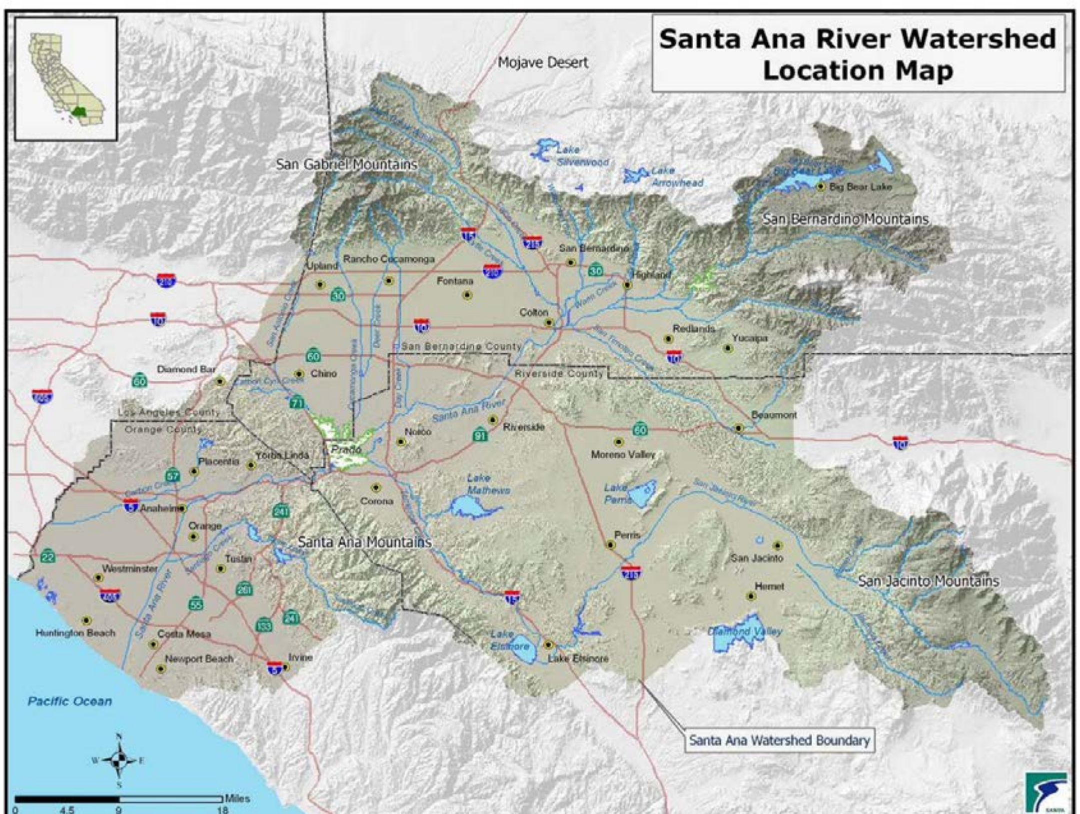
RECLAMATION

Managing Water in the West

Technical Memorandum No. 2

Greenhouse Gas Emissions Calculator for the Water Sector: User's Manual

Santa Ana Watershed Basin Study, California
Lower Colorado Region



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U.S. Department of the Interior
Bureau of Reclamation

August 2013

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

BUREAU OF RECLAMATION
Water and Environmental Resources Division (86-68200)
Water Resources Planning and Operations Support Group (86-68210)
Technical Services Center, Denver, Colorado

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Greenhouse Gas Emissions Calculator for the Water Sector: User's Manual

Santa Ana Watershed Basin Study, California
Lower Colorado Region

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Acronyms and Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
%	percent
~	Approximately
AB 32	Assembly Bill 32
AF	acre-feet
AFY	acre-feet per year
AR4	Fourth Assessment Report
CFS	cubic feet per second
CO_2e	Carbon Dioxide Equivalent
Corps	U.S. Army Corps of Engineers
DCP	Downscaled Climate Projections
DOE	U.S. Department of Energy
DWR	California Department of Water Resources
EMWD	Eastern Municipal Water District
EVMWD	Elsinore Valley Municipal Water District
GHG	Greenhouse Gas
GPCD	gallons per capita per day
IEUA	Inland Empire Utilities Agency
IPCC	Intergovernmental Panel on Climate Change
IRWM	Integrated Regional Water Management
km	kilometer

MAF	million acre-feet
MAFY	million acre feet per year
Metropolitan	The Metropolitan Water District of Southern California
MGD	million gallons per day
mtCO2e	million metric tons of carbon dioxide equivalent
MWDOC	Municipal Water District of Orange County
OCWD	Orange County Water District
OWOW	One Water One Watershed
PPPI	Plunge Pool Pipeline
Reclamation	U.S. Department of the Interior, Bureau of Reclamation
SAR	Santa Ana River
SARP	Santa Ana River Mainstem Project
SARW	Santa Ana River Watershed
SAWPA	Santa Ana Watershed Project Authority
SBVMWD	San Bernardino Valley Municipal Water District
SECURE	Science and Engineering to Comprehensively Understand and Responsibly Enhance (Water Act)
SCAG	Southern California Association of Governments
SWE	Snow Water Equivalent
USGCRP	U.S. Global Change Research Program
WaterSMART	WaterSMART (Sustain and Manage America's Resources for Tomorrow)
WMWD	Western Municipal Water District
WRMS	Water Resources Management System

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Executive Summary

The Santa Ana Watershed Basin Study (Basin Study) is a collaborative effort by the Santa Ana Watershed Project Authority (SAWPA) and the Bureau of Reclamation (Reclamation), authorized under the Sustain and Manage America's Resources for Tomorrow SECURE Water Act (Title IX, Subtitle F of Public Law 111-11). The Basin Study complements SAWPA's Integrated Regional Water Management (IRWM) planning process, also known as their "One Water One Watershed" (OWOW) Plan. It refines the watershed's water projections, and identifies potential adaptation strategies, in light of projected effects of climate change. The Climate Change Analysis for the Santa Ana River Watershed (SARW) is a contributing section to the Basin Study. The Greenhouse Gas (GHG) Emissions Calculator was developed as a tool to support the Climate Change Analysis. It was developed to evaluate mitigation strategies, while the Climate Change Analysis focused primarily on adaption and vulnerability analysis. Development of the tool began in 2012 and was completed in August 2013.

This report explains the methods used to develop the calculator and provides instructions on how to use it by introducing examples. The examples focus on the SARW to show how to develop a GHG emissions baseline, evaluate what it would take to meet specific GHG emission reduction goals, and illustrate how the GHG Emissions Calculator can be used to analyze projects. Chapter 1 provides an introduction to the project, a literature review, and a summary of California's GHG legislation. The methods used in the GHG Emissions Calculator can be found in Chapter 2. A guide showing users what data is needed and how to enter that data can be found in Chapter 3. Chapter 4 provides an introduction to the SARW, the GHG emission baseline for the SARW, discusses varies scenarios to reduce GHG emissions, and compares those reduction scenarios. In Chapter 5 SAWPA's 20 finalist for the Integrated Regional Water Management (IRWM) funding were analyzed using the GHG Emissions Calculator.

The GHG Emission Calculator is a decision-making tool that can be used to explore the links between water resources, energy, and GHG emissions. It can be used to determine water supply and energy demands for the study area, in addition to GHG emissions from 1990 to 2050. It can be used to analyze a study area ranging from a city block to an entire watershed, regardless of the level of detailed data available. The GHG Emissions calculator is a vital tool for decision makers when developing water supply plans for the future. It is also equipped to evaluate long term GHG emission reduction potential for new projects that will alter the water supply portfolio.

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1.0 Introduction

1.1 Purpose, Scope, and Objective of Study

The Santa Ana Watershed Basin Study (Basin Study) is a collaborative effort by the Santa Ana Watershed Project Authority (SAWPA) and the Bureau of Reclamation (Reclamation), authorized under the Sustain and Manage America's Resources for Tomorrow SECURE Water Act (Title IX, Subtitle F of Public Law 111-11). The Basin Study complements SAWPA's Integrated Regional Water Management (IRWM) planning process, also known as their "One Water One Watershed" (OWOW) Plan. It refines the watershed's water projections, and identifies potential adaptation strategies, in light of projected effects of climate change. The Climate Change Analysis for the Santa Ana River Watershed (SARW) is a contributing section to the Basin Study. The Greenhouse Gas (GHG) Emissions Calculator was developed as a tool to support the Climate Change Analysis. It was developed to evaluate mitigation strategies, while the Climate Change Analysis focused primarily on adaption and vulnerability analysis. Development of the tool began in 2012 and was completed in August 2013.

Climate change threatens California's natural environment, economic prosperity, public health, and quality of life. Recognizing the need for action, California has put in place ambitious GHG emission reduction goals. Recently California passed legislation requiring drastic reduction in GHG emissions. In order to meet these reduction goals a new methodology was required to determine GHG emissions in the past, present, and future. The GHG Emissions Calculator, developed by Reclamation, is a tool that fills that need.

The GHG Emission Calculator is a decision-making tool that can be used to explore the links between water resources, energy, and GHG emissions. It can be used to determine water supply and energy demands for the study area, in addition to GHG emissions from 1990 to 2050. The GHG Emissions calculator is a vital tool for decision makers when developing water supply plans for the future. It is also equipped to evaluate long term GHG emission reduction potential for new projects that will alter the water supply portfolio.

1.2 Literature Review

Water resource managers are currently faced with the challenge of developing sustainable methods for adaptation and mitigation to climate change. Demands for treatment and transportation of water are increasing globally due to developments in industrial, agricultural and domestic water use, as well as water quality regulation (King et al., 2008). Large increases in energy use in the water sector are driven by rising demand for food and bio-fuels, and their international trade, driving up irrigated cropland and cropping intensity (Curlee et al., 2003; DOE, 2006). Worldwide food production is expected to increase 50% by 2030, at the cost of considerable increase of irrigated area and water use (Bruinsma, 2003). This estimate excludes the effects of climate change, which in many cases will put further pressure on water resources (IPCC Secretariat, 2008). The demand for irrigation water is likely to increase as temperatures increase and precipitation become more variable (Doll, 2002; Bruinsma, 2004; Fischer et al., 2007; Rosenberg et al., 2003; Xiong et al, 2010). With increased irrigation, additional development of groundwater is highly likely. Declining groundwater will compound energy use, as deeper wells require more carbon-intensive electrical pumps.

Across the United States, the demand for electricity is colliding with the need for healthy and abundant fresh water. Large amounts of electricity are required to develop, treat, and transport the water supply for the growing population of the United States, currently 315.5 million (U.S. Census Bureau, 2013). However, in order to produce the requisite electricity to supply our water needs, a large amount of water is needed to produce that energy, regardless of the source (Bauer, 2009; Sovacool, 2009; DOE, 2011). The interdependence of water and energy has long been referred to as the water-energy nexus.

Although there is a potential for a shortage of either water or energy to limit the production of the other, the majority of research has been focused on water as the limiting factor (Alley et al., 1999; EPRI, 2002; DOE, 2006; Dziegielewski et al., 2006; Amons, 2007; ACEEE, 2011). Very little research has been done on what would happen if energy were to become the limiting factor, let alone adaptation and mitigation strategies (Racoviceanu, 2007).

There has been some research on greenhouse gas emissions (GHGE) from the various water supply methods. A study done by Stokes et al., in 2006 showed that for most U.S. utilities analyzed, higher GHG emissions result – by a factor of 1.5 to 2.4 percent – from desalination than either recycled water use or importation. Slightly more research has been done focusing on GHG emissions from wastewater systems (Racoviceanu et al., 2009; Shehabi et al., 2012).

A study published by the River Network in 2009 provides a qualitative analysis of GHG emissions from energy use in the water sector, developing a baseline estimate of water related energy use in the U.S., as well as a comparative overview of the energy embedded in different water supplies and end uses. Connections between Energy use and GHG emissions are poorly understood and have only been partially considered in water management and planning.

Growing populations are creating a higher water demand, and in areas where water is already scarce accelerated research will be required to help develop sustainable mitigation and adaptation scenarios to climate change while still meeting the demand. Research on planning and mainstream adaptation in water management is growing (Subak, 2000; Charlton & Arnell, 2011; Farley et al., 2011). However, few studies consider, in detail, the energy and emission implications of adaptation measures, and there is a need to achieve better linkage between adaptation and mitigation. Comparisons between the few studies that have been conducted are challenging due to the lack of a common carbon assessment methodology for the water sector (Frijns, 2011). Consideration of alternative water supply systems, treatment technologies, or water allocation may have a tendency to overlook the carbon cost. This is particularly the case in the absence of regulatory pressure.

1.3 Legislation to Reduce GHG Emission

National and international actions are necessary to fully address the issue of climate change. However, action taken by California to reduce GHG emissions has and will continue to have far-reaching effects by encouraging other states, the federal government, and other countries to act. The following section is a summary of State legislation and policy that California has passed in order to reduce GHG emissions.

1.3.1 Executive Order S-3-05

California began to lead the charge to reduce GHG emissions back in 2005 when Governor Schwarzenegger passed Executive Order S-3-05 (EO S-3-05). EO S-3-05 laid the groundwork for establishing the California Environmental Protection Agency's (Cal EPA) Climate Action Team (CAT) and developed GHG reduction targets for California including:

- Reduction of GHG emissions to 2000 levels by 2010
- Reduction of GHG emissions to 1990 levels by 2020
- Reduction of GHG emissions to 80% below 1990 levels by 2050

CAT established a sub-group known as the Water-Energy group, or WET-CAT, to monitor the progress of GHG emission reduction efforts and coordinate GHG mitigation strategies.

1.3.2 Assembly Bill 32: The California Global Warming Solutions Act of 2006

The passing of California's Assembly Bill 32: The Global Warming Solutions Act (AB 32) codified the GHG emission reduction targets set forth in EO S-3-05. A number of studies noted that climate change threatens California's natural environment, economic prosperity, public health, and quality of life (CEC, 2005; Lofman et al., 2006; AB 32, 2006). Recognizing the need for action, California put in place ambitious emission reduction goals in the form of AB 32. By requiring, in law, a reduction in GHGE, California set the stage to transition to a sustainable, clean energy future, while puting climate change on the national agenda and spurring action by many other states. For example, in 2008 Massachusetts Governor Deval Patrick signed into law that state's Global Warming Solutions Act that mirrors AB 32. Also in 2008, the government of the United Kingdom launched a new strategy for the water sector that includes the same GHGE targets as AB 32 (Stationary office, 2008). AB 32 directly links anthropogenic GHGE and climate change, provides a timeline for statewide GHGE reduction, requires quantitative accounting of GHGE, and enforces disclosure of GHGE from every major economic sector in the state.

AB 32 requires that every major sector in California reduce its GHGE to the 1990 levels by 2020, and to 80% below the 1990 levels by 2050 (see Figure 1). These targets were developed from the levels of reduction climate scientists agree are required to stabilize our climate (IPCC Tech Paper III, 1997). The 2020 Statewide baseline, shown in Figure 1, represents the projected GHGE out to 2050 if no action is taken. GHGE are measured in carbon dioxide equivalent (CO2e), which represents the equivalent amount of CO_2 that would cause the same effects as the greenhouse gas being represented.

It has been argued that, the only way for the water sector to achieve these ambitious GHGE reduction goals is to drastically reduce its energy use (Friedrich et al., 2007). This brings up one of the major issues when accounting for GHG emissions in the water sector – the majority of GHG emissions come from electricity use for pumping, treating, and transporting water. GHG emissions from electricity used in the water sector are accounted for in the electricity sector, resulting in double accounting. The Scoping Plan, summarized below, addresses this issue by categorizing the water sector's GHG reductions as a factor of safety.

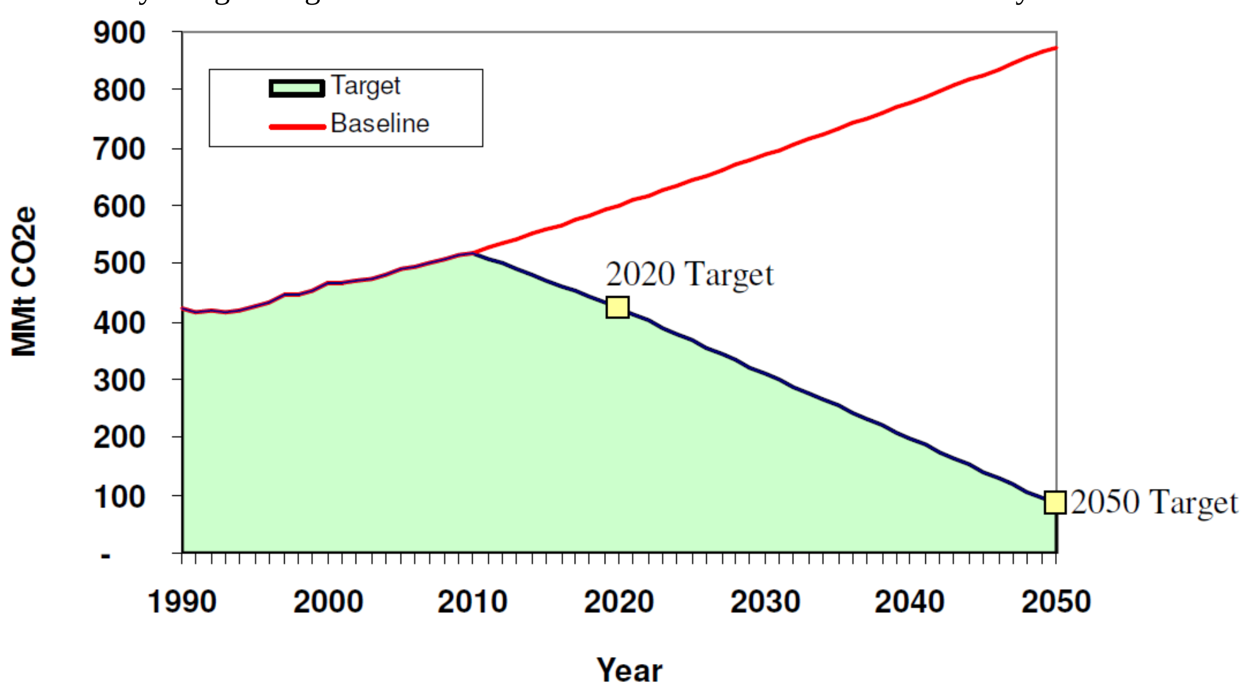

Figure 1: AB 32 Targets

1.3.3 Climate Change Scoping Plan

The Climate Change Scoping Plan, developed pursuant to AB 32, recommends specific strategies for each sector to achieve the GHG emission reduction goals set out by AB 32. The scoping plan, adopted in 2008, addresses double accounting by the water sector, and lays out six areas of focus to encourage the water sector to do its part.

- Water use efficiency
- Water recycling
- Water system energy efficiency
- Reuse of urban runoff
- Increased renewable energy production
- Public goods charge for water

The Scoping Plan identifies water use as a sector requiring significant amounts of energy. It sets goals to use cleaner energy to treat and move water and to work towards higher efficiency.

1.3.4 Water Code Section 10541

California Water Code Section 10541 requires that all Integrated Regional Water Management (IRWM) Plans address climate change by evaluating the adaptability of water management systems to climate change and by considering GHG emissions of all identified programs and projects.

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2.0 GHG Emissions Calculator Development

2.1 Methods

The methods used account for embodied energy and the subsequent GHG emissions of water consumption in a study area. Figure 2 illustrates the different energy consuming processes involved in the delivery and treatment of water. End-use of water (e.g. the energy used to heat water in the home) is not considered in this analysis due to the user specific data that would be required. To accurately inventory emissions, the energy intensity of each of the processes shown in Figure 2, and the volume of water passing through each, is required. The level of site specific data that is known will define the accuracy of the results when determining the GHG emissions from the water sector.

