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Sacramento Suburban Water District
2008 Greenhouse Gas Inventory

4 November 2009

Prepared for

Sacramento Suburban Water District
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K/J Project No. 0976001*00

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Executive Summary

The purpose of this project was to create a greenhouse gas (GHG) inventory, or “carbon footprint”, for the operations of the Sacramento Suburban Water District (SSWD) consistent with its sustainability policy.

This inventory included the GHG emissions from the all the electricity, natural gas and fuel used in SSWD operations including: groundwater supply, reservoirs and storage tanks, surface water supplies, fleet, administration and other buildings, capital improvement projects, small equipment, employee commuting, and air travel.

The total GHG emissions for SSWD for calendar year 2008 are 5,378 Metric Tons of CO_2e.

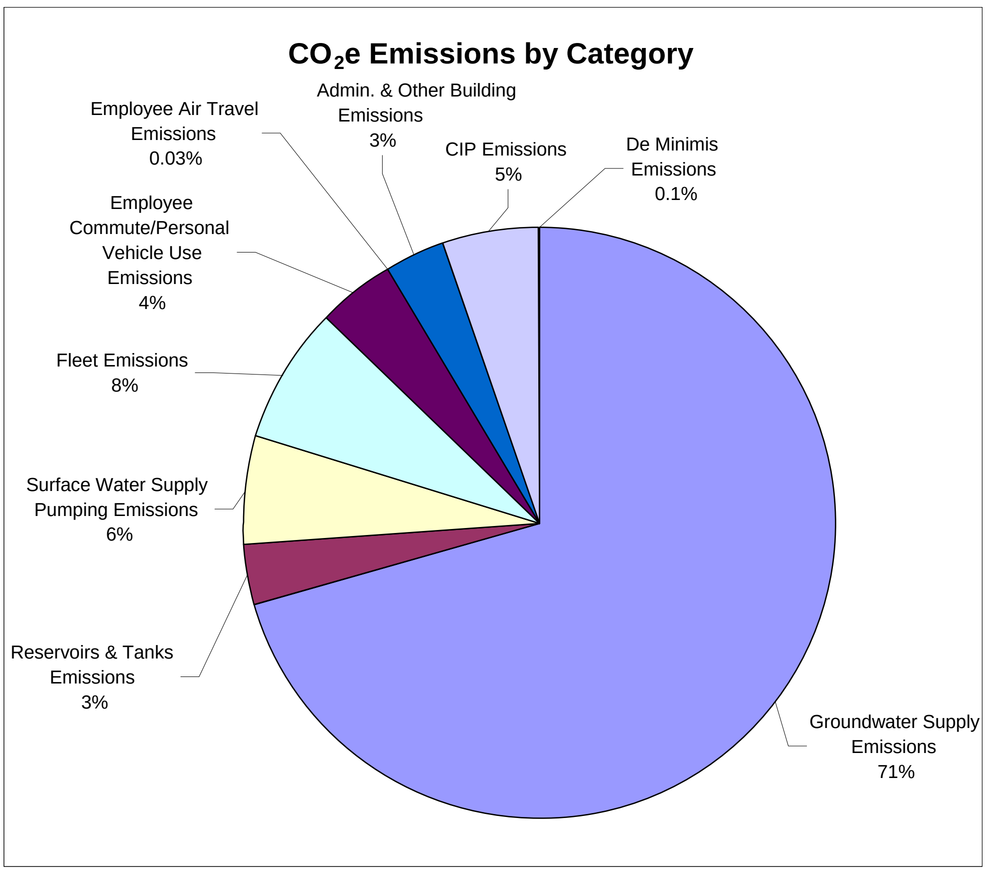

Figure ES-1: SSWD Total GHG Emissions by Category

This inventory uses units of metric tons of carbon dioxide equivalent (MT CO_2e) to describe inventory category total emissions. These are the units recognized internationally. One metric ton is equal to 2,204.6 U.S. pounds. Carbon dioxide equivalent (CO_2e) is a means of describing the cumulative effect of all greenhouse gases weighted by their global warming potential emitted from a specific source. At times, the quantity of emissions being discussed may require a smaller unit of measurement: kilograms of carbon dioxide equivalent (kg CO_2e).

5,378 MT CO_2e is equivalent to the emissions from approximately 1,070 cars on the road for one year.

The key points that emerge from this inventory are:

- By far the largest contributing emissions category is the Groundwater Supply Emissions at 3,801 MT CO_2e (71 percent of the total). The rest of the other emissions categories are only about 10 percent or less of the Groundwater Supply Emissions.
- What this indicates is that actions to reduce GHGs in a future Climate Action Plan will come primarily from the Groundwater Supply Emissions category. Emissions from this category come from the well electric pumps, natural gas and diesel stand-by power engines.
- By far the largest contributing emissions source is Electricity accounting for 80 percent of all emissions (4,298 MT CO_2e). The next largest emissions source is fuels which include: gasoline, diesel, and propane/LPG. The rest of the other emissions sources are insignificant.
- What this indicates is that actions to reduce GHGs in a future Climate Action Plan will come primarily from focusing on using electricity more efficiently, and secondarily from using fuels more efficiently.
- The electrical equipment used by SSWD includes: electric well pumps (85 percent of electricity use), electric reservoir booster pumps (4 percent of electricity use), and administration and other buildings (4 percent of electricity use). Electricity use that is not within the control of SSWD includes surface water supplier pumping (7 percent of electricity use).
- What this indicates is that actions to reduce GHGs in a future Climate Action Plan will come primarily from more efficient electrical well pumps, and secondarily improving the fuel efficiency of SSWD's fleet, and also promoting more fuel efficient methods for employee commuting (i.e., transit, carpooling, walking and biking).
- Most of the calculations done in this inventory came from actual data, but some of it was based on estimates. For future GHG inventories, which should be done on an annual basis, the data deficiencies and collection methodology deficiencies should be corrected.

Section 1: Introduction

1.1 Project Objective

The purpose of this project was to create a greenhouse gas (GHG) inventory, or “carbon footprint”, for the operations of the Sacramento Suburban Water District (SSWD) consistent with its sustainability policy.

1.2 Approach and Scope

Kennedy/Jenks Consultants used a seven step process to meet the project objective. Those seven steps were:

1. Use **recognized inventory protocols** that would enable SSWD to voluntarily report their GHGs and obtain third-party verification of the calculations.

2. Conduct a **kick-off meeting** with the SSWD staff to review the project scope, schedule, budget and assumptions, and to describe the process for collecting data to be used in the inventory.

3. Define the organizational and geographic **boundary** of the inventory.

4. **Identify and collect the data** necessary to complete the inventory. SSWD staff was responsible, with assistance from Kennedy/Jenks, for providing all the data necessary to complete the inventory. SSWD staff collected all the electricity and fuel used in SSWD operations including: groundwater supply, reservoirs and surface tanks, surface water supplies, fleet, administration and other buildings, capital improvement projects, small equipment, employee commuting, and air travel.

5. Kennedy/Jenks was responsible for gathering the data and **inputting it into an Excel spreadsheet**. The spreadsheet was organized into operational categories used by the District, e.g. Wells, Reservoirs, Buildings, and Fleet. For each category, equipment and operations that produce greenhouse gases were itemized and divided into subcategories where appropriate (e.g. pumps, emergency generators). Greenhouse gas emissions calculations were performed on each of these sheets. Once complete, the spreadsheet will be provided to SSWD so that staff can update the calculations in subsequent calendar years. The spreadsheet includes documentation that details all the calculation methodologies.

6. Kennedy/Jenks was responsible for **analyzing the data and reporting the results.** Kennedy/Jenks also identified data gaps and deficiencies, and made recommendations about how SSWD can modify their practices so that the information is accessible for future inventories.

7. Finally, Kennedy/Jenks will make a **presentation** to the Board of Directors and describe the process and convey the results of the inventory.

1.3 Project Team

The primary SSWD staff person responsible for gathering the necessary data for the inventory was John Valdes, Manager of Capital Improvement Projects. Other key staff that assisted with the data collection were: Jim Arenz, Production Superintendent, and Michelle Hirt, Facilities and Fleet Specialist. The project manager from Kennedy/Jenks was Alan Zelenka, Energy Services Leader; the spreadsheet and analysis was done by Sherri Peterson, P.E., LEED® AP; Linda Wirrick-Coad provided administrative support; and Alex Peterson is SSWD's client service manager and provided strategic advice and quality control for the project.

Kennedy/Jenks conducted a GHG inventory of the District's activities for calendar year 2008, using the California Climate Action Registry's General Reporting Protocol. This allows the District (if it chooses in the future) to obtain third-party verification of the calculations and ultimately voluntarily join CCAR or TCR. As part of this effort, Kennedy/Jenks worked with the District to determine the geographic and organizational boundaries for the GHG inventory; then calculated the direct and indirect emissions from the District's operations.

A GHG inventory is based on precise data where possible and clearly documented methodologies for estimation in other potentially important areas. All calculations will be performed in a clear and user-friendly spreadsheet that will be provided to the District so that District staff can update the calculations in subsequent calendar years. The spreadsheet will include documentation that details the calculation methodologies. Kennedy/Jenks will work closely with designated District staff in the development of the inventory so that they fully understand how the process is done and how to use the spreadsheet.

Section 2: Protocols Used

2.1 CCAR General Reporting Protocol

This greenhouse gas inventory, or carbon footprint, followed the standards set by the California Climate Action Registry's (CCAR) *General Reporting Protocol*.

CCAR is a private non-profit organization originally formed by the State of California, and serves as a voluntary greenhouse gas registry to protect and promote early actions to reduce GHG emissions by organizations. CCAR develops and promotes credible, accurate, and consistent GHG reporting standards and tools for organizations to measure, monitor, third-party verify, and reduce their GHG emissions consistently across industry sectors and geographical borders. CCAR's *General Reporting Protocol* outlines the principles, concepts, calculation methodologies and procedures required for effective participation in CCAR.

CCAR's *General Reporting Protocol* (GRP) is used as the "working" protocol to conduct this inventory and embodies current GHG accounting best practices. This inventory follows standards set by the CCAR-GRP to facilitate SSWD choosing to participate in their voluntary emissions reporting program.

However, CCAR will only be accepting emissions inventory data through the 2009 reporting year. After verification is completed in 2010, your reported data will be transferred to the California Registry's sister organization, The Climate Registry, as will all future reporting. The Climate Registry is now the platinum standard for emissions measurement and reporting, and the California Registry is using its expertise to focus on GHG project accounting (through the Climate Action Reserve), policy, and education and conferences.

2.2 The Climate Registry

The Climate Registry (TCR) is a non-profit collaboration among forty-one US states (including California), all the Canadian provinces, six Mexican states, territories and Native Sovereign Nations. It was created by the former President of CCAR, Diane Wittenberg to take the CCAR model national. Its mission is to set consistent and transparent standards to calculate, verify and publicly report greenhouse gas emissions into a single national registry. TCR supports both voluntary and mandatory reporting programs and provides comprehensive, accurate data to reduce greenhouse gas emissions. A GHG emissions registry is a bottom-up approach to emissions accounting, where companies and organizations quantify and report their emissions from various individual sources according to a uniform accounting standard.

TCR's General Reporting Protocol (GRP) is based on the CCAR's protocol. TCR's online reporting tool, the Climate Registry Information System (CRIS), is an updated version of CCAR's online reporting tool CARROT. TCR requires independent verification of a GHG inventory for it to be accepted by TCR. The annual cost for SSWD to join TCR would be $850 (the current rate for governmental agencies with revenues of $20-$100 million per year). Third-party verification would be an additional expense. The cost of the third-party verification depends on the complexity of the organization and the quality of their data, and SSWD would need to obtain a quote from an accredited verifier to get an estimate of the cost or issue an RFP.

The benefits of joining a voluntary registry include the following:

- Gain competitive advantage by increasing operational efficiency,
- Demonstrate action on GHG emissions by reporting emissions,
- Document early actions to voluntarily emissions,
- Identify and manage GHG risks and opportunities,
- Gain access to protocols, user-friendly web-based software, and technical assistance in developing and reporting an inventory,
- Get updates and participate in policy discussions relevant to the water industry and evolving GHG policy and regulation,
- Manage carbon-related risks,
- Preparing for a future cap and trade system by developing credible and transparent measurement, verification and reporting methods,
- Show environmental leadership by acting early to address climate change, and
- Prepare for up-coming regulation.

2.3 Regulatory Environment

In 2006 California passed AB 32 the Global Warming Solutions Act. AB 32 established GHG reduction targets for the State of California, established the California Air Resources Board (CARB) as the lead agency for climate change, and required that CARB create a "Scoping Plan" that sets forth a comprehensive set of actions to meet the state GHG reduction targets. The targets are to meet 1990 levels of GHGs by 2020, and to achieve a reduction of 80 percent below 1990 levels by 2050. The current statewide inventory is 469 million metric tons (MMT) of GHG gases. Under the business as usual case by 2020 the inventory of GHG will be 596 MMT. The 1990 target level is 427 MMT. So to achieve that target the state will need to reduce GHG emissions by 169 MMT by 2020. CARB's Scoping Plan establishes reduction targets for specific sectors and strategies.

Table 1: CARB Scoping Plan Reduction Targets by Sector or Strategy

CARB Reduction Strategy	2020 Reduction Targets (MMT CO_2e)
Capped Sectors	35.2
Light-Duty Vehicles	31.7
Energy-Efficiency	26.4
Renewable Portfolio Standard of 33%	21.2
Low Carbon Fuels	16.5
High Global Warming Potential Gases	16.2
Sustainable Forests	5.0
Water Sector	**4.8**
Vehicle Efficiency	4.8
Goods Movements (ports)	3.7
Heavy-to-Medium Vehicles	2.5
Million Solar Roofs	2.1

CARB Reduction Strategy	2020 Reduction Targets (MMT CO_2e)
Local Government Actions	**2.0**
State Government Actions	1.0
High Speed Rail	1.0
Landfill Control	1.0
Dairy Control	1.0

The water sector has a reduction goal of 4.8 MMT by 2020. To achieve this goal CARB has identified several broad Water Sector reduction strategies as shown in the table below.

Table 2: CARB Scoping Plan - Water Sector Reduction Targets

Water Sector Reduction Strategy	2020 Reduction Targets (MMT CO_2e)
Water System Energy Efficiency	2.0
Water Use Efficiency	1.4
Increased Renewable Energy Use	0.9
Water Recycling	0.3
Reuse Urban Runoff	0.2
TOTAL	**4.8**

CARB's mandatory reporting requirement applies to entities that emit more than 25,000 MT CO_2e per year. At the federal level, in September 2009, the US EPA finalized its mandatory GHG reporting rule for entities that emit more than 25,000 MT CO_2e per year. **SSWD's emissions are substantially below this threshold and will not be required to report their emissions to CARB or the US EPA.**

On June 26, 2009 the House of Representatives passed the American Clean Energy and Security Act of 2009 (ACES), otherwise known as the Waxman-Markey Bill or the climate change cap and trade legislation. The bill contains five titles: 1) clean energy, 2) energy efficiency, 3) reducing global warming pollution, 4) transitioning to a clean energy economy, and 5) agriculture and forestry related offsets.

Key provisions of the bill will:

- Require electric utilities to meet 6% of their electricity demand from renewables and energy efficiency by 2012, increasing to 20% by 2020 (three-quarters must come from renewables). As well ACES includes measures to increase the efficiency of water use, increased new building energy efficiency standards, and increased appliance efficiency standards.
- Increase investments in renewables and energy efficiency ($90 billion by 2025), carbon capture and sequestration ($60 billion), electric and advance vehicles ($20 billion), and R&D ($20 billion). These programs are funded through the value of the emissions allowances.
- Reduce carbon emissions from 2005 levels by 3% by 2012, 17% by 2020, 43% by 2030, and increasing to 83% by 2050.

- ACES also contains numerous cost-containment, trade-vulnerable and other industry protections, worker assistance and job training programs, and consumer protection provisions as recommended by the industry-environmental coalition known as United States Climate Action Partnership (USCAP). These provisions will help protect electricity, natural gas and heating oil customers from rate increases, as well as protecting low-income families from rate increase through direct payments. The bill uses the value of emissions allowances to offset the impacts to consumers and business. According to the Congressional Budget Office (CBO) ACES also meets “PAYGO” requirements, meaning it is revenue neutral to the federal budget. CBO estimates ACES will cost the average household about $175 by 2020, but that amount does not include any of the benefits or savings from the bill. According to EPA, families would actually spend less on utility bills by 2020 because of the energy efficiency provisions of ACES. A recent American Council for an Energy Efficient Economy (ACEEE) study concluded that households on average will actually save $1050 per year from the energy efficiency provisions alone.

Carbon reductions will be met through investments in energy efficiency, development of renewables and the establishment of a cap and trade system modeled after the successful acid rain program.

