



Executive Summary

Introduction

The Dry Creek Recycled Water Groundwater Recharge Feasibility Study identifies and evaluates potential opportunities to recharge groundwater in Placer and Sacramento Counties with recycled water. This study identifies and evaluates possible direct and in-lieu recharge¹ opportunities based on economics, legal considerations, public perception, and potential for groundwater benefit. The four principal goals of the study include:

- *Identify the potential market in the region for recycled water for irrigation purposes*
- *Evaluate participation in the regional groundwater banking and exchange program*
- *Investigate the institutional and regulatory issues that exist in implementing a recycled water groundwater recharge program*
- *Identify mechanisms for protecting Roseville's existing water rights*

The study included the following tasks:

Tasks

- 1 Prepare and Implement Project Management Plan**
Prepare a Project Management Plan (PMP) that clearly delineates the work plan, schedule, budget, and reporting responsibilities.
- 2 Confirm Feasibility Study Purpose And Goals**
Confirm with the study team, in particular responsible City and DWR staff, the purpose and goals of the feasibility study.
- 3 Develop Decision Support Approach**
Develop a process (analytical tools and approaches) for evaluating opportunities identified during the project.
- 4 Characterize Water Resources Setting**
Document the existing (and projected) water resources setting (that is, the physical, institutional, legal, and regulatory setting) so that baseline conditions can be established against which potential impacts of prospective program operations will be evaluated.
- 5 Identify Potential Opportunities**
Prepare a preliminary "menu" of potential direct recharge and in-lieu recharge opportunities along the Dry Creek corridor from the Dry Creek WWTP to the "confluence" of Dry Creek with the Natomas East Main Drainage Canal (and ultimately the Sacramento River).
- 6 Conduct Legal/Water Rights Analyses**
Conduct a search of SWRCB records to determine whether any individuals have appropriated the reclaimed wastewater the City has historically released for the Dry Creek WWTP or have filed statements of riparian use for these waters. Develop a water rights strategy regarding potential other users for the purpose of qualifying the volume of water available for the recharge program. Prepare and file an application with the SWRCB for the appropriation of reclaimed wastewater.

¹Direct recharge is the intentional infiltration of surface water into the groundwater system. In-lieu recharge is the practice of providing supplemental water to historic groundwater users, thereby leaving groundwater in storage for later use.

7

Evaluate Direct Recharge Opportunities

Conduct an evaluation of the hydrologic, engineering, institutional, legal, political, and economic feasibility of the direct recharge opportunities identified on the preliminary “menu”.

8

Evaluate In-lieu Recharge Opportunities

Evaluate the hydrologic, hydrogeologic, legal, engineering, and economic feasibility of the in-lieu recharge opportunities identified on the preliminary “menu”.

9

Develop Pilot Study Work Plans

Develop work plans for direct recharge opportunities remaining after screening. These plans will describe the field testing methods and procedures.

10

Develop Environmental And Permitting Strategy

Develop an environmental documentation and a permitting strategy for identified and selected feasible in-lieu and direct recharge sites.

11

Develop Stakeholder And Public Outreach

Gather the information required to develop an outreach campaign, and to develop a strategy for implementing that campaign.

12

Prepare Final Report

A final report will document the entire feasibility study. The objective of this report is to serve as the foundation for submittal of a grant application for the construction of any project opportunities that proved feasible from a hydrologic, hydrogeologic, legal, engineering, and economic standpoint.

Technical memoranda were prepared for Tasks 1 to 11 documenting the study methodology, results, findings and conclusions. Tasks 1 to 3 involved documenting the goals of the project and reaching agreement by the project team. During execution of these tasks, the team reached consensus on study objectives, planning assumptions, success indicators and screening and evaluation criteria. Tasks 4 to 11 involved completion of various technical analyses.



The existing water resources setting for the Dry Creek Recycled Water and Groundwater Recharge project was examined to characterize existing physical conditions.