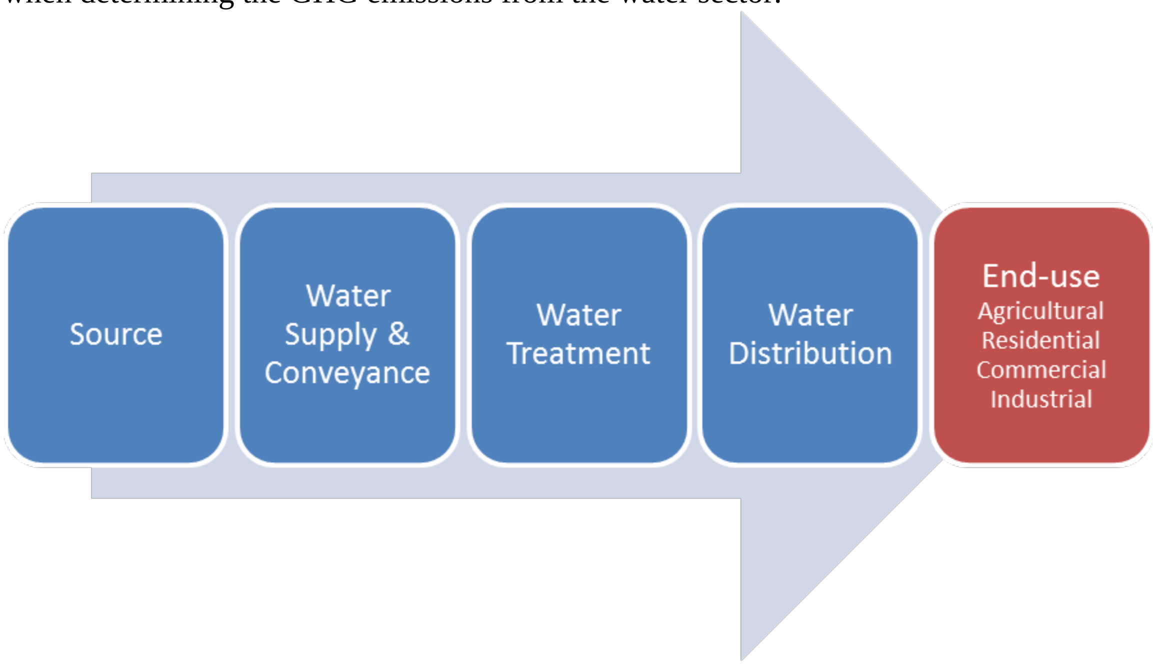


Figure 2: Energy Consuming Process in the Delivery and Treatment of Water (red not included in analysis)

This methodology depends on study area specific energy consumed per unit of water for each process in Figure 2. If site specific information is not available, southern California defaults are used. Default utility specific emission factors were obtained from the California Climate Action Registry Power/Utility Protocol reports. Annual average electricity emission factors came from the California Air Resources Board Greenhouse Gas Inventory (2007), and eGRID (2009).

Equation 1 depicts how total annual CO_2e emissions are calculated:

Annual CO_2e emissions = Extraction + Conveyance + Treatment + Distribution…….**Eq. 1**

Where:

$$\text{Extraction} = \Sigma\left(\text{Source Percentage} * \text{Population} * \text{per capita Use} * \text{Process Energy Intensity}_{\text{GW Extraction}}\right) * \text{Energy Emissions Factor} * \text{Unit Conversions}$$

$$\text{Conveyance} = \Sigma\left(\text{Source Percentage} * \text{Population} * \text{per capita Use} * \text{Process Energy Intensity}_{\text{Conveyance}}\right) * \text{Energy Emissions Factor} * \text{Unit Conversions}$$

$$\text{Treatment} = \Sigma\left(\text{Source Percentage} * \text{Population} * \text{per capita Use} * \text{Process Energy Intensity}_{\text{Treatment}}\right) * \text{Energy Emissions Factor} * \text{Unit Conversions}$$

$$\text{Distribution} = \Sigma\left(\text{Source Percentage} * \text{Population} * \text{per capita Use} * \text{Process Energy Intensity}_{\text{Distribution}}\right) * \text{Energy Emissions Factor} * \text{Unit Conversions}$$

The GHG Emissions Calculator detailed here was developed by Reclamation to allow users to implement this method to easily and quickly evaluate how water management decisions affect water demand, energy use, and GHG emissions.

3.0 Using the GHG Emissions Calculator

3.1 Data Entry

The consumption of water by a community's residents and businesses can have significant GHG implications depending on the source, treatment, distance, and topography traversed. Incorporating the relationship between water and energy consumption in a GHG inventory allows a community to use water conservation and policy measures as a GHG emissions reduction strategy. This tool allows the user to estimate GHG emissions from 1990-2050 regardless of data availability. It can be used with three levels of data: Required Data, Suggested Data, and Detailed Data, or any combination of the 3. Yellow cells in each worksheet take user input, blue cells are calculated values, and tan cells provide detailed instructions.

The only required data is population of the area being analyzed for 1990, 2000, 2010, and present. Suggested data includes the following site specific data for the study area:

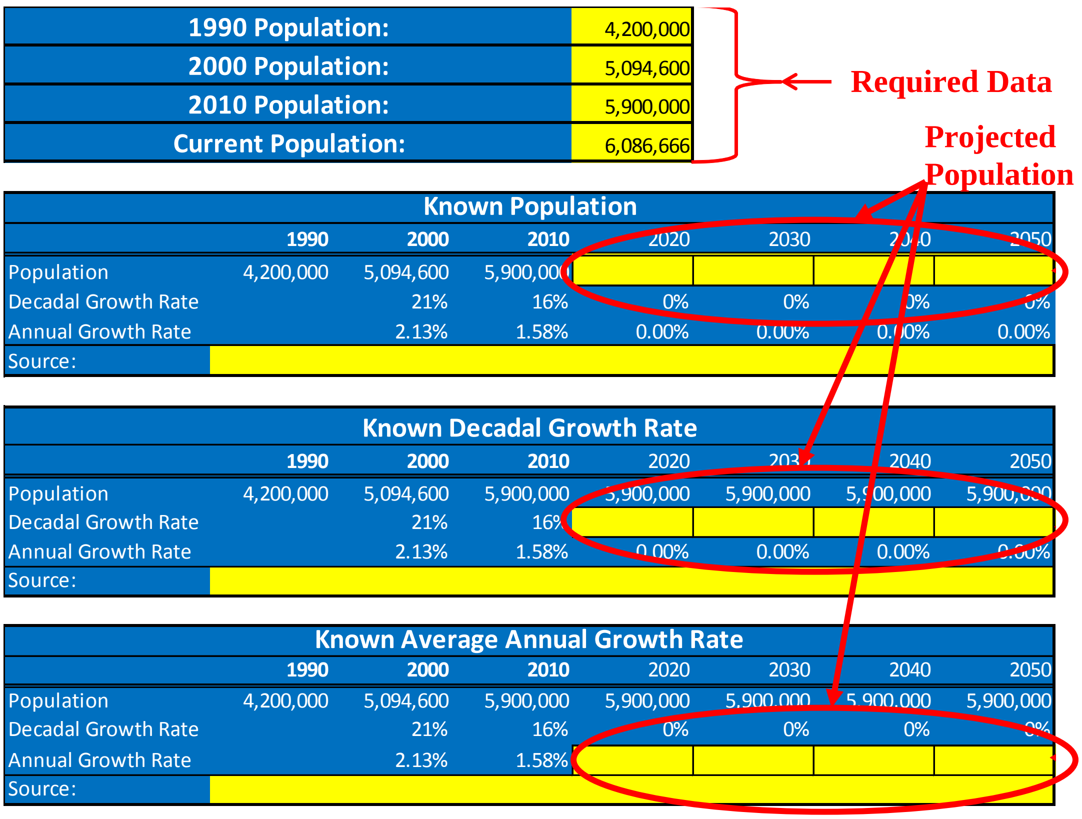
- Projected population data for 2020, 2030, 2040, and 2050
- Water use per capita for 1990, 2000, 2010, present, 2020, 2030, 2040, and 2050
- Percentage each of groundwater, State Water Project, and Colorado River Water

Detailed site specific data should be used when it is available, but default southern California data will fill any data gaps. The following detailed data can be entered on either a monthly or annual level under the blue tabs.

- State Water Project data (ac-ft)
- Colorado River Water data (ac-ft)
- Potable water treatment flow (gal for monthly data, MG for annual)
- Potable water treatment energy data (KWh)
- Groundwater elevation data (ft)
- Groundwater energy data (KWh)

3.1.1 Population Data

Required data should be entered in the spreadsheet marked with the "Population" tab in cells F1-F4, as seen in the screenshot found in Figure 3. If population projections for 2020, 2030, 2040, and 2050 are know they can be entered in cells F8-I8, also shown in Figure 3. If exact population projections are not known, default southern California projected growth rate will be used. If the user would prefer to evaluate population projection scenarios they can be entered as decadal percent growth or annual percent growth in cells F16-I16 and F24-I24 respectively (see Figure 3). Only one of the methods of entering projected population can be used at a time.



1990 Population:	4,200,000
2000 Population:	5,094,600
2010 Population:	5,900,000
Current Population:	6,086,666

Known Population							
	1990	2000	2010	2020	2030	2040	2050
Population	4,200,000	5,094,600	5,900,000				
Decadal Growth Rate		21%	16%	0%	0%	0%	0%
Annual Growth Rate		2.13%	1.58%	0.00%	0.00%	0.00%	0.00%
Source:							

Known Decadal Growth Rate							
	1990	2000	2010	2020	2030	2040	2050
Population	4,200,000	5,094,600	5,900,000	5,900,000	5,900,000	5,900,000	5,900,000
Decadal Growth Rate		21%	16%				
Annual Growth Rate		2.13%	1.58%	0.00%	0.00%	0.00%	0.00%
Source:							

Known Average Annual Growth Rate							
	1990	2000	2010	2020	2030	2040	2050
Population	4,200,000	5,094,600	5,900,000	5,900,000	5,900,000	5,900,000	5,900,000
Decadal Growth Rate		21%	16%	0%	0%	0%	0%
Annual Growth Rate		2.13%	1.58%				
Source:							

Figure 3: Screenshot of "Population" tab

3.1.2 Water Use Per Capita Data

Water use per capita data should be entered in the spreadsheet marked with "Water Use Per Capita". Current and historic data should be entered in cells F2-F5. If per capita water use projections for 2020, 2030, 2040, and 2050 are known, they can be entered in cells F9-I9. If exact per capita water use is not known, default southern California data will be used. If the user would like to evaluate various conservation scenarios, that can be done in the "Water Use Per Capita" tab using precise goals, a decadal percent reduction, or annual percent reduction in cells F9-FI, F17-I17, or F25-I25 respectively (see Figure 4). Only one of the methods of entering per capita water can be used at a time.

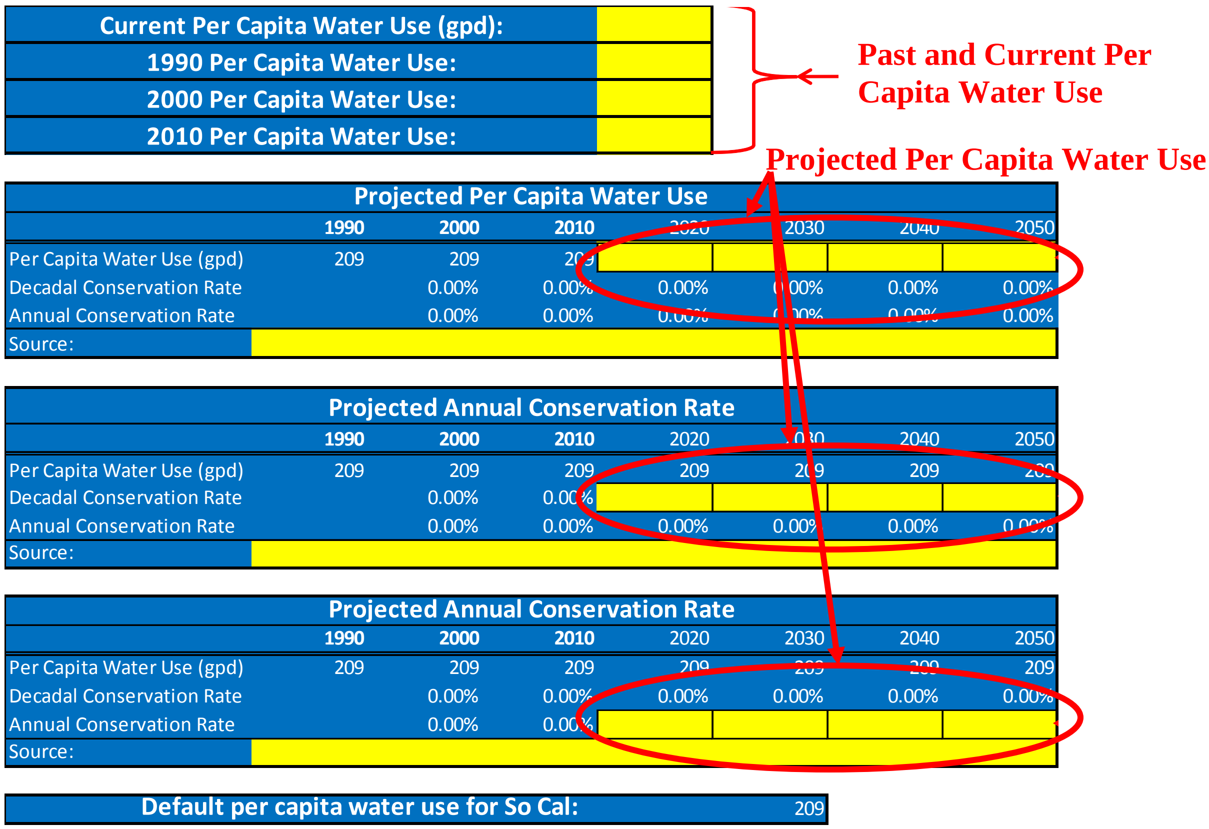


Figure 4: Screenshot of "Water Use Per Capita" tab

3.1.3 Water Supply Data

Water supply data should be entered in the spreadsheet marked "Water Supply". Current data should be entered as percentages in cells F2-F5. Self-supplied water should not be entered; rather it is calculated by subtracting the other supply data from the total. If historic water supply volumes are known for groundwater, State Water Project (SWP), and Colorado River Aqueduct (CRA) those should be entered in cells C9-E9, C15-E15, and C21-E21, respectively. Water supply portfolio projections for 2020, 2030, 2040, and 2050 can be entered as percent to total water supply in cells F10-I10, F16-I16, and F22-I22 for groundwater, SWP, and CRA respectively (see Figure 5). If no data is entered for water supply, the southern California defaults will be used.

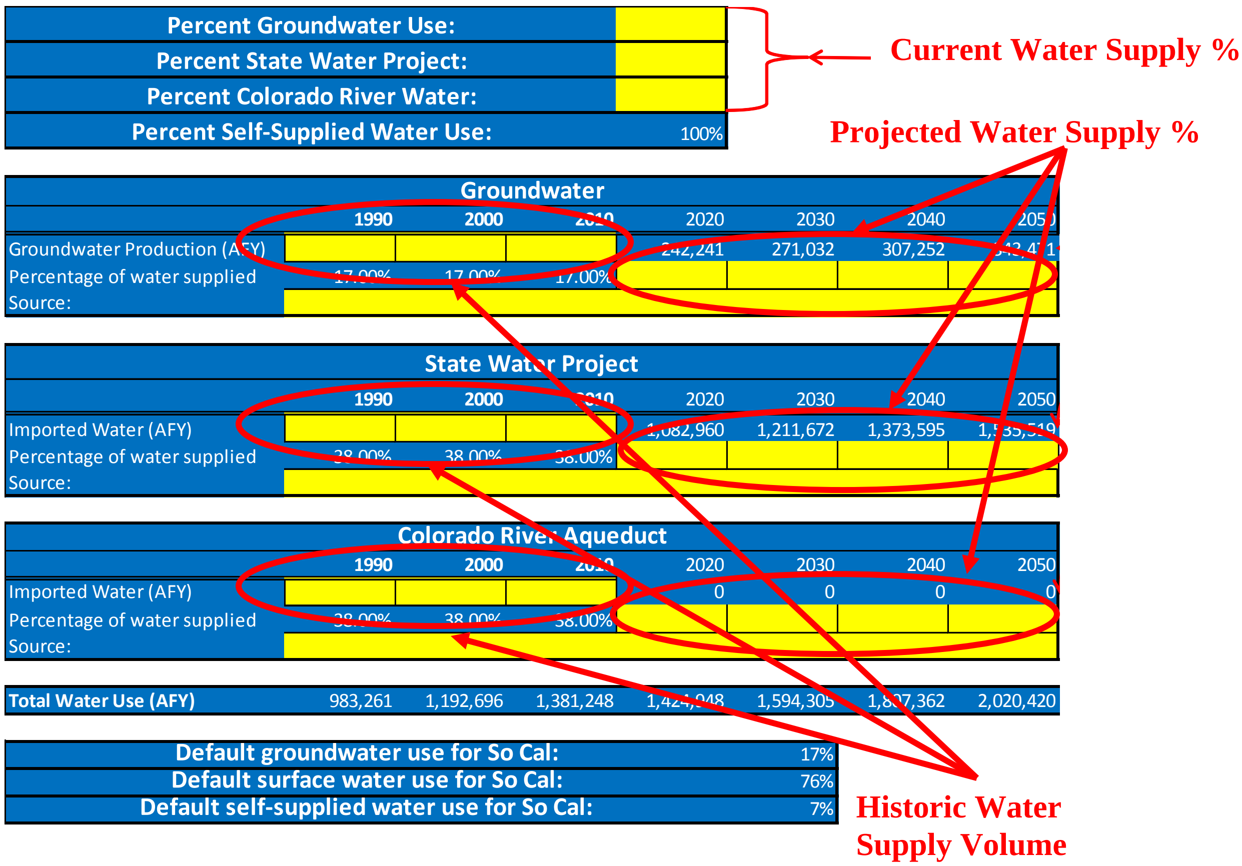


Figure 5: Screenshot of “Water Supply” tab

3.1.4 Potable Water Treatment Data

Potable water treatment data should be entered in the spreadsheet marked with “Potable Water Treatment”. Current and historic data should be entered in cells F2-F5. If projected daily flows for treatment plants for 2020, 2030, 2040, and 2050 are known, they can be entered in cells F9-I9. If exact daily flow to treatment plant is not known, default southern California data will be used. If the user would like to evaluate various conservation scenarios, that can be done in this tab using precise goals, a decadal percent reduction, or annual percent reduction in cells F9-FI, F17-I17, or F25-I25, respectively (see Figure 6). Only one of the methods of entering project daily flow to treatment plant can be used at a time.

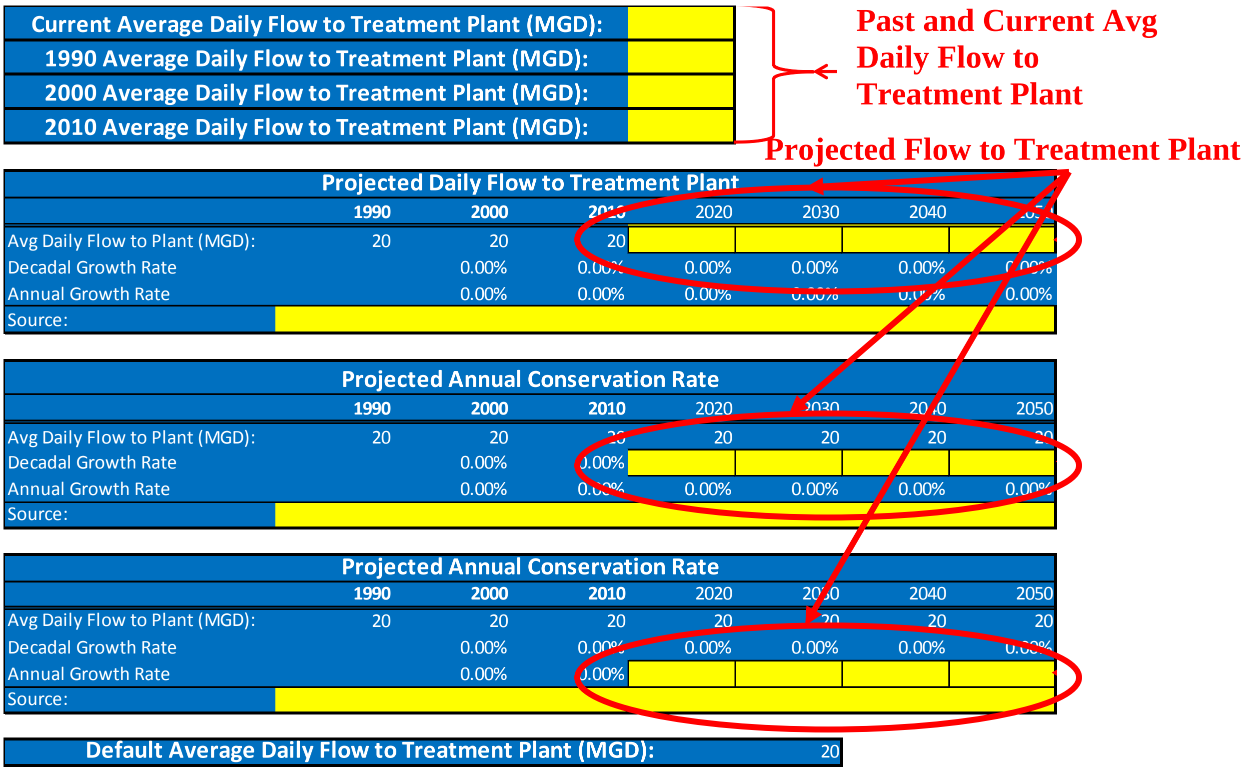


Figure 6: Screenshot of "Potable Water Treatment" tab

3.1.5 Detailed Data

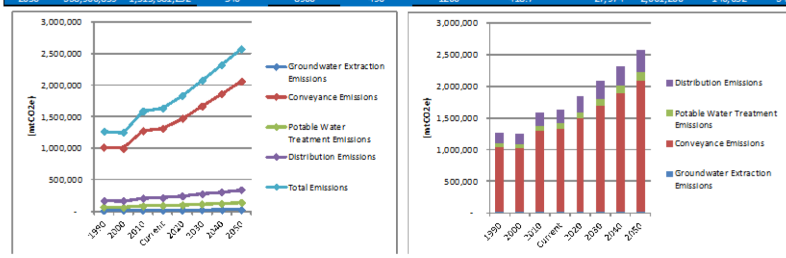
For the most accurate results it is always preferred to go with site specific detailed data when it is available. Detailed data for water supply portfolio, potable water treatment, and groundwater can be entered in spreadsheets with blue tabs. There is an energy tab and a water data tab for each area. For most accurate results, both energy data and water data should be used. Monthly or annual data can be entered, but not at the same time. If only a partial data set is available this should still be entered, as it will provide a more accurate site specific result. Please see tool for specific instructions on detailed data.

