WATER CONSERVATION OPPORTUNITIES REPORT

GOLDEN STATE CORRIDOR - ECONOMIC DEVELOPMENT INFRASTRUCTURE IMPROVEMENTS PROJECT

September 2011

Quad Knopf

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September 2, 2011

Fresno Council of Governments
Attn: Ms. Lauren Dawson, Project Manager
2035 Tulare Street, Suite 201
Fresno, CA 93721

Subject: Final Technical Report on Recycled Water Usage along the Golden State Corridor

Dear Ms. Dawson:

We are pleased to submit this final report regarding the use of Recycled Water along the Golden State Corridor. Although technically feasible, costs associated with treatment plant upgrades and distribution system improvements are prohibitive. However, the study did provide value by identifying other potential strategies, (particularly water exchange agreements) for achieving some of the primary goals of using recycled water to help create more sustainable communities.

The enclosed report addresses the scope of the review, describes the context of the review of recycled water usage opportunities with the Golden State Corridor Project, State recycled water policy and regulatory requirements, the SKF plant, various cost savings alternatives for treatment and distribution, funding alternatives that could help pay for the planning and construction of a recycled water system and a summary of critical issues for consideration when implementing a Recycled Water Distribution System.

Quad Knopf would like to acknowledge and thank Mr. Ben Munoz, SKF General Manager; Ms. Veronica Cazares, SKF District Engineer; Mr. Phil Desatoff, CID General Manager; Mr. David Martin, Landscape Architect with Caltrans District 6, and the City staff representing Fowler, Selma and Kingsburg for their time and assistance in providing critical information necessary to complete this report.

Sincerely,

Ronald J. Wathen, PE
Principal Engineer

100073

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ABBREVIATIONS

The following abbreviations may be used in this report to conserve space and improve readability.

AAF	Average annual flow
ADF	Average daily flow
AF, ac-ft	Acre Feet
ASCE	American Society of Civil Engineers
CEQA	California Environmental Quality Act
CCR	California Code of Regulations
CDPH	California Department of Public Health Services
C / I	Commercial and Industrial
CID	Consolidated Irrigation District
cfs	Cubic feet per second
CRWQCB	California Regional Water Quality Control Board
DAFT	Dissolved Air Flotation Thickening
EIR	Environmental Impact Report
ENR CCI	Engineering News Record Construction Cost Index
fps	feet per second
FY	Fiscal Year
GPD	Gallons per day
GWI	Groundwater infiltration
IRWMP	Integrated Regional Water Management Plan
IRWP	Incremental Recycled Water Program
KRCD	Kings River Conservation District
KRWA	Kings River Water Association
LF	Linear feet
MG	Million Gallons
MGD	Million Gallons per Day
MGY	Million Gallons per year
mL	milli-Liter
MPN	Most Probable Number
MSR	Municipal Services Review
NEPA	National Environmental Policy
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric turbidity limits
O & M	Operations and Maintenance
OWR	Office of Water Recycling, State of California
P / I	Public and Institutional
POPCC	Preliminary Opinion of Probable Construction Costs
ROW	Right of way
RWQCB	Regional Water Quality Control Board
SAT	Soil Aquifer Treatment
SKF	Selma Kingsburg Fowler County Sanitation District
SR	State Route
SS	Sanitary sewer

SSMP	Sanitary Sewer Master Plan
SWRCB	State Water Resources Control Board
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WWTF	Wastewater Treatment Facility

EXECUTIVE SUMMARY

As part of the Golden State Corridor Project, Quad Knopf has prepared this Technical Report to address the feasibility of using recycled water from the Selma-Kingsburg-Fowler County Sanitation District (SKF) Wastewater Treatment Plant for public open space irrigation purposes along the Corridor itself, as well as within the State Route (SR) 99 right-of-way. The Corridor has existing and planned public open space and linear parkway facilities which will need to be irrigated to support landscaping beautification goals. In addition, SR 99 landscaped embankments could be a receiver of recycled irrigation water to reduce the amount of potable water used (Exhibit 1: Recycled Water Use Examples). Within the surrounding areas, other potential customers include various agricultural and industrial facilities. The purpose of this Technical Report is to discuss the following information:

- Determine the State of California Regulatory Requirements for Recycled Water and how that water can be used for the purposes of the Golden State Corridor project and/or the surrounding areas.
- Review the SKF Facility and determine the necessary improvements required to provide recycled water to the Corridor project and/or the surrounding areas.
- Determine the feasibility of a recycled water distribution system.
- Determine if Soil Aquifer Treatment is a reasonable alternative to conventional tertiary treatment methods.
- Determine if Water Exchange Agreements can be executed to allow more flexibility with the distribution system.
- Identify the Critical Issues related to using Recycled Water and provide appropriate recommendations.

Project Background

The Golden State Corridor project is a revitalization project of the old US 99 Highway that spans the Cities of Kingsburg, Selma and Fowler (Exhibit 2: Golden State Corridor Project Limits). The Quad Knopf team has been retained by the Fresno Council of Governments (COG) to transform this former US Highway into the key transportation component of a vibrant regional economic center as identified in the 2003 Visioning Study prepared by Chabin Concepts. Key deliverables planned for this project include:

1. Planning Design Guidelines
2. Preliminary Engineering Design Plans
   a. Topographic Mapping and Design Aerial
   b. Preliminary Design Plans (30% level)
   c. Preliminary Intersection Plans (30% level)
   d. Preliminary Engineer's Estimate and Additional Considerations
3. Environmental Documents

a. NEPA Initial Study
b. CEQA Initial Study and Environmental Impact Report document.

4. Summary of Funding Assistance Opportunities

The interest in recycled water usage is related to implementing sustainability features of the Golden State Corridor revitalization as well as corridor beautification through more aesthetically pleasing landscape treatments.

