane are very small and the solid particles are left behind. The pore size of the membrane is chosen based on the desired level of treatment. The categories of membranes typically used for RO pretreatment are microfiltration and the smaller pore-size ultrafiltration. Membrane filtration does not remove dissolved constituents. The technology was demonstrated as effective in water recycling at San Diego's Aqua 2000 and at Orange County's Water Factory 21 in the late 1990s. This technology has rapidly advanced and today there are many manufacturers and numerous installations, some of them quite large. The Metropolitan Water District of Southern California (MWD) installed five membrane filtration plants for drinking water production along the Colorado River Aqueduct in the early 1990s. In north San Diego County, the water treatment facility operated by Olivenhain Municipal Water District uses membrane filtration to treat nearly 30 MGD.

4.2.4 Ion Exchange

Ion exchange may be used in conjunction with the other advanced treatment processes as an additional barrier to remove certain contaminants, such as in organic chemicals, which the others may not. Ion exchange is a versatile treatment process commonly used for nitrate removal in drinking water treatment and for producing ultra-high purity water for industrial applications such as semiconductor manufacturing. Ion exchange is a principle process in home water softeners (calcium and magnesium removal) and in the production of bottled drinking water. The ion exchange treatment process typically uses chemically coated resin beads that selectively adsorb a particular ion in the water and exchanges it with another specific ion from the surface of the beads. What is adsorbed or removed can vary with the composition of the resin bead. Periodically, ion exchange resins are regenerated by backwashing.

4.2.5 Advanced Oxidation

Another recent technological advancement is advanced oxidation. Virtually all man-made chemicals can be removed by oxidation (bleaching is a form of oxidation), but sometimes oxidation alone is too slow to be practical.

The basic idea of advanced oxidation is to introduce an oxidant and hydrogen peroxide to the water to create hydroxyl radicals, which is essentially the water molecule, H_2O, without one of the hydrogen atoms. The chemical products that result from this process are usually carbon dioxide and water.

There are two methods of advanced oxidation that are most common. The first, which was studied extensively by both the Los Angeles Department of Water and Power and by MWD, produces hydroxyl radicals by reacting hydrogen peroxide with the oxidant ozone. MWD coined the name, "peroxone" to describe it. This is the process that MWD has installed at one of its water treatment plants (and is planning to install at all five of its plants) to remove algae-produced organic compounds that periodically give the water an earthy-musky taste.

The second method to make hydroxyl radicals, which is used extensively to remove organic contaminants at hazardous waste sites, is to expose the hydrogen peroxide to ultraviolet (UV) light, another powerful oxidant. Orange County is proposing to employ advanced oxidation with UV and hydrogen peroxide for removal of the contaminant chemical NDMA in their groundwater.

5.0 Case Studies - Learning from Experience

CHALLENGE TO STAKEHOLDERS

To learn about the potential applications for recycled water and some of the places where it is being used.

Understanding other utilities' approaches to and experiences with planning, constructing and implementing water recycling projects is an important factor in weighing various reuse options being considered by the City. Valuable lessons can be learned from both successful and failed projects. Many communities in the United States and around the world have active and successful water recycling programs. Most of these programs primarily distribute recycled water for landscape and agricultural irrigation, but distribution of recycled water for industrial processes, cooling water, textile dyeing, water supply augmentation, and a host of other innovative uses have been introduced in recent years as more communities are attempting to expand and diversify their water resources.

The second White Paper to be distributed in conjunction with the second American Assembly Workshop next year will have a thorough description of important and groundbreaking water recycling projects operating in the United States covering a range of recycling applications. Those case studies will present a comprehensive discussion of the factors that were considered in the ultimate selection of the project elements, such as environmental setting, objectives, regulatory and local recycling criteria, public participation and concerns and how they were addressed, project costs, benefits, and water quality goals.