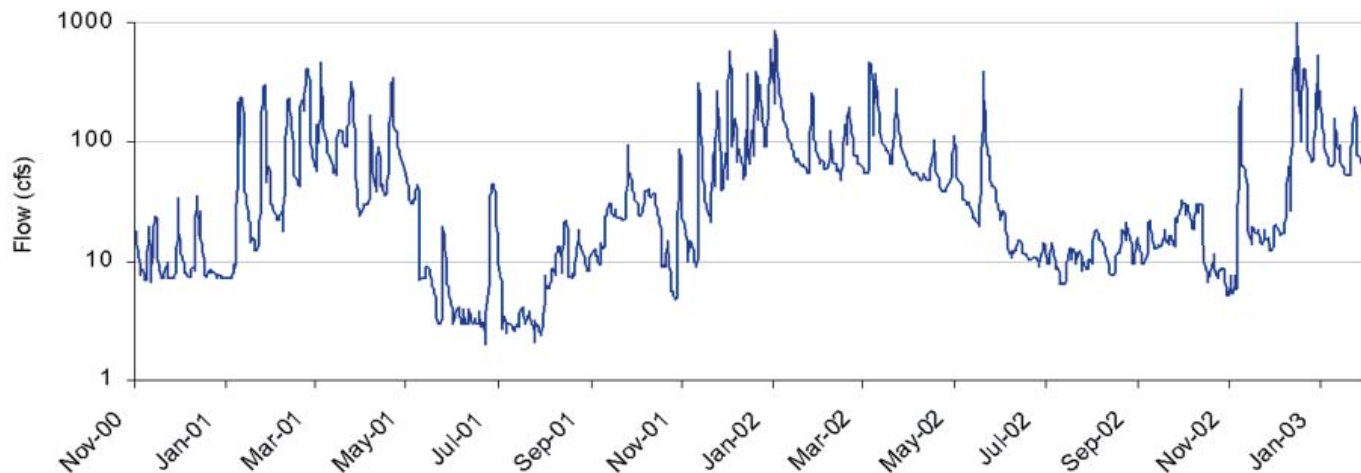
Surface Water Hydrology

Dry Creek is a perennial creek. Peak flows usually occur from December to April. Data gathered at a gage upstream of Dry Creek’s Wastewater Treatment Plant (WWTP) from November 2000 through January 2003 indicated that the average annual flow in the creek is approximately 58 cubic feet/second (cfs). Dry Creek can experience peak flows greater than 1,000 cfs during winter months (November through April) due to runoff. Flows are typically less than 10

cfs during dry months (June through November). Figure ES-1 displays the daily flow of Dry Creek at the gage upstream of the Dry Creek WWTP at the Vernon Street Gage (Figure 5 in Final Report).

Dry Creek water quality tests were conducted from July 2001 through November 2002 at a point upstream of the Dry Creek WWTP. The results of the tests indicate that Dry Creek has an average pH of 7.5, an average dissolved oxygen (DO) level of 9.5, an average turbidity of 7.1 nephelometric turbidity units (NTU) and an average temperature of 17.4 degrees Celsius. Dry Creek experiences its highest DO and turbidity levels during January through April when runoff is greatest.