Recycled Water Health Issues, Regulatory and Treatment Requirements

Recycled water regulations governing the production, distribution, and usage are contained in the California Code of Regulations (CCR) Titles 17 and 22. Title 17 establishes backflow protection for potable water supplies, and Title 22 bacteriological water quality standards on the basis of the expected degree of public contact with recycled water. Table 1 "Recycled Water Uses Allowed in California" of this report illustrates the wide variety of reuse applications and the level of treatment required by the regulatory agencies (Exhibit 3: Recycled Water Uses in California). The regulations help ensure consistent, reliable recycled water quality while protecting the public health.

Title 22 is one of the most stringent recycled water regulations in the world and is being used as a model for other states. The State Water Resources Control Board regulates the production, conveyance and use of recycled water through its Regional Water Quality Control Boards (RWQCBs). The RWQCBs issue permits, referred to as "Water Reuse Orders," to recycled water producers. CDPH provides input to the RWQCBs about requirements for specific recycled water projects. Individual customers are authorized to use recycled water through the producer's Water Reuse Order.

The required water quality for recycled water is based on the specific type of reuse and the extent of direct or indirect exposure to the general public health interest. The following levels of treatment are required based on the degree of human exposure:

1. Disinfected Tertiary Recycled Water: Disinfected Tertiary Recycled Water is required for publicly accessible areas that are irrigated with recycled water. This treatment level eliminates the potential for public health issues and allows uses that include human contact and agricultural. Tertiary treatment requires that the filtration process of the plant has been demonstrated to inactivate and/or remove 99.999 percent of the plaque-forming units of F-specific bacteriophage MS-2.

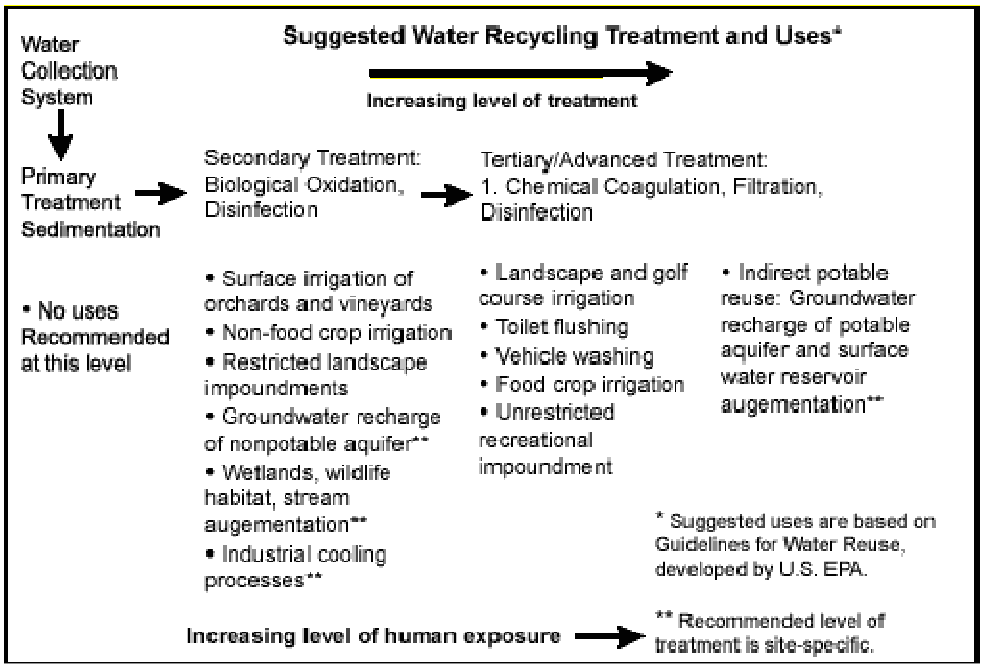
2. Disinfected Secondary-2.2 Recycled Water: The State of California defines Secondary 2.2 water as having been oxidized and disinfected so that the median concentration of total coliform bacteria in the disinfected effluent does not exceed a most probable number (MPN) of 2.2 per 100 milliliters. This level applies to the

bacteriological results of the last seven days for which analyses have been completed. The number of total coliform bacteria cannot exceed an MPN of 23 per 100 milliliters in more than one sample in any 30 day period. Disinfected Secondary 2.2 Recycled Water can be used for highway irrigated areas that are not accessible to the general public. This treatment level has some use restrictions; however, it is less expensive than Tertiary Treatment.

3. Disinfected Secondary-23 Recycled Water: The State of California defines Disinfected Secondary 23 water as having been oxidized and disinfected so that the median concentration of total coliform does not exceed a most probable number (MPN) of 23 per 100 milliliters. This level applies to the bacteriological results of the last seven days for which analyses have been completed. The number of total coliform bacteria cannot exceed an MPN of 240 per 100 milliliters in more than one sample in any 30 day period. Disinfected Secondary 23 Recycled Water has the most restricted uses; however, this treatment will be the least expensive.

Figure 1 below indicates the types of uses generally allowed with each level of treatment described above.

Figure 1: Typical Water Recycling Treatment and Uses



Appropriate treatment of recycled water depends on the application and the level of biodegradable organics such as the 5 day biochemical oxygen demand (BOD5) and the chemical oxygen demand (COD), suspended solids (total or volatile suspended solids), plant nutrients

(nitrogen, phosphorus and potassium), dissolved solids (usually measured through conductivity) and pathogens. Additional or more specific requirements may be required for various agricultural or industrial uses.

The presence of bacterial or viral pathogens and sometimes parasites are commonly determined by testing for an indicator organism such as coliform bacteria. While coliform bacteria remain an important sanitary quality measure of foods and drinking water, wastewater contains viruses which can survive the standard bacteria eradication processes. The primary viruses of interest include the presence of enteroviruses – viruses that infect the human intestinal tract. Where recycled water will be used in the most non-restricted uses allowed, the State of California requires the testing for F-specific bacteriophage MS-2 (polio virus) which is a surrogate for human viruses. Basically stated, if the bacteriophage is removed, then the harmful viral pathogens have also been removed. This is the primary reason that tertiary treatment is required for reuse applications where exposure to the public is unrestricted.