For the purposes of the first American Assembly Workshop we have included in this white paper examples of water reuse projects that were examined in the *Southern California Water Recycling Projects Initiative Recycled Water Project Implementation Strategies Technical Memorandum*, prepared in March 2004 for the U.S. Bureau of Reclamation in partnership with numerous water and wastewater agencies, including the City of San Diego. A total of eight case studies, taken directly from the technical memorandum, describe numerous implementation strategies and lessons learned.

5.1 Irvine Ranch Water District System

Project Description: The Irvine Ranch Water District (IRWD) Michelson Water Reclamation Plant can produce up to 15 MGD 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 to augment their water supply through long-term planning for recycled water, 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.

5.2 West Basin Water District System and Phase 4 Expansion

Project Description: The West Basin Water District (WBMWD) 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 by the consistency of water quality and quantity. When compared to existing potable water supplies, whose reliability can be affected 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 come 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.

5.3 Southwest Florida Water 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 for many activities that do not require potable quality water (i.e. irrigation and toilet flushing) conserves 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 reused.[2] 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. Florida's Water Reuse Work Group Water Conservation Initiative[3] asserts 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 SWFWMD 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 implementation extensive recycled water treatment and distribution system. Viewing the natural water systems in the area as an integrated system has enabled the SWFWMD 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.

[1] *Water Reuse for Florida – Strategies for Effective Use of Reclaimed Water, Reuse Coordinating Committee and the Water Conservation Initiative WaterReuse Work Group, June 2003, p. 4.*
[2] *IBID, p. 5.*
[3] *IBID, p.p. 8-12.*

5.4 Redwood Shores Recycled Water Project

Project Description: Redwood City, California consumes 1,100 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) irrigation water 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 EIR, 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 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 mandatory connection ordinance. In order to allay concerns regarding the project, Redwood City addressed public concerns by creating a community task force and technical/legal team, conducting a public hearing, producing a draft California Environmental Quality Act (CEQA) document 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 task force 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.

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 task force, set up by Redwood City, presented their alternatives and recommendations to the City Council on March 22, 2004. The task force objective was to identify ways to reduce potable water demand by 2,000 AFY 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 task force 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]

[1]*City 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.*

5.5 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 Municipal Water District (PDMWD), 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, 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 1.0 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 1 MGD-capacity activated sludge plant was upgraded to an advanced biological nutrient-removal system, which had a 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 are funded by recycled water revenues and wastewater cost offsets. PDMWD anticipates that future National Pollutant Discharge Elimination System (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 PDMWD 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 lifespan. 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: Harold Bailey, 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

5.6 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 AFY 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 CDHS, and the Upper Los Angeles River Area Water master, 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 AFY. 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 reinformed regarding the project need and review the steps undertaken to develop the project.

5.7 Moulton Niguel Water District

Project Description: The Moulton Niguel Water District (MNWD) in Orange County, California 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 schoolchildren, 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.

5.8 Orange County Water District

This case study is excerpted from the May 2004 *Innovative Applications in Water Reuse: Ten Case Studies* by Dr. James Crook.

Project Description: The Orange County Water District (OCWD) in Orange County, California, began pilot studies in 1965 to determine the feasibility of injecting effluent from an advanced wastewater treatment facility into aquifers at the mouth of the Santa Ana River to create a freshwater mound that prevents seawater intrusion. Construction of the advanced wastewater treatment facility known as Water Factory 21 began in 1972 and injection of treated municipal wastewater began in 1976 via multiple cased injection wells. Water Factory 21 received secondary effluent from the adjacent Orange County Sanitation District Plant No. 1. The reclaimed water was required to be blended with demineralized or deep well water prior to injection. Extensive monitoring has verified that the product water contains no pathogenic bacteria, viruses or parasites and continually meets all drinking water standards. The treatment train at Water Factory 21 has been modified to address new compounds that are probable human carcinogens or emerging contaminants. All wastewater treatment receives RO using thin-film composite membranes and the main disinfection process uses UV.