Figure ES-1
Dry Creek Streamflow Upstream of the Dry Creek WWTP



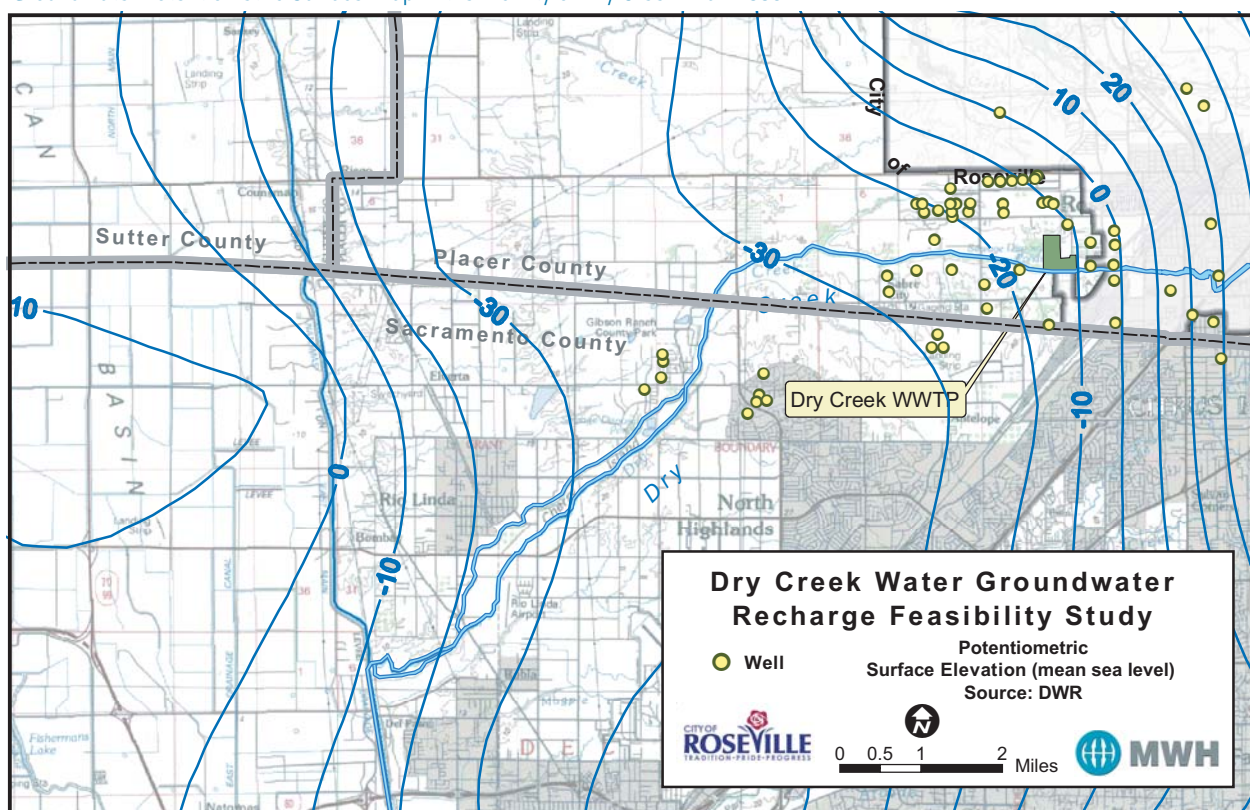
Groundwater Hydrology

Groundwater occurs in unconfined and semi-confined aquifers in this region. Semi-confined aquifers are localized; the degree of confinement typically increases with depth below ground surface. The main three water-bearing formations (Modesto Riverbank, Turlock Lake and Mehrten Formations) consist of fluvial deposits that may be hydraulically connected. Sources of recharge include active stream channels, subsurface recharge from fractured geologic formations to the east, deep percolation from

applied surface water, and precipitation, and small streams such as Dry Creek. Groundwater flow is regionally toward the west-southwest as shown on Figure ES-2.

Flow direction may be influenced by groundwater extraction for agricultural and municipal needs. Historical data from supply wells located near the site indicate that groundwater ranges in depths from approximately 60 to 160 feet below ground surface (bgs).

Figure ES-2
Groundwater Potentiometric Surface Map in the Vicinity of Dry Creek - Fall 1998



Soils Characteristics and Well Boring Data

Fine-grained deposits exposed at the surface in the vicinity of Dry Creek have weathered, giving rise to regionally extensive, well-developed soils which have been classified by the United States Department of Agriculture (USDA). The permeability of these alluvium-derived soils varies from moderate to very slow.

The most permeable soils occur in and directly adjacent to Dry Creek. In-stream environments (fluvial) such as Dry Creek, deposit coarse textured material such as sand and gravel. As the stream changes course over time, coarse grained deposits follow the meander and broad lenses of sand and gravel are formed. Silts and clays are typically deposited in lower energy environments in flood plains during high stands of water in the creek.

Dry Creek Waste Water Treatment Plant

The Dry Creek WWTP serves the cities of Roseville, Rocklin, and Loomis, and other areas of Placer County. The plant is fed by both a gravity and forced flow system. The plant discharges treated effluent into Dry Creek under an existing National Pollutant Discharge Elimination System (NPDES) permit (Order No. 92-221, NPDES No. CA0079502) issued by the California Regional Water Quality Control Board (RWQCB).

The Dry Creek WWTP has a capacity of 18 millions gallons per day (mgd). Its capacity may be expanded to 25 mgd in the future. Recycled water produced by the Dry Creek WWTP is classified as “disinfected tertiary water”.

Title 22, Division 4, Chapter 3 of the California Administrative Code (Title 22) defines disinfected tertiary water as wastewater that has been oxidized, coagulated, clarified, and filtered. It is approved for irrigation of food crops, golf courses, and landscaping. Title 22 requires that turbidity not exceed 2 NTU on average, should not exceed 5 NTU more than 5 percent of the time during any 24-hour period, and should never exceed 10 NTU.

Integration with Regional Banking and Exchange Program

The Sacramento Groundwater Authority (SGA) is implementing a regional conjunctive use program that includes a banking and exchange element. The SGA is a joint powers authority formed in 1998 to collectively manage and protect the region’s groundwater basin north of the American River.

Additional benefits from Dry Creek recycled are realized if recycled water is integrated into larger water programs, such as the Roseville existing water supply program and SGA’s regional groundwater banking and exchange program.

During a banking cycle, surface water from either or both the American and Sacramento Rivers is stored (or banked) in the groundwater aquifer underlying northern Sacramento County and southern Placer County. Banking occurs either through in-lieu recharge or direct recharge. During an exchange cycle, banked groundwater is extracted for local use in lieu of surface water diversions, thereby freeing the surface (exchange) water for other purposes. To date, the groundwater banking and exchange program has yielded 7,143 ac-ft for the Environmental Water Account (EWA) Water Transfer Program, 1,000 ac-ft for the Sacramento Area Flood Control Agency (SAFCA), and successfully procured a \$21.67 million Proposition 13 grant for SGA member agencies.



Preliminary in-lieu and direct recharge opportunities were identified, then screened to develop a list of refined opportunities to pursue.

Screening of Direct Recharge Opportunities

Opportunities considered for direct recharge are areas where in-stream pecculation or off-stream surface spreading adjacent to Dry Creek appeared feasible based on visual observations. These opportunities were then screened using the criteria described below.

Distance from Dry Creek

Direct recharge opportunities are screened based on their proximity to Dry Creek, with priority given to sites that are directly adjacent to Dry Creek..

Soil Type

USDA soil maps were evaluated and percolation rates of potential direct recharge locations estimated. Those sites with very low percolation rates (less than 0.25 feet per day) were

assigned lower priority, but retained for further evaluation since permeable soils may be found just below the surface.