3.2 Results and Scenario Manager

After entering the required population data the "Results" tab can be accessed at any time to see how different entries effect the GHG emissions. The "Results" tab contains a table showing a breakdown of demand, energy intensities for each source, emissions from each source, and total annual emissions, as seen in Figure 7. The "Results" tab also provides a graphical representation of the data in both a line graph and a bar graph. To conduct a scenario analysis of the study area, open the file called "GHG Scenario Manager", enter the name of the scenario in the yellow cell in the "Results" tab of the GHG Emissions Calculator, hit 'enter', then click on the "Export Results" button. Once five scenarios have been developed and exported, the user can go to the GHG Emissions Scenario workbook, go to the "Comparison Tab", and click on the "Compare" button. The scenarios will then be graphed together for easy comparison. An example is shown in Section 4 (Figure 16).

Final Values for Computation of Total Annual Emissions

	Groundwater (gpd)	Surface Water (gpd)	Groundwater Intensity (KWh/MG)	Supply & Conveyance Intensity (KWh/MG)	Treatment Intensity (KWh/MG)	Distribution Intensity (KWh/MG)	Electricity Emission Factors (kg CO2 eq./MWh)	Annual Groundwater Extraction Emissions (mtCO2e)	Annual Conveyance Emissions (mtCO2e)	Annual Treatment Emissions (mtCO2e)	Annual Distribution Emissions (mtCO2e)	Total Annual Emissions (mtCO2e)
1990	149,226,000	667,128,000	540	8900	496	1200	469.9	13,822	1,018,410	69,494	168,029	1,269,755
2000	181,011,138	809,226,264	540	8900	496	1200	380.9	13,588	1,001,222	68,321	165,193	1,248,325
2010	209,627,000	937,156,000	540	8900	496	1200	418.7	17,300	1,274,706	86,983	210,315	1,589,305
Current	216,259,243	966,806,027	540	8900	496	1200	418.7	17,847	1,315,036	89,735	216,969	1,639,588
2020	241,961,965	1,081,712,313	540	8900	496	1200	418.7	19,969	1,471,330	100,400	242,756	1,834,455
2030	274,296,930	1,226,268,626	540	8900	496	1200	418.7	22,637	1,667,953	113,818	275,198	2,079,606
2040	306,631,894	1,370,824,939	540	8900	496	1200	418.7	25,306	1,864,577	127,235	307,639	2,324,756
2050	338,966,859	1,515,381,252	540	8900	496	1200	418.7	27,974	2,061,200	140,652	340,080	2,569,906



Export Results

Scenario Name: No Action

Instructions	
Step 1:	After completing data entry according to instructions, name your scenario in yellow box above and hit enter.
Step 2:	Open GHG Scenario Manager, then return to this worksheet.
Step 2:	Click on export results.

Figure 7: Screenshot of "Results" tab

4.0 SARW GHG Emissions and Mitigation Analysis

4.1 Location and Description of Study Area

The Santa Ana River Watershed (also referred to as SARW, or 'Watershed') is home to over 6 million people, within an area of 2,650 square miles in southern California. The regional population is projected to grow to almost ten million within the next 50 years (U.S. Census Bureau, 2010). The watershed includes much of Orange County, the northwestern corner of Riverside County, the southwestern corner of the San Bernardino County, and small portions of Los Angeles County. The watershed is bounded on the south by the Santa Margarita watershed, on the east by the Salton Sea and Southern Mojave watersheds, and on the northwest by the Mojave and San Gabriel watersheds. SAWPA has five member agencies: Eastern Municipal Water District (EMWD), Inland Empire Utilities Agency (IEUA), Orange County Water District (OCWD), San Bernardino Valley Municipal Water District (SBVMWD), and Western Municipal Water District (WMWD) shown below in Figure 8.

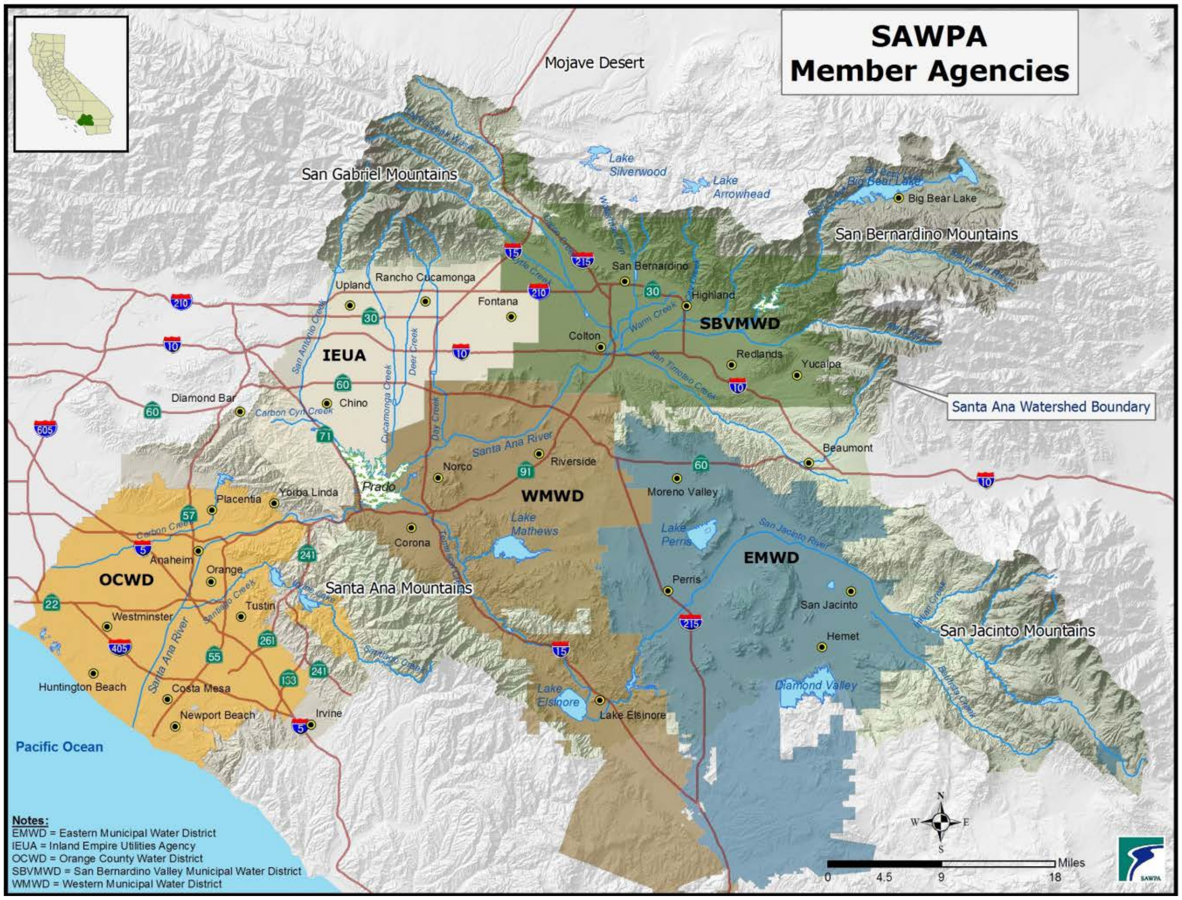


Figure 8: SAWPA member agencies

The climate and geography of the State of California present unique challenges to the management and delivery of water. While most of the State's precipitation falls on the northern portion of the State, the majority of California's population resides in the semi-arid, southern portion of the State. Water is diverted, stored, and then transferred from the water-rich north to the more arid central and southern sections of the state through the California State Water Project (SWP), the Central Valley Project, and the Los Angeles Aqueduct. In addition to the projects that transport water from the north to the south, the southern coastal area relies on water imported through The Metropolitan Water District of Southern California's (Metropolitan) Colorado River Aqueduct. The Bureau of Reclamation and seven basin states manage the Colorado River system under the authority of the Secretary of the Interior and for the benefit of the seven basin states. Over-allocation of this resource, along with a U.S Supreme Court Decision (Arizona v. California, 1964) and population and economic growth, led to the recent California "4.4 Plan" and Quantification Settlement Agreement (QSA). The QSA limits California's share of the Colorado River water supply to 4.4 million acre-feet (MAF). As a result of these actions, Metropolitan's supply from

the Colorado River was significantly reduced, especially during extended dry periods.
In the past, a buffer supply was developed by constructing new facilities, such as dams and/or aqueducts, to provide water supply for future growth. Today, the gap between supply and demand has closed and increasing emphasis is placed on conservation and development of local supplies. Building new facilities is costly and such projects face strict environmental review before they can be approved. This has caused California to seek more creative and sustainable solutions to water resource management.

4.2 Application of the GHG Emissions Calculator to the SARW

Many factors affect future water demands such as population growth, hydrologic conditions, public education, and economic conditions, among others. In 1990, 4.2 million people lived in the Watershed. In the 1990s, the population grew by 17.6%, and continued to grow to the present population of approximately 6.1 million, as shown in Figure 9. By 2050, the population is projected to reach 9.9 million (Santa Ana Integrated Watershed Plan, 2002).

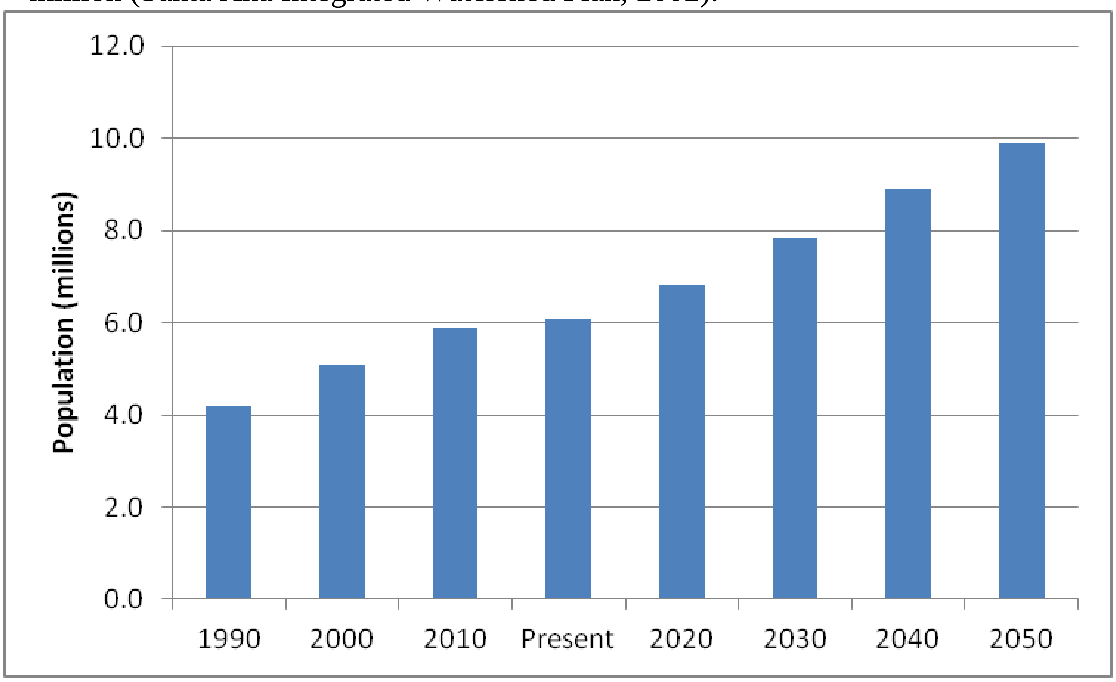


Figure 9: Population for the Santa Ana River Watershed

Using the GHG Emissions Calculator, water demand for the SARW was calculated for the watershed, as a whole, every ten years from 1990-2050, shown in Figure 10. The population projections from Figure 9 and historic per capita water use were incorporated to determine the demand (conservation was not taken into account).

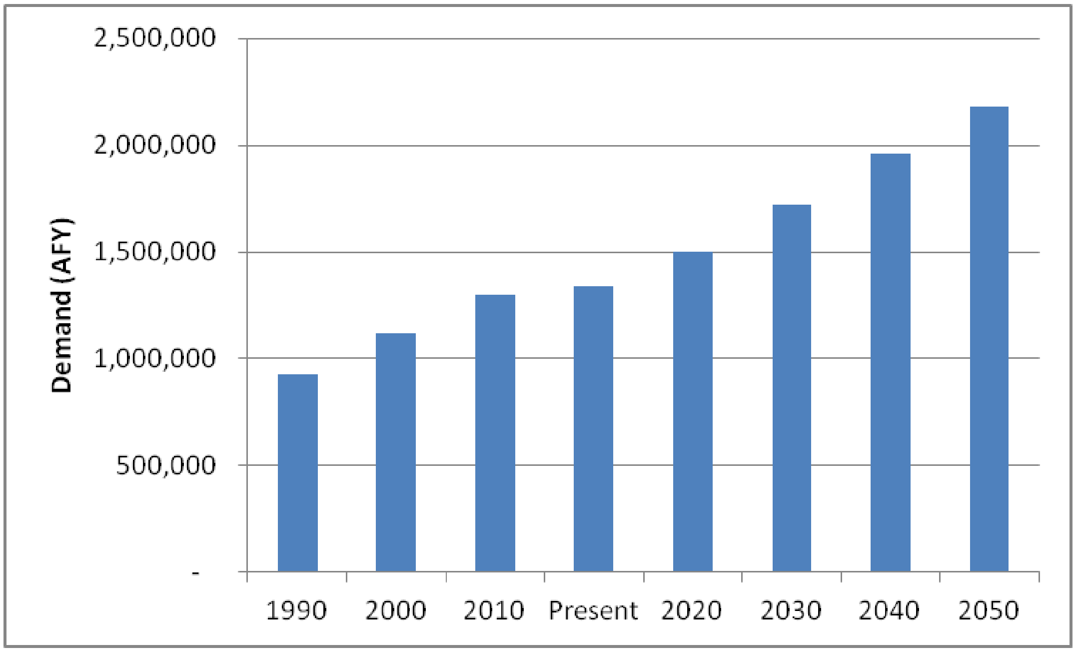


Figure 10: Santa Ana Watershed water demand calculated for this study

The population data found in Figure 9 was used in the GHG Emissions calculator to determine a GHG emissions baseline for the SARW in million metric tons of carbon dioxide equivalent (mtCO2e), shown in Figure 11.

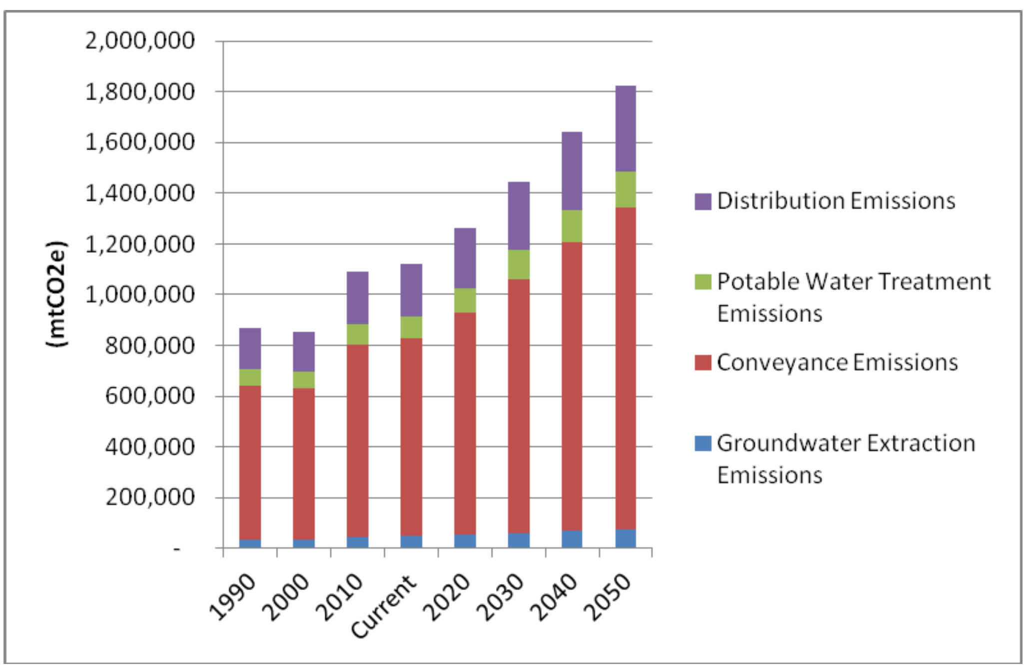


Figure 11: Baseline GHG emissions for the SARW

In February 2008, California Governor Schwarzenegger directed state agencies to develop a plan to reduce statewide per capita urban water use by 20% by the year 2020 (20x2020). The GHG Emissions Calculator was used to evaluate whether this conservation measure alone would be enough to meet AB 32 targets. The results, found in Figure 12, show that a 20% reduction by the year 2020 does not quite allow the SARW to meet the 2020 target (back to 1990 levels). However, if the SARW reduced per capita water use by 20% and also increased the self-supplied water by 10% by 2020 through changes to water supply portfolio, graywater reuse, or rainwater harvesting the AB 32 2020 target could be met, but the 2050 target of 80% below 1990 levels would not, as shown in Figure 13.

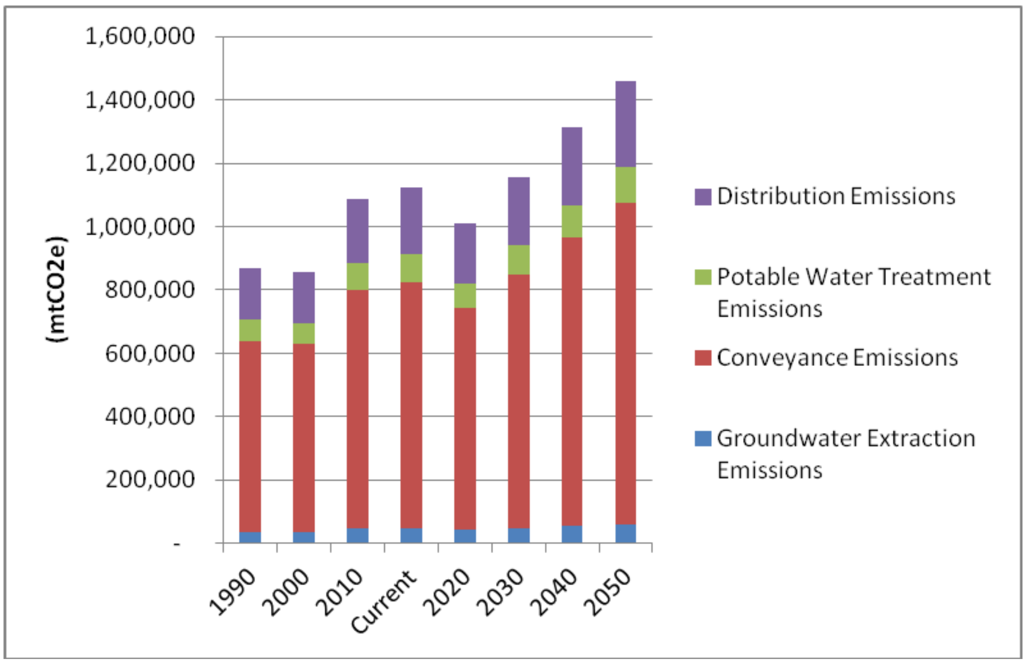


Figure 12: Conservation for SAWR to meet a 20% reduction in GHG emissions by 2020 (also referred to as 20x2020)

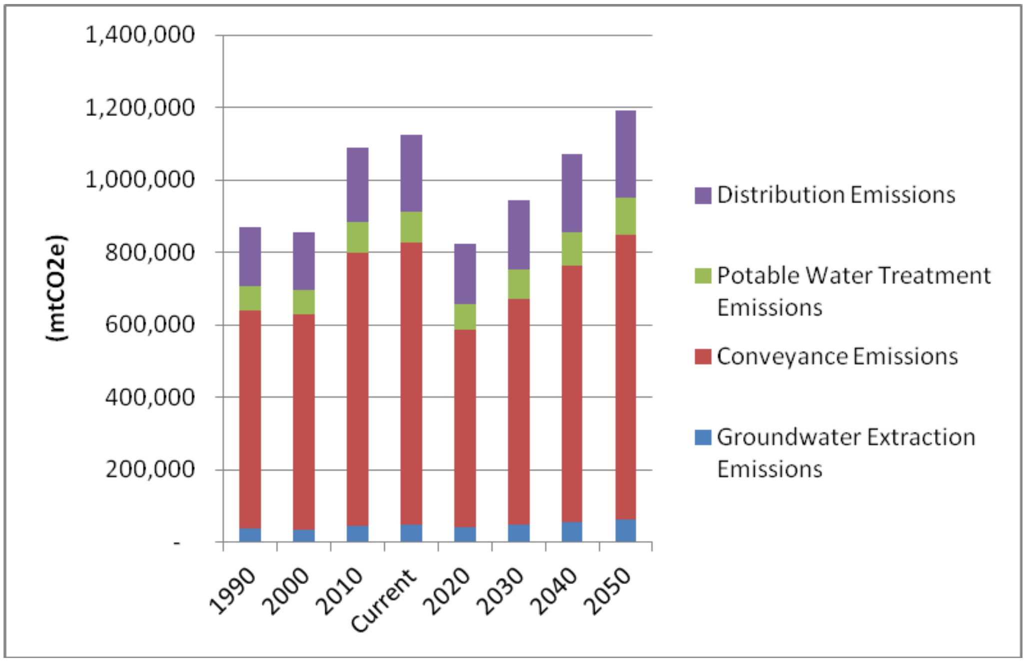


Figure 13: GHG emissions in the SARW resulting from 20x2020 in addition to 10% more self-supplied water by 2020

A 20% reduction in per capita water use every 10 years from 2020 to 2050 in addition to 10% more self supplied water by 2020 was evaluated using the GHG Emissions Calculator. These additional conservation measures only reach 30% below the 1990 GHG emission levels, as shown in Figure 14. One way to reach the AB 32 2050 target of 80% below the 1990 levels of GHG emissions is through a combined conservation per capita water use reduction of 40% each decade (2030-2050) in addition to 20x2020, and in imported water by 10% in 2020 and again in 2030, the results of which are shown in Figure 15. However, this level of conservation may not be feasible for the area. In Figure 16, the three conservation scenarios described above are compared to the no action scenario, a task easily accomplished by the GHG Emissions Calculator. The GHG Emissions Calculator can also be used to evaluate additional measures to reduce GHG emissions including changes to water supply portfolio, graywater reuse, and rainwater harvesting, among many others. It is likely that a combination of measures will be required to meet the GHG emission reduction targets laid out in AB 32.