The cap and trade system, and the mandatory reporting requirement, will only apply to large emitters emitting over 25,000 tons/year of GHG such as electric utilities, producers and importers of all petroleum fuels (i.e., refineries), natural gas distributors, producers of “F-gases” (e.g., fluorinated gases used as refrigerants) and other specified sources.

In a cap and trade system the government sets a “cap” that initially limits total emissions to current emissions. Emission allowances are then distributed within the capped sectors (1 metric ton of GHG = 1 emissions allowance). Capped sources can maintain or increase their carbon emissions only if they can purchase offsets, or carbon reduction projects, from other sources. These allowances can then be bought and sold (“traded”) between individuals or companies. The cap then declines over time (e.g. – in a stair step function). Emitters must then surrender allowances at the end of each compliance period to true-up their emissions. This process creates the demand for allowances and thus creates a new market for carbon allowances. The trading establishes a market price for the GHG allowances. ACES allows for up to 2 billion metric tons of emissions credits annually (half from domestic sources and half from international sources). There are provisions to ensure the integrity of the offsets including review by an independent scientific panel. Initially 80% of the allowance will be allocated for free and 20% will be auctioned. The amount auctioned will increase over time to about 70% by 2030. ACES sets a minimum price of $10 per metric ton (in 2009 dollars), and EPA and CBO estimate the price of offsets to be $13-$16 in 2015 and increasing to $26-$36 by 2030. This creates a market of about $70-$80 billion on 2015 and $90-$120 billion on 2030.

With regard to state climate initiatives, states may implement more stringent climate regulations, including mandatory reporting requirements, except for cap and trade programs. Any state trading programs would be put on hold from 2012 through 2017. Anyone holding a Western Climate Initiative allowance before December 31, 2011 can exchange their state allowance for federal allowances.

In early October 2009 Senators Boxer and Kerry introduced a companion bill to the Waxman-Markey bill into the Senate with very similar provisions. No action had been taken on this bill at the time of the writing of this report.

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Section 3: Categories of Greenhouse Gas Emissions

According to the World Research Institute and World Business Council for Sustainable Development (WRI/WBCSD) *Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (p. 25)*, emissions sources either produce direct or indirect emissions. Direct emissions are those produced from sources owned or controlled by organizations. Indirect emissions occur because of the organization's actions, but the direct source of emissions is controlled by a separate entity. To distinguish direct from indirect emissions sources, three "scopes" are defined for GHG accounting and reporting purposes.

3.1 Scope I – Direct Emissions

This category of emissions includes sources of greenhouse gas emissions that originate from equipment and facilities owned or operated by SSWD. This will include burning of natural gas, diesel, or other fuels in equipment or vehicles, or burning natural gas for heat.

3.2 Scope II – Indirect Emissions

This category of emissions includes greenhouse gas emissions that result from purchase of electricity, heat, or steam, and the purchase of treated surface water from neighboring agencies. This primarily includes electricity used by SSWD buildings, and electricity used by equipment.

3.3 Scope III – Optional Indirect Emissions

This category includes all other indirect sources of GHG emissions that may result from the activities of the institution but occur from sources owned or controlled by another person or company, such as: air travel of employees and Board members, and commuting by employees and Board members. Solid waste and embodied emissions were beyond the scope of the contract and this report.

CCAR and TCR require Scope 1 (direct) and Scope II (indirect) emissions to be reported. Reporting of Scope III emissions is optional. Scope III emissions help understand an organization's entire carbon footprint, can be quite substantial, and may be informative should carbon legislation be enacted.

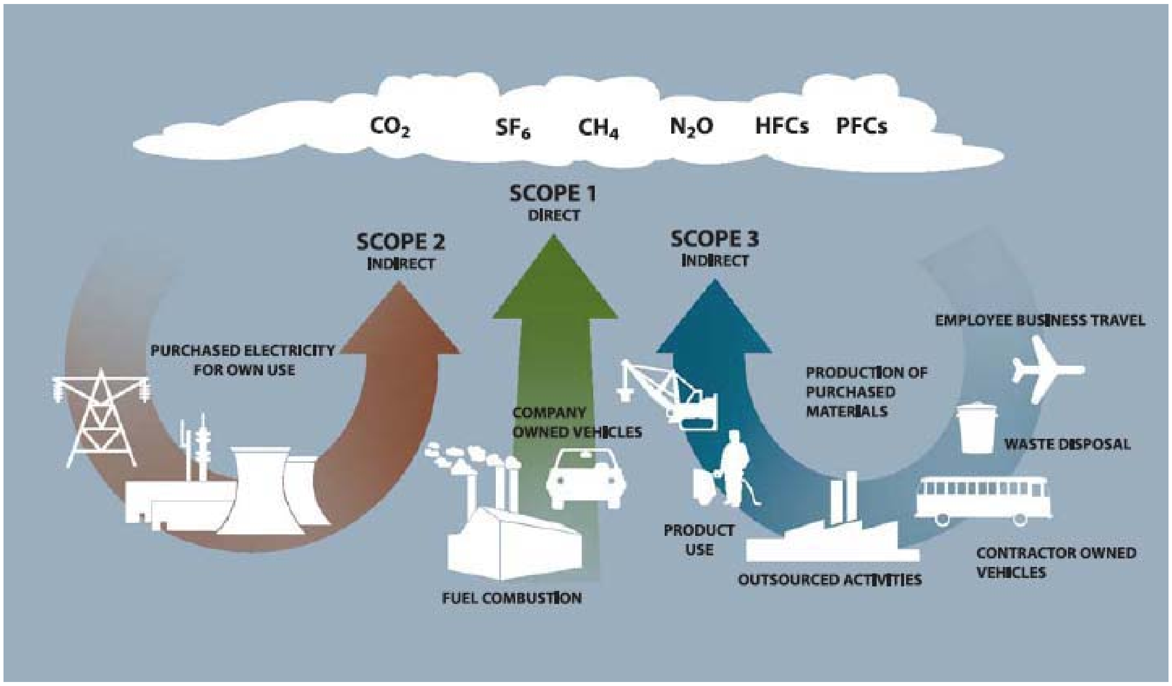

Figure 1: Scope Emissions Sources

Source: World Research Institute and World Business Council for Sustainable Development (WRI/WBCSD) *Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard, Chapter 4*

3.4 AB 32 Greenhouse Gases and Global Warming Potential

AB 32 regulates the six Kyoto Protocol greenhouse gases (GHG), which are listed in the California Climate Action Registry General Reporting Protocol, 2009, version 3.1. Each of these gases has an associated global warming potential (GWP). The GWP compares the ability of one unit of a particular GHG to affect global warming relative to carbon dioxide. For instance, one pound of methane (CH_4) has a GWP of 21, will produce the same global warming impact as 21 pounds of carbon dioxide.

Table 3: Global Warming Potentials of Regulated Greenhouse Gases

Gas	Chemical Formula	Global Warming Potential
Carbon dioxide	CO_2	1
Methane	CH_4	21
Nitrous oxide	N_2O	310
Hydrofluorocarbons	$C_xH_yF_z$	140 – 11,700
Perfluorocarbons	C_xF_y	6,500 – 9,200
Sulfur Hexafluoride	SF_6	23,900

Source: California Climate Action Registry General Reporting Protocol, 2009

Of these six gases, carbon dioxide is by far the most prevalent GHG emission by SSWD, and results from the burning of fossil fuels. Methane and nitrous oxide also appear in the SSWD inventory but at a much lower amount. Hydrofluorocarbons (HFC) and perfluorocarbons (PFC) are primarily used as refrigerants in building air conditioning systems, and are emitted when they escape, or become fugitive emissions. Sulfur Hexafluoride (SF_6) comes from high tech manufacturing and electric utility transformers. This inventory did not reveal any HFC, PFC or SF_6 emissions from the operations and equipment of SSWD but could be present in future inventories.

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Section 4: Analysis and Results

4.1 Baseline Year

A baseline, or a "base year," is a benchmark or reference point that allows an organization to track GHG emission increases and decreases over time. The baseline year should be selected to be the year that best represents an organization's standard emissions profile. CCAR does not require participants to establish a baseline, however, if a baseline is not established, by default the first year of reporting is generally viewed as a baseline. This document presents an estimate of the six AB 32 greenhouse gases emitted according to Scopes I, II and III by SSWD in calendar year 2008**. Thus 2008 will serve as the baseline year for future SSWD GHG Inventories.**

Since the purpose of a baseline is to compare emissions from an organization to a point in the past, CCAR requires that baseline year emissions be recalculated if organizational boundaries change over time (such as a merger, acquisition or divestiture, out-sourcing or in-sourcing activities), if there is a shift in the location of an emissions source, or if there is a change in calculation methodologies. Organic growth or decline (which refers to increases or decreases in production output), changes in product mix, plant closures, and openings of new plants that are not due to organizational structure changes or shift of operations, does not require a recalculation of the baseline. For more information, see *Chapter 4 of the CCAR-GRP*.

4.2 Frequency of Future GHG Inventory Updates

The largest emission from SSWD comes from electricity. The emissions factor for the Sacramento Municipal Utility District (SMUD), which provides all of SSWD's electricity, changes on an annual basis; therefore, the GHG inventory should also be updated on an annual basis.

4.3 Geographic and Organizational Boundaries

All of SSWD's service territory and assets are located within the State of California. All emissions from SSWD owned and controlled equipment, vehicles, wells, reservoirs, pumps and buildings are included in the inventory boundary. Buildings that are completely leased to other entities are not included in this inventory because they are not under the operational control of SSWD. For those buildings that are partially leased to another entity; only the portion that is under the operational control of SSWD is included in this inventory. As well, the estimated emissions from contracted capital improvement projects (that would have been otherwise done with in-house personnel and equipment) are also included in the inventory boundary. Finally, the up-stream sources of water supply from other entities, and its associated GHG emissions, are included in this inventory boundary. However, water that is passed-through the District and delivered to another entity is excluded from the inventory boundary.

The figure below shows the geographic boundary of the SSWD service territory.

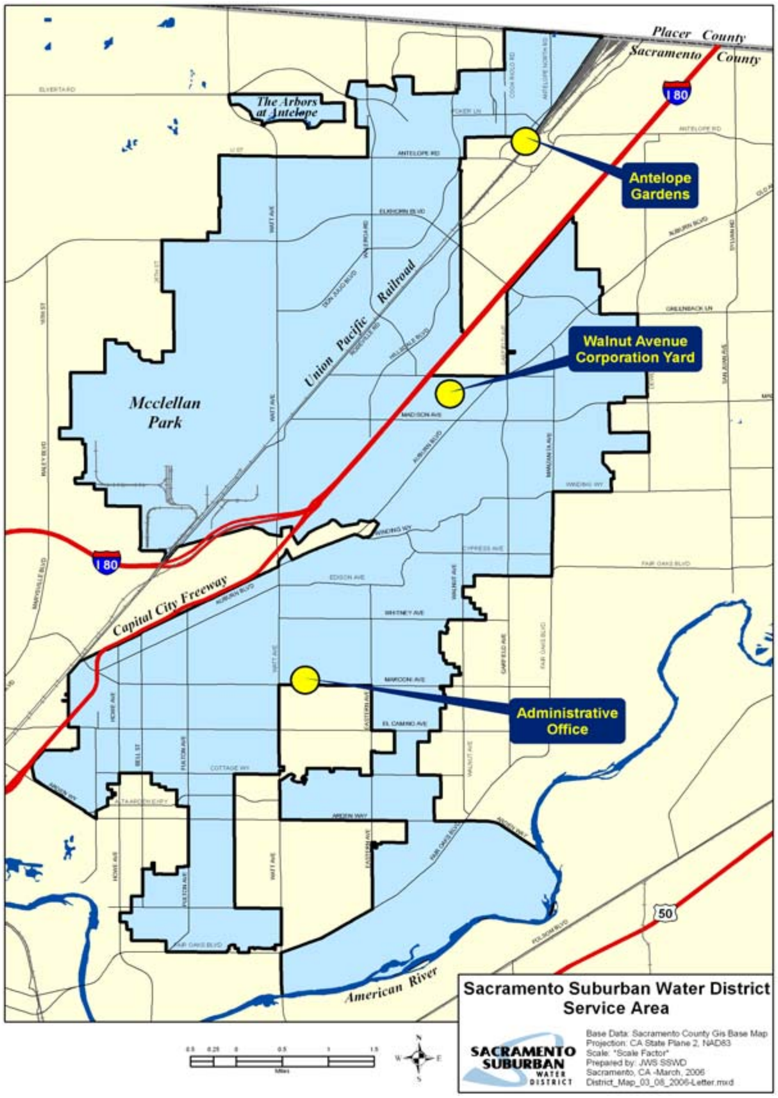

Figure 2: SSWD Service Territory Map
From: http://www.sswd.org/about_us/pdf_files/SSWD_District_Map.pdf

4.4 Reporting Units (MT CO_2e)

This inventory uses units of metric tons of carbon dioxide equivalent (MT CO_2e) to describe inventory category total emissions. This are the units recognized internationally. One metric ton is equal to 2,204.6 U.S. pounds. Carbon dioxide equivalent (CO_2e) is a means of describing the cumulative effect of all greenhouse gases weighted by their global warming potential emitted from a specific source. At times, the quantity of emissions being discussed may require a smaller unit of measurement: kilograms of carbon dioxide equivalent (kg CO_2e).

4.5 Total GHG Emissions

The total GHG emissions for SSWD for calendar year 2008 are 5,317 MT CO_2e.

4.6 GHG Emissions by Scope

The required Scope I - Direct and Scope II - Indirect emissions, as well as the optional Scope III – Optional Indirect emissions are shown in Table 4:

Table 4: GHG Emissions Included by Scope

GHG Protocol Scope	Emissions
Scope I – Direct	Natural Gas Use
	Vehicle Fleet
	Stationary Combustion
	Refrigerants
Scope II – Indirect	Purchased Electricity
	Purchased Water
Scope III – Optional Indirect	Employee Commuting
	Personal Vehicle Use
	Business-related Air Travel

In the figure below each of SSWD's GHG emissions is organized by scope. Scope I – Direct emissions includes: fleet vehicle fuel combustion, back-up power fuel combustion, building natural gas combustion and fugitive refrigerant emissions (used in building and vehicle air conditioning systems). Scope II – Indirect emissions includes: electricity consumption by pumps and electricity consumption by buildings. Scope III – Optional Indirect emissions includes: employee commute, personal vehicle use, and employee and board member air travel. Scope I – Direct emissions comprised 16 percent of the total SSWD emissions (849 MT CO_2e). Scope II – Indirect emissions comprised the vast majority of emissions at 80 percent of the total SSWD emissions (4,298 MT CO_2e). Scope III – Optional Indirect emissions comprised 4 percent of the total SSWD emissions (231 MT CO_2e). What this indicates is that the focus of the majority of reductions in GHGs identified in a future Climate Action Plan (CAP) will come from reducing Scope II – Indirect emissions which mostly comes from the purchase of electricity.

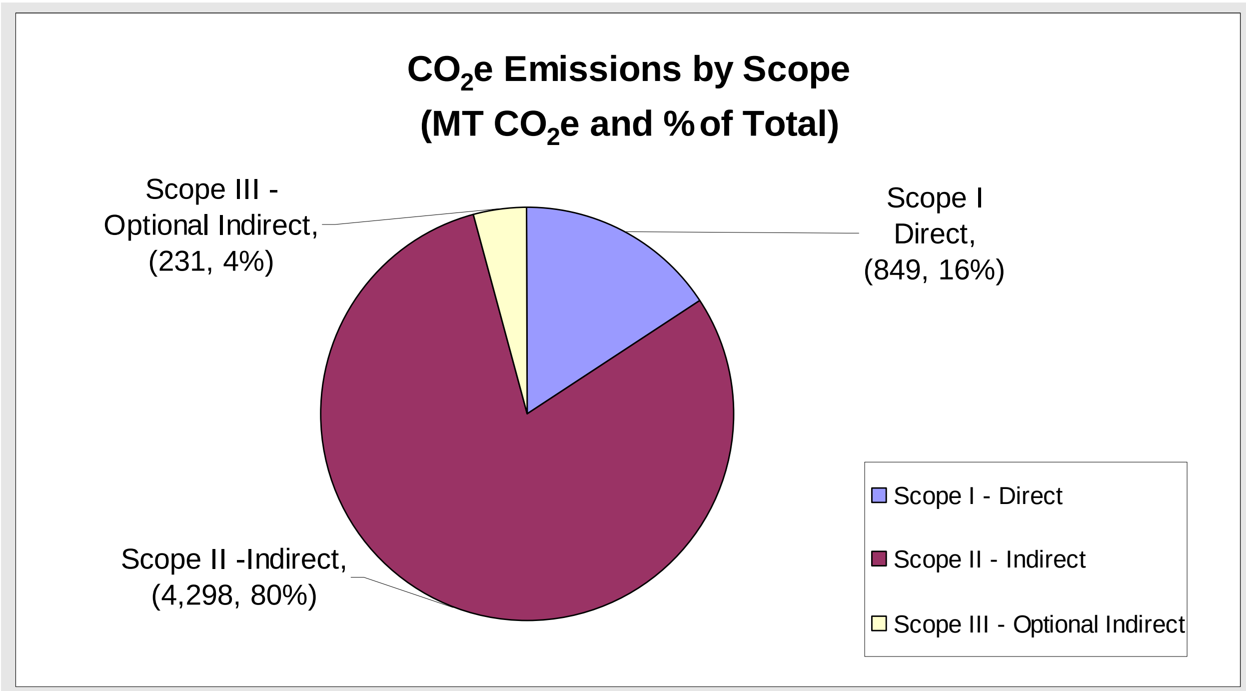

Figure 3: Total SSWD 2008 GHG Inventory Emissions by Scope Category

4.7 GHG Emissions by Category

The figure below shows SSWD's GHG emissions by category. By far the largest contributing emissions category is the Groundwater Supply Emissions at 3,801 MT CO_2e (71 percent of the total). The other emissions categories are each only 10 percent or less of the Groundwater Supply Emissions. What this indicates is that actions to reduce GHGs in a future Climate Action Plan will come primarily from the Groundwater Supply Emissions category. Emissions from this category come from the well electric pumps, and natural gas and diesel stand-by power engines.