SKF County Sanitation District Treatment Plant

The SKF Wastewater Treatment Plant (WWTP) is located approximately two miles west of Kingsburg in Fresno County (Exhibit 4: SKF Treatment Plant Facility). According to the last Municipal Services Review (MSR) submitted in 2007, SKF provides wastewater collection, treatment, and disposal services to the Cities of Selma, Kingsburg, and Fowler, serving approximately 38,400 people through nearly 10,300 connections. SKF also serves about 200 connections located outside the municipal boundaries of the three Cities. Approximately 80 percent of the flow is from residential and 20 percent is from Industrial and Commercial users. The SKF WWTP is permitted under the RWQCB Discharge Order No. 5-01-255. In review of the 2009 Annual Report, the SKF plant is currently permitted at 8.0 Million Gallons per Day (MGD) with current flows averaging 4.21 MGD and a maximum of 6.3 MGD.

According to the Recycled Water Feasibility Study prepared by Whitley Burchett & Associates in 2003 (Appendix A), wastewater flowing into the SKF Treatment Plant undergoes a secondary treatment process before it is discharged into the disposal ponds (Exhibit 5: SKF Treatment Flow Schematic). There, the treated wastewater is removed by evaporation and percolation. Secondary effluent water quality tested by Dellavalle Laboratories sampled prior to discharging into the ponds was shown to be similar to the quality of the groundwater for crop irrigation uses. Testing was limited to typical irrigation water criteria. Bacteriophage and other health related testing was not reported.

The 2003 Study indicated that the available recycled water volume would be approximately 2.8 MGD. The 2003 Study focused on agricultural uses for recycled water utilizing disinfected 2.2 Secondary Treatment. The intent was to evaluate the feasibility of selling recycled water to surrounding agricultural growers. In meeting with SKF representatives, the agriculture industry was not ready to embrace the use of recycled wastewater due to the public perception of health

concerns and the potential for consumer rejection; therefore, the effort to treat and distribute recycled water was stalled. However, these initial projections indicate that the plant has capacity to serve the entire Golden State Corridor landscape and irrigation needs and beyond.

Using the latest 2009 SKF WWTP Annual Study information available with a mean average daily influent of 4.2 MGD, the available recycled water volume is estimated to be approximately 3.8 MGD without causing a temporary drawdown in the groundwater table.

Recycled Water Treatment and Distribution

As indicated, the State of California requires Tertiary Treatment where reclaimed water is used in unrestricted public open space areas such as the planned trails and roadway landscaping. The State does allow 2.2 Secondary and Secondary 23 treated recycled water usage in restricted landscaped areas such as State Route (SR) 99. The plant currently treats the influent wastewater to secondary treatment standards where it is discharged into ponds for percolation purposes. In order to upgrade the plant treatment, a significant investment would be required to meet disinfected Tertiary Treatment Standards with an expected cost on the order of 7 to 10 million dollars (Exhibit 6: Typical Recycled Water Tertiary Treatment Schematic). An alternative approach involves Soil Aquifer Treatment (SAT) combined with shallow groundwater extraction well(s) which retrieve reclaimed water after being allowed to percolate a few hundred feet below the surface (Exhibit 7: Typical Soil Aquifer Treatment Schematic). The depth of percolation requirement is really determined by the time of travel requirement set by the State of California (six months minimum). However, Soil Aquifer Treatment (SAT) is still undergoing acceptance by the State of California Department of Public Health to ensure that compliance with the water quality regulations are met. It should be noted that significant efforts at the City of Fresno Wastewater Treatment Facility are underway to complete the acceptance of SAT and testing protocols to verify the State of California's mandatory 5 log reduction that essentially signals the inactivation of the F-specific bacteriophage MS-2.

With the treatment and disposal facilities located on the south end of the corridor, distribution piping facilities will be required to convey the treated recycled water to the Corridor. The cost for piping to supply the entire length of the corridor is anticipated to be approximately 15 to 20 million dollars. Alternatives to an extensive piping distribution system could be in the form of water exchange agreements with an irrigation water purveyor such as Consolidated Irrigation District (CID). This could allow less expensive access to surface water along the corridor and greater flexibility in constructing and servicing the recycled water distribution system. The exchange would occur at the SKF plant where recycled water would be discharged into CID system (Exhibit 8: CID Facility Crossings).

A portion of the SKF plant and facilities are fairly close in proximity to the SR 99 Corridor. Treatment levels required for restricted access freeway landscaping is much less expensive than unrestricted public open space. The restricted access to SR 99 and the lower treatment level

requirement for recycled water makes this easily the most feasible "initial" use of recycled water from the SKF plant.

Note: The City of Kingsburg has duly noted that other sources of water may be available from the large industrial users along the corridor. Example sources include Sun Maid, Lions and Guardian. By capturing industrial water along the corridor, the additional sources of water reuse could increase the availability and reduce the cost of service. These sources would be required to meet the same quality requirements by the State of California Department of Public Health. It is recommended that these sources be considered for landscape and irrigation where appropriate for the project.

Summary of Critical Issues Related To Using Recycled Water

1. **Wastewater Treatment:** Treating effluent from the SKF Wastewater Treatment Plant for the use of landscape irrigation of unrestricted public open space is technically feasible although the capital investment requirement for conventional Tertiary Treatment is prohibitive. The cost for conventional tertiary treatment upgrades to the plant will be substantial and are estimated to range from 7 to 10 million dollars. The cost for tertiary level treatment could be reduced by utilizing Soil Aquifer Treatment combined with shallow groundwater extraction wells to a depth of approximately 200 feet. Compliance testing technology is still being reviewed by the State for acceptance. The City of Fresno and the City of Dinuba are both using this technology which has also been successfully used for years on a worldwide level. According to Dr. Rick Danielson, PhD with Biovir Laboratories, the State of California is fairly close to accepting the revised Test Method 1601, which is used to demonstrate the necessary tertiary treatment (5 log reduction of bacteriophage) compliance.