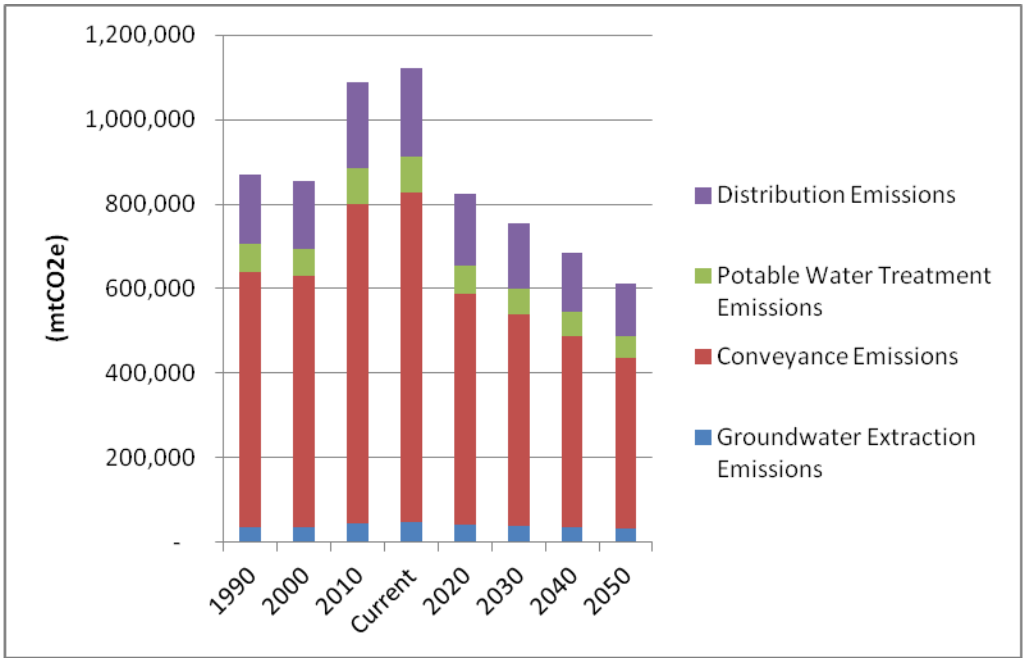


Figure 14: GHG emissions in the SARW resulting from a 20% decadal reduction in addition to 10% more self-supplied water by 2020

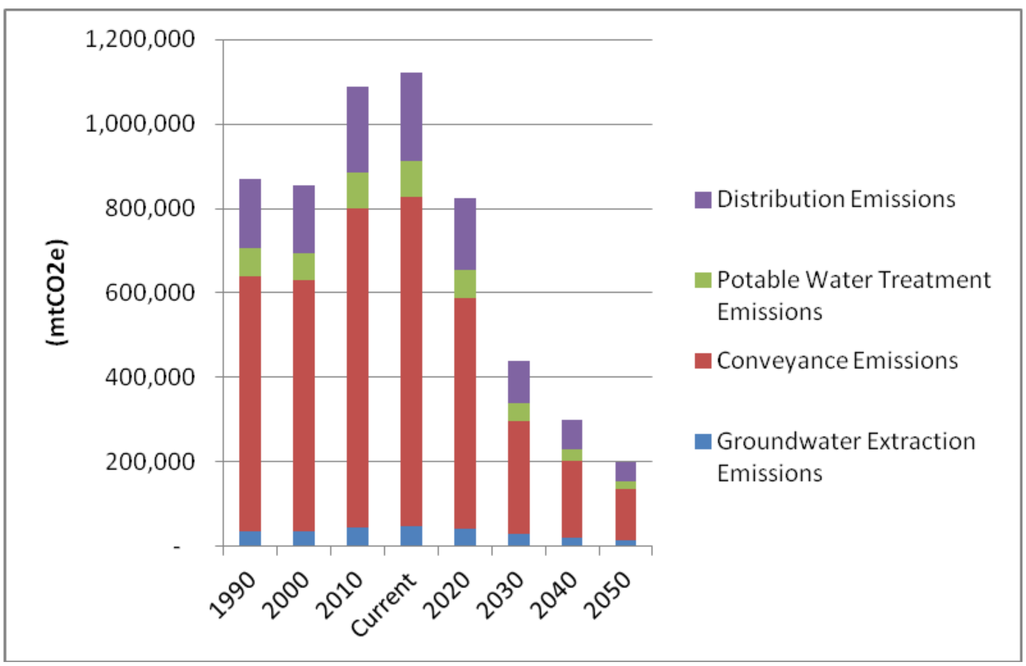


Figure 15: SARW GHG emissions resulting from 20x2020 followed by a 40% decadal reduction in GPCD (2030-2050) and decreases in imported water by 10% by 2020 and 2030

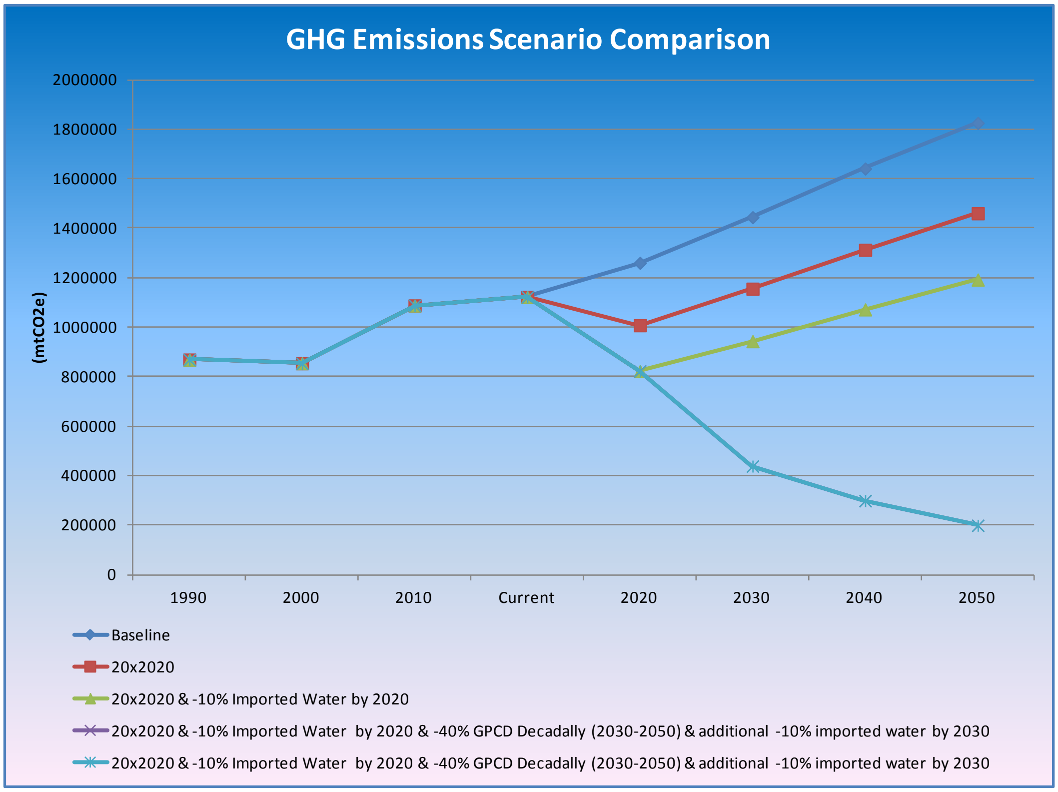


Figure 16: Comparison of GHG emissions resulting from conservation and reduced imported water scenarios for the SARW

5.0 Project Analysis Using GHG Emissions Calculator

California Water Code Section 10541 states that GHG emission of projects must be considered in IRWM Plans. The following section shows how to use the GHG Emissions Calculator to evaluate GHG emissions on the project level, using SAWPA's 20 project finalists as examples.

GHG emissions are important to evaluate when approving a new project, but they are by no means the only scoring criteria. Using this scoring plan each project is evaluated to determine if the project provides a GHG emission benefit through alteration of the water supply portfolio. If a benefit is provided the percent reduction can be determined using the GHG Emissions Calculator. The percent reduction can then be translated into a point scoring system that can be combined with evaluation of other criteria using a weighting system. If no benefit is provided, the project should receive a zero in the GHG category.

5.1 Wineville Regional Recycled Water Pipeline and Groundwater Recharge System Upgrades

5.1.1 Background

The proposed Wineville Recycled Water Line is a regional pipeline that forms part of the Inland Empire Utilities Agency (IEUA) recycled water distribution system covering a 242-square-mile region, including seven cities, four interconnected water recycling plants, several sub-watersheds and a system of 19 interconnected groundwater recharge facilities. The Wineville project will supply recycled water to two cities, one of which currently has no recycled water. It will also supply recycled water for two existing groundwater recharge facilities and a constructed wetlands. The pipeline will supply 1,500 acre-feet per year (AFY) for direct customer usage and 3,000 AFY for groundwater recharge.

The estimated cost of the 6.3-mile pipeline is $18 million. Selected public facility customers located along the pipeline alignment will be retrofitted with "purple pipe" as part of the project to allow immediate use of the recycled water. The retrofits will require an evaluation of the existing piping at each site, design plans to modify the piping at the site from potable to recycled water, an engineering report approved by the California Department of Public Health (CDPH), and cross-connection testing. The estimated cost of the retrofits is $2 million. The proposed recycled waterline includes turnouts to the RP-3 and Declez Groundwater Recharge Facilities. At these recharge basins, three manual control gates will be converted to automated gates and the power supply and control logic will be upgraded to match the new requirements.

IEUA has a SCADA system that simultaneously controls the recharge operations at RP-3, Declez and 17 other recharge basin sites and seven recycled water pumping stations. Remote control of these operations is very cost-effective, allowing automated collection and storage of data on flows and water quality. However, the current system is overloaded and outdated. Problems include having only one repeater for the approximately 200-square mile area; 15-year-old equipment and software that is no longer supported by the vender and it cannot be directly replaced; and radio telemetry bandwidth no longer available. IEUA has already completed a SCADA master plan and the backbone of a new communication network.

The scope for this project will include radio path surveys for the approximately 19 recharge sites and seven recycled water stations in the regional system, and procurement, installation and programming of new hardware and software to transition the remote sites to the new communication network. New major equipment includes microwave radios, switches, racks, SCADA servers, SCADA drives, and various cabling and appurtenances. In addition, the scope will include programming of all radio and SCADA components to provide a fully functional SCADA system. The estimated construction cost for these groundwater recharge system upgrades is $2 million.

5.1.2 Results

The Wineville project will reduce imported water by 4,500 acre-feet per year (AFY). The resulting groundwater supply portfolio will increase by 3,000 AFY, and the self-supplied water will increase by 1,500 AFY. Using the population and per capita water use data found in Table 1 and the water supply data found in Table 2 (provided by SAWPA) the GHG emission reduction provided by the project out to 2050 was determined, as seen in Figure 17. The percent GHG emission reduction when compared to the baseline of the study area for implementing the project is almost 12%. Southern California default data was used if site specific data was not available.

Table 1: Population and GPCD Water Use for the Wineville Project

	Ontario, City of (GPCD)	Population of Ontario, City of	Fontana, City of (GPCD)	Population of Fontana, City of
1990	232	133,179	281	114,167
2000	243	158,007		165,065
2010		174,536	216	196,069
2013		167,211	178	209,035
2020	198	246,304	175	221,603
2030		308,088	175	246,738

Table 2: No Action Water Supply Portfolio for the Wineville Project

	Groundwater (%)	SWP (%)	CRA (%)	Self-Supplied (%)
1990	50%	0%	0%	50%
2000	48%	0%	0%	52%
2010	39%	18%	18%	47%
2013	37%	19%	18%	42%
2020	35%	17%	16%	41%
2030	36%	18%	17%	42%

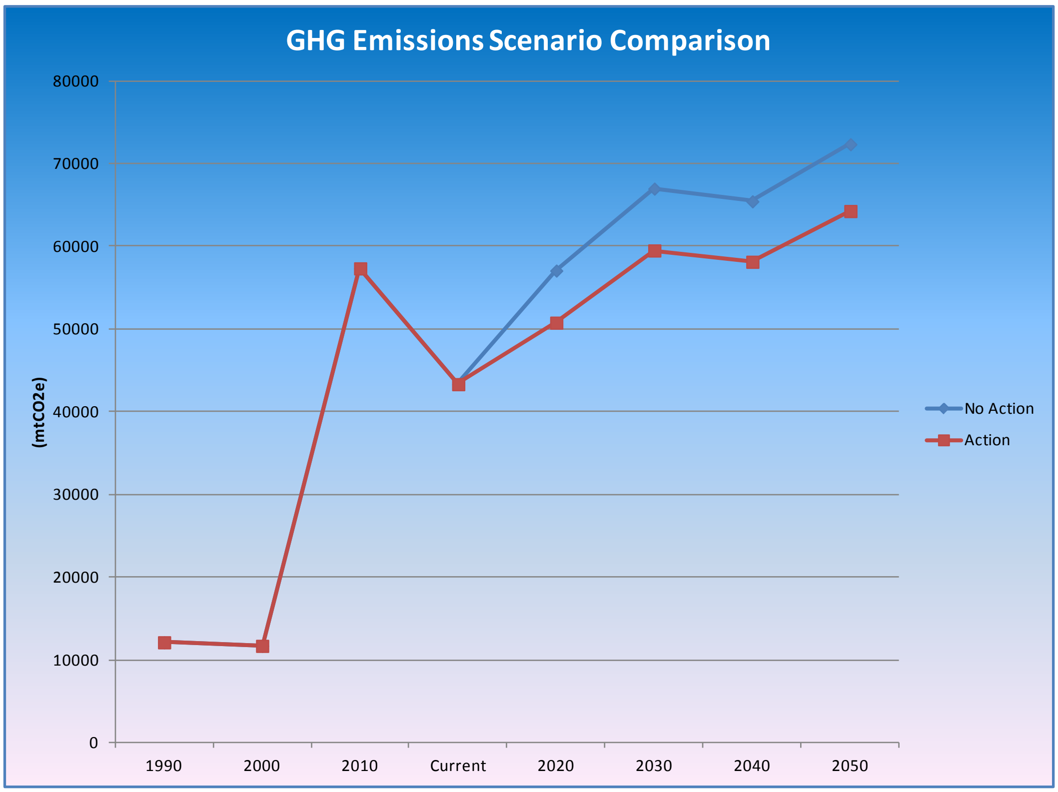


Figure 17: Wineville Project GHG Emission Comparison

5.2 Forest First - Increase Stormwater Capture and Decrease Sediment Loading through Forest Ecological Restoration

5.2.1 Background

The U.S. Forest Service and its partners seek to use a planned ecosystem restoration (thinning/vegetation removal and road reconstruction) project in the San Bernardino National Forest as a test site to quantify any benefits this type of forest management may have on water quality (sediment reduction), water supply (less evapotranspiration), and reduced operations and maintenance costs (sediment reduction). Fuel Reduction is planned in the Bluff area in the headwaters of Siberia Creek, tributary to Bear Creek and the Santa Ana River. The project will take place in the Bluff in Unit 3. This project area also includes an evaluation/monitoring plan to verify that forest management can increase flows, as proven in other locations, even in the San Bernardino National Forest where multiple endangered species considerations limit tree removal percentage. The cost and benefits of reduced sediment will be applied to the life of the Seven Oaks Dam (avoided costs = savings of being proactive versus reactive). Unit 3 of the Santa Ana Fuels reduction project area includes two perennial and multiple intermittent crossings along four miles of Forest Service Road (FSR) 1N09, as well as 145 acres of vegetation manipulation. Sediment delivery is active into tributaries of Plunge Creek.

5.2.2 Results

This project cannot be evaluated using the GHG Emissions Calculator. Given the information provided, the project does not alter the water supply portfolio, and therefore does not provide a GHG emission benefit. If more information were to become available showing that the project did alter the water supply portfolio then the project could be evaluated using the GHG Emissions Calculator.

5.3 Perris Desalination Program - Brackish Water Wells 94, 95 and 96

5.3.1 Background

The project will remove up to an additional 2,900 AFY of brackish water from the Perris groundwater basin by adding groundwater wells to the existing brackish water distribution system that supplies the existing Perris Desalter. It entails constructing three new wells and associated equipment; approximately 8,100 feet of pipeline; appurtenances, and other equipment. The Perris Desalter has sufficient capacity (reverse osmosis (RO) treatment) to treat the new well water to produce up to 1.8 million gallons per day (MGD) of potable water. This new water source will supply up to 4,000 families in the disadvantaged community within Riverside County, California, and reduce imported water demands at a rate of 1 to 1.

5.3.2 Results

The data provided on the Perris Desalter project is not sufficient to accurately estimate the GHG emission benefit. However, this is an ideal type of project to further evaluate using this tool if and when the data becomes available. If the concentration of the groundwater were to be determined, then the energy intensity could be evaluated. Also, the possibility of renewable energy-powered desalination needs to be addressed. Additional details on these two data issues are provided in the following paragraphs. If this additional data were to become available, the project could be accurately evaluated for its GHG emission benefit, which would likely be significant.

Brackish groundwater is defined as water with a total dissolved solids (TDS) concentration of 1,000 – 10,000 milligrams per liter (mg/L). For comparison, seawater has a TDS concentration of 35,000 mg/L. The energy intensity of desalinating brackish groundwater has been estimated to be 0.5-3 kilowatt-hours per cubic-meter (kWh/m3) (Carter, 2012) while other sources estimate this value to be 1-2.5 kWh/m3 (Papadakis, 2012). The energy requirement is proportional to the TDS concentration as well as the depth to the groundwater source.

Renewable energy-powered desalination installations are very common worldwide, and they greatly reduce the level of GHG emissions resulting from desalination. The most common combination of renewable energy and desalination is photovoltaic reverse osmosis, which accounts for 31% of renewable energy-energy powered desalination installations. Where possible, using solar panels directly for desalination eliminates the need to incorporate solar energy into the grid, although grid interconnectedness provides support for the system.

5.4 San Sevaine Groundwater Recharge Basin

5.4.1 Background

The San Sevaine Basins were originally constructed for flood control but are now operated for multiple purposes including groundwater recharge under a Four Party Agreement between San Bernardino County Flood Control, Chino Basin Watermaster, IEUA, and Chino Basin Water Conservation District. The basins are used to recharge imported water, stormwater, and recycled water in a conjunctive use program.

There are five, soft-bottomed basins located in series along San Sevaine Channel, comprising about 93 acres with the potential to recharge up to 8,500 AFY of recycled water. However, as the facility currently operates, recycled water is delivered to the lower basin, Basin 5, which has a lower infiltration rate compared to the upper basins, enabling a current recharge of approximately 500 AFY. In order to fully realize the valuable potential of the basin, it is proposed to build approximately 5,000 feet of pipeline to deliver water (recycled and stormwater) to the upper basins, which have higher infiltration rates. The project includes: (1) a small pump station that could pump either recycled water or stormwater to the upper basins; (2) a 2,000-foot pipeline from Basin 5 to Basin 3; (3) geophysical investigations to determine if poor infiltration rates in Basin 5 can be improved; (4) flow control and internal berms to route water between Basin 1 and Basin 2 and keep a minimum amount of water depth throughout the summer to help with vector control; (5) internal berms in Basin 5 to deepen water and alternate wet and drying cycles to control insect issues.