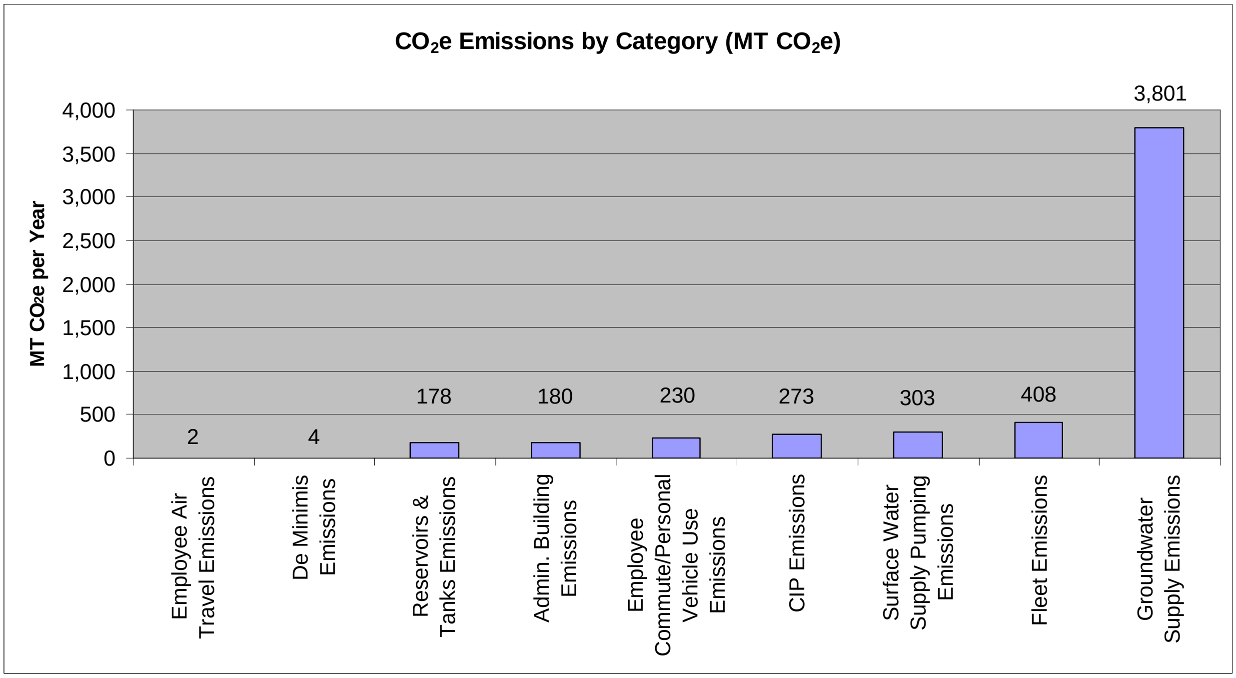

Figure 4: SSWD Total Greenhouse Gas Emissions by Source

4.8 GHG Emissions by Source

The figure below shows SSWD's GHG emissions by source. By far the largest contributing emissions source is electricity, accounting for 80 percent of all emissions (4,298 MT CO_2e). The next largest emissions source is fuels which include: gasoline, diesel, jet fuel from airline travel, and propane/LPG. The rest of the other emissions sources are insignificant. What this indicates is that actions to reduce GHGs in a future Climate Action Plan will come primarily from focusing on using electricity more efficiently, and secondarily from using fuels more efficiently. The electrical equipment used by SSWD includes: electric well pumps (85 percent of electricity use), electric reservoir booster pumps (4 percent of electricity use), and administration and other buildings (4 percent of electricity use). Electricity use that is not within the control of SSWD includes surface water supplier pumping (7 percent of electricity use). What this indicates is that actions to reduce GHGs in a future Climate Action Plan will come primarily from more efficient electrical well pumps, and secondarily improving the fuel efficiency of SSWD's fleet, and also promoting more fuel efficient methods for employee commuting (i.e., transit, carpooling, walking and biking).

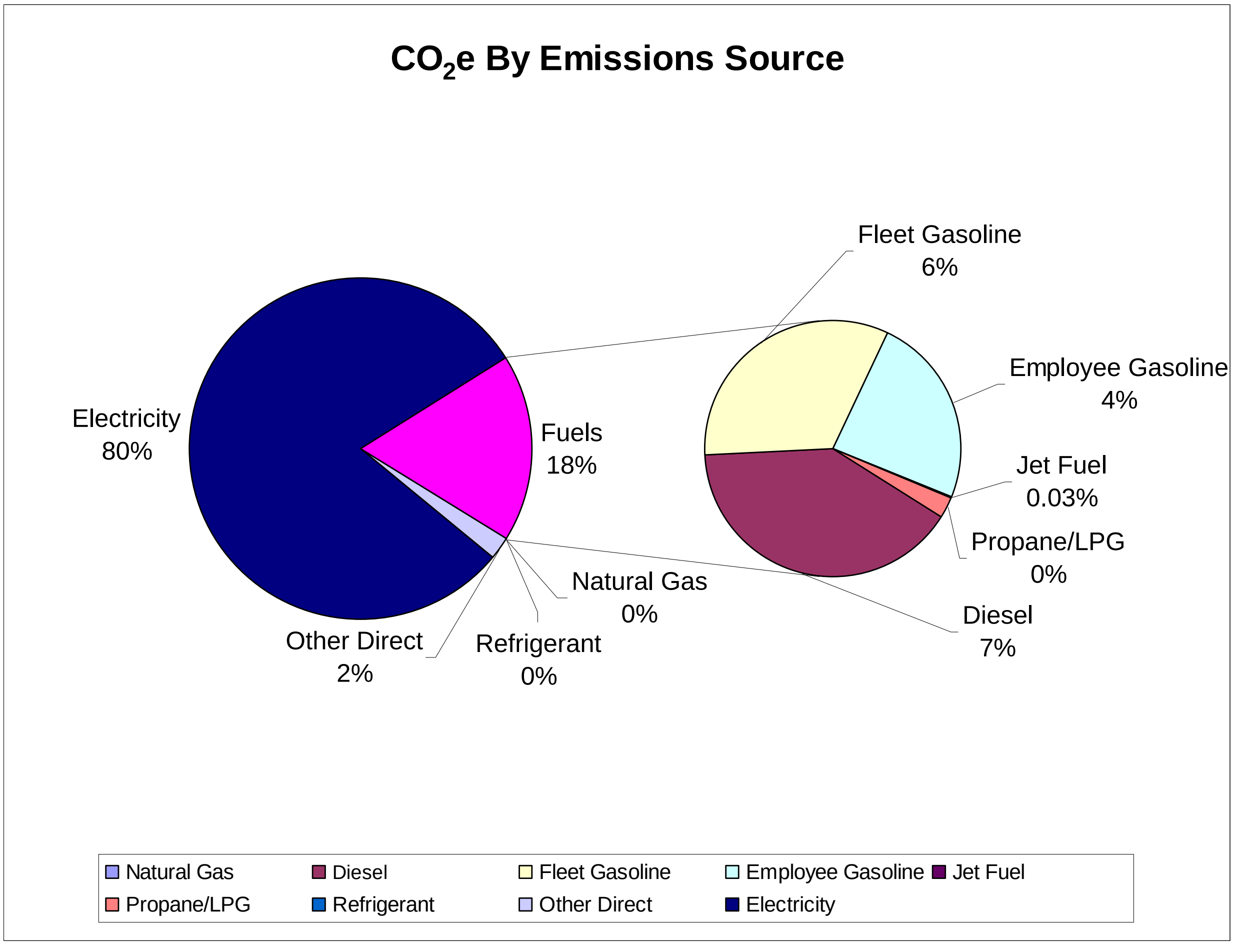

Figure 5: SSWD Total Greenhouse Gas Emissions by Source

4.9 Direct Emissions

4.9.1 Groundwater Supply Emissions

Direct emissions from groundwater supply operations result from engines burning natural gas that operate pumps at the wells, burning of diesel fuel for standby power, burning of propane for standby power, emissions of methane from air strippers, and fugitive refrigerant emissions from HVAC equipment.

4.9.1.1 Natural Gas Engines at Well Sites

Emissions from combustion of natural gas include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). SSWD provided actual natural gas consumption in units of standard cubic feet (scf) for each well location equipped with a natural gas engine. Total heat content in units of million British thermal units (MMBtu) was calculated using a heat content factor from Table C.7 of the CCAR General Reporting Protocol.

Emission factors for CO_2, CH_4, and N_2O from stationary combustion of natural gas were obtained from Tables C.7 and C.9 of the CCAR General Reporting Protocol. These factors were multiplied by the consumption in MMBtu for each engine to estimate emissions in kilograms (kg) for each GHG. These quantities were multiplied by their respective global warming potential, as reported by the Intergovernmental Panel on Climate Change (1996), to calculate total GHG emissions as CO_2 equivalents. GHG emissions related to combustion of natural gas in the engines located at wells are provided in Table 5:

Table 5: GHG Emissions from Well Site Natural Gas Engines

CO_2 Emissions (kg)	CH_4 Emissions (kg)	N_2O Emissions (kg)	Total Emissions (MT CO_2e)
3.7	0.0	0.0	0.004

4.9.1.2 Diesel Standby Power at Well Sites

Emissions from combustion of diesel fuel in stand-by engines include CO_2, CH_4, and N_2O. SSWD provided information for each generator including make, model, capacity in kilowatts, capacity in horsepower, and the actual number of hours each generator was operated during 2008.

Emissions factors for CO_2 and CH_4 from generator sets were retrieved from the South Coast Air Quality Management District (SCAQMD) Emissions Factors Model, (EMFAC 2007, version 2.3). No similar emissions factors were available from the Sacramento Metropolitan Air Quality Management District (SMAQMD).

Emissions factors for CO_2 and CH_4 emissions from generator sets were extrapolated to match the specific horsepower ratings for each of SSWD's generator sets, based on data from the SCAQMD Off-road Mobile Source Emission Factors (Scenario Years 2007 – 2025). Since SCAQMD provides emission factors for only selected horse power ratings it is necessary to use the provided data to estimate the emissions factor for non-specified equipment. Since emissions factors are not based on a linear relationship, for both CO_2 and CH_4, a line was fitted to the available SCAQMD data on horsepower versus emissions rate, using the data distribution with the highest coefficient of determination (R^2). The line of best fit was then used to estimate emissions from each generator set. Data distributions and corresponding R^2 values are presented in Table A-1 in Appendix A.

An emissions rate for N_2O was not available from SCAQMD for diesel generator sets. Thus, the N_2O emissions rate was estimated based on an assumed ratio of N_2O emissions to CO_2 emissions for diesel fuel use. The ratio was determined based on California Climate Action Registry General Reporting Protocol v 3.1 (January 2009) (CCAR GRP) emissions factors from off-road vehicles/construction equipment, which reports CO_2 emissions of 10.15 kg CO_2/gal (Table C.3 - transportation fuels), and N_2O emissions of 0.26 g N_2O /gal (Table C.6, non-highway vehicles). This ratio results in an N_2O emissions rate of 2.6×10^{-5} lb N_2O /lb CO_2.

These factors were multiplied by the hours operated for each generator set to estimate emissions in kilograms (kg) for each GHG. These quantities were multiplied by their respective global warming potential, as reported by the Intergovernmental Panel on Climate Change (1996), to calculate total GHG emissions as CO_2 equivalents. GHG emissions related to combustion of diesel fuel for standby power are provided in Table 6:

Table 6: GHG Emissions from Well Site Diesel Standby Power

CO_2 Emissions (kg)	CH_4 Emissions (kg)	N_2O Emissions (kg)	Total Emissions (MT CO_2e)
16,450	1.8	0.4	16.5

4.9.1.3 Propane Standby Power at Well Sites

Emissions from combustion of propane include CO_2, CH_4, and N_2O. SSWD provided information for the propane generator including make, model, capacity in kilowatts, capacity in horsepower, fuel consumption in cubic feet per hour, and the actual number of hours the generator was operated during 2008.

The consumption of propane in cubic feet was calculated using the consumption rate and the hours operated during 2008. The consumption of propane in gallons was then estimated by converting cubic feet to gallons. Emissions factors for CO_2, CH_4, and N_2O were obtained from Tables C.7 and C.9 of the CCAR General Reporting Protocol. These factors were multiplied by the fuel consumption in gallons for the generator set to estimate emissions in kilograms (kg) for each GHG. These quantities were multiplied by their respective global warming potential, as reported by the Intergovernmental Panel on Climate Change (1996), to calculate total GHG emissions as CO_2 equivalents. GHG emissions related to combustion of propane for standby power are provided in Table 7:.

Table 7: GHG Emissions from Well Site Propane Standby Power

CO_2 Emissions (kg)	CH_4 Emissions (kg)	N_2O Emissions (kg)	Total Emissions (MT CO_2e)
3,413	0.6	0.06	3.4

4.9.1.4 Air Strippers at Well Sites

SSWD operates air strippers at two well locations to remove entrained air and gas, including methane. SSWD provided analytical data for the water at both locations, as well as the amount of water processed each year at each location. At the Enterprise/Northrop Well, one analytical result for methane from 2002 was available and was assumed to represent average concentration. At the Eden/Root Well, five analytical results for samples collected during 2003 and 2004 were available, and the average of the 5 results was assumed to represent average concentration at this location. It was assumed that all methane is removed by the air strippers and is vented to the atmosphere.

The pre-treatment methane concentration was multiplied by the volume of water processed during the year to estimate methane emissions in kilograms (kg) for each air stripper. These quantities were multiplied by the global warming potential for methane, as reported by the Intergovernmental Panel on Climate Change (1996), to calculate total GHG emissions as CO_2 equivalents. GHG emissions related to the methane releases from the operation of air strippers are provided in Table 8:

Table 8: GHG Emissions from Operation of Well Site Air Strippers

CH_4 Emissions (kg)	**Total Emissions (MT CO_2e)**
5,705	119.8

4.9.1.5 Refrigerant Emissions

Fugitive refrigerant-related emissions could potentially be emitted from operation of heating, ventilation, and air conditioning (HVAC) system when the refrigerant escapes. The amount of HVAC system refrigerant recharges was used to estimate the amount of fugitive refrigerant. SSWD stated that during 2008, no refrigerant recharges were necessary. Therefore, it is assumed that there were no significant refrigerant-related fugitive emissions associated with groundwater supply operations.

4.9.2 Reservoirs and Storage Tanks

Direct emissions from reservoir and storage tank operations come from burning of diesel fuel for standby power, burning of propane for standby power, and fugitive refrigerant emissions from HVAC equipment.

4.9.2.1 Diesel Standby Power at Reservoirs and Storage Tanks

Emissions from combustion of diesel fuel include CO_2, CH_4, and N_2O. SSWD provided information for each generator including make, model, capacity in kilowatts, capacity in horsepower, and the actual number of hours each generator was operated during 2008.

Emissions factors for CO_2 and CH_4 from generator sets were also retrieved from the South Coast Air Quality Management District (SCAQMD) Emissions Factors Model, (EMFAC 2007, version 2.3). No similar emissions factors were available from the Sacramento Metropolitan Air Quality Management District (SMAQMD).