Well Boring Data

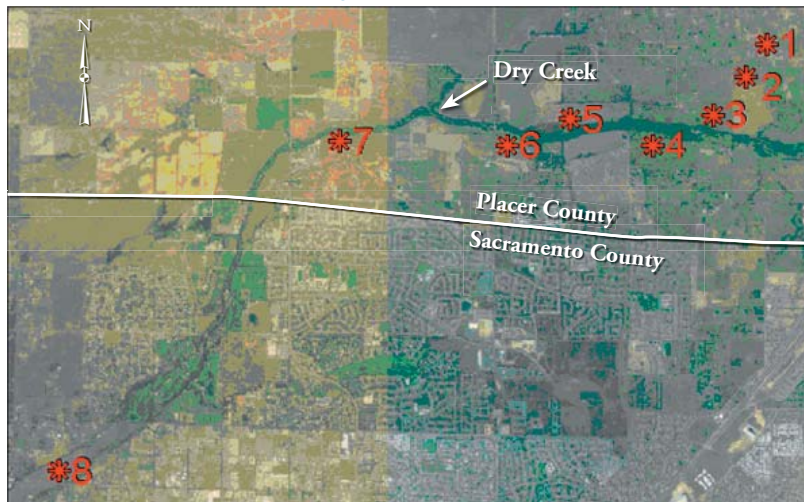
Well logs for domestic and production wells along the Dry Creek corridor were reviewed to assess the inter-connectedness of surface sands with the underlying aquifer. Priority was given to those locations with an abundance of sands and gravels in the unsaturated zone between land surface and the aquifer.

Land Use

Priority was given to those sites where present land use practices appeared to be compatible with direct groundwater recharge. Figure ES-3 shows the locations of eight sites where land use, soils and topography appear to be compatible with direct recharge facilities along Dry Creek.

After field inspection, four sites were retained for further evaluation: 2, 3, 7 and 8. These sites have surface soils most favorable for direct recharge and have land uses that are consistent with direct recharge of groundwater.

Figure ES-3
Candidate Areas for Direct Recharge



Screening of In-Lieu Recharge Opportunities

A list of 46 potential in-lieu recharge opportunities along the Dry Creek Corridor was developed by identifying users who are currently using groundwater or in the future may use groundwater for irrigation and other non-potable uses. Most of the potential users identified are golf courses, parks and schools with medium to large irrigation demands.

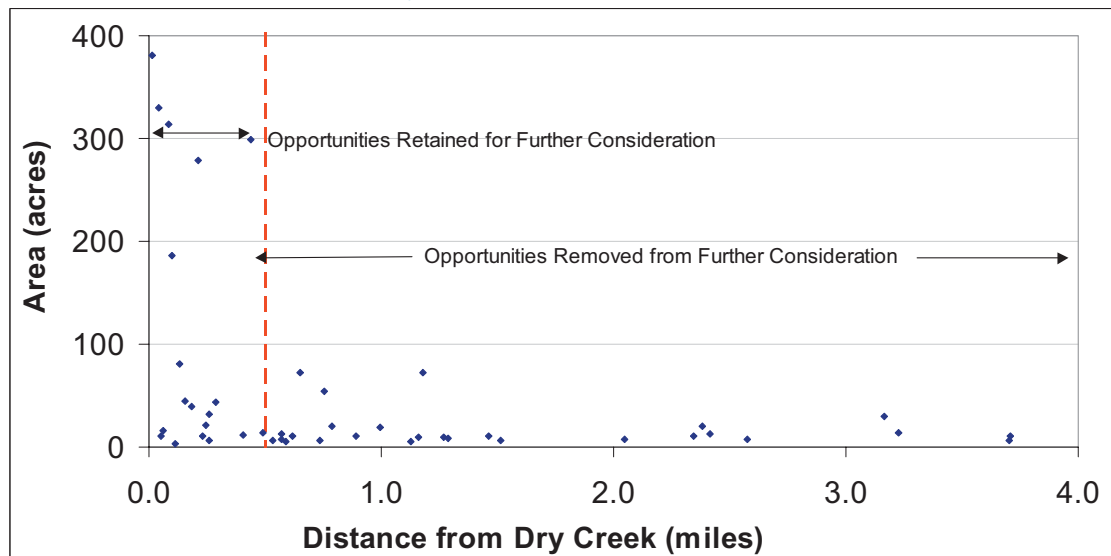
Initial screening of these opportunities was performed by considering irrigation demand and distance from Dry Creek. Figure ES-4 shows that those opportunities located greater than 0.5 miles from Dry Creek were removed from further consideration because of the cost to convey water this distance.

Fifteen in-lieu recharge opportunities have been retained for further consideration. These sites are listed in Table ES-1.