The project is expected to increase recharge by approximately 4,500 AFY of recycled water, 2,000 AFY of stormwater, and provide a 10% in increase in imported water recharge for conjunctive use. The project could also solve the vector control problems caused by the continuous inflow of dry weather nuisance runoff in the summer. The dry weather runoff causes vegetation growth and provides mosquito habitat. The project will construct berms to provide a conservation pool of water that is deep enough to stock with mosquito fish. This will prevent the need for emergency maintenance in the summer which could be destructive to wildlife. The project will also provide more water to the basins year-round which has the incidental benefit of increasing open water and shoreline habitat for waterfowl.

5.4.2 Results

The San Sevaine project will reduce imported water by 6,500 AFY. The resulting groundwater supply portfolio will increase by 6,500 AFY. Using the population and per capita water use data found in Table 3 and the water supply data found in Table 4 (provided by SAWPA) the GHG emission reduction provided by the project out to 2050 was determined, as seen in Figure 18. The percent GHG emission reduction for implementing the project is almost 8%. Southern California default data was used if site specific data was not available.

Table 3: Population and GPCD Water Use for the San Sevaine Project

	Chino, City of (GPCD)	Population of Chino, City of	Chino Hills, City of (GPCD)	Population of Chino Hills, City of	Fontana, City of (GPCD)	Population of Fontana, City of	Montclair, City of (GPCD)
1990	281	60,000	281	38,069	281	114,167	281
2000	240	70,000	221	66,787		165,065	218
2010	235	74,632	244	80,126	216	196,069	
2013	231	76,627	223	81,916	178	209,035	
2020	189	84,806		83,636	175	221,603	169
2030	187	98,238		85,500	175	246,738	

	Population of Montclair, City of	Ontario, City of (GPCD)	Population of Ontario, City of	Upland, City of (GPCD)	Population of Upland, City of	Rancho Cucamonga, City of (GPCD)	Population of Rancho Cucamonga, City of
1990	28,632	281	133,179	281	63,374	281	101,482
2000	33,049	243	158,007	298	68,393		127,743
2010	37,535		174,536		73,732		199,225
2013	39,600		167,211		76,110		204,133
2020	41,500	198	246,304		78,500		209,034
2030	44,250		308,088		80,870		218,995

Table 4: No Action Water Supply Portfolio for the San Sevaine Project

	Groundwater (%)	SWP (%)	CRA (%)	Self-Supplied (%)
1990	50%	0%	0%	50%
2000	62%	3%	3%	32%
2010	36%	15%	11%	38%
2013	35%	15%	12%	38%
2020	34%	15%	12%	39%
2030	34%	15%	12%	39%

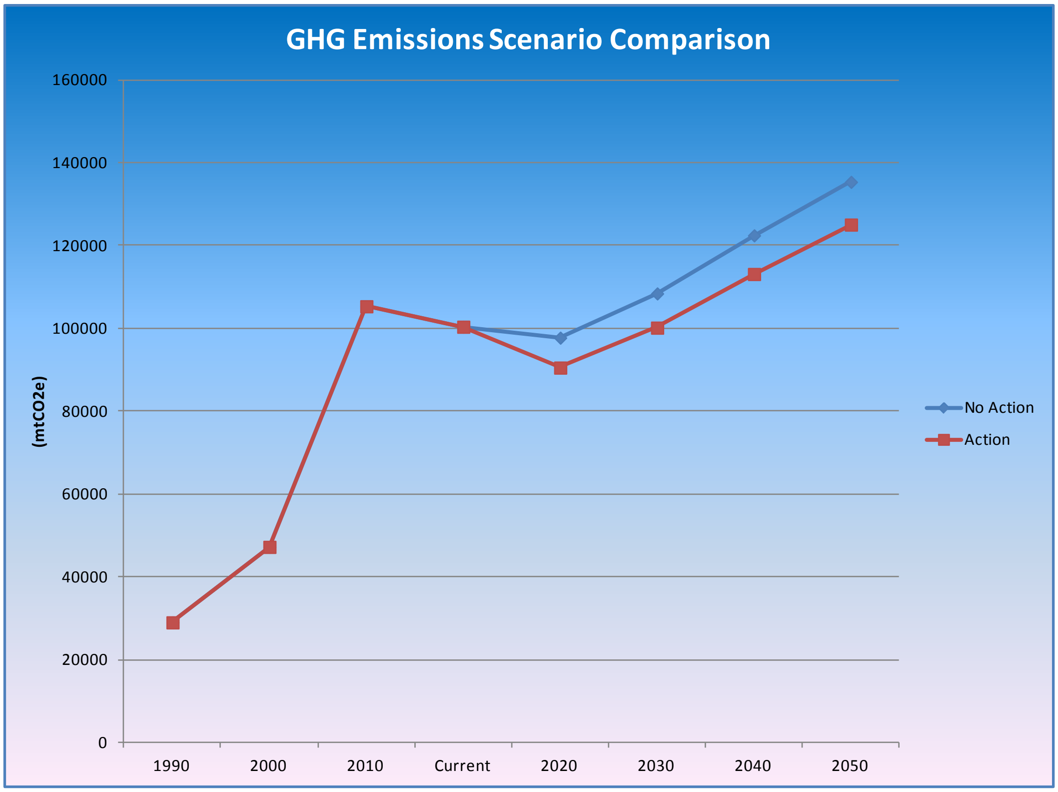


Figure 18: San Sevaine Project GHG Emission Comparison

5.5 Vulcan Pit Flood Control and Aquifer Recharge Project

5.5.1 Background

The proposed project includes basins and related improvements together with conveyance facilities for storm and recycled water systems. The basin site is 58 acres in size and is an abandoned pit mine. The proposed flood control and aquifer recharge basin will occupy the eastern 48 acres and the remaining 10 acres will be surplus property. Grading activities will occur over the entire site. The proposed recharge basin will have a storage volume of approximately 2,000 acre-feet, primarily below grade. The project will include construction of a state Division of Safety of Dams (DSOD) jurisdictional berm along the south, west, and east sides of the basin. To deliver water to the basin, two inlet facilities will be constructed – one along the east edge of the basin and the other along the west edge of the basin. Outlet facilities will include a low-flow pipe and a reinforced concrete spillway both located in the southwest corner of the recharge basin facility.

Wildermuth Environmental, the Chino Basin Watermaster consultant, has completed several studies of the project site and has concluded that the proposed project is the "ideal project" for groundwater recharge activities. Conveyance facilities will be constructed to deliver storm and recycled water to the basin for flood protection and recharge. The storm drain system will convey storm and recycled water to the basin. The system will include pipelines (ranging from 4' to 12' in diameter), manholes, catch basins, and diversion structures. The alignments will primarily occupy public rights-of-way including public streets and San Bernardino Associated Governments (SANBAG) trail right-of-way (80' wide). The alignments do not conflict with any notable historic or major infrastructure improvements. The recycled waterline is located in Baseline Avenue between I-15 and Cherry Avenue. The alignment will cross the San Sevaine Channel east of I-15. Otherwise, no other significant structures will be encountered.

5.5.2 Results

SAWPA has reported the total annual recharge volume to be 2,000 AFY. Assuming that the total volume is additional recharge provided by the project the Vulcan Pit project will reduce imported water by 2,000 AFY. The resulting groundwater supply portfolio will increase by 2,000 AFY. Using the population and per capita water use data found in Table 5 and the water supply data found in Table 6 (provided by SAWPA) the GHG emission reduction provided by the project out to 2050 was determined, as seen in Figure 19. The percent GHG emission reduction for implementing the project is approximately 26%. Southern California default data was used if site specific data was not available.

Table 5: Population and GPCD Water Use for the Vulcan Pit Project

	Fontana, City of (GPCD)	Population of Fontana, City of
1990	281	114,167
2000		165,065
2010	216	196,069
2013	178	209,035
2020	175	221,603
2030	175	246,738

Table 6: No Action Water Supply Portfolio for the Vulcan Pit Project

	Groundwater (%)	SWP (%)	CRA (%)	Self-Supplied (%)
1990				
2000				
2010	41%	1%	1%	57%
2013	40%	5%	4%	51%
2020	40%	5%	4%	51%
2030	40%	5%	4%	51%

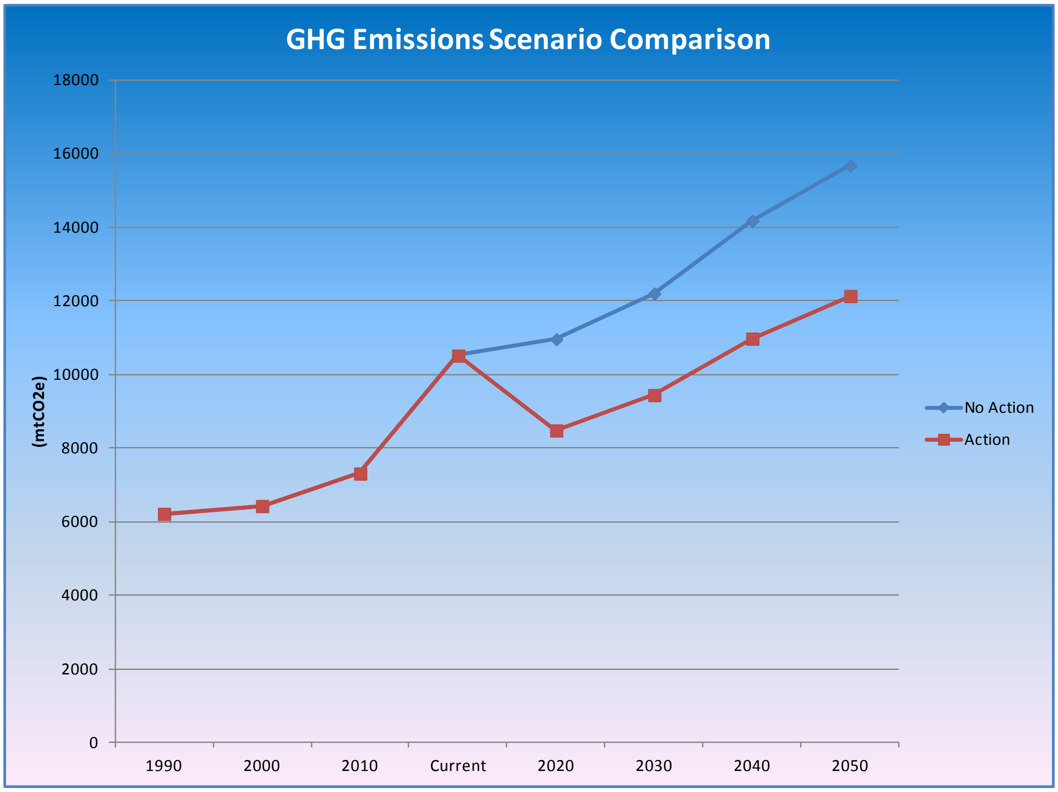


Figure 19: Vulcan Pit Project GHG Emission Comparison

5.6 Wilson Basins and Spreading Grounds

5.6.1 Background

This project consists of two distinct sites located along Wilson Creek in the City of Yucaipa. Site A is proposed within a 100-acre area currently owned by San Bernardino County Flood Control District (SBCFCD). The conceptual planning proposes a project footprint that utilizes 50 acres of the site to construct a number of detention/recharge basins. This provides an excellent location for discharge and percolation of State Water Project water for groundwater recharge in addition to new native water recharge.

Second Street is currently a dirt road across the Wilson Creek channel bottom with access for agency use only. The City's General Plan shows the street connecting across the wash for circulation purposes. As part of the project, 2nd St. will function as an embankment for the detention/recharge basin west of the project. The Wilson Creek and Oak Glen Creek confluence is the project boundary and conceptual planning shows recharge basins along the creek in the form of meandering channels with recharge pools in between channel sections.

The recharge area will also function to preserve the native habitat of the area and as a passive park for the community with walking trails, boulders, seat walls and educational signage at kiosk locations. Oak Glen Creek and Wilson Creek can readily be utilized for transport of State Water Project water to the site using existing outfalls located upstream. The site is located south of Oak Glen Rd. from the City's Community Park and the County's Yucaipa Regional Park making it an ideal location for expansion of and connection to existing master planned recreational trails which provide connectivity to Wildwood Canyon State Park.

Site B consists of 30 acres with highly productive spreading basins, which are currently being used for State Water Project water spreading. The project will modify basin inlets, outlets, spillways and basin-to-basin drains enabling the facility to expand the capture of native and artificial waters for recharge of the aquifer. The inlet modifications will allow major storm flows, laden with sediment and debris, to bypass the spreading basin area, while allowing the lower, cleaner flows from Wilson Creek to enter into the basin for spreading purposes. There is an existing turnout pipeline adjacent to the site, in Bryant Street, used to discharge import water into the facility for recharge purposes.

5.6.2 Results

SAWPA has reported the total annual recharge volume to be 1,300 AFY. Assuming that the total volume is additional recharge provided by the project the Wilson Basins and Spreading Grounds project will reduce imported water by 1,300 AFY. The resulting groundwater supply portfolio will increase by 1,300 AFY. Using the population and per capita water use data found in Table 7 and the water supply data found in Table 8 (provided by SAWPA) the GHG emission reduction provided by the project out to 2050 was determined, as seen in Figure 20. The percent GHG emission reduction for implementing the project is approximately 28%. Southern California default data was used if site specific data was not available.

Table 7: Population and GPCD Water Use for the Wilson Basins and Spreading Grounds Project

	Yupcaipa, City of (GPCD)	Population of Yucaipa, City of
1990	281	28,764
2000	264	34,862
2010		42,171
2013		45,627
2020	198	49,602
2030		60,435

Table 8: No Action Water Supply Portfolio for the Wilson Basins and Spreading Grounds Project

	Groundwater (%)	SWP (%)	CRA (%)	Self-Supplied (%)
1990				
2000				
2010	38%	14%	0%	48%
2013	33%	16%	7%	44%
2020	28%	17%	14%	40%
2030	25%	18%	15%	42%

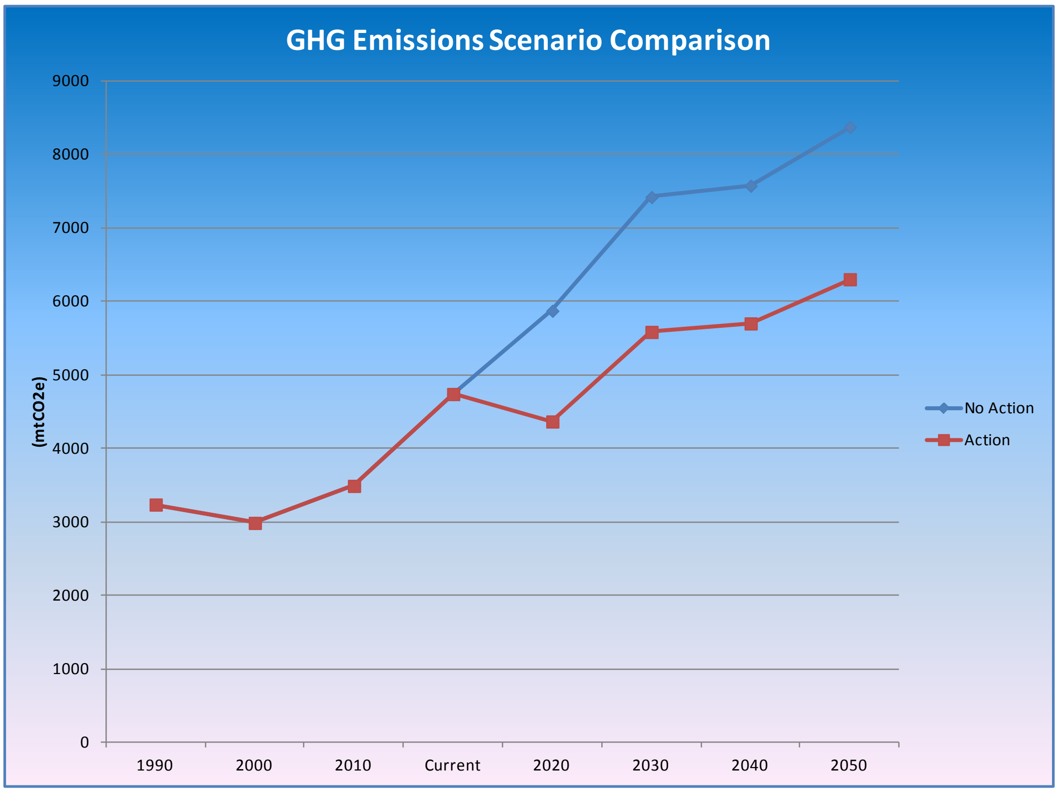


Figure 20: Wilson Basins and Spreading Grounds Project GHG Emission Comparison

5.7 Peters Canyon Channel Water Capture and Reuse Pipeline

5.7.1 Background

The Peters Canyon Channel Water Capture and Reuse Pipeline is designed to capture and permanently divert discharges of selenium-laden groundwater at four locations. Flows will be transported through an underground pipeline to the Orange County Sanitation District (OCSD) Fountain Valley facility via the Main Street Trunk Sewer for treatment and subsequent discharge to the Orange County

Water District (OCWD) Groundwater Replenishment System (GWRS). The flows will ultimately be reused through either injection wells, to create a seawater intrusion barrier, or percolation basins.

Total Maximum Daily Loads (TMDLs) for both selenium and nitrogen for the Newport Bay watershed include Peters Canyon Channel (Note: proponents' permitted discharges are currently in compliance; this Project is not required, but will provide significant environmental benefit). Historically, a naturally occurring geologic marsh known as Swamp of the Frogs covered the project area where naturally occurring selenium from the foothills was collected and immobilized. Today, this area is no longer a marsh, but selenium-laden groundwater exfiltrates into surface water drainages where it may create a biological risk for birds and fish throughout the watershed.

The Project will address discharges from three permanent roadway dewatering locations and two stormdrains within the Peters Canyon Channel subwatershed of Newport Bay. Two dewatering locations discharge into Como Channel, (Culver Rd @ BNSF railway, and Jeffrey Rd @ BNSF railway). These are operated by the City of Irvine, and one location (261 Tollway Groundwater Treatment Facility (GWTF)) is operated by CalTrans. The Project will also capture flows from two stormdrains beneath Edinger Avenue (Edinger Circular Drain) and Moffett Drive (Valencia Stormdrain). Groundwater infiltrates these drains and carries high levels of selenium and nitrogen to the channel. Diversion of these four flows (Como Channel, 261 Tollway GWTF, Edinger Circular Drain, and Valencia Stormdrain) will reduce selenium loadings by 258 lbs per year and nitrate loadings by 70,000 lbs per year.

If constructed, the Project will provide the largest selenium load removal in the entire watershed. The Project will begin at Walnut where discharges from the Caltrans 261 Tollway GWTF will be collected. The proposed alignment will run along the east side of Peters Canyon Channel approximately 10,000 feet from Walnut Avenue to Barranca Parkway. In this reach low flows from Como Channel, Edinger Circular Drain, and Valencia Drain will be added to the pipeline. At Barranca Parkway, the pipeline will cross the channel and travel approximately 6,000 feet along its west side past the confluence with San Diego Creek to the OCSD Main Street sewer. At the OCSD treatment facility, discharges will receive secondary treatment and be transferred to the co-located OCWD GWRS.

5.7.2 Results

Water quality projects generally do not provide a GHG emission benefit, and cannot be evaluated using the GHG Emissions Calculator. Unless additional information is provided showing that some of the stormwater collected will replace imported or groundwater, this project would receive a zero for the GHG emissions score.

5.8 Corona/Home Gardens Well Rehabilitation and Multi-Jurisdictional Water Transmission Line Project

5.8.1 Background

The City of Corona Department of Water and Power (DWP) is partnering with the Home Gardens County Water District to rehabilitate an inactive, non-potable, groundwater well located on Grant Street in the unincorporated area of Home Gardens. The District does not have the ability to treat the high nitrate non-potable groundwater with their current infrastructure. DWP, however, owns and operates a comprehensive well collection system just two miles away which will treat the water so it can be used.

The District has agreed to sell DWP the land and the well through an agreement that will benefit both agencies. The DWP will rehabilitate the well and construct over 11,000 feet of 12-inch pipeline from the well site to well collection lines on Quarry Street in Corona. The high nitrate flow will be blended with the low nitrate and total dissolved solids water produced by the Temescal Desalter from DWP's existing well collection system. The blended water will meet the regulatory standards of the EPA and the CDHS. The District will also benefit from the pipeline through a water purchase agreement that is currently being negotiated with the DWP.

This project provides a long-term, sustainable solution for increasing reliable, quality water. The DWP estimates the rehabilitated well will produce 1,600 AFY, which equates to enough water for 6,738 people, using the City of Corona's 20 by 2020 calculations. Utilizing local water sources is a sustainable practice which is also more cost effective than importing water and helps keep water rates lower for all residents. Over fifty years, this project has a low estimated cost of $57 per acre-foot, much lower than the cost of drilling a new well or building new treatment facilities. The regional integration and coordination efforts incorporated make this an affordable option that preserves and protects the environment while helping maintain quality of life for a disadvantaged community.