In 1991, OCWD began operation of the Green Acres Project (GAP), providing an average of 6 MGD of reclaimed water for landscape irrigation and industrial purposes. The reclaimed water receives tertiary treatment and is distributed for use in Fountain Valley, Huntington Beach, Costa Mesa, Newport Beach and Santa Ana. During the winter months the GAP plant is taken out of service and reclaimed water is supplied by the Irvine Ranch Michelson WRP. Future expansions of this project are being considered.

During the 1990's OCWD estimated that an additional 45 to 70 MGD could be recharged into the groundwater basin using exiting spreading basins in the Orange County Forebay area. A recharge project called the Groundwater Replenishment (GWR) System was conceived to provide a new reliable drought proof water supply, at 40 percent less cost than imported water, that would prevent seawater intrusion, improve groundwater quality, reduce ocean discharge and defer the need for a new ocean outfall. Monitoring at Water Factory 21 has verified that the treatment provided is capable of producing water that meets all requirements specified by CDHS for indirect potable reuse via groundwater recharge. The majority of the treated water will be pumped through a 78-inch diameter pipeline through the Santa Ana River corridor to Kraemer Basin in Anaheim, one of the deepest spreading basins in the Orange County Forebay area. The GWR System is supported by an active outreach program to inform water users on the need for the project and the water quality.

Project Relevance: This case study demonstrates how local water supply reliability can be improved with properly implemented reuse projects. OCWD's approach to ensuring safe and adequate water supplies within its service area include a commitment to "cutting edge" research, innovation in treatment technology, monitoring of treatment process performance beyond permit requirements and a close working relationship with regulatory agencies.

Lesson Learned: Extensive and continued public outreach, working closely with regulators and pursuing cutting edge technology, are integral components of a successful water reuse program. A long history of technical excellence and expertise helps to instill confidence in a water agency's efforts to protect public health.

Thank you for taking the time to read through this white paper in preparation for the American Assembly Workshop. Again, we appreciate your time and value your input on water reuse issues in San Diego. Below is a reminder of the key points on which we would like your input and feedback.

1. Have the appropriate goals and objectives been identified?
2. Are there other goals and objectives that should be considered?
3. What water reuse opportunities should be considered?
4. What are the key considerations associated with these reuse opportunities?
5. What should the study team investigate?
6. Are the values presented appropriate for comparing the reuse opportunities?

6.0 Glossary of Important Terms and Acronyms

Acre-foot: A unit used to measure large volumes of water. It equals the volume of water required to cover one acre to a depth of one foot. An acre-foot is 325,851 gallons and is considered enough water to meet the needs of two average-sized families with a house and yard for one year.

Adsorption: The physical process occurring when liquids, gases, or suspended matter adhere to the surfaces of, or in the pores of, an adsorbent medium. It is a physical process that occurs without chemical reaction.

Advanced Oxidation: Uses the same kind of ozone found in the atmosphere. By adding ozone to the water supply and then sending an electric charge through the water, disease-causing microbes are inactivated.

Advanced Treatment: Additional treatment provided to remove suspended and dissolved substances after conventional secondary treatment. Often this term is used to mean additional treatment after tertiary filtration and disinfection treatment for the purpose of further removing contaminants of public health or other water quality concern. This may include membrane filtration, reverse osmosis, and advanced oxidation and disinfection with ultraviolet light and hydrogen peroxide.

AFY: Acre-feet per year. See Acre-foot.

American Assembly: A process that brings together stakeholders to examine public policy questions and recommends action.

Augmentation: Adding recycled or repurified water to an existing raw water supply (such as a reservoir, lake, river, wetland and/or groundwater basin) that could eventually be used for drinking water after further treatment.

Beneficial Use (of Water): A use of water resulting in appreciable gain or benefit to the user, consistent with state law, which varies from one state to another. In California, beneficial uses of waters of the state that may be protected against quality degradation include, but are not necessarily limited to, domestic, municipal, agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves. (Water Code, Section 13050(f)).