Table ES-1
In-Lieu Recharge Opportunities Remaining After Screening

<i>In-Lieu Recharge Site</i>	<i>Area (Acres)</i>	<i>Irrigable Area (Acres)</i>
Hansen Ranch Park	380	380
Dry Creek Parkway	330	113
Central Rio Linda Park & Horse Arena	11	11
Roy E. Hayer Park	16	16
Gibson Ranch Regional Park	314	136
Cherry Island Golf Course	187	141
Northbrook Park	3	3
Antelope Greens Golf Course	80	69
Cherry Island Soccer Complex	44	41
Rio Linda High School & Junior High School	39	16
Placer Vineyards Parks	10	10
Depot Park & Community Center	21	21
Placer Vineyards Parks	6	6
Bell Aqua Water Ski Recreation Area	31	52
Placer Vineyards Parks	44	44
Total	2107	1060

Figure ES 4
In-Lieu Users' Area and Distance from Dry Creek





Evaluation of Potential Opportunities

The screened list of direct and in-lieu recharge opportunities were evaluated by comparing the cost of these projects to the benefits. Groundwater modeling was used to quantify the volume of water replenishing the groundwater aquifer and changes in groundwater elevation under 4 project scenarios. The modeling results were used to quantify the benefit for the economic analysis.

Project Cost

Cost for construction of direct and in-lieu facilities is based upon the 10% conceptual designs. Costs are derived from currently recognized industry cost relationships, quotes from vendors, and contractor line item prices as bid recently for construction of similar projects. Table ES-2 shows costs for each recharge site.

Table ES-2
Costs of Direct and In-Lieu Recharge Sites

	Location	Opinion of Capital Costs ^a (\$ 000s)	Annual Capital Costs ^b (\$ 000s)	Annual OM&E ^c (\$ 000s)	Estimated Annual Cost ^d (\$ 000s)	Estimated Annual Yield (TAF)	Per Acre Foot Cost of Recharge ^e (\$)
Direct Recharge Sites	Site #2	\$ 851.6	\$ 34.1	\$ 106.9	\$ 141.0	2.60	\$54
	Site #3	\$ 827.0	\$ 33.1	\$ 178.0	\$ 211.1	2.60	\$81
	Site #7	\$ 799.0	\$ 32.0	\$ 219.0	\$ 251.0	2.60	\$97
	Site #8	\$ 235.0	\$ 9.4	\$ 2.0	\$ 11.4	2.10	\$5
In-Lieu Recharge Sites	Gibson Ranch	\$ 297.0	\$ 11.9	\$ 10.0	\$ 21.9	.40	\$55
	Antelope Greens	\$ 133.0	\$ 5.3	\$ 4.0	\$ 9.3	.20	\$48
	Cherry Island	\$ 350.0	\$ 14.0	\$ 12.5	\$ 26.5	.56	\$47
	All Other	\$ 1,359.0	\$ 54.4	\$ 20.0	\$ 74.4	2.40	\$31
	Combined	\$ 3,493.0	\$ 139.7	\$ 532.0	\$ 671.7	13.20	\$51

a Opinion of construction, engineering, construction management, replacement, legal/ administrative and environmental/permitting over a 25-year project life.

b Annualized capital costs over a 25-year project life.

c Annual operation, maintenance and energy.

d Sum of annual capital costs and OM&E.

e Estimate annual costs divided by estimated annual yield.

Project Benefits

The benefits provided by the recharge programs were estimated assuming the water is used for one of two general purposes:

1

A component of a regional water transfer program such as that undertaken by the SGA in 2002.²

2

A source of dry-year water supply for Roseville (recharge in wet and normal years allows for extraction in dry years).

The per acre-foot cost of water generated by groundwater recharge program equals the cost of recharge plus the cost of extraction. The cost of extraction is assumed to be \$25.00 per acre-foot, making the range of per AF surface supply equal to \$30.00 to \$122.00 depending on the project.

Every alternative studied is economically justified, meaning that the derived benefits of each proposed recharge program are greater than the costs. The costs and benefits are summarized in Table ES-3 .

The per acre foot (AF) cost of recharge over a 25-year project life ranges from \$5.00 to \$97.00 depending on which alternative is pursued.

Table ES-3
Costs and Benefits of Proposed Recharge Program³

	Recharge	Dry-Year Supply
Cost	\$0 (corpus only) \$5.00 (Capital in Sacramento County) \$54.00 - \$97.00 (Capital in Placer County)	\$26.43 – \$71.37
Benefit	\$9.00 - \$48.00 (corpus only) \$150.00 - \$133.00 (corpus and capital)	\$100.00 - \$726.00

² EWA Pilot Study. In 2002, the SGA conducted an expanded pilot study. It entered into an agreement with Reclamation (on behalf of the EWA) for the one-year sale of up to 10,000 AF of surface water. A portion of this surface water (up to 5,000 AF) was made available in Folsom Reservoir through a transfer of a portion of SJWD's CVP contract entitlement. The other 5,000 AF was made available by Sacramento through forbearance of a surface water diversion right on the lower American River. In both cases, local demand was met by recovery of previously banked groundwater.

³ A more detailed description of program costs and benefits is provided in Section IV of the final report.