5.8.2 Results

The Corona/Home Gardens project will reduce imported water by 1,600 AFY. The resulting groundwater supply portfolio will increase by 1,600 AFY. Using the population and per capita water use data found in Table 9 and the water supply data found in Table 10 (provided by SAWPA), the GHG emission reduction provided by the project out to 2050 was determined, as seen in Figure 21. The percent GHG emission reduction for implementing the project is approximately 8%. Southern California default data was used if site specific data was not available.

Table 9: Population and GPCD Water Use for the Corona/Home Gardens Project

	Corona, City of (GPCD)	Population of Corona, City of
1990	264	75,000
2000	273	125,000
2010	265	150,000
2013		153,335
2020	212	155,819
2030	212	161,370

Table 10: No Action Water Supply Portfolio for the Corona/Home Gardens Project

	Groundwater (%)	SWP (%)	CRA (%)	Self-Supplied (%)
1990				
2000				
2010	35%	15%	12%	38%
2013	30%	17%	14%	38%
2020	24%	20%	17%	39%
2030	24%	20%	17%	39%

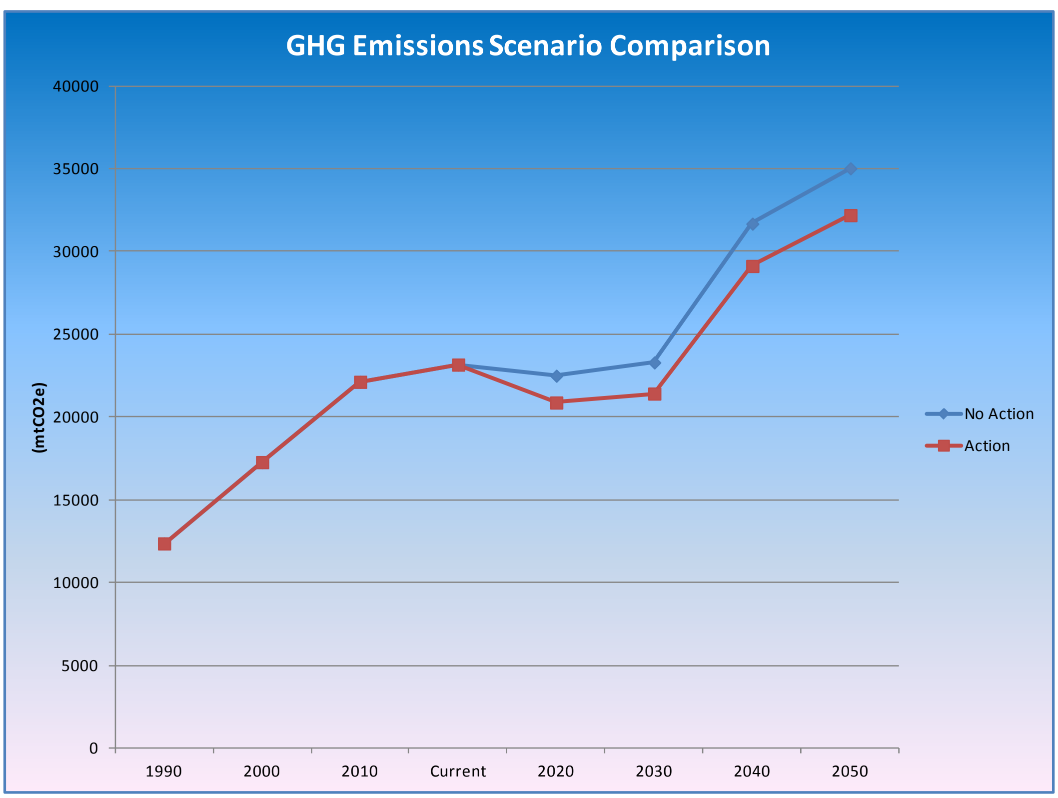


Figure 21: Corona Project GHG Emission Comparison

5.9 Commercial/Industrial/Institutional Performance-Based Water Use Efficiency Program

5.9.1 Background

The Municipal Water District of Orange County (MWDOC) proposes to develop and provide lead agency service for a holistic commercial, industrial, and institutional (CII) Performance-Based Water Use Efficiency Program. Through this program monetary incentives will be provided to CII and large-landscape (LL) sites (landscapes greater than one acre) based on water savings. The Program targets CII and LL sites, encouraging the reduction of CII/LL water use by offering incentives based on volumetric water savings to customers within the watershed.

At CII sites, projects will result in water reduction through comprehensive process improvements (e.g. on-site industrial process reuse) and/or the one-to-one replacement of high water-using devices for water efficient devices (e.g. standard toilet for a high-efficiency toilet). At LL sites, comprehensive landscape projects may include any combination of the following components: the replacement of non-functional turfgrass with climate-appropriate, non-invasive, California-Friendly landscapes or permeable surfaces; conversion of high-water-using spray heads to rotating nozzles; upgrade of conventional irrigation timers to smart timers; and irrigation management services.

This program is designed to encourage implementation of performance-based water use efficiency projects through financial incentives. Incentive payments from MWDOC are only offered to CII and LL sites successfully implementing long-term improvements. The incentive rate for comprehensive projects is $195 per acre-foot of water saved, with a savings life up to ten years. The incentive rate for one-to-one improvements will mimic The Metropolitan Water District of Southern California's (Metropolitan) regional rebate rates. Incentives may not exceed engineering, equipment, and construction costs. The program application will include: 1) complete description of the proposed project; 2) cost estimates for the proposed project improvements; 3) an engineering report or vendor proposal (for comprehensive CII/LL improvements); 4) a process schematic with meter locations shown or comparable monitoring methodology (for comprehensive CII/LL improvements); and 5) current water use, water savings estimate and, where appropriate, wastewater discharge savings estimates.

Monitoring of the proposed program is critical to maintaining the integrity and longevity of the water savings to be achieved. To ensure that the program is operating with the maximum integrity, installation inspections will be performed on all completed CII process-improvements and LL projects prior to payment. Participants will provide one full year of process water monitoring once the process change is fully operational. Water use data will be provided to MWDOC by retail agency staff. The data will be collected and analyzed, and actual water savings computed. MWDOC staff will compile savings assessments to be provided to customers, MWDOC management, member water agencies, Metropolitan, and the granting agency.

5.9.2 Results

SAWPA has reported the program saving goal to be 450 AFY. Assuming that the goal is reached the Commercial/Industrial/Institutional Performance-Based Water Use Efficiency Program will reduce imported water by 450 AFY. Using the population and per capita water use data found in Table 11 and the water supply data found in Table 12 (provided by SAWPA) the GHG emission reduction provided by the program out to 2050 was determined, as seen in Figure 22. The percent GHG emission reduction for implementing the program is approximately 7%. Southern California default data was used if site specific data was not available.

Table 11: Population and GPCD Water Use for the Commercial/Industrial/Institutional Performance-Based Water Use Efficiency Program

	Orange, City of (GPCD)	Population of Orange, City of
1990	223	110,658
2000	240	128,821
2010		136,416
2013		139,463
2020	178	141,472
2030	172	148,454

Table 12: No Action Water Supply Portfolio for the Commercial/Industrial/Institutional Performance-Based Water Use Efficiency Program

	Groundwater (%)	SWP (%)	CRA (%)	Self-Supplied (%)
1990				
2000				
2010	36%	14%	12%	38%
2013	38%	12%	10%	40%
2020	38%	12%	10%	40%
2030	38%	12%	10%	40%

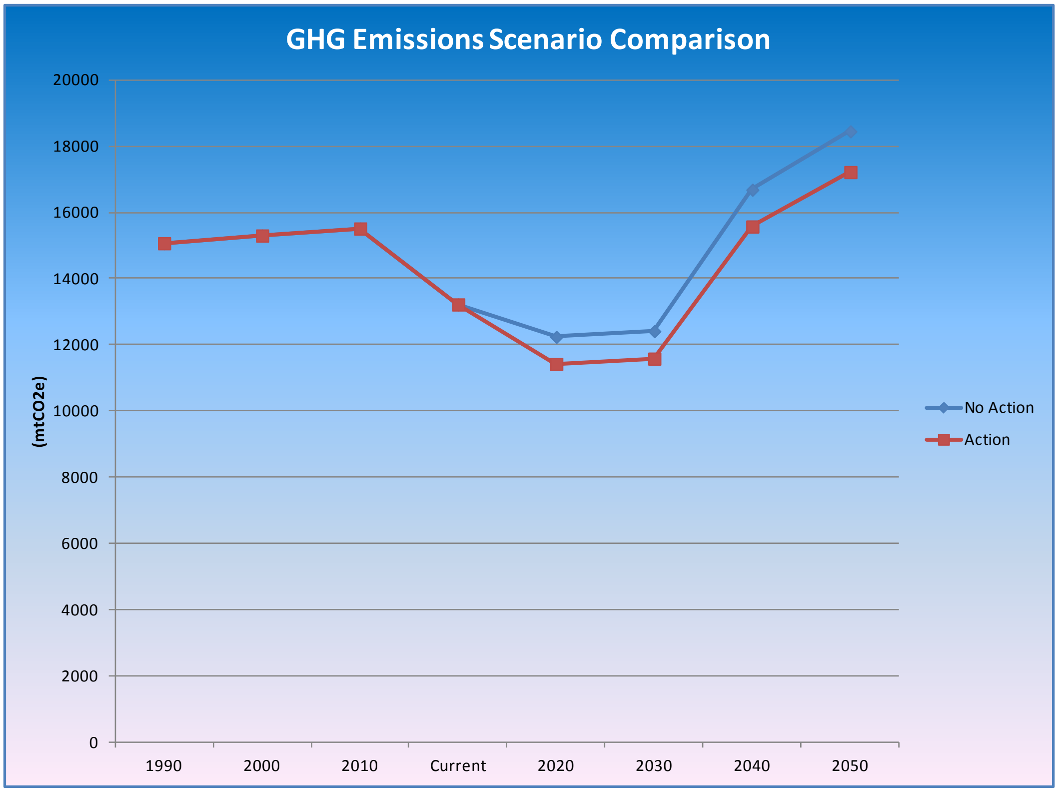


Figure 22: Commercial/Industrial/Institutional Performance-Based Water Use Efficiency Program GHG Emission Comparison

5.10 Quail Valley Subarea 9 Phase 1 Sewer System Project

5.10.1 Background

Quail Valley is in the City of Menifee, adjacent to the City of Canyon Lake. It is a severely Disadvantaged Community, with a yearly Median Household Income (MHI) of $31,650 (A Severely Disadvantaged Community is defined as having an MHI of less than 60% of the Statewide MHI). Eastern Municipal Water District (EMWD) provides potable water to the area. EMWD proposes to install a sewer collection system in a portion of Subarea 9 of Quail Valley to replace the approximately 149 failing individual septic systems. The proposed Phase 1 sewer system would replace the septic systems and eliminate the resulting health hazards from surface and subsurface sewer effluent, which flow to nearby Canyon Lake Reservoir, a potable water supply for Elsinore Valley Municipal Water District (EVMWD), and a recreational facility for the citizens of Canyon Lake. The failing septic systems result in septic effluent running through the community and downstream to Canyon Lake.

Canyon Lake has been listed as an impaired water body by the federal government, due to elevated levels of nitrates, phosphorus and pathogens.

Because of the failing septic systems, in some areas the soil between the surface and underlying bedrock has become saturated with septic effluent and gray water. Because the water lines in Quail Valley were constructed approximately 40 years ago, the potential exists for septic effluent to enter the potable water system. The hilly topography of the area creates challenges for design of a gravity sewer collection system. The 2010 sewer planning study commissioned by EMWD indicated that a gravity sewer system combined with a lift station and force main would provide the best solution to address the topographic challenges. The project includes approximately 8,400 linear feet of gravity sewer line, 22 manholes, 6,700 linear feet of laterals, and connection to EMWD’s sewer system at Fair Weather Drive, which connects to EVMWD’s sewage collection system. The flow would be treated at EVMWD’s Railroad Canyon Wastewater Treatment Plant.

5.10.2 Results

This project does not provide a GHG emission benefit, and cannot be evaluated using the GHG Emissions Calculator. According the scoring criteria laid out at the beginning of Section 5, this project would receive a zero for GHG emissions benefit.

5.11 Francis Street Storm Drain and Ely Basin Flood Control and Aquifer Recharge Project

5.11.1 Background

The proposed project includes conveyance facilities for stormwater together with basin improvements. Conveyance facilities will be constructed along Francis Street from Campus Avenue to the West Cucamonga Channel. The existing West Cucamonga Channel will convey runoff, currently lost to the region, to the Ely Basins. The system will include pipes ranging (from 18” to 132” in diameter), manholes, catch basins, and diversion structures. The alignments will only occupy public rights-of-way. The alignments do not conflict with any notable historic or major infrastructure improvements.

The three Ely Basins are located on the north side of Philadelphia Street between South Walker Avenue and South Carlos Avenue. The Basins, in their current condition, consist of three separate basins approximately 1,200’ long by 525’ high by 30’ deep. They are connected by shallow box tunnels with two 30”-diameter low-flow pipe connections with manually operated sluice gate valves. The concrete spillway structure is located in the southeast corner of the basins and directs flows back into the West Cucamonga Channel. The proposed project will further excavate the basins allowing for additional recharge capacity, capture and convey greater quantities of runoff to the basins, and will take advantage of the existing inlet and outlet facilities. With the proposed basin improvements, the basins will increase in storage volume by approximately 310 acre-feet.

5.11.2 Results

SAWPA has reported the total annual recharge volume to be 622 AFY. Assuming that the total volume is additional recharge provided by the project the Francis Street project will reduce imported water by 622 AFY. The resulting groundwater supply portfolio will increase by 622 AFY. Using the population and per capita water use data found in Table 13 and the water supply data found in Table 14 (provided by SAWPA) the GHG emission reduction provided by the project out to 2050 was determined, as seen in Figure 23. The percent GHG emission reduction for implementing the project is approximately 5%. Southern California default data was used if site specific data was not available.

Table 13: Population and GPCD Water Use for the Francis Street Project

	Ontario, City of (GPCD)	Population of Ontario, City of
1990	281	133,179
2000	243	158,007
2010		174,536
2013		167,211
2020	198	246,304
2030		308,088

Table 14: No Action Water Supply Portfolio for the Francis Street Project

	Groundwater (%)	SWP (%)	CRA (%)	Self-Supplied (%)
1990				
2000				
2010	37%	13%	11%	39%
2013	33%	15%	12%	40%
2020	29%	16%	13%	42%
2030	32%	13%	10%	45%

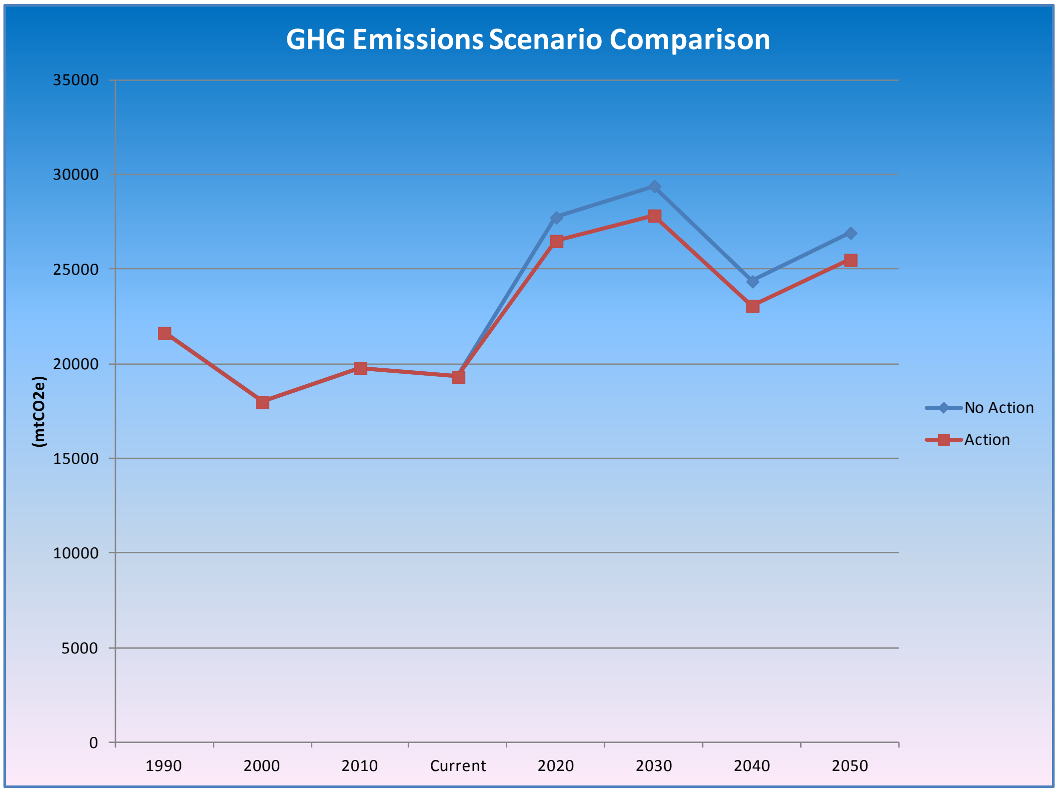


Figure 23: Francis Street Project GHG Emission Comparison

5.12 Customer Handbook to Using Water Efficiently in the Landscape

5.12.1 Background

This project is for the creation, development, and promotion of an engaging customer handbook to promote the use of, and assist customers in, using landscape water efficiently. The book will be specific to the SARW, authored by University of California Cooperative Extension researchers, approximately 50 pages in length, and available to everyone in the watershed in PDF format.

5.12.2 Results

The water savings of this program is estimated by the project proponents to be 7,240 AFY. Assuming that the goal is reached the Customer Handbook to Using Water Efficiently in the Landscape Program will reduce imported water by 7,240 AFY. Using the population and per capita water use data found in Table 15 and the water supply data found in Table 16 (provided by SAWPA) the GHG emission reduction provided by the program out to 2050 was determined, as seen in Figure 24. The percent GHG emission reduction for implementing the program is approximately 68%. Southern California default data was used if site specific data was not available.

Table 15: Population and GPCD Water Use for the Customer Handbook to Using Water Efficiently in the Landscape Program

	Riverside, City of (GPCD)	Population of Riverside, City of
1990		226,323
2000	267	249,032
2010	206	287,000
2013		295,000
2020	211	316,000
2030	211	373,000

Table 16: No Action Water Supply Portfolio for the Customer Handbook to Using Water Efficiently in the Landscape Program

	Groundwater (%)	SWP (%)	CRA (%)	Self-Supplied (%)
1990				
2000				
2010	48%	1%	1%	50%
2013	45%	3%	3%	49%
2020	41%	5%	4%	50%
2030	41%	5%	4%	50%

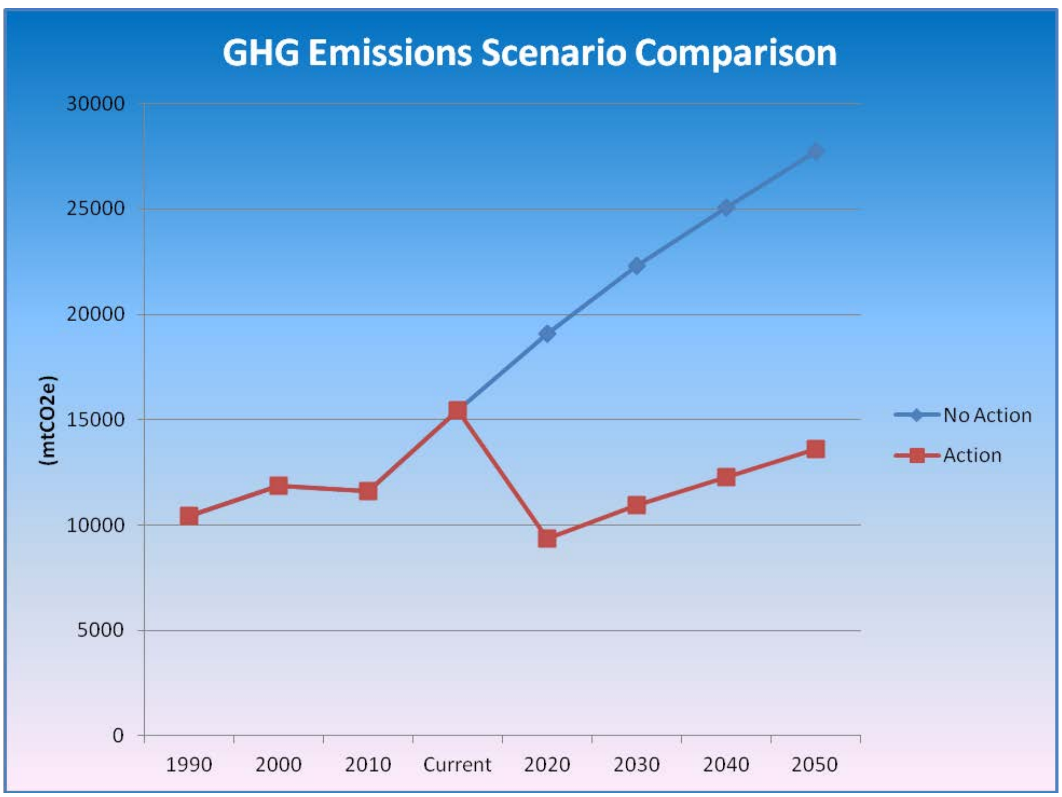


Figure 24: Customer Handbook to Using Water Efficiently in the Landscape GHG Emission Comparison

5.13 Plunge Creek Water Recharge and Habitat Improvement

5.13.1 Background

The San Bernardino Valley Water Conservation District proposes to include in its habitat conservation plan a combined San Bernardino Kangaroo Rat (SBKR) Habitat & Water Recharge Enhancement activity that will provide habitat improvements above the mitigation requirements for impacts to SBKR. These would result from providing groundwater recharge from native stream flow in Plunge Creek and from managed flows from water transmission canals that transmit water to the existing D Dike recharge facility.