2. **Distribution System:** A recycled water distribution system along the 14.2 mile corridor open space is technically feasible. The cost for the piping distribution system is roughly estimated to range between 15 and 20 million dollars. In order to serve the communities more efficiently, it may be reasonable to look into water exchange possibilities where surface water could be traded along the Corridor for recycled water downstream at the plant. Consolidated Irrigation District (CID) has a system of canals for surface water delivery that could afford the opportunity for exchanging water upstream to be used along the corridor while Recycled Water is deposited back into the CID distribution system downstream near their plant facilities. In addition, CID has indicated that increasing ground water recharge and the ability to capture storm water flows during peak wet weather years could also be included in the discussions regarding the proposed water exchange agreements.

3. **Cost:** In order to reduce the up front capital costs for treatment and distribution, as well as the operations and maintenance costs of the system, the plant needs to look at

cost effective alternatives for treatment. These alternatives would include items such as the Soil Aquifer Treatment described above as well as water exchange agreements to distribute recycled water in an economical manner. Since the Plant is on the south end of the Golden State Corridor, substantial piping costs just to deliver recycled water to the Corridor would be required.

4. **Public Acceptance:** A strong public outreach will be required to gain support and understanding for the use of recycled waste water. A negative public perspective could severely impact the use of recycled water for the area. California has many recycled water systems that can be shown as successful examples. These examples include public right-of-way landscape irrigation, industrial uses, and agricultural users that have proven to show no loss in value to the adjacent property or product.

5. **Develop a comprehensive Recycled Water System Master Plan.** As indicated in the 2003 Recycled Water Feasibility Study, The feasibility of recycled water is contingent upon willing customers and a reliable recycled water product that can be provided at competitive rates. Given the location of the SKF Plant, it is more feasible to envision an initial use that has a mix of agricultural users and large public open spaces. However, it is foreseeable that State or Federal Agencies will force greater use and acceptance of recycled water through legislation limiting groundwater overdraft practices.

6. **Pursue available Funding Resources**: Due to prohibitive costs, pursuit of alternative funding sources is recommended in order to finance the costs to plan, design, and construct the necessary treatment and distribution systems. A current funding source identified as WaterSMART for Recycled Water Projects is included in Appendix B and offers a good example of the type of criteria used to judge and fund both planning and construction activities for these projects.

7. **Engage Stakeholders:** The Stakeholders should be engaged as there are a number of issues that could be considered with water recycling system implementation. Stakeholders include the City of Fowler, Selma, Kingsburg, SKF, CID, Caltrans, the agricultural community, and potentially the large industrial water users, as well as the public. Other issues include regulatory requirements regarding urban water management, groundwater recharge and reductions to groundwater impacts from rural and urban uses.

   Note: In accordance with email correspondence with Mr. David Martin, Landscape Architect with Caltrans District 6, Caltrans has an interest in using recycled water within their rights-of-way for irrigation purposes. However, they currently do not have any landscape and irrigation projects being planned or under design that would potentially use recycled water within the project area. Continuing dialogue is

recommended so that opportunities to use recycled water are fully considered in the future.

8. **Simplified Approach**: The most feasible approach to implementing a recycled water system at the SKF plant is one that has the following components:

   a. Consider Soil Aquifer Treatment in order to meet the tertiary treatment standard which allows the most uses and represents the best public health and safety interest. SAT would provide the lowest cost treatment of recycled water

   b. Phase the recycled water system in a way that has the lowest cost distribution system for recycled water in order to deliver water at an economical cost to customers. There are a number of potential users located near the SKF plant would be good candidates for recycled water. Caltrans, agricultural growers and the City of Kingsburg are all located near the SKF plant and would be reasonable first phase customers. Consider industrial waste water available along the corridor as an alternate source of recycled water for added water conservation.

   c. Uses of recycled water along the Golden State corridor could follow and may become more feasible if the distribution costs can be mitigated by accessing water along the corridor through water exchange agreements with Consolidated Irrigation District.

SECTION 1 SCOPE OF RECYCLED WATER FEASIBILITY REVIEW

Pursuant to the project scope requesting the consultant to investigate the use of recycled water to fund the project, Quad Knopf has prepared this Technical Memorandum to describe our findings and conclusions on the opportunities to utilize recycled water along the Corridor and/or SR 99. As referenced in the request for proposal dated October 2009, the following scope was requested:

> *Consultant shall investigate the feasibility and provide a recommendation regarding the use of Selma-Kingsburg-Fowler County Sanitation District (SKF) reclaimed wastewater for irrigation purposes. In addition, water conservation in the selection of preferred landscaping and ease of maintenance shall be considered (xeroscaping). Additional consideration should be given to the potential of using the reclaimed wastewater on the landscaping along SR 99.*

The purpose of this Technical Report is to discuss the following information related to recycled water regulatory requirements, SKF Plant treatment capabilities, Treatment, distribution and other critical issues:

- Determine the State of California Regulatory Requirements for Recycled Water and how that water can be used for the purposes of the Golden State Corridor project and/or the surrounding areas.
- Review the SKF Facility and determine the necessary improvements required to provide recycled water to the Corridor project and/or the surrounding areas.
- Determine the feasibility of a recycled water distribution system.
- Determine if Soil Aquifer Treatment is a reasonable alternative to conventional tertiary treatment methods.
- Determine if Water Exchange Agreements can be executed to allow more flexibility with the distribution system.
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SECTION 2 PROJECT BACKGROUND

The Golden State Corridor project is a revitalization project of the old US 99 Highway that spans the Cities of Kingsburg, Selma and Fowler (Exhibit 2: Golden State Corridor Project Limits). The Quad Knopf team has been retained by the Fresno Council of Governments (COG) to transform this former US 99 Highway into the key transportation component of a vibrant regional economic center as identified in the 2003 Visioning Study prepared by Chabin Concepts. Key deliverables planned for this project include:

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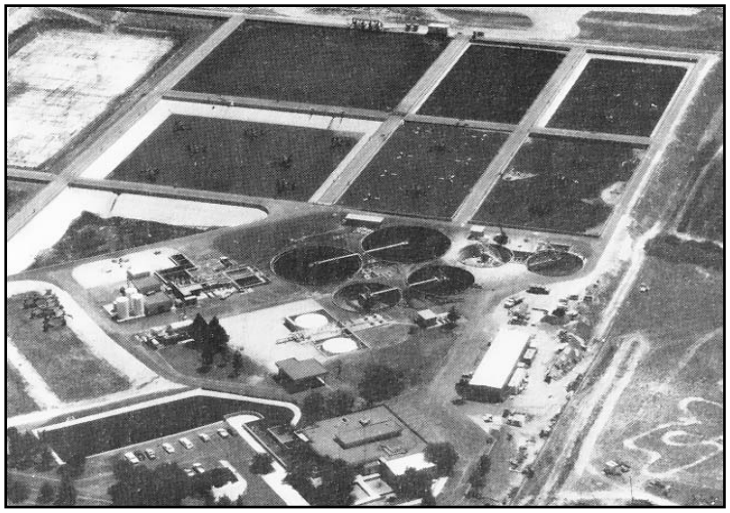
3. Environmental Documents
    a. NEPA Initial Study
    b. CEQA Initial Study
4. Funding Assistance
5. Public Meetings and Communications

The Corridor will have a revised roadway geometry, several intersection improvements, bike trails and landscaping along the entire route. It is envisioned that the Corridor will have opportunities to introduce recycled water for irrigation purposes in order to shift reliance from groundwater to promote a more balanced use of water resources.

The source of recycled water is the SKF Wastewater Treatment Plant located on a 550-acre site approximately 1.5 miles west of Kingsburg on Conejo Avenue. Pictured here on 30 acres are the operations, maintenance, laboratory and administration buildings along with the treatment process units.

With the treatment and disposal facilities located on the south end of the corridor, distribution piping facilities will be required to convey the treated recycled water to and along the Corridor.

SECTION 3 STATE OF CALIFORNIA RECYCLED WATER POLICY



From a statewide perspective, a more aggressive plan to increase the use of recycled water has been put in-place. On February 3, 2009, the State Water Resources Control Board adopted its Recycled Water Policy. The new policy is intended to support the Water Board's strategic plan to increase sustainable local water supplies. The purpose of the new policy is to increase the beneficial use of recycled water from municipal wastewater sources in a manner that fully implements state and federal water quality laws. Pursuant to Water Code Sections 13550 *et seq.,* the Water Board declared: "[I]t is a waste and unreasonable use of water for water agencies not to use recycled water when recycled water of adequate quality is available and is not being put to beneficial use…"

As a part of the new recycled water policy, the Water Board adopted the following four goals for California:

- Increase the use of recycled water over 2002 levels by at least one million acre-feet by 2020 and by at least two million acre-feet by 2030.
- Increase the use of storm water over use in 2007 by at least 500,000 acre-feet by 2020 and by at least one million acre-feet by 2030.
- Increase the amount of water conserved in urban and industrial uses by comparison to 2007 by at least 20% by 2020.
- Included in these goals is the substitution of as much recycled water for potable water as possible by 2030.

SECTION 4 STATE REGULATORY REQUIREMENTS

One of the primary considerations of using reclaimed water by the State of California is the protection of public health. The State has identified three levels of treatment that are required based on the use and exposure to human contact. Table 1 identifies the various uses and required treatment of the reclaimed water from the wastewater treatment plant.

Table 1
Treatment Requirements by Uses of Reclaimed Water

Uses of Reclaimed Water	Treatment Requirements		
	Tertiary Reclaimed	Secondary 2.2 Reclaimed	Secondary 23 Reclaimed
Irrigation			
Food Crops-contact with edible portion of crops	Allowed	Not allowed	Not allowed
Public Landscaped Areas - Parks, Parkways & Playgrounds	Allowed	Not allowed	Not allowed
School Yards and Playfields	Allowed	Not allowed	Not allowed
Residential Landscaping	Allowed	Not allowed	Not allowed
Golf Courses - Unrestricted Areas	Allowed	Not allowed	Not allowed
Food crops - edible portion above ground/no contact w/r.w.	Allowed	Allowed	Not allowed
Cemeteries	Allowed	Allowed	Allowed
Freeway Landscaping	Allowed	Allowed	Allowed
Restricted Access Golf Course	Allowed	Allowed	Allowed
Ornamental nurseries	Allowed	Allowed	Allowed
Pasture for animals producing milk	Allowed	Allowed	Allowed
Non-edible vegetation	Allowed	Allowed	Allowed
Orchards w/no contact between edible portion and r.w.	Allowed	Allowed	Not allowed
Vineyards w/no contact between edible portion and r.w.	Allowed	Allowed	Not allowed
Fodder (i.e. alfalfa hay) and Fiber (i.e. cotton) crops	Allowed	Allowed	Allowed
Seeds not for human consumption	Allowed	Allowed	Allowed
Food crops that receive commercial pathogen destroying process before human consumption	Allowed	Allowed	Allowed

The following levels of treatment are defined by the State Water Code:

§60301.220. Disinfected secondary-2.2 recycled water.
"Disinfected secondary-2.2 recycled water" means recycled water that has been oxidized and disinfected so that the median concentration of total coliform bacteria in the disinfected effluent

does not exceed a most probable number (MPN) of 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30 day period.

§60301.225. Disinfected secondary-23 recycled water.
"Disinfected secondary-23 recycled water" means recycled water that has been oxidized and disinfected so that the median concentration of total coliform bacteria in the disinfected effluent does not exceed a most probable number (MPN) of 23 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform. NOTE: This publication is meant to be an aid to the staff of the CDPH – formerly the Department of Health Services (DHS) – Drinking Water Program and cannot be relied upon by the regulated community as the State of California's representation of the law. The published codes are the only official representation of the law. Refer to the published codes – in this case, Chapters 22 and 17 CCR – whenever specific citations are required.

Last updated January 1, 2009 – from Titles 22 and 17 California Code of Regulations, California Department of Public Health's Recycled Water Regulations bacteria does not exceed an MPN of 240 per 100 milliliters in more than one sample in any 30 day period.