Legal/Water Rights Analyses

A legal analysis was performed to improve Roseville's understanding of the following issues:

- *Water rights applications that may need to be filed with the State Water Resources Control Board to appropriate the recycled water that Roseville discharges to Dry Creek*
- *Roseville's right to the recycled water discharged to Dry Creek and issues related to the use of the water to recharge the groundwater basin*

Each of the potential recharge sites were evaluated for relevant water rights issues using a framework that included:

- *Source of Supply of Water Treated at Dry Creek WWTP*
- *Place of Use*
- *Means of Conveyance*
- *Amount of Water*
- *Instream flow considerations*

Findings of the legal analysis are summarized below

Source of Supply of Water Treated at Dry Creek WWTP

The source of supply of the water treated and collected at the Dry Creek WWTP should not have any material impact on Roseville's water rights to that water. This is the case regardless of whether the water is applied for direct recharge, or diverted at the in-lieu recharge sites.

Place of Use

The proposed place of use of the recycled water will determine the number and extent of potentially affected downstream water users. Roseville will need to confirm with Reclamation and PCWA that the applicable water supply agreements do not present any contractual limitations on the proposed recharge projects. Assuming compliance with any applicable permitting requirements, Roseville may recharge and store that water at the proposed direct recharge sites, and retain title to the amount of water recharged, minus any losses.

The pursuit of any recycled water recharge project opportunities situated within the jurisdiction of the SGA (i.e., anywhere within Sacramento County, north of the American River) could be significantly impacted by the future actions and decisions of the SGA. In this regard, Direct Recharge Site 8 and all three in-lieu recharge sites are located within Sacramento County. To the extent that recharge projects are ultimately pursued at any or all of these sites, Roseville will need to address any actions or decisions by the SGA which could impose limitations or provide opportunities.

Means of Conveyance

Since Dry Creek would be used to convey the recycled water from the Dry Creek WWTP to all of the direct recharge and in-lieu recharge sites, the City would need to prepare and file an appropriate water rights application with the SWRCB. The water rights application could list any or all of the recharge sites as the places of use and/or points of storage, depending upon Roseville's final determinations as to which specific recharge sites it will pursue. In addition, Roseville would need to file a corresponding petition for change to add as a place of use any of the recharge sites that Roseville finally selects. Roseville should be able to rely on SWRCB Order WW-25 as having already confirmed Roseville's right to divert and beneficially use all of the recycled water produced at the Dry Creek WWTP

(above the required 4 mgd minimum baseline discharges to Dry Creek) for irrigation and industrial purposes.

Amount of Water

As discussed in the legal analysis, Roseville may already rely upon SWRCB Order WW-25 to reuse all of its existing discharge flows from the Dry Creek WWTP, above the 4 mgd baseline, at the places of use specified in the order. As a result, Roseville can currently develop and pursue recycled water projects in accordance with the terms of that order. In addition, Roseville could argue that there is no requirement for SWRCB approval under Water Code section 1211, to the extent that a given project would involve only deliveries of recycled water originating from future growth in wastewater flows. This would particularly be the case when the recycled water is conveyed via pipeline, and the point of delivery is at a connection point at the treatment plant. In this regard, because only growth flows would be used for deliveries to the given end user, and because such flows would be delivered at a point inside the treatment plant prior to discharge, Roseville will not have discharged to Dry Creek, or otherwise put to beneficial use, this recycled water prior to delivering it to the given end user. Accordingly, Roseville would not be changing the point of discharge, or the place of use or purpose of use of the recycled water, as contemplated under Water Code section 1211. However, given that the currently proposed

recharge sites would all utilize Dry Creek as a conveyance, and each would rely, at least in part, on existing discharges of recycled water from the Dry Creek WWTP, it is recommended that Roseville proceed with filing a petition for change for the projects.

Instream Flow Considerations

The last factor in the general analysis framework implicates whether the proposed reuse and/or recharge of recycled water could have some effect upon instream beneficial uses. It is important to recognize that any new action taken by Roseville to reuse or otherwise recharge its recycled water will be subject to the provisions of the California Environmental Quality Act. In this context, if it is determined that the reuse or recharge of recycled water will have significant impacts on the environment, mitigation measures may be needed. Importantly, Water Code section 1212 allows the owner of a wastewater treatment facility to dedicate a portion of its discharges for the purpose of maintaining or enhancing fishery, wildlife, recreational or other instream beneficial uses. Roseville could utilize this provision as a mitigation measure if it appears that the reuse of recycled water would have a significant adverse environmental impact.



An environmental documentation and permitting strategy was developed for the conduct of the field investigations as well as for the implementation of full-scale in-lieu or direct recharge projects. To provide background information on environmental and permitting requirements, a summary of regulatory considerations was developed that included the following:

- *Fisheries*
- *Existing Wetlands and Riparian Resources*
- *Growth Inducement*
- *Floodplain Issues*
- *Water Rights Issues*

Following that summary is a discussion of environmental strategies for both the field investigations (Pilot Test) and full-scale projects. Information on potential California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) compliance requirements is also included.

Pilot Recharge Program

Because the environmental impacts of the pilot program facilities construction and operation are anticipated to be minor and temporary, it is assumed that preparation of a CEQA Initial Study (IS) followed by a Negative Declaration (ND) or Mitigated ND will constitute adequate CEQA compliance. It is assumed that Roseville will act as Lead Agency under CEQA. As no federal nexus has been identified for the pilot program, it is assumed that there will be no NEPA requirements.