Emissions factors for CO_2 and CH_4 emissions from generator sets were extrapolated to match the specific horsepower ratings for each of SSWD's generator sets, based on data from the SCAQMD Off-road Mobile Source Emission Factors (Scenario Years 2007 – 2025). Since SCAQMD provides emission factors for only selected horse power ratings it is necessary to use the provided data to estimate the emissions factor for non-specified equipment. Since emissions factors are not based on a linear relationship, for both CO_2 and CH_4, a line was fitted to the available SCAQMD data on horsepower versus emissions rate, using the data distribution with the highest coefficient of determination (R^2). The line of best fit was then used to estimate emissions from each generator set. Data distributions and corresponding R^2 values are presented in Table A-1 in Appendix A.

An N_2O emissions rate was not available from SCAQMD for diesel generator sets. Thus, the N_2O emissions rate was estimated based on an assumed ratio of N_2O emissions to CO_2 emissions for diesel fuel use. The ratio was determined based on California Climate Action Registry General Reporting Protocol v 3.1 (January 2009) (CCAR GRP) emissions factors from off-road vehicles/construction equipment, which reports CO_2 emissions of 10.15 kg CO_2/gal (Table C.3 - transportation fuels), and N_2O emissions of 0.26 g N_2O /gal (Table C.6, non-highway vehicles). This ratio results in an N_2O emissions rate of 2.6 x 10^{-5} lb N_2O /lb CO_2.

These factors were multiplied by the hours operated for each generator set to estimate emissions in kilograms (kg) for each GHG. These quantities were multiplied by their respective global warming potential, as reported by the Intergovernmental Panel on Climate Change (1996), to calculate total GHG emissions as CO_2 equivalents. GHG emissions related to combustion of diesel fuel for standby power are provided in Table 9:

Table 9: GHG Emissions from Reservoir and Storage Tank Diesel Standby Power

CO_2 Emissions (kg)	**CH_4 Emissions (kg)**	**N_2O Emissions (kg)**	**Total Emissions (MT CO_2e)**
3,167	0.3	0.1	3.2

4.9.2.2 Propane Standby Power at Reservoirs and Storage Tanks

Emissions from combustion of propane include CO_2, CH_4, and N_2O. SSWD provided information for the propane generator including make, model, capacity in kilowatts, capacity in horsepower, fuel consumption in cubic feet per hour, and the actual number of hours the generator was operated during 2008.

The consumption of propane in cubic feet was calculated using the consumption rate and the hours operated during 2008. The consumption of propane in gallons was then converted from cubic feet to gallons. Emissions factors for CO_2, methane, and N_2O were obtained from Tables C.6 and C.7 of the CCAR General Reporting Protocol. These factors were multiplied by the fuel consumption in gallons for the generator set to estimate emissions in kilograms (kg) for each greenhouse gas. These quantities were multiplied by their respective global warming potential, as reported by the Intergovernmental Panel on Climate Change (1996), to calculate total GHG emissions as CO_2 equivalents. GHG emissions related to combustion of propane for standby power are provided in Table 10:

Table 10: GHG Emissions from Reservoir and Storage Tank Propane Standby Power

CO_2 Emissions (kg)	CH_4 Emissions (kg)	N_2O Emissions (kg)	Total Emissions (MT CO_2e)
17,527	3.1	0.3	17.7

4.9.2.3 Refrigerant Emissions at Reservoirs and Storage Tanks

Fugitive refrigerant-related emissions could potentially be emitted from operation of heating, ventilation, and air conditioning (HVAC) system when the refrigerant escapes. The amount of HVAC system refrigerant recharges was used to estimate the amount of fugitive refrigerant. SSWD stated that during 2008, no refrigerant recharges were necessary. Therefore, it is assumed that there were no significant refrigerant-related fugitive emissions associated with reservoirs and storage tanks.

4.9.3 District Fleet Vehicles

All fleet-related emissions are direct emissions from the combustion of fuels. Combustion of fuels generates CO_2, CH_4, and N_2O emissions.

4.9.3.1 Pool Cars, Pickup Trucks, and Dump Trucks

SSWD provided make, model, model year, fuel type used, miles driven for 2008, and miles per gallon for District pool cars and pickup trucks. The same information was provided, if available, for dump trucks. In some instances, miles driven and miles per gallon were not available for dump trucks, and hours operated during 2008 were provided instead. SSWD also provided information as to whether the pickup trucks were light duty versus heavy duty trucks, using the cutoff of 5,750 pounds gross vehicle weight (GVW) as the upper weight for the light duty category. This cutoff weight was obtained from the CCAR General Reporting Protocol, version 3.0, April 2008. Version 3.1 of the CCAR protocol does not define light duty and heavy duty vehicle weights, and it was assumed to be the same as that designated in the 2008 version 3.0 protocol.

For vehicles that had miles driven and mileage values provided, fuel consumption for the year was calculated. An average value of 5 miles per gallon was used for dump trucks where mileage rates were not available. This value was based on several reports available online that provided ranges of dump truck mileage values. The web addresses for the documents are:

- http://www.spa.usace.army.mil/fonsi/acequia/posecion_DEA.pdf
- http://www.napavalleyregister.com/articles/2008/06/02/news/local/doc4843779049cd1254363693.txt
- http://www.energy.ca.gov/sitingcases/riverside/documents/intervenors_files/2004-07-26_COMMENTS_DRAFT.PDF

Annual fuel consumption values were multiplied by emission factors from Tables C.3, C.4, C.5, and C.6 of the CCAR General Reporting Protocol. These quantities were multiplied by their respective global warming potential, as reported by the Intergovernmental Panel on Climate Change (1996), to calculate total GHG emissions as CO_2 equivalents. GHG emissions related to combustion of fuel in pool cars, pickup trucks, and dump trucks are provided in Table 11:

Table 11: GHG Emissions from Fleet Pool Cars, Pickup Trucks, and Dump Trucks

Category	Number of Units	CO_2 Emissions (kg)	CH_4 Emissions (kg)	N_2O Emissions (kg)	Total Emissions (MT CO_2e)
Pool cars	2	4,692	0.07	0.04	3.2
Pickup trucks	43	296,303	8.8	10.1	300
Dump trucks	4	77,901	0.004	0.004	77.9

4.9.3.2 Backhoes, Portable Compressors, Mini Excavators, and Other Equipment

SSWD provided make, model, model year, fuel type used, and hours operated for backhoes, portable compressors, mini excavators, and other equipment operated by the District. The District estimated the hours operated for these equipment types. For equipment using diesel as fuel, emission factors for CO_2 and CH_4 were retrieved from the South Coast Air Quality Management District (SCAQMD) Emissions Factors Model, (EMFAC 2007, version 2.3). No similar emissions factors were available from the Sacramento Metropolitan Air Quality Management District (SMAQMD).

The Tractors/Loaders/Backhoes composite values were used for the backhoe calculations, since horsepower information was unavailable for these vehicles. The air compressor composite values were used for calculation of emissions from the portable compressors, and the Other Construction Equipment composite values were used for the District's other diesel equipment. The District has some other construction equipment that uses gasoline and liquefied petroleum gas (LPG). For the gasoline-powered equipment emission factors from Tables C.3 and C.6 of the CCAR General Reporting Protocol were used. For LPG emission factors, version 3.0 of CCAR was used for emission factors for CH_4 and N_2O, as version 3.1 only provides LPG factors in units of grams per mile, and miles driven in 2008 is not known for these pieces of equipment.

Kennedy/Jenks Consultants was able to obtain horsepower information for the mini excavators from vendor websites based on the model types provided by the District. Emissions factors for CO_2 and CH_4 emissions from mini excavators were extrapolated to match the specific horsepower ratings for each of SSWD's mini excavators, based on data from the SCAQMD Off-road Mobile Source Emission Factors (Scenario Years 2007 – 2025). For both CO_2 and CH_4, a line was fitted to the available SCAQMD data on horsepower versus emissions rate, using the data distribution with the highest coefficient of determination (R^2). The line of best fit was then used to estimate emissions from each mini excavator. Note that the data in SCAQMD for excavators represents large excavators, and this method could overestimate actual emissions. Data distributions and corresponding R^2 values are presented in Table A-1 in Appendix A.

An N_2O emissions rate was not available from SCAQMD for construction-related equipment at the time of this report. Thus, the N_2O emissions rate was estimated based on an assumed ratio of N_2O emissions to CO_2 emissions for diesel fuel use. The ratio was determined based on California Climate Action Registry General Reporting Protocol v 3.1 (January 2009) (CCAR GRP) emissions factors from off-road vehicles/construction equipment, which reports CO_2 emissions of 10.15 kg CO_2/gal (Table C.3 - transportation fuels), and N_2O emissions of 0.26 g N_2O /gal (Table C.6, non-highway vehicles). This ratio results in an N_2O emissions rate of 2.6 x 10^{-5} lb N_2O /lb CO_2.

The emission factors were multiplied by the hours operated for each vehicle to estimate emissions in kilograms (kg) for each GHG. These quantities were multiplied by their respective global warming potential, as reported by the Intergovernmental Panel on Climate Change (1996), to calculate total GHG emissions as CO_2 equivalents. GHG emissions related to combustion of fuels from other equipment are provided in Table 12:

Table 12: GHG Emissions from Other Equipment

Category	Number of Units	CO_2 Emissions (kg)	CH_4 Emissions (kg)	N_2O Emissions (kg)	Total Emissions (MT CO_2e)
Backhoes	4	12,362	2.0	0.01	12.4
Portable compressors	4	851	0.1	0.02	0.9
Mini excavators	5	563	0.8	0.03	0.6
Other equipment	4	10,927	1.3	0.25	11.0

4.9.4 Administration and Other Buildings

Greenhouse gas emissions related to the District's administration and other buildings include combustion of natural gas for building heating, and diesel backup generators located at the buildings. Combustion of natural gas and diesel generates CO_2, CH_4, and N_2O emissions.

4.9.4.1 Natural Gas Combustion at Buildings

The Marconi Avenue administration building and Walnut Avenue Corporation Yard building is the only building where natural gas is used. A portion of this building (38 percent by area) is currently leased to another company. SSWD provided natural gas consumption (in standard cubic feet), the square footage of the building, and the square footage of the leased area of the building. The consumption in scf was converted to MMBtu using the heat content factor provided in Table C.7 of the CCAR General Reporting Protocol. Emission factors for CO_2, CH_4, and N_2O from the combustion of natural gas were obtained from Tables C.7 and C.9 of the CCAR General Reporting Protocol. These factors were multiplied by the total heat content in MMBtu to estimate the emissions of the greenhouse gases. These quantities were multiplied by their respective global warming potential, as reported by the Intergovernmental Panel on Climate Change (1996), to calculate total GHG emissions as CO_2 equivalents. The total emissions were reduced by 38 percent to account for the leased portion of the building for which SSWD does not have operational control. GHG emissions related to combustion of natural gas at the Marconi Avenue administration building are provided in Table 13:

Table 13: GHG Emissions from Building Natural Gas Combustion

CO_2 Emissions (kg)	CH_4 Emissions (kg)	N_2O Emissions (kg)	Total Emissions (MT CO_2e)
20.3	0.002	0.00004	0.02

4.9.4.2 Diesel Backup Generators at Buildings

Emissions from combustion of diesel fuel include CO_2, CH_4, and N_2O. SSWD provided information for each generator including make, model, capacity in kilowatts, capacity in horsepower, and the actual number of hours each generator was operated during 2008.

Emissions factors for CO_2 and CH_4 from generator sets were retrieved from the South Coast Air Quality Management District (SCAQMD) Emissions Factors Model, (EMFAC 2007, version 2.3). No similar emissions factors were available from the Sacramento Metropolitan Air Quality Management District (SMAQMD).

Emissions factors for CO_2 and CH_4 emissions from generator sets were extrapolated to match the specific horsepower ratings for each of SSWD's generator sets, based on data from the SCAQMD Off-road Mobile Source Emission Factors (Scenario Years 2007 – 2025). Since SCAQMD provides emission factors for only selected horse power ratings it is necessary to use the provided data to estimate the emissions factor for non-specified equipment. Since emissions factors are not based on a linear relationship, for both CO_2 and CH_4, a line was fitted to the available SCAQMD data on horsepower versus emissions rate, using the data distribution with the highest coefficient of determination (R^2). The line of best fit was then used to estimate emissions from each generator set. Data distributions and corresponding R^2 values are presented in Table A-1 in Appendix A.

An N_2O emissions rate was not available from SCAQMD for diesel generator sets. Thus, the N_2O emissions rate was estimated based on an assumed ratio of N_2O emissions to CO_2 emissions for diesel fuel use. The ratio was determined based on California Climate Action Registry General Reporting Protocol v 3.1 (January 2009) (CCAR GRP) emissions factors from off-road vehicles/construction equipment, which reports CO_2 emissions of 10.15 kg CO_2/gal

(Table C.3 - transportation fuels), and N_2O emissions of 0.26 g N_2O /gal (Table C.6, non-highway vehicles). This ratio results in an N_2O emissions rate of 2.6 x 10^{-5} lb N_2O /lb CO_2.

These factors were multiplied by the hours operated for each generator set to estimate emissions in kilograms (kg) for each GHG. These quantities were multiplied by their respective global warming potential, as reported by the Intergovernmental Panel on Climate Change (1996), to calculate total GHG emissions as CO_2 equivalents. GHG emissions related to combustion of diesel fuel for the backup generators are provided in Table 14:

Table 14: GHG Emissions from Building Diesel Backup Generators

CO_2 Emissions (kg)	CH_4 Emissions (kg)	N_2O Emissions (kg)	Total Emissions (MT CO_2e)
3,519	0.4	0.1	3.5

4.9.4.3 Refrigerant Emissions at Buildings

Fugitive refrigerant-related emissions could potentially be emitted from operation of heating, ventilation, and air conditioning (HVAC) system when the refrigerant escapes. The amount of HVAC system refrigerant recharges was used to estimate the amount of fugitive refrigerant. SSWD stated that during 2008, no refrigerant recharges were necessary. Therefore, it is assumed that there were no significant refrigerant-related fugitive emissions associated with HVAC equipment at the administration and other buildings.

4.9.5 Capital Improvement Projects

Major capital improvement projects performed by the District during 2008 included main replacement projects and a meter retrofit project. GHG emissions related to these projects are from combustion of gasoline and diesel fuel by construction equipment. Combustion of fuels generates CO_2, CH_4, and N_2O emissions.

4.9.5.1 Main Replacement Projects

During 2008, approximately 6.3 miles of new pipelines were installed. Both construction contractors provided SSWD with an actual value for diesel fuel use, and estimated a value for gasoline use. Kennedy/Jenks Consultants assumed that approximately 50 percent of the diesel fuel was used in construction equipment, with the remaining 50 percent used in heavy duty trucks. The gasoline was assumed to be used in light duty trucks of model years 2005 or newer. Since the actual type of construction vehicles was unknown, general construction emission factors were obtained from Tables C.3, C.4, C.5, and C.6 of the CCAR General Reporting Protocol. These factors were multiplied by the total fuel used by the equipment to estimate the emissions of the greenhouse gases. These quantities were multiplied by their respective global warming potential, as reported by the Intergovernmental Panel on Climate Change (1996), to calculate total GHG emissions as CO_2 equivalents. GHG emissions related to the pipeline projects are provided in Table 15:

Table 15: GHG Emissions from Main Replacement Projects

Total pipeline installed (miles)	CO_2 Emissions (kg)	CH_4 Emissions (kg)	N_2O Emissions (kg)	Total Emissions (MT CO_2e)
6.3	155,497	83.2	62.5	177

4.9.5.2 Meter Retrofit Project

During 2008, approximately 1,000 new water meters were installed as part of SSWD's meter retrofit program, and approximately 400 additional meters were installed as part of the main replacement projects. The construction contractor provided SSWD with an actual value for diesel fuel use, and estimated a value for gasoline use. Kennedy/Jenks Consultants assumed that approximately 50 percent of the diesel fuel was used in construction equipment, with the remaining 50 percent used in heavy duty trucks. The gasoline was assumed to be used in light duty trucks of model years 2005 or newer. Since the actual type of construction vehicles was unknown, general construction emission factors were obtained from Tables C.3, C.4, C.5, and C.6 of the CCAR General Reporting Protocol. These factors were multiplied by the total fuel used by the equipment to estimate the emissions of the greenhouse gases. These quantities were multiplied by their respective global warming potential, as reported by the Intergovernmental Panel on Climate Change (1996), to calculate total GHG emissions as CO_2 equivalents. GHG emissions related to the meter installations are provided in Table 16:

Table 16: GHG Emissions from Meter Installations

Number of Meters Installed	CO_2 Emissions (kg)	CH_4 Emissions (kg)	N_2O Emissions (kg)	Total Emissions (MT CO_2e)
1,000	91,719	18.7	15.2	96.8

(Note: does not include the approximately 400 additional new water meters installed as part of SSWD's main replacement program)

4.9.6 De Minimis Equipment and Services

This category includes small sources of greenhouse gases, typically small handheld fuel-burning equipment. The total GHG emissions from all equipment must be less than 5 percent of SSWD's total emissions to be considered de minimis, and would not be required to be reported.