§60301.230. Disinfected tertiary recycled water. (Requires a Large Storage tank, filtration device, etc)
"Disinfected tertiary recycled water" means a filtered and subsequently disinfected wastewater that meets the following criteria:

(a) The filtered wastewater has been disinfected by either:

(1) A chlorine disinfection process following filtration that provides a CT (the product of total chlorine residual and modal contact time measured at the same point) value of not less than 450 milligram-minutes per liter at all times with a modal contact time of at least 90 minutes, based on peak dry weather design flow; or

(2) A disinfection process that, when combined with the filtration process, has been demonstrated to inactivate and/or remove 99.999 percent of the plaque forming units of F-specific bacteriophage MS2 in the wastewater. A virus that is at least as resistant to disinfection as the polio virus may be used for purposes of the demonstration.

(b) The median concentration of total coliform bacteria measured in the disinfected effluent does not exceed an MPN of 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed

and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30 day period. No sample shall exceed an MPN of 240 total coliform bacteria per 100 milliliters. §60301.240.

SECTION 5 REVIEW OF THE 2003 SKF RECYCLED WATER FEASIBILITY STUDY

A SKF Recycled Water Feasibility Study was prepared by Whitley Burchett in 2003 that evaluated the possibility of effluent reuse on local crops was reviewed as part of this scope of service. The Feasibility Study was prepared in compliance with provision F.18 of the California Regional Water Quality Control Board Central Valley Region (RWQCB) Waste Discharge Requirements Order No. 5-01-255. Provision F.18 states:

> *"By October 15, 2003, the discharger is required to submit a feasibility study that describes opportunities to recycle effluent on agricultural lands where fresh water is currently used. The study shall also include implementation schedules for each identified opportunity."*

The study reviewed the following:

- Treatment Plant location – two miles west of Kingsburg, note the location of the Selma Colony Canal west of the plant and the Ward Drain Pipeline running directly through the plant site (Exhibit 4: SKF Wastewater Treatment Plant Location).

- Treatment Plant Facilities – Primary and secondary treatment which discharges wastewater into disposal ponds where it is removed by evaporation and percolation. (Exhibit 5: SKF Wastewater Treatment Flow Schematic).

- Water suppliers – Farmers in the area surrounding the Plant receive water from the Consolidated Irrigation District. In considering reclaimed water for the use of irrigation, the study also noted the effect of reclaimed water on the Kings River Water Association (oversees surface water rights and agreements) and the Kings River Conservation District (oversees groundwater use and is trying to address groundwater overdraft).

- Canal Network includes:
  - Ward Drainage Canal which runs eight miles beginning east of Selma and at Cole Slough, southwest of Kingsburg.
  - Selma Colony Canal which begins at the Kingsburg Branch Canal, east of Huntsman and Bethel Avenues and flows along the western boundary of the SKF WWTP. The Selma Colony Canal flows south for approximately 1.5 miles where it terminates at Ward Drain just south of Elkhorn and East of Del Rey Avenue.

- Tulare Lake Basin consists of 10.5 million acres and receives the bulk of the surface water supply from the Kings River as well as the Kaweah, Tule and Kern Rivers. Due to groundwater overdraft practices, groundwater quality has been depleted due to

salt leaching, etc. The Tulare Lake Basin Plan encourages reclamation on irrigated crops wherever feasible and recycled water use where opportunities exist to replace the use of fresh water.

- Agricultural Crops identified grapes, stone fruit, apples, almonds, and walnuts surrounding the SKF plant that are typically irrigated using drip and micro filtration which require a filtration system to remove seeds, weeds, sand, algae and other obstructions typically found in the surface water transport. Some furrow irrigation is still used as well.

SKF Recycled Water Conclusions:

- Use of recycled water from SKF was envisioned for crops surrounding the SKF WWTP. In addition, irrigation uses for a sports park complex was also envisioned. Irrigation of the Golden State Corridor or SR 99 was not considered.

- It is technically feasible to produce recycled water at the SKF WWTP. That means that by adding continuous Backflow Filtration and Disinfection (either Hypochlorite or UV Disinfection) the plant could produce effluent that will meet the stringent Title 22 requirements for disinfected secondary-2.2 recycled water. The study did not address Tertiary Treatment or the use of Soil Aquifer Treatment to meet the State Treatment Standards (Exhibit 6: Typical Tertiary Treatment Diagram).

- Capital costs used for a recycled water project were estimated to range between $ 4.2 million and $ 5.4 million depending on whether Hypochlorite or UV disinfection was selected. Filtration upgrades were estimated to cost 2.6 million, hypochlorite disinfection would cost 1.6 million and UV disinfection would cost 2.8 million in 2003 dollars.

- Three local agencies CID, KRCD and KRWA indicated support for the use of recycled water. CID would prefer that the water be utilized by accepting growers within the CID service area and then the Elkhorn area.

SECTION 6 SOIL AQUIFER TREATMENT

Soil Aquifer Treatment (SAT) is a natural process that has been cleaning up the earth's water for millions of years. It treats the percolating surface water through physical, biological and chemical processes. Physical treatment occurs through filtration which removes particles that may still be present in the water. Biological treatment takes place as natural microorganisms in the soil consume or break down any degradable organic material that may be present in the water. Chemical treatment occurs through processes such as neutralization, reduction, and oxidation. The SAT process has proven to be sustainable and reliable in recharge projects all over the world, with no diminishing effects on the earth's ability to clean up the water (Exhibit 7: Typical Soil Aquifer Treatment Process).

To ensure safety for humans and the environment, recycled water recharge projects in California are regulated by the California Department of Public Health (CDPH) and the Regional Water Quality Control Board (RWQCB). At each step, extensive monitoring, testing, and reporting are required for permit compliance. If any violations are found, then corrective actions must be quickly implemented.

A key issue in gaining full regulatory acceptance for using Soil Aquifer Treatment as an acceptable form of tertiary treatment has been in the development of Test Methods which show that there has been 5 log reduction of bacteriophage. However, several Cities including Fresno and Dinuba have been working to prove compliance with tertiary treatment requirements without disinfection. Further, EPA Test Method 1601 has been modified to show 5 log removal of bacteriophage per the tertiary treatment requirement. It appears now that EPA Test Method 1601 is near acceptance by the State of California.