The habitat and recharge enhancement would be located along the stream where it makes an abrupt course change from southerly to westerly, approximately 200 yards west of the northerly terminus of D Dike. The enhancement activity would consist of vegetation removal/thinning along with streamcourse widening to the south. The stream enhancement is anticipated to extend approximately one-half mile to the west. Vegetation removal would focus on clearing all non-native grass down to soil substrate to create habitat in excess of mitigation requirements.

5.13.2 Results

The Plunge Creek project can be evaluated using the GHG Emissions Calculator. However, not enough information was provided to accurately assess the GHG emission benefit from the project. In order to evaluate the project using this tool, the annual recharge volume would need to be estimated.

5.14 Prado Basin Sediment Management Demonstration Project

5.14.1 Background

Orange County Water District (OCWD) and the U.S. Army Corps of Engineers (Corps) have proposed to perform a demonstration project that restores sediment transport through Prado Basin. The project will remove sediment from within Prado Basin and reintroduce the sediment into the river below Prado Dam. Sediment will be removed from Prado Basin by dredging, and transported to a temporary holding area near the spillway. Sediment removal will occur during the late summer to fall to avoid impacts to endangered species. It will be located in areas with giant cane (Arundo Donax) to maximize removal of this non-native plant. Sediment will be re-entrained in Santa Ana River (SAR) flows during periods of high stormflow. The sediment will then be re-distributed in the lower SAR by natural sediment transport processes. The project will remove 300 acre-feet (500,000 cubic yards) of sediment from the basin and reintroduce the sediment into the river.

The project will demonstrate the ability to reverse sedimentation trends within Prado Basin and restore the flow of sediment to the lower reach of SAR. Restoring the flow of sediment past Prado Dam will have positive impacts within Prado Basin and in the lower reach of SAR. Enhanced sediment flow through Prado Dam will also help restore natural sedimentation patterns along the river upstream of Prado Basin, where the sediment is trending to an environmentally adverse condition of near uniform grain size. Under natural conditions, the sediment deposited by the river would include a range of cobble, gravel, and sand, but the current condition is mostly sand due to disruptions in sediment transport.

The project will occur in four geographic areas. The first area will include sediment removal over 30 acres within the Prado Basin. The second area will include a location northeast of the spillway where sediment would be temporarily stored and vegetation removed from the sediment excavation area will be handled. In the third area sediment will be reintroduced into the river at a location downstream of the dam, just west of the State Highway 71 crossing. The fourth area will be in the SAR from the sediment reintroduction area (downstream of Prado Dam) to the Pacific Ocean, where sediment analysis and environmental assessment will occur to assess the project's impacts.

5.14.2 Results

Water quality projects generally do not provide a GHG emission benefit, and cannot be evaluated using the GHG Emissions Calculator. Unless additional information is provided that shows that the project changes the water supply portfolio, conservation, or the volume of water treated in the area, this project would receive a zero for the GHG emissions score.

5.15 Enhanced Stormwater Capture and Recharge along the Santa Ana River

5.15.1 Background

This project consists of improving existing facilities owned and operated by the San Bernardino Valley Water Conservation District and constructing new facilities which will increase the amount of stormwater that can be captured and recharged along the Santa Ana River to 80,000 acre feet in a single year and 500 cubic feet per second (cfs) instantaneous flow. The improvements are as follows:

- Install mechanical trash rack on the existing Cuttle Weir diversion structure to push debris toward the notch in the Cuttle Weir where it can be flushed downstream.
- Install mechanical gate in Cuttle Weir notch to enable operators to more easily raise and lower the gate to flush debris and control the water surface elevation in front of the intake, as needed.
- Enhance existing sandbox diversion structure so that it also functions as an inlet to the proposed sedimentation basin.

- Construct sedimentation basin where heavier particles will settle out before the water enters the Plunge Pool Pipeline.
- Construct 96-inch diameter Plunge Pool Pipeline that will ultimately provide direct delivery of up to 500 cfs throughout the San Bernardino Valley Municipal Water District's service area and also to Western Municipal Water District (WMWD) via the Metropolitan Inland Feeder Pipeline. The first phase of the Plunge Pool Pipeline (PPPI) will go from the Sandbox Diversion Structure to the Municipal Water District's Foothill Pipeline. The ultimate capacity will be 500 cfs but it will likely only convey up to 300 cfs during the first phase. The 300 cfs capacity of the PPPI added to the 300 cfs capacity of the Conservation District's existing canal will provide the 500 cfs design capacity. It also enables direct delivery of up to 300 cfs.
- Construct additional canal downstream from the Municipal District Santa Ana Low turnout to convey up to 500 cfs to the new recharge basins.
- Construct over 150 acres of new recharge ponds.
- Property acquisition. Most of the property needed for this project is owned by the Conservation District. The Municipal District would be allowed to construct improvements on this land per a proposed agreement with WMWD and the Conservation District. Approximately 12 vacant areas will also need to be procured. The Municipal District Board has authorized staff to obtain appraisals for these parcels which would be followed by negotiations with property owners.

The California Environmental Quality Assessment is complete for this project and environmental permitting is in process. This project is estimated to capture nearly 15,000 AFY of high quality stormwater that would have otherwise flowed out of the area.

5.15.2 Results

The Enhanced Stormwater Capture and Recharge along the SAR project will reduce imported water by 15,000 AFY. The resulting groundwater supply portfolio will increase by 15,000 AFY. Using the population and per capita water use data found in Table 17 and the water supply data found in Table 18 (provided by SAWPA) the GHG emission reduction provided by the program out to 2050 was determined, as seen in Figure 25. The percent GHG emission reduction for implementing the program is approximately 7%. Southern California default data was used if site specific data was not available.

Table 17: Population and GPCD Water Use for the Enhanced Stormwater Capture and Recharge along the SAR Project

	San Bernardino, County of (GPCD)	Population of San Bernardino, County of
1990	281	1,645,131
2000	231	1,807,837
2010	203	1,986,635
2013		2,168,586
2020		2,367,202
2030		2,671,690

Table 18: No Action Water Supply Portfolio for the Enhanced Stormwater Capture and Recharge along the SAR Project

	Groundwater (%)	SWP (%)	CRA (%)	Self-Supplied (%)
1990	50%	0%	0%	50%
2000	62%	3%	3%	32%
2010	36%	15%	10%	39%
2013	35%	15%	11%	39%
2020	33%	15%	12%	40%
2030	33%	15%	12%	40%

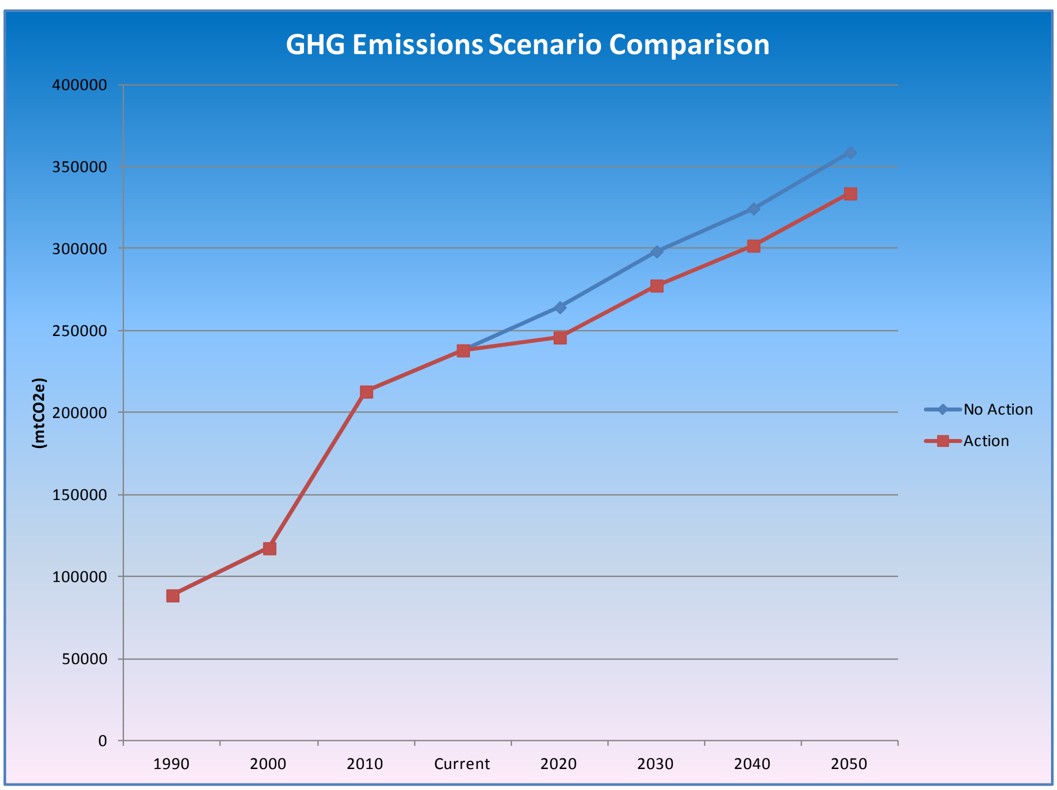


Figure 25: Enhanced Stormwater Capture and Recharge along the SAR Project GHG Emission Comparison

5.16 14th Street Groundwater Recharge and Storm Water Quality Treatment Integration Facility

5.16.1 Background

The City of Upland has a shovel-ready project that employs an integrated, regional approach to enhance water quality, increase aquifer recharge, and improve flood protection, directly benefiting water producers in the Santa Ana Watershed. Over the past 75 years, there has been a considerable amount of development in the City and open land has significantly decreased. This change magnified runoff flows, with small to medium storm events causing widespread flooding along residential and arterial streets. The City has been constructing drainage facilities using past standard flood control practices to convey flows away from streets with no focus on water quality or conservation.

The City recently completed the Upland Basin, the first basin owned and maintained by the City for flood control, recharge, and water conservation. It is situated in the southwest corner of the town, and is one in a series of basins designed to capture and retain local rainwater runoff for beneficial use as water resources within the Chino Basin. As part of the City's comprehensive approach to water resources management, the 14th Street Stormwater Collection/Integration Basin project is identified as high priority. It is up-gradient and, in conjunction with the Upland Basin, will enable the drainage system to capture and convey an additional flow of approximately 400 AFY to the Upland Basin. The proposed project consists of a 23 acre foot retention basin to collect upstream stormwater for flood control, water quality treatment and recharge; and approximately 4,800 ft of stormwater pipelines, ranging from 24-inch to 42-inch in diameter, to connect the proposed basin to existing storm drains, creating a system capturing and conveying storm water in a controlled fashion.

The project represents a hub for the management of water (stormwater, future recycled water, and canyon flow) and allows flexibility, treatment, and flood control of runoff from 100-year storm events. Additionally, green space will be added to the existing Greenbelt Park, situated nearby, to function as a bioswale. It will provide ample opportunities for public water conservation education. The proposed project will cost approximately $5 million, but will generate approximately $29 million in imported water purchase savings (assuming imported water static rate of $650 per af during the 50-year life of the basin). Based on the FEMA Benefit Cost Analysis software, the benefit-to-cost ratio is calculated to be 2.6 – the return of each $1 spent is $2.6 in avoided costs due to flooding damages. Moreover, there are resulting water quality benefits that are difficult to quantify. The proposed project provides a means for natural treatment of stormwater, which is of higher quality than (untreated) imported water and groundwater in the southern reaches of the Chino Basin.

5.16.2 Results

The 14th Street project will result in a reduction of 900 AFY of imported water. The resulting groundwater supply portfolio will increase by 900 AFY. Using the population and per capita water use data found in Table 19 and the water supply data found in Table 20 (provided by SAWPA) the GHG emission reduction provided by the project out to 2050 was determined, as seen in Figure 26. The percent GHG emission reduction for implementing the project is approximately 5%. Southern California default data was used if site specific data was not available.

Table 19: Population and GPCD Water Use for the 14th Street Project

	Upland, City of (GPCD)	Population of Upland, City of
1990	281	63,374
2000	298	68,393
2010		73,732
2013		76,110
2020		78,500
2030		80,870

Table 20: No Action Water Supply Portfolio for the 14th Street Project

	Groundwater (%)	SWP (%)	CRA (%)	Self-Supplied (%)
1990				
2000				
2010	19%	33%	28%	20%
2013	19%	32%	27%	22%
2020	20%	31%	26%	23%
2030	20%	31%	26%	23%

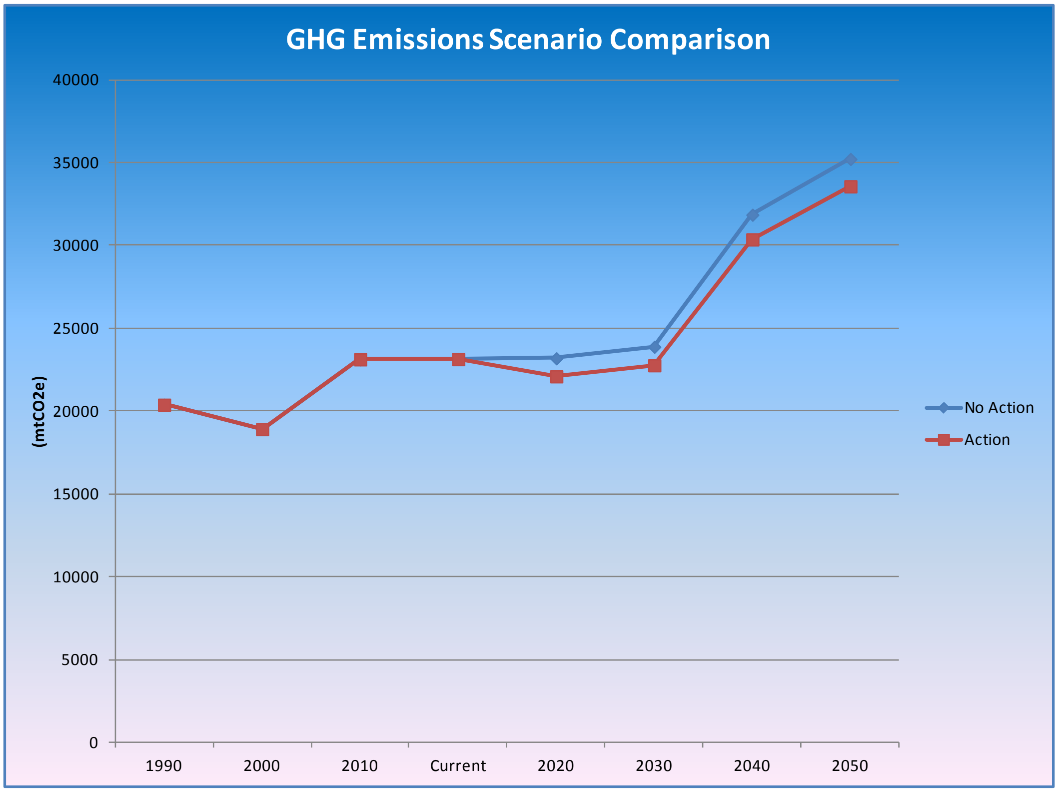


Figure 26: 14th Street Project GHG Emission Comparison

5.17 Soboba Band of Luiseño Indians Wastewater Project

5.17.1 Background

The Soboba Band of Luiseño Indian's Wastewater project provides an on-site centralized reservation wastewater treatment facility to improve service to residents and increase effectiveness of the wastewater treatment process. Several benefits derived from the completion of the facility include: a stabilized waste stream and high volume effluent available for reuse, the ability to address new contaminants in an efficient manner, increased protection of the groundwater basin by allowing more control of treatment, greater separation of waste and the water table, and a source of water that is suitable for recycling.

The Soboba Band of Luiseño Indians established a Memorandum of Understanding with two local water districts – the Eastern Municipal Water District and Lake Hemet Municipal Water District – to work collaboratively on water issues addressed under the Soboba Band of Luiseno Indians Settlement Act. The Tribe will solicit bids according to Reclamation procurement policies for consultants to work directly with the Tribal Council and consult with appropriate tribal government departments to determine site suitability, design and construction of a centralized wastewater treatment facility.

The Tribe's Public Works, Environmental and Cultural Resources departments have qualified staff to conduct much of the historical, archeological, and environmental reviews in collaboration with the consultants.

Phase 1 included solicitation of bids for all aspects of constructing a wastewater treatment facility on the Soboba Tribal lands including: location, environmental issues, cost benefit analysis which also identifies areas of challenge, obstacles or barriers that may exist and need to be addressed prior to the actual design and construction of the wastewater facility. In 2007-2009, the Tribe contracted with DHK Engineers to develop a feasibility study for a wastewater facility which addresses many of the issues listed above. Phase 2 includes facility design that incorporates mitigation measures identified in the feasibility study such as pollution control measures and treatment methods to serve the current and future population of the Soboba Reservation. Phase 3 is the actual implementation phase or building of the facility with associated infrastructure.

5.17.2 Results

This project does not provide a GHG emission benefit, and cannot be evaluated using the GHG Emissions Calculator. According the scoring criteria laid out at the beginning to Section 5, this project would receive a zero for GHG emissions benefit.

5.18 Canyon Lake Hybrid Treatment Process

5.18.1 Background

The proposed Canyon Lake Hybrid Treatment Process will consist of a combination alum application and installations of a hypolimnetic oxygenation system using oxygen injection to maintain aerobic conditions throughout the water column in the main body of Canyon Lake all year. This system will address aerobic conditions in Canyon Lake and is expected to provide improvements in water quality including reduced iron, manganese, ammonia, hydrogen sulfide, and phosphorus, with probable reductions in algal densities.

The alum application component of the Canyon Lake Hybrid Treatment Process will provide for the temporary treatment of in-lake water quality from inputs of high concentrations of phosphorus from the San Jacinto River Watershed. Aluminum sulfate (alum) is a metal salt that can combine with inorganic phosphorus and/or remove phosphorus-containing particles from the water column. The alum application will reduce phosphorus concentrations in the water column by binding phosphorus to the sediments, thus reducing the potential for algae growth. Of all metal salts, aluminum is the most effective for this purpose because phosphorus binds tightly to its salts over a wide range of conditions including low or zero dissolved oxygen. When alum is added to water, it forms aggregates of aluminum hydroxide. The floc formed contains aluminum hydroxide, phosphorus and bits of organic and inorganic matter. Over the course of several hours, the floc settles to the sediment surface forming a layer 1 to 2 inches thick. The alum application rapidly clears the water and the floc significantly retards the recycling of phosphorus from the sediment into the water column.

5.18.2 Results

Water quality projects generally do not provide a GHG emission benefit, and cannot be evaluated using the GHG Emissions Calculator. Unless additional information is provided that shows that this project would have an impact on the water supply portfolio, this project would receive a zero for the GHG emissions score.

5.19 Recycled Water Project Phase I (Arlington-Central Avenue Pipeline)

5.19.1 Background

This project consists of the construction of 8”, 12”, 16”, and 24”-diameter recycled water pipelines to convey recycled water produced at the City of Riverside’s Regional Water Quality Control Plant. The pipelines will transverse along Arlington-Central Avenue in the City and will supply recycled water to irrigate parks, large industrial/institutional customers, golf courses, schools, and medians. The construction of this pipeline is a major operable unit to the City’s recycled water distribution system and will serve as the backbone to this system.

5.19.2 Results

The Recycled Water Project Phase I project can be evaluated using the GHG Emissions Calculator. However, not enough information was provided to accurately assess the GHG emission benefit from the project. In order to evaluate the project using this tool, the annual volume of recycled water would need to be estimated. The self-supplied water for the study area would then increase, and the imported water would decrease by the estimated volume.

5.20 Regional Residential Landscape Retrofit Program

5.20.1 Background

The proposed program saves water through outdoor surveys and retrofits of landscape devices. The target audience is residential customers that fall within the top ten percent of the associated retail water providers’ customer base. Retrofits include the installation of smart controllers and high efficiency sprinkler nozzles where the resident approves the changes.

5.20.2 Results

The water savings of this program is estimated by the project proponents to be 1,000 AFY. Assuming that the goal is reached the Regional Residential

Landscape Retrofit Program will reduce imported water by 1,000 AFY. Using the population and per capita water use data found in Table 21 and the water supply data found in Table 22 (provided by SAWPA) the GHG emission reduction provided by the program out to 2050 was determined, as seen in Figure 27. The percent GHG emission reduction for implementing the program is approximately 3%. Southern California default data was used if site specific data was not available.