SSWD provided a list of equipment used by the District, including chainsaws and other equipment, the type of fuel used in the equipment, and an estimate of the number of hours the equipment was used during 2008. Kennedy/Jenks Consultants estimated the fuel consumption rate in gallons per hour for chainsaws based on a conversation with a Husqvarna representative on 23 September 2009. The Husqvarna representative stated that chainsaws typically run for approximately an hour on one tank of gasoline. The capacity of the tank is typically 1.4 pints. It was assumed that all chainsaws have the same fuel consumption rate. For other small equipment, Kennedy/Jenks Consultants assumed that a Honda engine, model GC190 represents a typical engine used for water pumps, rammers, weed eaters, and blowers. Engine specifications obtained from http://www.honda-engines.com/engines/gc190.htm indicates a fuel consumption of 1.37 quarts per hour. The fuel consumption data was multiplied by the hours of use during 2008 for each piece of equipment to estimate the fuel consumption.

This equipment was treated as stationary combustion sources, and emission factors for CO_2, CH_4, and N_2O were obtained from Tables C.7 and C.9 of the CCAR General Reporting Protocol.

This calculation also included emissions associated with uniform cleaning services. SSWD stated that the roundtrip distance for the uniform cleaning service is approximately 20 miles, and that pickup and delivery occurs once a week throughout the year. It was assumed that the mileage of the delivery van is approximately equal to the average of light duty gasoline-fueled trucks, 15 miles per gallon. It was further assumed that the van was of model year 2005 or newer. Emission factors for CO_2, CH_4, and N_2O were obtained from Tables C.3 and C.4 of the CCAR General Reporting Protocol.

These factors for the de minimis equipment and services were multiplied by the total fuel used by the vehicle or equipment to estimate the emissions of the GHG. These quantities were multiplied by their respective global warming potential, as reported by the Intergovernmental Panel on Climate Change (1996), to calculate total GHG emissions as CO_2 equivalents. GHG emissions related to de minimis equipment and services are provided in Table 17:

Table 17: GHG Emissions from De Minimis Equipment and Services

CO_2 Emissions (kg)	**CH_4 Emissions (kg)**	**N_2O Emissions (kg)**	**Total Emissions (MT CO_2e)**
4,099	0.57	0.05	4.1

4.10 Indirect Emissions

Indirect emissions related to SSWD's operations consist of electricity used to operate pumps located at wells and reservoir booster pump stations, electricity used to supply surface water to the District by the City of Sacramento and Placer County Water Agency/San Juan Water District, and electricity used by the administration and other buildings owned by SSWD.

4.10.1 Groundwater Supply Emissions and Reservoirs/Storage Tanks

Indirect emissions from groundwater supply operations result from electricity used to operate pumps located at the wells and booster pump stations. SSWD provided actual electricity consumption data in units of kilowatt-hours for each well and booster pump station equipped with an electric pump. The electricity is supplied to SSWD by the Sacramento Municipal Utility District (SMUD). SMUD's 2007 Annual Emissions Report was accessed from the Climate Registry's website on 8 June 2009. The website address for the report is: (https://www.climateregistry.org/CARROT/Public/Reports.ASPX. The 2007 report was the most recent report available from SMUD. In this report, SMUD reports an emission factor of 714.31 pounds of CO_2, per megawatt-hour of electricity delivered. SMUD did not report emission factors for CH_4, and N_2O for 2007.

SMUD's CO_2, emission factor was multiplied by the total electricity consumption for each pump to estimate the emissions of CO_2. GHG emissions related to electricity used by the pumps are provided in Table 18:

Table 18: GHG Emissions from Electric Pumps at Wells and Reservoir Booster Pump Stations

Category	CO_2 Emissions (kg)	Total Emissions (MT CO_2e)
Groundwater Supply – Wells	3,661,683	3,662
Reservoirs/Storage Tanks – Booster Pump Stations	156,990	157

4.10.2 Surface Water Supply Pumping

Some of SSWD's water is supplied by the City of Sacramento and by Placer County Water Agency (PCWA)/San Juan Water District. Electricity is used to convey water from these entities to SSWD. The City of Sacramento and PCWA are also supplied electricity by the Sacramento Municipal Utility District (SMUD). SSWD obtained data from each water provider, including water supplied to the District in acre-feet, total electricity used to deliver water by the provider, and the total water delivered by the provider. The City of Sacramento provided SSWD with consumption data for the period between July 1, 2007 and June 30, 2008. It was assumed that this value was representative of 2008 calendar year consumption. PCWA supplied consumption data for the period between July 1, 2008 and June 30, 2009. It was assumed that this value was representative of 2008 calendar year consumption for SSWD. It should be noted that PCWA's value does not include the electricity required to pump the water from Folsom Lake to San Juan Water District's treatment plant, therefore, the emissions related to water supplied by PCWA are underestimated.

For each water provider, the total electricity used by the provider to deliver water was divided by the total water delivered by the provider to calculate an energy consumption rate in units of kilowatt-hours per acre-feet. This rate was then multiplied by the number of acre-feet of water delivered to SSWD by each provider to estimate the total electricity used to obtain water from each provider. SMUD's 2007 CO_2 emission factor was multiplied by the total electricity consumption to estimate the emissions of CO_2 associated with water supplied by each provider. SMUD did not report emission factors for CH_4, and N_2O for 2007.

GHG credits were calculated for delivery contracts SSWD has with CalAM Water Company and Rio Linda Water District. In addition, surface water is passed through SSWD's system from PCWA to the Citrus Heights Water District. SSWD provided the water delivered or passed through for each of the contracts in acre-feet. The water supplied to CalAM and going to Citrus

Heights Water District is supplied by PCWA, as is a portion of the water supplied to Rio Linda Water District. The PCWA electricity consumption rate was used to estimate the total electricity consumption used for these contracts. This rate was multiplied by the total electricity consumption to estimate the emissions of CO_2 associated with water supplied for each contract. These GHG emissions are then applied as credits to SSWD's inventory.

GHG emissions and credits related to surface water supply pumping are provided in Table 19:

Table 19: GHG Emission Credits Associated with Surface Water Supply

Provider/Delivery Contract	CO_2 Emissions (kg)	Total Emissions (MT CO_2e)
City of Sacramento	289,621	290
PCWA	15,208	15
CalAM Water Company	(1,748)	(1.7)
Rio Linda Water District	(2.5)	(0.002)
Citrus Heights Water District	(60.1)	(0.1)

4.10.3 Administration and Other Buildings

Electricity is used at the District's four administration and/or operations buildings. SSWD provided actual electricity consumption data in units of kilowatt-hours for each building for the period from mid-December 2007 through mid-December 2008. It was assumed that this is representative of the 2008 calendar year. Two of the buildings are either fully or partially leased. SSWD provided the square footage of the building that is partially leased, and the square footage of the leased area. The electricity is supplied to SSWD by the Sacramento Municipal Utility District (SMUD).

SMUD's CO_2, emission factor was multiplied by the total electricity consumption for each building to estimate the emissions of CO_2. This was multiplied by the percentage of the building that is used for SSWD operations (62 percent). SMUD did not report emission factors for CH_4, and N_2O for 2007. GHG emissions related to electricity used by the buildings are provided in Table 20:

Table 20: GHG Emissions Associated with Administration and Other Buildings

CO_2 Emissions (kg)	Total Emissions (MT CO_2e)
176,114	176

4.11 Optional Indirect Emissions

Optional indirect emissions calculated for SSWD include emissions associated with employee commutes and use of personal vehicles for District business, and employee air travel. Solid waste and embodied emissions were beyond the scope of the contract and this report.

4.11.1 Employee Commuting and Personal Vehicle Use

SSWD provided estimates of each employee's mileage based on the distance they live from their office. Information as to the make, model, model year, fuel type used and miles per gallon for employee's vehicles were not available. It was assumed that on average employees drive a gasoline-fueled car of model year 2005 or newer, commute to work 264 days per year, and get an average of 20 miles per gallon. SSWD also provided miles traveled by employees and board members for District business in personal vehicles. The same assumptions were made regarding the vehicles used by board members.

The total miles traveled for employee commutes was multiplied by the vehicle mileage rate and the number of days worked for 2008 to obtain an estimate of the gallons of fuel used. Emissions factors for CO_2, CH_4, and N_2O were obtained from Tables C.3 and C.4 of the CCAR General Reporting Protocol. These factors were multiplied by the fuel consumption to estimate emissions of CO_2, CH_4, and N_2O associated with employee commuting and employee and board member personal vehicle use. These GHG emission estimates are provided in Table 21:

Table 21: GHG Emissions from Employee Commuting and Personal Vehicle Use

CO_2 Emissions (kg)	**CH_4 Emissions (kg)**	**N_2O Emissions (kg)**	**Total Emissions (MT CO_2e)**
175,046	292	157	230

4.11.2 Employee and Board Member Air Travel

SSWD provided miles flown by employees and board members for District business. To estimate emissions from air travel based on miles traveled, it was necessary to develop emission factors based on mileage. An estimate of energy intensity in units of MMBtu per passenger mile was obtained from the U.S. Department of Transportation, Bureau of Transportation Statistics, National Transportation Statistics (October 2008, 4-20). This can be located at: http://www.bts.gov/publications/national_transportation_statistics/#chapter_4. The carbon content of jet fuel was obtained from Table C.3 of the CCAR General Reporting Protocol. The carbon content was multiplied by the energy intensity, then multiplied by the molar mass ratio of CO_2 to C to create a CO_2 emission factor in units of kilograms of CO_2 per mile traveled. CH_4, and N_2O emission factors in units of grams per gallon of jet fuel were obtained from the Energy Information Administration from Appendix H of the instructions to Form EIA-1605, located at:

http://www.eia.doe.gov/oiaf/1605/excel/Fuel%20Emission%20Factors.xls. The energy intensity was divided by the product of the CH_4, or N_2O emission factor and the heat content of a gallon of jet fuel to obtain emission factors in units of kilograms per mile.

The emission factors were multiplied by the air miles traveled to estimate emissions of CO_2, CH_4, and N_2O associated with employee and board member air travel. These GHG emission estimates are provided in Table 22:

Table 22: GHG Emissions from Employee and Board Air Travel

CO_2 Emissions (kg)	**CH_4 Emissions (kg)**	**N_2O Emissions (kg)**	**Total Emissions (MT CO_2e)**
1,486	0.04	0.05	1.5

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Section 5: Data Deficiencies and Future Data Collection Recommendations

5.1 Refrigerant

For all operations that include HVAC equipment, records should be reviewed annually to estimate volume of refrigerant recharge necessary, and this data should be used to estimate emissions of fluorocarbons associated with this equipment. If possible, recharge data should be gathered for each HVAC system separately.

5.2 Groundwater Supply

For electricity emissions, in the future SMUD will be required to provide emission factors for methane and nitrous oxide. At present, emissions of these gases are not calculated, and are therefore not accounted for in SSWD's inventory.

Methane emissions from the air strippers were based on limited analytical data. Newer analytical data could be collected to refine this estimate. No data is available regarding methane concentration post treatment by the air stripper. To be conservative, it is assumed that all methane is removed by the process.

5.3 Reservoirs and Storage Tanks

For electricity emissions, in the future SMUD will be required to provide emission factors for methane and nitrous oxide. At present, emissions of these gases are not calculated, and are therefore not accounted for in SSWD's inventory.

5.4 Surface Water Supply Pumping

The data regarding the electricity use for water obtained from PCWA does not include the electricity required to pump the water from Folsom Lake to San Juan Water District's Water Treatment Plant, therefore underestimating the emissions related to obtaining water from this provider. Obtaining this information would provide for a more accurate accounting of the emissions associated with PCWA's water.

For the calculated credits associated with surface water supply, the SJWD electricity consumption rate was assumed to be applicable to the water delivered to Rio Linda/Elverta Community Water District (RLECWD). Therefore, it is possible that the calculated emissions are lower than actual emissions. As this is a credit calculation, using the SJWD rate is conservative, and since the delivery contract to RLECWD is for a relatively small amount of water, it is assumed that more accurate data would not significantly impact the total GHG emissions for the District.

5.5 Fleet Vehicles

It is preferable to estimate emissions based on actual miles driven and mileage of the vehicle. Some of the dump trucks did not have this data available. Collection of this data in the future will result in more accurate estimates of emissions from these vehicles.

For backhoes, air compressors, and other fuel-burning equipment, better estimates could be made if either horsepower information was obtained, or if actual fuel usage could be tracked. For the mini excavators, it would also provide for a better estimate of emissions if actual fuel use could be tracked. South Coast emission factors used for the emission estimates are based on excavators of 25 horsepower or greater, so it is possible that the emissions calculated using these factors overestimate the emissions from the excavators.

5.6 Employee Commuting

Employee commute data is based on several assumptions about vehicle type that is applied to all employee vehicles. To refine these estimates, more detailed data should be collected to more accurately reflect the types of vehicles used by employees and board members.

5.7 Administration and Other Buildings

For electricity emissions, in the future SMUD will be required to provide emission factors for methane and nitrous oxide. At present, emissions of these gases are not calculated, and are therefore not accounted for in SSWD's inventory.

5.8 Capital Improvement Projects

For both main replacement projects and meter retrofit projects, gasoline usage was estimated. In addition, no specific information was available regarding the type, age, miles traveled, or mileage of the actual vehicles used on the projects. Obtaining this information, as well as actual gasoline usage, would provide for a more accurate representation of emissions from these projects.

5.9 De Minimis Equipment and Services

For small fuel-burning tools and equipment, actual fuel consumption data may provide a better estimate of emissions from this equipment. The assumption was made that all fuel-burning equipment had the same consumption rate, which introduces a degree of inaccuracy in the emission estimates.

Additionally, specific information regarding the delivery truck used by the uniform cleaning service would provide a better estimate of emissions related to this activity.

However, because these equipment and services are such a small portion of SSWD's inventory (thus they are de minimis or less than 5 percent of the total) it probably does not make sense to spend much time refining this data.

References

California Climate Action Registry. 2008. General Reporting Protocol, Version 3.0.

California Climate Action Registry. 2009. General Reporting Protocol, Version 3.1.

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SSWD Carbon Calculator, Version 1
Created in July 2009 by Kennedy/Jenks Consultants

INTRODUCTION

This calculator was created as part of SSWD's 2008 greenhouse gas inventory to assist the organization to conduct future inventories internally. This calculator is designed to capture the major greenhouse gas emission sources and relative impacts of SSWD's operations.

Summaries and Worksheets: The sheet named "Summary-GHG Emissions" provides a breakdown of greenhouse gas emissions by category, i.e. emissions from groundwater supply operations, emissions of reservoirs, etc. Nine of the tabs provide the calculations of greenhouse gas emissions for each category. The remaining tabs are described below.

Employee Commute Data, Wells by Service Area: The Employee Commute Data tab provides the breakdown of data by employee. The aggregate of these data is used on the Employee Commute calculation tab. The Wells by Service Area tab provides of a list of the district wells

Emission Factors, OffRoad EFs: The emissions factors and offroad EFs tabs provide the emission factors (EF) used to calculate emissions resulting from each source category. The sources for the emission factors are provided on these tabs. The emission factors tab also provides unit conversion factors.

Constants: The global warming potential (GWP) tab includes constants used in emission calculations that are common to all groups.

SPREADSHEET COLOR LEGEND
Colors are used throughout the spreadsheet to indicate the function of individual cells. The color legend is as follows.

Input box:
Calculated cell:

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**The tab titles are interactive and will take you to the tab with their namesake. Once at the desired tab it is possible to return to this tab by clicking the "Back to Intro&TOC" button in each tab.