Key advantages of a Soil Aquifer Treatment system are identified below:

- Sustainable Groundwater Recharge.
- Recovery of treated water for subsequent reuse or discharge.
- Possible recharge of adjacent surface streams.
- Seasonal storage of treated water beneath the site with seasonal recovery for agriculture.
- A consistent supply of irrigation water even in drought and low water availability years.
- Low cost alternative to conventional Tertiary Treatment technology.

SECTION 7 DISTRIBUTION ALTERNATIVES/WATER EXCHANGE AGREEMENTS

With the SKF Facility situated at the south end of project limits, there is limited flexibility for the Selma and Fowler communities in accessing the recycled water until the distribution system is constructed along the corridor. One alternative to avoid the potentially high cost of the required distribution system along the 99 corridor includes water exchange agreements with the local Irrigation District (Consolidated Irrigation District). This approach would provide greater flexibility by allowing water to be delivered by CID facilities to points further upstream where it provides greater benefit in exchange for treated water to be discharged into CID facilities adjacent to the SKF plant for use by agricultural customers downstream from the plant. There are several CID irrigation facilities (Exhibit 8: CID Facility Locations) along the Golden State Corridor project limits between Kingsburg and Fowler, At the SKF facility, there are two CID facilities identified as the Selma Colony Canal, situated west of the plant, and the Ward Drain Pipeline which runs directly through the plant site.

It is possible that a water exchange agreement could be drafted in such a way as to allow access to CID water along the corridor either for landscape irrigation purposes within public right-of way areas, or for ground water recharge intended to offset ground water withdrawals from wells. The agreements could provide a year-round continuous flow to CID from treated waste water even during drought years and especially during periods of high irrigation demand from agricultural uses.

Note: The City of Kingsburg has duly noted that other sources of water may be available from the large industrial users along the corridor. Example sources include Sun Maid, Lions and Guardian. By capturing industrial water along the corridor, the additional sources of water reuse could increase the availability and reduce the cost of service. These sources would be required to meet the same quality requirements by the State of California Department of Public Health. It is recommended that these sources be considered for landscape and irrigation where appropriate for the project.

SECTION 8 FUNDING ASSISTANCE

Given the cost of the facilities necessary to construct the improvements related to recycled water uses along the corridor, we recommend that alternative funding opportunities be pursued. The State Water Resources Control Board (SWRCB) Office of Recycled Water provides funding for the planning, design and construction of water recycling projects. On the federal level, the Title XVI Program is part of the US Department of the Interior's WaterSMART (Sustain and Manage America's Resources for Tomorrow) program to work toward a sustainable water strategy to meet the Nation's water needs. There are two current funding opportunities available including a Feasibility Study Development (50% of the cost) and a separate opportunity for Construction Activities (25% of the cost). The WaterSMART recycled water funding opportunity is attached in Appendix B.

For purposes of understanding the Title XVI program, a water reuse project is defined as a project that reclaims and reuses municipal, industrial, domestic, or agricultural wastewater and naturally impaired groundwater and/or surface waters. The program specifies that reclaimed water can be used for a variety of purposes, such as environmental restoration, fish and wildlife, groundwater recharge, municipal, domestic, industrial, agricultural, power generation, or recreation.

Funding Criteria for Feasibility Study Development is as follows:

1. Statement of Problems and Needs – 10 points
2. Water Reclamation and Reuse Opportunities – 15 points
3. Description of Potential Alternatives – 15 points
4. Stretching Water Supplies – 15 points
5. Environment and Water Quality – 15 points
6. Legal and Institutional Requirements – 10 Points
7. Renewable Energy and Energy Efficiency – 10 points
8. Watershed Perspective – 10 points

Funding Criteria for Construction Activities is as follows:

1a. Stretching Water Supplies – 35 points

1b. Contributions to Water Supply Sustainability – 20 points

2a. Progress toward Completion of an Authorized Title XVI Project – 20 points

2b. Readiness to Proceed – 10 Points

3. Environment and Water Quality – 30 points

4. Renewable Energy and Energy Efficiency – 25 points
5. Cost per Acre-Foot of Water and Other Project Benefits – 25 points

6a. Legal and Contractual Water Supply Obligations – 10 Points

6b. Benefits to Rural or Economically Disadvantaged Communities – 10 Points

7. Watershed Perspective – 15 points

Total– 200 points

Funding for construction activities is contingent upon the following being completed:

1. A finding that the feasibility study meets the requirements of Title XVI.
2. Complete compliance with the National Environmental Policy Act (NEPA) and in California the California Environmental Quality Act (CEQA) clearances;
3. An approved determination of financial capability; and
4. An executed financial assistance agreement between Reclamation and the project sponsor.

SECTION 9 SUMMARY OF CRITICAL ISSUES RELATED TO USING RECYCLED WATER

1. **Wastewater Treatment:** Treating effluent from the SKF Wastewater Treatment Plant for the use of landscape irrigation of unrestricted public open space is technically feasible although the capital investment requirement for conventional Tertiary Treatment is prohibitive. The cost for conventional tertiary treatment upgrades to the plant will be substantial and are estimated to range from 7 to 10 million dollars. The cost for tertiary level treatment could be reduced by utilizing Soil Aquifer Treatment combined with shallow groundwater extraction wells to a depth of approximately 200 feet. Compliance testing technology is still being reviewed by the State of California for acceptance. The City of Fresno and the City of Dinuba are both using this technology which has also been successfully used for years on a worldwide level. According to Dr. Rick Danielson, PhD with Biovir Laboratories, the State of California is fairly close to accepting the revised Test Method 1601, which is used to demonstrate the necessary tertiary treatment (5 log reduction of bacteriophage) compliance.