Table 21: Population and GPCD Water Use for the Regional Residential Landscape Retrofit Program

	San Bernardino, County of (GPCD)	Population of San Bernardino, County of
1990	281	1,645,131
2000	231	1,807,837
2010	203	1,986,635
2013		2,168,586
2020		2,367,202
2030		2,671,690

Table 22: No Action Water Supply Portfolio for the Regional Residential Landscape Retrofit Program

	Groundwater (%)	SWP (%)	CRA (%)	Self-Supplied (%)
1990	50%	0%	0%	50%
2000	62%	3%	3%	32%
2010	36%	15%	10%	39%
2013	35%	15%	11%	39%
2020	33%	15%	12%	40%
2030	33%	15%	12%	40%

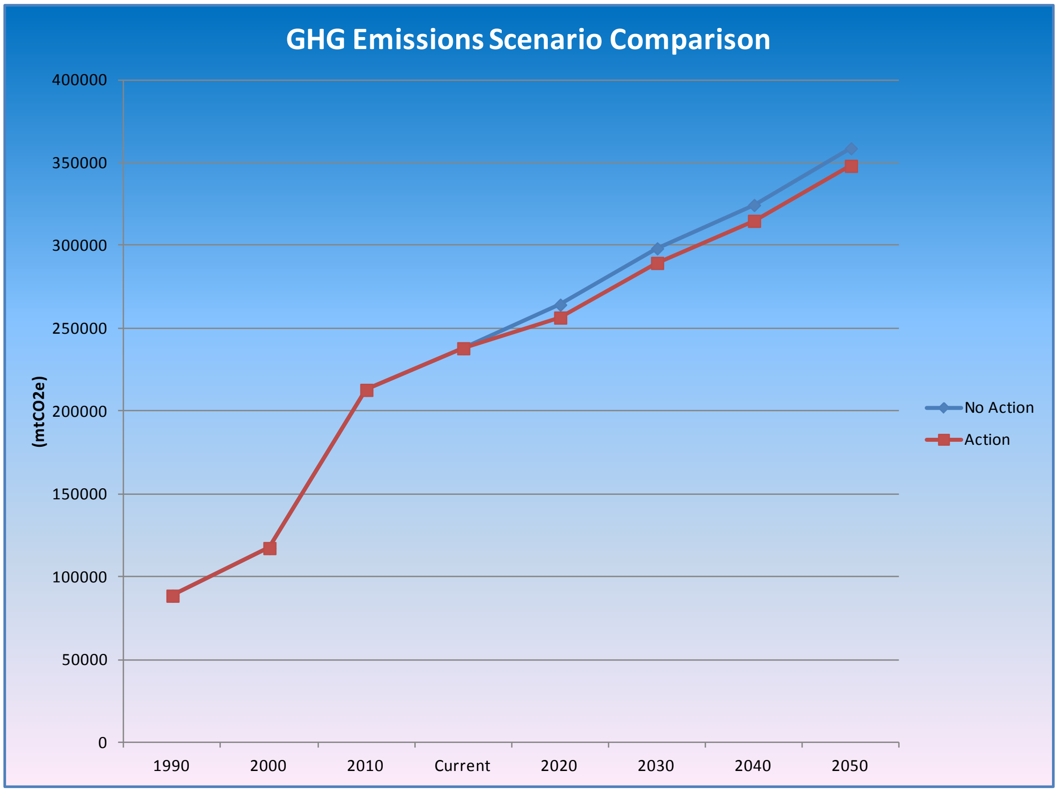


Figure 27: Regional Residential Landscape Retrofit Program GHG Emission Comparison

5.21 SAWPA Project Evaluation Summary

The 20 SAWPA projects analyzed in this section can be found in Table 23, along with whether or not the project can be analyzed using the GHG Emissions Calculator, if enough details were provided to analyze the project, and the percent reduction of GHG emissions if the project was analyzed. The percent reduction is in reference to the baseline for the project area if the project were not constructed. Evaluating the percent reduction in this manner directly links the results to the total volume of GHG emission in the study area. This means that two projects having the same volume of GHG emission reduction potential, located in two different study areas, will have different percent reductions, with the study area with the larger population having a lower percent reduction. A different way to evaluate the percent reduction would be to evaluate the volume of GHG emission reduction for the project compared to the baseline for the entire SARW. This method would result in smaller GHG emission reduction percentages, but would level the playing field by reducing the effect the project area has on the statistic.

Table 23: SAWPA 20 Project Finalists

	Project Name	Can it be evaluated using the GHG Emissions Calulator	Was enough detailed data provided to do so	% Reduction GHG Emissions
1	Wineville Regional Recycled Water Pipeline and Groundwater Recharge System Upgrades	Yes	Yes	12%
2	Forest First - Increase Stormwater Capture and Decrease Sediment Loading through Forest Ecological Restoration	No	No	
3	Perris Desalination Program - Brackish Water Wells 94, 95 and 96	Yes	No	
4	San Sevaine Ground Water Recharge Basin	Yes	Yes	8%
5	Vulcan Pit Flood Control and Aquifer Recharge Project	Yes	Yes	26%
6	Wilson III Basins Project and Wilson Basins/Spreading Grounds	Yes	Yes	28%
7	Peters Canyon Channel Water Capture and Reuse Pipeline	No	No	
8	Corona/Home Gardens Well Rehabilitation and Multi-Jurisdictional Water Transmission Line Project	Yes	Yes	8%
9	Commercial/Industrial/Instritutional Performance-Based Water Use Efficiency Program	Yes	Yes	7%
10	Quail Valley Subarea 9 Phase 1 Sewer System Project	No	No	
11	Francis Street Storm Drain and Ely Basin Flood Control and Aquifer Recharge Project	Yes	Yes	5%
12	Customer Handbook to Using Water Efficiently in the Landscape	Yes	Yes	68%
13	Plunge Creek Water Recharge and Habitat Improvement	Yes	No	
14	Prado Basin Sediment Management Demonstration Project	No	No	
15	Enhanced Stormwater Capture and Recharge along the Santa Ana River	Yes	Yes	7%
16	14th Street Groundwater Recharge and Storm Water Quality Treatment Integration Facility	Yes	Yes	5%
17	Soboba Band of Luiseño Indians Wastewater Project	No	No	
18	Canyon Lake Hybrid Treatment Process	No	No	
19	Recycled Water Project Phase I (Arlington-Central Avenue Pipeline)	Yes	No	
20	Regional Residential Landscape Retrofit Program	Yes	Yes	3%

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6.0 References

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7.0 Appendix: Member Agency Baselines and Default Data

GHG emissions baselines were created for each of SAWPA's five member agencies using the GHG Emissions Calculator (Figures A-1 through A-5). A combination of site specific data and southern California default data were used to develop each of the baselines. The southern California default data was used to determine energy intensities for each process. Site specific data includes population, GPCD water use, and water supply portfolio. The site specific data was obtained through each of the member agencies 2010 Urban Water Management Plans, except in the case of OCWD. OCWD provided site specific detailed data for many of their facilities which were used to determine the energy intensity for each process.

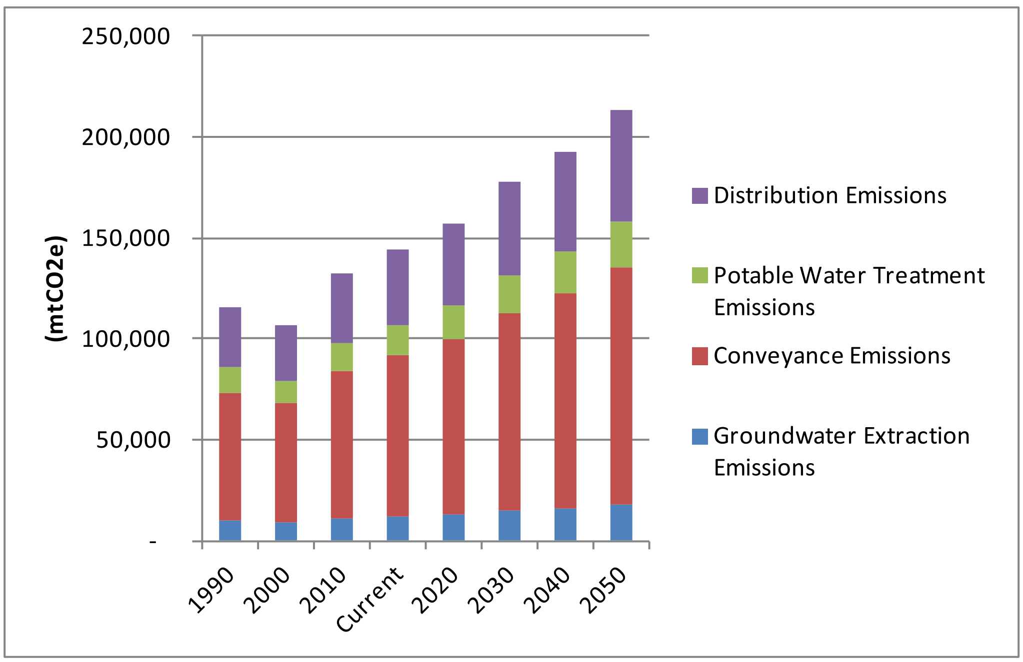

Figure A-1: Baseline GHG emissions for the SBVMWD

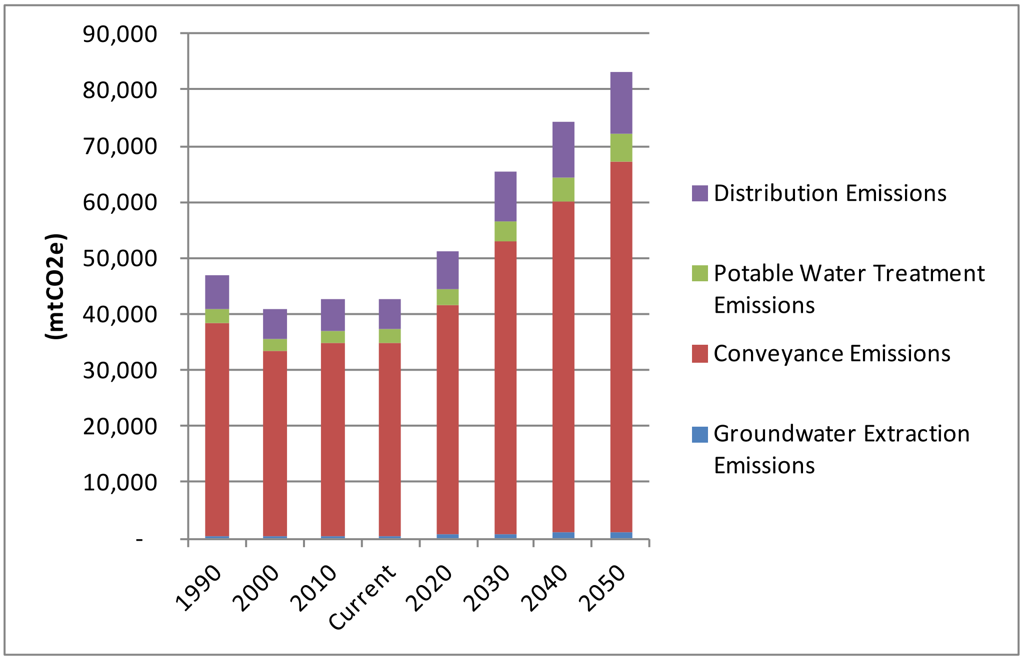

Figure A-2: Baseline GHG emissions for the WMWD

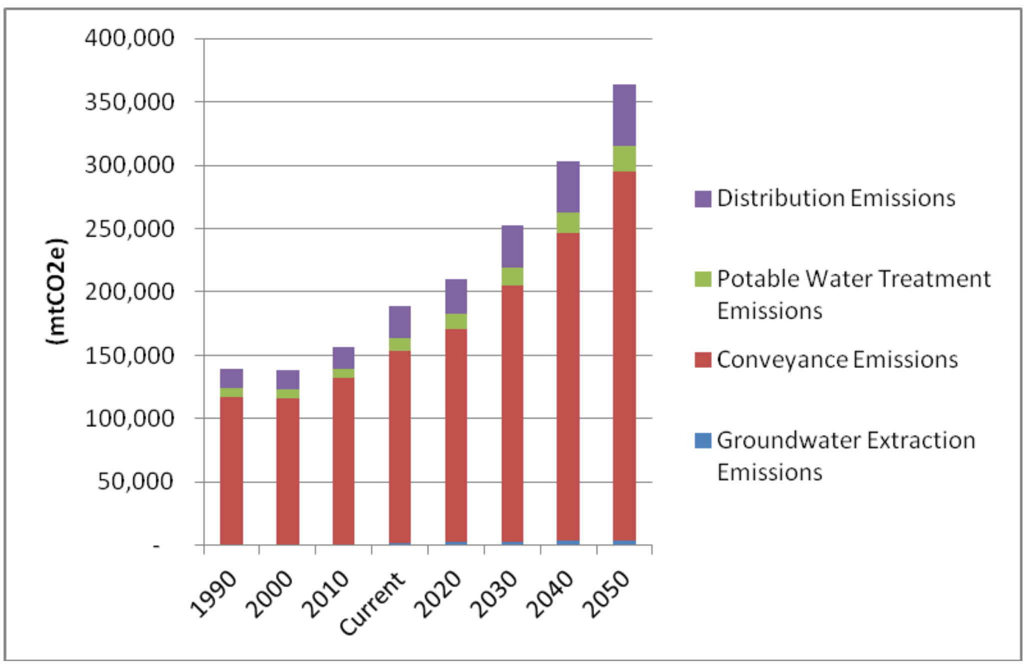

Figure A-3: Baseline GHG emissions for the EMWD

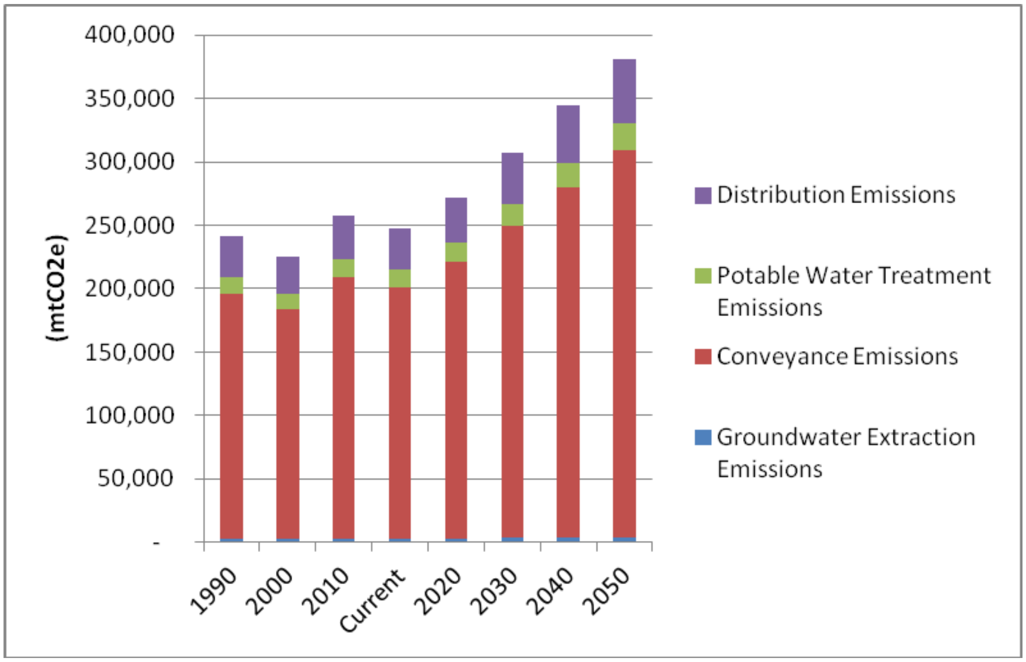

Figure A-4: Baseline GHG emissions for the IEUA

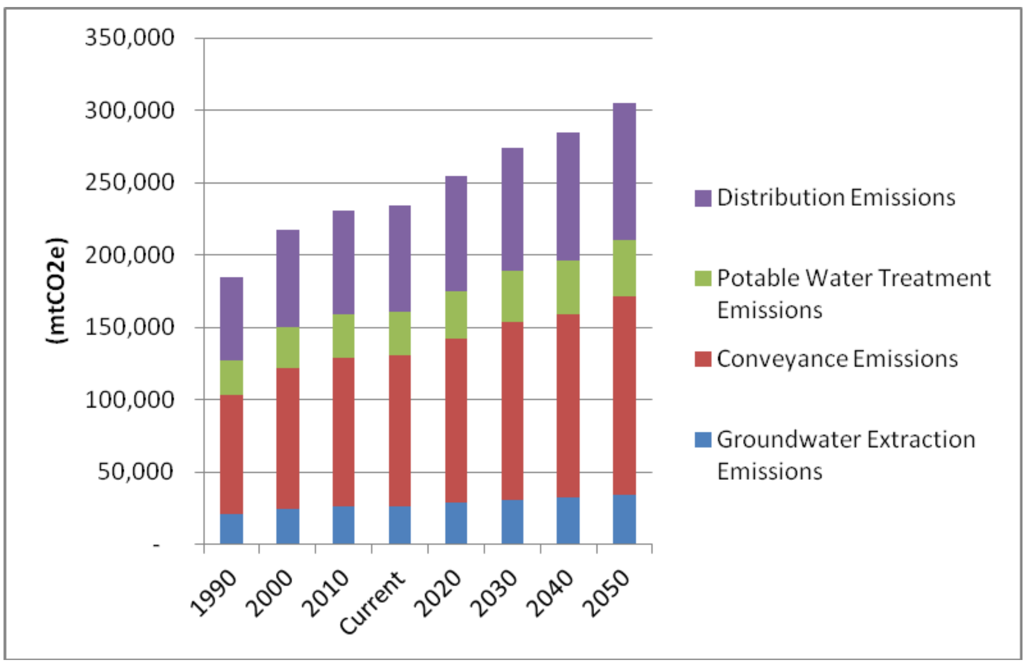

Figure A-5: Baseline GHG emissions for the OCWD

Although it is ideal to use site specific data, the southern California default data (Figures A-6 and A-7) was collected and developed to represent an average for southern California, and is therefore representative of what is likely happening in the SARW. As new data becomes available each of these baselines should be updated and refined using the GHG Emissions Calculator.

Energy intensities for Groundwater Extraction

	Groundwater Extraction (kWh/MG)	Water Table Depth (ft)
Low Value (default)	540	120
High Value	2270	500
Source:	From Energy Down the Drain: The Hidden Costs of California's Wa	

Energy intensities for Water Conveyance

	Local Water (kWh/MG)	Imported Water
Low Value	88	1900
Median Value	110	3000
High Value	330	5300
Source:	Adapted from Implications of Future Water Supply Sources for En	

Energy intensities for Water Treatment

	<1MGD (kWh/MG)	1-5 MGD (kWh/MG)	5-20 MGD (kWh/MG)	>20 MGD (kWh/MG)
Low Value	620	300	180	120
Median Value	1500	750	560	210
High Value	2000	1300	1100	2000
Source:	Adapted from Implications of Future Water Supply Sources for Energy Demands, W			

California Specific Water Intensities

Water use cycle segments	So Cal (kWh/MG)	No Cal (kWh/MG)
Supply and Conveyance	8900	150
Treatment	100	100
Distribution	1200	1200
Source:	http://www.energy.ca.gov/2005publications/CEC-700-	

Energy intensities for Water Distribution

	Distribution Intensity (kWh/MG)
Low Value	360
Median Value	540
High Value	860
Source:	Adapted from Implications of Future Water S

CO2 Emissions Factor (lbs CO2/MWh)	2004	2005	2006	2007
Southern California Edison	678.88	665.72	641.26	630.89
Source:	Data from the California Climate Action Registry Power/Utility Protoco			

Figure A-6: Default energy data

California Grid Average Electricity Emission Factors (lbs/MWh)				
Year	CO2	CH4	N2O	CO2e
1990	1031.14	0.04	0.014	1036.19
1991	994.03	0.037	0.013	998.72
1992	984.42	0.04	0.012	988.87
1993	1007.26	0.037	0.013	1011.91
1994	1071.19	0.04	0.013	1075.94
1995	929.77	0.031	0.012	934.03
1996	827.65	0.029	0.011	831.57
1997	874.96	0.029	0.011	878.88
1998	941.54	0.029	0.011	945.46
1999	917.6	0.031	0.011	921.56
2000	829.5	0.029	0.009	839.82
2001	1009.75	0.033	0.011	1013.75
2002	865.28	0.031	0.01	868.94
2003	888.41	0.031	0.011	892.37
2004	958.49	0.029	0.011	962.41
2005	948.28	0.03	0.011	952.22
2006	889.75	0.031	0.009	893.11
2007	919.64	0.029	0.01	923.26
Source:	Sources: Calculated from total in-state and imported electricity			

Figure A-7: California grid average electricity emissions factors