Tab Name	Description
Intro&TOC	The table of contents provides an introduction to the SSWD Carbon Calculator.
Summary-GHG Emissions	The greenhouse gas summary provides a table and graph of emissions totals by source category and by scope category as well as graphs of emissions by fuel type.
Groundwater Supply Emissions	Use the groundwater supply emissions tab to input electrical and natural gas consumption for the pumps, as well as data regarding diesel and propane standby power. Information regarding the air strippers is also entered on this tab. This tab will then calculate carbon dioxide equivalent emissions associated with groundwater supply operations.
Reservoirs_Surface Tanks	This tab is used to calculate the emissions from electric pumps located at the booster pump stations, as well as emissions from diesel and propane standby power used at the reservoirs.
Surface Water Supply Pumping	The electricity-related emissions associated with water supply are calculated on this tab. Additionally, credits for delivery contracts are also estimated on this tab.
Fleet	Use the ground travel fleet tab to input gallons of fuel or vehicle miles traveled for the SSWD owned fleet. This tab will then calculate the carbon dioxide equivalent emissions from SSWD's ground fleet.
Employee Commute	This tab provides a summary of emissions related to employee commuting and use of personal vehicles for business.
Employee Air Travel	This tab provides a summary of emissions related to employee and board member air travel.
Admin Bldgs	This tab contains the emission factors associated with purchased electricity from the local utility and natural gas. These factors should be reviewed annually and updated when appropriate.
CIP	Use the CIP tab to input information about construction projects such as pipeline projects or meter installations. This tab will then calculate the carbon dioxide equivalent emissions from SSWD's CIP.
De Minimus	Use the De Minimus tab to input information regarding small fuel-burning equipment such as saws, weed eaters, etc.
Employee Commute Data	Use this tab to estimate miles traveled and gallons of fuel used related to employee commuting and personal vehicle use for business. Totals calculated on this page are pulled into the "Employee Commute" tab for use in the calculations.
Emission Factors	This tab contains the emission factors used in this workbook. Sources for the factors are noted on this sheet.
OffRoad Efs	This tab contains the emission factors from the South Coast Air Quality Management District (SCAQMD) Emissions Factors Model, (EMFAC 2007, version 2.3), which are used to calculation emissions for much of the construction equipment, e.g. backhoes or generator sets.
GWP	This tab contains the global warming potential of various greenhouse gases as specified by the Intergovernmental Panel on Climate Change (IPCC) 2nd Assessment Report, which are the values internationally recognized by the Kyoto Protocol.
Wells by Service Area	This provides a list of the wells organized by Service area.

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SSWD 2008 GHG Inventory Emissions Summary

	Greenhouse Gas Emissions				Data for Graphs & Charts	
	MT CO_2	MT CH_4	MT N_2O	MT CO_2e		
Emissions by Sources					**Data Label**	**% of Total**
Natural Gas Emissions (Scope I)	0.02	0.000002	0.00000005	0.02	Natural Gas	0.0004%
Fuel Emissions -- Diesel (Scope I)	371.84	0.06	0.05	387.96	Diesel	7.2%
Fuel Emissions -- Gasoline (Scope I)	302.69	0.06	0.04	316.36	Fleet Gasoline	5.9%
Fuel Emissions -- Gasoline (Scope III) *(employee commute)*	175.05	0.29	0.16	229.84	Employee Gasoline	4.3%
Fuel Emissions -- Jet Fuel (Scope III)	1.49	0.000	0.000	1.50	Jet Fuel	0.03%
Fuel Emissions -- Propane/LPG (Scope I)	24.89	0.004	0.0004	25.11	Propane/LPG	0.5%
Refrigerant Emissions (Scope I)	0.00	0.00	0.00	0.00	Refrigerant	0.0%
Other Direct Emissions (Scope I)	0.00	5.71	0.00	119.81	Other Direct	2.2%
Electricity Emissions (Scope II)	4,297.80	0.00	0.00	4297.80	Electricity	79.9%
Emissions by Scope					**Data Label**	**% of Total**
Scope I - Direct	699.44	5.83	0.09	849.27	849	16%
Scope II - Indirect	4,297.80	0.00	0.00	4,297.80	4,298	80%
Scope III - Optional Indirect	176.53	0.29	0.16	231.34	231	4%

	Greenhouse Gas Emissions				Data for Graphs & Charts	
	MT CO_2	MT CH_4	MT N_2O	MT CO_2e		
Emissions by Category					**Data Label**	**MT CO_2e**
Groundwater Supply Emissions	3681.55	5.71	0.000	3801.43	Employee Air Travel Emissions	2
Reservoirs & Tanks Emissions	177.68	0.003	0.000	177.85	De Minimis Emissions	4
Surface Water Supply Pumping Emissions	303.02	0.000	0.000	303.02	Reservoirs & Tanks Emissions	178
Fleet Emissions	404.02	0.013	0.011	407.57	Admin. Building Emissions	180
Employee Commute/Personal Vehicle Use Emissions	175.05	0.29	0.16	229.84	Employee Commute/Personal Vehicle Use Emissions	230
Employee Air Travel Emissions	1.49	0.000	0.000	1.50	CIP Emissions	273
Admin. And Other Building Emissions	179.65	0.000	0.000	179.66	Surface Water Supply Pumping Emissions	303
CIP Emissions	247.22	0.102	0.078	273.42	Fleet Emissions	408
De Minimis Emissions	4.10	0.001	0.000	4.13	Groundwater Supply Emissions	3,801

Total by Category:	**5174**	**6.1**	**0.2**	**5378**
Total by Scope:	**5174**	**6.1**	**0.2**	**5378**
Total by Sources:	**5174**	**6.1**	**0.2**	**5378**

Breakdown of Electricity Uses		
Electricity Uses	**MT CO2e**	**% of Total**
Electric Well Pumps	3,662	85%
Electric Reservoir Booster Pumps	157	4%
Admin and Other Buildings	176	4%
Surface Water Supply System Pumping	303	7%
TOTAL	**4,298**	**100%**

2008 SSWD Data

A. This tab estimates the emissions from wells from use of electricity, natural gas, and fuel for emergency generators

Total Groundwater Supply Emissions

CO_2 emissions (kg):	3,681,550.93
Methane emissions (kg):	5,707.55
N_2O emissions (kg):	0.06
Emissions (MT CO_2e):	3,801.43
Electricity Emissions (MT CO_2e):	3,661.68
Nat. Gas Emissions (MT CO_2e):	0.004
Fuel Emissions- Diesel (MT CO_2e):	16.49
Fuel Emissions- Propane (MT CO_2e):	3.4442
Other Emissions (MT CO_2e):	119.81

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1. Electric Pumps (may include onsite buildings and other equipment)

Well Location/Meter ID	Total Consumption (kWh)	Total Consumption (MWh)	CO_2 emissions (kg)	Methane emissions (kg)	N_2O emissions (kg)	Emissions (kg CO_2e)	Emissions (MT CO_2e)
2A	69,880	69.88	22,641.51	0.000	0.000	22,641.51	22.64
3A	1,886	1.886	611.07	0.000	0.000	611.07	0.61
4B	1,154,000	1154	373,902.42	0.000	0.000	373,902.42	373.90
5	1,035	1.035	335.35	0.000	0.000	335.35	0.34
7	304	0.304	98.50	0.000	0.000	98.50	0.10
9	1,055	1.055	341.83	0.000	0.000	341.83	0.34
12	3,200	3.2	1,036.82	0.000	0.000	1,036.82	1.04
13	247	0.247	80.03	0.000	0.000	80.03	0.08
14	4,056	4.056	1,314.17	0.000	0.000	1,314.17	1.31
18	4,095	4.095	1,326.80	0.000	0.000	1,326.80	1.33

19	94,868	94.868	30,737.76	0.000	0.000	30,737.76	30.74
20A	210,210	210.21	68,109.21	0.000	0.000	68,109.21	68.11
22	28,949	28.949	9,379.64	0.000	0.000	9,379.64	9.38
23	723	0.723	234.26	0.000	0.000	234.26	0.23
24	9,360	9.36	3,032.69	0.000	0.000	3,032.69	3.03
25	8,190	8.19	2,653.61	0.000	0.000	2,653.61	2.65
26	31,080	31.08	10,070.09	0.000	0.000	10,070.09	10.07
27	860	0.86	278.64	0.000	0.000	278.64	0.28
28	7,181	7.181	2,326.68	0.000	0.000	2,326.68	2.33
30	5,573	5.573	1,805.68	0.000	0.000	1,805.68	1.81
31A	14,820	14.82	4,801.76	0.000	0.000	4,801.76	4.80
32A	906,960	906.96	293,860.09	0.000	0.000	293,860.09	293.86
33A	610,400	610.4	197,773.00	0.000	0.000	197,773.00	197.77
34	4,860	4.86	1,574.67	0.000	0.000	1,574.67	1.57
35	181,793	181.793	58,901.94	0.000	0.000	58,901.94	58.90
37	11,279	11.279	3,654.46	0.000	0.000	3,654.46	3.65
38	123	0.123	39.85	0.000	0.000	39.85	0.04
39	487	0.487	157.79	0.000	0.000	157.79	0.16
40	26,883	26.883	8,710.24	0.000	0.000	8,710.24	8.71
40A	225,840	225.84	73,173.42	0.000	0.000	73,173.42	73.17
41	107,724	107.724	34,903.18	0.000	0.000	34,903.18	34.90
42	121	0.121	39.20	0.000	0.000	39.20	0.04
43	1,710	1.71	554.05	0.000	0.000	554.05	0.55
44	0	0	0.00	0.000	0.000	0.00	0.00
45	100	0.1	32.40	0.000	0.000	32.40	0.03
46	5,661	5.661	1,834.20	0.000	0.000	1,834.20	1.83
47	209,684	209.684	67,938.78	0.000	0.000	67,938.78	67.94
50	1,948	1.948	631.16	0.000	0.000	631.16	0.63
51	220	0.22	71.28	0.000	0.000	71.28	0.07
52	84,240	84.24	27,294.23	0.000	0.000	27,294.23	27.29
55A	86,580	86.58	28,052.40	0.000	0.000	28,052.40	28.05
56A	510,480	510.48	165,398.36	0.000	0.000	165,398.36	165.40
58	2,891	2.891	936.70	0.000	0.000	936.70	0.94

59A	315,720	315.72	102,295.04	0.000	0.000	102,295.04	102.30
60	115,176	115.176	37,317.67	0.000	0.000	37,317.67	37.32
64	7,840	7.84	2,540.20	0.000	0.000	2,540.20	2.54
65	116,858	116.858	37,862.64	0.000	0.000	37,862.64	37.86
66	534,360	534.36	173,135.61	0.000	0.000	173,135.61	173.14
68	5,760	5.76	1,866.27	0.000	0.000	1,866.27	1.87
69R	300	0.3	97.20	0.000	0.000	97.20	0.10
70	1,227	1.227	397.55	0.000	0.000	397.55	0.40
71	833,820	833.82	270,162.32	0.000	0.000	270,162.32	270.16
72/73/74	1,033,680	1033.68	334,918.07	0.000	0.000	334,918.07	334.92
75	190,480	190.48	61,716.58	0.000	0.000	61,716.58	61.72
76	1,989	1.989	644.45	0.000	0.000	644.45	0.64
77	500	0.5	162.00	0.000	0.000	162.00	0.16
MC-C1	12,600	12.6	4,082.47	0.000	0.000	4,082.47	4.08
MC-C2	2,520	2.52	816.49	0.000	0.000	816.49	0.82
MC-C3	984	0.984	318.82	0.000	0.000	318.82	0.32
MC10	9,760	9.76	3,162.29	0.000	0.000	3,162.29	3.16
N1	600	0.6	194.40	0.000	0.000	194.40	0.19
N3	932,460	932.46	302,122.23	0.000	0.000	302,122.23	302.12
N5	172,860	172.86	56,007.60	0.000	0.000	56,007.60	56.01
N6	2,280	2.28	738.73	0.000	0.000	738.73	0.74
N7	264,527	264.527	85,708.22	0.000	0.000	85,708.22	85.71
N8	57,880	57.88	18,753.44	0.000	0.000	18,753.44	18.75
N9	4,600	4.6	1,490.43	0.000	0.000	1,490.43	1.49
N10	417,960	417.96	135,421.37	0.000	0.000	135,421.37	135.42
N12	65,760	65.76	21,306.61	0.000	0.000	21,306.61	21.31
N14	840	0.84	272.16	0.000	0.000	272.16	0.27
N15	22,920	22.92	7,426.21	0.000	0.000	7,426.21	7.43
N17	761	0.761	246.57	0.000	0.000	246.57	0.25
N20	18,960	18.96	6,143.15	0.000	0.000	6,143.15	6.14
N22	360	0.36	116.64	0.000	0.000	116.64	0.12
N23	1,500	1.5	486.01	0.000	0.000	486.01	0.49
N24	5,460	5.46	1,769.07	0.000	0.000	1,769.07	1.77

N25	21,600	21.6	6,998.52	0.000	0.000	6,998.52	7.00
N26	112,920	112.92	36,586.71	0.000	0.000	36,586.71	36.59
N27	960	0.96	311.05	0.000	0.000	311.05	0.31
N29	18,000	18	5,832.10	0.000	0.000	5,832.10	5.83
N30	5,940	5.94	1,924.59	0.000	0.000	1,924.59	1.92
N31	466,200	466.2	151,051.39	0.000	0.000	151,051.39	151.05
N32A/N32B/N32C	669,720	669.72	216,993.01	0.000	0.000	216,993.01	216.99
N33	129,780	129.78	42,049.44	0.000	0.000	42,049.44	42.05
N34	67,260	67.26	21,792.61	0.000	0.000	21,792.61	21.79
N35	24,060	24.06	7,795.57	0.000	0.000	7,795.57	7.80
	Total:		**3,661,683.45**	**0.00**	**0.00**	**3,661,683.45**	**3,661.68**

2. Natural Gas Engines

Well Location/Meter ID	Total Consumption (scf)	Total Consumption (MMBtu)	CO_2 emissions (kg)	Methane emissions (kg)	N_2O emissions (kg)	Emissions (kg CO_2e)	Emissions (MT CO_2e)
37	4	0.0041	0.218	2.06E-05	4.12E-07	0.22	0.0002
38	N/A						
39	8	0.0082	0.437	4.12E-05	8.23E-07	0.44	0.0004
40	45	0.0463	2.457	2.32E-04	4.63E-06	2.46	0.0025
41	0	0.0000	0.000	0.00E+00	0.00E+00	0.00	0.0000
42	0	0.0000	0.000	0.00E+00	0.00E+00	0.00	0.0000
43	1	0.0010	0.055	5.15E-06	1.03E-07	0.05	0.0001
44	0	0.0000	0.000	0.00E+00	0.00E+00	0.00	0.0000
45	7	0.0072	0.382	3.60E-05	7.20E-07	0.38	0.0004
46	2	0.0021	0.109	1.03E-05	2.06E-07	0.11	0.0001
47	0	0.0000	0.000	0.00E+00	0.00E+00	0.00	0.0000
N20	1	0.0010	0.055	5.15E-06	1.03E-07	0.05	0.0001
	Total:		**3.713**	**0.00035**	**0.00001**	**3.722**	**0.004**

3. Diesel Standby Power

Emissions are calculated based on capacity in horsepower, and the annual hours operated.