2. **Distribution System:** A recycled water distribution system along the 14.2 mile corridor open space is technically feasible. The cost for the piping distribution system is roughly estimated to range between 15 and 20 million dollars. In order to serve the communities more efficiently, it may be reasonable to look into water exchange possibilities where surface water could be traded along the Corridor for recycled water downstream at the plant. Consolidated Irrigation District (CID) has a system of canals for surface water delivery that could afford the opportunity for exchanging water upstream to be used along the corridor while Recycled Water is deposited back into the CID distribution system downstream near their plant facilities. In addition, CID has indicated that increasing ground water recharge and the ability to capture storm water flows during peak wet weather years could also be included in the discussions regarding the proposed water exchange agreements.

3. **Cost:** In order to reduce the up-front capital costs for treatment and distribution, as well as the operations and maintenance costs of the system, the plant will need to look at cost effective alternatives for treatment. These alternatives would include items such as the Soil Aquifer Treatment described above as well as water exchange agreements to distribute recycled water in a more economical manner. Since the Plant is on the south end of the Golden State Corridor, there are substantial piping costs just to deliver recycled water to the Corridor.

4. **Public Acceptance:** A strong public outreach will be required to gain support and understanding. A negative public perspective could severely impact the use of recycled water for the area. There are many recycled water systems in California to use as

successful examples including public right-of-way landscape irrigation, industrial uses, and agricultural users without any loss in value to the adjacent property or product.

5. **Develop a comprehensive Recycled Water System Master Plan.** As indicated in the 2003 Recycled Water Feasibility Study, The feasibility of recycled water is contingent upon willing customers and a reliable recycled water product that can be provided at competitive rates. Given the location of the SKF Plant, it is more feasible to envision an initial use that has a mix of agricultural users and large public open spaces. However, it is foreseeable that State or Federal Agencies will force greater use and acceptance of recycled water through legislation limiting groundwater overdraft practices.

6. **Pursue available Funding Resources**: Due to prohibitive costs, it is recommended that alternative funding sources be pursued in order to finance the costs to plan, design, and construct the necessary treatment and distribution systems. A current funding source identified as WaterSMART for Recycled Water Projects is attached in Appendix B and offers a good example of the type of criteria used to judge and fund both planning and construction activities for these projects.

7. **Engage Stakeholders:** The Stakeholders should be engaged, as there are a number of issues that could be considered with water recycling system implementation. Stakeholders include the Cities of Fowler, Selma and Kingsburg, SKF, CID, Caltrans, the agricultural community, and potentially several large industrial water users, as well as the public. Other issues to be considered include regulatory requirements regarding urban water management, groundwater recharge and reductions to groundwater impacts from rural and urban uses.

   Note: In accordance with email correspondence with Mr. David Martin who is a Landscape Architect with Caltrans District 6, Caltrans does have an interest in using recycled water within their right-of-way for irrigation purposes. However, they currently do not have any landscape and irrigation projects being planned or under design that would potentially use recycled water within the project area. It is recommended that continuing dialogue be maintained so that opportunities to use recycled water are fully considered in the future.

8. **Simplified Approach**: The most feasible approach to implementing a recycled water system at the SKF plant is one that has the following components:

   a. Consider Soil Aquifer Treatment in order to meet the tertiary treatment standard that allows the most uses and represents the best public health and safety interest. SAT would provide the lowest cost treatment of recycled water.

   b. Phase the recycled water system in a way that has the lowest cost distribution system for recycled water in order to deliver water at an economical cost to

customers. There are a number of users near the SKF plant that would be a good fit for recycled water. Caltrans, agricultural growers and the City of Kingsburg are all located near the SKF plant and would be reasonable candidates as first phase customers. Consider industrial waste water available along the corridor as an alternate source of recycled water for added water conservation.

c. Additional uses of recycled water along the Golden State corridor could follow and may become more feasible if the distribution costs can be mitigated by accessing water along the corridor through water exchange agreements with Consolidated Irrigation District.

REFERENCES

1. Request for Proposal, Golden State Corridor Economic Development Infrastructure Improvements: Planning, Engineering, and Environmental Study dated October 2009.
2. Recycled Water Feasibility Study, prepared by Whitley Burchett & Associates dated October 8, 2003.
3. Title 22, California Code of Regulations, Division 4 Environmental Health, Chapter 3 Recycling Criteria.
4. Treatment Technology Report for Recycled Water, prepared by the State of California Division of Drinking Water and Environmental Management, January 2007.
5. State Board Resolution No. 77-1, Policy with Respect to Water Reclamation in California
6. The Water Recycling Law (California Water Code Sections 13500-13529.4).
7. 1996 Memorandum of Understanding between DHS and the State Water Resources Control Board on the Use of Reclaimed Water.
8. Title 22 Engineer's Report, in accordance with DHS guidelines 2003.
9. Groundwater Recharge Reuse DRAFT Regulation, August 5, 2008.
10. California's Draft Criteria for Groundwater Recharge with Reclaimed Water & Emerging Contaminant Control Presentation at the 2008 Water Quality & Regulatory Conference, Ontario California.
11. Validation of large volume MPN techniques using a modification of USEPA Method 1601: detecting low concentrations of coliphage from secondary effluent substrata infiltration systems presented by the City of Fresno and BioVir Laboratories – 2010.
12. Phages Demystified – A key parameter in recycled water testing. Simmonds and Bristow.
13. Reclaiming Wastewater through Soil Aquifer Treatment prepared by the University of Arizona
14. Wastewater Technology Fact Sheet, Rapid Infiltration Land Treatment.
15. Soil Aquifer Treatment (SAT) – The long term performance of the Dan Region Reclamation Project.
16. Reclamation Water Guide for Southwest Florida Water Management District.
17. Municipal Services Review, SKF County Sanitation District 2007.
18. City of Livermore Guidelines for Water Reuse Program, May 2003.
19. Upper Kings Basin Integrated Regional Water Management Plan, July 2007.
20. AWWA Manual M24, Planning for the distribution of Reclaimed Water
21. SKF Annual Report, 2009

22. Email Correspondence dated December 24, 2010 from Caltrans regarding the use of Recycled Water for Landscape and Irrigation areas.