Beneficial reuse: The use of recycled water for purposes that contribute to the economy or environment of a community.

Blending: Mixing or combining one water source with another.

CDHS: California Department of Health Services.

CEQA: California Environmental Quality Act

City: City of San Diego.

CWA: Clean Water Act (Federal).

Demineralization: A process which removes dissolved minerals from a fraction of the filtered water, and blends the product water with the remaining filtered water to achieve a total dissolved solids (TDS), goal of less than 1,000 milligrams per liter (mg/l). For perspective, sea water contains a TDS level of about 35,000 mg/l.

Direct Injection: Usually referring to the injection of water that has been treated above the tertiary level directly into a groundwater aquifer via an injection well.

Disinfection: Removal or inactivation of any organism.

Drought: Hydrologic conditions during a defined period when rainfall and runoff are much less than average.

EDR: See Electrodialysis Reversal.

EIR: Environmental Impact Report.

EIS: Environmental Impact Statement.

Electrodialysis Reversal: A process in which solutions are desalted or concentrated electrically.

EPA: Environmental Protection Agency (Federal).

Gray Water: Wastewater from a household or small commercial establishment that does not include water from a toilet, kitchen sink, dishwasher, or water used for washing diapers.

Groundwater: Water that fills the pore spaces that occur beneath the land surface.

Groundwater Recharge: Using recycled water to augment underground aquifers, by allowing the treated water to seep through the ground and into the aquifer.

GPD: Gallons per day.

IBWC: International Boundary and Water Commission (Federal)

Indirect Potable Reuse: The addition of advanced treated recycled water to a natural water source (ground water basin or reservoir) that supplies water directly to a drinking water treatment facility.

Ion Exchange: A reversible chemical process in which ions from a resin (typically an array of insoluble manufactured organic polymer beads) are exchanged for ions in a solution or fluid mixture surrounding the resin.

MG: Million gallons.

MGD: million gallons per day.

mg/l: milligrams per liter.

Microfiltration: The separation or removal from a liquid of particulates and microorganisms in the size range of 0.1 to 2 microns in diameter. A micron is a millionth of a meter.

Multiple Treatment Barriers: Each barrier is expected to provide substantial protection, and a requirement for multiple barriers will assure that the water treatment process remains effective even if one treatment barrier fails.

MWD: Metropolitan Water District of Southern California.

MWWD: Metropolitan Wastewater Department (City of San Diego).

Nanofiltration: A membrane liquid separation technology that is positioned between reverse osmosis (RO) and ultrafiltration. While RO can remove the smallest of solute molecules, in the range of 0.0001 micron in diameter and smaller, nanofiltration (NF) removes molecules in the 0.001 micron range.

NCWRP: North City Water Reclamation Plant.

Non-potable Reuse: Includes all recycled water reuse applications except those related to drinking water.

NPDES: National Pollutant Discharge Elimination System

Ocean Outfall: A large pipeline used to dispose of treated (usually primary or secondary) wastewater several miles offshore.

OMWD: Olivenhain Municipal Water District.

O&M: Operation and Maintenance.

OPRA: Ocean Pollution Reduction Act (Federal).

Pathogen: A disease-producing agent; referring to a living organism (i.e., biological). Generally, any viruses, bacteria, or fungi that cause disease.

Reclaimed Water: The end product of wastewater reclamation that meets water quality requirements for biodegradable materials, suspended matter, and pathogens. Reclaimed water is another name for recycled water.

Recycled Water: Reclaimed water that meets appropriate water quality requirements and is reused for a specific purpose**.**

Repurified Water: Recycled water treated to an advanced level suitable for augmentation to a drinking water source.

Reverse Osmosis: A filtration process that uses a membrane that is semi-permeable, allowing the fluid that is being purified to pass through it, while rejecting the contaminants that remain.

RO: See reverse osmosis.

RWQCB: Regional Water Quality Control Board (State of California).

SBWRP: South Bay Water Reclamation Plant.