Well Location/ Genset ID	Make	Model	Capacity (kW)	Capacity (HP)	Consumption (gallons)	Hours Operated	CO_2 emissions (kg)	Methane emissions (kg)	N_2O emissions (kg)	Emissions (kg CO_2e)	Emissions (MT CO_2e)
4B	Cummins	6BT5.9 M	320	519	N/A	10	1075.01	0.11	0.03	1,077.41	1.0774
31A	Caterpillar	3306	205	337	N/A	26.5	2043.20	0.23	0.05	2,048.11	2.0481
32A	Caterpillar	3406DI TA	320	519	N/A	7	752.51	0.08	0.02	754.19	0.7542
33A	Caterpillar	3406	320	519	N/A	8.8	946.01	0.10	0.02	948.12	0.9481
40A	Caterpillar	3406	320	519	N/A	12.7	1365.26	0.15	0.03	1,368.31	1.3683
55A	Caterpillar	3406C DITA	320	475	N/A	9.9	994.11	0.11	0.03	996.36	0.9964
56A	Caterpillar	3406	320	519	N/A	38.1	4095.78	0.44	0.10	4,104.92	4.1049
59A	Caterpillar	3406	320	519	N/A	0	0.00	0.00	0.00	0.00	0.0000
66	Caterpillar	3306	205	316	N/A	1.2	88.05	0.01	0.00	88.27	0.0883
71	Caterpillar	3406	320	475	N/A	10.8	1084.48	0.12	0.03	1,086.94	1.0869
72	Caterpillar	3406	320	519	N/A	5.7	612.75	0.07	0.02	614.12	0.6141
75	Caterpillar	3406	320	519	N/A	7.8	838.51	0.09	0.02	840.38	0.8404
MC-C1	Cummins	6BT5.9 M	N/A	134	N/A	2.9	109.95	0.01	0.00	110.26	0.1103
MC-C2	Cummins	6BT5.9 M	N/A	165	N/A	3.1	137.95	0.02	0.00	138.32	0.1383
N3 - (Port 3)	Komatsu	SA6D1 08E	225	217	N/A	2.1	115.38	0.01	0.00	115.68	0.1157
N5 - (Port 6)	Komatsu	SA6D1 08E	236	273	N/A	1.35	88.51	0.01	0.00	88.73	0.0887
N10	Cummins	6CTA8. 3-G	150	277	N/A	7.7	510.52	0.06	0.01	511.79	0.5118
N14 - (Port 1)	Komatsu	SA6D1 25E	300	345	N/A	15.35	1205.08	0.14	0.03	1,207.96	1.2080
N15 - (Port 4)	Komatsu	SA6D1 08E	225	217	N/A	0.2	10.99	0.00	0.00	11.02	0.0110
N31 -	Komatsu	SA6D1	188	188	N/A	3.2	157.44	0.02	0.00	157.86	0.1579

(Port 5)		25E									
N34 - (Port 2)	Komatsu	SA6D1 25E	300	345	N/A	2.79	219.03	0.02	0.01	219.56	0.2196
						Total:	**16450.51**	**1.80**	**0.42**	**16488.30**	**16.49**

Propane Standby Power

Well Location/ Genset ID	Make	Model	Capacity (kW)	Capacity (HP)	Consumption (cf/hr)	Hours Operated	Consumption (cf)	Consumption (gallons)	CO_2 emissions (kg)	Methane emissions (kg)	N_2O emissions (kg)	Emissions (kg CO_2e)	Emissions (MT CO_2e)
N32	Cummins	GTA28	480	738	5850	3.7	21645	595	3413.25	0.59	0.06	3,444.17	3.4442

4. Air Strippers

Well Location/ Equipment ID	Pre-treatment Methane Concentration (mg/l)	Post-treatment Methane Concentration (mg/l)[1]	Million gallons processed per year	Methane emissions (kg/yr)	Emissions (kg CO_2e)	Emissions (MT CO_2e)
Enterprise/Northrop Well (#75)	8	0	52.198	1580.56	33191.66	33.19
Eden/Root Well (#32A)	2.2	0	495.328	4124.60	86616.52	86.62
			Total:	**5705.15**	**119808.19**	**119.81**

5. HVAC Servicing and Recharge

Building Name	Equipment Serviced (HVAC Unit #)	Pounds Gas Recharge	Service Interval (Years)	Gas Used

No system refrigerant recharges in 2008

Notes:
1. At Enterprise Well, one analytical result for methane from 2002 was available and was assumed to represent average concentration.
At Eden Well, 5 analytical results for samples collected during 2003 and 2004 were available, and the average of the 5 results was assumed to represent average concentration at this location. It is assumed that all methane is removed by the air stripper and vented to the atmosphere.

2008 SSWD Data

B. Reservoirs/Storage Tanks

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Total Reservoirs/Storage Tanks Emissions

CO_2 emissions (kg):	177,684.92
Methane emissions (kg):	3.37
N_2O emissions (kg):	0.31
Emissions (MT CO_2e):	177.85
Electricity Emissions (MT CO_2e):	157
Nat. Gas Emissions (MT CO_2e):	
Fuel Emissions- Diesel (MT CO_2e):	3.17
Fuel Emissions- Propane (MT CO_2e):	17.69

1. Electric Pumps

Booster Pump Station Location/Meter ID	Consumption (kWh)	Total Consumption (MWh)	CO_2 emissions (kg)	Methane emissions (kg)	N_2O emissions (kg)	Emissions (kg CO_2e)	Emissions (MT CO_2e)
Antelope Reservoir	135,120	135.12	43,779.63	0.000	0.000	43780	44
Enterprise/Northrop Reservoir	294,240	294.24	95,335.40	0.000	0.000	95335	95
Walnut Elevated Tank							0
Watt/Elkhorn Reservoir	44,560	44.56	14,437.69	0.000	0.000	14438	14
McClellan BP #1A & 1B	7,440	7.44	2,410.60	0.000	0.000	2411	2
McClellan BP #2	3,168	3.168	1,026.45	0.000	0.000	1026	1
		Total:	**156,989.77**	**0.00**	**0.00**	**156990**	**157**

2. Diesel Standby Power

Emissions are calculated based on capacity in horsepower, and the annual hours operated.

Booster Pump Station Location/Genset ID	Make	Model	Capacity (kW)	Capacity (HP)	Consumption (gallons)	Hours Operated	CO_2 emissions (kg)	Methane emissions (kg)	N_2O emissions (kg)	Emissions (kg CO_2e)	Emissions (MT CO_2e)
Enterprise / Northrop Reservoir	Detroit	D750F RX4	N/A	1119	N/A	9.9	1922.50	0.18	0.05	1,926.26	1.93
Watt / Elkhorn Reservoir	Caterpillar	3406	320	475	N/A	12.4	1245.15	0.13	0.03	1,247.97	1.25
						Total:	**3167.65**	**0.31**	**0.08**	**3174.23**	**3.17**

3. Propane Standby Power

(If emission rates are available, i.e. from air permitting, that is preferable, otherwise provide consumption data)

Booster Pump Station Location/Genset ID	Make	Model	Capacity (kW)	Capacity (HP)	Consumption (cf/hr)	Hours Operated	Consumption (cf)	Consumption (gallons)	CO_2 emissions (kg)	Methane emissions (kg)	N_2O emissions (kg)	Emissions (kg CO_2e)	Emissions (MT CO_2e)
Antelope Reservoir	Cummins	GTA28	500	738	5850	19	111150	3054	17527.50	3.05	0.31	17,686.29	17.69

4. HVAC Servicing and Recharge

Building Name	Equipment Serviced (HVAC Unit #)	Pounds Gas Recharge	Service Interval (Years)	Gas Used

No system refrigerant recharges in 2008

2008 SSWD Data

C. Surface Water Supply Pumping

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Total Surface Water Supply Emissions

CO_2 emissions (kg):	303,016.81
Methane emissions (kg):	0.000
N_2O emissions (kg):	0.000
Emissions (MT CO_2e):	303
Electricity Emissions (MT CO_2e):	303

1. City of Sacramento

If Sacramento has a GHG inventory, provide data for metric tons of CO2 per delivered acre-feet:
Otherwise, provide the following information:

Water supplied by City of Sacramento to District (acre-feet)	Total electricity to deliver water by City of Sacramento Fairbaim WTP (kWh)	Total water delivered by City of Sacramento (MG)	Electricity provider	Electricity to deliver water prior to District Pumps (kWh/acre-foot)	Total Consu mption (MWh)	CO_2 emissions (kg)	Methane emissions (kg)	N_2O emissions (kg)	Emissions (kg CO_2e)	Emissions (MT CO_2e)
2743	19166363	19158	SMUD	325.88	893.88	289,620.60	0.000	0.000	289621	290

* City of Sacramento supplied consumption data for July 1, 2007 - June 30, 2008. Assume this is representative of 2008 calendar year consumption.

2. Placer County WA/San Juan Water District

If Placer County Water Agency and San Juan Water District have a GHG inventory, provide data for metric tons of CO2 per delivered acre feet:

Otherwise, provide the following information:

Water supplied by PCWA/SJWD (acre-feet)	Total electricity to deliver water by San Juan WTP (kWh)	Total water delivered by San Juan WTP (MG)	Electricity provider	Electricity to deliver water prior to District Pumps (kWh/acre-foot)	Total Consumption (MWh)	CO_2 emissions (kg)	Methane emissions (kg)	N_2O emissions (kg)	Emissions (kg CO_2e)	Emissions (MT CO_2e)
12239	682880	58001	SMUD	3.84	46.94	15,207.89	0.000	0.000	15208	15

* San Juan Water District supplied consumption data for July 1, 2008 - June 30, 2009. Assume this is representative of 2008 calendar year consumption. Does not include power required to pump the water from Folsom Lake to the WTP (could not be provided by San Juan)

3. Delivery Contracts (GHG Credits)

Customer	Water delivered (acre feet)	Electricity to deliver water prior to District Pumps (kWh/acre-foot)	Total Consumption (MWh)	CO_2 emissions (kg)	Methane emissions (kg)	N_2O emissions (kg)	Emissions (kg CO_2e)	Emissions (MT CO_2e)
CalAM Water Company	1407	3.84	5.40	1,748.30	0.000	0.000	1748	1.7
Rio Linda Water District	2	3.84	0.01	2.49	0.000	0.000	2	0.002
Citrus Heights Water District*	49	3.84	0.19	60.89	0.000	0.000	61	0.061
County of Sacramento	0		0.00	0.00	0.000	0.000	0	0.000
		Total:		**1,811.68**	**0.00**	**0.00**	**1,811.68**	**1.81**

* In 2008, 49 acre-feet of CHWD's surface water (from PCWA) was wheeled through the District's pipelines.
SSWD 2008 Total Production 12,544 MG.
CalAm Water 100% supplied from PCWA. Electricity rate (kWh/acre-foot) from PCWA (above) used in calculation.

2008 SSWD Data

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For Fuel type, Enter "Gas", "Diesel", or LPG
For Model Year, enter a 4-digit year

D. Fleet

Total Fleet Emissions

CO_2 emissions (kg):	404020.36
Methane emissions (kg):	13.41
N_2O emissions (kg):	10.54
Emissions (MT CO_2e):	407.57
Fuel Emissions- Diesel (MT CO_2e):	140.40
Fuel Emissions- Gas (MT CO_2e):	263.18
Fuel Emissions- LPG (MT CO_2e)	3.98

1. Pool cars

Make	Model	Model Year	Fuel type	Miles driven	MPG	Estimated Fuel Consumption (gallons)	CO_2 emissions (kg)	Methane emissions (kg)	N_2O emissions (kg)	Emissions (kg CO_2e)	Emissions (MT CO_2e)
Ford	Explorer XLS	2005	Gas	4541	12.38	366.80	3231.52	0.07	0.04	3244.04	3.24
Ford	Explorer XL	2000	Gas	2794	16.85	165.82	1460.84	0.05	0.08	1485.53	1.49
					Total:		**4692.36**	**0.12**	**0.11**	**4729.57**	**4.73**

2. Pick-up Trucks

Make	Model	Model Year	Fuel type	Miles driven	MPG	Estimated Fuel Consumption (gallons)	CO_2 emissions (kg)	Methane emissions (kg)	N_2O emissions (kg)	Emissions (kg CO_2e)	Emissions (MT CO_2e)
Light Duty Trucks (<5750 GVW)											
Toyota	Tacoma 2.4L 4Cyl	2000	Gas	6,279	15.78	397.91	3505.58	0.22	0.39	3631.02	3.63
Toyota	Tacoma 3.4L 6Cyl	2000	Gas	12,818	14.48	885.22	7798.80	0.44	0.80	8054.87	8.05
Toyota	Tacoma 2.4L 4Cyl	2001	Gas	4,093	17.96	227.90	2007.76	0.06	0.07	2029.86	2.03
Toyota	Tacoma 2.4L 4Cyl	2001	Gas	6,281	19.62	320.13	2820.37	0.09	0.10	2854.29	2.85
Toyota	Tacoma 2.4L 4Cyl	2002	Gas	1,131	15.22	74.31	654.67	0.02	0.03	663.09	0.66
Toyota	Tacoma 2.4L 4Cyl	2002	Gas	4,511	14.95	301.74	2658.32	0.08	0.10	2691.89	2.69
Toyota	Tacoma 2.4L 4Cyl	2002	Gas	7,717	15.51	497.55	4383.42	0.14	0.18	4440.84	4.44
Ford	Ranger 4L 6Cyl	2000	Gas	1,513	13.09	115.58	1018.30	0.05	0.09	1048.52	1.05
Ford	Ranger 3.0L V6	1999	Gas	9,158	16.22	564.61	4974.23	0.29	0.52	5140.52	5.14
Ford	Ranger 4L 6CyL	2000	Gas	8,579	13.53	634.07	5586.18	0.30	0.53	5757.57	5.76
Ford	Ranger 3.0L V6	2000	Gas	5,930	13.33	444.86	3919.23	0.21	0.37	4037.69	4.04
Toyota	Tacoma 2.4L 4Cyl	2002	Gas	6,881	12.80	537.58	4736.06	0.12	0.16	4787.27	4.79
Heavy Duty Trucks (>5750 GVW)											

Ford	F-350 5.4L V8	2005	Gas	7,948	8.22	966.91	8518.48	0.26	0.14	8567.53	8.57
Toyota	Tundra 4.7L V8	2001	Gas	7,769	13.64	569.57	5017.95	0.41	0.96	5324.00	5.32
Ford	F-150 4.6L V8	2004	Gas	7,416	10.58	700.95	6175.33	0.25	0.21	6246.16	6.25
Ford	F-150 4.6L V8	2005	Gas	12,241	9.82	1246.54	10982.00	0.40	0.22	11057.54	11.06
Ford	F-250 5.4L V8	2005	Gas	10,013	8.73	1146.96	10104.76	0.33	0.18	10166.55	10.17
Ford	F-150 4.6L V8	2004	Gas	5,264	9.58	549.48	4840.90	0.18	0.15	4891.18	4.89
Ford	F-350 6.8L V10	1999	Gas	478	9.00	53.11	467.91	0.03	0.07	489.75	0.49
Toyota	Tundra 4.7 V8	2002	Gas	13,227	13.55	976.16	8599.99	0.72	1.73	9151.07	9.15
Toyota	Tundra 4.7L V8	2002	Gas	7,629	13.87	550.04	4845.82	0.42	1.00	5163.67	5.16
Ford	F-250 5.4L V8	2006	Gas	11,258	6.78	1660.47	14628.76	0.37	0.20	14698.24	14.70
Ford	F-150 4.6L V8	2007	Gas	8,957	10.57	847.40	7465.58	0.29	0.16	7520.86	7.52
Ford	F-150 4.6L V8	2007	Gas	10,425	7.37	1414.52	12461.91	0.34	0.18	12526.25	12.53
Ford	F-250 5.4L V8	2006	Gas	10,617	7.51	1413.72	12454.83	0.35	0.19	12520.35	12.52
Ford	F-250 5.4L V8	2006	Gas	14,194	8.54	1662.06	14642.76	0.46	0.25	14730.36	14.73
Ford	F-250 5.4L V8	2006	Gas	7,806	5.88	1327.55	11695.72	0.25	0.14	11743.90	11.74
Ford	F-250 5.4L V8	2008	Gas	6,867	12.38	554.68	4886.77	0.22	0.12	4929.16	4.93
Ford	F-250 5.4L V8	2007	Gas	7,353	10.37	709.06	6246.86	0.24	0.13	6292.24	6.29
Ford	F-150 4.6L V8	2008	Gas	11,193	11.22	997.59	8788.80	0.36	0.20	8857.88	8.86
Ford	F-150 4.6L V8	2008	Gas	8,406	9.82	856.01	7541.43	0.27	0.15	7593.31	7.59
Ford	F-250 5.4L	2008	Gas	6,701	5.04	1329.56	11713.45	0.22	0.12	11754.81	11.75

	V8										
Ford	F-250 5.4L V8	2008	Gas	1,295	5.04	256.94	2263.68	0.04	0.02	2271.67	2.27
Ford	F-250 5.4L V8	2008	Gas	103	5.04	20.44	180.05	0.00	0.00	180.68	0.18
					Total (gas):		**218586.63**	**8.45**	**9.84**	**221814.60**	**221.81**
Ford	F-350 7.3L V8	2002	Diesel	10,285	8.52	1207.16	12252.67	0.05	0.05	12269.08	12.27
Ford	F-350 7.3L V8	2000	Diesel	8,990	8.36	1075.36	10914.89	0.05	0.04	10929.23	10.93
International	4700	1997	Diesel	1,896	10.00	189.60	1924.44	0.01	0.01	1927.46	1.93
Ford	F-350 7.3L V8	2000	Diesel	8,865	8.73	1015.46	10306.96	0.05	0.04	10321.10	10.32
Ford	F-350 7.3L V8	2000	Diesel	5,075	7.63	665.14	6751.15	0.03	0.02	6759.24	6.76
Ford	F-350 7.3L V8	2000	Diesel	5,372	13.33	403.00	4090.46	0.03	0.03	4099.03	4.10
Ford	F-450 7.3L V8	2000	Diesel	7,582	5.96	1272.15	12912.30	0.04	0.04	12924.39	12.92
Ford	F-450 7.3L V8	2000	Diesel	5,463	6.53	836.60	8491.49	0.03	0.03	8500.21	8.50
Ford	F-550 6.0L V8	2004	Diesel	5,299	5.34	992.32	10072.07	0.03	0.03	10080.52	10.08
					Total (diesel):		**77716.43**	**0.30**	**0.28**	**77810.26**	**77.81**
					Total (all pickup trucks):		**296303.06**	**8.75**	**10.12**	**299624.86**	**299.62**