The pilot program will likely require:

- 1 Well permits from Placer and Sacramento counties**
- 2 Coordination with Placer and Sacramento counties (e.g., road or utility crossings, etc.)**
- 3 Coordination with SGA groundwater management and planning efforts**
- 4 Right-of-access agreements and permission to conduct pilot program activities from landowners**
- 5 Section 404 permit from the U.S. Army Corps of Engineers**
- 6 Section 7 consultation with the National Oceanic and Atmospheric Administration (NOAA) Fisheries and USFWS**
- 7 Streambed Alteration Agreement from DFG**

Full Scale Program

In consideration of potential environmental issues associated with a full-scale system, the appropriate CEQA compliance documentation will likely be an Environmental Impact Report (EIR). It is assumed that Roseville will act as Lead Agency under CEQA.

If a federal nexus is created (e.g., through receipt of federal funding), compliance with NEPA will also be required (i.e., preparation of an Environmental Assessment (EA) or an Environmental Impact Statement (EIS)). The identification of a Lead Agency under NEPA will be largely dependent upon the specifics of the full-scale system. Preparation of a joint CEQA/NEPA document will likely be explored to minimize the time and expense of environmental compliance.

The agencies listed in Table ES-4 potentially have permit authority over this project. The specific agencies involved in the full-scale system will depend upon the specifics of the proposed system, but in all cases the effort will be coordinated

with SGA. In addition, discussions with landowners regarding right-of-access agreements, permission to conduct activities, and land acquisitions will likely be required.

Table ES-4
Potential Roles of Regulatory and Trustee Agencies

	Agency	Role
Federal Agencies	Federal Emergency Management Agency	Permitting for structures within floodways
	NOAA Fisheries	Management of anadromous fish and habitats
	Army Corps of Engineers	Section 404 Clean Water Act permitting pertaining to excavation or dredging within a river or stream
	Environmental Protection Agency	National Pollutant Discharge Elimination System permitting; Enforcement of Section 404 permits
	Fish and Wildlife Service	Review of Section 404 permits and consultation on endangered species
State Agencies	Department of Fish and Game	Streambed modification permitting; endangered/threatened species mitigation
	Department of Health Services	Regulation of recycled water use, including direct recharge
	Department of Parks and Recreation	Management function pertaining to stream channel restoration and riparian vegetation
	Department of Water Resources	Permitting jurisdiction for dams higher than 25 feet or impounding more than 50 acre-feet
	Reclamation Board	Permitting for projects within floodways
	Regional Water Quality Control Board	Waste discharge permitting
Local Agencies	Water Resources Control Board	Appropriation of water rights and approval of change in place of use of recycled water
	Placer County	Flood Control District; Placer County – Department of Health Services; City of Roseville – Departments of Environmental Utilities, Planning, Public Works, Community Development; Dry Creek Greenway Master Plan; Resource Conservation District; Dry Creek Conservancy; Dry Creek Watershed Group
	Sacramento County	Flood Control District; preliminary concept plans for the portion of Dry Creek within the county; City of Sacramento – Departments of Utilities and Public Works; Sacramento County – Public Works Agency, Water Resources, Health and Human Services



Stakeholder And Public Outreach Strategy

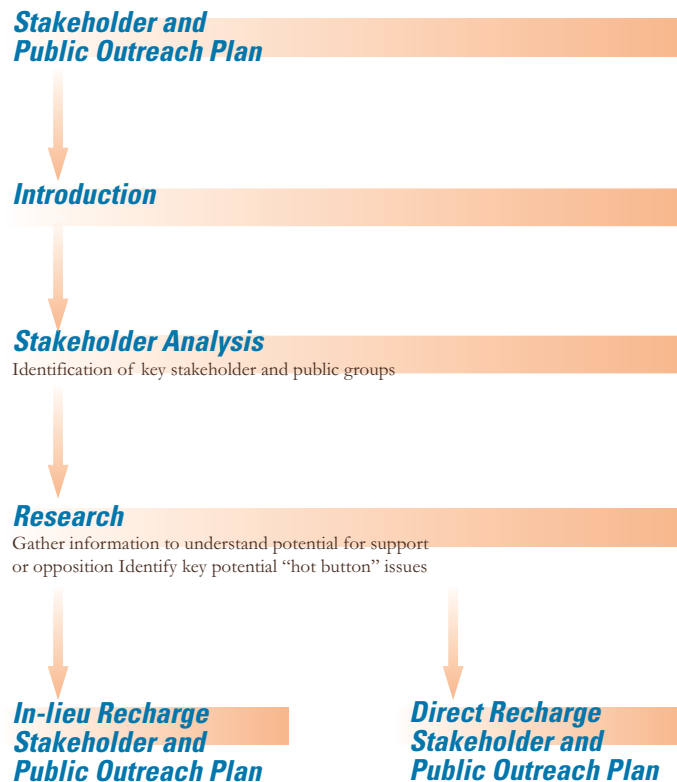
A stakeholder and public outreach plan was developed during the feasibility study. Figure ES-5 shows the organization of the plan. The objectives of the outreach plan are listed below:

- *To compile educational materials on the subject of in-lieu and direct groundwater recharge using recycled water.*
- *Determine selling points and potential pitfalls for use of recycled water for irrigation.*
- *Introduce direct recharge as another method of groundwater banking to stakeholders; gain their understanding and work toward their acceptance of the project.*

The approach followed in developing the plan is summarized below:

- 1 Identify key stakeholder and public groups**
- 2 Identify relevant issues**
- 3 Develop a stakeholder and public outreach plan. In developing the outreach plan, the differences between direct and in-lieu recharge were considered. Since the two recycled water methods have different audiences requiring different approaches, the public outreach plan is divided into two components: component 1 covers in-lieu groundwater recharge and component 2 covers direct recharge of the groundwater basin.**

Figure ES-5
Structure of Outreach Plan





Pilot Study Work Plan

It is recommended that field data be collected and analyzed to further evaluate the feasibility of direct recharge at each of the 4 locations remaining after screening. A work plan was developed describing the collection and analysis of data needed to complete the evaluation. Preliminary testing and analysis will provide a better understanding of the local percolation rates, aquifer permeability, porosity, thickness, and continuity. This information may be used by Roseville to properly size and design full-scale facilities. Specifically these test sites will provide information on the following:

- *Exploration of the nature, thickness, and permeability of the aquifers in the area and the quantity of water they contain*
- *Estimations of infiltration rates at four direct recharge sites*
- *Examination of the magnitude and rate of groundwater recharge and mound buildup and dissipation*
- *Feasibility of the sites for future long-term use*

The work plan for direct recharge pilot testing consists of an initial field reconnaissance, two phases of field data collection, two phases of data analysis, and pilot recharge plot construction

activities. Initial field data collection will gather information regarding surficial geology and preliminary estimates of infiltration. The second round of field data collection includes implementation of the direct recharge pilot test and will take between 4 and 6 weeks. Project duration at each test location will span a period of three months.

The work plan provides guidance for performing the following field activities:

- *Borehole drilling and logging*
- *Falling-bead borehole percolation testing*
- *Monitoring well construction*
- *Source water and groundwater sampling*
- *Construction of pilot recharge basins*
- *Performance of a 4-6 week pilot recharge test*

The work plan also includes a description of activities required before field testing begins and recommendations on how to evaluate and present the results of field testing at each of the direct recharge sites.



Conclusions

The goals of the Dry Creek Recycled Water Groundwater Recharge Feasibility Study are to evaluate the regional potential market for recycled water, describe a mechanism for participation with the SGA's regional groundwater banking and exchange program and to investigate the institutional and regulatory issues surrounding recycled water.

Though the efforts memorialized in this report, four direct recharge sites and 15 in-lieu users have been identified. These potential recharge opportunities have been evaluated on economics, environmental concerns and legal issues. This report also quantifies the benefit that a recycled water recharge program may have on the underlying groundwater aquifer. When a system is established by the SGA to give credit to agencies that contribute to groundwater recharge, this report will serve as the foundation for Roseville to integrate their program with SGA's efforts.

The institutional and regulatory issues that a recycled water groundwater recharge program may face are explored in this report. The water resources issues of Dry Creek are described and special attention is paid to legal concerns that Roseville may face in implementing this program. The next steps in fully realizing a recycled water groundwater recharge program are illustrated. A permitting strategy for the conduct of field investigations is given as well as a public outreach strategy. This document lays the groundwork for a pilot recharge program near Dry Creek as well as future environmental documentation.

As water supply becomes more constrained, cities such as Roseville will need to look for alternatives for supplying water. Recycled water is an under utilized resource that can help to stretch existing water supplies. The Dry Creek Recycled Water Groundwater Recharge Feasibility Study can help Roseville to continue to meet water users' needs while ensuring the long-term sustainability of the region's groundwater basin and protecting the Lower American River through cooperation with the SGA.



Recommendations

1) *Pursue in-lieu recharge at locations shown on Table ES-1.*

1a

Develop a pricing scheme for delivery of Dry Creek water at these locations.

1b

Meet with landowners and other project stakeholders identified on Figure 34 of the final report.

1c

To educate them on the program and gain support. Proceed to facility designs and environmental documentation, in-lieu opportunities that have landowner/stakeholder support.

3) *Continue to Coordinate with Water Forum Successor Effort - Present the results of this study to RWA/SGA.*

4) *Maximize in-lieu recharge by using Dry Creek supply to meet irrigation demand spring through fall as shown on Figure 21. Use surplus supply for direct recharge (Figure 21).*

2) *Pursue pilot testing at sites 2, 3, 7, and 8 shown on Figure ES-3 to further evaluate feasibility of direct recharge.*

2a

Meet with landowners to educate, answer questions and obtain right of entry.

2b

Complete environmental documentation and permitting as described in Section VI.

2c

Implement site investigation as described in pilot study work plans, Section V.