Soil-Aquifer Treatment: The process of water being purified by percolating through soil and into an underground aquifer.

SWRCB: State Water Resources Control Board (State of California).

TDS: See Total Dissolved Solids.

Total Dissolved Solids: All the solids (usually salts) that are dissolved in water. Used to evaluate water quality.

Title 22 Treatment: A method of tertiary waste water treatment approved by CDHS for many water reuse applications. Title 22 outlines the level of treatment required for allowable uses for recycled water, including irrigation, fire fighting, residential landscape watering, industrial uses, food crop production, construction activities, commercial laundries, road cleaning, recreational purposes, decorative fountains and ponds.

UF: See ultrafiltration.

Ultrafiltration: A membrane filtration process that falls between reverse osmosis and microfiltration in terms of the size of particles removed, with ultrafiltration removing particles in the 0.002 to 0.1 micron range, and typically removing organics over 1,000 molecular weight while passing ions and smaller organics.

Ultraviolet Treatment: The use of Ultraviolet light for disinfection.

UV: See Ultraviolet treatment.

Wastewater Reclamation: Treatment or processing of wastewater to make it reusable.

Water Authority: San Diego County Water Authority.

Water Recycling: See Water Reuse.

Water Reuse: The planned use of recycled water for specific beneficial purposes.

Wetland: An area that is inundated or saturated by water and supports plant and animal life. Wetlands serve a critical function in protecting endangered species. Wetlands also filter pollutants in stream courses, provide flood control and erosion prevention, and may provide recreational opportunities.

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Attachment A.
City Council Resolution R-298781

(R-2004-440)

RESOLUTION NUMBER R-298781

ADOPTED ON JAN 13 2004

RESOLUTION OF THE CITY COUNCIL REGARDING THE STUDY OF INCREASED ASPECTS OF WATER REUSE

WHEREAS, the Council of the City of San Diego adopted Resolution No. R-291210 on January 19, 1999, directing the City Manager not to spend any monies on water repurification until options for such reuse of water are evaluated and further direction is given by the Council; and

WHEREAS, the State of California in June 2003 issued a report entitled "Water Recycling 2030: Recommendations of California's Recycled Water Task Force," which called for a community-based process to evaluate a wide range of potential uses of recycled water; and

WHEREAS, on October 10, 2003, the City Manager issued City Manager's Report No. 03-203 entitled "Status Report on City of San Diego Long-Range Water Resources Plan (2002-2030)," which identified reclaimed water as an important source of a locally produced water supply and identified the City's two water reclamation plants: the North City Water Reclamation Plant and the South Bay Water Reclamation Plant, as important sources of reclaimed water to reduce the City's imported potable water demand; and

WHEREAS, the City's Natural Resources and Culture Committee on November 19, 2003 heard a full presentation on Alternative Water Sources, including testimony on the recently issued "Water Recycling 2030: Recommendations of California's Recycled Water Task Force" and unanimously recommended that the City Manager conduct a study of all aspects of increased water reuse; NOW, THEREFORE, BE IT RESOLVED, by the Council of the City of San Diego, that the City Manager is directed to conduct a study of one year duration evaluating all aspects of a viable increased water reuse program, including but not limited to groundwater storage, expansion of the distribution system, reservoirs for reclaimed water, livestream discharge, wetlands development, and reservoir augmentation. The study and report of same shall include a general assessment of costs and benefits of such projects including, but not limited to, consideration of public health, public acceptance, water costs, water supply reliability issues, compilation of research/studies concerning reservoir augmentation, and information concerning potential impacts of pharmaceuticals, endocrine disruptors, personal care products, and additional constituents of the wastewater stream on water quality and health. The study and report, when completed, shall be calendared before the Natural Resources and Culture Committee for such action as it deems appropriate.

APPROVED: CASEY GWINN, City Attorney

By Ted Bromfield

Ted Bromfield
Senior Deputy City Attorney

TB:mb
11/20/03
Or.Dept:NRC
R-2004-440