3. Backhoes (emissions estimated using tractors/loaders/backhoes composite values from offroad emissions factors page)

Make	Model	Model Year	Fuel type	Hours Operated *	CO_2 emissions (kg)	Methane emissions (kg)	N_2O emissions (kg)	Emissions (kg CO_2e)	Emissions (MT CO_2e)
John Deere	310D	1995	Diesel	111	3363.30	0.55	0.003	3375.70	3.38
Case	380B	1988	Diesel	10	303.00	0.05	0.000	304.12	0.30
John Deere	310C	1989	Diesel	107	3242.10	0.53	0.003	3254.06	3.25
John Deere	310SG	2003	Diesel	180	5453.99	0.89	0.005	5474.11	5.47
			Total:		**12362.39**	**2.02**	**0.01**	**12407.99**	**12.41**

2008 SSWD Data

E. Employee Commuting and Personal Vehicle Use

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Enter Data on "Employee Commute Data" sheet

Total Employee Commute/Personal Vehicle Use Emissions

CO_2 emissions (kg): 175046.01

Methane emissions (kg): 292.07

N_2O emissions (kg): 156.97

Emissions (MT CO_2e): 229.84

Fuel Emissions- Gas (MT CO_2e): 229.84

Employee No.	Work Days Per Year	Total Miles Traveled	Est. Fuel Economy (mpg)	Fuel Type	Fuel Used (gallons/year)	CO_2 emissions (kg)	Methane emissions (kg)	N_2O emissions (kg)	Emissions (kg CO_2e)	Emissions (MT CO_2e)
Employee Commute	264	1,487	20	Gas	19633.68	172972.72	288.62	155.11	227116.52	227.12
Employee and Board Member Personal Vehicle use for District Business		3415.9	20	Gas	170.80	1504.70	2.51	1.35	1975.71	1.98
Board Members - Reimbursed Mileage		632	20	Gas	31.60	278.40	0.46	0.25	365.54	0.37
Board Members - Non-Reimbursed Mileage (Estimated)		658.78	20	Gas	32.94	290.19	0.48	0.26	381.03	0.38
Note: All vehicles are assumed to be cars.				***Total:***		**175046.01**	**292.07**	**156.97**	**229838.79**	**229.84**

2008 SSWD Data

F. Employee and Board Member Air Travel

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Total Employee/Board Member Air Travel Emissions

CO_2 emissions (kg):	1485.65
Methane emissions (kg):	0.04
N_2O emissions (kg):	0.05
Emissions (MT CO_2e):	1.50
Fuel Emissions- Jet Fuel (MT CO_2e):	1.50

Name	To/From	Total # of Miles Flown	CO_2 Emissions (kg)	Methane Emissions (kg)	N_2O Emissions (kg)	Emissions (kg CO_2e)	Emissions (MT CO_2e)
Employees							
Employee #1	Sac to Long Beach (RT)	782	171.7084	0.0048	0.0056	173.53	0.17
Employee #1	Sac to Atlanta (RT)	4200	922.2188	0.0260	0.0299	932.03	0.93
Employee #2	Sac to San Diego(RT)	968	212.5495	0.0060	0.0069	214.81	0.21
Board Members							
Board Member #1	Sac to Orange Co. (RT)	816	179.1739	0.0051	0.0058	181.08	0.18
	Total:	**6766**	**1485.65**	**0.04**	**0.05**	**1501.45**	**1.50**

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E. Administration Buildings

Total Administration Building Emissions

CO_2 emissions (kg):	179,653.27
Methane emissions (kg):	0.43
N_2O emissions (kg):	3.83E-05
Emissions (MT CO_2e):	179.66
Electricity Emissions (MT CO_2e):	176.11
Nat. Gas Emissions (MT CO_2e):	0.0204
Fuel Emissions- Diesel (MT CO_2e):	3.53

1. HVAC Servicing and Recharge

Building Name	Equipment Serviced (HVAC Unit #)	Pounds Gas Recharge	Service Interval (Years)	Gas Used
No system refrigerant recharge in 2008				

2. Electricity Use

Building Name	Square footage of building	Square footage of building leased	Percent Leased	Consumption (kWh)[1]	Total Consumption (MWh)	CO_2 emissions (kg)	Methane emissions (kg)	N_2O emissions (kg)	Emissions (kg CO_2e)	Emissions (MT CO_2e)
5331 WALNUT AVE		0	0%	159280	159.28	51,607.61	0.000	0.000	51608	52
3701 MARCONI AVE (portion is leased to Cheap Ins.)	17730	6781	38%	349440	349.44	69,918.29	0.000	0.000	69918	70
2736 AUBURN BL (entire building leased to music co.)			100%	27120	27.12	0.00	0.000	0.000	0	0
7800 ANTELOPE NORTH RD		0	0%	168480	168.48	54,588.46	0.000	0.000	54588	55
					Total:	**176,114.36**	**0.00**	**0.00**	**176,114.36**	**176.11**

3. Natural Gas Use

Building Name	Square footage of building	Square footage of building leased	Percent Leased	Consumption (scf)	Total Consumption (MMBtu)	CO_2 emissions (kg)	Methane emissions (kg)	N_2O emissions (kg)	Emissions (kg CO_2e)	Emissions (MT CO_2e)
Marconi Office	17730	6781	38%	603	0.6205	20.332	0.002	0.00004	20.38	0.0204

4. Backup Generators
Emissions are calculated based on capacity in horsepower, and the annual hours operated.

Building Name/Genset ID	Make	Model	Fuel Type	Capacity (kW)	Capacity (HP)	Consumption (gallons)	Hours Operated	CO_2 emissions (kg)	Methane emissions (kg)	N_2O emissions (kg)	Emissions (kg CO_2e)	Emissions (MT CO_2e)
Auburn Yard Building	Perkins	YPKXL05.9YH1	Diesel	100	165	N/A	24.1	1072.41	0.14	0.03	1,075.25	1.0752
Marconi Office	Olympian	5.OLDT	Diesel	79	125	N/A	36.4	1308.10	0.17	0.03	1,311.73	1.3117
Portable A	Caterpillar	3406	Diesel	320	519	N/A	3.4	365.50	0.04	0.01	366.29	0.3663
Portable B	Caterpillar	3406	Diesel	320	475	N/A	3.6	361.49	0.04	0.01	362.29	0.3623
Walnut Yard Building	Cummins	6CTA8.3-G	Diesel	150	277	N/A	6.2	411.07	0.05	0.01	412.06	0.4121
Notes:							***Total:***	**3518.58**	**0.43**	**0.09**	**3527.63**	**3.53**

1. Electricity use for 2008 approximated by period from mid-December 2007 to mid-December 2008.
Consumption is for entire building. Leased area not included in SSWD emission calculations.

2008 SSWD Data

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G. Capital Construction Projects

Total Capital Construction Projects Emissions

CO_2 emissions (kg):	247216.69
Methane emissions (kg):	101.88
N_2O emissions (kg):	77.62
Emissions (MT CO_2e):	273.42
Fuel Emissions- Diesel (MT CO_2e):	223.75
Fuel Emissions- Gas (MT CO_2e):	49.67

1. Main Replacement Projects

Preferred Data:

Contractor	Equipment type	Number of each equipment type	Fuel type	Miles Driven or Hours Operated
(add lines as necessary)				

Alternate Data:

Contractor	Pipeline installed (miles)	Fuel Type	Fuel used (gallons)	CO_2 emissions (kg)	Methane emissions (kg)	N_2O emissions (kg)	Emissions (kg CO_2e)	Emissions (MT CO_2e)
Ahlstrom Construction[1]	6.32	Diesel	12716	129067.40	36.11	32.17	139798.94	139.80
		Gas	3000	26430.00	47.10	30.30	36812.10	36.81
			Total:	**155497.40**	**83.21**	**62.47**	**176611.04**	**176.61**

2. Meter Retrofit Project(s)

Preferred Data:

Contractor	Equipment type	Number of each equipment type	Fuel Type	Miles Driven or Hours Operated

Alternate Data: Provide data for the first two columns and either Fuel Cost or Fuel Used per Meter Install
Provide additional information if available

Contractor	Number of Meter Installs	Fuel Cost per Meter install	Fuel used (gallons)	Fuel Type	Vehicle types	Vehicle MPG	CO_2 emissions (kg)	Methane emissions (kg)	N_2O emissions (kg)	Emissions (kg CO_2e)	Emissions (MT CO_2e)
GM Construction	1000		4638	Diesel	heavy equipment		47075.70	2.69	0.12	47169.02	47.17
			3132	Diesel	trucks		31789.80	15.97	15.03	36785.65	36.79
					Total:		**78865.50**	**18.66**	**15.15**	**83954.67**	**83.95**
			1459	Gas	trucks		12853.79	0.000	0.000	12853.79	12.85
					Total:		**12853.79**	**0.000**	**0.000**	**12853.79**	**12.85**
					Total (all vehicles):		**91719.29**	**18.66**	**15.15**	**96808.46**	**96.81**

2008 SSWD Data

H. DeMinimus Emissions Sources

Total De Minimus Emissions

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CO_2 emissions (kg):	4098.88
Methane emissions (kg):	0.570616
N_2O emissions (kg):	0.050096
Emissions (MT CO_2e):	4.13
Fuel Emissions- Diesel (MT CO_2e):	0.61
Fuel Emissions- Gas (MT CO_2e):	3.51

This category includes small sources of greenhouse gases, which could include small fuel-powered tools or fugitive emissions
The total GHG emissions from all sources in this category must be less than 5% of SSWD's total emissions.

1. Saws

Equipment	Fuel	Hours Operated (hr/yr)	Fuel Consumption (gal/hr)[1]	Fuel Consumption (gallons)	CO_2 emissions (kg)	Methane emissions (kg)	N_2O emissions (kg)	Emissions (kg CO_2e)	Emissions (MT CO_2e)
Mark II - Partner II K650-II cut off saw	Gasoline	2	0.175	0.35	3.0835	0.00049	0.000035	3.10	0.003
Norton Clipper Concrete Saw Model #C119	Gasoline	0.5	0.175	0.0875	0.770875	0.0001225	0.00000875	0.78	0.001
Stihl TS400 Cut Off Saw	Gasoline	1.5	0.175	0.2625	2.312625	0.0003675	0.00002625	2.33	0.002
Stihl TS760 Cut Off Saw	Gasoline	1.5	0.175	0.2625	2.312625	0.0003675	0.00002625	2.33	0.002
Husqvarna Cut Off Saw #3120K	Gasoline	1.5	0.175	0.2625	2.312625	0.0003675	0.00002625	2.33	0.002
Husqvarna Cut Off Saw #371K	Gasoline	1.5	0.175	0.2625	2.312625	0.0003675	0.00002625	2.33	0.002
Stihl TS760AV Chop Saw	Gasoline	0	0.175	0	0	0	0	0.00	0.000
Husqvarna Cut Off Saw #375K 14"	Gasoline	1.5	0.175	0.2625	2.312625	0.0003675	0.00002625	2.33	0.002
Stihl TS400 Cut Off Saw	Gasoline	0	0.175	0	0	0	0	0.00	0.000
#DPC7311 Makati Chop Saw	Gasoline	1	0.175	0.175	1.54175	0.000245	0.0000175	1.55	0.002
Husqvarna Model #345 9670123-1	Gasoline	6	0.175	1.05	9.2505	0.00147	0.000105	9.31	0.009
Stihl MS170 14" blade	Gasoline	4	0.175	0.7	6.167	0.00098	0.00007	6.21	0.006
Husqvarna 18" Chainsaw #345	Gasoline	6	0.175	1.05	9.2505	0.00147	0.000105	9.31	0.009
Husqvarna 18" Chainsaw #345	Gasoline	6	0.175	1.05	9.2505	0.00147	0.000105	9.31	0.009
Stihl Chainsaw 311Y	Gasoline	4	0.175	0.7	6.167	0.00098	0.00007	6.21	0.006
Husqvarna 18" Chainsaw #345	Gasoline	6	0.175	1.05	9.2505	0.00147	0.000105	9.31	0.009
				Total:	**66.30**	**0.01**	**0.00**	**66.75**	**0.07**

2. Uniform Cleaning Services

Delivery truck type	Fuel Type	Vehicle MPG	Miles driven for pickup and delivery	Frequency of delivery (weeks/year)	Miles/year	Fuel Used (gallons)	CO_2 emissions (kg)	Methane emissions (kg)	N_2O emissions (kg)	Emissions (kg CO_2e)	Emissions (MT CO_2e)
Large van	Gas	15	20	52	1040	69.33	610.83	0.02	0.01	614.43	0.61

3. Other Equipment

Equipment	Fuel	Hours Operated (hr/yr)	Fuel Consumption (gal/hr)[2]	Fuel Consumption (gallons)	CO_2 emissions (kg)	Methane emissions (kg)	N_2O emissions (kg)	Emissions (kg CO_2e)	Emissions (MT CO_2e)
Whacker Rammer BS600	Gasoline	2	0.3425	0.685	6.03485	0.000959	0.0000685	6.08	0.006
Bomag BT65/4 Upright Rammer w/4-cycle Honda engine	Gasoline	72	0.3425	24.66	217.2546	0.034524	0.002466	218.74	0.219
Multiquip Inc Tamping Rammer model #MT-85H	Gasoline	2	0.3425	0.685	6.03485	0.000959	0.0000685	6.08	0.006
Wacker Model VPG160B	Gasoline	10	0.3425	3.425	30.17425	0.004795	0.0003425	30.38	0.030
MQD206H 2" Diaphram Water Pump	Gasoline	312	0.3425	106.86	941.4366	0.149604	0.010686	947.89	0.948
MQD206H 2" Diaphram Water Pump	Gasoline	312	0.3425	106.86	941.4366	0.149604	0.010686	947.89	0.948
MQD206H Pump w/Honda GX120 4.0 Engine GCAAT-1094735	Gasoline	312	0.3425	106.86	941.4366	0.149604	0.010686	947.89	0.948
Honda Deluxe Pump WD20X	Gasoline	2	0.3425	0.685	6.03485	0.000959	0.0000685	6.08	0.006
MQD206H 2" Diaphram Water Pump	Gasoline	20	0.3425	6.85	60.3485	0.00959	0.000685	60.76	0.061
MQD206H 2" Diaphram Water Pump	Gasoline	20	0.3425	6.85	60.3485	0.00959	0.000685	60.76	0.061
SRM-211 Echo Weed Eater	Gasoline	15	0.3425	5.1375	45.261375	0.0071925	0.00051375	45.57	0.046
SRM-211 Echo Weed Eater	Gasoline	15	0.3425	5.1375	45.261375	0.0071925	0.00051375	45.57	0.046
SRM-211 Echo Weed Eater	Gasoline	15	0.3425	5.1375	45.261375	0.0071925	0.00051375	45.57	0.046
SRM-211 Echo Weed Eater	Gasoline	15	0.3425	5.1375	45.261375	0.0071925	0.00051375	45.57	0.046
Husqvarna 155BF Carb II Backpack Blower	Gasoline	10	0.3425	3.425	30.17425	0.004795	0.0003425	30.38	0.030

Homelite Weed Eater ST-385 17" cut	Gasoline	0	0.3425	0	0	0	0	0.00	0.000
Homelite Weed Eater	Gasoline	0	0.3425	0	0	0	0	0.00	0.000
				Total:	**3421.76**	**0.54**	**0.04**	**3445.22**	**3.45**
				Total (all de minimis):	**4098.88**	**0.57**	**0.05**	**4126.39**	**4.13**

Notes:

1. Phone call with Husqvarna 9/23/09. They stated that chainsaws typically run for about an hour on one tank of gasoline. Gasoline tank is 1.4 pints capacity.
2. Assume Honda engine GC190 represents typical engine for water pumps, rammers, weed eaters. From engine specifications, fuel consumption is 1.37 quarts per hour. Source: http://www.honda-engines.com/engines/gc190.htm

Table B-1: Details of CO_2 and CH_4 extrapolations for horsepower versus emissions rate which are based on SCAQMD 2008 off-road equipment data (used in emissions estimates for construction equipment).

Equipment	CO_2		CH_4	
	Fitted Equation and R^2 value	**Distribution of Line of Best Fit**	**Fitted Equation and R^2 value**	**Distribution of Line of Best Fit**
Concrete/Industrial Saws	y = 12.783e0.0146x R2 = 0.99	exponential	y = 0.008Ln(x) - 0.0219 R2 = 0.8714	lognormal
Excavators	y = 0.7424x0.9482 R2 = 0.9883	power	y = 3E-05x + 0.0074 R2 = 0.8302	linear
Generator Sets	y=1.9274x0.7697 R2 = 0.9165	linear	y = 0.0006x0.5978 R2 = 0.9097	linear
Other Construction Equipment	y = 0.5043x + 7.773 R2 = 0.9906	linear	y = 0.0049Ln(x) - 0.0115 R2 = 0.8714	lognormal
Tractors/Loaders/Backhoes	y = 0.7076x - 12.867 R2 = 0.9964	linear	y = 4E-05x + 0.005 R2 = 0.9272	linear

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